



**ENVIRONMENTAL ACCEPTABLE LUBRICANTS**

## 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](http://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.



## 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 biodegradability 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

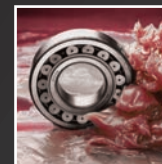
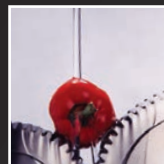
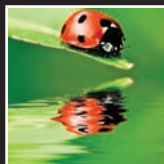
An extensive range of specialty greases and pastes, including polyurea, calcium sulphonate, aluminium, barium, silicon, inorganic and PFPE. By using the latest technology and materials we are able to provide high performance and problem solving products.

## 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, MoS<sub>2</sub>, PTFE and Boron Nitride (hBn). These can be used as additives, lubricants and processing products.



## Biodegradable Lubricants & Greases

Historically Biodegradable lubricants & greases are considered having a lower performance than their industrial equivalents. To some extent this used to be correct. When Biodegradable Products were introduced the main development criteria were related to the highest biodegradability and some extent non-toxicity. Nowadays the latest generation is not only biodegradable, has a very low toxicity but can provide a technical performance and life time which outperforms standard industrial products. Matrix used the latest technology to develop a range of biodegradable lubricants which does not only help to less pollute our planet, they also keep your equipment running smoothly and provide the highest cost efficiency possible. In this brochure, we highlight our standard range of EAL (Environmental Awareness Lubricants) but in case you are looking for a product not in this catalogue please contact us. We love and live for challenges! We have also tried to make this brochure more than only a listing of available products, we tried to make it educational sharing as much of information as possible for you to understand the world of EAL lubricants and greases.

## Biodegradable Fluids are defined in 4 major classification HETG, HEES, HEPR, HEPG

**HETG** (rapeseed) vegetable-based fluids are readily biodegradable; however, these fluids are primarily designed for total loss applications. They have temperature restrictions and should not be used above 60°C, when used at higher temperatures they will oxidize quickly resulting often in lacquer and deposit formation on equipment components. When exposed to water the fluid will become very unstable.

**HEES** This category includes both unsaturated and saturated esters which are both readily biodegradable. Unfortunately, this category includes a wide variety of products in the market which can perform quite differently. The saturated version has a large preference concerning performance.

**HEPR** category contains fluids like PAO (Polyalphaolefins) and HT (Hydrotreated) based products. They are inherently biodegradable and have superior hydrolytic stability in the presence of water. They have a more rapid biodegradability than mineral oils but less than most esters and vegetable oils.

**HEPG** (Polyglycols) can both be water miscible or non-water miscible. The downside is that they cannot be mixed with other mineral, PAO or HT based fluids.

## Fluid Performance Criteria

### Oxidation Resistance

Oxidation of a fluid is caused by a reaction of oxygen with the fluid. The result will be an increase of the viscosity and the total acid number. When a fluid is oxidized to much varnish and other deposits might be seen. Vegetable-based (HETG) and unsaturated ester-based fluids (HEES) have many open bonds that react with oxygen when exposed to thermal load. This will cause the fluid to oxidize even quicker. Saturated Esters (HEES) and PAO & HT based fluids (HEPR) have substantial lower amounts of open bonds which results in much better oxidation resistant fluids which last much longer even when exposed to higher temperatures.

### Anti-Corrosion

Most fluids are formulated to have good anti-corrosion properties although the chemical backbone differs. It speaks for itself that water intrusion should be kept to a minimum and when possible, water should be drained from the system. Products with good and quick water separation are preferable.

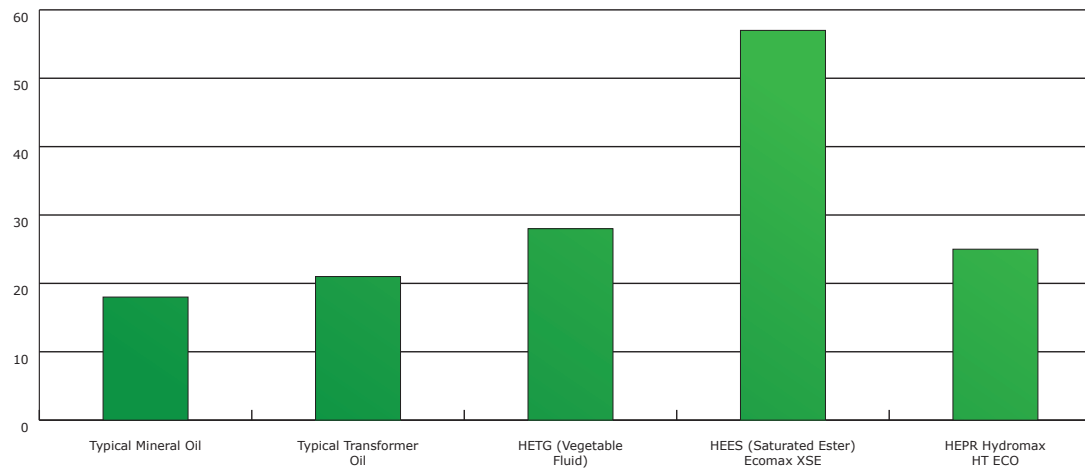
### Insulation Properties & Conductivity

