

Technical Information

August 2013

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Last change WF-No. 2597

® = Registered trademark of BASF

Lutensol® AT types

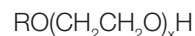
Lutensol® AT 11
Lutensol® AT 18 20%
Lutensol® AT 25 E
Lutensol® AT 25 Powder
Lutensol® AT 25 Flakes
Lutensol® AT 50 E

Lutensol® AT 50 Powder
Lutensol® AT 50 Flakes
Lutensol® AT 80 E
Lutensol® AT 80 Powder
Lutensol® AT 80 Flakes

Nonionic surfactants for use in detergents and cleaners and for the chemical and allied industries

Chemical nature

The Lutensol® AT types are nonionic surfactants. They are alkylpolyethylene glycol ethers made from a linear, saturated C₁₆-C₁₈ fatty alcohol. They conform to the following formula.



R = Linear, saturated C₁₆-C₁₈-fatty alcohol

x = 11, 18, 25, 50 or 80

The number in the alphanumeric code indicates the nominal degree of ethoxylation.

The Lutensol® AT types are manufactured by causing the fatty alcohol to react with ethylene oxide in stoichiometric proportions. The ethoxylation temperature is kept as low as possible. This, combined with the high purity of the feedstocks, ensures that a high-performance product with low toxicity is obtained.

PRD-Nos.*

30043946	Lutensol® AT 11
30043945	Lutensol® AT 18 20%
30043973	Lutensol® AT 25 E
30043944	Lutensol® AT 25 Powder
30043971	Lutensol® AT 25 Flakes
30062229	Lutensol® AT 50 E
30043970	Lutensol® AT 50 Powder
30043969	Lutensol® AT 50 Flakes
30043967	Lutensol® AT 80 E
30043968	Lutensol® AT 80 Powder
30043966	Lutensol® AT 80 Flakes

* BASF's commercial product numbers.

Properties

Lutensol® AT 18 20% is a clear or cloudy, colourless or slightly yellowish liquid.

Lutensol® AT 11 are colourless or slightly yellowish, waxy cast solids.

Lutensol® AT 25 E, Lutensol® AT 50 E and Lutensol® AT 80 E are colourless or slightly yellowish cast solids.

Lutensol® AT 25 Powder, Lutensol® AT 50 Powder and Lutensol® AT 80 Powder are colourless or slightly yellowish powders.

Lutensol® AT 25 Flakes, Lutensol® AT 50 Flakes and Lutensol® AT 80 Flakes are colourless or slightly yellowish spicular flakes.

