Voltatex® 4201

Impregnating Resin

Chemical base

Unsaturated polyester imide resin

Product description

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

Voltatex® 4201 is compliant with the EU-directives
- 2003/11/EU (polybrominated diphenyl ethers)
- 2006/121/EU (REACh-directive)
- 2011/65/EU (RoHS- directive)

Special properties

- single component
- low emission
- minimum exposure in the working area
- no classification as dangerous goods

The cured resin compound is characterised by:
- very good adhesion
- high thermomechanical strength, also when sustained loading is applied
- hard and tough

UL-approval

UL-File-Nr.: E101752 (M) Underwriters Laboratories Inc, USA

Application area

- electric motors, also for large drives
- high speed rotors
- transformers, especially with thick wires and shaped conductors
- suitable for: insulation systems of **thermal class 220 (R)** acc. to IEC 60085:2007

No mixing of components required

Voltatex® 4201 is supplied ready to use and does not require the addition of extra hardener or accelerator.
Optionally the viscosity can be adjusted using the **thinner Voltatex® T032** upon customer needs and wishes.

Processing

The impregnating resin can be applied by using

- all kind of conventional dip & bake equipment
- continuous and vacuum dip processes
- VPI process
- trickle feed process

Unlimited tank stability with resin Voltatex® 4201 can be achieved as long as the material is kept below 25 °C and at least 20 % of the tank content is used and replaced with fresh resin per month.

Curing

Voltatex® 4201 is a low emission product, nevertheless to minimize evaporation of reactive components during curing; the impregnated objects should be heated up to curing temperature in the shortest possible time. The air flow in the curing oven should also be kept to the minimum permitted by safety considerations.

Cleaning

Cured Voltatex® 4201 is almost insoluble. Therefore, application equipment should be regularly cleaned with cleaner Voltatex® T050. All equipment cleaning and maintenance should be carried out in accordance with the equipment manufacturer's instructions.

Delivery & Storage

Voltatex® 4201 is supplied in one-way-cans containing 25 kg, 200 kg or 1000 kg. In closed original cans the resin can be stored for more than 6 months if provided storage temperature does not exceed 25 °C. Opened containers have to be closed immediately to protect the material from daylight!

Health & Safety

Cured Voltatex® 4201 is biologically inactive and not dangerous to health. When processing the liquid resin, please refer to the Material Safety Data Sheet (MSDS) for Voltatex® 4201 and the regulations of your local authority.

Table 1: Properties of the liquid resin Voltatex® 4201

Appearance	yellow – amber, clear to slightly cloudy	
Viscosity at 25 °C in acc. with DIN 53019	900 ± 200 mPa·s	
Storage Stability, Shelf Life at 25 °C	8 month	
Reactivity at 100 °C in acc. with Company Standard Energy Solutions - 001[1)]		typ. value
Gel Time	7,0 - 13,0 min	8,7
Reaction Time	8,0 - 15,0 min	9,9
Curing Time [2)]		
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	
Effect on Enamelled Wire [3)]	compatible with all common magnet wires	
Emissions in acc. with DIN EN 60455-3-5: 2006	approx. 2,4 % (by weight)	

Information regarding health and precautions for the safe handling, transport regulations and labelling of this material are subjects of permanent adaptation to law regulations. They are given in the MSDS.

(1) Company Standard Energy Solutions – 001 "Measurement of Gel time and Reaction Time at one component Impregnating Resins" in acc. with DIN 46448. Shown values relate to the time of manufacture. In dependence of storage time reactivity can vary.

(2) Curing time begins when objects come up to the indicated curing temperature. For objects having to endure high mechanical or chemical stress during service, longer curing times are recommended.

(3) Test in acc. with IEC 60851-4: 1996 "Winding Wires Test Methods", part 4: Chemical Properties. The quoted solvent is replaced by the respective impregnating resin.

Table 2: Tests on cured Voltatex® 4201 in acc. with IEC-60455-3-5

Curing Conditions for Test Specimens: 1h 150°C	
Bond Strength of Twisted Coils in acc. with IEC 60455-2, test acc. to IEC 61033, testing method A	
Room Temperature	(240 ± 30) N
130°C	(90 ± 10) N
155°C	(78 ± 10) N
180°C	(70 ± 10) N
Shore-D-Hardness in acc. with IEC 60455-2, Test Method in acc. with ISO 868	
Room Temperature	78 ± 5
Coefficient of Linear Thermal Expansion	
Temperature range -20 °C to 50 °C	$180 \cdot 10^{-6 \cdot K-1}$
Temperature range 60 °C to 140 °C	$260 \cdot 10^{-6 \cdot K-1}$
Thermal Conductivity in acc. with DIN 501046	0,23 W $(m\ K)^{-1}$
Tracking Resistance in acc. with IEC 60455-2, Test Method acc. to IEC 60112, paragraph 6.2	CTI 600 M, test passed
Dielectric Strength in acc. with IEC 60455-2, Test Method in acc. with IEC 60243-1	
at 23 °C and 50 % rel. humidity	≥ 80 kV/mm
at 155 °C	≥ 80 kV/mm
at 23 °C after 96 h storage at 92 % rel. humidity	≥ 80 kV/mm
at 105 °C after 168 h storage in oil	≥ 90 kV/mm
Relative Permittivity ε_r in acc. with IEC 60455-2, Test Method in acc. with IEC 60250	
at 23°C between 50 Hz and 1 MHz	(4,0 ± 0,5)
Dielectric Dissipation Factor tan δ in acc. with IEC 60455-2, Test Method in acc. with IEC 60250	
at 23 °C between 50 Hz and 1 MHz	$\leq 30 \cdot 10^{-3}$
intersection point 0,2 = $200 \cdot 10^{-3}$	≥ 135 °C
Volume Resistivity in acc. with IEC 60455-2, Test Method in acc. with IEC 60093	
at 23 °C	$\geq 10^{15}$ Ω cm
at 155 °C	$\geq 10^{10}$ Ω cm

Table 3: Resistance

Effect of Liquid Chemicals in acc. with IEC 60455-2, Test Method in acc. with ISO 175	resistant to - distilled water - transformer oil
Effect of a refrigerant / refrigerant oil system R 22 / Shell 22-12 in acc. with UL 984-41	resistant

Table 4: Thermal Properties, Thermal Class

Temperature Index in acc. with IEC 60455-3-5, Testing Method in acc. with IEC 60216	**Type 220**
Bond Strength acc. to IEC 61033, Method B End-Point Criterion 22 N	IEC 60317-8/MW 30: 238°C IEC 60317-8/MW 35: 229°C
Proof Voltage in acc. with IEC 60172	IEC 60317-8/MW 30: 212°C IEC 60317-8/MW 35: 222°C

Table 5: UL-Approval

Temperature Class in acc. with UL 1446		
Twisted Pair	ASTM D2307	MW 30: 200 MW 35: 220
Helical Coil	ASTM D2519	MW 30: 240 MW 35: 220
Electrical 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

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