

QUALITY PERFORMS.



K-FLEX®

Plasticizers and Coalescents

- High Performing
- Fast Fusing
- Broadly Compatible
- Non-Phthalate
- Low-VOC

QUALITY WORKS.

LANXESS
Energizing Chemistry

GENERAL USES

K-FLEX® plasticizers and coalescents are known for their excellent value and balance of performance properties. They are non-phthalate, low in VOCs, and have positive attributes from a product safety and health perspective compared to other choices.

The K-FLEX® product line continues to grow as we invest in developing new offerings and expanding into new applications to meet the evolving needs of the industries we serve. Our team is engaged – participating in key industry associations, delivering presentations on our latest technical developments and seeking out creative new ways to bring value-added solutions to our customers.

One of the key properties of K-FLEX® products is their **compatibility with a wide range of polymers**, particularly polar materials. This makes K-FLEX® products highly effective in many of the most widely used non-olefin based polymers: PVC, polyvinyl-acetate, polyvinyl-acetate/ethylene copolymers, acrylic, styrenated acrylic, styrene-butadiene, polysulfide, nitrocellulose, nitrile, and polyurethane. These polymers are also widely used in many end-use applications, including adhesives, sealants, caulks, paint, coatings, graphic arts, resilient flooring, vinyl wall covering and artificial leather.

K-FLEX® Plasticizers for Adhesives and Sealants

For decades, our adhesives customers have turned to K-FLEX® plasticizers because they offer the best overall performance, providing **excellent viscosity response, reduced set times, increased open times, increased film flexibility and clarity, reduced heat sealing temperatures, and improved water resistance**. These properties are valued in mastics and caulking compounds, sealants, and adhesive applications used in the packaging industry for carton sealing and forming, book binding, labeling, furniture, luggage and shoes. Specific 21 CFR listings for use in adhesives and coatings with direct contact to food (as indirect food additives) are shown in the product selection guide in this brochure.

K-FLEX® Coalescents for Coatings

In recent years, an increasing number of customers have come to appreciate the value that very low VOC K-FLEX® coalescents can bring as they work to meet lower and lower VOC industry requirements or seek an alternative to phthalates. New technologies deliver performance benefits to coatings that **extend beyond the reduction of VOCs: improving scrub resistance and gloss while maintaining important features such as good blocking resistance and low dirt pick-up**. This balance of performance features may be surprising to many formulators, who expect plasticizers – which are more permanent in the film than traditional volatile coalescents – to have unsatisfactory performance in these areas. The newest generation K-FLEX® products provide very effective performance in coatings.

K-FLEX® Plasticizers for Vinyl

Our latest developments in plasticizers for vinyl applications provide outstanding performance features. These very high solvators for PVC are **fast fusing and will increase processing speed and lower processing temperatures**. K-FLEX® plasticizers also provide **superior wear performance, increased stain resistance and resistance to extraction by solvents** such as kerosene, olive oil and other non-polar materials. These properties make FLEX® an excellent choice for the production of vinyl flooring, artificial leather and wallpaper. Blends of K-FLEX® plasticizers with general purpose-type plasticizers – or with other specialty plasticizers such as adipates and citrates – are often used to take advantage of the exceptional properties of the K-FLEX® plasticizers. Non-phthalate general purpose plasticizer performances can be greatly enhanced with the addition of K-FLEX®, reducing or eliminating issues arising from poor compatibility, such as exudation or slow manufacturing speeds.

OFFERINGS AVAILABLE

K-FLEX® DP

Highly versatile polar plasticizer offering excellent compatibility with a wide range of polar polymers and rubbers

- High solvator often blended with other plasticizers
- Stays liquid well below 0°C
- Excellent choice for nitrocellulosic and acrylic lacquers and plastisol printing

K-FLEX® PG

Very high solvator specifically designed for vinyl, making it particularly useful in blends of plasticizers to tailor characteristics, with an extremely low freeze point and no GHS label requirements in the U.S. or Europe

- Outstanding stain resistance, extraction resistance, and durability in PVC
- Excellent choice for vinyl applications
- Ask us about applicability to EU Ecolabel claims

