

Lutensol® XL types

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BASF Aktiengesellschaft

Lutensol® XL 40
Lutensol® XL 50
Lutensol® XL 60
Lutensol® XL 70
Lutensol® XL 79
Lutensol® XL 80
Lutensol® XL 89
Lutensol® XL 90
Lutensol® XL 99
Lutensol® XL 100
Lutensol® XL 140

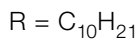
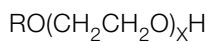
**Nonionic surfactants for detergents and cleaners, and for the
chemical and allied industries**

Lutensol® XL types

Chemical character

The Lutensol® XL types are nonionic surfactants. They are alkyl polyethylene glycol ethers made from a C10-Guerbet Alcohol and ethylene oxide. These products contain also higher alkylene oxides in small amounts.

They conform to the following formula:



$$x = 4, 5, 6, 7, 8, 9, 10, 14$$

The numeric code in the product name indicates in general the degree of ethoxilation.

Properties

Lutensol® XL 40, XL 50, XL 60, XL 70, XL 80 and XL 90 are cloudy liquids at room temperature, and they tend to form a sediment. Lutensol® XL 100 and XL 140 are soft, clourless or slightly yellowish pastes at 23 °C.

Lutensol® XL 70, XL 80, XL 90, XL 100 and XL 140 become clear liquids at 50 °C

Lutensol® XL 79, XL 89 and XL 99 are clear liquids at room temperature.

Lutensol®		XL 40	XL 50	XL 60	XL 70	XL 79
Physical form (23 °C)		Liquid	Liquid	Liquid	Liquid	Liquid
Degree of ethoxilation		ca. 4	ca. 5	ca. 6	ca. 7	ca. 7
Concentration	%	ca. 100	ca. 100	ca. 100	ca. 100	ca. 85
Cloudpoint (EN 1890)*						
Method A	°C	< 5	< 5	< 5	< 5	< 5
Method B	°C	< 5	< 5	< 5	< 5	< 5
Method C	°C	< 5	< 5	< 5	< 5	< 5
Method D	°C	ca. 54	ca. 64	ca. 69	ca. 71	ca. 71
Method E	°C	ca. 43	ca. 58	ca. 65	ca. 68	ca. 68
Average molar mass (from OH number)	g/mol	ca. 380	ca. 440	ca. 490	ca. 560	ca. 560
pH (EN 1262, solution B)**		ca. 7	ca. 7	ca. 7	ca. 7	ca. 7
Density (DIN 51757, 23 °C)	g/cm ³	ca. 0.95	ca. 0.97	ca. 0.98	ca. 0.99	ca. 1.01
Dropping point (DIN 51801)	°C	< 0	< 0	< 0	ca.18	< 0
Solidification point (ISO 2207)	°C	< 0	< 0	< 0	ca. 4	< 0
Melting point		°C	–	–	–	–
Viscosity (EN 12092, 23 °C, Brookfield, 60 rpm)	mPa·s	ca. 40	ca. 50	ca. 60	ca. 70	ca. 120
Hydroxylnumber (DIN 53240) mgKOH/g		ca. 150	ca. 130	ca. 115	ca. 100	ca. 100
HLB value		ca. 10.5	ca. 11.5	ca. 12.5	ca. 13	ca. 13
Flash point (DIN 51376)		°C	> 170	> 190	> 200	> 180
Wetting (EN 1772, distilled water, 23 °C, 2 g Soda ash/l)						
0.5 g/l	s	ca. 50	ca. 50	ca. 40	ca. 40	ca. 40
1 g/l	s	ca. 30	ca. 20	ca. 10	ca. 10	ca. 10
2 g/l	s	ca. 20	ca. 5	ca. 5	ca. 5	ca. 5
Foam volume (EN 12728, 40 °C, 2 g/l water at a hardness of 1.8 mmol Ca-ions/l, after 30 s)	cm ³	ca. 10	ca. 200	ca. 240	ca. 300	ca. 300
Surface tension (DIN 53914, 1 g/l in distilled water, 23 °C)***		mN/m	ca. 27	ca. 27	ca. 27	ca. 27

