Matrix
specialty lubricants

HYDRAULIC 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

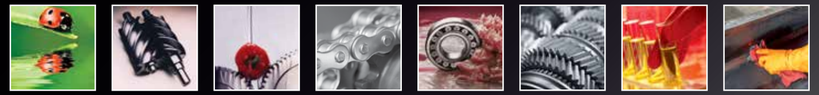
This line of products includes the latest technology soluble metal working fluids, neat cutting oils, cold and hot forging, quenching, drawing and stamping products.

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.



Hydraulic Fluids

Although hydraulic fluids are very often regarded as the most common lubricating products, the choice of a high-performance hydraulic fluid really can make a difference. Most new machines operating today are more demanding and precise than they have ever been, hence pump configurations have changed and resulted in:

- Better accuracy
- Filtering at much finer measures
- System designs are getting more compact
- Bearing designs and quality have improved. Thus they are reduced in size, yet carrying more load and subjected to higher speeds and temperature.

The choice of correct hydraulic fluid is crucial in the above mentioned pumps. Price is very often the main driver when a hydraulic fluid is purchased but it would be much better to look at the total cost of operating systems using a high-performance hydraulic fluid. i.e. When a fluid provides a much longer lifetime and anti-wear capacity, a higher fluid cost can be easily justified.

Matrix Specialty Lubricants invites you to look closer into the world of specialty hydraulic fluids to get the maximum performance out of hydraulic systems with the lowest possible operational costs.

Information on Hydraulic Fluids

A hydraulic fluid is a fluid that is needed to transmit energy in hydraulic systems.

Requirements for hydraulic fluids – especially in construction machinery:

- Good lubrication properties
- High resistance to aging
- High wetting capacity and adhesive power
- High flashpoint
- Low pour point (lowest temperature at which oil is still fluid; e.g. -5 degrees Celsius)
- Must not affect gaskets
- Resin and acid free
- Low influence of temperature on viscosity - both dynamic viscosity, which usually increases as the temperature rises, and kinematic viscosity (the relationship between the dynamic viscosity and the density)
- Low compressibility

Hydraulic fluids are composed differently depending on the application and required properties:

Mineral oil-based

The most frequently used hydraulic liquid is mineral oil-based, with suitable additives. It is also known as hydraulic oil. The requirements for this hydraulic oil are set out in ISO 6743-4 with the designations HL, HM, HV.

H and HH: Mineral oil with no active ingredients – is no longer used in practice
HL: with active ingredients to increase the corrosion protection and resistance to aging
HM: with active ingredients to increase the corrosion protection and resistance to aging and to reduce wear due to scoring in the mixed friction area
HLP: further active ingredients in addition to HL oil to reduce wear and increase resistance in the mixed friction area – widest application in practice
HV and **HVLP:** like HLP, but with increased resistance to aging, as well as an improved temperature-viscosity relationship
HLPD: like HLP, but with additives to improve particle transport (detergent effect) and dispersion capacity (water carrying capacity) and active ingredients to increase the corrosion protection

Flame resistant fluids

HFAE: Oil in water emulsions

- The water content is above 80% and is mixed with a mineral oil or soluble polyglycol-based concentrate
- With a mineral-oil based concentrate, there is the risk of separation and microbe growth
- Flame resistant, can be used at temperatures between +5°C and +55°C

HFAS: Synthetic concentrates dissolved in water

- No risk of separation, since this is a true solution, which means the hydraulic components are considerably more susceptible to corrosion

HFB: Water in oil emulsions

- The water content is above 40% and is mixed with a mineral oil. This emulsion is rarely used.
- Flame resistant, can be used at temperatures between +5°C and +60°C.

HFC: Water glycols

- The water content is more than 35% in a polymer solution
- Flame resistant, can be used at temperatures between -20°C and +60°C
- Can be used at pressures of 250 bar

HFD: Synthetic fluids

- **HFD-R:** phosphoric esters
- **HFD-S:** anhydrous chlorinated hydrocarbons
- **HFD-T:** mixture of HFD-R and HFD-S
- **HFD-U:** anhydrous other composition (consisting of fatty acid esters)
- Synthetic fluids have a higher density than mineral oil or water (not HFD-U), they can cause problems with the suction performance of pumps and affect a lot of gasket materials
- Flame resistant, can be used at temperatures between -20°C and +150°C

Biodegradable

Biodegradable hydraulic fluids are manufactured using plant oils (e.g. rapeseed oil) and used in biologically critical environments (construction machinery in water protection areas, snowgrooming equipment in mountains, etc.). The fluids are class 1 harmful substances.