K-FLEX® 500

High solvating, economical plasticizer for adhesives and caulks, as well as other PVC and PVA applications

- High compatibility with polymers such as PVC or polyvinyl acetate
- Low freeze point

K-FLEX® 500P

Designed as a coalescent for environmentally friendly coatings, providing formulators with a solution that meets regulations and consumer demands for lower VOC content, without sacrificing performance and value

- High scrub resistance and gloss
- Low freeze point
- Excellent choice for low-VOC architectural paints and coatings

K-FLEX® 850P

Fast fusing plasticizer designed for vinyl applications with economy as a focus, which can be used alone or in blends with plasticizers such as DOTP to close the performance gap when replacing phthalates such as DINP.

- Exceptional stain and extraction resistance and reduced or eliminated exudation
- Excellent choice for plastisol flooring and flexible PVC applications, as well as latex caulks and elastomeric sealants

K-FLEX® 850S

Economical to use and tailored for performance, compatibility, and economy in waterborne latex applications.

- In VAE and PVAc emulsions, optimizes wet tack, open/set times, T_g , and viscosity response of the base emulsion to the plasticizer
- Good hardness and salt fog resistance in metal coatings
- Effective, low-VOC choice for waterborne adhesives, hot melt adhesives, putty, and food packaging adhesives

K-FLEX® 975P

Economical to use and created to offer a broad range of compatibility with polar polymers, with a low freeze point

- Optimized stain resistance, extraction resistance, and durability in vinyl
- Improves elastomeric and adhesion characteristics, wet tack, and open/set times in adhesives and sealants
- Good gloss, hardness, salt fog resistance, and T_g suppression in coatings, plus resistance to scrubbing, dirt, and blocking



K-FLEX®

PLASTICIZERS

K-FLEX® DP

Dipropylene glycol dibenzoate is one of the most versatile polar, high solvating plasticizers. It is compatible with a wide range of polar polymers and rubbers, including TPU. It is an excellent choice for high solvating plasticizer applications.

K-FLEX® PG

Propylene glycol dibenzoate is designed primarily for use in PVC compositions. It imparts outstanding stain resistance and durability in vinyl applications and can be used in adhesives to achieve higher percent solids.

K-FLEX® 500

A classic dibenzoate blend. As a polar plasticizer, it is a high solvator for PVC and compatible with polar polymers such as polyvinyl acetate. It is primarily used in adhesive applications.

K-FLEX® 500P

A dibenzoate blend designed for coatings or other applications where ultra low levels of VOCs are desired.

K-FLEX® 850P

A dibenzoate blend designed for vinyl and latex caulk applications with economy as a focus. It offers excellent stain resistance, durability and can be used alone or in blends with other plasticizers.

K-FLEX® 850S

A low VOC blend of dibenzoates optimized for use in waterborne latex applications. Widely used in the industry because of the excellent combination of efficiency, economy and performance benefits it provides to the formulator. In Europe **K-FLEX® 850S** is label-free.

Typical Physical Properties

Property	K-FLEX® 850S	K-FLEX® 850P	K-FLEX® 500	K-FLEX® 500P	K-FLEX® 975P*	K-FLEX® PG	K-FLEX® DP
Boiling Point (5 mm Hg, °C)	180	180	191	236	215	157	195
Boiling Point (750 mm Hg, °C, extrapolated)	>330	>330	>350	>350	>350	>300	>350
Density, ASTM D1475, 25°C, g/ml	1.14	1.14	1.15	1.15	1.15	1.14	1.11
Density, ASTM D1475, 25°C, lbs/gal	9.6	9.6	9.6	9.6	9.6	9.5	9.3
Freeze Point, °C	14	12	6	0	6	-50**	-51**
Moisture Content, %	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Viscosity, Brookfield RVT, 20 RPMs at 25°C, cps and mPa·s	72	76	80	107	73	81	99
Viscosity, Kinematic, 25°C, cSt	63	66	70	93	63	71	89
VOC%, ASTM D2369	2.2	1.7	2.9	0.9	2	5.8	3.2

