KLÜBER LUBRICATION

your global specialist

Detailed information

Healthcare for your rotary screw gas compressor.

Improved gas compressor reliability with Klüber

Content

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No matter where your gas compressor operates, we are specialists for its effective lubrication.

Whether for on- or off-shore applications, whether for the extraction of oil or gas, for refineries, the chemical or petrochemical industry – Klüber offers special lubricants that are precisely tuned to your needs and the types of gases in your compressor.

We regard the lubricant as an essential design element of the compressor, just as bearings, rotors or slide valves. More than 80 years of practical experience in research, development and application of special lubricants ensure a product quality that increases the reliability, availability and production capacity of compressors. These benefits enable maximum asset performance in particular in the oil and gas industry where the cost of downtime and machine failure is extremely high.

The outstanding benefit offered by Klüber is not only lubrication as such, but also the fact that our lubricants are precisely tuned to the particular type of gas stream that is being compressed. Depending on the composition of the gas stream in your process, it can dilute the compressor oil. The gas stream may consist of hydrocarbon gases like propane, inert gases like nitrogen or aggressive gases like methyl chloride, all in varying concentrations. Under pressure, many gases tend to be dissolved in certain lubricating oils and may reduce their viscosity significantly.

Lubricant additives or base oils may react with components of the gas, leading to the formation of sludge and deposits. Premature wear, extra downtime for maintenance, high oil consumption and shorter oil change intervals are common consequences.

Klüber Lubrication help you avoid such lubrication-related problems. A detailed analysis of the gas stream in the compressor and an extraordinarily wide range of fully and semi-synthetic compressor oils enable us to offer you a solution that optimally suits the needs of your individual compression process – anywhere in the world. After all, the choice of lubricant has a decisive effect on the reliability of your rotating equipment, your production and hence also your competitiveness.

Klüber Summit gas compressor lubricants:

... benefits for your gas compressor:

- ❑ **less wear**
- ❑ **longer component life**
- ❑ **longer machine life**
- ❑ **minimum oil consumption**
- ❑ **maximum oil change intervals**

... benefits for you:

- ❑ **less downtime due to maintenance**
- ❑ **lower spare parts cost**
- ❑ **higher reliability in operation and manufacture, higher availability**
- ❑ **optimum economic efficiency**

Special lubricants: a decisive design element of process gas compressors as well as of the reliability of production and its economy

Benefits you can use worldwide.
With our international organization, we can supply you reliably and on-time anywhere around the world any time – both on- and off-shore. Being a global player, having addresses to contact on every continent and more than 1,700 staff worldwide make this possible. We can be found in all regions where oil and process gas compressors operate, from North and South America to South-East Asia, Australia, Russia and Europe to Africa and the Middle East.

Rotary screw gas compressors

1.1. Many compressor shut-downs due to wear? Viscosity and gas solubility are a decisive factor

With the right lubricating oil you will not only reduce wear and increase the life of individual components as well as that of your machines as a whole, but you will also boost your operational reliability and hence your profits. But which lubricating oil will release this potential?

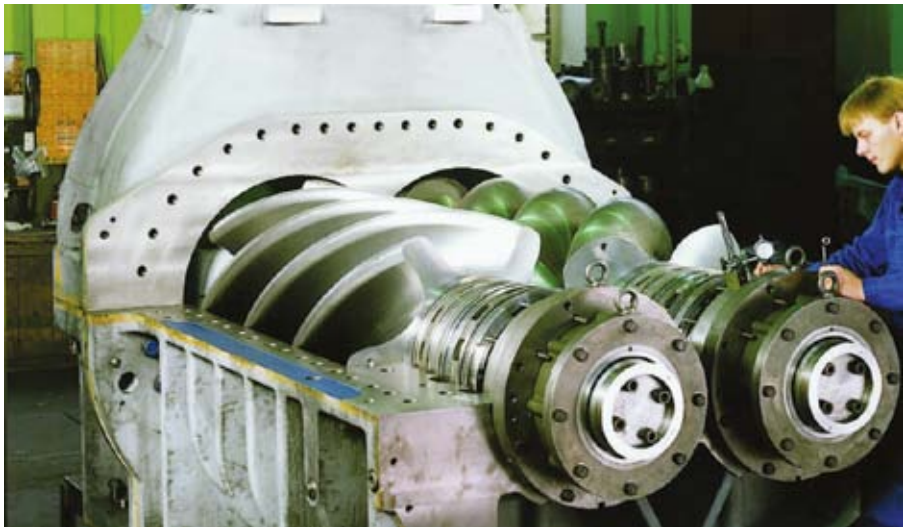
Lubricating oils in rotary screw-type compressors for process gases fulfill a number of different tasks:

- ❑ They lubricate the rotors and the bearings.
- ❑ They seal the gap between rotor and casing, and between the rotors.
- ❑ They cool the gas stream being compressed.
- ❑ They remove heat.
- ❑ They protect against corrosion.

