

MARKETS // PRODUCTS

INSULATING SYSTEMS

FOR ROTATING MACHINERY,
MOTORS AND GENERATORS

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

A VARIETY OF INSULATION SYSTEMS

Von Roll offers a great variety of insulation materials for low-voltage motors and generators: flexible laminates, resins, tapes and other structural materials. All these have been developed to create the most reliable machines. For every application there is an ideal set of materials that form a fully compatible system. We also supply engineering application support and testing services to maximize production efficiency and optimize approval processes. Von Roll is a global company with multiple manufacturing sites in most continents, allowing optimized regional support.

The insulation systems for low-voltage motors and generators are composed of the following materials and services:

- + Slot insulation
- + Impregnation resin
- + End-winding tape
- + Wedges and closures
- + Finishing varnishes
- + UL testing

Most of these products are listed in UL under different thermal classes.

For wedges, Von Roll recommends thicker DMD or NKN laminates or composite materials such as Vetronite G-11 or Delmat Epoxy 68660, which can be delivered either as sheets or machined parts. U and L profiles with bounded Nomex® layers are also part of the rotor slot insulation program.



FLEXIBLE LAMINATES

Von Roll is a world leader in flexible laminates and coated materials. Von Roll materials for slot liners, phase insulation, barrier applications, and closures for low-voltage motors and generators are outstanding. We supply them in a wide variety of thicknesses. The following are some of the suitable products:

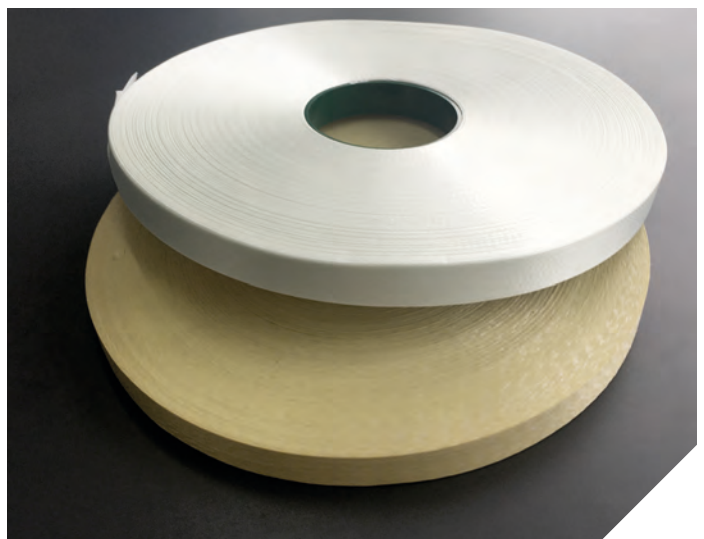
Material	Temperature Index	Composition	Special Properties
ACUFLEX® RM, RMR	Class 155°C	Two or three ply laminates made with cotton paper, PET film and high temperature laminating adhesive	• Excellent resistance to cut through at higher temperatures • Slick surfaces suitable for automatic insertion
ACUFLEX® DMD70, DMD100	Class 180°C	Three ply laminates made from PET fleece, PET film and high temperature laminating adhesive. The fleece can be partially or fully saturated	• A tough affordable laminate • Excellent resistance to edge tear • Top coats designed for automatic insertion
ACUFLEX® NMN, NMNE	Class 180°C	Three ply laminates made from Nomex® papers, PET film and high temperature laminating adhesive	• Outstanding mechanical properties • Good resistance to thermal stress thanks to high performing adhesive system • designed for automatic insertion
ACUFLEX® NKN	Class 220°C	Three ply laminates made from Nomex® papers, Polyimide film and high temperature laminating adhesive	• Outstanding thermal and mechanical properties • Resistant to transmission fluids • Designed for automatic insertion
THERMAL H®	Class 180°C	Polyester-coated glass cloth with or without an acrylic pressure-sensitive adhesive on one side	• Used as slot liners or phase cloth where extreme flexibility is required • Excellent electrical, mechanical and conformability properties
FUSA-FLEX®	Class 155°C	Flexible B-stage epoxy resin on Daglas® cloth	When properly applied it results in a watertight sealed coil with outstanding electrical strength for use where VPI is not available
FUSA-FAB®	Class 155°C/180°C	Flexible B-stage polyester resin on glass cloth	Used as core insulation on field coils, as bolt insulators and repairing tubes

OTHER MATERIALS

Other applicable materials for low-voltage applications supplied by Von Roll are:

Mica tapes – The use of mica-based tapes in low-voltage applications is mainly for traction and inverted-driven motors. The value of these tapes is very important to protect these machines from voltage peaks that can be 2 to 3 times higher than the rated voltage. Mica is an excellent insulator that is commonly used for high-voltage applications. The commitment of Von Roll to mica is unique, starting with the mining of this raw material followed by the production of paper and mica tapes and going as far as taping conductors.

