AXALTA COATING SYSTEMS
Energy Solutions

Voltatex® 4200 Impregnating Resin

Technical Data Sheet

Chemical Base

Unsaturated polyester imide resin, low emission

Product Description

Our Voltatex® 42xx product-line offers a full range of low emission, ready to use impregnating resins.

Voltatex® 4200 is compliant with:

- Regulation (EC) No 1907/2006 (REACH)
  - including Annex XIV (SVHC's, PBT/vPvB)
  - including Annex XVII and Regulation (EU) No 2017/1000 (PFOA)
- Directive 2011/65/EU (RoHS)
- Regulation (EU) 2019/1021 (persistent organic pollutants)

Characteristics

- single component
- high reactivity
- environmentally friendly
- free of styrene and vinyltoluene
- low emission
- no dangerous good acc. to ADR (road), RID (rail), IMDG (sea) and IATA (air)
- minimum exposure in the working area

The cured resin compound is characterized by:

- extreme high thermal and high mechanical strength, especially under long-term stress
- good adhesion
- good resistance against solvent gases
- resistance to refrigerants, ATF-fluids and gearbox oils

UL (Underwrites Laboratories)

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

Typical Applications

- (H)EV powertrain motors
- electric motors, low voltage
- (wind)generators, also for large drives
- hermetic motors

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

Ready to use; no mixing required

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

Optionally the viscosity can be adjusted by using **Thinner Voltatex® T033** upon customer needs and wishes.

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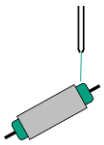

Processing

The impregnating resin can be applied by using:

- trickle and roll / dip-process
- all kind of common dip & bake equipment, including vacuum and VPI
- hot dipping processes
- resistance heating and gelling processes with oven post-curing

Stability

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

Example:

Tank content:	1,000 kg
Resin refreshment:	200 kg per month

Voltatex® 4200 is **sensitive to light** and therefore must be protected accordingly. 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** after the curing process is included in the process, please ensure to not exceed a temperature reduction on the part of maximal 5 °C (5 K) per minute to minimize cracking.

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Cleaning

Once cured Voltatex® 4200 is almost insoluble. Therefore, all application equipment should be cleaned in time with cleaner **Voltatex® T050** or **Voltatex® T060** (data sheets available on request).

All cleaning and maintenance of the impregnating equipment should follow operational needs and must be carried out in accordance with the equipment manufacturer's instructions.

Packaging / Stock Items

Voltatex® 4200 is available in:

- 25 kg cans (non-returnable)
- 200 kg drums (non-returnable)
- 1,000 kg containers (returnable - return service provided by the IBC manufacturer; not for oversea export)

Storage

A temperature range of above -40 °C and below 25 °C is recommended as storage temperature, at lower temperatures please consult us. In originally closed delivery items, the product has a **shelf life of 8 months** if the storage temperature doesn't exceed 25 °C. We recommend storing the product between 20 – 25 °C.

If not consumed completely, opened containers have to be closed immediately again after taking out the required amount of resin.

Health & Safety

Completely cured Voltatex® 4200 is biologically inactive and not dangerous to health.
When processing the liquid resin, please consult the Material Safety Data Sheet (MSDS) of Voltatex® 4200 and follow the regulations of your local authorities.

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Product Specifications

Table 1: Specifications of the Liquid Product

Specific Weight at 20 °C	1.05 – 1.19 g/cm³
Viscosity at 25 °C in acc. with DIN 53019 [1)]	1,800 – 2,700 mPa·s (cP)
Storage Stability / Shelf Life at 25 °C [2)]	8 months
Reactivity at 100 °C in acc. with Company Standard Energy Solutions 014 [1), 3)]	
Gel Time	7.0 – 13.0 min
Reaction Time	8.0 – 16.0 min

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

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Product Specifications

Table 2: Specifications of the Cured Product

Curing Condition: 1 h at 150 °C [4)]

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 room temperature and 50 % rel. humidity	≥ 70 kV/mm
at 155 °C	≥ 65 kV/mm
at room temperature, after 96 h storage at 92 % rel. humidity	≥ 40 kV/mm
at room temperature, after 168 h storage in oil at 105 °C	≥ 85 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 room temperature and 50 % rel. humidity	≥ 10^{14} Ω·cm
at 155 °C	≥ 10^{10} Ω·cm
at 180 °C	≥ 10^{09} Ω·cm
at 200 °C	≥ 10^{09} Ω·cm
at room temperature, after 168 h water storage at room temperature	≥ 10^{14} Ω·cm

4) The curing condition of 1h at 150 °C refers to all measurements of the cured product and is to be understood as temperature and time on the test specimen. Other curing conditions can lead to different values than given in this data sheet.

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Typical Characteristics

Table 3: Typical Characteristics of the Liquid Product

Appearance	yellow-brownish, clear-up to slightly turbid
Emissions while Curing in acc. with IEC 60455-3-5: 2006	approx. 1.2 % (weight) [5)]
Curing Time (Curing Grade ≥ 95 %, measured by DSC-Method)	
at 150 °C	≥ 15 min
at 130 °C	≥ 120 min

5) The country-specific VOC value is available on request.

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. The required time to heat up the part to the curing temperature is not included. It is recommended to adapt the curing conditions to the requirements of the end product.

