

MARKETS // PRODUCTS

# IMPREGNATING RESINS AND COATINGS



**vonRoll**

# WE ENABLE ENERGY

As one of the oldest industrial companies in Switzerland, founded in 1803, we focus on products and systems for power generation, transmission and distribution, rotating machines and mechanical engineering. Von Roll is the global market leader for insulation products and the only company to offer the complete range of insulation products, composites, consulting, tests and services for the electrotechnical industry.

For more than 100 years, we have been making outstanding contributions to this market, developing a number of highly innovative products that have enabled both steady increases in power output and smaller and more compact machines.

**Customers enjoy the following benefits:**

- + One single source for all insulating materials
- + Thorough expertise from power generation and transmission to its efficient utilization
- + Proven compatibility for system components
- + Testing at Von Roll of both materials and systems
- + Consulting for applications and technologies
- + Training in insulation materials and systems

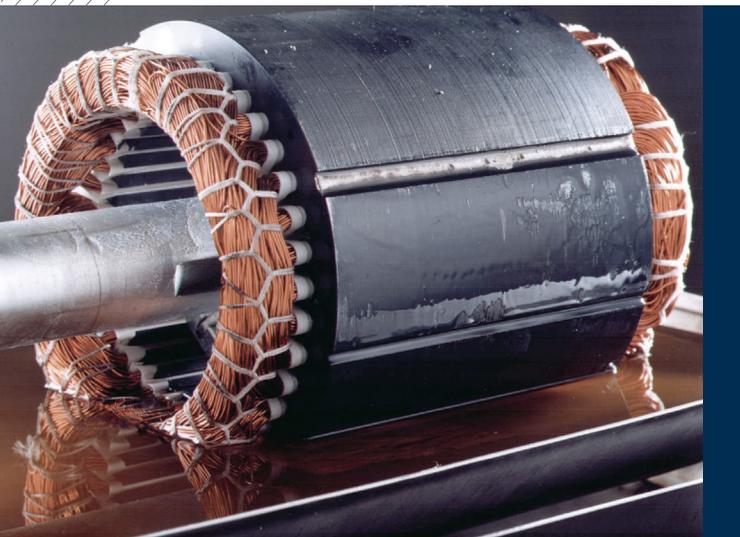
# ATMOSPHERIC DIP AND HOT DIP PROCESS

Dipping is the most common impregnation process for any kind of low-voltage electrical component, such as motors, generators or transformers. It is highly versatile with simple processing equipment.

Nevertheless, the resin choice is always highly critical due to environmental constraints (smell, fire risks, irritation, toxicity and more), process issues (stability, viscosity, reactivity, productivity, etc.) and technical properties (thermal class, chemical resistance, electrical properties, bonding strength, etc.).

Product Name	Chemistry	Viscosity at 23°C (cps)	Typical Curing Temp (°C)	UL 1446 TP rating MW 35 (°C)	Main Characteristics
<b>Solvent-based</b>					
Hi-THERM® BC-346A	Modified Polyester	230	150	200°C	High-temperature-resistant, tough, flexible, meets MIL-I-24092D standard, universal application. Also available in black color.
Hi-THERM® BC-359	Polyurethane	260	120	180°C	Low-temperature curing, flexible with superior moisture and chemical resistance.
DOLPHON® BC-352	Epoxy	200	150	180°C	High strength, moisture, chemical and refrigerant resistant
PERMAFIL® 74043	Epoxy	1200	150	180°C	High strength, moisture, chemical and refrigerant resistant
<b>Water-based</b>					
AQUA-THERM® BC-365	Polyester	Adjustable	135	180°C	Environmentally-friendly, low VOCs. Dilute with water to desired solids & viscosity.
AQUA-THERM® BC-365-LTC	Polyester	Adjustable	130	180°C	Lower temperature curing environmentally friendly, low VOC water reducible polyester. Easy to dilute.
AQUA-THERM® BC-365-FC	Polyester	Adjustable	125	180°C	Lowest temperature curing environmentally friendly, low VOC water reducible polyester. Easy to dilute.
<b>Solventless</b>					
PERMAFIL® 724	Unsaturated Polyester	700	150	180°C	Medium viscosity for dipping, high bonding strength, fast cure
DOLPHON® CC- 1170	Unsaturated Polyester	900	150	180°C	Medium viscosity, semi-rigid for large machines or thermal cycling resistance.
PERMAFIL® 716	Unsaturated Polyester	900	150	180°C	Blended monomer polyester with enhanced stability and improved film build. High strength and fast cure.

