



**GEAR LUBRICANTS & GREASES**



## 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

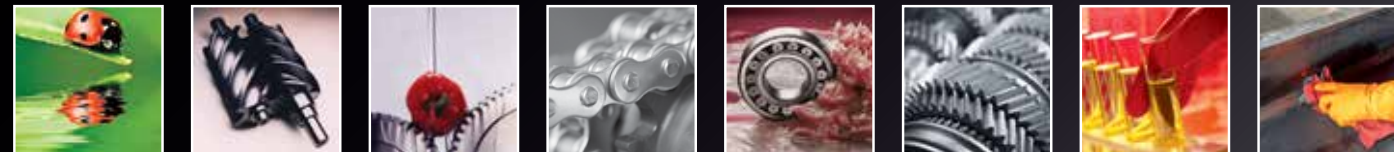
This line of products includes the latest technology soluble metal working fluids, neat cutting oils, cold and hot forging, quenching, drawing and stamping products.

## 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, 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.

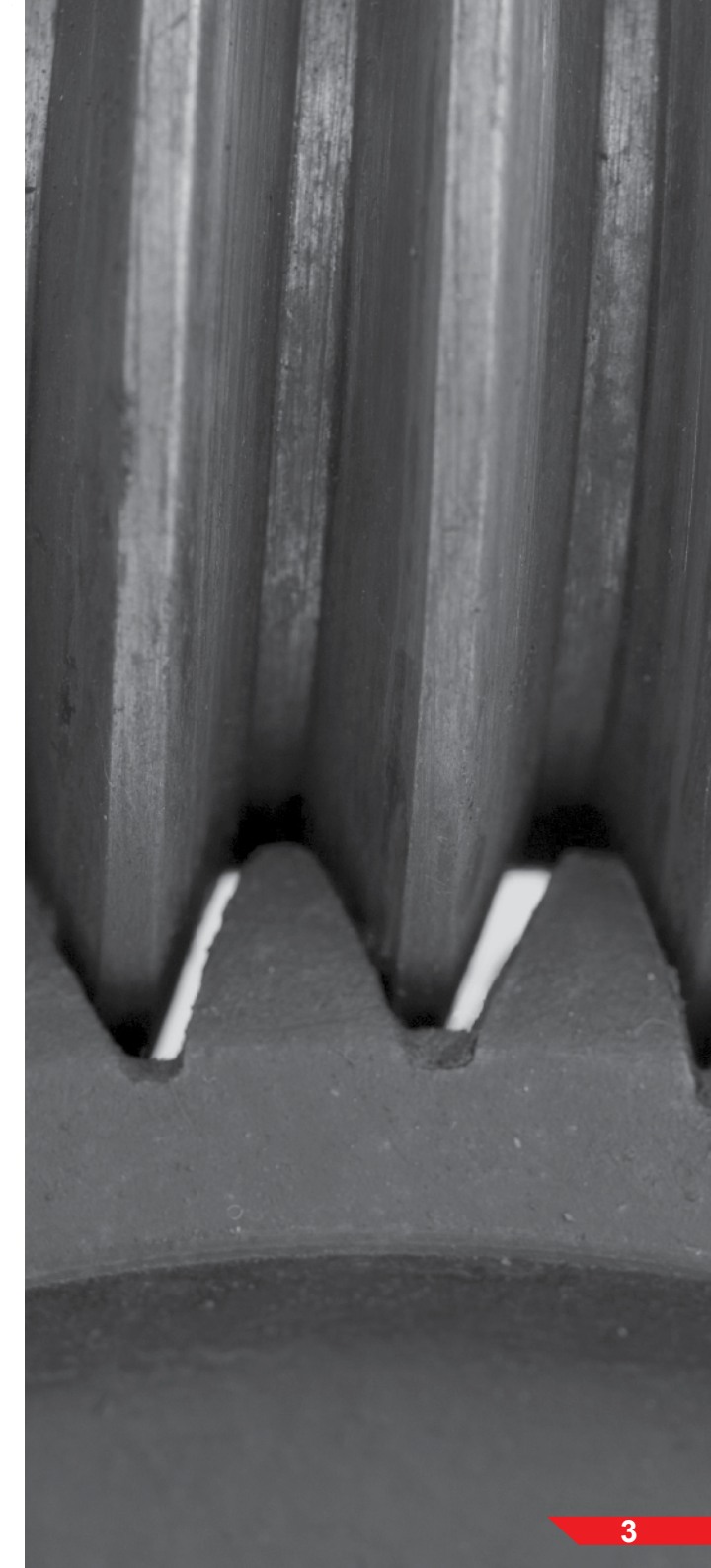


## Gear Lubricants and Greases

Gears and transmissions are used in all industries being an essential part of many production processes, reducing or increasing speed or torque. Gears are found between the primary drives (motors or engines) and the driven equipment such as conveyors, elevators, mills and screws.

