KLÜBER LUBRICATION

your global specialist

Klüber product solutions for the chemical industry – segment industrial gases

a brand of FREUDENBERG

Speciality lubricants and services for chemical plants

Reliable and resistant

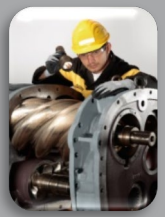
Klüber Lubrication offers lubrication solutions for the high requirements in the chemical industry and oil refineries. A vital criterion in this sector is **lubricant's chemical resistance to the process media** used in production in order to attain long service intervals and high process reliability.

The use of optimum speciality lubricants and services offers many benefits:

- Cost savings due to extended maintenance intervals and less downtime for more productivity.
- Klüber lubricants and services increase often the efficiency resulting in energy savings.
- Klüber lubricants and services are **supporting the objectives of ISO 50001** (energy management) and **ISO 14001** (environmental management).

Production equipment for Klüber speciality lubricants

Compressors



Fittings & valves

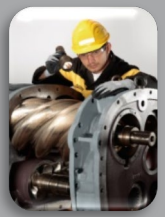
Rolling bearings

Gear boxes

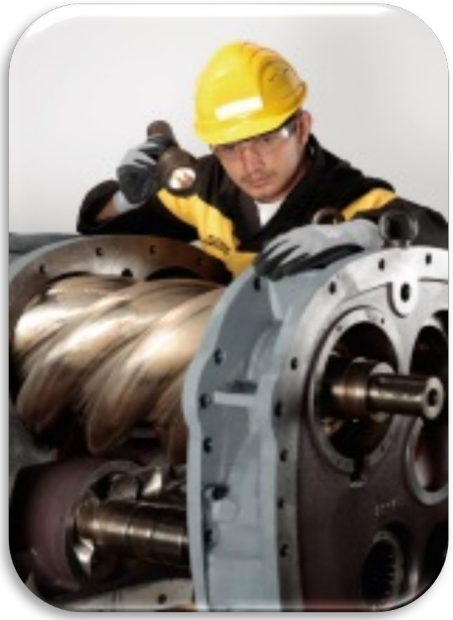
Screw connections

Production equipment for Klüber speciality lubricants

Compressors



Compressor for Nitrogen (used as protective gas in the food industry)



*Reference: Air Liquide

Application

- Compressor for protective gases; technical gases such as nitrogen are often used to keep the food longer in a fresh condition

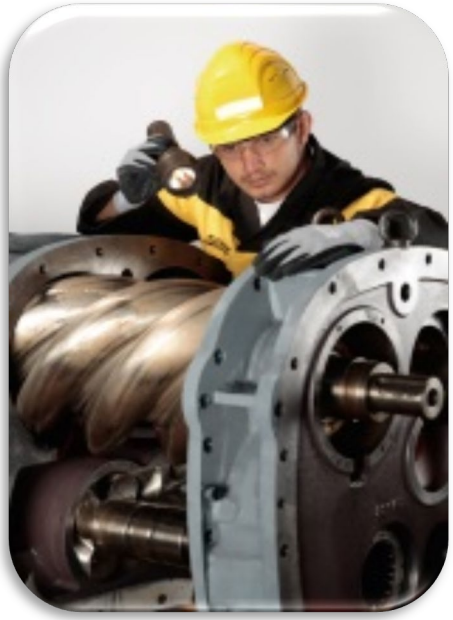
Solution

Klüber Summit FG range*

Customer benefit

- Higher efficiency due to reduced oil deposits
- NSF H1 registered and NSF ISO 21469 certified for higher process reliability

Air compressors



*Reference Linde Group Germany

Application

- Air compressors

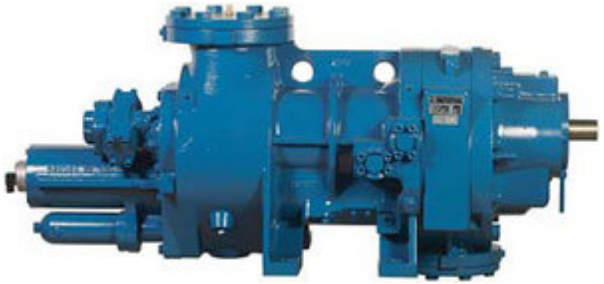
Solution

Klüber Summit SH range*

Customer benefits

- High efficiency due to reduced oil deposits
- Longer service intervals due to the excellent oxidation stability of the oil

Refrigeration compressor – cooling agent ammonia



Aerzener refrigeration compressor

Application

- Screw compressor (OEM Aerzener) with ammonia as cooling agent

Solution

Klüber Summit RHT range

Customer benefit

- Lower maintenance costs due to long oil change intervals and reduced oil consumption
- High refrigeration efficiency due to reduced oil deposits
- Lower operating costs due to long filter and oil separator lifetimes

CRYOSTAR Turbo-expandes for natural gas processing and petrochemical industries

Application

- CRYOSTAR Turbo-expander

KlüberConsult: Klüber‘s „Gas Compressor Simulator“ uses compressor‘s discharge temp. and pressure to determine the dilution potential of the gas in the lubricant.

