CLARIANT

Components and additives for **INDUSTRIAL GEAR OILS**

what is precious to you?

Components and additives for **INDUSTRIAL GEAR OILS**

Clariant is one of the leading suppliers of high-performance com-ponents and additives for industrial gear oils. As a key supplier to lubricant formulators, we understand our customers' needs. The quality of our products is the basis for the success of your formulation.

Clariant understands that the only guarantee of long-term success is to deliver products that offer consistent quality and stable properties.

To deliver the right solution for industrial gear oils requires a deep understanding of our customers' formulation problems and application requirements.

A clear and detailed description of our products is the first step toward building a sustainable business relationship.

Today, customers for industrial gear oils expect components and additives to provide a range of properties, including:

- High and consistent quality
- Excellent compatibility with other formulation components
- Easy and safe handling
- Global and long-term availability

Our products will deliver all these and contribute significantly to the success of your formulation, meeting and exceeding your own customers' application requirements, for example:

- Reduced friction and wear to expand system lifetime
- Low foaming tendency
- Excellent thermo-oxidative stability
- Operability in a wide temperature range, with a high viscosity index
- Fast heat removal and high thermal conductivity
- Reduction of micro-pitting

We understand that meeting all these requirements will help your customers generate higher profits by:

- Lowering maintenance costs
- Increasing productivity
- Improving quality
- Addressing new market opportunities

Our understanding of sustainability and quality assurance requires that we know everything about our products – where they come from and where they go.

1 | Base fluids for industrial gear oils

The base fluid is the heart of any gear oil formulation because it is responsible for accurate power and heat transfer. Clariant is one of the world's leading producers of polyalkylene glycols (PAGs). Our strength is our diverse portfolio, covering all application-relevant requirements for high-load industrial gear oils.

Common to all our products is their high quality standard, achieved through intensive research and development, modern production methods and constant quality monitoring.

1 | BASE FLUIDS

Product	Ratio EO:PO	ISO VG classes	Water solubilty	Range of viscosities at 40°C in mm^2/s	Range of viscosities at 100°C in mm^2/s	Viscosity index range	Pour point range in °C
Polyglykol B01- and D01-range	0:1	32-320	no	30-350	6-61	170-233	-23 to -50
Polyglykol B11-range	1:1	46-220	yes	45-225	5-42	174-249	-45
Polyglykol D21-range	2:1	220-1000	yes	220-1000	11-185	174-291	-21 to -46
Polyglykol P41/300	4:1	460	yes	450	69	231	-10

1 | LUBRICANT DATA FOR SELECTED PRODUCTS

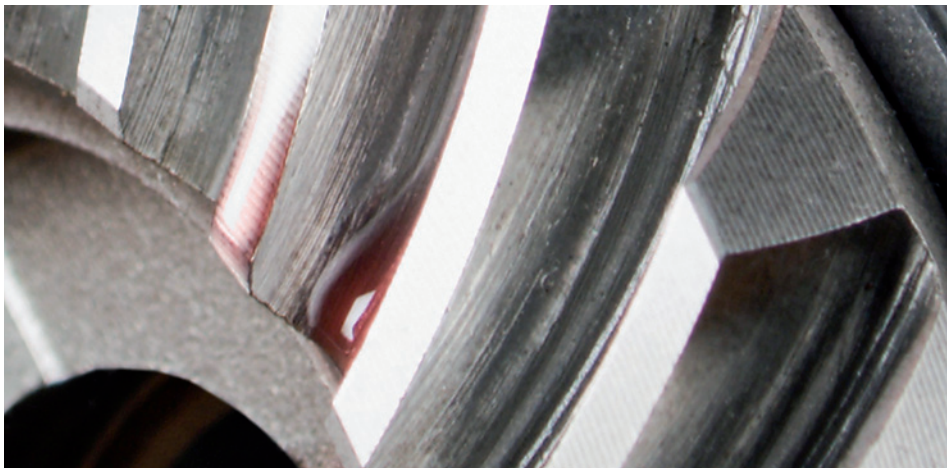
Product	ISO VG class	Water solubilty	Viscosity at 40°C in mm^2/s	Viscosity at 100°C in mm^2/s	Viscosity index	Four-ball wear test DIN 51350/3	Four-ball DIN 51350/ 2 seizure/welding load in N	FZG-test DIN 51354 level	Pour point in °C
Polyglykol B01/40	46-68	no	58	11	185	0.66 mm	1600/1800	9	-45
Polyglykol B01/80	100-150	no	120	21	202	0.60 mm	1600/1800	9	-45
Polyglykol B01/120	150	no	171	29	213	0.58 mm	1600/1800	9	-40
Polyglykol B01/240	320	no	350	58	237	0.53 mm	1600/1800	12	-40
Polyglykol B11/50	68	yes	74	15	219	0.52 mm	1400/1600	10	-45
Polyglykol P41/300	460	yes	450	69	231	0.55 mm	2200/2400	<12	-10
Polyglykol PR 600	46-68	yes	55	10	164	0.65 mm	1600/1700	6	-5