Gear lubricants are crucial when it comes to trouble-free operation of these applications. During operation, the oil often has multiple tasks to fulfill including cooling and removing friction heat but above all to lubricate the sliding rolling contacts protecting against wear and friction. In comparison with all machine elements of a transmission such as wheels, bearings, shafts and seals the lubricant is the least expensive however it is essential to select the right product in order to warrant a trouble-free operation and increased service life of the equipment.

The purpose of this brochure is to allow the user to select the right lubricant based on the various parameters which are key in gear lubrication: temperature, load and gear type.



## Mineral Gear Lubricants

### Gearmax

Gearmax is a mineral gear oil designed for the lubrication of open and closed gears working under heavy conditions and/or shock loads. Excellent wear protection under extreme pressures/shock loads. High thermal and oxidation stability allowing continuous use at elevated temperatures. Effective protection against rust and corrosion. Very good anti-foam properties as well as water separation characteristics.

### Gearmax Heavy

Gearmax Heavy has been specially formulated for heavy loaded and high temperature submitted gears such as large gear boxes and reducing gears and rolling mills. For the lubrication of all equipment that need highly viscous oils. Gearmax Heavy fluids provide maximum protection from oxidation and rust to steel and brass materials and very fast water separation in those gears where water occasionally can enter the gear boxes.

### Gearmax XP

Gearmax XP is range of premium mineral gear oils developed for any type of gearbox. The latest technology in base oils and a special additive package provides excellent protection against micro pitting. Gearmax XP provides superior EP properties, a very good anti oxidant and rust protection, excellent anti wear properties and has a low tendency to foaming. Furthermore Gearmax XP provides quick moisture separation and optimal filterability. Gearmax XP can be used in industrial gears when EP properties are needed or whenever US STEEL 224, DIN 51517 CLP or CINCINNATI MILACRON. Additionally It meets the FLENDER specifications.

### Geartop HP

The Geartop HP range is formulated with a new generation of technically advanced additives and paraffinic base fluids which show higher performance compared to conventional gear lubricants. Geartop HP is advised in any type of gearbox and in general whenever an extreme pressure lubricant is required. The product contains liquid molybdenum to improve the EP properties of Geartop HP. Geartop HP is free of lead and silicone components. As a result of the special formulation lower friction is expected, resulting in a lower operating temperature and energy consumption.



## Mineral Gear Lubricants

Gearmax	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	FZG A/8.3/90
Gearmax 68	68	Mineral	68	98	-15	201	> 12
Gearmax 100	100	Mineral	100	>95	-27	>210	> 12
Gearmax 150	150	Mineral	149	>95	-21	>201	> 12
Gearmax 220	220	Mineral	221	>96	-15	>201	> 12
Gearmax 320	320	Mineral	319	>95	-9	>201	> 12
Gearmax 460	460	Mineral	462	>96	-9	>201	> 12
Gearmax 680	680	Mineral	678	>96	-15	>201	> 12

Gearmax Heavy	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	FZG A/8.3/90
Gearmax Heavy 1500	1500	Mineral	1500	107	-12	> 200	> 12
Gearmax Heavy 3800	3800	Mineral	3800	90	-6	> 200	> 12

Gearmax XP	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	FZG A/8.3/90
Gearmax XP 100	100	Mineral	100	95	-15	210	> 12
Gearmax XP 150	150	Mineral	150	95	-15	210	> 12
Gearmax XP 220	220	Mineral	220	90	-13	210	> 12
Gearmax XP 320	320	Mineral	320	90	-10	215	> 12
Gearmax XP 460	460	Mineral	460	90	-9	220	> 12

