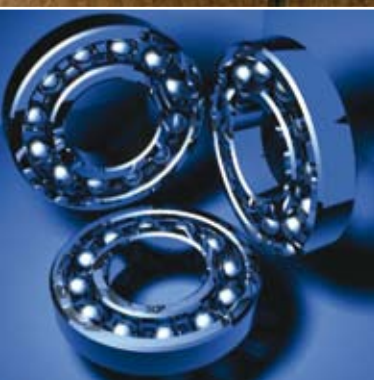


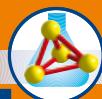
YOUR VERSATILE PARTNER IN CHEMISTRY



Lubricants & Specialty Chemicals



*Ketjenlube Polymer Esters
Synthetic and Fatty Acid Esters
Lube & Fuel Additives
Acid Chlorides
Phosphites*



Italmatch Chemicals

Italmatch Chemicals SpA is a specialty chemical company, leader in its traditional sector of phosphorus and melamine derivatives.

The company's strategic and long term focus is mainly in the lube oil and plastic markets, with two manufacturing units in Italy (Spoleto and Arese) and three in China. The Group is particularly committed to the Asian market growth, leveraging also on its historical access to China, with established local manufacturing and marketing presence.

Italmatch Chemicals Group has a strong international and global presence with more than 80% of production being exported.

The Arese product portfolio includes Ketjenlube Polymer Esters, synthetic and fatty acid esters, amides and chlorides, as well as phosphorous acid and nitrogen containing polymers. An additional part of the Arese activities is toll production for third parties.



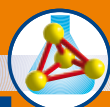
The Arese site is located near Milan in northern Italy. Various reactors (glass lined and stainless steel) of different sizes allow high flexibility in production planning with additional capacity for optimization and expansion. Core technologies/competence include, among others, polymerization, esterification, chlorination and amidation/amination.

A consistent and high product quality is ensured by a team of experienced and skilled people, with particular focus on joint product and technical development with customers/Partners. The Arese site is certified according to ISO 9002 and ISO 14001.

ARESE

Lubricants & Specialty Chemicals

		CHEMICAL NAME	TRADE NAME	APPLICATIONS	PAGE
$H_3PO_3/PCl_3/POCl_3/P_2O_5$	Esterification	Phosphonates Phosphite esters Phosphate esters	-	Lubricants Intermediates	14
Alcohols • renewable sources • petrochemical sources	Esterification	Di-esters Polyol esters Mono-esters Glycol esters PEG esters	Ketjenlube Kessco Armotan	Lubricants Fuels Agro Pharma Cosmetics	12; 18
Organic Acids • renewable sources • petrochemical sources	Chlorination	Acid chlorides	-	Agro Pharma Peroxides	16-17
		Phosphorous acid			17
Ammonia/Amines	Amidation	Amides	DAPRAMID DAPRASLIP	Lubricants Polymers Inks	15
Olefins Unsaturated Di-esters	Polymerization	Ester copolymer	Ketjenlube Daprals	Lubricants	4 - 11



Italmatch Chemicals

KETJENLUBE ESTERS for Automotive and Industrial Lubricants

Ketjenlube type		KL 115	KL 135	KL 165	KL 1300	KL 230
Physical and Chemical Characteristics	Method	Medium/high polar products				
Viscosity at 100 °C (mm ² /s)	ASTM D-445	15	34	65	260	30
Viscosity at 40 °C (mm ² /s)	ASTM D-445	112	340	770	4100	280
Viscosity index	ASTM D-2270	135	139	152	200	138
Pour point (°C)	ASTM D-97	-28	-32	-23	-15	-33
Flash point (°C)	ASTM D-92	250	250	255	260	250
Acid number (mgKOH/g)	ASTM D-974	0.4	0.2	0.3	< 0.1	0.3
Density 20 °C (g/cm ³)	ASTM D-1217	0.93	0.96	0.98	0.99	0.94
Colour Gardner	ASTM D-1500	< 1	< 1	< 1	< 1	< 1
Applicational Properties						
Volatility Noack (%)	ASTM D-5800	4	3	3	1	3
Hydrolytic stability Acid number (mgKOH/g) after 48 h oil phase water phase	ASTM D-2619	0.32 0.18	0.29 0.24	0.25 0.03	0.10 0.24	0.36 0.27
Thermo-oxidative stability (200 °C; 12 h; 15 liter air/hour) Weight loss (%) Viscosity increase (%)	IP 48	7 160	6 150	4 140	4 90	6 150
Lubricity (% wear volume; 150 N oil = 100 %) pure Ketjenlube 10 % Ketjenlube in 150 N oil	Reichert	33 82	25 70	13 66	6 50	26 74
Compatibility 10 % in 150 N oil (48 h at -10 °C) 10 % in PAO 6 (48 h at -25 °C) 10 % in PAO 40 (48 h at -10 °C) 10 % in water (48 h at 20 °C)		+ + + -	+ ± - -	+ - - -	± - - -	+ + + -
Seal compatibility	CEC-L-39-X-95	neutral				
Major applicational areas		two-stroke; four-stroke (gasoline and Diesel); gear oils, greases, MWF				

KL 240	KL 290	KL 2500	KL 2700	KL 23000	KL 305	KL 445	KL 445 VLP	KL 522
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Ketjenlube Polymer Esters

Low polar products (PAO compatible)					Unsaturated product	Watersoluble/-emulsifiable products			
39	100	300	700	3000	5.5	–	–	–	
400	1000	4300	11000	43.000	27	450	350	2500	
160	190	225	255	300	138	–	–	–	
–3	–15	–18	–10	–	–42	–12	–6	–4	
260	260	270	270	270	230	220	230	180	
0.08	0.3	< 0.1	< 0.1	0.3	1.1	ca 10	ca 7	ca 65	
0.93	0.93	0.96	0.96	0.92	0.93	1.06	1.05	1.05	
< 1	< 1	< 1	< 1	< 1	< 1	6	4	2	