Lutensol®		XL 80	XL 89	XL 90	XL 99	XL 100	XL 140
Physical form (23 °C)		Liquid	Liquid	Liquid	Liquid	Liquid	Liquid
Degree of ethoxilation		ca. 8	ca. 8	ca. 9	ca. 9	ca. 10	ca. 14
Concentration	%	ca. 100	ca. 80	ca. 100	ca. 80	ca. 100	ca. 100
Cloudpoint (EN 1890)*							
Method A	°C	ca. 56	ca. 56	ca. 69	ca. 69	ca. 80	ca. 96
Method B	°C	ca. 43	ca. 43	ca. 53	ca. 53	ca. 64	ca. 78
Method C	°C	ca. 34	ca. 34	ca. 42	ca. 42	ca. 52	ca. 62
Method D	°C	ca. 75	ca. 75	ca. 78	ca. 78	ca. 80	ca. 85
Method E	°C	ca. 74	ca. 74	ca. 77	ca. 77	ca. 80	ca. 85
Average molar mass (from OH number)	g/mol	ca. 860	ca. 860	ca. 600	ca. 600	ca. 630	ca. 730
pH value (EN 1262, solution B)**		ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7
Density (DIN 51757, 23 °C)	g/cm ³	ca. 1.00	ca. 1.02	ca. 1.02	ca. 1.03	ca. 0.99 (60 °C)	ca. 1.01 (60 °C)
Dropping point (DIN 51801)	°C	ca. 23	ca. 3	ca. 24	ca. 4	ca. 26	ca. 31
Solidification point (ISO 2207)	°C	ca. 10	< 0	ca. 11	< 0	ca. 13	ca. 18
Melting point	°C	–	–	–	–	not measurable	not measurable
Viscosity (EN12092, 23 °C, Brookfield, 60 rpm)	mPa·s	ca. 120	ca. 150	ca. 30 (60 °C)	ca. 160	ca. 30 (60 °C)	ca. 40 (60 °C)
Hydroxyl number (DIN 53240) mgKOH/g		ca. 95	ca. 95	ca. 90	ca. 90	ca. 75	ca. 65
HLB value		ca. 14	ca. 14	ca. 14.5	ca. 14.5	ca. 15	ca. 16
Flash point (DIN 51376)		> 180	> 180	> 180	> 180	> 190	> 200
Wettin (EN 1772, distilled water, 23 °C, 2 g Soda ash/l)							
0.5 g/l	s	ca. 50	ca. 50	ca. 60	ca. 60	ca. 80	ca. 160
1 g/l	s	ca. 10	ca. 10	ca. 10	ca. 10	ca. 20	ca. 50
2 g/l	s	ca. 5	ca. 5	ca. 5	ca. 5	ca. 10	ca. 10
Foam volume (EN 12728, 40 °C, 2 g/l water at a hardness of 1.8 mmol Ca-Ions/l, after 30 s)	cm ³	ca. 360	ca. 360	ca. 420	ca. 420	ca. 470	ca. 500
Surface tension (DIN 53914, distilled water, 23 °C)***	mN/m	ca. 27	ca. 27	ca. 27	ca. 27	ca. 28	ca. 29

The above information is correct at the time of going to press. It does not necessarily form part of the product specification. A detailed product specification is available from your local BASF representative.

* Cloud point EN 1890:

Method A : 1 g of surfactant + 100 g of dist. Water

Method B : 1 g of surfactant + 100 g of NaCl solution (c = 50 g/l)

Method C : 1 g of surfactant + 100 g of NaCl solution (c = 100 g/l)

Method D : 5 g of surfactant + 45 g of butyldiglycol solution (c = 250 g/l)

Method E : 5 g of surfactant + 25 g of butyldiglycol solution (c = 250 g/l)

** The pH of the Lutensol® XL types can decrease during storage, but this does not have any effect on their performance

*** Applying Harkins-Jordan correction

Solubility

Details on the solubility of the Lutensol® XL types in various solvents are given in the table below.

Solubility of the Lutensol® XL types (10 % at 23 °C)

	Distilled water	Potable water (2.7 mmol Ca ²⁺ -ions/l)	Caustic soda (5%)	Hydrochloric acid (5%)	Salt solution (5%)	Solvent naptha	Ethanol Isopropanol	Aromatic hydrocarbons
Lutensol® XL 40	–	–	–	–	–	±	±	+
Lutensol® XL 50	○	○	–	+	○	±	±	+
Lutensol® XL 60	+	+	○	+	–	±	±	+
Lutensol® XL 70	+	+	○	+	–	+	+	+
Lutensol® XL 79	+	+	○	+	–	+	+	–
Lutensol® XL 80	+	+	–	+	+	±	+	+
Lutensol® XL 89	+	+	–	+	+	+	+	–
Lutensol® XL 90	+	+	+	+	+	±	+	+
Lutensol® XL 99	+	+	+	+	+	+	+	–
Lutensol® XL 100	+	+	+	+	+	–	+	+
Lutensol® XL 140	+	+	+	+	+	–	+	+

