setral®
Competence in Lubricants

webinar series Setral

Basics about compressors and their lubrication

Setral Chemie GmbH
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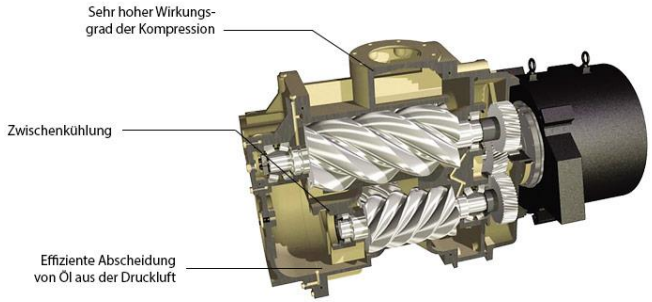
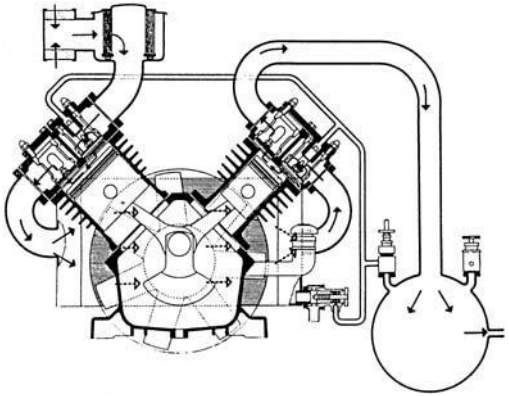
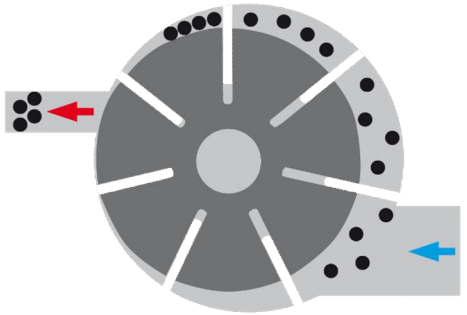
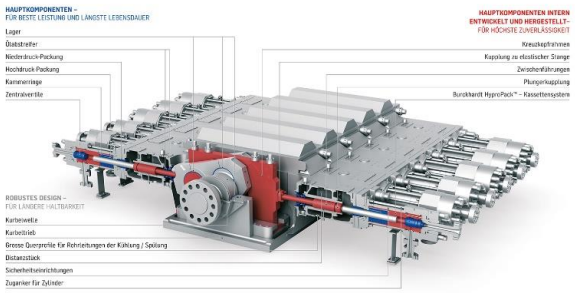
Types

- Screw compressors
- Piston compressors
- Rotary vane compressors
- Hypercompressors
- Turbocompressors









Bildquelle: BASF

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Well known manufacturers

ÅAtlas Copco

ÅBoge

ÅBurckhardt Compression

ÅCompAir (Denver Gardner)

ÅGE (Nuove Pignone)

ÅIngersoll Rand (GHH Rand)

ÅKaeser

Mobility

Stationary compressors

Mobile compressors

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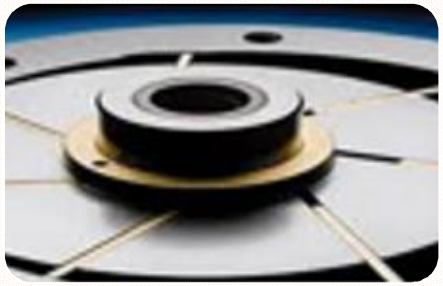
Principal of function