Lutensol®		AT 11	AT 18 20%	AT 25 E	AT 25 Powder	AT 25 Flakes
Degree of ethoxylation	mol	approx. 11	approx. 18	approx. 25	approx. 25	approx. 25
Concentration	%	approx. 100	approx. 20	approx. 100	approx. 100	approx. 100
Cloud point (EN 1890)*						
Method A	°C	approx. 87	>100	>100	>100	>100
Method B	°C	approx. 70	approx. 92	approx. 95	approx. 95	approx. 95
Method C	°C	approx. 60	approx. 72	approx. 80	approx. 80	approx. 80
Method D	°C	approx. 89	–	approx. 93	approx. 93	approx. 93
Method E	°C	approx. 92	–	approx. 95	approx. 95	approx. 95
Molar mass (calculated from hydroxyl number)	g/mol	approx. 740	approx. 1050	approx. 1360	approx. 1360	approx. 1360
pH (EN 1262, 5% in water)**		approx. 7	approx. 7	approx. 7	approx. 7	approx. 7
Density (DIN 51757, 60 °C)	g/cm ³	approx. 0.97	approx. 1.01 (23 °C)	approx. 1.02	approx. 1.02	approx. 1.02
Apparent density (ISO 697)	kg/l	–	–	–	approx. 0.6	approx. 0.5
Dropping point (DIN 51801)	°C	approx. 35	<5	approx. 45	approx. 45	approx. 45
Congeaing point (ISO 2207)	°C	approx. 30	<5	approx. 38	approx. 38	approx. 38
Clear melting point	°C	approx. 34	<5	approx. 46	approx. 46	approx. 46
Viscosity (EN 12092, 60 °C, Brookfield, 60 rpm)	mPa·s	approx. 30	approx. 25 (23 °C)	approx. 70	approx. 70	approx. 70
Hydroxyl number (DIN 53240)	mg KOH/g	approx. 75	approx. 53	approx. 40	approx. 40	approx. 40
Hydrophilic-lipophilic balance		approx. 13	approx. 15	approx. 16	approx. 16	approx. 16
Wetting power (EN 1772, in distilled water with 2 g/l soda ash)						
0.5 g/l, 23 °C	s	>300	>300	>300	>300	>300
1.0 g/l, 23 °C	s	>300	>300	>300	>300	>300
2.0 g/l, 23 °C	s	>300	>300	>300	>300	>300
0.5 g/l, 70 °C	s	approx. 150	>300	>300	>300	>300
1.0 g/l, 70 °C	s	approx. 100	>300	>300	>300	>300
2.0 g/l, 70 °C	s	approx. 60	>300	>300	>300	>300
Foam formation (EN 12728, 40 °C, 2 g/l in water with a hardness of 1.8 mmol Ca ²⁺ ions/l, after 30 sec)	cm ³	approx. 100	approx. 200	approx. 200	approx. 200	approx. 200
Surface tension*** (EN 14370, 1 g/l in distilled water at 23 °C)	mN/m	approx. 39	approx. 40	approx. 45	approx. 45	approx. 45

* Cloud point according to EN 1890:

Method A: 1 g of surfactant + 100 g of distilled 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 diethylene glycol monobutyl ether solution (c = 250 g/l)

Method E: 5 g of surfactant + 25 g of diethylene glycol monobutyl ether solution (c = 250 g/l)