+ = clear solution

± = sparingly soluble (insoluble sediment)

– = insoluble (phase separation)

○ = forms an opaque soluble, homogeneous emulsion

Viscosity

The relationship between viscosity and temperature is always an important point to consider when Lutensol® XL types are stored or shipped. This is shown in the following table (mPa·s, Brookfield LVT):

Viscosity at °C	0	10	20	23	30	40	50	60
Lutensol® XL 40	120	60	50	40	20	20	20	10
Lutensol® XL 50	200	110	60	50	40	30	20	10
Lutensol® XL 60	250	120	80	60	50	40	30	10
Lutensol® XL 70	>10 ⁵	1500	100	70	50	40	30	20
Lutensol® XL 79	550	250	130	120	80	50	30	20
Lutensol® XL 80	>10 ⁵	>10 ⁵	400	120	60	40	30	20
Lutensol® XL 89	>10 ⁵	350	180	150	100	60	40	30
Lutensol® XL 90	>10 ⁵	>10 ⁵	4000	500	100	50	40	30
Lutensol® XL 99	>10 ⁵	400	190	160	100	60	40	30
Lutensol® XL 100	>10 ⁵	>10 ⁵	>10 ⁵	>10 ⁵	200	60	40	30
Lutensol® XL 140	>10 ⁵	>10 ⁵	>10 ⁵	>10 ⁵	300	80	50	40

We would recommend the preparation of 10–25 % stock solutions of Lutensol® XL types if they are to be used in the form of very dilute solutions, or if they are to be added to other solutions. This makes it very much easier to dilute them later on.

The Lutensol® XL types can form fairly stiff gels at certain concentrations when water is added. The figures below were measured using a Brookfield-viscosimeter at 23 °C and 60 rpm.

The viscosity of Lutensol® XL types at 23°C as a function of concentration in water (all values in mPa·s)

Water-content %	Lutensol® XL 40	Lutensol® XL 50	Lutensol® XL 60	Lutensol® XL 70	Lutensol® XL 79	Lutensol® XL 80	Lutensol® XL 89	Lutensol® XL 90
0	40	50	60	70	120	120	150	400
10	50	70	90	100	1600	150	>10 ⁵	150
20	70	80	100	150	>10 ⁵	200	82000	200
30	80	>10 ⁵	>10 ⁵	>10 ⁵	>10 ⁵	>10 ⁵	1600	85000
40	160 ¹⁾	>10 ⁵	>10 ⁵	90000	4300	17000	220	400
50	300 ¹⁾	50000	500 ¹⁾	2000	140 ¹⁾	300	200	350
60	50 ¹⁾	500 ¹⁾	100 ¹⁾	200 ¹⁾	120	200	120	300
70	30 ¹⁾	100 ¹⁾	50	100	60	100	30	60
80	30 ¹⁾	70 ¹⁾	30	30	20	20	20	20
90	10 ¹⁾	60 ¹⁾	10	10	10	10	10	10

¹⁾ two separate phases are formed

Water-content %	Lutensol® XL 99	Lutensol® XL 100	Lutensol® XL 140
0	160	>10 ⁵	>10 ⁵
10	>10 ⁵	150	200
20	320	200	300
30	280	300	400
40	350	400	>10 ⁵
50	300	>10 ⁵	>10 ⁵
60	100	300	250
70	30	50	50
80	20	20	20
90	10	10	10

The numbers reported have to be regarded as maximum values; the values measured immediately after mixing will be lower than the numbers reported.

Storage

- The Lutensol® XL types should be stored indoors in a dry place. Storerooms must not be overheated.
- The Lutensol® XL types are hygroscopic due to their good solubility in water, with the result that they may absorb moisture very quickly. Drums must be resealed each time they are opened.
- The storage temperature should not be allowed to fall substantially below 20 °C. The setting points of these products also need to be taken into account.
- Lutensol® XL 40, XL 50, XL 60, XL 70, XL 80 and XL 90 are cloudy liquids at room temperature, and they tend to form a sediment. Lutensol® XL 100 and XL 140 are soft, clourless or slightly yellowish pastes at 23 °C.

Lutensol® XL 70, XL 80, XL 90, XL 100 and XL 140 become clear liquids at 50 °C

Lutensol® XL 79, XL 89 and XL 99 are clear liquids at room temperature.