1 | THERMAL DATA FOR SELECTED PRODUCTS

Product	ISO VG class	Temperature in °C	Viscosity in mm2/s	Specific heat in kJ/K kg	Thermal conductivity in W/m.K
Polyglykol B01/20	32	-20	1700	1.87	-0.161
		0	240	1.90	0.158
		100	6.8	2.15	0.144
		200	2.0	2.40	0.128
Polyglykol B01/240	320	-20	50000	1.87	–
		0	5000	1.90	0.162
		100	62	2.11	0.155
		200	16	2.31	0.149
Polyglykol B11/50	68	-20	5000	–	–
		0	700	1.83	0.285
		100	14	2.08	0.145
		200	5.5	2.32	–

Thermal conductivity of mineral oil: approx. 0.13 W/m.K (20°C)

2 | Lubricant Additive 1655 – our high-performance package for your industrial gear oils



The “Lubricant Additive 1655” package boosts the performance of our base fluids to new limits.

Characteristics of gear oils containing the additive are:

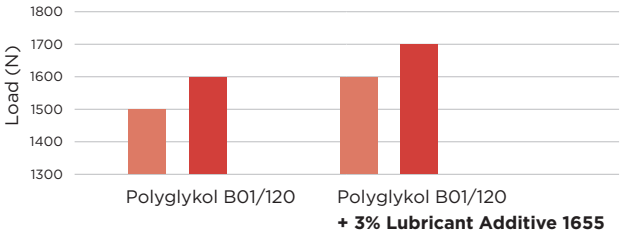
· Excellent extreme/anti-wear (EP/AW) properties increasing load carrying properties and lubricity
· Highly improved thermo-oxidative stability

2 | EXCELLENT EXTREME PRESSURE PROPERTIES

Normal load can be increased successively until seizure and weld of test balls are observed.

The higher the load for seizure or weld the better the loading capacity of the lubricant.

FOUR-BALL LUBRICITY TEST RESULTS:

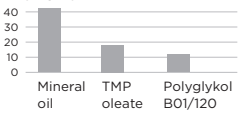


Oil’s load capacity is improved by Lubricant Additive 1655

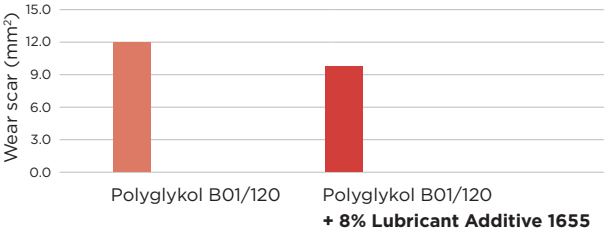
2 | EXCELLENT LUBRICITY

TEST CONDITIONS:
Ring and roller material: steel
Sliding speed: 1.6 m/s
Loading weight: 1.5 kg
Test duration: 100 m

BASE OILS:



REICHERT LUBRICITY TEST RESULTS:

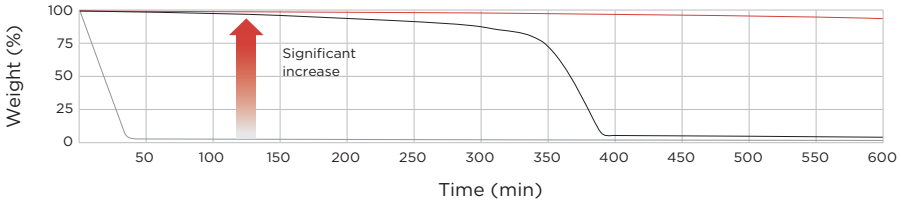


The addition of Lubricat Additive 1655 results in smaller wear scar and better wear protection.
Reference: Shell Gravex 915 (naphtenic mineral oil): 42 mm²

2 | SIGNIFICANT IMPROVEMENT IN THERMO OXIDATIVE STABILITY WITH LUBRICANT ADDITIVE 1655

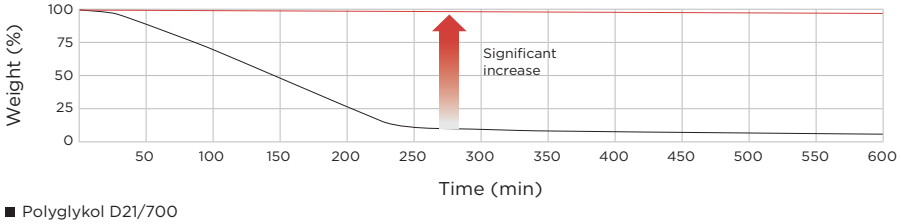
TEST CONDITIONS FOR THERMO GRAVIMETRIC ANALYSIS:
Air flow through the cell: 50 ml/min
Heating rate: 20°C/min (50-190°C)
2°C/min (190-200°C)
Constant temperature at 200°C
Total time: 600 min

CHART 1: POLYGLYKOL B01/120



- Polyglykol B01/120
- Polyglykol B01/120 + 3% Lubricant Additive 1655
- Polyglykol B01/120 + 8% Lubricant Additive 1655

CHART 2: POLYGLYKOL D21/700



- Polyglykol D21/700
- Polyglykol D21/700 + 6% Lubricant Additive 1655

3 | Powerful extreme pressure/ anti-wear additives (EP/AW)

Phosphoric acid esters are effective EP/AW additives, enhancing the industrial gear oil by providing protection under extreme friction.

3 | EXTREME PRESSURE/ANTI-WEAR ADDITIVES (EP/AW)

Product			Four-ball test	
	Phosphorus content in %	Acid value mg KOH/g	Wear test: Load 500 N, 1 hour/X% in mineral oil	Seizure and welding load in N/% in mineral oil
Hordaphos® MDAH	11.5	308	0.35 mm (5%)	1700/1800 (5%)
Hordaphos® MDHX	13.1	375	0.41 mm (5%)	1600/1700 (5%)
Hordaphos® MDIT	8.5	230	0.41 mm (5%)	1600/1700 (5%)

TECHNICAL, COMMERCIAL AND REGULATORY SUPPORT

As one of the world's largest specialty chemical companies, with global strength and local resources, we are committed to the industrial lubricants market and have the depth and product diversity to satisfy customers' needs. Through a dedicated sales force, strong local supply chain and local manufacturing sites, we are close to our customers, wherever they are.

Our R&D group has deep application expertise to assist our customers in formulation development, addressing technical questions as well as regulatory and labeling issues. Besides supporting our customers with guideline recipes, we can also deliver solutions on more specific questions thanks to dedicated and well-equipped laboratories.

This application brochure contains a representative selection of our products. For specific needs and requirements, alternative specialties may be provided. To discover our full range of products, please consult your local Clariant representative, contact us by e-mail at industriallubricants@clariant.com or visit our website www.industriallubricants.clariant.com

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