Matrix
specialty lubricants

COMPRESSOR & VACUUM PUMP FLUIDS

Matrix Specialty Lubricants

Matrix Specialty Lubricants is a company based in The Netherlands, producing and marketing specialty lubricants and greases.

Matrix Specialty Lubricants was created by a nucleus of industry specialists with a collective experience of many years working for major oil companies. Our vision is to harness new technology and, with the expertise of our chemists, provide the correct lubricant for each application. It is just a matter of knowledge.

Specific product information is available in our brochures and most of the technical data sheets can be found on our website:
www.matrix-lubricants.com. Our main products are divided into groups with the most common being presented in our brochures. The most up to date information can always be found on our website.

ISO 21469:2006 ISO 9001:2015 ISO 14001:2020

Bio Lubricants

This group of products includes biodegradable hydraulic, gear, and other lubricants as well as a range of greases and concrete mould release agents. High performance, long life, low toxicity and biodegradabilty are key factors within this product group.

Compressor, Vacuum and Refrigeration Fluids

A comprehensive range of gas and refrigeration compressor fluids providing long life and low maintenance costs in combination with high efficiency. The range consists of mineral, and synthetic (hydro treated, PAO, POE, Alkyl Benzenes, Di-Ester, Ester, PAG, PFPE) based lubricants with performance up to 12.000 hour drain intervals.

Food Grade Lubricants

A complete range of fluids, lubricants and greases for applications whenever a food grade lubricant is required. The high performance Foodmax® line is NSF and InS approved and includes a range of spray cans.

Industrial Specialty Products

This product group includes a range of specialty chain lubricants, gear oils, transformer oils and many more products. All the products exceed performance expectations contributing to lower maintenance costs.

Greases and Pastes

An extensive range of specialty greases and pastes, including polyurea, calcium sulphonate, aluminium, barium, silicon, inorganic and PFPE. By using the latest technology and materials we are able to provide high performance and problem solving products.

Metal Working Fluids and Rust Preventatives

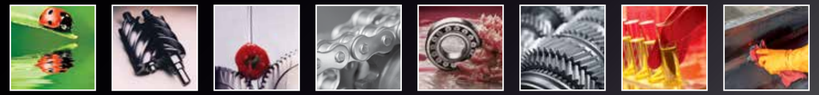
This line of products includes the latest technology soluble metal working fluids, neat cutting oils, cold and hot forging, quenching, drawing and stamping products.

Specialty Base Oils and Dispersions

These base oils are used in the formulation of metalworking fluids, biodegradable hydraulic fluids, top tier 2 stroke engine oils, mould release agents and many more. They include DTO, TOFA and various types of esters. Another range includes both technical and pharmaceutical white oils. The Matrix line of D-MAX colloidal dispersions contains products based on graphite, MoS2, PTFE and Boron Nitride (hBn). These can be used as additives, lubricants and processing products.

Cleaners

A range of process and workplace cleaners, both for the industry as well as for food processing plants. The cleaners for the Food Industry are NSF H-1, C-1 and K-1 approved.



Compressor & Vacuum Pump Fluids

In almost every factory compressed air & gas is crucial for the manufacturing process. Therefore, the trouble-free operation of compressors is important for the continuity of many production processes. Nearly in all compressors lubricants play a key role to cool, seal or lubricate internal components. Proper lubrication will ensure that compressors provide continuous operation, provide cooling, and use less electricity.

Matrix offers an extensive range of compressor fluids which provide optimal lubrication. They reduce the temperature and energy consumption because of the lower friction.

In this brochure our core line of products is highlighted. If you are looking for a product which is not listed feel free to contact us for a specific inquiry.

Operating Hours

If selected carefully, synthetic lubricants generally outperform mineral oils and greases by far in all sorts of equipment. Usually, their life time is at least four to five times longer even under severe operating conditions. Synthetic lubricants offer higher chemical, thermal and oxidation stability, better rust and corrosion protection, lower wear rates, better water separation, lower evaporation loss, less waste disposal and lower toxicity etc. Consequently this means higher efficiency, less equipment down time, lower operating cost and last but not least longer equipment life.
Drain intervals of 4000 hours and more are in rotary compressors and more than 2000 hours in high pressure reciprocating compressors are no exception if all other maintenance operations, especially filter changes, are executed properly and in accordance to the instructions of the engine manufacturer.

Matrix specialty lubricants

Compressor Oils Application and Equipment

Compressors are used to pressurize many different types of gases throughout many industry sectors. The type of gas being compressed needs to be taken into account when selecting lubricants for compressors, because reactions between the gas and the lubricant can occur and adversely affect the lubrication. Air compressors are by far the most common of all gas compressors. They provide compressed air to pneumatic tools and control systems. Hydrocarbon gases are routinely compressed in the process industries while natural gas is compressed as part of extensive gas transmission systems.