3	2	1	< 1	1	14	–	–	–	
0.11 0.07	0.12 0.09	0.42 0.11	0.07 0.02	0.13 0.14	1.21 0.13	– –	– –	– –	
6 144	4 105	4 40	4 40	4 42	15 320	– –	– –	– –	
28 75	14 69	5 60	5 55	8 60	44 80	40	1% in water: 43	60	
+	+	+	+	+	+	–	–	–	
+	+	+	+	+	+	–	–	–	
+	+	–	–	–	–	–	–	–	
–	–	–	–	–	–	±	±	+	
neutral					slightly swelling				
gear oils (automotive; industrial)					two-stroke	MWF (soluble oils; synthetic fluids)			

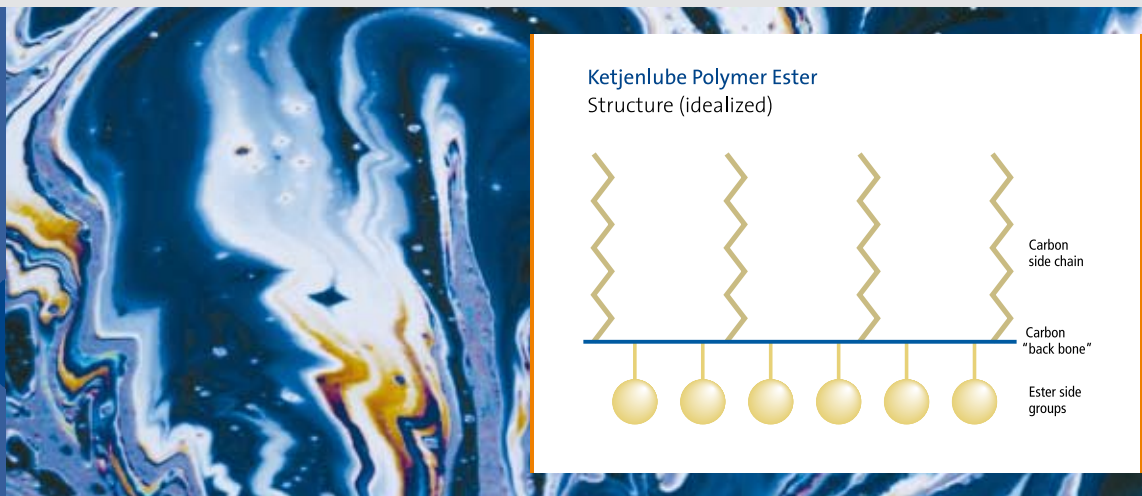
KETJENLUBE POLYMER ESTERS; General Information

Ketjenlube Polymer Esters are unique, patented specialty components used in the formulation of synthetic and semi-synthetic high performance lubricants and industrial fluids. They reduce wear much more efficiently than other conventional synthetic base fluids. This feature has made Ketjenlube Polymer Esters an important tool in the lubricating oil area during the last twenty years.

CHEMISTRY:

Ketjenlube Polymer Esters are copolymers of α -olefins and dicarboxylic acids which are esterified with various kinds of alcohols. The product viscosities range from 5 mm²/s up to 700 mm²/s. As the average molecular weights (Mw) do not exceed 7,000 Dalton, even the highest viscous Ketjenlube Polymer Esters are completely shear stable.

Structurally Ketjenlube Polymer Esters can be regarded as functionalized polyalphaolefines.



PROPERTIES:

Outstanding inherent lubricity

Ketjenlube Polymer Esters exhibit the highest load carrying capacity compared to most other lube oil base fluids available in the market.

Powerful synergy with AW/EP-additives

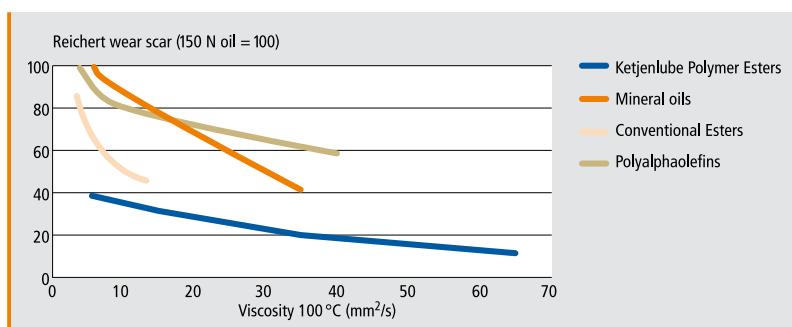
This makes it possible to replace e.g. chloroparaffins in metal working fluids by a combination of Ketjenlube Polymer Esters and sulfur/phosphorus additives without losing EP-performance.

Superior hydrolytic stability

Ketjenlube Polymer Esters are stable for more than six months in aqueous emulsions at pH 9 and are one of the most hydrolytically stable esters available for metal working fluids (soluble oils).

Clean burning, clean evaporation

Ketjenlube Polymer Esters burn or evaporate at high temperatures without giving rise to smoke or hazardous fumes. This allows the formulation of low-smoke two-stroke engine oils or industrial oils for high temperature applications.



Inherent Lubricity of base fluids
Reichert test; standard conditions

KETJENLUBE POLYMER ESTERS in Two-Stroke Engine Oils

The high inherent lubricity together with their clean burning make the Ketjenlube Polymer Esters an ideal base fluid for two-stroke motor bike engine oils. The ISO-L-EGD results of four different formulation examples (semi-synthetic, synthetic, high solvent oils) containing Ketjenlube Polymer Esters as ester component are summarized.