Structural materials – A wide range of structural materials can be used for low-voltage applications. Rigid laminates and molded parts as well as prepregs and B-staged materials are the answer to many design challenges in blocking and reinforcements, terminals, switch insulations and others. POLY GLAS® b-stage banding tapes are useful for reinforcements of rotating parts such as armatures, generator exciters and rotor components.



APPLICATION SUGGESTIONS

Von Roll has developed state-of-the-art materials for stack consolidation:

INDUSTRIAL AND TRACTION DC MOTORS & GENERATORS

Flexible Laminates, Ground & Phase

ACUFLEX® NK, NKN
ACUFLEX® KNK
MICA MAT® Tapes
FUSA-FAB® Tapes

Impregnation and potting compounds

PERMAFIL® 707C
PERMAFIL® 777C
PERMAFIL® 711C
Damisol 3551

Composites and banding tapes

POLY GLAS® 76870
POLY GLAS® K220
Vetronite GPO Laminates

AUTOMOTIVE

Flexible Laminates, Ground & Phase

ACUFLEX® RM, RMR
ACUFLEX® NM, NMN, NMNM
ACUFLEX® NK, NKN
MYOFLEX® AHA

Impregnation and potting compounds

DOLPHON® CC-1170
DOLPHON® XL-3101
DOLPHON® XL-3105
DOLPHON® CC-1180 HiR

Composites and banding tapes

POLY GLAS® 76843
POLY GLAS® 76870
POLY GLAS® K220
Vetronite® G-11 Composites

COMMERCIAL AND INDUSTRIAL MOTORS & GENERATORS

Flexible Laminates, Ground & Phase

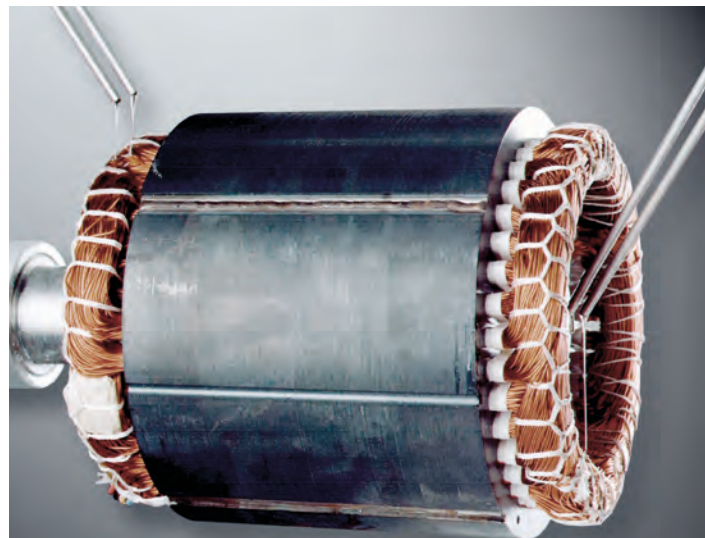
ACUFLEX® DMD70, DMD100
ACUFLEX® NM, NMN, NMNM
ACUFLEX® MNM
THERM-AL H®

Impregnation and potting compounds

HI-THERM® BC-346-A
DOLPHON® BC-352
DOLPHON® CC-1170
PERMAFIL® 724C
DOLPHON® CC-1180
PERMAFIL® 74035
DOLPHON® XL-3102
DOLPHON® CB-1107

Composites and banding tapes

POLY GLAS® 76843
POLY GLAS® 76870
POLY GLAS® K220
Vetronite Composites
B-stage glass cloth
Bondable Papers