Labelling : HE = Hydraulic Environmental

Classification:

- **HETG** (triglyceride base = plant oils)
- **HEES** (synthetic ester base)
- **HEPG** (polyglycol base)
- **HEPR** (other base fluids, primarily Poly-alpha-olefins)

Water

Water is unobjectionable as a hydraulic fluid in every respect (without corrosion protection, however). Pure water is not used in power hydraulics; it is mixed with oil to form an emulsion, similar to cutting oil in cutting machines (in some cases there is the problem of separation here). The first technical use of hydraulics employed water as the fluid. Water has a practically constant low viscosity.

Classification:

- **Tap water** (filtered)
- **Technical water** (water-oil emulsion)
- **Sea and salt water** (filtered, not suitably due to aggressiveness)

Standard Hydraulic Fluids

Hydromax AW
Hydromax AW is a range of standard quality hydraulic oils. Suitable for most hydraulic systems operating at stable temperatures.

Hydromax ZF
Hydromax ZF is a standard quality hydraulic oil like Hydromax AW, however formulated with a zinc-free (ashless) additive package. This makes the hydraulic fluid suitable for applications where ''yellow" metals are used or when a zinc-free formulation is required.

Hydromax ZF AS
Hydromax ZF AS (anti-static) is similar to Hydromax ZF and therefore a zinc-free (ash less) formulation, the absence of metals in zinc free formulation of the hydraulic oil influences conductivity which can create issues with the unloading of static electricity. Hydromax ZF AS is a specially formulated metal-free formulation which has a very good conductivity (>2000pS/m). Applications can be found in high flow hydraulic systems used in for example the gas and offshore industry.

Hydromax HVI
Thanks to its higher Viscosity Index Hydromax HVI is perfectly suitable for applications in which frequent temperature changes occur.

Hydromax HLPD
Hydromax HLPD is a high viscosity index mineral hydraulic oil which can absorb up to 2% water. If presence of water in a hydraulic system cannot be avoided, it is recommended to use a fluid which absorbs water. Free water in hydraulic systems will cause problems such as rust and pump cavitation.

Standard Hydraulic Fluids

Hydromax AW	DIN 51524	ISO 6743-4	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)
Hydromax AW 10	HLP	HM	10	Min	10	98	-42	160	2000
Hydromax AW 15	HLP	HM	15	Min	15	98	-39	180	2000
Hydromax AW 22	HLP	HM	22	Min	22	102	-36	180	2000
Hydromax AW 32	HLP	HM	32	Min	32	98	-27	180	2000
Hydromax AW 46	HLP	HM	46	Min	46	102	-27	180	2000
Hydromax AW 68	HLP	HM	68	Min	68	99	-27	180	2000
Hydromax AW 100	HLP	HM	100	Min	100	95	-27	180	2000
Hydromax AW 150	HLP	HM	150	Min	155	92	-24	248	2000

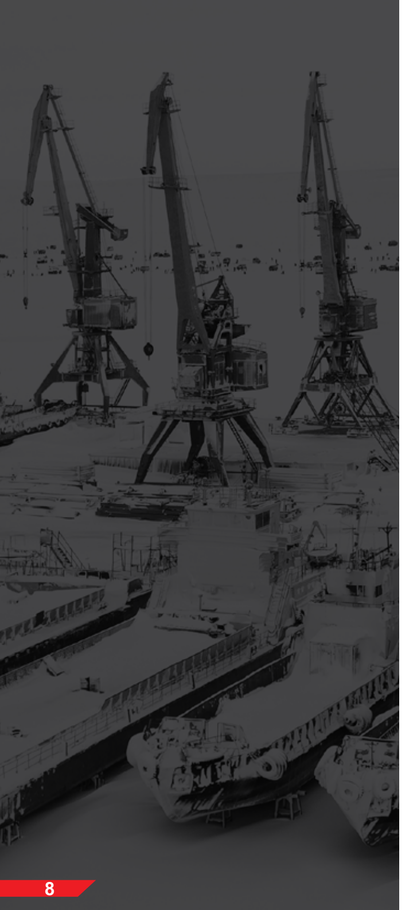
Hydromax ZF (AS)*	DIN 51524	ISO 6743-4	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)
Hydromax ZF 32	HLP	HM	32	Min	35	100	-18	180	2000
Hydromax ZF 46	HLP	HM	46	Min	47	100	-15	180	2000
Hydromax ZF 68	HLP	HM	68	Min	69	95	-15	190	2000