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

*** Applying Harkins-Jordan correction.

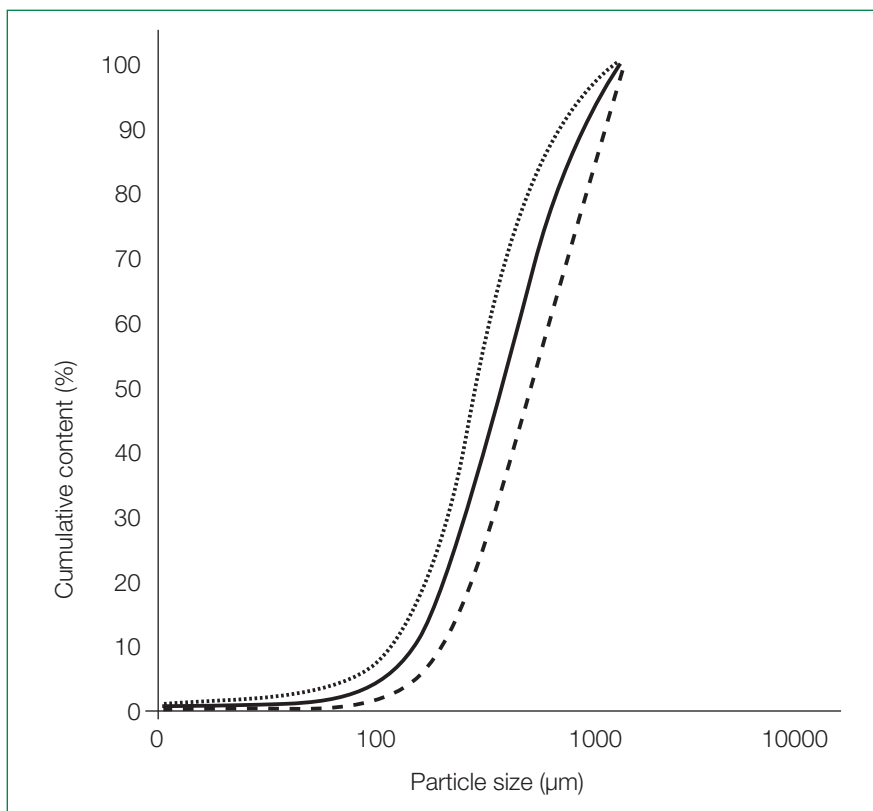
Lutensol®		AT 50 E	AT 50 Powder	AT 50 Flakes	AT 80 E	AT 80 Powder	AT 80 Flakes
Degree of ethoxylation	mol	approx. 50	approx. 50	approx. 50	approx. 80	approx. 80	approx. 80
Concentration	%	approx. 100	approx. 100	approx. 100	approx. 100	approx. 100	approx. 100
Cloud point (EN 1890)*	°C						
Method A	°C	>100	>100	>100	>100	>100	>100
Method B	°C	approx. 92	approx. 92	approx. 92	approx. 87	approx. 87	approx. 87
Method C	°C	approx. 75	approx. 75	approx. 75	approx. 73	approx. 73	approx. 73
Method D	°C	approx. 94	approx. 94	approx. 94	>100	>100	>100
Method E	°C	approx. 97	approx. 97	approx. 97	>100	>100	>100
Molar mass (calculated from hydroxyl number)	g/mol	approx. 2460	approx. 2460	approx. 2460	approx. 3780	approx. 3780	approx. 3780
pH (EN 1262, 5% in water)**		approx. 7	approx. 7	approx. 7	approx. 7	approx. 7	approx. 7
Density (DIN 51757, 60 °C)	g/cm ³	approx. 1.04	approx. 1.04	approx. 1.04	approx. 1.04	approx. 1.04	approx. 1.04
Apparent density (ISO 697)	kg/l	–	approx. 0.6	approx. 0.5	–	approx. 0.6	approx. 0.55
Dropping point (DIN 51801)	°C	approx. 50	approx. 50	approx. 50	approx. 52	approx. 52	approx. 52
Congeaing point (ISO 2207)	°C	approx. 40	approx. 40	approx. 40	approx. 43	approx. 43	approx. 43
Clear melting point	°C	approx. 54	approx. 54	approx. 54	approx. 56	approx. 56	approx. 56
Viscosity (EN 12092, 60 °C, Brookfield, 60 rpm)	mPa·s	approx. 150	approx. 150	approx. 150	approx. 300	approx. 300	approx. 300
Hydroxyl number (DIN 53240)	mg KOH/g	approx. 23	approx. 23	approx. 23	approx. 14	approx. 14	approx. 14
Hydrophilic-lipophilic balance		approx. 18	approx. 18	approx. 18	approx. 18.5	approx. 18.5	approx. 18.5
Wetting power (EN 1772, in distilled water with 2 g/l soda ash)							
0.5 g/l, 23 °C	s	>300	>300	>300	>300	>300	>300
1.0 g/l, 23 °C	s	>300	>300	>300	>300	>300	>300
2.0 g/l, 23 °C	s	>300	>300	>300	>300	>300	>300
0.5 g/l, 70 °C	s	>300	>300	>300	>300	>300	>300
1.0 g/l, 70 °C	s	>300	>300	>300	>300	>300	>300
2.0 g/l, 70 °C	s	>300	>300	>300	>300	>300	>300
Foam formation (EN 12728, 40 °C, 2 g/l in water with a hardness of 1.8 mmol Ca ²⁺ ions/l, after 30 sec)	cm ³	approx. 200	approx. 200	approx. 200	approx. 200	approx. 200	approx. 200
Surface tension*** (EN 14370, 1 g/l in distilled water at 23 °C)	N/m	approx. 48	approx. 48	approx. 48	approx. 50	approx. 50	approx. 50

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.