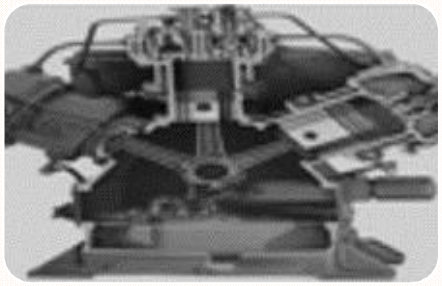
Screw compressor

Srews with opposit rotation direction– also oil free



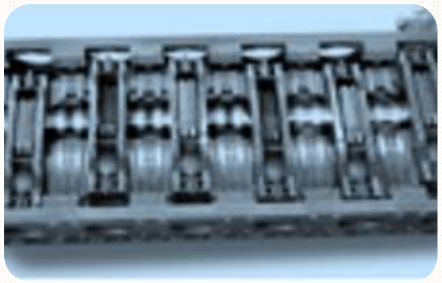
Rotary vane compressor

Rotating vanes/ multicell



Piston compressor

piston standing or lying



Hypercomp ressor

Many pistons connected with block in the middle

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Application areas

Industrial air compressors

- Screw compressors
- Rotary vane compressors
- Piston compressors

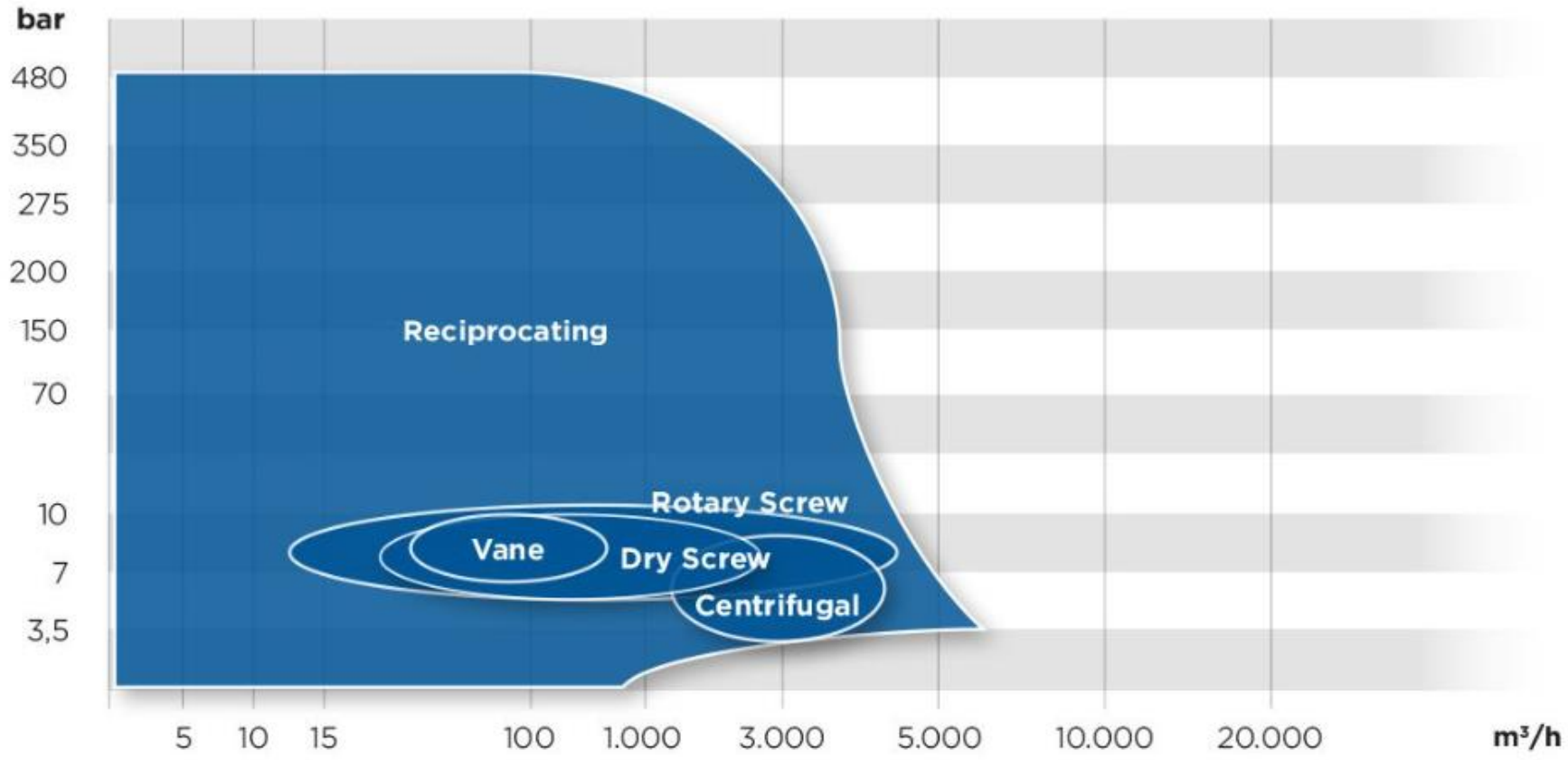
Compressors for reactive gases

- Screw compressors
- Piston compressors

Special applications

- LDPE hypercompressors
- Raffineries/ oil platforms

Capacities and performances of compressor types



Graphik: BASF

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Task of the oil

- Lubrication of the parts (screws/pistons/vanes/bearings)
- Reduction of wear
- Cooling effect via heat dissipation from the part
  - → Modern stationary compressors have heat recovering systems
- No attack of surfaces
- As few deposits as possible
- Sealing effect