*** AS (Anti Static) formulations are having a high conductivity (>2000pS/m) to allow static electricity unloading.**

Hydromax HVI	DIN 51524	ISO 6743-4	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)
Hydromax HVI 15	HVLP	HV	15	Min	15.5	151	-42	180	2000
Hydromax HVI 22	HVLP	HV	22	Min	22.1	153	-39	195	2000
Hydromax HVI 32	HVLP	HV	32	Min	31.8	155	-36	211	2000
Hydromax HVI 46	HVLP	HV	46	Min	46.4	152	-33	213	2000
Hydromax HVI 68	HVLP	HV	68	Min	67	147	-30	216	2000
Hydromax HVI 100	HVLP	HV	100	Min	101	146	-27	231	2000

Hydromax HLPD	DIN 51524	ISO 6743-4	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)
Hydromax HLPD 15	HLPD	HV	15	Min	15	100	-21	>201	2000
Hydromax HLPD 32	HLPD	HV	32	Min	33	100	-15	180	2000
Hydromax HLPD 46	HLPD	HV	46	Min	47,5	100	-15	190	2000
Hydromax HLPD 68	HLPD	HV	68	Min	68	98	-15	>201	2000

Min = Mineral



Superior Performance Hydraulic Fluids

Hydromax HT HVI
Hydromax HT HVI fluids are made of hydrotreated paraffinic base oils. During the process of hydro treating the base fluids are exposed to very high temperatures and pressures. As a result of this refining process, Hydromax HT HVI has better thermal stability and high pressure resistance in comparison to standard mineral hydraulic fluids. This makes them extremely suitable for high-pressure and heavy duty equipment. Because of the absence of impurities and aromatic components the oxidation resistance is extremely good resulting in up to a five times longer lifetime of the fluid. The natural high Viscosity Index makes Hydromax HVI suitable for equipment used in environments where temperature variations occur.

Hydromax HT ECO
Hydromax HT ECO performs at the same level as Hydromax HT HVI and is formulated using the latest additive technology. As a result of this the product is non-toxic and biodegradable. The ashless chemistry provides trouble-free performance in hydraulic systems in which 'yellow'metals are used. Due to the extremely high performance level, up to five times longer lifetime, biodegradability and non-toxicity and lower electricity consumption, this hydraulic fluid is one of the most sustainable solutions on the market.

Hydromax HT ECO AS
Hydromax HT ECO AS (anti-static) is similar to Hydromax HT ECO and therefore a zinc-free (ash less) formulation, the absence of metals in zinc-free formulation of hydraulic oil influences conductivity which can create issues with the unloading of static electricity. Hydromax HT ECO AS is a specially formulated metal-free formulation which has a very good conductivity (>2000pS/m). Applications can be found in high-flow hydraulic systems, used in for example the gas and offshore industry.

Hydromax Arctic
Hydromax Arctic is specially developed for ultra low temperature applications. It provides correct lubrication under the most severe low temperatures thanks to the PAO base oil and additive package.

Hydromax Arctic M
High-performance hydraulic fluid specially recommended for low temperature applications. The high viscosity index make the oils especially suitable for the use in hydraulic systems which are used in cold environments (offshore, outdoor and cold stores).

Hydromax CWH
Hydromax CWH is a hydraulic oil specially formulated for the lubrication of hydraulic systems used in modern carwash stations and replaces conventional mineral hydraulic oils. In the event of leakage and spillage of oil from hydraulic installations, Hydromax CWH will contribute to easy clean-up operations that prevents from downtime and traces of oil on floors, cleaning installations and cars.