An important factor especially for the lubrication of bearings and rotors is the right viscosity of the lubricating oil, which should under all operating conditions comply with the instructions provided by the compressor manufacturer.

If the gas stream did not affect the lubricating oil, the choice of viscosity would be a fairly simple task. But certain gases tend to be dissolved in certain lubricants. This effect may considerably reduce the oil's viscosity and prevent the formation of an effective lubricant film. This may in turn lead to reduced service life or failure of the “air end“ and hence machine downtime.

The composition of the gas streams to be compressed is as varied as the processes for which they are used. The lubricating oil for the compressor should be chosen just as individually.



Klüber calculates viscosity

Every gas stream is unique.
Klüber Lubrication is the only lubricant supplier to have tailor-developed a program to calculate the tendency of the individual gases to be dissolved in lubricating oil. All factors determining this tendency are taken into account, including the actual operating conditions:

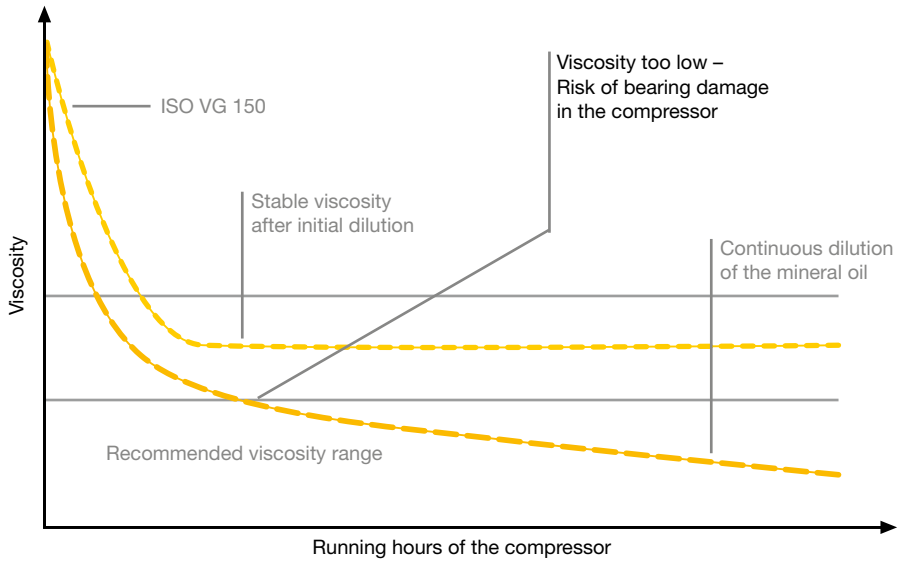
1. Pressure:
The higher the compression, the higher the tendency of the gas to be dissolved in the oil.

2. Temperature:
The higher the compression temperature, the lower the tendency of the gas to be dissolved in the oil.

3. Molecular weight:
The higher the molecular weight of the gas, the higher its tendency to be dissolved in the oil. "Heavy" hydrocarbons such as toluene are more easily dissolved than "light" ones such as methane or propane.

4. Polarity:
When it comes to polarity, the principle of "likeness" applies. Polar gases such as ammonia are easily dissolved in polar oils such as polyglycol, while homopolar gases such as hydrocarbons are less easily dissolved in polar oils.

Taking into account these criteria, Klüber can calculate the tendency of your gas to be dissolved in the lubricating oil already before your rotary screw compressor is filled with lubricant. This gives us valuable information about the oil's viscosity under actual operating conditions, and we can suggest a lubricant that will meet the manufacturer's viscosity requirements in all real-life situations.