Temperature requirements

Å60 – 90 °C normal operating temperatures for air compressors

- screw
- piston
- rotary vane

ÅExceptions operate at temperatures up to 110 °C

e.g. Atlas Copco

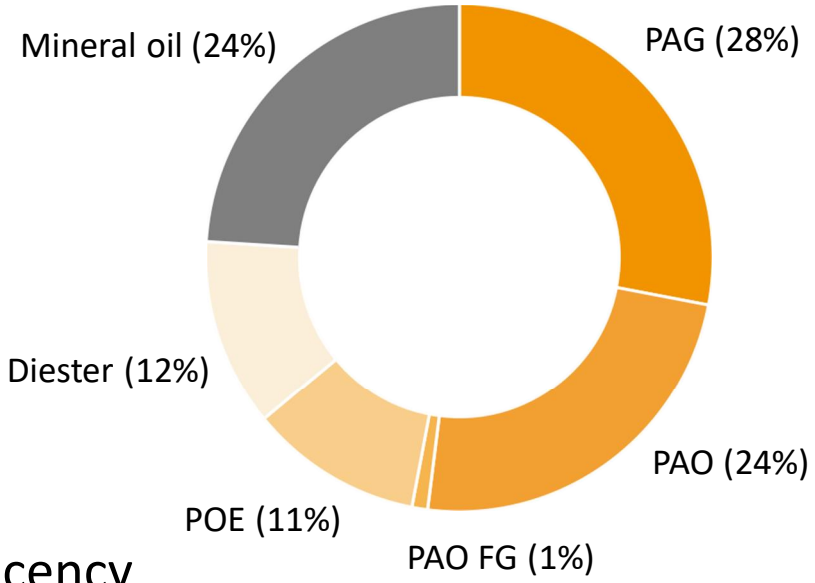
Å40 °C sump temperatur, but ca. 300 – 350 °C at the contact point

- Hyper

Base oil overview

- Originally mineral based
- Today mostly PAO and PAG
- POE-based base oils have increased life span
  (because of small evaporation rate),
  but expensive: special applications

- Trend towards increased life span and energy-efficency



Bildquelle: BASF

General trends

- goes away from type I, II and III mineral oils to semi synthetic and fully synthetic products
- percentage of ester based oils because of better additive solubility compared to MI and PAO
- viscosity for reduced inner friction and better energy efficiency
- higher performance densities, this enables higher operating temperatures and sheer forces
- elongated oil change intervals, increased protection of the parts
- higher viscosity index to enable a larger interval of application temperatures

Basic formulation of a completely formulated compressor oil

Å Base oil and additives:

Å Base oil delivers the basic properties:

- Å Viscosity and VI
- Å Pour point (devines the possible interval)
- Å Flash point
- Å Compatibilities (oil, water, sealings, paintings)
- Å volatility

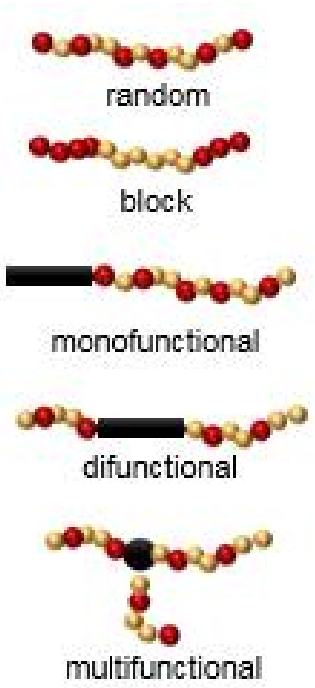
Å Additives improve some properties or add new ones:

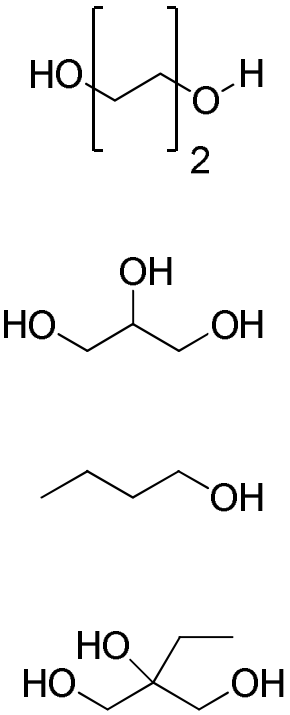
- Å Antioxidants
- Å Corrosion inhibitors
- Å Wear protection additives
- Å Pour point improvers
- Å Anti foam agents
- Å VI-improvers

PAG-base oils

Catalysator and process conditions determine:
- Chain length
- Viscosity
- End group functionality
- Volatility
- Flash point
- Temperature range
- etc.