Standard hydraulic fluids are often formulated with metals (zinc) containing additives. These additives provide a good conductivity in this type of fluids. Biodegradable and less environmentally sensitive products normally are formulated with non-toxic (metals free) additives. As a result, the conductivity is very low. Depending on the application this is either a benefit or a downside.

The benefit of products with a low conductivity is the fact that a high breakdown voltage can be applied. In such a case a biodegradable fluid acts as a transformer oil as well. This might allow rationalization of fluids used. Important in this case is to keep the amount of water low (below 500 ppm).

In Figure 1 Breakdown Voltage according to IEC 60156 for the various products is illustrated. These values are for new products. When water intrusion in the various products is seen the Breakdown Voltage will drop if the water is not taken out of the products.

**Figure 1: Breakdown Voltage according to IEC:60156 (kv)**



## Fluid Performance Criteria

### Seal compatibility

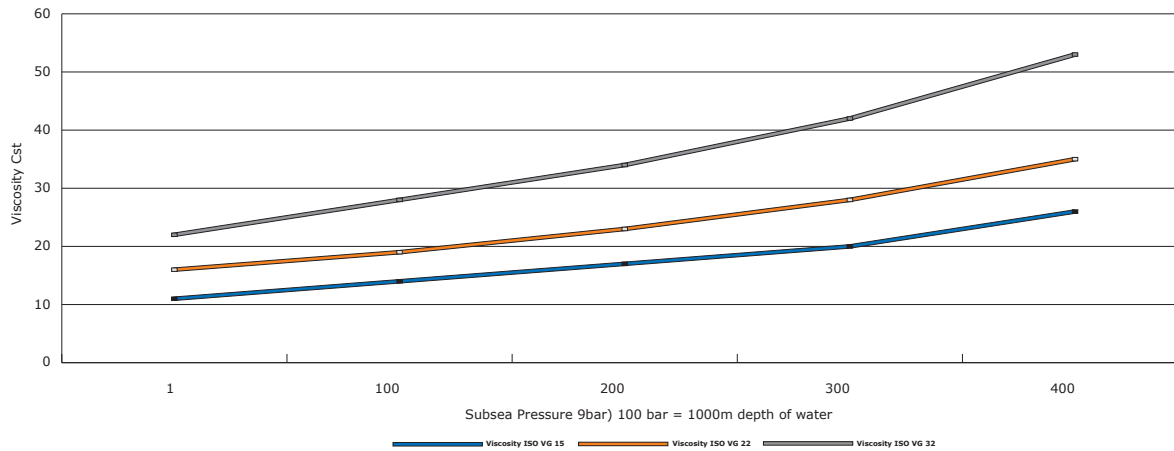
Compatibility of seals used in combination with different type of fluids is essential and should be investigated. Besides the choice of seal material, the type of fluid the actual viscosity of the fluid might have an influence on the seal compatibility as well.

### Viscosity, Temperature and Pressure

There is a clear relationship between Viscosity, Temperature and Pressure. Viscosity Index (VI) is a measure for the change of viscosity related to temperature changes. The higher the VI to lower the viscosity changes when temperature vary. Fluids can have a high VI because of the nature of the fluid (inherently high VI) or because they are boosted by VI Improvers. The downside of the use of VI improvers is that they can shear down when in use. Fluids with a high VI based on VI improvers might look good on paper but the actual VI in the working environment might drop quickly resulting in unexpected performance losses. Knowledge of the chemistry and the type of fluids ensures the choice of the right product for a certain application.

Many fluids tend to thicken when they are exposed to high pressures. Below figure illustrates the relationship between viscosity, temperature and pressure.

**Figure 2; Relationship between Viscosity, Temperature and Pressure**



### Density

Compared to standard mineral oils is the density of biodegradable fluids slightly higher (denser). Besides HEPG (density around 1) this higher density is not considered significant.