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A calculation that pays

A lubricant with a viscosity that is in line with manufacturer's instructions inevery stage of compressor operation helps you to extend your production capacity. After all, less compressor wear leads not only to

- ❑ longer component life and
- ❑ higher operational and production reliability throughout your plant

but also to

- ❑ less production loss due to maintenance downtime,
- ❑ a higher degree of compressor availability and
- ❑ a better utilization

An example:

The first step is analyzing the gas stream composition:

54 % methane CH_4	16 % C_2H_{10}, C_5H_{12}, C_6H_{14}
16 % hydrogen H_2	36 ppm hydrogen sulfide H_2S
16 % ethane C_2H_6	16 ppm hydrogen chloride HCl
8 % propane C_3H_8	

2. The second step is analyzing the operational data of the compressor:

Discharge pressure:	8.5 bar
Discharge temperature:	95°C
Suction pressure:	1.2 bar
Suction temperature:	28°C
Oil temperature to the bearings:	65°C

3. The third step is the viscosity requirement of the OEM:

Application example: oil-injected rotary screw compressor

>12 mm^2/s at 65°C *(oil injection temperature to the bearings)*

> 8 mm^2/s at 95°C *(oil injection temperature to the rotors)*

4. The fourth step is suggesting a suitable oil for the application:

For this operational data, we would suggest Klüber Summit NGSH-150.

We have enclosed a "Technical Questionnaire for Process Gas Compressors", which will help you to quickly and easily compile your application data and send them to us so that we can recommend a suitable product. We will also gladly calculate the lubricating oil viscosity that brings you maximum benefit.

1.2. Problems with residues, deposits and sludge in the Oil. Chemical compatibility may be the cause

Reduce your maintenance and operating costs by using compressor oils from Klüber Lubrication. How's that possible? Because with Klüber oils you will need less new oil filters and separators, reduce reaction by-products in the compressor and cut your oil consumption.

The pitfalls of chemistry: reaction products.
When mixing under high pressure and temperature, gases may not only be dissolved in the oil, they may also react with base oils or additives. Conventional mineral oils, in particular, contain unsaturated hydrocarbons and sulphur compounds that tend to react with reactive gas components. Furthermore, base oils and additives may be affected by acids or humidity contained in the gas stream. The complex chemical system present in a compressor hosts a vast potential for chemical reaction and polymerization.

A typical consequence of this type of reaction is the formation of sludge or solid residues. Both may severely affect the lubricity of the oil and lead to considerable wear on rotors and bearings.

Another possible effect is the clogging of oil filters and separators, which in turn leads to higher oil consumption. So a high consumption of oil filters and separators, short oil change intervals, frequent machine stoppage for maintenance, high oil consumption – all leading to substantial costs – are inevitable. Or maybe they aren't?

Our reaction: low-reaction lubricants.

To avoid the formation of reaction by-products and prevent avoidable costsfor maintenance and spare parts, Klüber Lubrication checks the compatibility of gas stream and lubricating oil before it is used in a particular compressor.

Based on chemical expertise gathered during more than 75 years of advanced research and development, our team of experienced chemists ensure that we know and understand the possible reactions between gas and oil components, and about the conditions under which they occur.

With this background, an accurate analysis of the gas stream being compressed enables us to find a suitable lubricant for your rotary screw compressor from our range of more than 25 different process gas compressor oils.

This means for you:

- ❑ less reaction by-products, deposits and sludge
- ❑ lower filter consumption due to less deposits
- ❑ lower costs due to longer oil separator life
- ❑ lower oil consumption due to longer oil change intervals and high separator performance
- ❑ less wear on rotors and bearings caused by reaction by-products *(consequent longer rotor and bearing life)*
- ❑ less downtime for normal and extraordinary maintenance stops to replace oil filters, oil separators, bearings and rotors.
- ❑ lower operating and maintenance costs

In brief – you will save a lot of inconvenience and costs.

