



Voltatex® 4200

Impregnating Resin

Chemical Base

Unsaturated polyester imide resin, low emission

Product Description

Our Voltatex® 4200 product line offers a full range of low emission, ready to use impregnating resins.

Voltatex® 4200 is compliant with the EU-directives

- Directive (EG) No. 1907/2006 (REACH)
- Directive 2011/65/EU (RoHS)
- Directive 2017/1000/EU (PFOA)

Characteristics

- single component
- free of styrene and vinyltoluene
- low emission / VOC-free
- resistant to refrigerants
- no dangerous good acc. to ADR/RID, IMDG and IATA

The cured resin compound is characterized by:

- high thermal and mechanical strength, especially under long-term stress
- good resistance against solvent gases
- good adhesion

UL-Approval

UL-File-Nr.: E 101752 (M) Underwriters Laboratories Inc., USA

Mixing Ratio

Voltatex® 4200 is supplied ready to use and does not require the addition of hardener, accelerator or thinner.

Typical Applications

- electric motors and large drives
- (H)EV powertrain motors
- hermetic motors
- transformers, especially with thick wires / conductors

- suitable for insulation systems up to **thermal class 220 (R)** acc. to IEC 60085:2007

Processing

The impregnating resin can be applied by using:

- trickle and roll/dip-processes
- all kind of common dip & bake equipment, including vacuum and VPI
- hot dipping processes
- resistance heating processes with oven post-curing
- resistance heating and gelling processes ("Hot-Dip-Gel-Process")

Stability

A virtually unlimited tank stability can be achieved provided Voltatex® 4200 is kept below 25 °C and at least 20 % of the tank contents is used and replaced by fresh resin per month.

Example:

Tank contents: 1000 kg
Resin refreshment: 200 kg per month

Voltatex® 4200 is **sensitive to light** and therefore must be protected against direct sunlight, UV-light and intensive daylight. This is valid for the material inside the delivered items as well as for the material inside the impregnating equipment.

Curing

Voltatex® 4200 is a low emission product. Nevertheless, to minimize evaporation of reactive components while curing, the impregnated objects should be heated up to the curing temperature in the shortest possible time. The air exchange in the curing zone should be kept to the minimum permitted by safety considerations.

If active cooling is in place, please ensure to not exceed a temperature reduction on the part of maximal 5 °C (5 K) per minute.

Cleaning

Once cured Voltatex® 4200 is almost insoluble. Therefore, all application equipment should be cleaned timely with cleaner **Voltatex® T050** or **Voltatex® T060**.

All equipment cleaning and maintenance should be carried out in accordance with the equipment manufacturer's instructions.

Delivery Items

Voltatex® 4200 is available in:

- 25 kg cans (one way)
- 200 kg drums (one way)
- 1000 kg containers / IBC's, returnable
(return service provided by the IBC manufacturer; not for oversea export)

Storage

Voltatex® 4200 needs to be kept in a temperature range of above -20 °C and below 25 °C. In originally closed delivery items the product has a **shelf life of 6 months** if the storage temperature doesn't exceed 25 °C. We recommend storing the product between 20-25 °C.

Health & Safety

Completely cured Voltatex® 4200 is biologically inactive and not dangerous to health.

When processing the liquid resin, please refer to the Material Safety Data Sheet (MSDS) of Voltatex® 4200 and the regulations of your local authorities.

Product Specifications

Table 1: Specifications of the liquid resin Voltatex® 4200

Specific Weight (liquid) at 20 °C	1,05 - 1,19	g/cm ³
Viscosity at 25 °C in acc. with DIN 53019 ¹⁾	1800 - 2700	mPa·s (cP)
Storage Stability, Shelf Life at 20-25 °C ²⁾	6	months
Reactivity at 100 °C in acc. with Company Standard - Energy Solutions 001 ^{1); 3)}		
Gel Time	7,0 - 13,0	minutes
Reaction Time	8,0 - 16,0	minutes