## Fluid Performance Criteria

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### Biodegradability & Ecotoxicity

Lubricants that claim readily biodegradability should have a biodegradability of minimum 60% over 28 days according to the OECD 301B test. Some fluids claim biodegradability against other test methods such as CEC-L-33-A93, however this method is only an indication of primary degradation. Below the different biodegradability test methods are further explained.

#### 1982-CEC-L-33-T82

This test was developed to attempt to clarify the parameters of biodegradable oils. The Austrian, German and Swiss authorities used this test to evaluate the biodegradation of two-stroke outboard engine oils. The test runs for 21 days and only checked the primary degradation.

#### 1993-CEC-L-33-A93

This test superseded CE-L-33-T82 and suppose to become an approved test but it also only tests the primary biodegradation. The test uses 2 fluid mixtures in parallel;

- Oil sample under test without poisonous chemical which should show bacterial bio decomposition
- Oil sample under test with poisonous chemical, which should show no bio decomposition. This procedure detects volatile substances such as solvents, by killing the bacteria.

#### 1996- OECD 301B

This is the most current test method and is accepted by the majority of international environmental agencies (like EU Eco label). The test runs over 28 days and evaluates primary and final degradation.

### Water Intrusion

Any type oil will take in and dissolve a certain amount of water. How much this depends on a number of factors like; temperature, relative humidity and the chemical composition of the oil. As long as the amount of water remain low (around 100 ppm or 0.01%) the appearance of the fluid will not change. The oil will stay transparent and the water is not visible because it is dissolved at a molecular level. The water at such a long level of intrusion will not separate. The higher the temperature and relative humidity the higher the saturation point of a fluid will be. Mineral oils have normally a saturation point of 300-400 ppm where HEES (Ester) type of fluids saturate at 800-1000 ppm. Once this saturation point has exceeded contamination of water will become a real issue. Water contamination above the mentioned saturation points will influence the lubricating properties, cause corrosion and when the contamination is based on salt water, the salt will become an issue on itself.

## Fluid Performance Criteria

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### Hydrolysis

Synthetic esters are made by condensing or combining an acid with an alcohol. This process is called esterification. Hydrolysis (tendency to go back to an acid and an alcohol) is the reverse of this process and will create problems in the application where the fluid is being used. When an ester fluid is exposed to larger quantities of water in combination with an elevated temperature (90-950 C) Hydrolyses might occur. Saturated Esters are more resistant against Hydrolysis than Unsaturated Esters. HEPR biodegradable fluids do not hydrolyze. An increase TAN normally indicates if hydrolysis is occurring. Normally the fluid should be changed before the TAN increases more than 2.0 mg KOH/g. Important however is to make sure what the starting TAN of a fluid is to recommend fluid changes based on a TAN increase.

### Filtration

Filtration of Hydraulic fluids is always recommended. When an oil is in use filters will filter out, debris, oxidation particles, wear particles contaminants and also water. Although often neglected we can come to the conclusion that if an oil is very clean from the beginning (no or less oxidation catalysts) less filters and filter capacity is needed to keep the oil clean. A product like Hydromax HT ECO is such a product. Delivered at a very clean level and the absence of metallic additives like ZDDP will result in substantial savings on the usage of filters. Water separation is also easier since the water will separate very quickly.



## EAL Lubricants Regulations & Approvals

### ECOLABEL certified lubricants

European regulations make it obligatory to use lubricants compliant with the ECOLABEL specification in certain defined zones, called sensitive zones, so as to limit the use of lubricants of petroleum origin as lost oils.

Created in 1992, the European ECOLABEL is the only official European ecological label that can be used in all the member countries of the European Union allowing the identification of products that respect the environment. This ecological community label is based on a multi-criteria approach: all the impacts on the environment due to provenance, manufacture, use and end of life of a lubricant are taken into account. This label guarantees the preservation of sensitive natural zones.

### The Ecolabel criteria

- **Ultimate Biodegradability – OECD 301 B:** aptitude of a product to be transformed into a simple element by living organisms. The OECD 301B standard replaces the obsolete CEC standard (primary biodegradability)
- **Ecotoxicity – OECD 201-202-203:** measure of the critical concentration of a product for which a harmful effect is observed (immobilization or death) in aquatic organisms.
- **Non bio accumulation – OECD 117:** the product must not be bio accumulating. Bio accumulation corresponds to a substance present in the environment that a living organism cannot transform, and which will become concentrated in a part of its organism.
- The **product safety sheet must not include any hazard phrase**, which guarantees perfect safety for the user.
- The use of **renewable raw materials** for which the quantity to be incorporated is variable according to the type of product.
- **Absence of dangerous chemical compounds according to the ECOLABEL criteria** – list of forbidden substances 2000/60/EC + OSPAR.
- The product must meet **technical performance** levels.
- The families of lubricants concerned by the ECOLABEL following the modifications resulting from the vote of 24 June 2011 are:
  - Category 1: Hydraulic and UTTO oils
  - Category 2: Greases and grease for stern tubes
  - Category 3: Chainsaw oils, concrete mould-release agents, cable lubricants, stern tube oils and other lost-oil lubricants
  - Category 4: Two-stroke engine oils
  - Category 5: Industrial and marine gear oils