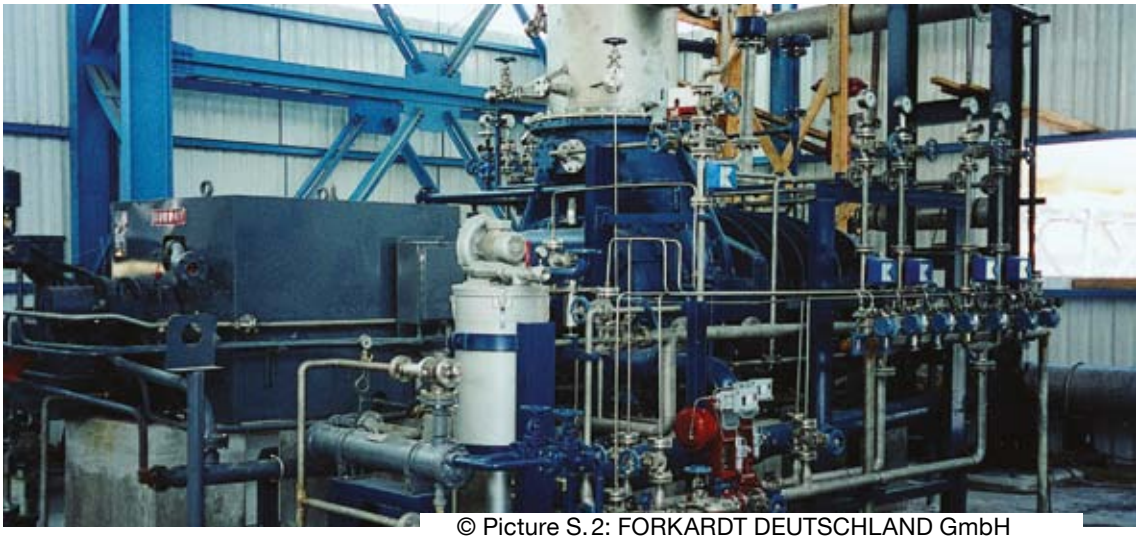
1.3. High oil consumption and high oil carryover to the gas stream? Low evaporation and carryover for a pure gas stream

Our special lubricants for the compression of inert gases such as pure hydrogen or nitrogen ensure that the gas stream remains pure. After all it's the compressor that needs lubrication, and not the gas stream.

When standard oils beat it.
At high compression temperatures, the oil injected into the compressor tends to evaporate – in particular standard-quality mineral oils – and is carried along with the gas stream. There it is present in two forms: as oil vapor and as oil aerosol *(small droplets)*. The aerosol is mostly filtered out mechanically by the oil separator; the oil vapor, however, can cause problems as it remains in the gas stream, being one of the causes of continuous oil consumption. Consequently, the more oil evaporates, the more is consumed.

In chemical processes where the purity of the gas stream is essential, the presence of oil in the gas is highly undesirable. But a high oil content can also cause problems in applications in the oil and gas industry. Downstream catalysts may suffer damage due to the effect of certain oils and additives. Components such as heat exchangers or pipes may be clogged by condensing oil vapor. In addition, a high oil content in the gas stream leads to high oil consumption.

A lot of problems for which Klüber Lubrication offer tailor-made solutions.



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Klüber Summit: synthetic problem solvers.
With our Klüber Summit oils we offer you an extremely wide choice of fully and semi-synthetic products for all types of compression processes. The high resistance to evaporation of these oils comes into play in particular at temperatures above 70°C, which ensures that the amount of oil vapor carried along in the gas stream is kept to a minimum.

Furthermore, several of our oils have been approved by a leading manufacturer of catalysts in the oil and gas producing sector: UOP. Consequently Klüber Lubrication can supply the ideal oil for every application.

This means for the compression process:

- ❑ Highly reliable processes, especially chemical ones
- ❑ Less oil carryover, continuously high efficiency and long service life of catalysts and downstream components
- ❑ Less stoppage for cleaning *(heat exchanger)* and replacement of contaminated components

This means for you:

- ❑ Purity requirements are met.
- ❑ Oil consumption is lower *(refill quantities).*
- ❑ Downstream components live longer.

  Need for maintenance as is caused by oil in the gas that makes cleaning of the contaminated components necessary is reduced.
- ❑ Maintenance and operating costs are reduced and the availability of your compressor increased.

Lubrication with know-how – synthetic special oils.

1.4. The art of choosing the right gas compressor oil – in three steps

Under the name of Klüber Summit alone we offer you eight different series of special oils for rotary screw gas compressors: they include oils for the compression of light hydrocarbon gases as well as oils for use with aggressive gases such as ammonia. In addition we offer the Klüber Tyreno Fluid series: inert oils for use with highly reactive gases.

Besides the compressor oil of course we offer you suitable oils for the mechanical seals. As the oil from the seal can get in contact with the compressor oil, both oils need to be compatible. For this task we can offer a mechanical seal oil suitable for each gas compressor oil. The full package.