Compressors can be classified into two major types: **Positive-displacement and Dynamic**

Positive-displacement compressors
Positive-displacement compressors are further subdivided into rotary and reciprocating types.
Both types move a fixed volume of gas. For example, as a rotary screw turns, it moves a set volume of gas, and as a piston moves, it displaces a set volume with each stroke. Rotary compressors may be of a screw, vane or lobe type, while reciprocating compressors are generally of the piston type. Different types of compressors have different lubrication requirements.
Rotary compressors can be dry or wet (oil-flooded). In the dry type, the rotors run inside the stator without a lubricant and, due to the limited cooling and sealing, are limited to single-stage compression. The lubricant for these machines is not exposed to the gas, and so general circulating lubricants can typically be used. Oil-flooded machines have oil injected into the stator to provide cooling, sealing and lubrication. In these types, the oil is separated from the gas discharge at the exit and continuously recycled.

In reciprocating compressors, the cylinder and crankcase may be lubricated from a common system, or the cylinders may be lubricated from a separate system. Apart from some small compressors where splash lubrication is used, the cylinders are lubricated by means of oil injection to the cylinders or suction valves. The oil will pass out of the compressor with the gas and collect in the discharge pipework.
With splash lubrication, the oil thrown onto the cylinders is scraped off the cylinder liner by scraper rings fitted to the piston. The scraper ring controls the amount of oil feed to the upper cylinder and valves. The bearings are lubricated by oil contained in a reservoir in the base of the compressor. Although splash lubrication can be used in smaller machines, a forced lubrication system is typically used, where a pump delivers oil under pressure to the various lubricated parts.

Dynamic compressors
Dynamic compressors generate pressure by increasing kinetic energy of a gas with an impeller, much like a fan blows air. These compressors are either centrifugal- or axial-flow types. Like the dry compressors above, the lubricant for these machines is generally not exposed to the gas, so circulation-type lubricants can be used. Screw compressors are reliable machines and are increasingly replacing the traditional workhorse of industry — the reciprocating compressor.
As with other industrial equipment, more compact units with higher power-to-size ratios are being designed and built.
Due to the severe conditions and demand for longer oil-drain intervals, the use of synthetic lubricants is common in air compressors. To handle the various quality levels found in the industry, compressor OEMs are increasingly requiring the use of their own oils during the warranty period.

Alkylated Naphtalenes (AN)
AN are fully synthetic cyclic hydrocarbons which are compatible with mineral, HT, PAO and ester oils. They are inert against various reactive and aggressive compounds such as strong acids and alkalis but must not be used in presence of pure oxygen, peroxides and other strong oxidizers. They can be used in all kinds of compressors and mechanical vacuum pumps allowing vakua of < 10^{-1} mbar.
Some of them are food grades according to FDA 21 CFR Title 21, 178.3570 H-1 for incidental food contact.

Lubricant requirements

The lubricant requirements for gas compressors can be summarized as follows:

- **Good compatibility with the gas being compressed**
- **Correct viscosity for compressor type**
- **Good resistance to oxidation and carbon formation**
- **Elevated flash/fire point and auto-ignition temperature**
- **Good water separation (demulsibility)**
- **Good anti-wear and corrosion protection**
- **Good low temperature and detergency (portable equipment)**

By far, most lubrication problems are related to the severe operating conditions experienced by reciprocating (piston) compressors and rotary screw or vane compressors. In fact, oil-flooded screw compressors probably provide the most difficult set of conditions that any lubricant is likely to face: high oil temperatures, intimate mixing of hot oil with high temperature air, high-pressure surface contact and water condensation.
This means that the quality of the base oil is very important for air compressor lubricants. The high temperatures of operation (120°C to 260°C) require drain intervals with mineral oil to be in the range of 500 to 1,000 hours. The use of synthetic fluids can increase drain intervals up to 8,000 hours for rotary compressors, and provide good discharge-valve cleanliness in reciprocating compressors.

Matrix specialty lubricants

Selecting the right Compressor Lubricant

In order to choose the type of lubricant for specific compressor we need to determine the type of compressor first, there are centrifugal, reciprocating, rotary screw, rotary vane or dry screw compressors for which different type of compressor lubricants are suitable. Choosing the right viscosity is equally important. When Foodgrade or Biodegradability is requested other types of compressor and vacuumpump lubricants are suitable. Matrix will be able to recommend the right compressor lubricant for almost every application.

Important criteria for Compressor & Vacuum Lubricants

- **Long life without the need for changeout (high oxidation stability)**
- **Prevention of acidity, sludge and deposit formation**
- **Excellent protection against rust and corrosion, even during shutdown**
- **Good demulsibility to shed water that enters the lubrication system**
- **Easy filterability without additive depletion**
- **Good foam control**

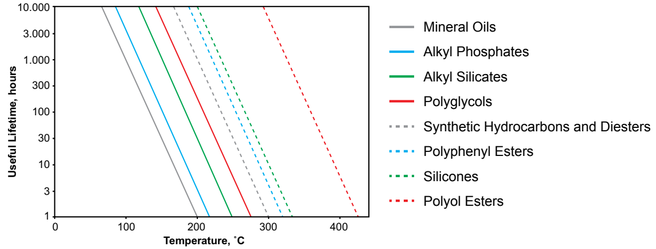
Base Oil Selection

Mineral compressor oils deteriorate when they oxidize or react chemically with dissolved atmospheric oxygen. This raises oil acidity and encourages varnishlike surface deposits, both of which can shorten equipment life. Oxidation inhibitors can be added to help break down hydroperoxides that form during the initial oxidation step.
Additives extend oil life by interrupting oxidation chain reactions and by deactivating any catalytic metal surfaces touching the oil. Oxidation-inhibiting additives are slowly consumed during the initial oxidation period.