Geartop HP	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	FZG A/8.3/90
Geartop HP 220	220	Paraffinic	200-240	100	-12	250	> 14
Geartop HP 320	320	Paraffinic	290-350	100	-10	260	> 14
Geartop HP 460	460	Paraffinic	420-490	100	-9	270	> 14



## Synthetic Gear Lubricants

### Geartop PAO

The Geartop PAO gear oils are a range of products particularly suited to gear applications operating under extreme conditions. These products are formulated with PAO synthetic base stocks in order to provide performance superior to conventional mineral oils. Furthermore Geartop PAO series are fully compatible with mineral products guaranteeing a smooth change over. The product provides significantly improved load carrying ability, excellent wear and rust protection, high viscosity index, high flash point, low pour point, outstanding oxidative stability and cleaner systems.

### Geartop PAG

Geartop PAG fluids are premium quality, 100% synthetic polyalkylene glycol based industrial gear oils containing antioxidant and anticorrosion additives with excellent thermal properties. The very high viscosity index offers fluidity down to very low temperatures and adequate film thickness at elevated temperatures. These are recommended for heavily loaded gearboxes and worm wheel boxes, including the so-called filled-for-life units. As a result of the special formulation lower friction is achieved, resulting in a lower operating temperature and energy consumption.

### Geartop PFPE

Geartop PFPE is a non flammable, colourless and odourless PFPE oil. It is completely inert both physically and chemically and therefore Geartop PFPE is extremely suitable in situations where aggressive liquids or gasses are attacking the lubricant. Provides excellent lubrication under circumstances where both mineral and other type of synthetic lubricants will fail and is fully compatible with all widely used elastomers, seals, gaskets, plastics and metals. When normal and even other synthetic gear oils are not providing the technical properties required Geartop PFPE might be the only solution left.

### Geartop OG

Geartop OG is a special clear lubricant designed for the lubrication of large open gears. It is formulated from special synthetic oils. Offering excellent high pressure resistance and, outstanding wear protection. Geartop OG can be used at temperatures of up to 120 °C. It is free of bitumen, solvents, chlorine and solid lubricants. Geartop OG provides extra-ordinary extreme pressure properties without the presence of solid black lubricants like used in the past. The clear and transparent appearance allows easy gear inspection. Thanks to its high viscosity, Geartop OG provides very good surface adherence, creating a thick and stable lubrication film even when lower lubricant amounts are used. Geartop OG provides a reliable running operation of the gear drive.

## Synthetic Gear Lubricants

Geartop PAG	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	FZG A/8.3/90
Geartop PAG 150	150	PAG	150	210	-40	240	12
Geartop PAG 220	220	PAG	220	210	-40	240	12
Geartop PAG 320	320	PAG	320	220	-40	240	12
Geartop PAG 460	460	PAG	460	240	-30	240	12
Geartop PAG 680	680	PAG	680	245	-30	240	12
Geartop PAG 1000	1000	PAG	1000	284	-30	296	12

Geartop PAO	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	FZG A/8.3/90	4-ball Welding Load, kg
Geartop PAO 68	68	PAO	68	> 140	< -50	> 260	> 12	650
Geartop PAO 100	100	PAO	100	> 140	< -50	> 265	> 12	650
Geartop PAO 150	150	PAO	150	> 140	< -45	> 260	> 12	650
Geartop PAO 220	220	PAO	220	> 140	< -45	> 260	> 12	650
Geartop PAO 320	320	PAO	320	> 150	< -45	> 260	> 12	650
Geartop PAO 460	460	PAO	460	> 160	< -40	> 260	> 12	650
Geartop PAO 680	680	PAO	680	> 160	< -35	> 265	> 12	650
Geartop PAO 1000	1000	PAO	1000	> 200	< -40	> 265	> 12	250

Geartop PFPE	ISO VG	Base Oil	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	FZG A/8.3/90	4-ball Welding Load, kg
Geartop PFPE 250	250	PFPE	250	134	-25	none	14	390
Geartop PFPE 350	350	PFPE	350	141	-25	none	14	390

Geartop OG	ISO VG	Base Oil	Kinematic Viscosity 100 °C	Pour Point °C	Flash Point °C	FZG A/8.3/90
Geartop OG 150	150	Synthetic Blend	150	< -10	> 220	> 12
Geartop OG 320	320	Synthetic Blend	320	< 8	> 200	> 12
Geartop OG 490	490	Synthetic Blend	490	< 8	> 200	> 12
Geartop OG 1000	1000	Synthetic Blend	1000	< 8	> 200	> 12
Geartop OG 1200	1200	Synthetic Blend	1200	< 10	> 220	> 12

## Special Gear Greases

### Grease Lithium GL

Grease Lithium GL is suitable for the lubrication of rams in mechanical presses, gear motors, small gears, worm gears with steel or steel components, toothed couplings, slide ways, guides and large chain drives. Can be applied through centralized systems or immersion lubrication of gears.