APPLIANCE AND POWER TOOL MOTORS

Flexible Laminates, Ground & Phase

ACUFLEX® RM, RMR
ACUFLEX® DMD70, DMD100
ACUFLEX® NM, NMN, NMNM

Impregnation and potting compounds

AQUA-THERM® BC-365, BC-365-LTC, BC-365-FC
HI-THERM® BC-346-A
DOLPHON® BC-352
DOLPHON® CC-1170
DOLPHON® CC-1174
DOLPHON® CC-1096
DOLPHON® CC-1105
DOLPHON® XL-3101 / XL-3105
Damisol 3007-2 Gelcoat

AIRCRAFT AND MILITARY MOTOR

Flexible Laminates, Ground & Phase

ACUFLEX® NK, NKN
ACUFLEX® KNK
Flake Mica Tapes

Impregnation and potting compounds

PERMAFIL® 707C
Damisol 3551
DOLPHON® XL-3101
DOLPHON® XL-3102

Composites and banding tapes

Vetronite G30 Polyimide Laminate
Vetronite G7 Silicone Laminates

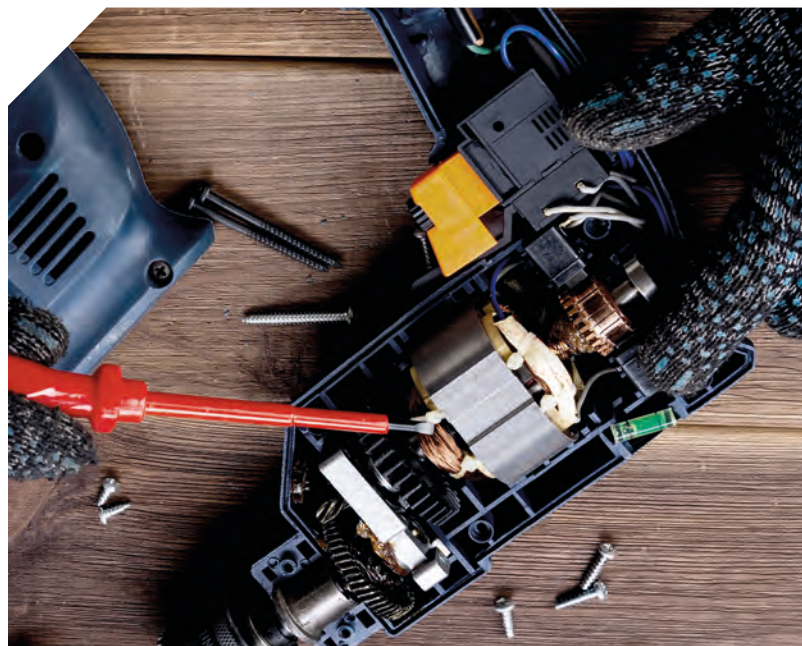
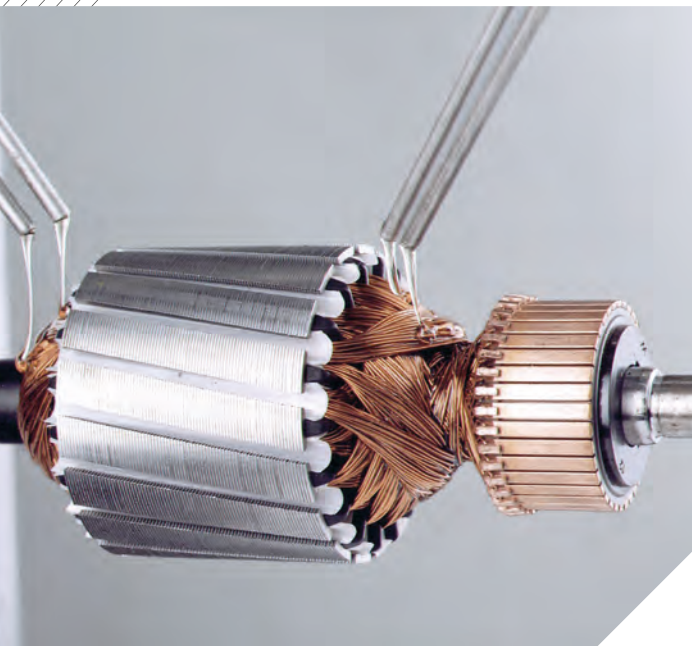
HERMETIC MOTORS