Synthetic base oils generally last longer at elevated temperature than Mineral oils resulting in a longer life of the compressor & vacuum pump oil.

Elevated temperatures are probably the biggest contributor to oil oxidation. A rule of thumb is often used to determine the lifecycle of the compressor or vacuum pump oil; every 10**°C** increase in temperature cut the life of a compressor or vacuum pump fluid in half. This rule is useful but not exact, because the rate of change increases as the temperature increases.

Figure 1: Life Expectancy of inhibited Lubricating oils in Air



Synthetic Compressor & Vacuum Pump Lubricants

When synthetic Compressor & Vacuum pump lubricants are preferred 4 main type of base oils are the most suitable:

Polyalkylene glycol (PAG)

PAGs offer the ability to dissolve sludge and deposits, burn without leaving residues when degraded, have a low solubility with hydrocarbons, and have good hydrolytic stability. Their downfall is that they absorb vast amounts of water and have very poor compatibility with mineral and PAO oils.

Diesters & Polyolesters

Esters have a very high detergency and solvency, making them excellent at dissolving sludge and deposits. They are compatible with mineral and PAO oils, and most seal and gasket materials. However, they also absorb moisture from the air and are hydrolytically unstable at high temperatures.

Polyalphaolefins (PAO)

PAOs are most similar to minerals, so they are very compatible. They also are generally compatible with seals and gasket materials. They offer excellent hydrolytic stability, low water solubility and poor solvency. Because of this poor solvency, they should be avoided in applications where high discharge temperatures are present. They have a tendency to form deposits in these situations.

Hydrotreated (HT)

HT base oils are very similar to minerals as well providing the same compatibility as seen when using PAO's. They offer excellent hydrolytic stability, low water solubility as well as poor solvency. They provide more or less similar performance properties as PAO's.

Many of the Matrix Compressor and Vacuum lubricants use above mentioned synthetic lubricants to provide the best possible properties. In some cases combinations of Esters & PAO's/HT and PAG & Esters are used in the formulations to get the best synergetic effect.

Alkylated Naphtalines (AN)

Alkylated naphtalins (AN) are almost inert synthetic cyclic hydrocarbon-based lubricants. They offer extreme chemical, thermal and oxidation stability and withstand attack from aggressive media such as strong acids and alkalis. Food Grades are available.

They supply low vapor pressure, excellent lubricity, quick water separation, no tendency to deposit formation, good wear protection and long drain intervals.

Matrix specialty lubricants

Air Compressors

Matrix	Base Fluid	Description	Compressor Type	Vac. Pump Type	Remarks
Aircomp series ISO VG 32, 46, 68, 100, 150	Mineral	Air compressor fluids formulated with oxidationb stable base stocks and selected additives. Low deposit forming.	Centrifugal Screw ● Reciprocating ● Rotary Vane ●	Rotary Vane ● Screw ● Reciprocating ● Roots/Lobe ● Claw ●	DIN 51.524 T2 DIN 51.506 VDL ISO 6743-3 DAJ
Matrix	**Base Fluid**	**Description**	**Compressor Type**	**Vac. Pump Type**	**Remarks**
Airtop HT series ISO VG 32, 46, 68, 100, 150	Group III Synthetic	Compressor fluids, are formulated with synthetic base stocks and special synergistic super high perfomance additives, specifically for rotary screw air applications.	Centrifugal ● Screw ● Reciprocating ● Rotary Vane ●	Rotary Vane ● Screw ● Reciprocating ● Roots/Lobe ● Claw ●	DIN 51.524 T2 DIN 51.506 VDL ISO 6743-3 DAJ
Matrix	**Base Fluid**	**Description**	**Compressor Type**	**Vac. Pump Type**	**Remarks**
Airtop Superior series ISO VG 32, 46, 68, 150, 220	PAO-Ester-Mix	Formulated from highly oxidation stable base oils and selected additives. Low formation of deposits.	Centrifugal ● Screw ● Reciprocating ● Rotary Vane ●	Rotary Vane ● Screw ● Reciprocating ● Roots/Lobe ● Claw ●	DIN 51.524 T3 DIN 51.506 VDL ISO 6743-3 DAJ
Matrix	**Base Fluid**	**Description**	**Compressor Type**	**Vac. Pump Type**	**Remarks**
Airtop DI series ISO VG 32, 46, 68, 100, 150, 220, 320	Ester	Fully synthetic oils with high thermal, chemical and oxidation stability. For compressors and vacuum pumps running under extreme operating conditions. Drain intervals up to 8 times longer than mineral oil.	Centrifugal ● Screw ● Reciprocating ● Rotary Vane ●	Rotary Vane ● Screw ● Reciprocating ● Roots/Lobe ● Claw ●	DIN 51.506 VDL ISO 6743-3 DAJ Advanced additive technology Compatible with various aggressive gasses Special grades available