## EAL Lubricants Regulations & Approvals

### EALs mandated by EPA (Environmental Protection Agency)

On March 28th, the US Environmental Protection Agency (EPA) published the final version of its 2013 Vessel General Permit (VGP) which will apply to all vessels entering US waters from **19th December 2013**. The VGP requires that **“All vessels must use an Environmentally Acceptable Lubricant (EAL) in all oil-to-sea interfaces, unless technically infeasible”**.

The applications covered by the VGP, which will be regulated by the US Coast Guard, include Controllable Pitch Propellers; Thruster Fluids and other Oil-to-Sea Interfaces including:

- Lubrication Discharges from Paddle Wheel Propulsion;
- Stern Tubes;
- Thruster Bearings;
- Stabilisers;
- Rudder Bearings;
- Azimuth Thrusters;
- Propulsion Pod Lubrication;
- Wire Rope and Mechanical Equipment Subject to Immersion.

There are certain situations where “technical infeasibility” can be shown, which have been defined in the legislation as:

1. That no EAL products are approved for use in a given application that meet manufacturers specifications for that equipment.
2. That products which come pre-lubricated (eg wire ropes) have no available alternatives manufactured with EALs.
3. That products meeting a manufacturer’s specification are not available within any port in which the vessel calls.
4. Or that change over and use of an EAL must wait until the vessel’s next dry-docking.

We are pleased to confirm that most of Matrix ranges of Environmentally Acceptable Lubricants (EALs) meet the detailed ecological definitions and requirements described in the 2013 Vessel General Permit (VGP)



## Hydraulic Fluids

Probably the lubricants where Biodegradability is most common. In the early days of biodegradable lubricants these products were based on vegetable base oils. These first-generation products caused a lot of issues concerning material compatibility, maximum temperatures, early oxidation resulting in blocked systems. Nowadays Matrix makes a range of last generation Biodegradable Hydraulic fluids providing the technical properties you are looking for from an engineering point of view as well as sustainability. Biodegradable Hydraulic Fluids are used in all applications where leakage into the environment might occur.

## Matrix Product Range

### Ecomax SE



Ecomax SE fluids are a range of environmentally acceptable hydraulic oils based on unsaturated synthetic esters. Ecomax SE is formulated with high viscosity index base oils which provide very low pour points resulting in good low temperature characteristics. Its additive package ensures good oxidation stability and possesses good anti corrosion and anti-wear characteristics and less impact on aquatic and marine environments.

Ecomax SE can be categorized by the ISO/FDIS 15380 standard as HEES

### Ecomax XSE



Ecomax XSE are a range of environmentally acceptable hydraulic oils based on 100% saturated synthetic esters. Ecomax XSE is formulated with high viscosity index base oils which provide very low pour points resulting in good low temperature characteristics. Its additive package in combination with the saturated esters ensures good oxidation stability resulting in a long lifetime of the fluid in applications. Ecomax XSE possesses good anti corrosion and anti-wear characteristics and less impact on aquatic and marine environments. Intended for use particularly for severe applications where high pressures, fluctuating temperatures are found and where long drain intervals are required.

Ecomax XSE can be categorized by the ISO/FDIS 15380 standard as HEES

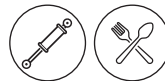
### Hydromax HT ECO



Hydromax HT ECO is a range of high performance hydraulic and hydro turbine fluids, based on the latest technology hydro treated base oil and ash less (zinc free) additive technology. The use of special additive packs warrants optimal performance and a long service life. Hydromax HT ECO combines high viscosity – temperature characteristics with good extreme pressure and anti-wear properties for reliable and trouble-free performance even at high operating temperatures. The long lifetime of Hydromax HT ECO (up to 5 times longer than standard mineral Hydraulic oils) makes this product not only Biodegradable and non-toxic but very sustainable. The long life and cleanliness results in less waste material, low oilfilter consumption and as a result of very low friction a proven lower energy consumption (between 3 and 5%) can be generated. Hydromax HT ECO has very good water separation properties which allow draining of water from systems when water intrusion is seen. Conductivity for Hydromax HT ECO is very low which allows this oil to work as a Transformer and Hydraulic oil at the same time.