Oil	1	2	3	4
Type	synthetic; high solvent	synthetic	semi synthetic	semi synthetic
Composition (wt %)				
Ad-pac A	–	–	5.2	–
Ad-pac B	9.3	–	–	5.2
Ad-pac C	–	5.2	–	–
Polyisobutylene	40.7	49.8	30.0	30.0
Ketjenlube 305	–	25.0	15.0	–
Ketjenlube 135	–	–	–	10.0
Ketjenlube 115	15	–	–	–
150 SN mineral oil	–	–	–	30.0
600 SN mineral oil	–	–	34.8	10.0
Solvent	35.0	20.0	15.0	14.8
Viscosity 100 °C (mm ² /s)	8.8	9.6	9.5	9.5
ISO-L-EGD-engine test results:				
Exhaust smoke index (FC limit: 85 min)	193	172	85	89
Lubricity index (FC limit: 95 min)	116	100	103	97
Torque index (FC limit: 98 min)	98	100	102	100
Detergency index 1 hour (FC limit: 95 min)	not determined	not determined	105	108
Detergency index 3 hours (GD limit: 125 min)	135	137	125	not determined
Exhaust port blocking index (FC limit: 90 min)	210	111	110	125



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ANTI-WEAR ADDITIVES, ESTER BASEFLUIDS

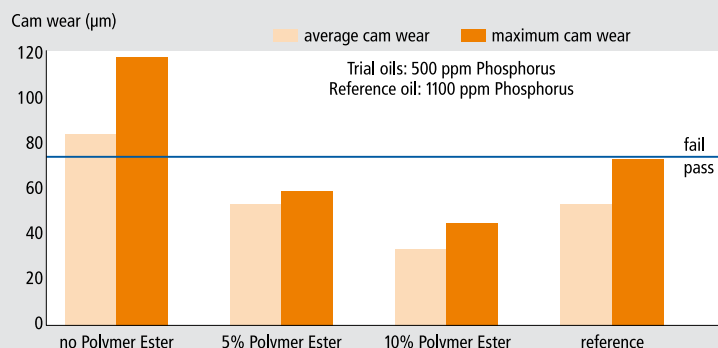
KETJENLUBE POLYMER ESTERS in Four-Stroke Engine Oils

WEAR REDUCING EFFECT

Ketjenlube Polymer Esters are used commercially both in Diesel and gasoline engine oils, mainly as a means of wear protection. This wear reduction is a function of

- the inherently high affinity of Ketjenlube Polymer Esters to metal surfaces, allowing strong oil films at high temperatures whilst permitting the start of a cold engine without excessive wear.
- the strong synergy of Ketjenlube Polymer Esters with zinc-dithiophosphates (ZDDP), allowing the formulation of low ZDDP oils without losing anti-wear performance

VW Cam & Tappet
test results of
a low SAPS oil
(500 ppm phos-
phorus) with
and without
Ketjenlube 135



KETJENLUBE POLYMER ESTERS in Gear Oils

The two high viscous Ketjenlube Polymer Esters Ketjenlube 23,000 and Ketjenlube 2700 are tailor-made for applications in gear oils and are cost-effective alternatives to higher viscosity polyalphaolefins. Besides their superior load-carrying capacity they exhibit

- Excellent thermo-oxidative and hydrolytic stability
- Shear stability
- Compatibility with non-polar base stocks and polar additives
- Excellent viscosity characteristics at low temperatures

Automotive gear oils, formulation examples

	"KL 2700"	"KL 23,000"	"PAO 100"	"PAO 40"
Viscosity grade	75W-140	75W-90		
Composition				
Ketjenlube 2700	50.5			
Ketjenlube 23,000		30		
PAO 100			45	
PAO 40				58
PAO 4	30	60	30	10
Di-ester (adipate)	9.5	—	15	15
Ad-pac, anti-foam	10	10	10	17
Performance data				
Viscosity 100 °C (mm ² /sec)	24.3	14.8	15.1	14.9
Viscosity -40 °C (mPas)	125,500	29,400	57,500	56,800
Appearance (-15 °C)	homogeneous, clear			
Copper corrosion ASTM D 130	1a	1a	1a	1a
Shear loss after 20 h (%)	< 1	4.7	1.0	0.7
CEC L-45-T93				
GFC-oxidation test CEC L-48-A-95 (160 °C, 192 h):				
acid number after test (mgKOH/g)	0.45	1.2	1.0	1.1
viscosity increase (%)	32	51	47	40

Industrial gear oil, formulation example

	Ketjenlube 2700/PAO 6		PAO/Ester
	experimental product	commercial product	commercial product
Composition			
PAO 6	53.5	proprietary	10.5
PAO 40	—	proprietary	80
TMP-ester	—	—	8
Ketjenlube 2700	45	34	-
ad-pac	1.5	proprietary	1.5
Physical Properties			
Viscosity 40°C (cSt)	219.6	218.0	221.1
Viscosity index	172	175	149
Flash point (°C)	265	265	260
Pour point (°C)	-48	-46	-50
Performance Tests			
Copper corrosion ASTM D 130 (3H, 100°C)	1B	1A	1B
Rust preventing characteristics ASTM D 665 Procedure A and B	Pass	Pass	Pass
Oxidation test ASTM D-2893 (121°C, 312 h) # Viscosity increase (%)	3.54	3.80	3.80
Demulsibility ASTM D 2711	free water: 87 ml emulsion: 0.0 ml water in oil: 0.4%	free water: 87 ml emulsion: 0.0 ml water in oil: 0.8%	free water: 87 ml emulsion: 0.0 ml water in oil: 0.3%
Water separation ASTM D 1401	42-38-0 (45)	not determined	40-40-0 (30)
Foaming characteristics ASTM D 892	Sequence I: 0/0 Sequence II: 20/0 Sequence III: 0/0	Sequence I: 0/0 Sequence II: 60/0 Sequence III: 10/0	Sequence I: 30/0 Sequence II: 60/0 Sequence III: 30/0
Four-ball test ASTM 2783	LWI: 51,1 Weld load: 250 kg	LWI: 64,2 Weld load: 250 kg	LWI: 53,2 Weld load: 250 kg
Falex Pin & Vee test ASTM D 2670; wear teeth	1	3	1