Air Compressors

Matrix	Base Fluid	Description	Compressor Type	Vac. Pump Type	Remarks
Airtop AN series ISO VG 32, 46, 68, 100, 150	Blend of Alkylated Naphtalenes and PAO	Fully synthetic oils with high thermal, chemical and oxidation stability. For compressors and vacuum pumps running under extreme operating conditions with agressive media. Drain intervals up to 8 times longer than mineral oil.	Centrifugal Screw ● Reciprocating ● Rotary Vane ●	Rotary Vane ● Screw ● Reciprocating ● Roots/Lobe ● Claw ●	DIN 51.506 VDL ISO 6743-3 DAJ Advanced additive technology Compatible with various aggressive gasses Special grades available

Compressor Types

Centrifugal · Screw · Reciprocating · Rotary Vane

Vacuum Pump Types

Rotary Vane · Screw · Reciprocating · Roots/Lobe · Claw

Vacuum Pumps

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Vacumax series ISO VG 22, 32, 68, 100, 150	Mineral	Vacuum pump oils, good oxidation stability, high vscosty. Low volatility. Not recommended in pumps strong oxidizing media.				●	DIN 51.506 VDL DP 6521 (DAA, DAB, DAH, DAG) DIN 51.524 T2 (ISO VG 46, 68, 100) DIN 51.524 T3 (ISO VG 150, 220) For vacua down to 10^{-2} mbar
			●		●		
			●		●		
			●		●		
						●	

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Vacumax HT series ISO VG 22, 32, 68, 100, 150	Group III Synthetic	Vacuum pump and compressor oils, good oxidation stability, high viscosity index, low volatility.	●		●		DIN 51.506 VDL DP 6521 (DAA, DAB, DAH, DAG) For vacua down to 10^{-2} mbar
			●		●		
			●		●		
			●		●		
						●	

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Vacutop S series ISO VG 15, 22, 32, 46, 68, 100	PAO	vacuum pump and compressor oils for cylinder, gear and circular lubrication, very good lubricity, wear and corrosion protection, high thermal and oxidation stability, low volatility.	●		●		DIN 51.506 VDL DP 6521 (DAA, DAB, DAH, DAG) For vacua down to 10^{-2} mbar
			●		●		
			●		●		
			●		●		
						●	

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Vacutop DI Special series ISO VG 100, 100/150, 150, 220	Ester	vacuum pump and compressor oils for cylinder, gear and circular lubrication, very good lubricity, wear and corrosion protection, high thermal and oxidation stability, low volatility. Advanced additive technology.	●		●		DIN 51.506 VDL DP 6521 (DAA, DAB, DAH, DAG) For vacua down to 10^{-3} mbar Meet vacuum pump OEM's specifications worldwide.
			●		●		
			●		●		
			●		●		
						●	

Vacuum Pumps

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Vacutop FL / FLX series Viscosity @ 40 °C: 46, 68, 70, 85 250 mm²/s	PFPE	Inert vacuum pump and compressor oils for cylinder, gear and circular lubrication at high temperture and/or in presence of aggressive media, e.g. O_2, Cl, O_3, strong acids, alkalies etc. Very low vapour pressure.	●		●		Particularly suitable for applications in the semiconductor industry. Special viscosities available.
			●		●		
			●		●		
			●		●		
						●	

Compressor Types

Centrifugal · Screw · Reciprocating · Rotary Vane

Vacuum Pump Types

Rotary Vane · Screw · Reciprocating · Roots/Lobe · Claw

Gas Compressors

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Gastop DI series	Ester	Methane, biogas and process gases.		●		●	DIN 51.506 VDL
ISO VG 32, 46, 68, 100, 150				●		●	ISO 6743-3 DAJ
				●		●	Advanced additive technology
				●		●	Compatible with various agressive gasses
						●	Special grades available

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Gastop PG series	PAG	Reduced sludge and deposit formation. Excellent oxidation and thermal stability.				●	DIN 51.506 VDL
ISO VG 68, 100, 150, 220				●		●	ISO 6743/3 DAJ
				●		●	
				●		●	
						●	

Compressor Types

Centrifugal · Screw · Reciprocating · Rotary Vane

Vacuum Pump Types

Rotary Vane · Screw · Reciprocating · Roots/Lobe · Claw

Biodegradeable Compressor Fluids

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Airtop ECO series	Ester	Non-glycol replacement for polyglycol (PAG) based compressor fluid. Environmentally neutral.		●		●	DIN 51.506 VDL
ISO VG 32, 46				●			ISO 6743-3 DAJ
							OECD 301B
						●	For compressors and vac. pumps
						●	requiring low viscosity grades