Hydromax HT ECO can be categorized by the ISO/FDIS 15380 standard as HEPR

### Foodmax BIO HVI



Foodmax BIO HVI is the best of both worlds, this product is Biodegradable, nontoxic and besides this the formulation contains only components which allow the product to be Foodgrade. The High Viscosity Index allows the product to perform well under extreme temperature variations. Foodmax BIO HVI can be used in applications where both the environment as well as Foodgrade is of concern. Applications can be found in farming and agricultural environments as well as vessels processing food like for example salmon and other pelagic fishes.

Foodmax BIO HVI can be categorized by the ISO/FDIS 15380 standard as HEES

## Comparison Matrix Biodegradable Hydraulic Fluids based on Performance Characteristics

Performance characteristic	Mineral NON Bio Hydraulic fluid	HETG	HEES (Unsaturated)	HEES (Saturated)	HEPR	HEPG
Matrix product	Hydromax AW & HVI	Not available	Ecomax SE	Ecomax XSE Foodmax BIO HVI	Hydromax HT ECO	Hydromax PAG
Low temperature properties	+	-	+/-	++	+	++
Oxidation Stability	+/-	--	+/-	++	+++	++
Evaporation loss	+/-	+	+	++	++	-
Water separation	-	-	+/-	++	++	Water soluble
Anti-Rust Protection	+	++	++	++	++	-
Miscibility with mineral oils	Yes	Yes after checking	Yes after checking	Yes after checking	Yes	No
Hydrolytic Stability	++	-	+/-	+	++	++
Compatibility with seals	+	+/-	+/-	+/-	++	+
Shelf life	++	+/-	+/-	+/-	++	++
Insulation	-	+	+	++	++	-
Price	++	+	+/-	-/-	+	+/-



## Stern Tube, Stabilizer, CCP, Thruster and Gear Lubricants

Matrix has a range of Biodegradable Gear, Thruster, CPP, Stabilizer and Stern Tube lubricants. Depending on the requirements and the circumstances can be chosen from saturated esters and both emulsifying and non-emulsifying characteristics. All these products meet the detailed ecological definitions and requirements laid down in the 2013 Vessel General Permit (VGP) published by the US EPA in March 2013.

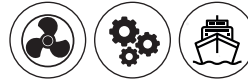
## Matrix Product Range

### Ecomax ESE



Ecomax ESE are a range of high performance emulsifying biodegradable oil based on Unsaturated Synthetic esters, developed primarily for use in stern tubes and bearings where water ingress may occur. Ecomax ESE meets the criteria in the US Coastguard Vessel General Permit (VGP) definitions for biodegradable, minimally toxic and non-bio accumulative published by the US EPA in March 2013. Next to stern tubes, Ecomax ESE is also suited for the application in reduction gear, thrusters, spur, couplings and helical and planetary gear units.

### Ecomax XESE



Ecomax XESE is high performance emulsifying biodegradable fluid for marine stern tubes and stabilisers bearings that meets Vessel General Permit (VGP). Ecomax XESE is formulated from saturated synthetic esters and ashless additives to provide maximum lubrication, effective protection over a wide range of conditions, low temperature pumpability due to its high viscosity index and good ability to withstand oxidation at high temperatures. Applications for Ecomax XESE are: Marine stern tube system, fin stabilizers and CPP (Controllable Pitch Propellers) where spills or leakage could occur.

### Ecogear X



Ecogear X is formulated to optimize lubrication in applications operating under severe circumstances such as heavy loads and temperature fluctuations. Thanks to its high biodegradability Ecogear X is a perfect solution for application found in environmentally sensitive places such as public works and many other industrial operations such as stern tubes, gear units (reduction, spur, helical) but also for the lubrication of heavy duty bearings. Ecogear X does not emulsify with water.