Superior Performance Hydraulic Fluids

Hydromax HT HVI	DIN 51524	ISO 6743-4	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)	FZG Stage Pass
Hydromax HT HVI 15	HVLP	HV	15	HT	14	168	-42	154	10000	12+
Hydromax HT HVI 22	HVLP	HV	22	HT	22	145	-50	190	10000	12+
Hydromax HT HVI 36	HVLP	HV	36	HT	35	141	-45	200	10000	12+
Hydromax HT HVI 46	HVLP	HV	46	HT	46	165	-42	206	10000	12+
Hydromax HT HVI 68	HVLP	HV	68	HT	59	141	-40	210	10000	12+
Hydromax HT HVI 100	HVLP	HV	100	HT	100	145	-40	228	10000	12+

Hydromax HT ECO (AS)**	DIN 51524	ISO 6743-4	VDMA	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)	Zinc Free	FZG Stage Pass
Hydromax HT ECO 15 (AS)	HVLP	HV	HEPR	15	HT	15	179	-45	185	10000	X	12
Hydromax HT ECO 22 (AS)	HVLP	HV	HEPR	22	HT	22	188	-45	229	10000	X	12
Hydromax HT ECO 32 (AS)	HVLP	HV	HEPR	32	HT	32	165	-45	201	10000	X	12
Hydromax HT ECO 36 (AS)	HVLP	HV	HEPR	36*	HT	35	179	-42	235	10000	X	12
Hydromax HT ECO 46 (AS)	HVLP	HV	HEPR	46	HT	45	182	-42	240	10000	X	12
Hydromax HT ECO 68 (AS)	HVLP	HV	HEPR	68	HT	71	153	-42	242	10000	X	12
Hydromax HT ECO 100 (AS)	HVLP	HV	HEPR	100	HT	100	145	-42	245	10000	X	12

***ISO VG grade which allows replacement of ISO VG 32 and ISO VG 46. ** AS (Anti Static) formulations are having a high conductivity (>2000pS/m) to allow static electricity unloading**

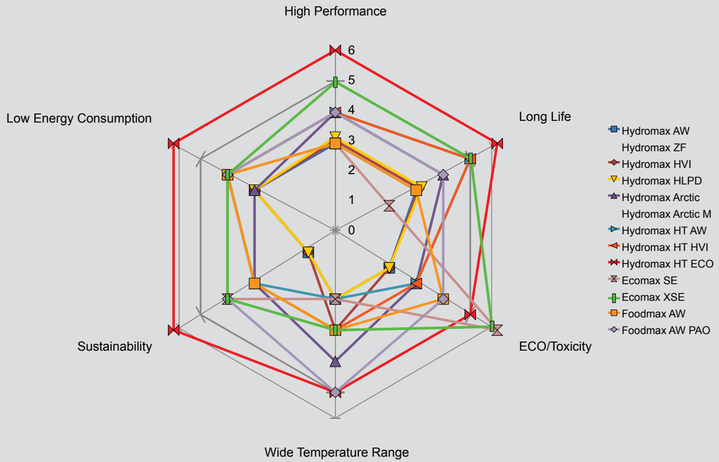
Hydromax Arctic + Arctic M	DIN 51524	ISO 6743-4	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)
Hydromax Arctic 32	HLP	L-HS	32	PAO	32	133	-63	244	12000
Hydromax Arctic M 15	HVLP	L-HS	15	Min	15	300	-54	> 110	3000
Hydromax Arctic M 32	HVLP	L-HS	32	Min	32	300	-54	> 162	3000
Hydromax Arctic M 46	HVLP	L-HS	46	Min	46	> 260	-42	> 162	3000

Remarks: Ultra low temperature applications

Hydromax CWH	DIN 51524	VDMA	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C
Hydromax CWH 46	HFC	HEPG	46	WG	47	> 180	-51	None

HT = Hydrotreated, PAO = Poly Alpha Olefin, Min = Mineral, PAG = Poly Alkylene Glycol, WG = Water Glycol

Multi Selection Criteria Radar for Hydraulic Oils



Fire-resistant Hydraulic Fluids

In many production processes there are numerous sources of ignition. In the event of a leakage, mineral oils will easily catch fire resulting in excessive damage to equipment and danger to workers. In cases where these ignition sources cannot be avoided it is recommended to use fire resistant fluids (FRF). These fluids often are used in the production of steel, titanium, aluminum, or in casting operations, production of glass and for example in mining or ovens. Fire-resistant hydraulic fluids are categorized according to the table below. Besides the below mentioned standards it is a matter of personal choice and OEM requirement for selecting the right fluid. Every type of product has its own specific characteristics.