Asynthesis:

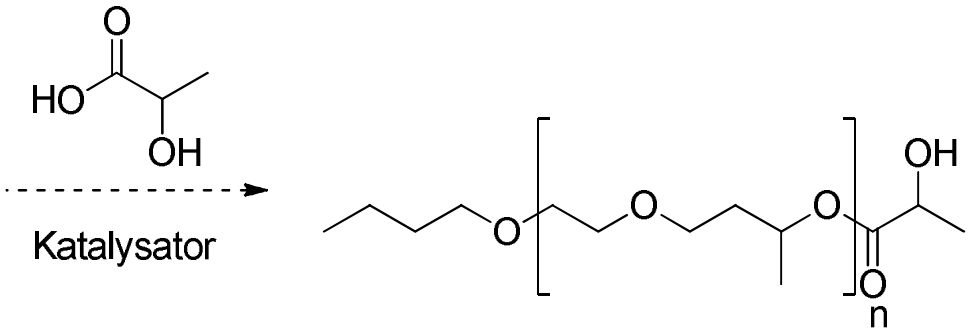




Startmoleküle

+

Monomere



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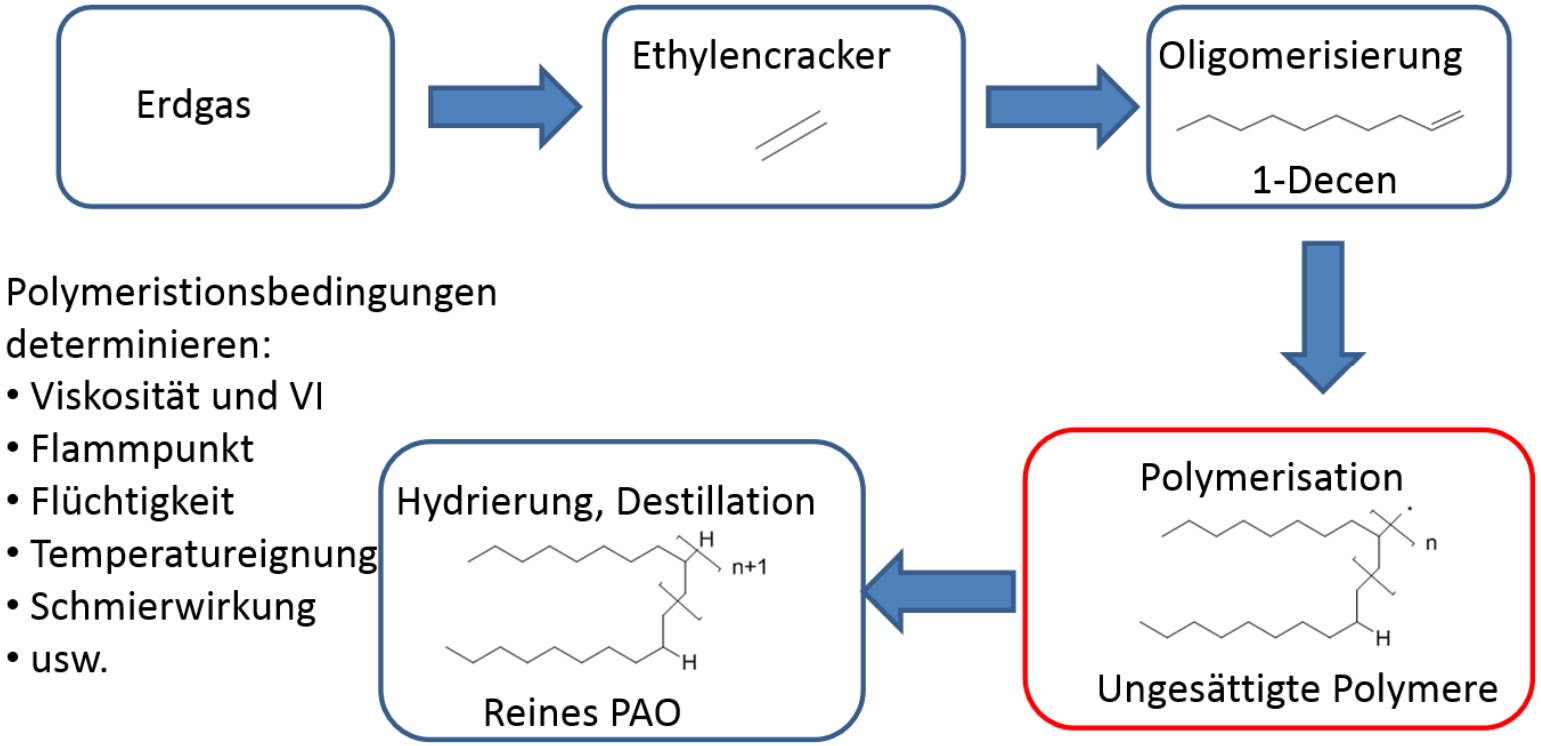
PAG-Base oils

- Good wear protection therefore elongated part- and lubricant life
- **High VI and low friction coefficient therefore higher energy efficiency**
- Excellent low temperature behavior
- Excellent lubricity
- Outstanding load carrying capacity
- High hydrolytic stability
- **Inherent tendency to dissolve deposits and high water tollerance. This enables a clean operation**
- Outstanding oxidation stability
- Withstands the formation of deposits
- Low volatility therefore reduced oil consumption and long relubrication intervals
- Low tendency towards foam formation
- Good air separation ability
- Compatible with common sealing materials