### Ecogear WMX



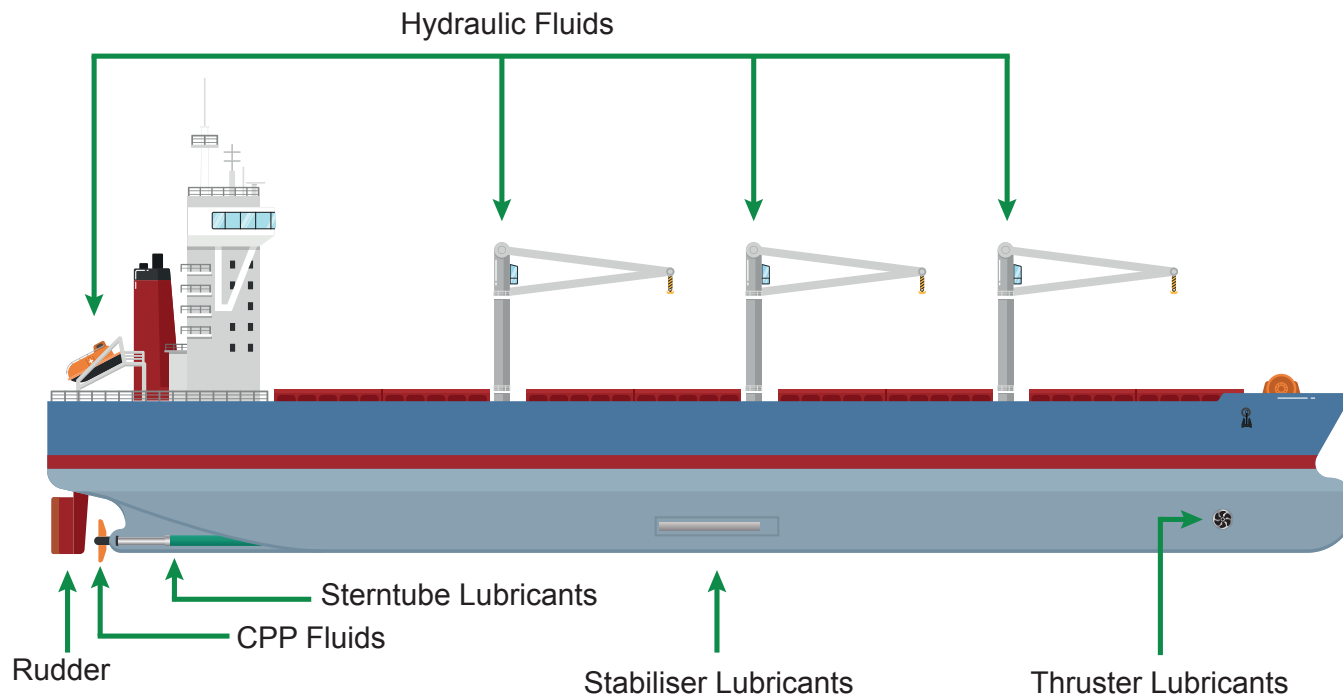
Ecogear WMX is a premium synthetic biodegradable gear oil designed to provide exceptional anti-wear/extreme pressure (AW/EP) protection and corrosion control under the most adverse conditions. The product is specially formulated for lubricating wind turbine gearboxes for effective operation and long service life. It has a high viscosity index that minimizes changes in viscosity at elevated temperatures, while ensuring good low temperature fluidity of the lubricant for cold temperature operation. It also offers good micropitting resistance and high scuffing load.

Due to its saturated ester base biodegradable composition it is environmentally friendly and good for use in sensitive areas such as at open sea.

## Matrix Products Range

### Biodegradable Gear/Stern Tube/Thruster gear oil products table

	Ecomax ESE	Ecomax XESE	Ecogear X	Ecogear WMX
Emulsifying	yes	yes	no	no
Saturated Esters	no	yes	yes	yes
Biodegradability	CEC-L-33-T93	CEC-L-33-T93	CEC-L-33-A-94	CEC-L-33-A-94
OECD 203 LC50 (96 h) mg/l	>10000	>10000	>10000	>10000
OECD 203 part 2 EL50 (15 d) mg/l	>2570	>2570	N/A	N/A
OECD 209 EC50 (3 h) mg/l	>10000	>10000	>10000	>10000



\*CPP Fluids = Controllable Pitch Propellers Fluids

## EAL Greases

Matrix EAL greases offer superior performance and excellent corrosion protection and resistance to wash off from rain and salt water. Depending on the application and the operation circumstances a specific grease can be chosen. These EAL greases meet the ecological definitions and requirements described in the Vessel General Permit (VGP).

## Matrix Product Range

### Grease BIO KBL



Cables need to be lubricated to avoid internal friction and eventually wear. Besides this they need to be protected against severe weather conditions seen on off offshore and onshore applications which can result in corrosion. Grease BIO KBL is a semi-fluid solvent free biodegradable lubricant containing solid lubricants (MoS<sub>2</sub>). This product is formulated to offer lubrication and corrosion prevention requirements of wire ropes working under all conditions. Will reduce wear and avoid seizing in chains, joints, wheel flanks and many more applications. Also possesses excellent conductive properties. The ingredients used in Grease BIO KBL naturally biodegrade by micro-organisms, making this product environmentally friendly when compared to conventional rope lubes. Typical applications areas are dockside cranes, draglines, water treatment and other situations where biodegradable lubricant is preferred for environmental reasons.