Our product range is as comprehensive as the possible uses of rotary screw compressors in oil and gas extraction, refineries, the chemical and petrochemical industries. For you to obtain the special oil that is optimally suited for your application, the following selection steps are recommended:

1st step – data collection.
The following information must be available to find a suitable oil:

- ❑ Accurate analysis of the gas stream being compressed
- ❑ Suction and discharge temperature
- ❑ Suction and discharge pressure
- ❑ Viscosity instructions by compressor manufacturer
- ❑ Operating conditions such as intermittent operation, ambient temperatures and other influencing factors
- ❑ Important additional information e.g. if catalysts are used, or limits for the oil content in the gas stream

On the last page, you will find the "Technical Questionnaire for Process Gas Compressors" as an insert. Going through its questions is an easy way of compiling all the data you need

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2nd step – data evaluation.
We will use your data to determine a suitable oil taking into account the following aspects:

- ❑ Determination of tendency of the gas to be dissolved in the oil and hence its viscosity during operation
- ❑ Selection of base oil and additives tuned to components in the gas stream
- ❑ Catalysts taken into account
- ❑ Check of particularities of gas stream and operating conditions

3rd step – product recommendation.
We will make you a comprehensive offer for a lubricant:

- ❑ We will submit a product suggestion together with production information leaflet and material safety data sheet.
- ❑ We will outline the viscosity behavior of the product as supplied and during actual operation – the latter being the viscosity specified by the compressor manufacturer.
- ❑ We will provide a summarized explanation why Klüber is suggesting this product.
- ❑ We will provide a comment regarding the operating conditions found in the application: what to observe for oil changes, for compressors running with catalysts, how to deal with the risk of the gas falling below the dew point, or the formation of acids in the compressor.

1.5. Specialty oils versus mineral oils – an example

Naturally quality has its price. But comparison with other products does not worry us. After all, the high quality of our special oils will pay in the long term: by increasing the availability of your compressor and hence your production capacity. Figures are more conclusive than words, so please have a look at the following calculation.

One of the world's major oil producers turned to Klüber Lubrication in the following case. A low pressure vapor recovery *(LPVR)* rotary screw compressor is used offshore for the recovery of hydrocarbon gases, which are used to power several gas turbines. When the compressor is down, the gas turbines cannot be used, and the gases must be flared off.
After seven years of numerous breakdowns, bearing damage and production downtime, the operator contacted Klüber Lubrication. Following a detailed analysis of the gas stream, a special gas compressor oil was suggested for this application. Use of the new oil – Klüber Summit PGS 100 – started when the defective compressor had been replaced.

Operational reliability and availability of the LPVR compressor:

Five years of operation prior to changeover to Klüber Summit PGS 100

- ❑ After each 8,000 operating hours the compressor had to be repaired or replaced due to bearing failure and high wear; six compressors were required in these five years
- ❑ Monthly oil changes as hydrocarbon condensate reduced oil viscosity and flash point.
- ❑ Approx. five weeks downtime for repair each year
- ❑ Approx. 4,900,000 m^3 of gas burned off per year, at 20,000 m^3/day
- ❑ Approx. 840 man-hours for maintenance

with Klüber Summit PGS 100

- ❑ Since the changeover, the same compressor has been running for 19,000 operating hours without bearing failure
- ❑ Oil change was extended to over one year
- ❑ No unwanted downtime in over two years
- ❑ Volume of burned gas reduced to 140,000 m^3 since changeover
- ❑ Approx. 140 man-hours since the changeover

The following savings were attained since the changeover:

162,800.- US$	**Costs for monthly oil change (22 · 7,400.- US$)**
22,000.- US$	**Replacement of compressor**
>1,000,000 m³	**Additional volume of gas recovered**
256 hours	**Working time for compressor maintenance**

Conclusion: Since it has been changed over to Klüber Summit PGS 100, the LPVR compressor has been running much more reliably. Downtime has been reduced significantly and failure of peripherals minimized. The rig crew called the changeover a great success.

Machine data:

Compressor:	oil injected rotary screw gas compressor
Discharge pressure:	8.5 bar
Discharge temperature:	95 °C
Gas stream:	Hydrocarbon gas of varying composition, from methane to hexane
Problems encountered:	Oil change every 1,000 op. hrs. because of oil dilution and decreasing flash point; yearly exchange of compressor due to pronounced wear, downtime and production loss

	before changeover to Klüber Summit PGS 100	**with Klüber Summit PGS 100**
Lubricant costs - per oil change - per year	7,400.- US$ 12 · 7,400.- US$ = 88,000.- US$	16,000.- US$ 1 · 16,000.- EUR = 16,000.- US$
Maintenance time per year Maintenance costs per year	160 hrs 160 hrs · 50.- US$ = 8,000.- US$	65 hrs 65 hrs · 50.- US$ = 3,250.- US$
Spare parts and replacement compressor, costs per year	15,000.- US$	3,000.- US$ *(assumed service life 40,000 op. hrs)*
Production loss Costs of production loss	700,000 m³ gas / year 700,000 m³ · 0.1 US$ / m³ = 70,000.- US$	140,000 m³ gas per year 140,000 m³ · 0.1 US$ /m³ = 14,000.- US$
Total costs **Costs saved**	181,800.- US$ --	36,250.- US$ **145,550.- US$**

Make use of this saving potential and put it into practice!

1.6 A specialist for every application – Klüber oils for rotary screw gas compressors.

Application, gas stream	Klüber product	Viscosity
Light hydrocarbon gases without acid gas components and their mixtures with inert gases or low concentrations *(< 21%)* of oxygen	**Klüber Summit PS 100 ... 400**	32, 46, 68, 100, 150
Light to heavy medium hydrocarbon gases Especially if acid gas components are existent like hydrogen sulfide *(H_2S)*	**Klüber Summit NGSH 68 ... 220**	68, 100, 150, 220
Heavy medium to heavy hydrocarbon gases Especially if acid gas components are existent like hydrogen sulfide *(H_2S)*	**Klüber Summit PGS 68 ... 220**	68, 100, 150, 220
Heavy hydrocarbon gases Especially if acid gas components are existent like hydrogen sulfide *(H_2S)*	**Klüber Summit PGS 2**	90
Refrigeration compressor oils for hydrocarbon refrigerants like propane, propylene and butane	**Klüber Summit PGI 68 ... 150**	68, 100, 150
Light to heavy medium hydrocarbon gases Especially if process catalysts are installed after the compressor	**Klüber Summit DSL 100 ...125 XM**	100, 125
Aggressive gases like ammonia, methyl chloride or vinyl chloride Refrigeration compressors with ammonia as refrigerant	**Klüber Summit R 100 ... 500**	32, 68, 85, 220
Aggressive gases for special applications For pure oxygen or gas mixtures with oxygen contents higher than 21 % For applications with very high standards regarding the oil carryover into the gas stream	**Klüber Tyreno Fluid 3/6V, 6/14V and 12/25V**	30, 60, 100
Lubrication of mechanical seal of the gas compressor	**Klüber Summit PGS- 10A** **Klüber Summit HySyn FG-15**	10, 15

The product suggestions in © Picture S. 2: FORKARDT DEUTSCHLAND GmbH *s table does not contain any product recommendations for different applications. For a detailed product selection specific*

Here is a brief overview of our products. To determine which oil is the right one for you, please send us all relevant data for the gas stream in your compressor and the operating conditions. As an insert on the last page you will find our "Technical Questionnaire for Process Gas Compressors". This questionnaire will help you to quickly and easily compile your application data and send them to us so that we can recommend a suitable product.

Properties and operating range	Possible customer value
Semi-synthetic gas compressor oil based on mineral oil and synthetic ester Good oxidation stability especially if oxygen is present in the gas stream	
Synthetic gas compressor oil based on Polyalphaolefines and synthetic ester Contain additives to protect equipment from wear, rust and hydrogen sulfide corrosion Low pourpoint for starting the equipment at low oil temperatures High evaporation stability minimizes the oil carryover into the gas stream in comparison to standard mineral oils	▰ Increased availability of the process gas compressor and of the whole process
Synthetic gas compressor oils based on polyglycol High resistance to thinning out by hydrocarbon dilution Contain additives to protect equipment from wear, rust and hydrogen sulfide corrosion Low pourpoint for starting the equipment at low oil temperatures	▰ Increased operational reliability of the gas compressor and of the entire process
Synthetic gas compressor oils based on polyglycol High resistance to thinning out by hydrocarbon dilution Contain additives to protect equipment from wear, rust and hydrogen sulfide corrosion Low pourpoint for starting the equipment at low oil temperatures Not miscible with liquid hydrocarbons in wet gas streams which keeps the viscosity stable over a long period of time	▰ Economic operation of the gas compressor due to reduced maintenance and spare parts costs
Synthetic gas compressor oils based on polyglycol High resistance to thinning out by hydrocarbon dilution Contain additives to protect equipment from wear, rust and hydrogen sulfide corrosion Low pourpoint for starting the equipment at low oil temperatures Controlled miscibility of hydrocarbon refrigerants in these oils allows oil to return from evaporator at low temperatures and to maintain stable viscosity in the compressor	▰ High pureness of the gas stream due to reduced oil carryover into the gas stream ▰ Increased effectiveness and lifetime of process catalysts
Synthetic gas compressor oils based on special ester Good compatibility with process catalysts Approved by catalyst manufacturer UOP	▰ Long-term partnership for consulting, after sales service and special gas compressor oils for the oil selection of many individual and unique gas streams and applications
Synthetic gas compressor oil based on polyalphaolefines High chemical stability against aggressive gases Low pourpoint for starting the equipment at low oil temperatures	
Synthetic gas compressor oil based on perfluorinated polyether High chemical stability against aggressive gases like oxygen Positive BAM approval for the use with gaseous oxygen Very low vapour pressure for low oil carryover into the gas stream	
Synthetic oils for mechanical seal lubrication based on polyalphaolefine (Klüber Summit HySyn FG 15) and polyglycol (Klüber Summit PGS 10A) Compatible with Klüber Summit gas compressor oils of the same base oil basis	