### Grease CGL LS

Grease CGL LS is a synthetic lubricating grease especially designed for the lubrication of closed gears and systems requiring a long life grease with excellent resistance to aging within a wide range of operating temperatures (-40 to 150 °C) under very severe service conditions. Grease CGL LS is provided with high stability and high adhesion properties and provides life time lubrication reducing maintenance costs. Grease CGL LS is formulated according to the latest performance specification for the use in closed gears, endless crown reducers and variators. Grease CGL LS lasts at least 5 times longer in comparison with mineral based grease designed for this application. Also suitable for worm gears and heavy loaded gears.

### Grease OGL

Grease OGL is a special, rheopectic grease with high adhesion and resistance properties. rheopectic greases will increase in consistency under mechanical pressure. Does not contain any solid lubricants, offering excellent lubrication properties thanks to the carefully selected EP additives. Free of heavy metals and bitumen.

### Foodmax® OGL

Foodmax OGL is an H-1 grease for incidental contact with food, designed primarily for open gear applications where a soft grease is called for crushing and other applications, widely found in sugar cane processing. Also suitable for wire rope lubrication.

## Open Gear Greases

### Inomax H-series

The range of Inomax H contains state of the art, solids fortified product for the lubrication of open gears. The product is aluminium complex thickened and formulated with high quality base oil and a set of anti seize, anti corrosive additives and EP (Extreme Pressure) and adhesion improvers. The added graphite provides a very stable lubricating and adherent film possessing superior resistance to high temperatures and loads. Inomax H shows optimum efficiency and meets the requirements of crown drives in ball and rotary mills. It also passes the DeLimon and Helios spraying tests, suitable for application through centralised lubrication or lubrication systems. The range of Inomax H products is free of components which are harmful to the environment (bitumen, chlorine, heavy metals and solvents).

### Inomax HM-series


Inomax H-00/000 HM has been specially designed to lubricate heavy duty mills and open gear sets from cement and mining industry as well as from some chemical and metallurgic industry. The product is also very suitable for the lubrication of preheated rotary ball mills, usually used for carbon milling in electricity plants. Thanks to its very high base oil viscosity these products provide hydrodynamic lubrication even at high temperatures.

### Inomax H-R


Inomax H-R is a mineral based lubricant with solid lubricants. It is specially formulated for the running-in of new gears and avoids seizing with limited loads. Inomax H-R is also used when early pitting and seizing occurs, to level or smoothen the tooth flanks.

The Inomax range also contains special repair fluids for open gears. Specific data is available upon request.

## Special Gear Greases

Grease 	NLGI Class	Base Oil	Thickener	Base Oil Viscosity 40 °C	Temperature Range °C	FZG A/8.3/90	4-ball Welding Load, kg
Grease Lithium GL	00/000	Mineral	Lithium	680	-10 - 100	> 12	> 700
Grease CGL LS	00	PAG	Lithium	220	-40 - 150	> 12	> 160
Grease OGL	1	Semi Synthetic	Inorganic	750	-30 - 150	> 12	700
Foodmax® OGL	0	Synthetic	Inorganic	190	-40 - 160	> 12	620

## Open Gear Greases

Inomax® 	NLGI Class	Base Oil	Thickener	Base Oil Viscosity 40 °C	Solids	FZG A/8.3/90	4-ball Welding Load, kg
Inomax H-0	0	Mineral	Aluminium Complex	600-650	Graphite	> 12	> 700
Inomax H-1000	0	Mineral + Polymer	Aluminium Complex	1000	Graphite	> 12	> 700
Inomax H-1500 plus	0	Mineral + Polymer	Aluminium Complex	1500	Graphite	> 12	> 800
Inomax H-3000	0	Mineral + Polymer	Aluminium Complex	3500	Graphite	> 12	> 800
Inomax H-00 HM	00	Mineral + Polymer	Aluminium Complex	13000	Graphite	> 12	> 800
Inomax H-000/HM	000	Mineral + Polymer	Aluminium Complex	21000	Graphite	> 12	> 800
Inomax H-00/R	00	Mineral	Aluminium Complex	550	Graphite	> 12	> 700
Inomax H-1/R	1	Mineral	Aluminium Complex	1000	Graphite	> 12	> 700