### Grease BIO HT



Grease Bio HT 2 is formulated to provide an excellent balance between environmental requirements and lubricating-anticorrosive properties. It possesses superior sealing capacity and very good resistance to water ingress, combined with good adhesion to metal surfaces. Grease Bio HT 2 is based on a biodegradable ester and an essentially non-toxic additive package to eliminate the contaminating effect of the grease on the environment. The nature of the base oil with high viscosity and lubricating film will even outperform conventional greases, specially at elevated temperatures. Applications can be found in Forrest & Public work Machinery. Bearings in water treatment plants, Bearings in Hydro Turbines, Water Pumping Installations and Marine and Off Shore applications.

### Grease BIO M WR



Grease Bio M 0 WR is used for pumps in water treatment plants like the lower bearings of Archimedes screws which are used to raise water from one level to another as well as the lubrication of chains used in cleaning bars in bio discs. Often standard industrial Calcium greases are used in this application because of the water-resistant properties. Grease BIO M WR possesses better pumpability, lubricating performance and outstanding water resistance. Grease BIO M WR can also be used as a bearing grease within its temperature range of -20 until 90 °C.

## Matrix Product Range

### Grease BIO MG/G



Grease Bio MG greases are specially developed for applications where the lubricant is an important contaminating factor to the environment and whenever it is possible that uncontrolled lubricant losses pass to the soil or to water. Suitable for general purpose greasing of all types of bearings as well as providing excellent de-watering performance on wet sliding surfaces, open gears, and heavy-duty bearings. Especially intended for railway lubrication, wheels flange and rail. Grease BIO MG/G dewater and can therefore be applied to wet surfaces. Grease BIO MG-00G and MG-000G are formulated for the lubrication of wheel flanges. Grease BIO MG-000G is approved by REBS wheel flange lubrication systems.