Food Grade Compressor Fluid

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Foodmax Air series ISO VG 32, 46, 68, 100, 150, 220	Group III Synthetic	Food Grade compressor/vacuum pump oils, high critical temperatures, low deposit formation, good anticorrosion and good wear protection, long drain intervals. For all kinds of compressors and vavuum pumps.				●	NSF H-1 FDA 21 CFR 178.3570 DIN 51.506 VDL
				●		●	
				●		●	
						●	
						●	
Matrix	**Base Fluid**	**Description**	**Compressor Type**		**Vac. Pump Type**		**Remarks**
Foodmax Air PAO series ISO VG 32, 46, 68, 100, 150	PAO	Fully synthetic Food Grade compressor/vacuum pump oils, high critical temperatures, low deposit formation good anticorrosion and good wear protection, long drain intervals. For all kinds of compressors and vacuum pumps.	●		●		NSF H-1 FDA 21 CFR 178.3570 DIN 51.506 VDL
			●		●		
			●		●		
			●		●		
					●		
Matrix	**Base Fluid**	**Description**	**Compressor Type**		**Vac. Pump Type**		**Remarks**
Foodmax Air AN Superior series ISO VG 32, 46, 68, 100	Alkyl-naphtalene	Fully synthetic Food Grade oils with high thermal, chemical and oxidation stability. For compressors and vacuum pumps operating under extreme operating conditions, especially in presence of aggressive media such such as acids and alkalis. Drain intervals up to 8 times longer than mineral oil.	●		●		DIN 51.506 VDL ISO 6743-3 DAJ Advanced additive technology Compatible with various aggressive gasses FDA 21 CFR Title 21, 178.3570 H-1
			●		●		
			●		●		
			●		●		
					●		
Matrix	**Base Fluid**	**Description**	**Compressor Type**		**Vac. Pump Type**		**Remarks**
Foodmax BIO Air series ISO VG 32, 46, 68, 100	Ester	High thermal, chemical and oxidation stability. For compressors and vacuum pumps under extreme operating conditions. Up to 8 times longer oil change intervals.	●		●		DIN 51.506 VDL ISO 6743-3 DAJ FDA 21 CFR Title 21, 178.3570 H-1 OECD 301 B
			●		●		
			●		●		
			●		●		
					●		

Cleaners

Matrix	Base Fluid	Description	Compressor Type		Vac. Pump Type		Remarks
Cleanmax CCT		Cleanmax CCT is mixed with the existing fluid to dissolve and remove deposits so that they may be drained with the fluid as required when converting from mineral oils or PAO to PAG based fluids.		●		●	Airtop Clean can be used as a short term compressor oil up to 300 hours.
				●		●	
				●		●	
				●		●	
						●	
Matrix	**Base Fluid**	**Description**	**Compressor Type**		**Vac. Pump Type**		**Remarks**
Airtop Clean Flush	Ester	For flushing old lubricant and contaminants from rotary vane and screw and vacuum pumps prior to refilling with proper grade oil.		●		●	OECD 301B
				●			
						●	
				●			

Compressor Types

Centrifugal **Screw** **Reciprocating** **Rotary Vane**

Vacuum Pump Types

Rotary Vane **Screw** **Reciprocating** **Roots/Lobe** **Claw**

Compressor Oil Changeover Procedure

How to change from one compressor oil to another

Making the change to the lubricant best suited for your compressor can help improve the profitability and reliability of your operation.

Some of these benefits could include:
- **Longer Machinery Life**
- **Increased Equiment Up-Time**
- **Longer Drain Intervals**
- **Reduced Maintenance and Unscheduled Downtime**

Unlike changing engine oils, where typically a simple drain and fill is sufficient, changing a compressor oil has some complexity involving compatibility of different brands, base oils and additives. Incompatibility of two oils may cause additives to gel and drop out of the oil, which could result in degradation of lubrication performance. Consequently, it is extremely important to plan and execute a successful compressor oil change-out process, based on these complexities and OEM requirements. Always follow the recommendations of the OEM.

Typically base oils used in compressor lubricants are either mineral Gr I(napthenic/paraffinic), Mineral Gr II, Synthetic Gr III, PAO, ester (diester and polyolester), silicone, or PAG. Usually PAGs are not compatible with other base fluids besides themselves.

Usually mineral oils and PAOs are compatible, however, PAOs and ester base oils could have varying degrees of compatibility with other products. Some diesters may be incompatible with some types of paint and elastomers. Even if two different products are made with the same type of base oil, there is a possibility that there could be incompatibility with the additives.

Additionally, there is a possibility that a new replacement compressor oil could be incompatible with the existing in-service oil, due to levels of contamination, including water. Again, there are many complexities to consider. It is imperative to be cautious even when changing from one base oil type compressor fluid to a similar compressor fluid of the same base oil, because variations of incompatibility could come into play. We should never assume that we can displace a PAG compressor oil with anything other than a PAG compressor oil, without taking extra steps of caution. The compatibility table of base oils shown below when used in compressor oil formulation reiterates the need for caution and appropriate decision regarding compatibility, flushing, etc.