Solution

Klüber Summit PGS 68*

Customer benefit

- Lower maintenance costs due to long oil change intervals and reduced oil consumption
- Lower operating costs due to long filter and oil separator lifetimes

*Oil viscosity and the type of oil can vary.

Production equipment for Klüber speciality lubricants

Fittings

Benefits of Klüber specialty lubricants for valves and fittings

'Ensure a Steady Flow' – Klüber solutions for valves and fittings in the chemical industry

Valves and fittings usually contain components with complex tribological systems.
To minimize wear of these components, lubricants have to be compatible with the materials.

We developed lubricants specifically for valves and fittings in order to ensure reliable operation during the entire service life of the equipment.

Customer benefits

- Cost reduction by means of low actuating torques, low wear as well as long service life
- Lubricants for extreme conditions like temperature, pressure, humidity, aggressive process media, high flow rates, weather effects of valves in outdoor applications
- Worldwide availability of our lubricants and experts on site
- Batch-related testing reports according to the adiabatic pressure surge method (e.g. BAM test method) for gaseous and, if necessary, liquid oxygen applications.

Valves and fittings subject to hydrocarbons like crude oil, ethane, propane, butane, etc.

Maintenance of a valve flap

References:
Petroleo in Brazil
White Martins in Brazil

Lubrication points in valves and fittings

- Valve flaps: bearings, shaft journals, shaft-flap neck connection, seals
- Ball valve: ball, bearing
- Gate valves: internal thread, wherever there are lifting and rotational movements, e.g. on O-rings in gland seals

Klüber solution

Klübersynth VA 62-253 G

Customer benefits

- Very good sealing effect and adhesion of lubricant
- Very good resistance to hydrocarbons
- Very good load-carrying capacity to prevent fretting

Production equipment for Klüber speciality lubricants

Fittings

under the impact of oxygen

O_2

Safe handling of oxygen

The **oxygen test equipment** is used for investigating and assessing fire and explosion hazards in plants, components and materials in highly compressed, flowing oxygen under "worst case" conditions. (adiabatic oxygen pressure surge method)

The natural oxygen content in air is ≤21 vol %.

With nonmetallic materials, even **a low increase of the oxygen content** in air increases the burning rate and combustion temperature and reduces the ignition temperature.

The test equipment can also be used to determine the influence of metallic and nonmetallic particles on the flammability of system components.

In addition, ignition tests can be performed with valves and system components subjected to oxygen pressure surges.

Safe handling of oxygen

The German Institute for Research and Testing has been developing test methods for the safe handling of oxygen for more than 50 years:

1. Tests to determine the influence of gaseous oxygen on valves and fittings.
2. Devices for determining the self-ignition temperature of oxygen under high pressures.
3. Tests to determine the reactivity of nonmetallic materials like sliding agents from Klüber Lubrication with liquid oxygen in the presence of metallic components.

Lubricants used under the influence of oxygen can be classified in two categories:

1. Sliding agents for valves and fittings
2. Filling fluids for vacuum pumps

Every batch of the Klüber sliding agents and filling fluids used for oxygen applications is tested according to the adiabatic pressure surge method (e.g. BAM test method).

Klüber sliding agents inspected by BAM

Klüber sliding agents inspected by BAM have been successfully used for more than 40 years in oxygen applications.

They are used in installations of

Air Liquide	Linde (BOC, Praxair)
Flowserve	Hersil
Parker	Air products
Ceimsa	Ultra Controlo
Messer	Oelikon Leybold

and many other companies and have been tested and approved for safe handling of oxygen.

Klüber Tyreno Fluids are mainly used as filling fluids for vacuum pumps or as assembly aid under the influence of oxygen.

- The use of Klüber sliding agents inspected by BAM increases the service life of components due to their very good tribological characteristics.
- The sliding agents offer high chemical and thermal stability, are nonflammable and have a relatively low vapour pressure.