### Grease BIO MG-LT

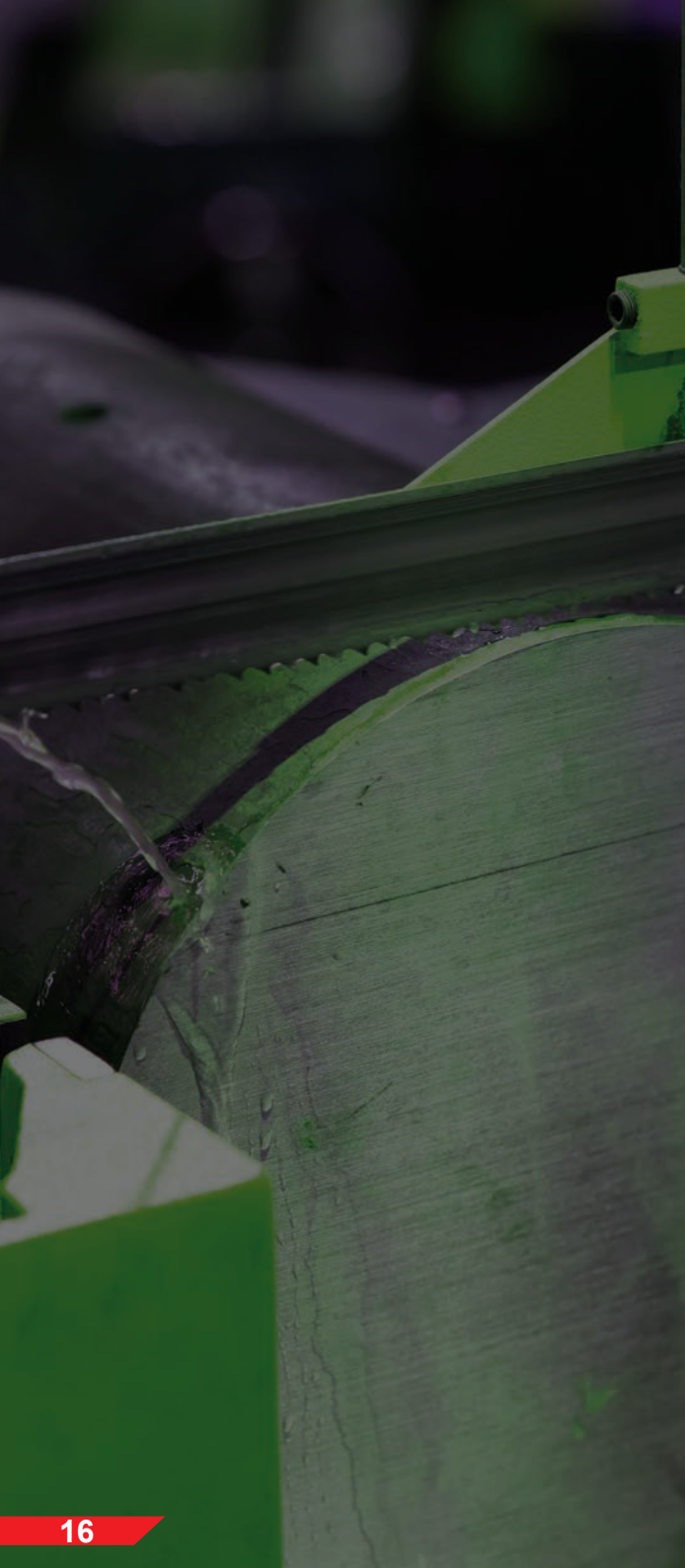


Grease BIO MG-LT has similar properties as Grease MG/G but is formulated using a low temperature Ester. Besides better low temperature characteristics properties are very similar to Grease BIO MG/G

### Biodegradable Greases Table

	Grease BIO KBL	Grease BIO M WR	Grease BIO HT	Grease BIO MG/G	Grease BIO MG/G	Grease BIO MG LT
NLGI	000/00	0 & 2	2	000	00 & 1	000 & 1
Color	Metallic Grey	Brown	Brown	Black	Black	Black
Thickener	Inorganic	Calcium	Lithium	Inorganic	Inorganic	Calcium
Base Oil	Vegetable	Ester	Ester	Ester	Ester	Ester
Base Oil Viscosity, cSt @ 40 °C	820	250	350	46	130	46
Solids	MoS2	no	no	Graphite	Graphite	Graphite
Biodegradability, % (CEC-L-33-A93)	>80	91	>80	>90	>90	>80
Operating Temperature, °C	-30 - 180	-25 - 90	-25 - 120	-25 - 180	-25 - 180	-40 - 110





## Matrix Product Range

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### Ecosaw

Ecosaw is a low viscosity synthetic oil based on esters specially formulated for the lubrication of sawing bands. It is formulated to saw wood, composites, plastics and metals. Ecosaw improves performance and increases life of saw blades, taps and cutting tools.

### Bioslide

Bioslide is a biodegradable slide way oil based on vegetable base oils. The vegetable base oils provide excellent stick slip on slide ways by reducing friction between the metal surfaces.

### Rock Drill Oil BIO 220

Rock Drill Oil Bio is an environmental alternative to standard rock drills oils used in Rock Drills, Jackhammers and other pneumatic tools. Rock Drill Oil Bio 220 provides outstanding performance even in hard and severe drilling conditions. Meets the requirement of Atlas Copco, Ingersoll Rand, Gardner Denver and Joy Manufacturing.

### Biolube XL

Biolube XL is a synthetic high-performance multipurpose lubricating fluid based on synthetic biodegradable esters. Biolube XL contains Boron Nitride and PTFE. The synergistic effect between the 2 solid lubricants provides excellent Extreme Pressure and Anti-Wear properties resulting in less wear and longer equipment life even at elevated temperatures up to 240 °C. Biolube XL can be used on chains and any application where boundary lubrication is required.

## Matrix Product Range

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### Airtop UC

Airtop UC is based on a PAG and Synthetic Ester and suitable for air compressors. Airtop UC provides a long life and trouble free operation.

### Airtop ECO

Non-glycol replacement for polyglycol (PAG) based compressor fluid. Environmentally neutral.

### Transmax ECO

Transmax Eco is a full synthetic biodegradable Transformer oil confirming IEC 61099. Transmax ECO has a higher flashpoint as regular Mineral based Transformer oils and contributes therefore to a safer operation.

### Matrix Cut BIO series

Matrix Cut BIO is a range of biodegradable metalworking fluids. The range includes products for MQL (Minimum Quantity Lubrication) systems.

### Formmax ECO

Biodegradable Concrete Release fluid formulated with vegetable components for good release and excellent finishing of the concrete surface.

### Anti Rust 4 BIO

Ester based rust preventative forming an oily film. Long term protection of ferrous and non-ferrous metals. Indoor storage 3-5 months. High flashpoint for safe operation.



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#### Disclaimer

Information presented in this brochure is considered reliable, but conditions and methods of use, which are beyond our control, may modify results. Before adopting our products for commercial use, the user should confirm their suitability. In no case should recommendations or suggestions for the use of our products be understood to sanction violation of any patent.

## 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 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 manufactured 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.