Flexible Laminates, Ground & Phase

ACUFLEX® DMD70
ACUFLEX® NM, NMN, NMNM
MICA MAT® Tapes

Impregnation and potting compounds

DOLPHON® BC-352
PERMAFIL® 74043
DOLPHON® CC-1180 HiR
PERMAFIL® 74035
PERMAFIL® 74041



IMPREGNATING RESINS

Impregnation resins are one of the most important components in any low-voltage machine. We offer a wide range of impregnation resins ideally optimized for every impregnation system, such as vacuum pressure impregnation, trickling, dipping or dip rolling. Below are some materials that are particularly suited to these applications:

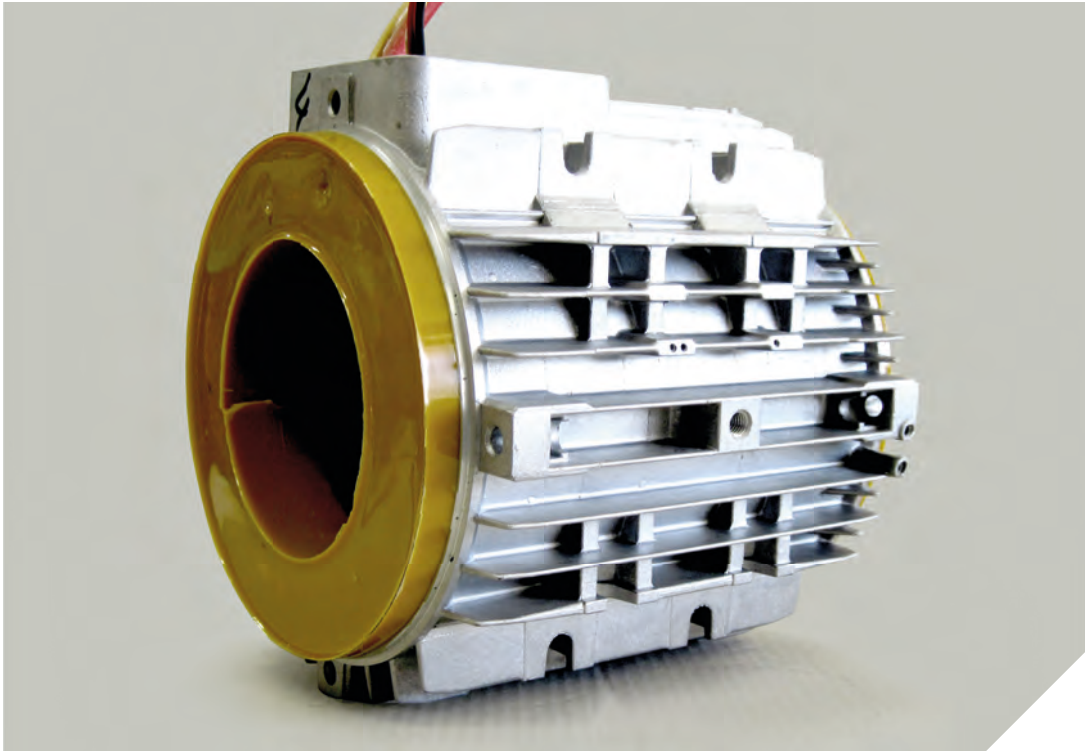
	Chemistry	Viscosity at 25°C (cps)	Process	Curing Process	Special properties
SYNTHITE® AC-43	Alkyd / phenolic Solvent borne	50	Atmospheric Dip, Spray	Air Dry	One component resin with outstanding bond strength at elevated temperatures
HI-THERM® BC-346-A	Alkyd / phenolic Solvent borne	230	Atmospheric Dip	Bake	High temperature resistant, tough, flexible, Mil-I-24092, universal applications
DOLPHON® BC-352	Epoxy. Solvent borne	200	Atmospheric Dip	Bake	High strength, moisture, chemical and refrigerant resistant
PERMAFIL® 74043	Epoxy. Solvent borne	1200	Atmospheric Dip	Bake	High strength, moisture, chemical and refrigerant resistant
AQUA-THERM® BC-365, BC-365-LTC, BC-365-FC	Alkyd Polyester Water reducible	Adjustable	Atmospheric Dip	Bake	Environmentally friendly, low VOCs, easy to dilute
DOLPHON® CC-1096	Unsaturated polyester in Styrene	250	Trickle, roll dip	100-140°C	Two part resin, low viscosity, high bonding strength, excellent penetration, fast cure at low temperature
DOLPHON® CC-1174	Unsaturated polyester in Vinyl Toluene	300	Trickle, roll dip	100-140°C	Two part resin, low viscosity, high bonding strength, excellent penetration, fast cure at low temperature
DOLPHON® CC-1170-TR, CC- 1170	Unsaturated polyester in Vinyl Toluene	300, 900	Trickle, roll dip, atmospheric dip and VPI versions	100-140°C, Bake	One or two part resin, low viscosity, semi-rigid for large machines or thermal cycling resistance
PERMAFIL® 707C, 777C, 711C	Unsaturated polyesters in Vinyl Toluene	900, thixos	Atmospheric dip and VPI	Bake	Semi-rigid resins excellent for all transportation applications
PERMAFIL® 724C	Unsaturated polyester in Vinyl Toluene	700	Atmospheric dip and VPI	Bake	Medium viscosity for dipping, high bonding strength, fast cure
DOLPHON® CC-1105	Unsaturated polyester, low VOC	600	Atmospheric dip and VPI	Bake	Low odor, low viscosity, high stability, excellent bonding strength