PAO base oils



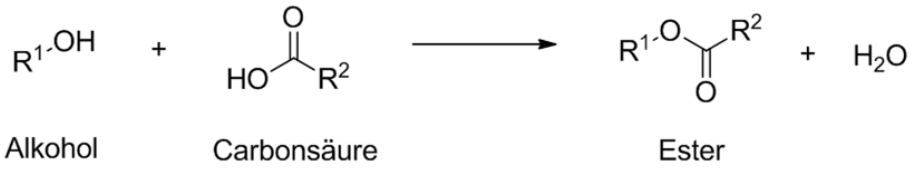
Polymeristionsbedingungen determinieren:

- Viskosität und VI
- Flammpunkt
- Flüchtigkeit
- Temperatureignung
- Schmierwirkung
- usw.

PAO base oils

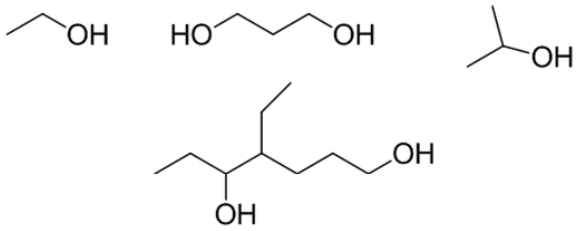
- **Wide possible viscosity range** (2-150 cSt)
- Excellently suited for low temperatures
- Excellent pour points
- High VIs, therfore increased wear protection and energy efficency
- Easy and consistent availability
- Outstanding oxidation stability
- Superior volatility
- Elongated relubrication intervals because of outstanding thermal and oxidative stability
- **Nonpolar substances, therefore small foam formation and good demulsibility**
- **Completely miscible with mineral oils**
- Compatible with common sealing materials

Ester-base oils

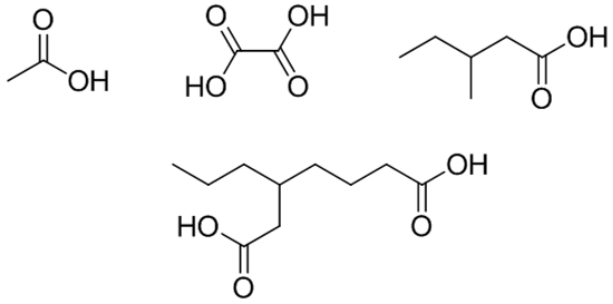


Alkohol Carbonsäure Ester

Alkoholkomponente, Beispiele:



Carbonsäurekomponente, Beispiele:



Selection of the components determine:

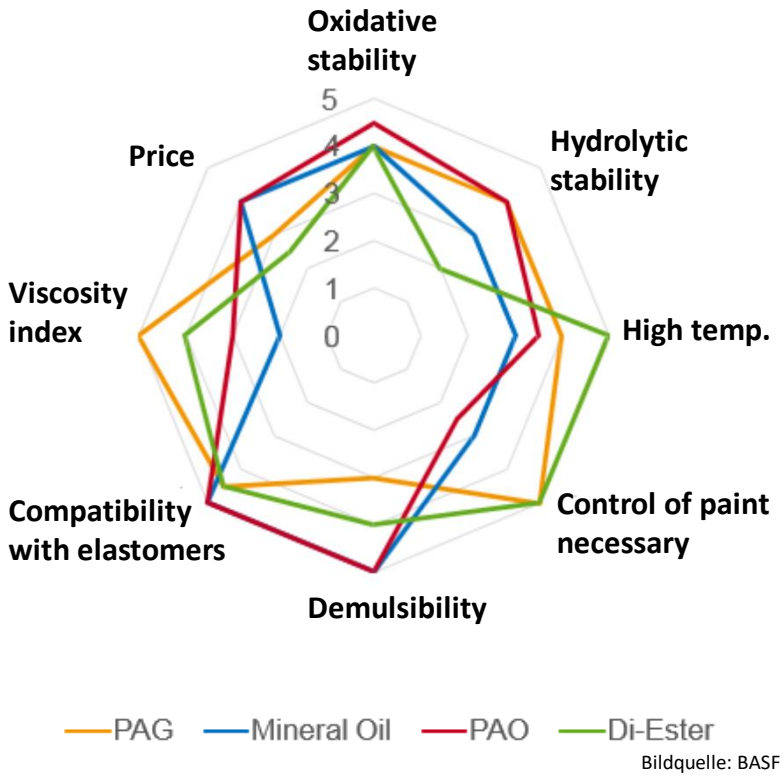
- Viscosity, VI
- Volatility
- Flash point
- Low temperature behavior
- Thermal, oxidative and hydrolytic stability
- Renewability