Product Name	Chemistry	Viscosity at 23°C (cps)	Typical Curing Temp (°C)	UL 1446 TP rating MW 35 (°C)	Main Characteristics
<b>Low Volatile Organic Compound (VOC)</b>					
DOLPHON® CC-1105	Unsaturated Polyester	600	150	200°C	Low odor, low viscosity. High stability and excellent bonding strength.
DOLPHON® CC-1305	Unsaturated Polyester	1600	150	180°C	Low odor, high flash point, high build solventless polyester resin.
DOLPHON® XL-2102	Unsaturated Polyester	260	120	180°C	High flash point, low odor, excellent tank stability. EN45545-2 approved for railway applications.
DOLPHON® XL-2103-LV	Unsaturated Polyester	700	150	180°C	Higher build version in our XL-2100 series. High flash point, low odor and very low emissions.
DOLPHON® XL-3102	Unsaturated Polyester	900	150	180°C	Low odor, low viscosity, high bond strength with good thermal resistance. Tank stable resin with low VOCs.
DOLPHON® CC-1180 LoV	Epoxy	550	150	180°C	Highly chemical- and moisture-resistant resin, good adhesion
Damisol 3500 LoV	Epoxy	600	160	180°C	Very low emission epoxy resin, Excellent stability and dielectric properties up to class H.
Damisol 3500 HiR	Epoxy	600	160	180°C	High reactivity version of our very low emission epoxy resin for hot dipping and curing using the joule effect. Excellent stability and dielectric properties up to class H.



Dipping process for stator impregnation.

# TRICKLE AND DIP-ROLL PROCESS

Trickling and roll-through processes are more convenient when high productivity is required on standard small/medium motors and generators. These two processes enable a higher resin filling factor with less resin usage.

Due to hot processes, the resin quality has to be carefully managed. Von Roll has developed and optimized a complete range of resins that combine safety, quality and fast processing.

Product Name	Chemistry	Viscosity at 23°C (cps)	Typical Curing Temp (°C)	UL 1446 TP rating MW 35 (°C)	Main Characteristics
<b>Solventless</b>					
DOLPHON® CC-1096	Unsaturated Polyester	250	130	180°C	Two-part resin with styrene, low viscosity, high bonding strength, excellent penetration, fast cure at low temperature.
DOLPHON® CC-1174	Unsaturated Polyester	300	130	180°C	Two part resin with vinyl toluene, low viscosity, high bonding strength, excellent penetration, fast cure at low temperature
DOLPHON® CC-1170-TR	Unsaturated Polyester	300	125	180°C	Two part resin with vinyl touene, low viscosity, semi-rigid for large machines or thermal cycling resistance.
<b>Gel Coat</b>					
Damisol 3007-2	Polyesterimide gel coat	20000	120	180°C	Two-part resin, highly reactive filled gel coat. High vibration resistance.
<b>Low VOC</b>					
DOLPHON® CC-1105-OPT	Unsaturated Polyester	235	150	200°C	One component resin, highly stable and strongly reactive.
DOLPHON® XL-2101	Unsaturated Polyester	350	130	180°C	One component resin, highly stable and strongly reactive.
DOLPHON® XL-3101-OPT	Unsaturated Polyester	500	130	180°C	New generation one component resin. Low odor, low hazard level, highly stable resin with fast cure time.
DOLPHON® XL-3105	Unsaturated Polyester	500	120	180°C	Two component version of the XL®-3100 series. Fastest cure with good mixed pot life.
DOLPHON® CC-1180 HiR	Epoxy	550	170	180°C	One component highly reactive epoxy. High moisture and chemical resistance. Good adhesion.
Damisol 3500 HiR	Epoxy	600	160	180°C	High reactivity version of our very low emission epoxy resin for hot dipping and curing using the joule effect. Excellent stability and dielectric properties up to class H.

# VACUUM PRESSURE IMPREGNATION

Vacuum pressure impregnation (VPI) is mainly used when the penetration and filling factor of the resin need to be improved. Von Roll offers a large choice of resins and varnishes suited to a wide range of processes and properties.



Product Name	Chemistry	Viscosity at 23°C (cps)	Typical Curing Temp (°C)	UL 1446 TP rating MW 35 (°C)	Main Characteristics
DOLPHON® CC- 1170	Unsaturated Polyester	900	150	180°C	Medium viscosity, semi-rigid for large machines or thermal cycling resistance.
PERMAFIL® 707C, 777C, 711C	Unsaturated Polyester	900, thixos	150	180°C	Semi-rigid resins excellent for all transportation applications.
PERMAFIL® 724C	Unsaturated Polyester	700	150	180°C	Medium viscosity for dipping, high bonding strength, fast cure
DOLPHON® CC-1105	Unsaturated Polyester	600	150	180°C	Low odor, low viscosity, high stability, excellent bonding strength
DOLPHON® XL-3102	Unsaturated Polyester	900	150	180°C	Low odor, low viscosity, high bond strength with good thermal resistance. Tank stable resin with low VOCs.
DOLPHON® CC-1180-LoV	Solventless Epoxy	550	150	180°C	High chemical and moisture resistant resin, good adhesion.
PERMAFIL® 74035	Solventless Epoxy	Thixo	150	180°C	Thixotropic, high film build with superior chemical and moisture resistance.
PERMAFIL® 74041	Solventless Epoxy	Thixo	150	180°C	Thixotropic, high film build with superior chemical and moisture resistance.
Mica MAX 74050, 74050T	Solventless Epoxy	500, Thixo	150	NA	Epoxy resin suitable for use through highest voltages. Outstanding electrical and thermal endurance at high temperature.
Damisol 3418	Solventless Epoxy	400	150	NA	Catalyzed epoxy anhydride resin suitable for high voltage systems. Outstanding electrical properties at temperature.
Damisol 3551	Solventless Silicone	1300	170	NA	High temperature performance for transit and traction motors.