ISO 6743/CETOP Lux. Ber. /VDMA DIN 51502	Composition	Field of Application	Temperature Range °C
HFA	Oil in water emulsion, max 20% concentration	Mining, hydraulic presses	5 to 55
HFB	Water in oil emulsion, containing max 60% oil	Mining	5 to 60
HFC	Polymer solution containing 35-55% water. Reasonable lubricity and anti-wear properties	Mining, foundries, moderate pressure, environmental protection	-20 to 60
HFDU	Carboxylic ester, good lubricity and anti-wear properties	Steel industry, foundries, die-casting, mining	-35 to 100
HFDR	Phosphate ester, excellent lubricity and anti-wear properties	Turbine control units, steel industry, foundries, die-casting, mining	20 to 150

Fire-resistant Hydraulic Fluids

Sol Plus 44 TF

Matrix Sol Plus 44 TF is a transparent fluid suitable for HFA-S hydraulic systems. The product is formulated from carefully selected components which are working actively to fight smell problems and corrosion of components. Applications are often found in system where components are tested at high pressures.

Hydromax FR-WG

Water-based solution of special glycols and anti-wear, antioxidant and anticorrosive additive package. Suitable for wide range of hydraulic applications. Meets the requirements of ISO HFC class. (Aluminium die-casting)

Hydromax FR-E

Hydromax FR-E is a long-life hydraulic fluid with a high flash point based on a synthetic ester, providing excellent lubricating properties and increases equipment life. Hydromax FR-E should be used whenever systems are operating close to heat sources. Hydromax FR-E is highly biodegradable, so small leakages will not result in environmental damage. Meets the requirements of ISO 6743/4 standard ISO HFDU class. Hydromax FR-E is suitable for hydraulic applications in i.e.:

- Hot rolling
- Continuous casting
- Ingots conveyors
- Metal casting
- Stamping, forging and sintering
- Thermal treatments ovens
- Welding machines

Hydromax FR-PE

Hydromax FR-PE is a hydraulic fluid with a high flash point based on a synthetic triaryl phosphate ester fluid providing high chemical stability and good oxidation resistance. The fluid should be used whenever systems are operating close to heat sources. Hydromax FR-PE is a self-extinguishing, non-aqueous hydraulic fluid that does not support its own combustion.

- Steel and aluminum furnaces
- Die-casting
- Compressors
- Hydraulic systems of power turbines

Fire-resistant Hydraulic Fluids

Sol Plus 44 TF	ISO 6743 CETOP Lux. Ber./ VDMA DIN 51502	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C
Sol Plus 44 TF	HFA-S	N/A	Synthetic	Close to the viscosity of water	3-5%	N/A	None
				concentration in water			

Hydromax FR-WG	ISO 6743 CETOP Lux. Ber./ VDMA DIN 51502	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C
Hydromax FR-WG 2	HFC	2	WG	2	N/A	< -40	None
Hydromax FR-WG 46	HFC	46	WG	46	N/A	-47	None
Hydromax FR-WG 68	HFC	68	WG	68	250	< -30	None

Hydromax FR-E	ISO 6743 CETOP Lux. Ber./ VDMA DIN 51502	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C
Hydromax FR-E 46	HFDU	46	E	42-50	180	-25	270
Hydromax FR-E 68	HFDU	68	E	62-74	180	-27	300

Hydromax FR-PE	ISO 6743 CETOP Lux. Ber./ VDMA DIN 51502	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C
Hydromax FR-PE 46	HFDR	46	PE	42-48	25	-17	245

WG = Water Glycol, E = Ester, PE = Phosphate Ester

Biodegradable Hydraulic Fluids

Ecomax SE

Ecomax SE is a series of biodegradable hydraulic fluids based on synthetic esters which come from renewable resources. They are both approved according to Swedish Standard and EU ECO label. In comparison to other vegetable-based bio fluids Ecomax SE has excellent oxidation stability resulting in increased working life while at the same time the fluid provides very good lubricating capacity.

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 performs at the same level as Hydromax HT HVI and is formulated using the latest additive technology. As a result of this the product is non-toxic and biodegradable. The ashless chemistry provides trouble-free performance in hydraulic systems in which 'yellow'metals are used. Due to the extremely high performance level, up to five times longer lifetime, biodegradability and non-toxicity and lower electricity consumption this hydraulic fluid is one of the most sustainable solutions on the market.