- Liquid that has solidified or that shows signs of sedimentation should be heated to 50 – 60 °C and homogenized before it is processed.

- f) Drums that have solidified or that have begun to precipitate should be reconstituted by gentle heating, preferably in a heating cabinet. The temperature must not be allowed to exceed 60 °C. This also applies if drums are heated by external electrical elements. Internal electrical elements should not be used because of the localized anomalies in temperature that they cause.
- g) The Lutensol® XL types must be blanketed with nitrogen if they are stored in heated tanks (at 50 – 60 °C) to prevent them from coming into contact with air. Constant, gentle stirring helps to prevent them being discoloured as a result of prolonged contact with electrical elements or external heating coils.

Materials

The following materials can be used for tanks and drums.

- a) AISI 321 stainless steel (X6 CrNiTi 1810)
- b) AISI 316 Ti stainless steel (X10 CrNiMoTi 1810)

Shelf life

Provided they are stored properly and drums are kept tightly sealed, the Lutensol® XL types have a shelf life of at least two years in their original packaging.

Applications

The Lutensol® XL types belong to a group of nonionic surfactants that have established themselves in detergents and cleaners, and in other branches of the chemical industry, by virtue of the high levels of surface activity they display. Their main area of application is in detergents and cleaners for household, industrial and institutional use.

Because they are nonionic, the Lutensol® XL types can be combined with anionic, cationic and nonionic surfactants and auxiliaries. They are fully compatible with alkylaryl sulphonates (Lutensit® A-LB types), ether sulphates and other sulphated and sulphonated products. This enables synergistic effects and very high levels of performance to be obtained. They are also compatible with the Lutensit® TC-KLC 50 types (cationic biocides based on dimethyl fatty alkylbenzeneammonium chloride) and with other nonionic surfactants such as our Lutensol® A N, TO, ON, AT, AO and GD types, and the low-foaming surfactants in our Plurafac® LF and Pluronic® PE and RPE ranges. Their compatibility with dyes, pigments, protective colloids, thickeners and other substances with a molar mass in the upper range is also very good.

The versatility of the Lutensol® XL types is such that they can be used to formulate acidic, alkaline and neutral cleaners that satisfy the most varied requirements. They are very effective emulsifiers in combination with Emulan® and other products from the Lutensol® range.

Very large amounts of acids, alkali, salts and organic solvents may have to be added to some formulations in order to fulfil special requirements. High concentrations of inorganic salts, bases and acids can impair the solubility of the Lutensol® XL types.

Nevertheless, this does not necessarily affect their performance. Although electrolytes of this type do not cause the Lutensol® XL types to decompose, they can still cause solutions to become cloudy or to separate but, provided they are still homogeneous, their performance is not affected.

Cleaners

We recommend the following Lutensol® XL types for the products listed below.

Household cleaners

Cleaners for floors, sanitary ware, tiles and enamel can be formulated with Lutensol® XL 70, XL 80 XL 90 and XL 100 in combination with other Lutensol® types and anionic surfactants from our Lutensit® range (especially Lutensit® A-LB types), dispersing agents (Sokalan®) and chelating agents (Trilon®). It can be advisable to add a solubilizer such as cumene sulphonate to highly concentrated formulations.

Neutral water based cleaners	The water soluble products like Lutensol® XL 70, XL 80, XL 90 and XL 100 perform well in neutral cleaners in combination with Lutensit® A types, dispersing agents (Sokalan®) and chelating agents (Trilon®). Again, it can be advisable to add a solubilizer such as cumene sulphonate to highly concentrated formulations.
Neutral metal cleaners	Neutral cleaners and degreasers with a corrosion-inhibiting action for metal pretreatment can be formulated from products such as our Korantin® MAT and Korantin® PAT. The water-soluble surfactants in the range, especially Lutensol® XL 70, XL 80, XL 90 and XL 100, are very effective wetting agents for use in this type of formulation.
Alkaline water-based cleaners	Cleaners of this type are based on caustic alkali, on alkali carbonates, silicates and phosphates. They are mainly used to clean metal before it is plated, coated, phosphatized or anodized. Lutensol® XL 70, XL 80, XL 90, XL 100 are recommended for this purpose, in combination with other Lutensol® types, dispersing agents (Sokalan®) and, chelating agents (Trilon®).
Acid cleaners	Lutensol® XL 70, XL 80, XL 90, XL 100 and XL 140 can be used in pickling solutions, degreasers, descalers and derusters based on hydrochloric, sulphuric, phosphoric or amidosulphonic acid. Formulations can also contain Lutensol® FA 12, Lutensit® TC-KLC 50 and Lutensit® A-LB types as well as corrosion inhibitors such as our Korantin® BH.
Building care, disinfectants	For the formulation of disinfectants and cleaners for building care we recommend the use of the water soluble Lutensol® XL types like Lutensol® XL 70, XL 80, XL 90 and XL 100 in combination with Lutensol® A 8, Lutensol® TO types, Lutensol® FSA 10, FA 12, Lutensit® TC-KLC 50 and Lutensit® A-LB types, dispersing agents (Sokalan®) and chelating agents (Trilon®).
Solvent-based cleaners	Lutensol® XL 40 can be used alongside Emulan® A, P and PO to emulsify hydrocarbons such as mineral spirits and kerosene in solvent-based cleaners that are applied cold. Cleaners of this type are used to clean motor vehicles, engines, machine parts, road and rail tankers, etc., and to degrease metal.