factors have to be considered like a gas stream analysis as well as the exact operating conditions of the compressor. Please consult Klüber Lubrication for an individual oil selection for your application.

Our service – available worldwide

No matter where in the world you are, whether off-shore or on firm ground, we will not only supply you with lubricants reliably in time, but we also offer you our services. We provide assistance with the cleaning of compressors and used oil analysis.

Compressor cleaning made easy.
With the special cleaning fluid Klüber Summit Varnasolv you can clean your rotary screw gas compressor during operation – fast and effectively, without machine stoppage. Klüber Summit Varnasolv is a highly effective concentrate: It is added to the oil fill at a concentration of 10 % before the oil change. While the compressor is still operating, it releases contaminants and deposits from the walls, which remain suspended in the oil. When the old oil is then drained for the changeover, these particles are removed.

This method is much more effective than simply flushing the compressor with a normal lubricating oil. Normal oil has a poor cleaning effect and hardly manages to remove chemical reaction products and contaminant particles from the walls. However, if these deposits are likely to affect the new oil fill or cause additional wear, thorough cleaning is indispensable.

You have the option of using Klüber Summit Varnasolv, or else you may resort to disassembling your compressor completely to clean all its parts manually. You can imagine which solution we will suggest to increase the efficiency and availability of your compressor.

Caution! When changing over to special oils, the compressor as well as all major oil lines and filters should be thoroughly cleaned. Otherwise residues of the old oil may affect the quality of the newly filled Klüber oil.

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Regular used-oil analyses.
If you wish to accurately time oil maintenance stoppage and avoid additional downtime, you should have the oil in use inspected on a regular basis. As the gas composition in a compressor is never the same, any prediction of compressor oil life is a rough estimate. Oils may age faster or live longer than expected. It is therefore advisable to regularly analyze the compressor oil being used.

Depending on the types of gases, operating conditions and compressor runtime, we will define sampling intervals together with you. We will provide you with standardized sample bottles, which you fill and send to our lab at the specified intervals. A few days later, you will receive a comprehensive lab report informing you about the conditions of your oil and any steps to be taken.

This measure will help to prevent machine downtime, reduce maintenance costs and increase compressor availability.

You can find us where you need us.
Having addresses to contact on every continent and more than 1,400 staff worldwide, we are never far away from you.

This will make contacting us as smooth as lubrication with our products. You will find the closest partner to contact in all matters regarding lubrication on the back of this brochure.

Comments

Technical Questionnaire
Process Gas Compressors

KLÜBER LUBRICATION

Company: _____

Contact person/Department: _____

Phone/Fax/E-mail: _____

1. Compressor type

Reciprocating piston compressor: ☐ Single-acting ☐ Double-acting

☐ Screw-type compressor

Other types: _____

Manufacturer/OEM: _____

Compressor designation/type: _____

2. Composition of gas

Data indicated in:

☐ % by mol or ☐ % by volume

Please enter portions of each gas or enclose complete gas analysis.