Table 2: Specifications of the cured resin Voltatex® 4200

Curing condition for the preparation of the test specimen: 1h at 150 °C ⁴⁾

Specific Weight (cured) at 20 °C	1,15 - 1,25	g/cm ³
Dielectric Strength in acc. with IEC 60455-2, Test Method in acc. with IEC 60243-1, Test Specimen in acc. with IEC 60464-2		
at 23 °C and 50 % rel. humidity	70 - 90	kV/mm
at 155 °C	65 - 105	kV/mm
at 23 °C after 96 h storage at 92 % rel. humidity	40 - 90	kV/mm
at 105 °C after 168 h storage in oil	85 - 130	kV/mm
Volume Resistivity in acc. with IEC 60455-2 respectively IEC 60455-3-4, Test Method in acc. with IEC 62631-3-1		
at 155 °C	10 ¹⁰ - 10 ¹²	Ω cm
at 180 °C	10 ⁰⁹ - 10 ¹¹	Ω cm
at 200 °C	10 ⁰⁹ - 10 ¹¹	Ω cm
after water storage 7 d	10 ¹⁴ - 10 ¹⁶	Ω cm
Comparative Tracking Index (CTI) in acc. with IEC 60455-2, Test Method acc. to IEC 60112	CTI 600 M	Test passed

Information regarding health and safety, transport regulations and labelling of this material are subject to permanent adaptation to law regulations. They are given in the MSDS.

Footer

- 1) The values refer to the time of manufacturing. As the product is chemically reactive, both reactivity and viscosity can change during storage depending on the local storage conditions. Especially inside impregnating machines the product can take on individual values in dependence of material consumption / turnover and processing parameters.
- 2) As the product is chemically reactive, the shelf life is considered from the **date of manufacturing**, not from the delivery date. The shelf life of the delivered product batch is printed on the label of the delivery item or can be taken from the delivery papers.
- 3) Company Standard - Energy Solutions - 014 „Reactivity Determination“ in acc. with DIN 46448.
- 4) When choosing different curing conditions the properties can deviate from the values shown in this data sheet.

Additional, Typical Product Properties

Table 3: Typical Properties of Voltatex® 4200

Curing condition for the preparation of the test specimen: 1h at 150 °C¹⁾	
Appearance	Yellow-brownish, clear up to slightly turbid
Emissions while curing in acc. with IEC 60455-3-5: 2006	approx. 1,2 % (weight)
Curing Time	
Trickle Process at 130 °C	15 - 30 min
Trickle Process at 150 °C	10 - 15 min
Dip & Bake Process at 130 °C	2 h
Dip & Bake Process at 150 °C	1 h
<p>The curing conditions stated here are to be understood as examples and recommendations based on best practice. They are considered from the time when the part reaches the indicated temperature. It is recommended to adapt the curing conditions to the requirements of the end product.</p>	
E-Modulus in acc. with ISO 527, preparation of the test specimen in acc. with Company Standard - Energy Solutions - 016²⁾	
at Room Temperature	approx. 2000 MPa
Bond Strength on twisted coils in acc. with IEC 60455-2, test procedure in acc. with IEC 61033, method A^{1), 3)}	
Room Temperature	285 - 365 N
130 °C	70 - 110 N
155 °C	70 - 90 N
180 °C	40 - 64 N
Shore-D-Hardness in acc. with IEC 60455-2, test method acc. to ISO 868	
Room Temperature	72 - 82
Thermal Conductivity in acc. with ASTM E1530	
	0,21 - 0,23 W/m-K
Dissipation Factor tan δ in acc. with IEC 62361-2-1: 2018-12	
at 23°C and 1 kHz	90 - 150 °C
Footer	
<p>1) The curing condition of 1h at 150 °C refers to all measurements on the cured resin compound. Other curing conditions can lead to different values than given in this data sheet. 2) Company Standard Energy Solutions – 016 „Preparation of specimen for E-Modulus measurements“ in acc. with ISO 527. 3) Magnet wire quality used for the preparation of the test specimen: MW 35 C, diameter 0,315 mm, grade 2, no lubricant</p>	

Table 4: Chemical Resistances

Liquid Chemicals in acc. with Company Standard - Energy Solutions 017	resistant to - transformer oil - distilled water - soap solution
Solvent Vapours in acc. with Company Standard Energy Solutions 019	resistant to - hexane - methanol - acetone - xylene
Refrigerants	resistant to - Frigen R22 / Shell 22-12