Food Grade Hydraulic Oils

Foodmax® AW

Foodmax® AW is non-toxic and formulated using specially selected ,highly-refined base stocks in combination with the latest additive technology. Foodmax® AW is suitable for applications where incidental contact with food or raw materials is possible during the production process. Due to the very low pour point Foodmax®AW PAO is better suited to low temperature applications in comparison to Foodmax®AW. Foodmax® AW 22 is a higher performance alternative to soap/water mixtures for the lubrication of conveyor belts in the beverage industry.

Foodmax® AW PAO

Foodmax® AW PAO is non-toxic and formulated using specially selected synthetic base stocks in combination with the latest additive technology. Foodmax® AW PAO is suitable for applications where incidental contact with food or raw materials is possible during production. Because of its great performance characteristics and carefully chosen additives, Foodmax® AW PAO oils can be used in most applications in the food manufacturing and processing industry.

Foodmax® BIO HVI

Food grade and biodegradable hydraulic fluid, a truly unique combination of a non-toxic (food grade) fluid and biodegradability. This makes the product suitable for application where both characteristics are needed. Examples can be found in hydraulic systems which are operated in food processing which takes place in environmental sensitive areas such as the fishing industry.

For more information about the extensive Foodmax® range please consult our separate Food grade lubricants and greases brochure.

Biodegradable Hydraulic Fluids

Ecomax SE	VDMA 24568 ISO/FDIS 15380	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)	Zinc Free
Ecomax SE 15	HEES	15	E	15	170	-45	> 200	650	X
Ecomax SE 22	HEES	22	E	22	150	-44	> 200	650	X
Ecomax SE 32	HEES	32	E	32	210	-42	> 200	650	X
Ecomax SE 46	HEES	46	E	46	195	-42	> 200	650	X
Ecomax SE 68	HEES	68	E	65	195	-39	> 200	650	X

Ecomax XSE	VDMA 24568 ISO/FDIS 15380	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)	Zinc Free
Ecomax XSE 46	HEES	46	E	46	>190	< -40	> 235	> 8000	X

Hydromax HT ECO	DIN 51524	ISO 6743-4	VDMA	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)	Zinc Free	FZG Stage Pass
Hydromax HT ECO 15	HVLP	HV	HEPR	15	HT	15	175	-45	160	>10000	X	12
Hydromax HT ECO 22	HVLP	HV	HEPR	22	HT	22	150	-35	220	>10000	X	-
Hydromax HT ECO 32	HVLP	HV	HEPR	32	HT	32	165	-45	201	>10000	X	12
Hydromax HT ECO 36	HVLP	HV	HEPR	36*	HT	35	165	-45	201	>10000	X	12
Hydromax HT ECO 46	HVLP	HV	HEPR	46	HT	45	165	-45	206	>10000	X	12
Hydromax HT ECO 68	HVLP	HV	HEPR	68	HT	71	162	-39	242	>10000	X	12
Hydromax HT ECO 100	HVLP	HV	HEPR	100	HT	100	137	-21	230	>10000	X	12