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Typical Characteristics

Table 4: Typical Characteristics of the Cured Product

Curing Condition: 1 h at 150 °C [4)]

Specific Weight at 20 °C	1.15 – 1.25 g/cm³
Shore-D-Hardness in acc. with IEC 60455-2, Test Method acc. to ISO 868	
at room temperature	72 – 82
E-Modulus in acc. with ISO 527, preparation of the test specimen in acc. with Company Standard - Energy Solutions - 016 [6)]	
at room temperature	1,500 – 2,500 MPa
Bond Strength on Twisted Coils in acc. with IEC 60455-2, Test Procedure in acc. with IEC 61033, Method A [7)]	
at room temperature	285 – 365 N
at 130 °C	70 – 110 N
at 155 °C	70 – 90 N
at 180 °C	40 – 64 N
Thermal Conductivity in acc. with ISO 22007-2-2008	0.19 – 0.23 W/m·K
Dissipation Factor tan δ in acc. with IEC 60455-2, Test Method in acc. with IEC 62631-2-1 (replacing IEC 60250)	
at room temperature and 1 kHz, test voltage 500 V	≤ 0,01 (1 %)
Permittivity in acc. with IEC 60455-2, Test Method in acc. with IEC 62631-2-1 (replacing IEC 60250)	
at room temperature and 1 kHz, test voltage 500 V	≤ 3
Comparative Tracking Index in acc. with IEC 60112	CTI 600 C

6) Company Standard Energy Solutions 016 „Preparation of specimen for E-Modulus measurements“ in acc. with ISO 527.
7) Magnet wire quality used for the preparation of the test specimen: MW 35 C, diameter 0,315 mm, grade 2, no lubricant

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Table 5: Chemical Resistance

Solvent Vapours [8)] in acc. with Company Standard Energy Solutions 019	resistant to: • hexane • methanol • acetone • xylene
Liquid Chemicals [8)] in acc. with Company Standard Energy Solutions 017	resistant to: • transformer oil • distilled water conditionally resistant to: • soap solution
Refrigerants [8)]	resistant to: • Shell 22-12/R-22

8) other substances can be tested upon request, please consult us

Table 6: 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

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Table 7: 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
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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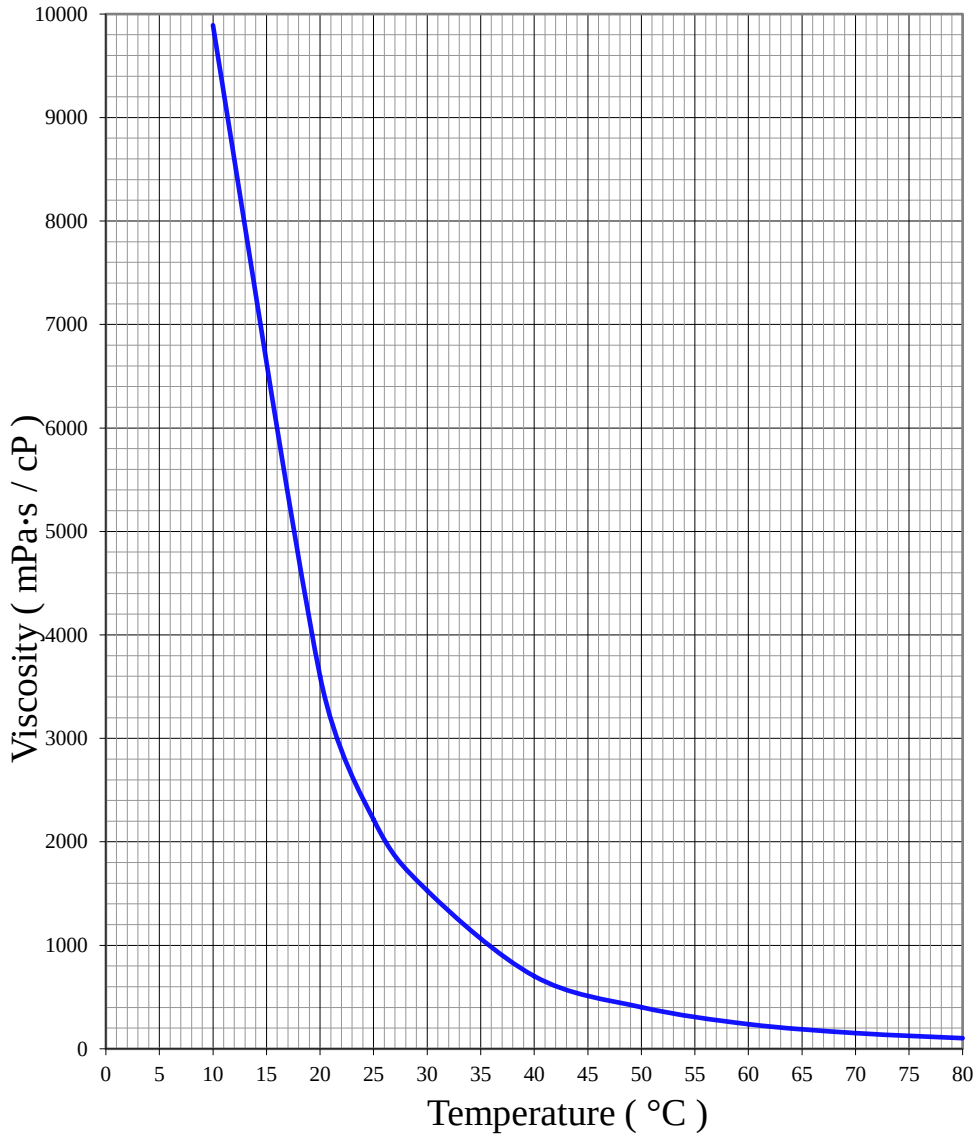
Annex: Diagram of Viscosity vs. Temperature (Example)



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