Von Roll provides as well a wide range of potting materials perfectly suited for low-voltage motors and generators. The following is an example of these high quality products:

	Chemistry	Viscosity at 25°C (cps)	Process	Curing Process	Special properties
DOLPHON® XL 3101	Unsaturated polyester, low VOC	600	Trickle, roll dip	100-140°C	Low odor, low viscosity, high bond strength with good thermal resistance. One part resin with low VOCs
DOLPHON® XL 3102	Unsaturated polyester, low VOC	900	Atmospheric dip and VPI	Bake	Low odor, low viscosity, high bond strength with good thermal resistance. Tank stable resin with low VOCs
DOLPHON® XL-3105	Unsaturated polyester, low VOC	600	Trickle	100-140°C	Low odor, low viscosity, high bond strength with good thermal resistance. Two part resin with low VOCs and fast cure
Damisol 3007-2 Gelcoat	Polyesterimide in styrene	20000	Trickle	100-140°C	Two part resin, excellent bonding gel coat. Excellent crack resistance
DOLPHON® CC-1180-HiR	Solventless epoxy	600	Trickle, roll dip	Bake	Very low emission epoxy resin, Excellent stability and dielectric properties up to class H. High reactivity for hot dipping using the joule effect
DOLPHON® CC-1180-LoV	Solventless epoxy	550	Atmospheric dip and VPI	Bake	High chemical and moisture resistant resin, good adhesion
PERMAFIL® 74035	Solventless epoxy	Thixo	VPI	Bake	Thixotropic, high film build with superior chemical and moisture resistance
PERMAFIL® 74041	Solventless epoxy	Thixo	VPI	Bake	Thixotropic, high film build with superior chemical and moisture resistance
Damisol 3551	Solventless silicone	1300	Atmospheric dip and VPI	Bake	High temperature performance for transit and traction motors

POTTING & CASTING COMPOUNDS

Potting Compounds	Chemistry	Mix Ratio	Mixed viscosity at 25°C (cps)	Hardness	Cure Temp	Thermal Conductivity W/mK	Special properties
DOLPHON® CB-1107	Epoxy	100/20 RE-2001	3000	D45	RT	0,9	Semi-rigid epoxy, RT curing, low shrinkage, good crack resistance after thermal shocks.
DOLPHON® CN-1037	Epoxy	100/30 RE-2007	1850	D85	120°C	0,7	Good mechanical properties at high temperature, high glass transtion temperature and excellent crack resistance after thermal shocks.
DOLPHON® CB-1078	Epoxy	100/5 RE-2000	6000	D80	RT	0,5	Black filled resin with good thermal conductivity and low shrinkage
DAMIVAL 13682	Urethane	100-9 13481	5000	A46	RT	0,95	MDI-free system. High thermal conductivity usable up to 150°C. Compliant with EN45545-2 railway standard.



TESTING



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

At Von Roll High-Voltage and Low-Voltage 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 δ -measurements at different temperatures
- + Partial discharge measurements with different voltage ranges



Testing in the Von Roll laboratory



Training courses

TRAINING

For a number of years we have been offering a unique program of high-voltage and low-voltage insulation training within 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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