Particle size distribution

A typical particle size distribution curve for the powders in the Lutensol® AT range is shown below:



Particle size distribution of Lutensol® AT powders

Solubility

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

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

Lutensol®	AT 11	AT 25	AT 50	AT 80
Distilled water	○	+	+	+
Potable water (approx. 2.7 mmol Ca ²⁺ ions/l)	○	+	+	+
Caustic soda (5% w/w)	-	-	-	-
Hydrochloric acid (5% w/w)	○	+	+	+
Sodium chloride solution (5% w/w)	○	+	+	+
Mineral oils	-	-	-	-
Ethanol	+	+	+	+
Aromatic hydrocarbons	+	+	+	+

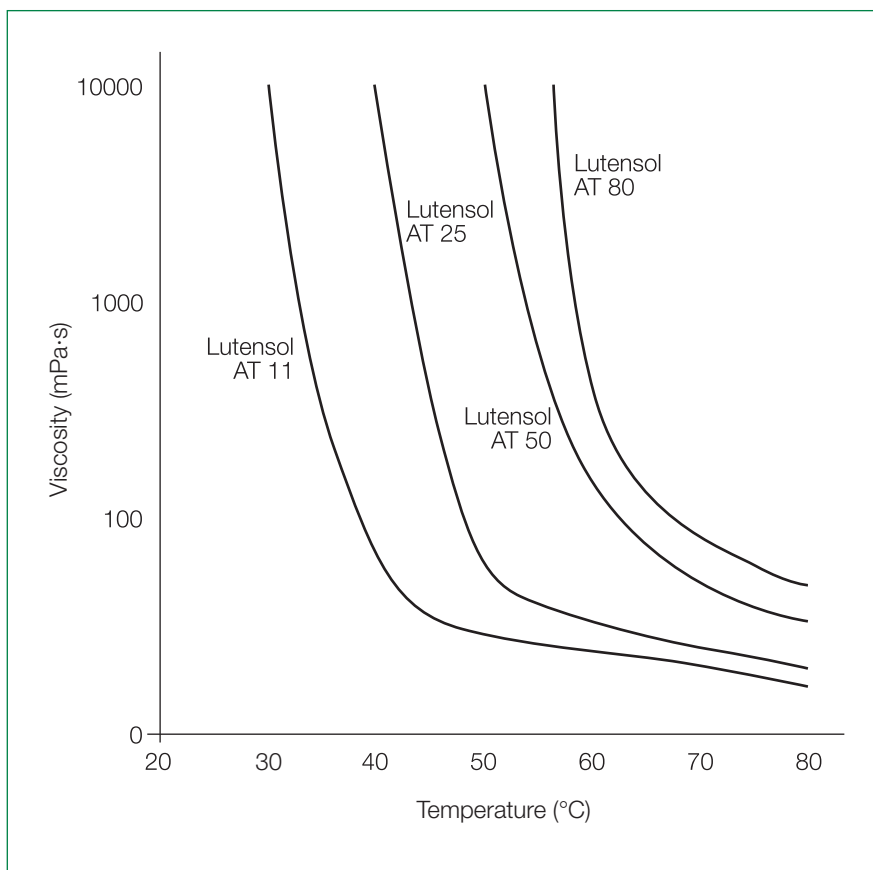
+ = Clear solution

○ = Sparingly soluble

- = Insoluble

Viscosity

The relationship between viscosity and temperature is always an important point to consider when Lutensol® AT types are to be stored or shipped. The following curves show the viscosity of the Lutensol® AT types as a function of temperature.



Lutensol® AT types

Dynamic viscosity as a function of temperature

Method: EN 12092, Brookfield LVT

It is advisable to prepare stock solutions with a concentration of 10 – 15% for mixing with other solutions or for preparing very dilute solutions. These solutions are then easy to dilute down to their final concentration.

The Lutensol® AT types tend to form a gel at certain concentrations when they are diluted with water, as can be seen from the table overleaf. The viscosity was measured with a Brookfield viscometer at 60 rpm.