Compressor oils mixing table

	Ester	PAG	PAO	Synthetic Gr. III	Mineral Gr. I	Mineral Gr. II	Silicone
Ester	OK	Never	Possible	Possible	Possible	Possible	Never
PAG	Never	OK	Never	Never	Never	Never	Never
PAO	Possible	Never	OK	Possible	Possible	Possible	Never
Synthetic Gr. III	Possible	Never	Possible	OK	Possible	Possible	Never
Mineral Gr. I	Possible	Never	Possible	Possible	OK	OK	Never
Mineral Gr. II	Possible	Never	Possible	Possible	OK	OK	Never
Silicone	Never	Never	Never	Never	Never	Never	OK

Compressor Oil Changeover Procedure

There is no absolute answer to compatibility, including issues caused by the variability of additives, and contamination of the in-service oil. When changing oils, our primary recommendation for compressors is to drain and flush the system no matter what the base oil of the current and replacement product is, because of all these variables of potential incompatibility. This conservative recommendation is additionally substantiated in the risk vs reward model, when speaking of the size of the reservoir in question, usually small. So, because of the small volume of current product in a reservoir, i.e. not much to be lost on disposal, it is best to drain and flush knowing the risk and complexity of compatibility.

The risk of contamination can be reduced by not only draining the old compressor fluid, but by also flushing the system and changing the filters. To benefit from the full potential of the new compressor oil, simply topping up the system is not enough, which is why the full process including draining, flushing and filter changes is encouraged. This process will not only reduce risk, but lead to better performance too.

Individual circumstance might warrant a verification with local Technical Support. If that same scenario is complicated by a potential need to remove carbon and lacquer deposits, this can escalate the level of caution to that level where fluids are not compatible. This level of caution may include flushing, potential for solvent flushing, seal replacement, etc.

There are two common recommendations for flushing procedures in the industry. They should be used as a guide to supplement OEM recommendations.

Procedure A is recommended for changing out compatible products and when there is no need for cleaning excessive carbon deposits or lacquers.

Procedure B is recommended when changing out incompatible products (e.g. changing from PAG to another type of lubricant which is not based on PAG) and for changing out normally compatible products/base oil fluids, when there is potential for incompatibility from additives or contamination, including water. Procedure B is additionally used when there are deposits in the system. Often at this level of incompatibility, changing from PAG to PAO, etc, OEMs have requirements around seal replacement and should be consulted.

Procedure A – Compatible Base Oils
Step 1. Start and run the compressor at the normal operating temperature for 1 hour minimum.
Step 2. Shut down compressor, electrically isolate, relieve pressure, potentially pull oil analysis.
Step 3. Drain compressor oil from the main reservoir, cooler, separator tank and any low points in the piping system.
Step 4. Replace filters.
Step 5. Fill main reservoir to proper level with appropriate compressor oil.
Step 6. Repeat steps one through five.
Step 7. Restart and operate compressor as usual/Pull oil sample.
Submit the sample for oil analysis evaluate effectiveness of flush/change out. Repeat steps one through five if needed.

Procedure B – Incompatible base oils, incompatible testing result, and/or need for chemical flush to remove deposits
Step 1. Shut down system, electronically isolate, relieve pressure/pull oil analysis.
Step 2. Replace filters and seals if OEM recommended. Follow directions of both OEM-approved flushing procedure and flush fluid manufacturer's guidance. Dependent upon manufacturer and condition of compressor, this may entail extensive circulation, warm up, drain, flush and filter replacement.
Step 3. Once flushing fluid procedures are completed, follow Procedure A to include drain, fill, replace filters as delineated, submitting oil analysis to evaluate flushing effectiveness, repeating flushing procedure if warranted.

Matrix specialty lubricants

Glossary of terms

Additive
A chemical added in small quantities to a product to improve certain properties. Among the more common petroleum product additives are: oxidation inhibitors for increasing the product's resistance to oxidation and for lengthening its service life; rust and corrosion inhibitors to protect lubricated surfaces against rusting and corrosion, demulsifiers to promote oil-water, separation, VI improvers to make an oil's viscosity less sensitive to changes in temperature, pour-point depressants to lower the cold temperature fluidity of petroleum products, oiliness agents, anti-wear agents, and EP additives to prevent high friction, wear, or scoring under various conditions of boundary lubrication, detergents and dispersants to maintain cleanliness of lubricated parts, anti-foam agents to reduce foaming tendencies, and tackiness agents to increase the adhesive properties of a lubricant, improve retention, and prevent dripping or spattering.

Anhydrous
Free of water, especially water of crystallization.

Anti-Foam Agent
An additive that causes foam to dissipate more rapidly. It promotes the combination of small bubbles into large bubbles which burst more rapidly.

Anti-Oxidant
A chemical added in small quantities to a petroleum product to increase its oxidative resistance in order to prolong its storage and/or service life. The additive activates in two ways: by combining with the peroxides formed initially by oxidation paralyzing their oxidizing influence, or reacting with a catalyst to coat it with an inert film.