Portions:

Water vapour [H_2O]:	Helium [He]:	Nitrogen [N_2]:
Hydrogen [H_2]:	Carbon dioxide [CO_2]:	Carbon monoxide [CO]:
Oxygen [O_2]:	Methane [CH_4]:	Ethane [C_2H_6]:
Propane [C_3H_8]:	Isobutane [i-C_4H_{10}]:	N-butane [n-C_4H_{10}]:
Isopentane [i-C_5H_{12}]:	N-pentane [n-C_5H_{12}]:	Hexane [C_6H_{14}]:
Heptane [C_7H_{16}]:	Ethylene [C_2H_4]:	Propylene [C_3H_6]:
Butene [C_4H_8]:	Benzole [C_6H_6]:	Toluene [C_7H_8]:
Xylene [C_8H_{10}]:	Methyl chloride [CH_3Cl]:	Vinyl chloride [$H_2C=CHCl$]:
Ammonia [NH_3]:	Hydrogen sulphide [H_2S]:	Hydrogen chloride [HCl]:

Miscellaneous: _____

3. Operating conditions

Suction temperature [☐ °C/☐ °F]: 1st stage: _____ 2nd stage: _____

Suction pressure [bar]: 1st stage: _____ 2nd stage: _____

Compression discharge temperature [☐ °C/☐ °F]: 1st stage: _____ 2nd stage: _____

Compression discharge pressure [bar]: 1st stage: _____ 2nd stage: _____

Ambient temperature [☐ °C/☐ °F]: _____

With circulation lubrication: Oil sump temperature [☐ °C/☐ °F]: _____

4. Screw-type compressor

Lubrication details

Lubricating oil used: _____

Oil fill quantity [l]: _____ Oil change interval [operating hours]: _____

Refill quantity [litres/1000 operating hours]: _____

Change interval of: Oil filter [operating hours]: _____ Oil separator cartridge [operating hours]: _____

Viscosity details

Minimum viscosities: in the bearing: _____ mm^2/s at _____ ☐ °C/☐ °F

at the rotors: _____ mm^2/s at _____ ☐ °C/☐ °F

Floating ring seal

Manufacturer: _____ Material: _____

Oil used: _____ Fill quantity [l]: _____ Operating temperature [☐ °C/☐ °F]: _____

What do you want to improve?

☐ Extend oil change intervals ☐ Reduce oil consumption ☐ Extend service life of bearings and rotors (reduce wear)

☐ Avoid residues/deposits ☐ Extend service life of oil separator and filter

Miscellaneous: _____

5. Reciprocating piston compressor

Lubrication details

Lubricating oil used for: Cylinder: _____ Crankshaft: _____

Fill quantities / oil reservoir: Cylinder [l]: _____ Crankshaft [l]: _____

Oil consumption in cylinder: lubrication [l/d]: _____

Viscosity details

Minimum viscosities:

in the cylinder: _____ mm^2/s at _____ ☐ °C/☐ °F

at the crankshaft: _____ mm^2/s at _____ ☐ °C/☐ °F

Compressor data

Stroke: Stage 1: _____ mm Stage 2: _____ mm

Bore: Stage 1: _____ mm Stage 2: _____ mm

Speed: _____ min^{-1}

Materials: Piston: _____ Cylinder: _____ Piston ring: _____

Plunger packing: _____ Valves: _____

Catalytic converter data

Manufacturer: _____ Material: _____ Service life: _____

What do you want to improve?

☐ Extend service life of valves ☐ Reduce oil consumption ☐ Extend service life of catalytic converter

☐ Extend service life of piston rings and plunger packings ☐ Minimize residues in downstream pipes and heat exchangers

Miscellaneous: _____

Notes

The data in this document is based on our general experience and knowledge at the time of publication and is intended to give information of possible applications to a reader with technical experience. It constitutes neither an assurance of product properties nor does it release the user from the obligation of performing preliminary field tests with the product selected for a specific application. All data are guide values which depend on the lubricant's composition, the intended use and the application method. The technical values of lubricants change depending on the mechanical, dynamical, chemical and thermal loads, time and pressure. These changes may affect the function of a component. We recommend contacting us to discuss your specific application.
If possible we will be pleased to provide a sample for testing on request. Klüber products are continually improved. Therefore, Klüber Lubrication reserves the right to change all the technical data in this document at any time without notice.

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Klüber Lubrication – your global specialist

Innovative tribological solutions are our passion. Through personal contact and consultation, we help our customers to be successful worldwide, in all industries and markets. With our ambitious technical concepts and experienced, competent staff we have been fulfilling increasingly demanding requirements by manufacturing efficient high-performance lubricants for more than 80 years.

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