PAG = Polyalkylene Glycol



## Foodgrade Gear Lubricants

Gearboxes are seen everywhere in food processing plants. Most of the time they are relatively small and will operate at both low and high temperatures. Depending on the circumstances and type of gearbox the right choice can be made from Foodmax® Gear, Gear PAO or Gear PAG.

### Foodmax® Gear

Food grade range of lubricants for gears, bearings and transmissions. Foodmax® Gear is a range of lubricants in which a combination of the latest base stock technology together with special additives delivers a very high performance. All base components used for the formulation are non-toxic and food grade. Also suitable as chain oil when a non-sticky lubricant is required.


### Foodmax® Gear PAO


Range of fully synthetic food grade gear oils, particularly suited for the lubrication of drive chains, conveyor chains, gearboxes and reduction units. Foodmax® Gear PAO 680 and 1000 contain special additives that extend relubrication intervals. These lubricants can also be used as chain oils. Foodmax® Gear PAO is specially designed for low temperature applications. Foodmax Gear PAO 220 Premium contains a UV marker for tracing leakages in for example paper machines.


### Foodmax® Gear PAG

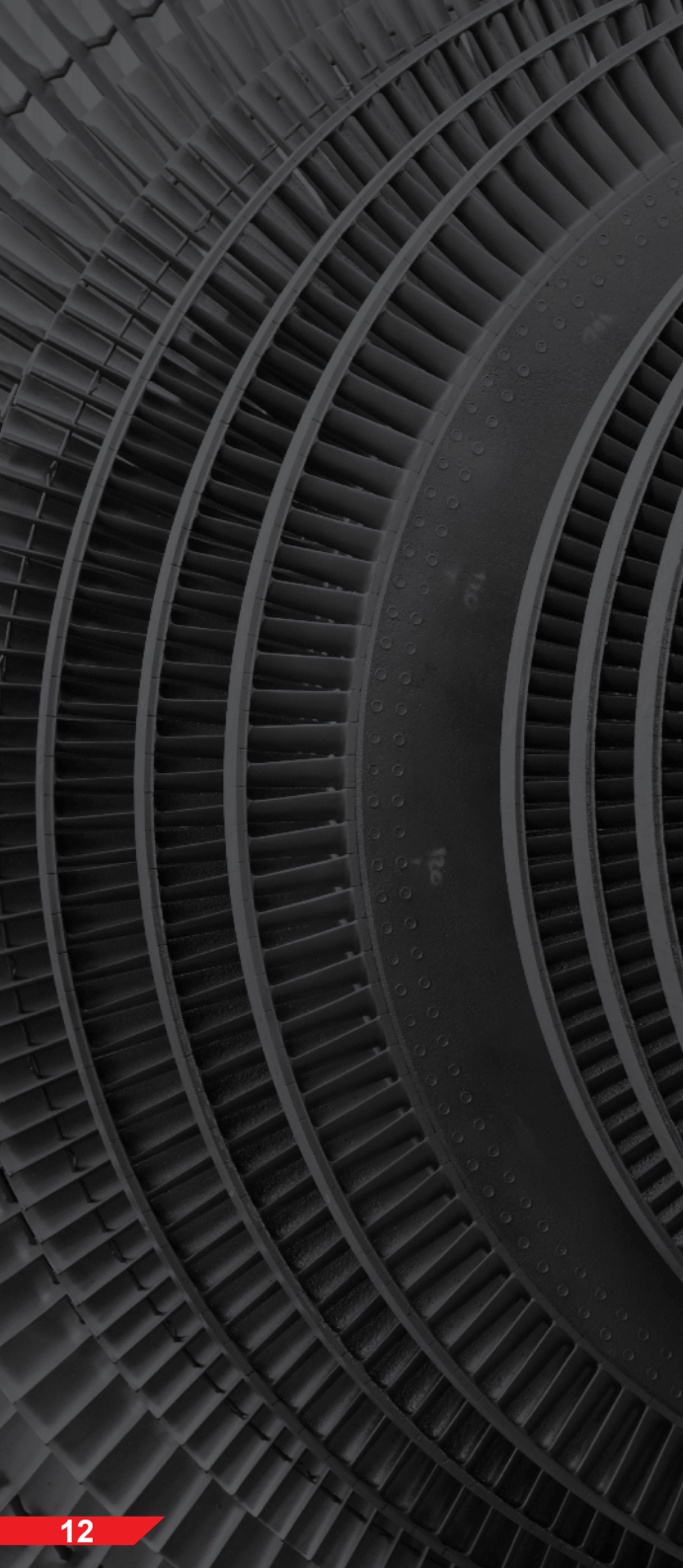
Foodmax® Gear PAG is a synthetic oil with excellent anti-wear properties, high stability to oxidation and a low pour point. It is neutral to metals including aluminum alloys and copper. It resists mechanical shearing, is very stable to ageing and has very good viscosity temperature characteristics. Foodmax® Gear PAG is suitable for the most severely loaded gearboxes. Foodmax® Gear PAG is not miscible with other synthetic and mineral fluids.