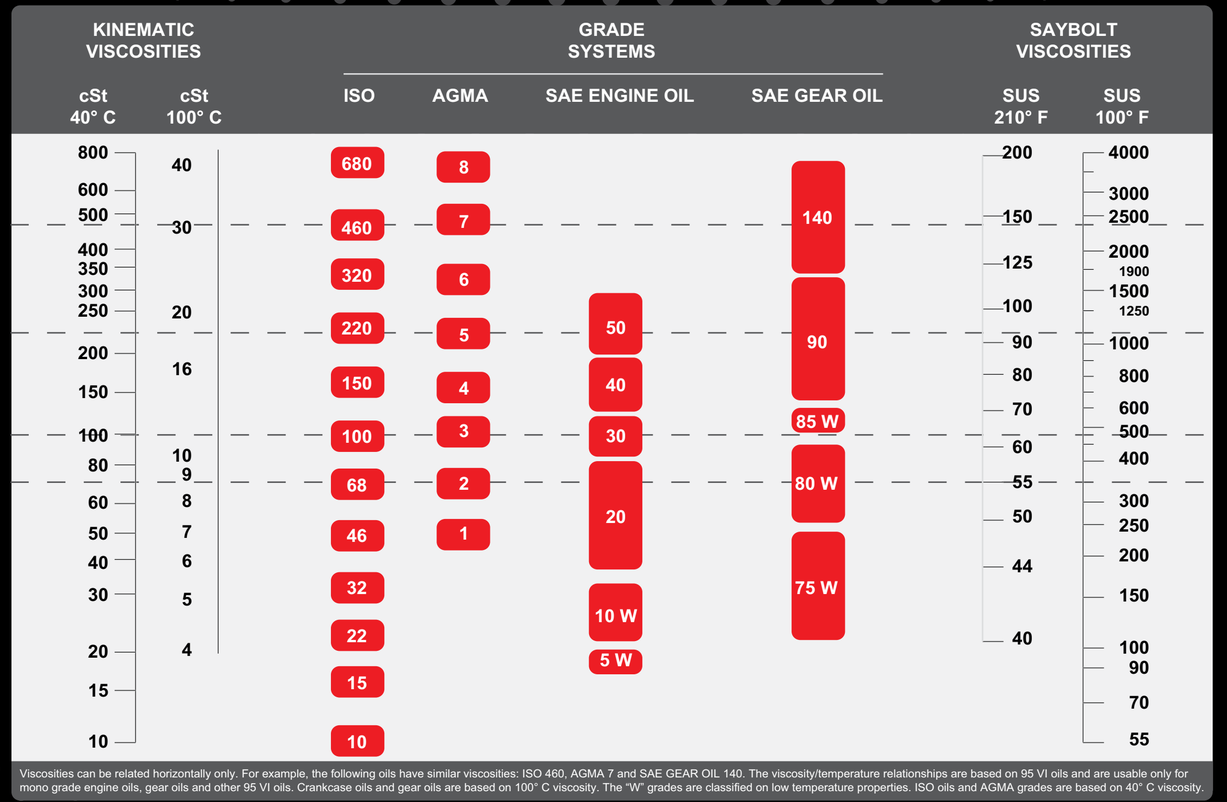
***ISO VG grade which allows replacement of ISO VG 32 and ISO VG 46**

Food Grade Hydraulic Fluids

Foodmax® AW	DIN 51524	ISO 6743-4	NSF Category	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Oxidation Stability (D943)	Zinc Free
Foodmax® AW 22	HLP	HM	H1	22	HT	22	105	-24	165	10000	X
Foodmax® AW 32	HLP	HM	H1	32	HT	32	105	-24	170	10000	X
Foodmax® AW 46	HLP	HM	H1	46	HT	46	105	-21	180	10000	X
Foodmax® AW 68	HLP	HM	H1	68	HT	68	105	-21	200	10000	X
Foodmax® AW 100	HLP	HM	H1	100	HT	100	100	-21	215	10000	X
Foodmax® AW PAO 22	HVLP	HM	H1	22	PAO	22	127	-60	200	10000	X
Foodmax® AW PAO 32	HVLP	HM	H1	32	PAO	32	141	-60	222	10000	X
Foodmax® AW PAO 46	HVLP	HM	H1	46	PAO	46	143	-57	248	10000	X
Foodmax® AW PAO 68	HVLP	HM	H1	68	PAO	68	140	-58	258	10000	X
Foodmax® AW PAO 100	HVLP	HM	H1	100	PAO	100	144	-55	268	10000	X
Foodmax® AW PAO 100	HVLP	HM	H1	100	PAO	100	144	-55	268	10000	X
Foodmax® BIO HVI 32	N/A	N/A	H1	32	E	29-35	>190	<-39	>280	1000	X
Foodmax® BIO HVI 46	N/A	N/A	H1	46	E	42-50	>190	<-39	>280	1000	X
Foodmax® BIO HVI 68	N/A	N/A	H1	68	E	59-77	>190	<-39	>280	1000	X

E = Ester, HT = Hydrotreated, PAO = Poly Alpha Olefin

Notes



Viscosities can be related horizontally only. For example, the following oils have similar viscosities: ISO 460, AGMA 7 and SAE GEAR OIL 140. The viscosity/temperature relationships are based on 95 VI oils and are usable only for mono grade engine oils, gear oils and other 95 VI oils. Crankcase oils and gear oils are based on 100° C viscosity. The "W" grades are classified on low temperature properties. ISO oils and AGMA grades are based on 40° C viscosity.

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 any 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: Naphthenics, 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), Hydrocracked/Hydroisomerized, Unconventional Base Oils (UCBO), Organic Esters, Polyglycols (PAG).

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

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. Healing 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.

UK version 3.2

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