Table 5: Temperature Index, Thermal Class

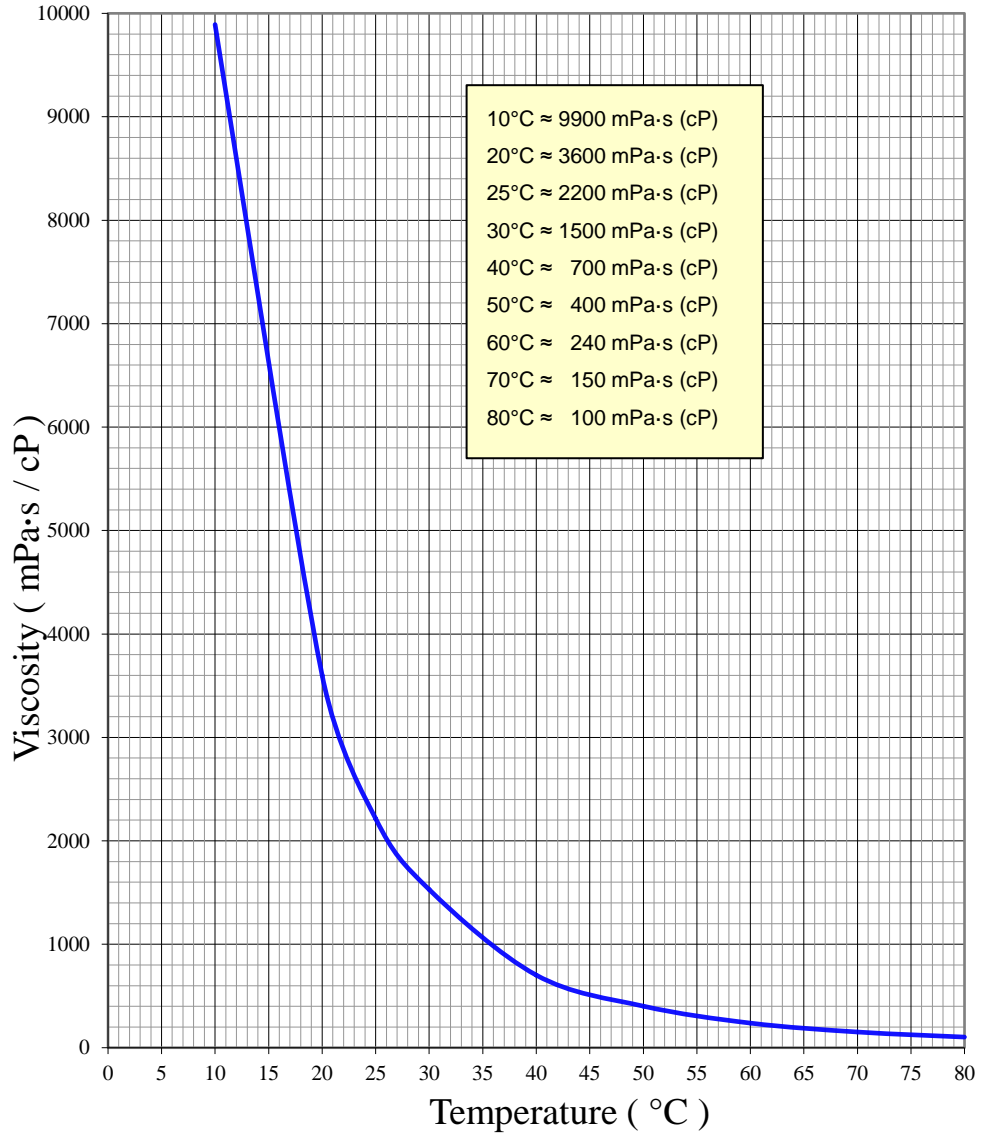
Temperature Index in acc. with IEC 60455-3-5, Test Method in acc. with IEC 60216	Type 220	
Bond Strength in acc. with IEC 61033, method B, ("Helical Coil Method"), endpoint criterion 22 N	MW 30 MW 35	238 °C 229 °C
Proof Voltage in acc. with IEC 60172 ("Twisted Pair Method")	MW 30 MW 35	212 °C 222 °C

Table 6: UL-Approval

Temperature Class in acc. with UL 1446				
	Twisted Pair	ASTM D2307	MW 30 MW 35	200 220
	Helical Coil	ASTM D2519	MW 30 MW 35	240 220
Insulation Systems in acc. with UL 1446 (IEC 61858)				
	Class 130		C190HE R150HE Z130HE Z150HE	
	Class 155		C290HE CZ255HE R201HE R203HE Z200HE	
	Class 180		R342HE R342HE2	

Annex 1

Viscosity as a Function of Temperature (nominal viscosity)



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