## Foodmax® Selection Table

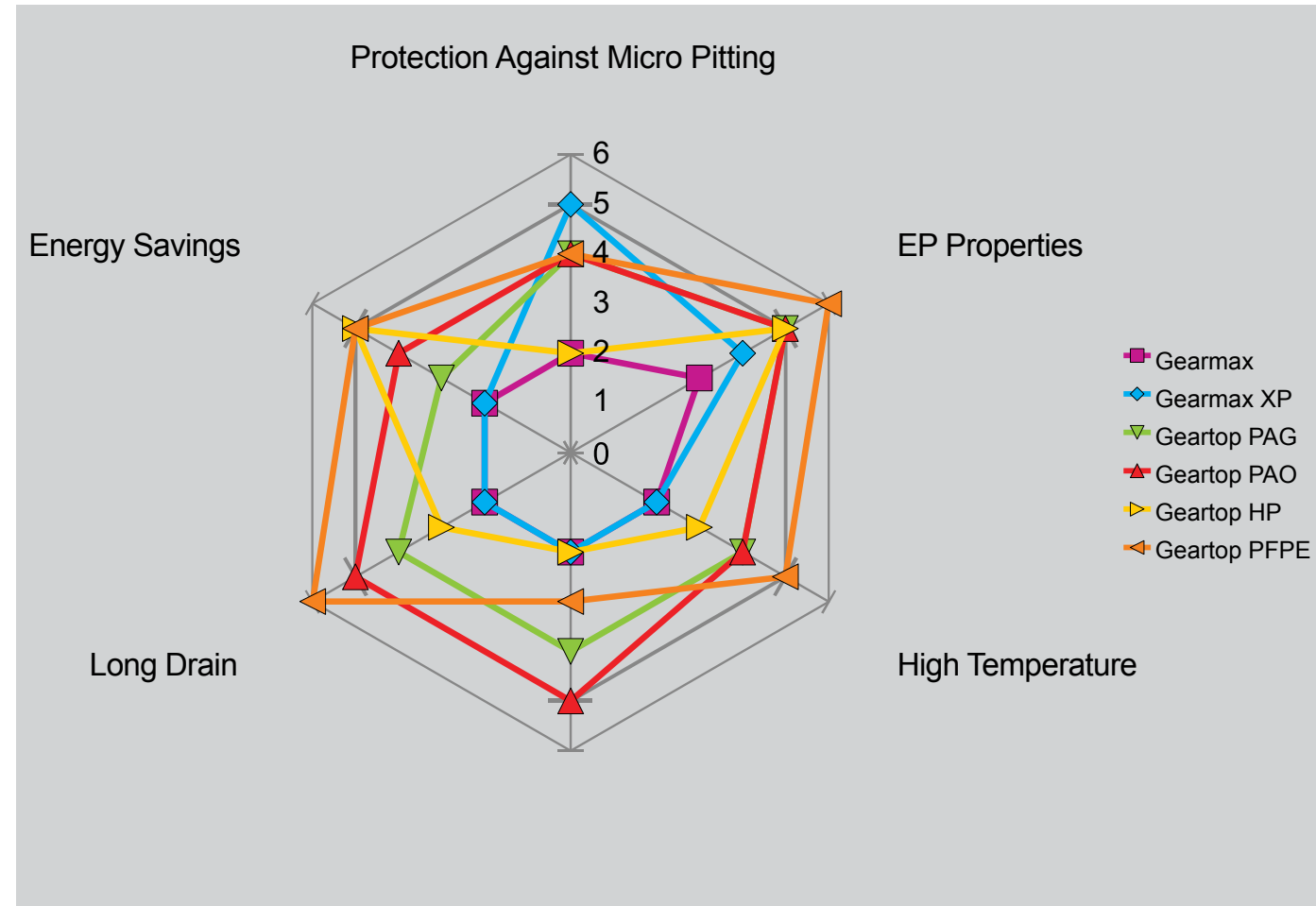
Foodmax® 	ISO VG	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Airline Lub	Basic Lub	Hydraulic	Gear	Chain	Compressor	Vacuum pump	NSF Approval	Temp.			Load	
														High	Medium	Low	High	Medium
Foodmax® Gear 68	68	68	130	< -20	> 200								H1					
Foodmax® Gear 100	100	100	118	< -18	> 200								H1					
Foodmax® Gear 150	150	150	118	< -15	> 200								H1					
Foodmax® Gear 220	220	220	120	< -12	> 220								H1					
Foodmax® Gear 320	320	320	120	< -12	> 240								H1					
Foodmax® Gear 460	460	460	121	< -12	> 250								H1					
Foodmax® Gear 680	680	680	120	< -12	> 250								H1					