Anti Wear Agent
An additive that minimizes wear caused by metal-to-metal contact by reacting chemically with the metal by forming a film on the surfaces under normal operating conditions.

Acid Number
Also referred to as NEUT or NEUTRALIZATION number: the specific quantity of reagent required to 'neutralize" the acidity or alkalinity of a lube oil sample. In service , the oil will, in time, show increasing acidity as the result of oxidation and, in some cases, additive depletion. Though acidity is not, of itself, necessarily harmful, an increase in acidity can be indicative of oil deterioration, and NEUT number is widely used to evaluate the condition of an oil in service. The most common measurement is ACID NUMBER, the specific quantity of KOH (potassium hydroxide) required to counterbalance the acid characteristics. How high an acid number can be tolerated depends on the oil and the service conditions, and only broad experience with the individual situation can determine such a value.

Auto-Ignition Temperature
Minimum temperature at which a combustible fluid will burst into flame without the assistance of an extraneous ignition source. This temperature is typically several hundred degrees higher than the flash and fire point.

Base Oils
Base stocks or blends used as an inert ingredient in the manufacturing of automotive and industrial lubricants.

Base Stocks
Refined petroleum oils that can either be blended with one another or supplemented with additives to make lubricants.

Base Oil Viscosity in a Grease
Because oil does the lubricating in a grease, and viscosity is the most important property of the lubricant, the viscosity of the base oil needs to be designed correctly for the application.

Boundary Lubrication
A form of lubrication effective in the absence of a full fluid film. Made possible by the inclusion of certain additives in the lubricating oil that prevent excessive friction and scoring by forming a film whose strength is greater than that of oil alone. These additives include oiliness agents, compounded oils, anti-wear agents, and extreme pressure agents.

Carbon Residue
Coked material formed after lubricating oil has been exposed to high temperatures.

Copper Strip Corrosion
Evaluation of a product's tendency to corrode copper or copper alloys. ASTM D130. Test results are based on the matching of corrosion stains.

Corrosion Inhibitor
A lubricant additive for protecting surfaces against chemical attack from contaminants in the lubricant.

Compatibility of a Grease
This is one of the most important grease properties. Whenever two incompatible thickeners are mixed, grease usually becomes soft and runs out of the bearing. When mixing different thickener types, consult supplier on compatibility. Some incompatible thickeners are aluminum and barium soaps, clay and some polyureas.

Consistency
NLGI grade is based on the amount of thickener. Consistency describes the stiffness of the grease. NLGI 2 is the most common grade.

Demulsibility
A lubricant's ability to separate from water, an important consideration in the lubricant maintenance of many circulating systems.

Detergent
An additive which chemically neutralizes acidic contaminants in the oil before they become insoluble and fall out of the oil forming sludge. Particles are kept finely divided so that they can remain dispersed throughout the lubricant.

Dropping point
The temperature at which a grease changes from semi-solid to a liquid state under test conditions. It may be considered an indication of the high temperature limitation for application purposes.

Entrainment
Describing a state of an immiscible fluid component. Minute quantities of a fluid (typically water) can be dissolved or absorbed into the oil, but excess quantities can be most harmful to equipment due to the entrainment leaving gaps in the lubricated areas.

Emulsion
A mechanical mixture of two mutually insoluble liquids (such as oil and water).

EP agent
An additive to improve the extreme pressure properties of a lubricant.

Flash Point
Lowest temperature at which the air vapor from a sample of a petroleum product or other combustible fluid will "flash" in the presence of an ignition source. The flash can be seen in the form of a small spark over the liquid.

Fire Point
Lowest temperature at which a combustible fluid will burst into flame in the presence of an extraneous ignition source. Very little additional heat is required to reach the fire point from the flash point.

Foaming
A possible reaction of an oil when mixed with air. This entrained air can result in reduced film strength and performance reduction.

Foam Inhibitor
An additive which causes foam to dissipate more rapidly. It promotes the combination of small bubbles into large bubbles which burst more easily.

Four-Ball Tests
Two test procedures on the same principle. The Four Ball Wear Test is used to determine the relative wear-preventing properties of lubricants operating under boundary lubrication conditions. The Four Ball Extreme Pressure Test is designed to evaluate performance under much higher unit loads.

Hydrocarbons
Compounds of hydrogen and carbon of which petroleum products are typically examples. Petroleum oils are generally grouped into two parts: Napthenics, which possess a high proportion of unsaturated cyclic molecules; and paraffinic, which possess a low proportion of unsaturated cyclic molecules.

Glossary of terms continued

Hydro Treating
A Gulf patented process used to make lubricant base stocks. In the process, lubricant feedstocks are reacted with hydrogen in the presence of a catalyst at very high temperature (400°C) and pressure (3000 plus psi). The process displaces impurities and unsaturated hydrocarbons.