KETJENLUBE POLYMER ESTERS in Metal Working Fluids

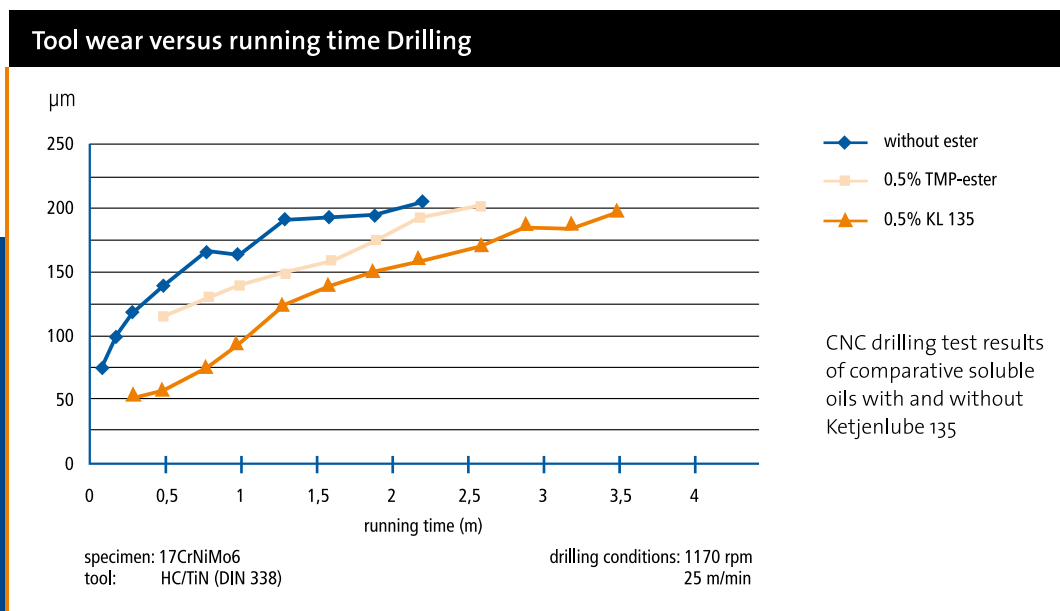
Ketjenlube Polymer Esters are used commercially in a wide range of metal working applications at treat levels of 5% to 25% depending on the application

- in neat oils
- in emulsion systems (concentrates)
- for metal cutting operations (e.g. broaching, tapping, milling)
- for metal forming operations (e.g. rolling, drawing, stamping)

The performance of Ketjenlube Polymer Ester containing fluids is further increased when combined with antiwear/EP agents, so enabling high performance formulations to be made which are entirely chloroparaffin-free.

SOLUBLE OILS (EMULSIONS)

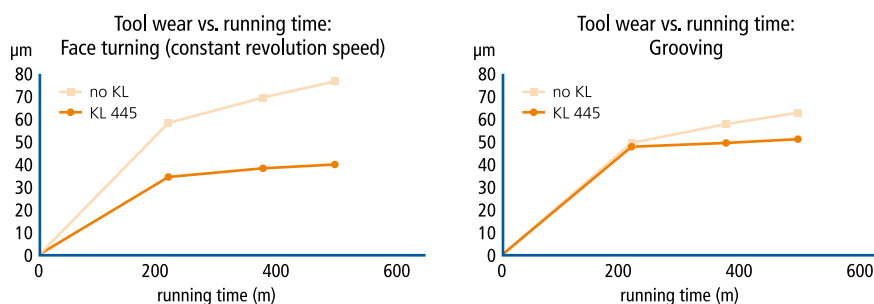
All Ketjenlube Polymer Esters can be emulsified using state-of-the-art emulsifiers, enabling high performance soluble oils to be formulated. Various guideline formulations for different applications are available on request.



SYNTHETIC CONCENTRATES

With Ketjenlube Polymer Esters it is also possible to formulate aqueous solutions, using Ketjenlube 445 or Ketjenlube 522.

Ketjenlube 445 is not truly watersoluble, but is easily emulsifiable due to its ethoxylated side chains which give the product an HLB-value of 11.5. Ketjenlube 445 improves the surface finish in metal processing, for example in aluminium or copper metal working. The effect on the tool wear of the addition of 0.5% Ketjenlube 445 to an aqueous cutting formulation is shown in the subsequent graphs:



In addition to ethoxylated side chains Ketjenlube 522 contains free acid groups which can react with amines. Aqueous solutions of Ketjenlube 522 show an outstanding lubricity which still is unsurpassed in the area of synthetic aqueous solutions, however, without careful formulation Ketjenlube 522 can exhibit a foaming tendency in line with its degree of ethoxylation, which may restrict its application to low agitation operations.

For more detailed information about the use of Ketjenlube 445 and Ketjenlube 522 please refer to the corresponding data leaflets.