FDA Listing†

21 CFR 175.105	Yes	Yes	Yes	Yes	Yes	Yes	Yes
21 CFR 176.170	Yes	Yes	Yes	Yes	No*	No	Yes
22 CFR 176.180	Yes	Yes	Yes	Yes	No*	No	Yes

* K-FLEX® 975P may be used as a plasticizer at a level not to exceed 20% in an adhesive under 21 CFR 176.170 and 21 CFR 176.180, provided the adhesive is separated from the food by a functional barrier, or is limited to contact with food so as not to exceed trace amounts at seams and edges.

** Glass Point by DSC

† LANXESS does not warrant that these product(s) are suitable under applicable food additive / food contact regulations of any potential use. The responsibility for determining the overall compliance with applicable food additive / food contact laws and regulations is with the company manufacturing the final consumer product and/or the person placing the products described herein in contact with food. This information is provided in good faith and is believed

Plasticizer/Polymer Compatibility¹

Plasticizer	Solubility Parameter (cal/cm ³)	Resin Compatibility %																	
		PVC	PVAC	PVButyral (% PVOH Content)		Cellulose Nitrate	Cellulose Acetyl (Acetyl Content)		CAP	CAB (% Butyryl Content)		EC	PS	PU	PC	PMMA	SBR	Chlorinated Rubber	
				13%	21%		Lo	Hi		CR	N								
Diethylene Glycol Dibenzoate (DEGDB) ²	10.1	100	100	100	33	100	10	10	100	100	100	100	0		50	100			
Dipropylene Glycol Dibenzoate (DPGDB) ³	9.6	100	100	100	100	100	10	10		25	100	100	33	100	33	100	100 ⁴	100	100
Acetyl Tri-n-butyl Citrate (ATBC)	9.0	100	100	50	50	100	30	50										100	100
Butyl Benzyl Phthalate (BBP)	9.9	100	100	100	50	100	10	10	80	100	100	100	100	25	60	100	50	80	30
Di-2-Ethylhexyl Adipate (DEHA)	8.5	75	0	25	25	35	0	0	10	25	25	100	100	15	10	15	50	100	30
Di-2-Ethylhexyl Phthalate (DEHP)	8.2	100	5	>15	>15	100	0	0	20	50	50	100	100	25	25	100	50	100	30
Di-2-Ethylhexyl Terephthalate (DOTP)	n/a	100	5	>15	>15	100	0	0	20	50	50	100	100	25	25	100	50	100	30

¹ Source: The Technology of Plasticizers, Sears and Darby, John Wiley & Sons.

² Component of K-FLEX 850S and K-FLEX 500.

³ Component of K-FLEX 850S, K-FLEX 500 and K-FLEX DP.

⁴ Value for DEGDB and DPGDB blend. No values were provided for the individual dibenzoates.

REGULATORY LISTING

FDA CFR Listings*

The intentional components of **K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 975P*, K-FLEX® 500P, K-FLEX® PG, K-FLEX® DP** Plasticizers can be safely used as plasticizers in food packaging adhesives; in paper and paper coatings in contact with dry foods; and/or, in certain instances in paper and paperboard coatings in contact with aqueous and fatty foods. Please refer to the following for specific 21 CFR citations, as well as the tabular summary of FDA Listings within the Typical Physical Properties table on page 5 of this brochure.

21 CFR § 175.105:

Adhesives or Substances for Use Only as Components of Adhesives.

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® 975P, K-FLEX® PG, K-FLEX® DP Plasticizers can be safely used as adhesive components intended for use in packaging, transporting, or holding food in accordance with the prescribed conditions and limitations listed in 21 CFR § 175.105.

21 CFR § 176.170:

Components of paper and paperboard in contact with aqueous and fatty foods.

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® DP Plasticizers can be safely used in aqueous and fatty application areas in accordance with the prescribed conditions and limitations listed in 21 CFR § 176.170. Please see footnote* regarding the use of **K-FLEX® 975P**.