Hydrodynamic Lubrication
A type of lubrication effected solely by the pumping action developed by the sliding of one surface over another in contact with an oil. Adhesion to the moving surface draws the oil into the high-pressure area between the surfaces, and viscosity retards the tendency to squeeze the oil out. If the pressure developed by this action is sufficient to completely separate the two surfaces, full-fluid-film lubrication is said to prevail.

ISO
International Standard Organization

Load Carrying Ability
Under high-load conditions, high-viscosity base stock is required and usually with an EP additive or solid additive like molybdenum disulfide.

NLGI classifying stiffness of a Grease
The best way to define the consistency or stiffness of the grease is set out by the NLGI (National Lubricating Grease Institute). A test method defines the following grades according to a level of penetration measured at a temperature of 25°C. The consistency of the grease will change as soon as the temperature of the application will increase or decrease. When temperature falls below 25°C, the NLGI grade rises and the grease will appear more stiff.

On the other hand, as soon as the temperature will go beyond 25°C, the NLGI grade is reduced and the grease becomes less stiff.

Oxidation
A form of chemical deterioration to which all petroleum products are subject to, and involves the addition of oxygen atoms resulting in degradation. It is accelerated by higher temperatures above 25°C, with the rate of oxidation doubling by each 10°C increase. With fuels and lubricant oils, oxidation produces sludges, varnishes, gums, and acids, all of which are undesirable.

Oxidation Inhibitor
A chemical added in small quantities to a petroleum product to increase its oxidation resistance in order to prolong its storage and/or service life. The additive activates in two ways: by combining with the peroxides formed initially by oxidation, paralyzing their oxidizing influence, or reacting with a catalyst to coat it with an inert film.

Oil Separation of a Grease
For a grease to be effective, a small amount of oil must separate from the thickener (usually less than 3%).

Pumpability of a Grease
This is an important property when pumping grease in centralized systems at low temperatures. Most common test is Lincoln Ventmeter.

Pour Point
A widely used low temperature flow indicator, depicted as -15°C above the temperature to which a normal liquid petroleum product maintains fluidity. It is a significant factor in cold weather start-up. Paraffinic oils typically have higher pour points due to the formation of wax crystals, while many other lubricants reach their low pour points through an increase in viscosity.

Rust Inhibitor
A lubricant additive for protecting ferrous (iron and steel) components from rusting caused by water contamination or other harmful materials from oil degradation.

Shear Stress
A unit of frictional force overcome in sliding one layer of fluid along another. This is typically measured in pounds per square foot, with pounds representing the frictional force, and square feet representing the area of contact between the sliding layers.

Shear Stability
Grease needs to maintain its consistency under high shear conditions. The shear stability test measures the softening of grease when sheared for 10,000 or 100,000 double strokes with a grease worker. Loss of less than one NLGI grease grade signifies a stable thickener under high shear conditions.

Sludge
The collective name for contamination in a compressor and on parts bathed by the lubricating oil. This includes decomposition products from the fuel, oil, and particulates from sources external to the compressor.

Solvency
The ability to dissolve into a solution producing a homogeneous physical mixture. The degree of solvency varies along with the rate of dissolution depending on the amount of heat added to the solution.

Synthetic lubricants
Lubricants manufacturered by a process, where a chemical conversion or transformation of one complex mixture of molecules into another complex mixture takes place.
Common types of synthetic base oil include: Polyalpha olefins (PAO), Unconventional Base Oils (UCBO), Organic Esters, Polyglycols (PAG), Hydrocracked/Hydroisomerized.

Timken OK load
Measure of the extreme pressure properties of a lubricants.

Thickener for Grease
A grease consists of a base oil, additives and a thickener. There are soap and non-soap thickeners. Each thickener type provides unique characteristics to the grease.

Vapor Pressure
The measure of a liquid's volatility. The higher the pressure at a standard test temperature, the more volatile the sample, and the more readily it will evaporate.

Varnish
A deposit resulting from oxidation and polymerization of fuels and lubricants. Similar to but softer than lacquer.

Viscosity
Measure of a fluid's resistance to flow. This is typically measured as the time required for a standard quantity of fluid at a certain temperature to flow through a standard orifice. The higher the value, the more viscous the fluid. Viscosity varies inversely with temperature so the measurements are always expressed together. Tests are typically conducted at 40°C and 100°C.

Viscosity Index
The measure of the rate of change of viscosity with temperature. Heating tends to make lubricants thinner, cooling makes them thicker. The higher a VI is on a particular fluid, the less of a change in viscosity there will be over a given temperature range. In determining the VI, two temperatures of viscosity are taken, one at 40°C and the other at 100°C.

Volatility
The property of a liquid that defines its evaporation characteristics. Of two liquids, the more volatile one will boil at a lower temperature and will evaporate faster when both liquids are at the same temperature. The volatility of petroleum products can be evaluated with tests for flash point, vapor pressure, distillation, and evaporation rate.

Water Resistance
Water washout test measures ability of a thickener to remain intact in bearing when submerged in water. Water spray-off measures ability of a thickener to remain in bearing in presence of water spray. Both of these tests measure percent grease removed.

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