Klüber sliding agents and filling fluids inspected by BAM

1. Sliding agents for valves and fittings

Product	operating temperature	upper oxygen pressure limit
Klüberalfa YV 93-1202	up to 60° C up to 200° C	450 bar 200 bar
Klüberalfa YV 93-302	up to 60° C up to 150° C	360 bar 150 bar
Klübertemp YV 93-302	up to 60° C	100 bar
Klübertemp YV 93-92	up to 60° C	150 bar

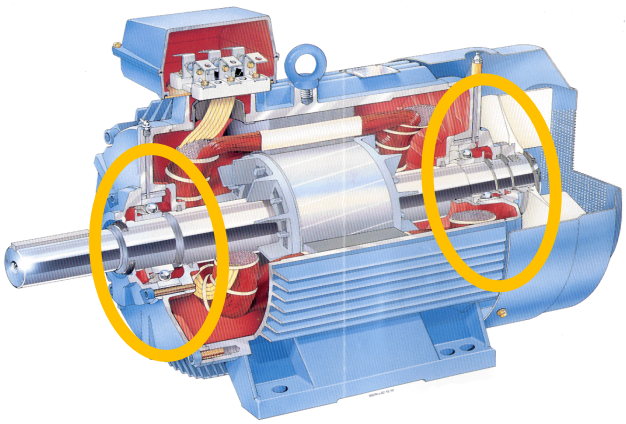
2. Filling fluids

Product	operating temperature upper oxygen pressure limit	upper temperature limit as filling liquid for vacuum pumps with maximum operating pressure of 2 bar, acc. to BAM
Klüber Tyreno Fluids 3/6 V	up to 60° C 100 bar	150° C
Klüber Tyreno Fluids 6/14 V	up to 60 ° C 100 bar	150° C
Klüber Tyreno Fluids 12/25V	up to 60° C° 100 bar	150° C

Production equipment for Klüber speciality lubricants

Rolling bearings

Rolling bearings of electrical motors used for CRYOSTAR pumps in the cryogenic technology



Application

- Rolling bearings of electrical motors used for CRYOSTAR (OEM approved)

Solution

Klüberquit BQ 72-72

Customer benefits

- Long-term operation due to optimised wear protection and smooth running
- Wide service temperature range allows a variety of applications
- Cost savings due to long service life of grease

Production equipment for Klüber speciality lubricants

Screw connections

Screw connections at fittings

Reference:
Approved by KSB for screw connections at fittings

Application

- Screw connections at fittings

Solution

Klüberpaste HS 91-21

Customer benefit

- Efficient assembly due to constant preload forces
- Fasteners easy to undo even if exposed to high temp. for extended periods
- Minimum impact on screws as paste is virtually free of chlorine, fluorine and sulphur (high degree of purity)

Production equipment for Klüber speciality lubricants

Gear boxes

Gear boxes at agitators, extruder or cooling towers

Application

- Gear boxes at agitators, extruder or cooling towers

Solution

Klübersynth GEM 4 range

Klübersynth GH 6 range (worm gear boxes)

Klüberoil 4 UH1 range (H1 registered for food/pharma)

Customer benefits

- Synthetic high-performance gear oils for extended service intervals
- Wide service temperature range due to good viscosity-temperature behaviour
- Excellent wear protection for gears and rolling bearings
- With our **service KlüberEnergy significant energy savings** can be realized by changing from a mineral oil to Klübersynth GEM 4 or Klübersynth GH 6.

Further lubricant solutions for the maintenance

Application	Klüber solution	Benefits for the application
Maintenance – rust remover	Klüberbio Z 2-5 Spray	• Eco-friendly, because readily biodegradable • Less maintenance required as the product provides a cleaning, lubricating and anticorrosion effect at the same time
Concentrated, synthetic conditioner for compressors, hydraulic systems, gears and other oil circulation systems	Klüber Summit Varnasolv	• Dissolves varnish and carbon deposits, thus reducing maintenance and cleaning costs – no dismantling of systems needed prior to cleaning • Reduced operating and maintenance costs due to higher efficiency (e.g. compressor) and longer service life of the fresh oil fill

Chemie Industry - References

KLÜBER LUBRICATION

	Chemical companies	Refineries
# Enduser	BASF The Chemical Company; Bayer MaterialScience; Linde Gas Linde; Braskem; WACKER; AIR LIQUIDE; EVONIK INDUSTRIES; LANXESS Energizing Chemistry; DOW; DUPONT; INEOS; …	Finke; Dhunseri; Holborn Europa; MundoPetróleo.com; Mehr bewegen. OMV
# OEMs	**OEM – pumps, centrifuges, fittings, gas compressors**	
	KSB; HEINKEL; GEA Westfalia Separator; auma Solutions for a world in motion; ALFA LAVAL; SMS Buss-SMS-Canzler; BUSCH Vacuum Pumps and Systems; SAMSON; CRYO STAR	Burckhardt Compression; AERZEN; Howden

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Many thanks for your attention.