Ester-base oils

- High performace oils for reduced wear and increased oil change intervals: safe of costs
- Low coefficient of friction and high VI, therefore increased energy efficiency
- Increased thermal and oxidative stability therefore wide application temperature range and clean application
- **Compatible with mineral oils, PAOs and PAGs**
- **Esters are polar, therefore: good lubricity, high flash point, low volatility, very good solvolysis properties**
- Longterm lubricant, oil change intervals up to eight times higher than for mineral oils
- Ability to flow at low temperatures, low starting torque redues wear of parts
- Outstanding demulsibility therefore good corrosion protection
- **Low volatility therefore reduced danger of fire and explosions and minimized procrastination**
- Compatible with elastomers and compressor materials therefore easy exchange

Comparison between the different oil types

Option	advantges	disadvantages
PAG	Å High viscosity index Å Hydrolytic stability Å Cleanliness	Å Compatibility with PAO/mineral oil Å Price
PAO	Å Water separation Å Compatibility with elastomers Å Oxidative stability	Å Relatively dirty
Di-Ester	Å Suitable for high temperatures Å Cleanliness	Å Hydrolytic stability
Mineral oil	Å Price Å Water separation Å Compatibility with elastomers	Å low VI Å Relatively dirty



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COVA-setral-SMG-series

General information: PAO-based product, availabe in ISO-VG-classes 32, 46, 68 cSt

Applications: Suited manily for the lubrication of screw- and rotary vane compressors and vacuum pumps for air

Features: Up to 10000 hours relubrication interval, low evaporation rate, **high flash point**

Temperature range: -40 to +130 °C (depending on the product)

Company	Competitor products	Value selling
Klüber	Klüber Summit SB-series and Klüber Summit SH-series	Setral-product has higher VI
Fuchs	Renolin Eterna and Renolin Eterna SGV series, Renolin SC and Renolin SC MC series	Setral-product has higher VI

COVA-setral-SHB/A-series

General information: PAO-based product, availabe in ISO-VG-classes 32, 46, 68 cSt

Applications: Suited manily for the lubrication of screw- and rotary vane compressors and vacuum pumps for air

Features: Up to 8000 hours oil change interval, no tendency to form foam, good demulsibility

Temperature range: -35 to 120 °C

Company	Competitor products	Value selling
Klüber	Klüber Summit SB-series and Klüber Summit SH-series	Setral-product demulsifies faster, setral-product has higher VI
Fuchs	Renolin Eterna and Renolin Eterna SGV-series, Renolin SC and Renolin SC MC series	Setral-product has higher VI

COVA-setral-SHF FD series

General information: H1-PAO-based product, availabe in ISO-VG-classes 32, 46, 68, 100 and 150 cSt

Applications: Suited for lubrication of compressors and vacuum pumps in the food industry. ISO-VGs 32, 46 and 68 for screw and rotary vane, 100 and 150 cSt for piston-systems

Features: H1 registered, Kosher, Halal, ideal wear protection, free of GMO, plastic compatibility in most cases given. Up to 8000 h relubrication interval.

Temperature range: -30 to 150/160 °C (for two higher ISO-VGs)

Company	Competitor products	Value selling
Klüber	Klüber Summit HySyn FG-series	Setral-product has higher VI and demulsifies faster
Fuchs	Cassida Fluid VP series, Renolin VAC series	-
Castrol	Aircol HV series, Aircol PD series, Aircol SR series	Setral-product has higher VI and demulsifies faster

COVA-setral-PGB/G-series

General information: PG-based product, availabe in ISO-VG-classes 100, 150, 190 cSt

Applications: Suited manily for the lubrication of piston compressors and vacuum pumps for process gases like ammonia, vinyl chloride, butadiene

Features: Approval by Burckhardt compression, does not tend to foam formation, lower gas solubility than mineral oils, does not promote butadiene dimerisation. Up to 8000 hours relubrication interval.

Temperature range: -35 to 175 °C

Company	Competitor products	Value selling
Klüber	Summit NGL series	-
Fuchs	Renolin LPG series	Setral-product has higher VI, setral-product has lower pour point
Castrol	Aircol PG series	Setral-product has higher VI, setral-product has lower pour point, setral has higher flash point

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COVA-setral-PGB/A-series

General information: PG-based product, availabe in ISO-VG-classes 32, 46, 68 cSt

Applications: Suited manily for the lubrication of screw- and rotary vane compressors and vacuum pumps for air

Features: Very good viscosity temperature behavior. Low foaming tendency. Up to 10000 hours relubrication interval.