Performance of an aqueous cutting formulation with and without 0.5% Ketjenlube 445 in face turning and grooving of aluminium alloy (AlMgSi 1).

NEAT OILS

The performance improvement of neat oils with Ketjenlube Polymer Esters for instance is demonstrated in the Falex Pin & Vee test according to ASTM D-2670. A chloroparaffin based neat oil (24% chlorine) was compared with the same oil where the chlorine component has been replaced by a combination of Ketjenlube Polymer Esters and sulfur-phosphorus based EP-additives.

Oil	"chloroparaffin"	"KL 135"	"KL 1300"
Composition (wt %)			
"Chlorine" oil	100	—	—
Ketjenlube 135	—	10	—
Ketjenlube 1300	—	—	10
Sulfurized fat (15% S)	—	5	5
Ashless dithiophosphate	—	—	2
Original oil without chlorine	—	85	83
Falex Pin & Vee test; wear teeth	57	14	8

HOT DRAWING OILS

Ketjenlube 6300 has been specially developed to lubricate hardened-steel forming dies in the drawing of non-ferrous tubes. The use of Ketjenlube 6300 results in longer tool life and high surface finish with a concomitant low fume emission.

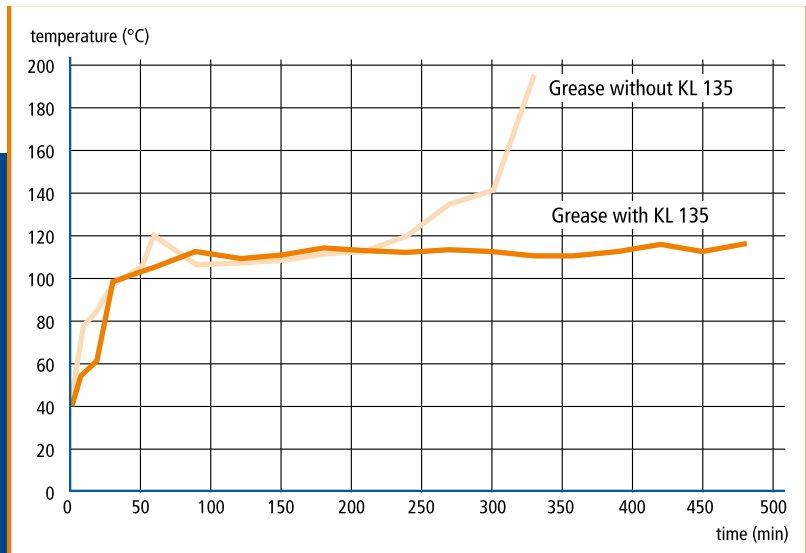
KETJENLUBE POLYMER ESTERS in Greases

Ketjenlube Polymer Esters are used commercially in semi-synthetic and synthetic greases. They do significantly improve the AW/EP-properties without disturbing the grease texture. Greases with Ketjenlube Polymer Esters also show significantly increased ageing resistance in the presence of iron.

For more detailed information and test results about the use of Ketjenlube Polymer Esters please refer to the data-leaflet Ketjenlube Polymer Esters in Greases.



Four-ball endurance test of a lithium soap grease with and without Ketjenlube 135 (load: 2000 Newton)



Regulatory Information

Ketjenlube type	KL 115; KL 135 KL 215; KL 230	KL 165; KL 305 KL 1300; KL 2100; KL 2500	KL 290; KL 2300; KL 2700; KL 23,000	KL 445; KL 445 VLP	KL 522
CAS-Registry Number	128218-63-3	138208-69-2	173521-40-9	135397-33-0	120366-25-8
EINECS (Europe)	no (polymer)*	no (polymer)*	no (polymer)*	no (polymer)*	no (polymer)*
TSCA (USA)	yes	yes	yes	yes	yes
DSL (Canada)	yes	no	yes	yes	yes
AICS (Australia)	yes	yes	yes	yes	no
MITI (Japan)	yes	yes	yes	no	no
China	yes	yes	yes	yes	yes
Thailand	—**	—**	—**	—**	—**
Korea	yes	no	yes	yes	no

* Polymers cannot be registered in EINECS. All Ketjenlube Polymer Esters are free to sell in Europe.

** Only hazardous products need to be registered. All Ketjenlube Polymer Esters are free to sell.

All Ketjenlube types printed in green are HX-1 registered by NSF for the use in lubricants with incidental food contact. Reach: All Ketjenlube types are pre-registered.

CONVENTIONAL ESTERS

Appart from the patented Ketjenlube[®] Polymer Esters Italmatch Chemicals is offering also a wide range of various other esters under the Ketjenlube trade name:

- Polyol Esters
- Dibasic Acid Esters
- Complex Esters
- Trimellitate Esters

A selection of the ester types currently available is given in the table below. For esters sold mainly outside the lubricant area please refer to page 18 "Fatty Acid Esters - Cosmetics; Personal Care".