Emulsification

The Lutensol® XL types generally perform well as emulsifiers, although some perform better than others. Their practical performance as emulsifiers can be gauged according to their hydrophilic-lipophilic balance, which correlates with their degree of ethoxylation.

The Lutensol® XL types can be combined with other emulsifiers from our nonionic Emulan and anionic Emulphor® ranges, and with alkali soaps, amine soaps and sulphonated oils. Graduated tests are the most effective means of determining the best combination of emulsifiers and the amounts required. Tests are indispensable if emulsions are subjected to severe demands due to the presence of electrolytes, finely divided suspended solids or water-soluble, organic solvents. Special emulsifier combinations often have to be employed to cope with exceptional thermal or mechanical stress.

Dispersing

The dispersing capacity of surfactants, which plays an important part in cleaning and emulsification processes, is the single most important attribute that has to be considered if sparingly soluble solids are to be dispersed in water or other solvents. The Lutensol® XL types can be used to disperse the solids generated by precipitation, coagulation and other chemical reactions. They can be used alone or in combination with protective colloids.

Wetting

The Lutensol® XL types are very effective wetting agents. They can be employed in a variety of refining, mixing, impregnating and surface-treatment processes.

Again, graduated tests under practical conditions are the most effective means of determining the best products for specific applications.

Other applications

There are many applications for the Lutensol® XL types in the leather, paper, paints and building products industries.

Substitutes for alkylphenol ethoxylates (APEO)

Legislation and voluntary agreements have been adopted in many countries to prohibit the use of alkylphenol ethoxylates in detergents and cleaners. This was prompted by the ecological objections that have been raised owing to the toxicity of degradation products of APEO to fish.

The Lutensol® XL types can be employed as substitutes for alkylphenol ethoxylates in most detergent and cleaner formulations. The choice of the respective substitute may be based on criteria like HLB value or cloud point. Our Lutensol® AO, Lutensol® TO and Lutensol® ON types may be more appropriate depending on the formulation in question.

Safety

We know of no ill effects that could have resulted from using Lutensol® XL types for the purpose for which it is intended and from processing it in accordance with current practices.

According to the experience that we have gained over many years and other information at our disposal, Lutensol® XL types do not exert harmful effects on health, provided they are used properly, due attention is given to the precautions necessary for handling chemicals, and the information and advice given in our Safety Data Sheets are observed.

Handling

Protect the eyes and avoid prolonged contact with the skin. Safety glasses should be worn when handling these products in their undiluted form.

Biological Degradability

The Lutensol® XL types are readily biodegradable according to test methods OECD 301 A – F. This refers also to the alcohol basis of the Lutensol® XL types.

Classification

The Lutensol® XL types are classified as following according to the German chemical legislation based on the EU guideline 67/548/EWG.

Lutensol® XL 40	irritant
Lutensol® XL 50	irritant
Lutensol® XL 60	irritant, harmful
Lutensol® XL 70	irritant, harmful
Lutensol® XL 79	irritant, harmful
Lutensol® XL 80	irritant, harmful
Lutensol® XL 89	irritant, harmful
Lutensol® XL 90	irritant, harmful
Lutensol® XL 99	irritant, harmful
Lutensol® XL 100	irritant, harmful
Lutensol® XL 140	irritant, harmful

Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, these data do not relieve processors from the responsibility of carrying out their own tests and experiments; neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

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