Temperature range: -25 to +120 °C

Company	Competitor products	Value selling
Klüber	Klüber summit Supra-series	Setral has lower pour point and higher flash point, setral has higher VI

COVA-setral-SE-series

General information: Ester-based product, availabe in ISO-VG-classes 100 and 150 cSt

Applications: Suited for application in compressors and vacuum pumps operating in aerial environment

Features: Less condensate, avoids gumming and carbonization, high flash- and self-ignition points. Also suitable for most process gases. Up to 8000 h relubrication interval.

Temperature range: -30 to +200 °C

Company	Competitor products	Value selling
Klüber	Summit DSL-series	Setral has higher flash point
Fuchs	Renolin SE-series	-
Castrol	Aircol SN series, Tribol CS series	Setral has higher flash point

COVA-setral-SHF/C 68 FD

General information: PAO-based product developed for cooling compressors

Applications: Cooling compressors using ammonia as cooling agent (not suitable for other cooling agents)

Features: H1 registered, Kosher, Halal, outstanding low temperature behavior, high demulsibility, up to 8000 hours relubrication interval

Temperature range: -50 to +140 °C

Company	Competitor products	Value selling
Fuchs	RENSO SYNTH 68, RENSO UltraCool 68	Setral has lower pour point and higher VI

Compressor oil folder

product / Produkt	area of application / Einsatzbereich	specialty / Spezialität	registrations / certifications / Registrierungen/Zertifizierungen
COVA-setral-PGB/G 100	gas compression Gasverdichtung	compatible with reactive gases verträglich mit reaktiven Gasen	-
COVA-setral-PGB/G 150	gas compression Gasverdichtung	compatible with reactive gases verträglich mit reaktiven Gasen	-
COVA-setral-PGB/G 190	gas compression Gasverdichtung	compatible with reactive gases verträglich mit reaktiven Gasen	-
COVA-setral-SMG 32	air compression Luftverdichtung	high flash point hoher Flammpunkt	-
COVA-setral-SMG 46	air compression Luftverdichtung	high flash point hoher Flammpunkt	-
COVA-setral-SMG 68	air compression Luftverdichtung	high flash point hoher Flammpunkt	-
COVA-setral-SHB/A 32	air compression Luftverdichtung	miscible with common mineral oils mischbar mit handelsüblichen Mineralölen	-
COVA-setral-SHB/A 46	air compression Luftverdichtung	miscible with common mineral oils mischbar mit handelsüblichen Mineralölen	-
COVA-setral-SHB/A 68	air compression Luftverdichtung	miscible with common mineral oils mischbar mit handelsüblichen Mineralölen	-
COVA-setral-SE 100	vacuum pumps/air/gas compression Vakuumpumpen/Luft-/Gasverdichtung	low carbonisation/for most process gases Geringe Verharzungsneigung/für die meisten Prozessgase	-
COVA-setral-SE 150	vacuum pumps/air/gas compression Vakuumpumpen/Luft-/Gasverdichtung	low carbonisation/for most process gases Geringe Verharzungsneigung/für die meisten Prozessgase	-
COVA-setral-PGB/A 32	air compression Luftverdichtung	high viscosity index hoher Viskositätsindex	-
COVA-setral-PGB/A 46	air compression Luftverdichtung	high viscosity index hoher Viskositätsindex	-
COVA-setral-PGB/A 68	air compression Luftverdichtung	high viscosity index hoher Viskositätsindex	-
COVA-setral-SHF 32 FD	air compression Luftverdichtung	for food and pharmaceutical industry für Lebensmittel- und Pharmaindustrie	H1, kosher, halal, produced according to ISO 21469 H1, koscher, halal, nach ISO 21469 hergestellt
COVA-setral-SHF 46 FD	air compression Luftverdichtung	for food and pharmaceutical industry für Lebensmittel- und Pharmaindustrie	H1, kosher, halal, produced according to ISO 21469 H1, koscher, halal, nach ISO 21469 hergestellt
COVA-setral-SHF 68 FD	air compression Luftverdichtung	for food and pharmaceutical industry für Lebensmittel- und Pharmaindustrie	H1, kosher, halal, produced according to ISO 21469 H1, koscher, halal, nach ISO 21469 hergestellt
COVA-setral-SHF 100 FD	air compression/vacuum pumps Luftverdichtung/Vakuumpumpen	for food and pharmaceutical industry für Lebensmittel- und Pharmaindustrie	H1, kosher, halal, produced according to ISO 21469 H1, koscher, halal, nach ISO 21469 hergestellt
COVA-setral-SHF 150 FD	air compression/vacuum pumps Luftverdichtung/Vakuumpumpen	for food and pharmaceutical industry für Lebensmittel- und Pharmaindustrie	H1, kosher, halal, produced according to ISO 21469 H1, koscher, halal, nach ISO 21469 hergestellt
COVA-setral-SHF/C 68 FD	cooling compressors Kältekompressoren	suitable for ammonia operated cooling compressors geeignet für ammoniakbetriebene Kältekompressoren	H1, kosher, halal, produced according to ISO 21469 H1, koscher, halal, nach ISO 21469 hergestellt
CLEAN-setral-COVA	cleaning/flushing of compressors Reinigung/Spülung von Kompressoren	excellent flushing oil ausgezeichnetes Spülöl	-