21 CFR § 176.180:

Components of paper and paperboard in contact with dry food.

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® DP Plasticizers can be safely used in dry application areas in accordance with the prescribed conditions and limitations listed in 21 CFR § 176.180. Please see footnote* regarding the use of **K-FLEX® 975P**.

Bringing value with high quality products produced in our world-scale facilities with ISO 9001:2015 and ISO-14001:2015 certified management systems

Global Inventory

K-FLEX® coalescents and plasticizers are included on or exempted from many global inventories. Please reference the product safety data sheet (SDS) for current global inventory status and other regulatory information. Current SDS's can be found on our website at **lanxess.com/en/Products-and-Solutions/Brands/K-FLEX** or can be requested from **product.compliance@emeraldmaterials.com**.

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LANXESS does not warrant that these product(s) are suitable under applicable food additive / food contact regulations of any potential use. The responsibility for determining the overall compliance with applicable food additive / food contact laws and regulations is with the company manufacturing the final consumer product and / or the person placing the products described herein in contact with food. This information is provided in good faith and is believed accurate as of the date of this letter. No warranty is subsequently expressed or implied. Liability is expressly disclaimed.

COMMITTED TO EXCELLENCE IN SERVICE AND MANUFACTURING

U.S. OSHA Communication Standard

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® 975P, K-FLEX® PG and K-FLEX® DP are not regulated as hazardous substances.

Canadian WHMIS Classification

K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® 975P, K-FLEX® PG and K-FLEX® DP are not regulated as hazardous substances.

Storage and Handling:

At LANXESS production facility, the K-FLEX plasticizers are stored in type 304 stainless steel storage tanks. These storage tanks are nitrogen padded to reduce discoloration of the product. Type 304 stainless steel pipe and valves are also used. High density polyethylene has been shown to be suitable for product shipment but we have no direct experience in piping systems.

Since K-FLEX products are excellent plasticizers for polyvinyl chloride (PVC), PVC piping systems should not be used. Sliding vane type positive displacement pumps have given us excellent service.

It is recommended that storage tanks be heated and insulated and that pumps and transfer piping also be heat-treated and insulated. Our engineers are always ready to discuss the storage and handling of any of our products.

Additional information can be found in the Safety Data Sheet.

* K-FLEX® 975P and K-FLEX® PG contain a component on Canada's NDSL.

As a leader in benzoate chemistry, we focus on operational excellence. We produce our K-FLEX product line in Rotterdam, the Netherlands and Kalama, Washington (USA), from operations strategically located on ports and rail lines to serve our customers globally. Both plants are backward integrated into key feedstocks to produce a wide array of benzoates, plasticizers, aroma chemicals and other intermediates.

Extending Our Portfolio and Capabilities

We have continued to add new chemistries to our portfolio, as well as expand our application expertise from our world-scale technical center. We are backward integrated in benzoic acid and recently completed a \$40M expansion to increase our capabilities.

Serving Customers Globally

Our network includes partnerships with distributors and sales offices all over the world.

LANXESS is a leading specialty chemicals company with sales of EUR 6.1 billion in 2020. The company currently has about 14,800 employees in 33 countries. The core business of LANXESS is the development, manufacturing and marketing of chemical intermediates, additives, specialty chemicals and plastics. LANXESS is listed in the leading sustainability indices Dow Jones Sustainability Index (DJSI World and Europe) and FTSE4Good.





LANXESS Deutschland GmbH
Business Unit Polymer Additives
Kennedyplatz 1
50569 Cologne, Germany

**Customers in the USA are
kindly requested to refer to**
Emerald Kalama Chemical LLC,
a company of the LANXESS group
Vancouver, WA, USA
800 223 0035 or
+1 360 954 7100

polymer.additives@lanxess.com
<http://pla.lanxess.com>

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Unless specified to the contrary, the values given have been established on standardized test specimens. The figures should be regarded as guide values only and not as binding minimum values. Kindly note that the results refer exclusively to the specimens tested. Under certain conditions, the test results established can be affected to a considerable extent by the processing conditions and manufacturing process.

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