Foodmax® 	ISO VG	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Slideways	Airline Lub	Basic Lub	Hydraulic	Gear	Chain	Compressor	Vacuum pump	NSF Approval	Temp.			Load	
															High	Medium	Low	High	Medium
Foodmax® Gear PAO 68	68	68	> 140	< -52	> 250									H1					
Foodmax® Gear PAO 100	100	100	> 140	< -50	> 265									H1					
Foodmax® Gear PAO 150	150	150	> 140	< -45	> 260									H1					
Foodmax® Gear PAO 220	220	220	> 140	< -45	> 260									H1					
Foodmax® Gear PAO 220 Premium	220	218	> 145	-35	280									H1					
Foodmax® Gear PAO 320	320	320	> 150	< -45	> 260									H1					
Foodmax® Gear PAO 460	460	460	> 160	< -40	> 260									H1					
Foodmax® Gear PAO 680	680	680	> 160	< -35	> 265									H1					
Foodmax® Gear PAO 1000	1000	1000	> 200	< -40	> 265									H1					

Foodmax® 	ISO VG	Kinematic Viscosity 40 °C	VI	Pour Point °C	Flash Point °C	Airline Lub	Basic Lub	Hydraulic	Gear	Chain	Compressor	Vacuum pump	NSF Approval	Temp.			Load		
														High	Medium	Low	High	Medium	
Foodmax® Gear PAG 150	150	162	202	-39	278									H1					
Foodmax® Gear PAG 220	220	220	210	-40	240									H1					
Foodmax® Gear PAG 320	320	320	220	-40	240									H1					
Foodmax® Gear PAG 460	460	460	240	-30	240									H1					
Foodmax® Gear PAG 680	680	680	272	-33	287									H1					
Foodmax® Gear PAG1000	1000	1000	284	-30	296									H1					



### Multi Selection Criteria Radar for Gear Oils



KINEMATIC VISCOSITIES		GRADE SYSTEMS				SAYBOLT VISCOSITIES	
cSt 40° C	cSt 100° C	ISO	AGMA	SAE ENGINE OIL	SAE GEAR OIL	SUS 210° F	SUS 100° F
800	40	680	8				200
600							
500	30	460	7		140	150	3000
400							
350		320	6				2000
300							1900
250	20	220	5	50	90	125	1500
200							1250
150	16	150	4	40		100	1000
100							
80	10	100	3	30	85 W	90	800
60	9	68	2				600
50	8						
40	7	46	1	20	80 W	80	500
30	6						400
20	5	32					300
15	4	22		10 W	75 W	50	250
10		15		5 W		44	200
		10				40	150
							100
							90
							70
							55

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 may 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. 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.