# COATINGS

Coating is used mainly for protection of fragile or exposed components. The coating process has to be adjusted according to the varnish choice and expected properties. Several coatings are available with different colors and chemical properties to be used on many processes (brushing, spraying or dipping).

Product Name	Chemistry	Viscosity at 23°C (cps)	Typical Curing Temp (°C)	UL 1446 TP rating MW 35 (°C)	Main Characteristics
<b>Standard Protection</b>					
SYNTHITE® AC-41	Polyurethane	250	25	180°C	Tough, flexible, fast-drying chemical and moisture-resistant film.
SYNTHITE® AC-43	Alkyd / phenolic.	50	25	180°C	Tough, flexible, fast-drying chemical and moisture-resistant film. Included in multiple UL systems through Class H.
SYNTHITE® AC-46, AC-46-1	Polyurethane	200	25	180°C	Tough, flexible, fast-drying chemical and moisture-resistant film. Includes antifungal and UV tracer ingredients. No HAP version AC-46-1 available.
SYNTHITE® EB-41/ER-41	Polyurethane	300	25	180°C	Glossy, tough, flexible and fast-drying. Abrasion, chemical, moisture resistant. Commonly used on class H systems. Available in red and black.
SYNTHITE® EB-43	Alkyd / phenolic.	100	25	180°C	Tough, flexible, fast-drying chemical and moisture-resistant film. Available in flat black and high gloss versions.
<b>High Protection</b>					
Hi-THERM® BB-346-A	Alkyd / phenolic.	350	150	200°C	BC-346-A base with glossy black finish.
<b>Very High Protection</b>					
DOLPHON® CB-1128	Polybutadiene	Thixotropic	25	NA	Thixotropic two component black rubber for winding protection. Brush on application.
DOLPHON® CB-1145	Polybutadiene	2500	150	NA	A tough resilient dip & bake or spray coating for electrical and electronic equipment. One component heat cure.
DOLPHON® CW-1081	Epoxy	Thixotropic	RT or 60	NA	Thixotropic two component resin. Excellent abrasion and chemical resistance

# TESTING



Materials and systems have to be tested in order to ensure the requested specifications concerning mechanical, electrical and thermal characteristics.

At Von Roll HV laboratories we are able to test our customers' materials and systems according to IEC, UL and other specifications.

- + Thermal, electrical and mechanical aging tests
- + Tan  $\delta$ -measurements at different temperatures
- + Partial discharge measurements with different voltage ranges



# TRAINING

For a number of years we have been offering a unique program of high-voltage insulation training within our Von Roll Corporate University. The objectives of this program are:

- + Better understanding of high-voltage insulation technology for rotating machines and up-to-date knowledge on insulating materials and systems
- + Practical experience in the application of electrical insulating materials

# WE ENABLE ENERGY

Von Roll is the sole full-range supplier of materials and systems for the insulation of electrical machines as well as high-performance products for various high-tech industries.



## Mica

All materials related to high-voltage insulation. Von Roll's commitment to mica starts with mining and ends with finished tapes.



## System components

Producer of integrated and ready-to-install system components for high-voltage electric motors, railway drives and generators.



## Cables

Mica tapes for fire-resistant cables. Von Roll provides a wide range of products that are ideally suited to all commonly used standards.



## Resins

Impregnation resins for high- and low-voltage, potting resins, casting resins, as well as encapsulating and conformal coatings.



## Composites

Engineered materials made from a resin and a support structure with distinct physical, thermal and electrical properties. They can be molded, machined or semi-finished.



## Flexibles

Insulating flexible materials for low-voltage applications such as flexible laminates.



## Ballistic Protection

High-quality systems for armored defense based on thermoset / thermoplastic products in single-use or tailored combinations.



## Testing

Von Roll provides electrical, thermal and mechanical testing of individual materials as well as complete insulating systems.



## Training

Von Roll Corporate University provides a training program in high- and low-voltage insulation for its customers.

As one of Switzerland's longest-established industrial companies, Von Roll focuses on products and systems for electrical power generation, transmission, storage and industrial applications.

Von Roll's business portfolio is divided into the following businesses: Von Roll Insulation offers electrical insulation products, systems and services for generators, high- and low-voltage motors, transformers and other applications. Von Roll Composites produces composite materials and parts for a variety of industrial equipment.

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