Trade Name	Description	Acid Value	V 40	Colour	Pour Point	Flash Point	Recommended Application
		mgKOH/g	cSt	Gardner	°C	°C	
Ketjenlube 09	Dimer Ester	0.1 max	94	8 max	< -40	> 260	Two-stroke; MWF
Ketjenlube 10	Polyol ester	0.1 max	22	6 max	< -40	> 250	Automotive & Industrial lubes
Ketjenlube 9100	Complex ester	0.5 max	28	6 max	< -40	> 250	
Ketjenlube 9101	Complex ester	0.5 max	73	6 max	< -40	> 260	
Ketjenlube 9200	Complex ester	0.2 max	32	6 max	< -40	> 220	Biodegradable hydraulic fluids ecolabel)
Ketjenlube 9201	Complex ester	0.2 max	45	6 max	< -56	> 250	
Ketjenlube 9202	Complex ester	0.2 max	60	5 max	< -40	> 250	
Ketjenlube 15	Dibasic acid ester	0.2 max	26	2 max	-50	> 240	Biodegradable hydraulic fluids gear oils)
Ketjenlube 16	Dibasic acid ester	0.2 max	14	3 max	-50	> 230	
Ketjenlube 18	Polyol ester	3 max	45	8 max	-40	> 280	MWF
Ketjenlube 9350	Complex ester	45-55	1000	8 max	-30	> 250	MWF (self emulsifying esters)
Ketjenlube 9450	Complex ester	25-35	2200	15 max	-25	> 240	MWF
Ketjenlube 39*	Complex ester	0.5 max	135	10 max	-35	> 280	Two-stroke. MWF
Ketjenlube 9501*	Complex ester	0.5 max	380	10 max	-36	> 300	Industrial lubes, MWF
Ketjenlube 9503*	Complex ester	0.5 max	1650	10 max	-35	> 300	
Ketjenlube 9505*	Complex ester	0.5 max	45000	10 max	-	> 300	
Ketjenlube 73	Trimellitate ester	0.1 max	50	< 100**	< -40	> 240	High temperature lube applications
Ketjenlube 75	Trimellitate ester	0.1 max	90	< 100**	< -40	> 240	

* Saturated and unsaturated version available

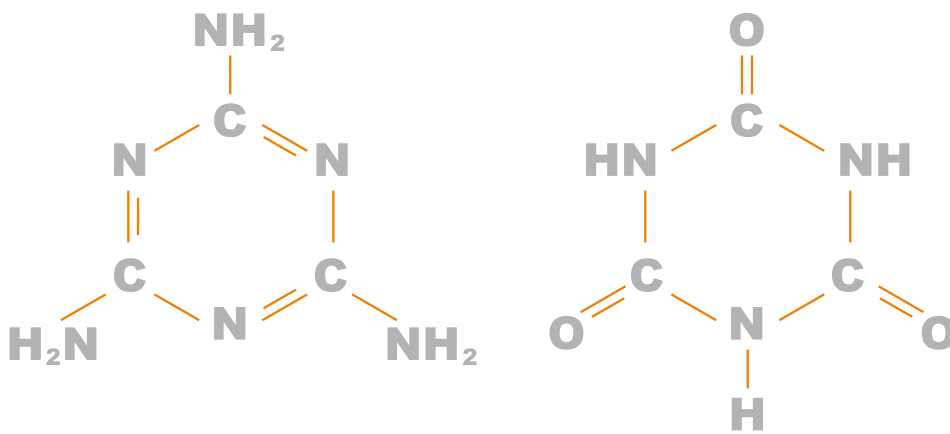
** Colour Hazen

MELAMINE CYANURATE

Melamine Cyanurate is a salt of melamine and cyanuric acid. It is a non-toxic additive during its life cycle, including during fire situations, it is easy to handle, non-hazardous, recyclable and biodegradable.

The use of Melamine Cyanurate (MC) in greases has been developed in Japan around 30 years ago, and there are known uses in Japan and the USA.

A lubricant containing MC is effective for use in high-temperature, or high-pressure atmospheres, or places where black-color producing contamination is not desired, or in metal working, cutting or grinding of metals. MC not only functions as a solid lubricant but also as an agent to thicken liquid lubricants such as mineral oil.



12

13

POUR POINT DEPRESSANTS FOR MIDDLE DISTILLATE FUELS

Polymeric amides/-imides are well-known cold flow improvers for diesel fuel and heavier fuel grades. They can also be used to liquify heavy oils and tars for burning.

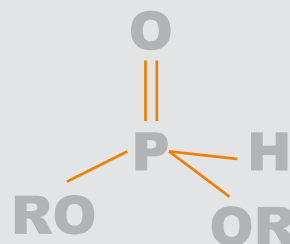
Under the Ketjenlube 700 trade name Arese is offering a range of polymeric amides based on various long chain fatty amines. They assist in

- Lowering the pour point
- Keeping the fuel pumpable at low temperatures
- Improving the cloud point of the fuel



PHOSPHITES

Italmatch Chemicals is manufacturing a series of highly pure and phenol free Di-and Tri-substituted phosphites used mainly as chemical intermediates and finished additives in industrial lube oils and ATF fluids

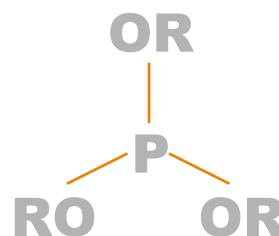


Di-Phosphites (Phosphorous acid, di-alkyl esters)

	Typical P%
DiButyl Phosphite	15.8
Di-n-Octyl Phosphite	10.8
Di-2-Ethylhexyl Phosphite	10.0
DiOleyl Phosphite	7.4
DiLauryl Phosphite	5.3

Tri-Phosphites (Phosphorous acid, tri-alkyl esters)

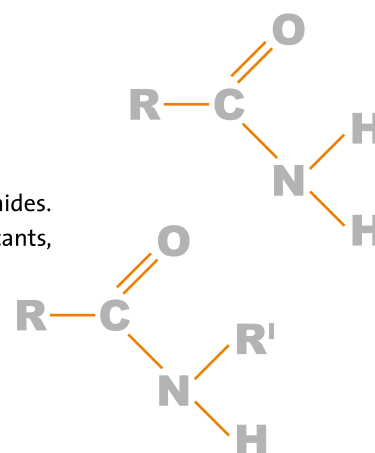
	Typical P%	Typical S%
Tri-LaurylTriThiophosphite	4.4	15.2
Tri-Lauryl Phosphite	5.2	
Tri-IsoTridecyl Phosphite	4.9	



Italmatch Chemicals is available for Joint development and/or cooperation to manufacture custom made products and derivatives based on these technologies.