We would recommend preparing stock solutions with a concentration of 10 – 15% by heating the water and the surfactant to approx. 70 °C and then stirring the surfactant into the water in small portions until the required concentration is reached. Care should be taken to ensure that the solution does not form a gel.

Viscosity of the Lutensol® AT types as a function of temperature and concentration (all figures in mP·a)

Temperature in °C	Water content (%)	Lutensol®			
		AT 11	AT 25	AT 50	AT 80
23	0 – 65	>10 ⁵	>10 ⁵	>10 ⁵	>10 ⁵
	70	approx. 800	>10 ⁵	>10 ⁵	>10 ⁵
	75	approx. 50	>10 ⁵	>10 ⁵	>10 ⁵
	80	approx. 20	approx. 50	>10 ⁵	>10 ⁵
	85	approx. 10	approx. 20	approx. 20	approx. 80
	90	approx. 10	approx. 10	approx. 10	approx. 20
	95	approx. 10	approx. 10	approx. 10	approx. 10
50	0 – 65	>10 ⁵	>10 ⁵	>10 ⁵	>10 ⁵
	70	approx. 70	>10 ⁵	>10 ⁵	>10 ⁵
	75	approx. 40	approx. 50	>10 ⁵	>10 ⁵
	80	approx. 20	approx. 20	approx. 50	approx. 70
	85	approx. 10	approx. 10	approx. 20	approx. 30
	90	approx. 10	approx. 10	approx. 10	approx. 10
	95	approx. 10	approx. 10	approx. 10	approx. 10
70	0 – 65	>10 ⁵	>10 ⁵	>10 ⁵	>10 ⁵
	70	approx. 70	approx. 120	approx. 140	>10 ⁵
	75	approx. 30	approx. 60	approx. 70	approx. 100
	80	approx. 20	approx. 30	approx. 40	approx. 50
	85	approx. 10	approx. 20	approx. 20	approx. 20
	90	approx. 10	approx. 10	approx. 10	approx. 10
	95	approx. 10	approx. 10	approx. 10	approx. 10

Storage

- The Lutensol® AT types should be stored in a dry place in their original packaging, which should be kept tightly sealed. Storerooms must not be overheated.
- The Lutensol® AT types are hygroscopic and soluble in water, with the result that they absorb moisture very quickly. Drums and bags should be tightly resealed each time material is taken from them.
- Lutensol® AT 11, AT 25 E, AT 50 E and AT 80 E should be heated to a maximum of 70 °C and homogenized before use. The most convenient method of melting cast solids is to place the drums in a heating cabinet. External blanket heaters can also be used, but the temperature must not be allowed to exceed 70 °C. Internal electrical elements should not be used because of the localized anomalies in temperature that they cause.
- Lutensol® AT 25 E, AT 50 E and 80 E can be stored in heated tanks at temperatures not exceeding 70° C. They must be blanketed with nitrogen to prevent them from coming into contact with air. Gentle, constant stirring helps to prevent them being discoloured as a result of prolonged contact with electrical elements or external heating coils.
- Products supplied in powder form – Lutensol® AT 25, Lutensol® AT 50 and Lutensol® AT 80 – should be stored in a dry place at a temperature not exceeding 30 °C. They must be protected from sunlight to ensure that they do not form lumps.

Materials

The following materials can be used for tanks and drums used to store Lutensol® AT 25 E, AT 50 E and 80 E.

- AISI 321 stainless steel (X6CrNiTi1810)
- AISI 316 Ti stainless steel (X6CrNiMoTi17122)

Shelf life

The Lutensol® AT types have a shelf life of at least two years, provided they are stored in their original packaging and kept tightly sealed.

Safety

We know of no ill effects that could have resulted from using the Lutensol® AT types for the purpose for which they are intended and from processing them in accordance with current practice.

According to the experience we have gained over many years and other information at our disposal, the Lutensol® AT types do not exert any harmful effects on health, provided that 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.

Please refer to the latest Safety Data Sheets for detailed, up-to-date information on classification, labelling and product safety.

Note

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