PG: polyglycol; E: ester; MI: mineral oil; PAO: polyalphaolefine; ++ very well suited; + well suited
[1] no ISO-VG; [2] not relevant, because not used in pure form; [3] serves as a guide, checking of the miscibility is always recomended in any case;
[4] depending on the respective operating conditions

Further products are available on request.

base oil type / Grundöl	ISO VG	temperature range / Temperaturbereich	piston compression / Kolbenkompressoren	cleaning/flushing / Reinigung/Spülung	cooling compression / Kältekompressoren	vacuum pump / Vakuumpumpen	screw-/rotary vane compression / Schrauben-/Drehschieberkompressoren	compatibility with coatings / Lackverträglichkeit	compatibility with seals / Dichtungsverträglichkeit	behavior against other oils [3] / Verhalten gegenüber anderen Ölen [3]	typical oil change intervals [4] / Typische Ölwechselintervalle [4]
PG	100	-35 to +175 °C	++			+	+	+	+	miscible with most other PGs, not miscible with E, MI, PAO mischbar mit den meisten anderen PG, nicht mischbar mit E, MI, PAO	8 000 h
PG	150	-35 to +175 °C	++			+		+	+	miscible with most other PGs, not miscible with E, MI, PAO mischbar mit den meisten anderen PG, nicht mischbar mit E, MI, PAO	8 000 h
PG	190[1]	-35 to +180 °C	++			+		+	+	miscible with most other PGs, not miscible with E, MI, PAO mischbar mit den meisten anderen PG, nicht mischbar mit E, MI, PAO	8 000 h
PAO	32	-40 to +120 °C					++	++	++	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	10 000 h
PAO	46	-35 to +120 °C					++	++	++	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	10 000 h
PAO	68	-35 to +130 °C	+				++	++	++	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	10 000 h
PAO	32	-35 to +120 °C					++	+	+	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
PAO	46	-35 to +120 °C					++	+	+	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
PAO	68	-35 to +120 °C	+				++	+	+	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
E	100	-30 to +200 °C	++			+	+	+	+	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
E	150	-30 to +200 °C	++			+	+	+	+	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
PG	32	-25 to +120 °C					++	+	+	miscible with most other PGs, not miscible with E, MI, PAO mischbar mit den meisten anderen PG, nicht mischbar mit E, MI, PAO	10 000 h
PG	46	-25 to +120 °C					++	+	+	miscible with most other PGs, not miscible with E, MI, PAO mischbar mit den meisten anderen PG, nicht mischbar mit E, MI, PAO	10 000 h
PG	68	-25 to +120 °C	+			+	++	+	+	miscible with most other PGs, not miscible with E, MI, PAO mischbar mit den meisten anderen PG, nicht mischbar mit E, MI, PAO	10 000 h
PAO	32	-35 to +145 °C					++	++	++	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
PAO	46	-30 to +150 °C					++	++	++	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
PAO	68	-30 to +150 °C	+			+	++	++	++	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
PAO	100	-25 to +160 °C	++			++	++	++	++	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
PAO	150	-25 to +160 °C	++			++	+	++	++	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
PAO	68	-50 to +140 °C			++			++	++	miscible with E, MI, PAO, not miscible with PG mischbar mit E, MI, PAO, nicht mischbar mit PG	8 000 h
-	70	-30 to +140 °C	[2]	++	[2]	[2]	[2]	[2]	[2]	miscible with most other common oils, not with PG mischbar mit den meisten handelsüblichen Ölen, nicht mit PG	-

PG: Polyglykol; E: Ester; MI: Mineralöl; PAO: Polyalphaolefin; ++ sehr gut geeignet; + gut geeignet
[1] keine ISO-VG; [2] nicht relevant, da nicht in reiner Form verwendet; [3] dient als Richtschnur, es empfiehlt sich dennoch in jedem Einzelfall die Mischbarkeit zu überprüfen;
[4] abhängig von den jeweiligen Betriebsbedingungen

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All information in this document are based on general experience and knowledge as of the date of publication. Technical changes and error reserved. The information should provide guidelines for possible applications to the technically skilled reader and refer to the known state of the art and are publicly available.

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All data are based on empirically determined values or on guideline values taken from technical literature.

Depending on the type of mechanical, dynamical chemical and thermal stress lubricants change their technical values. These values may affect the function of components.

Bildquelle: BASF

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