FATTY ACID AMIDES

The Arese product range comprises of various long chain fatty acid amides. These amides are used among others as additives in automotive lubricants, anti-slip agents in polymer processing and additives for printing inks.



Fatty Acid Amide Product Range

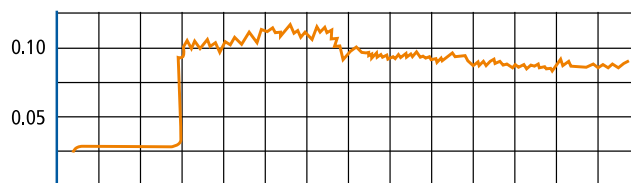
Trade Name	Chemical Description	Appearance	Area of Use
Dapramid O	Oleylamide	pellets hot molten liquid	lubricants, polymers
Dapramid E	Erucamide	pellets	polymers
Dapramid HT	Stearylamine	pellets	inks, waxes
Dapraslip OPA	N-Oleyl palmitamide	pellets	polymer processing
Dapraslip SSA	N-Stearyl palmitamide	pellets	polymer processing
Dapraslip SEA	N-Stearyl erucamide	pellets	polymer processing

Dapramid O (oleylamide) is a traditional organic friction modifier typically used in four-stroke engine oils to enhance their fuel saving capability. An example of its friction reducing ability is given below.

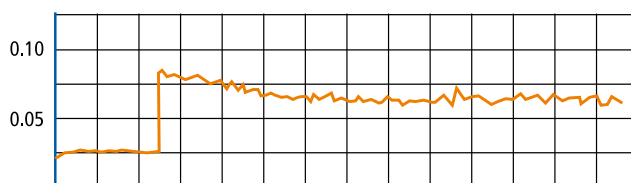
FRICION PATTERN OF AN ENGINE OIL WITH AND WITHOUT DAPRAMID O

Friction Pattern of an Engine Oil with and without Dapramid O

Model engine oil; no friction modifier present
HFRR friction diagrams (90 N, temperature 50 °C – 120 °C)*



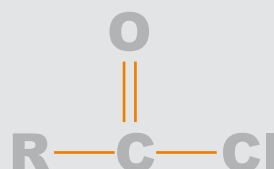
plus 0.3% **Dapramid O**



* for detailed test conditions please refer to the corresponding technical data leaflets.

ACID CHLORIDES

Arese is one of the world's largest producers of acid chlorides using the phosphorus trichloride route. A wide product range of distilled and undistilled (technical) acid chlorides of both renewable and synthetic acids is regularly available.



Acid chloride qualities available

	Technical Grade (AG)	Distilled Grade (LD)
Residual Phosphorus content	2,000 – 3,000 ppm	< 50 ppm
Residual Phosphorus trichloride content (PCl ₃)	approx. 1%	< 0.1%
Hydrochloride content (HCl)	approx. 3%	< 0.5%
Residual acid content	approx. 2%	< 0.5%

Standard product range of

Chloride Name*

2-Ethylbutyroyl-
Capronoyl-; n-Hexanoyl-
n-Heptanoyl-
Capryloyl-; n-Octanoyl-
2-Ethylhexanoyl-
n-Nonanoyl-
iso-Nonanoyl-
Caprinoyl-; n-Decanoyl-
neo-Decanoyl-
10-Undecenoyl-
Lauroyl-; n-Dodecanoyl-
Myristoyl-; n-Tetradecanoyl-
Palmitoyl-; n-Hexadecanoyl-
Stearoyl-; n-Octadecanoyl-
Oleoyl-; n-Octadenenoyl-
Cocoyl-
Stearoyl-/Palmitoyl-
Sunflower-
Linseed-



Acid chlorides find use in many different applications. They are chemical intermediates for instance in the production of:

- Peroxides / peresters
- Pharmaceuticals
- Surfactants (amide surfactants, fluorosurfactants)
- Paper sizing agents
- Toner resins
- Herbicides

acid chlorides

Chemical Intermediates for:				
	Peroxides	Pharma	Surfactants	Others
	X			
		X		4)
		X		3)
	X	X	X	3), 4)
	X			
	X	X		
	X			
		X	X	
	X			4)
	X			
	X	X	X	
		X	X	
		X	X	
			X	1), 2)
			X	1)
			X	
			X	2)
			X	
			X	

* generic names refer to natural acid sources

¹⁾ Toner resins

²⁾ Paper sizing

³⁾ Herbicides

⁴⁾ Aroma chemicals

Special acid chlorides can be produced on demand. The availability of glass-lined reactors of various sizes also allows a high flexibility in batch size from two up to ten tons.

Certificates for Kosher production are available on request for various acid chlorides.

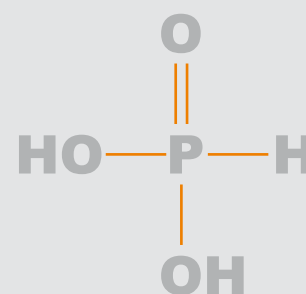
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PHOSPHOROUS ACID

Phosphorous acid is a by-product of the production of acid chlorides via the phosphorus trichloride route. The quality obtained is a concentrated liquid of about 70%, low in organic matter and chloride content. This quality is a valuable raw material for the production of e.g.

- PVC-stabilizers
- Textile auxiliaries
- Agrochemicals/Fertilizers
- Sequestering agents



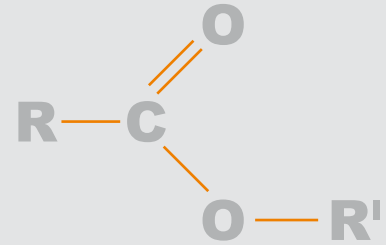
Physical properties of the phosphorous acid quality available

Property	Value	Specification Item
Appearance	slightly hazy liquid	yes
Colour Gardner	max. 4	yes
Assay	70 %	yes
Organic matter	max. 1	yes
Chloride content	max. 0.05	yes
Freezing point	- 21 °C	
Density 20 °C	1.420 g/cm ³	

FATTY ACID ESTERS

Apart from esters for semi-synthetic and synthetic lubricants (cf. page 12) Arese is producing a wide range of esters for various other applications:

- Cosmetic and Personal Care
(lipophilic/hydrophilic emulsifiers, thickeners, emollients, gloss enhancers, pearlizing agents)
- Polymer processing
(plasticizers, lubricants, antistatic agents, antifogging agents)
- Textile and leather auxiliaries
- Agrochemicals



Usually the ester raw materials used are from renewable, vegetable sources. Raw materials derived from animal sources can be used on request.

A selection of the standard ester product range is given in the table overleaf. Many other ester types can be tailored according to customer demands.

Standard product range of esters

Ester type	Appearance		Major Application Areas			
	liquid	solid	Cosmetics / Personal Care	Lubricants	Polymer Additive	Others
Glycerol Esters						
Ethylene Glocol Monostearate		X	X			
Ethylene Glocol Distearate		X	X			
Propylene Glycol Monooleate	X			X		1); 2)
Propylene Glycol Monostearate		X	X			
Triethylene glycol di-2-ethylhexanoate	X				X	4)
PEG 6000 distearate		X	X			
Polyol Esters						
PE Tetravalerianate	X			X		
PE Tetraisononanoate	X			X		
PE Tetraisostearate	X		X			
Sorbitol Esters						
Sorbitol Monolaurate	X		X		X	
Sorbitol Monopalmitate		X	X			
Sorbitol Monooleate	X		X			
Sorbitol Monostearate		X	X		X	
Mono-/Di-Esters						
Ethyl-oleate*	X					3)
Isopropyl-myristate (IPM)*	X		X	X		1)
Isopropyl-palmitate (IPP)*	X		X			1)
2-Ethylhexyl-palmitate*	X		X			
Isocetyl Stearate	X		X			

* distilled ester

¹⁾ textile

²⁾ leather

³⁾ agro

⁴⁾ rubber/resins



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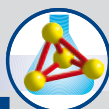
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Version:

March 2010

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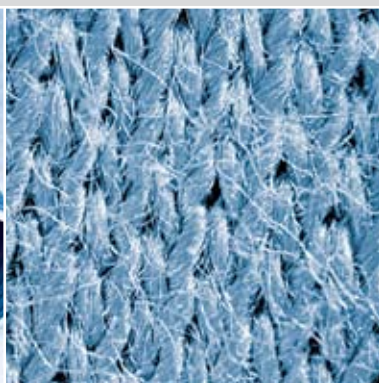
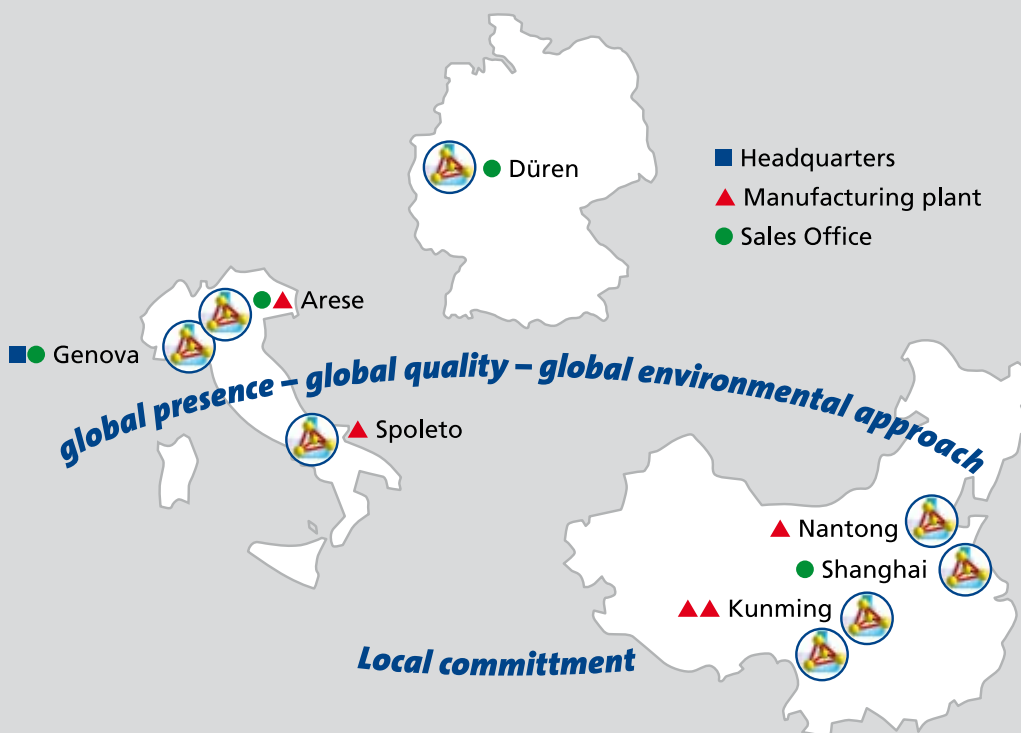
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