MARKETS // **PRODUCTS**

PRODUCTS & SYSTEMS FOR THE **ELECTRONICS INDUSTRY**

established 1910 Dolph's vonRoll

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

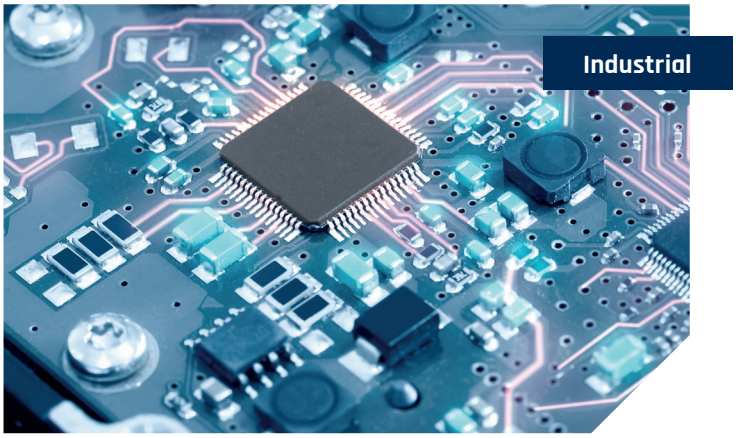
We offer you global in-depth know-how and are happy to support you in fulfilling your needs. In doing so, we tailor our products to your specific requirements to achieve the results you are looking for. We develop our customized solutions together with you to achieve the best suited resin system for your application, equipment with the expected performance.
Von Roll provides an extensive range of systems designed to insulate and protect electrical and electronic components.

The product range has properties excellently suited to:

+ Overmolding, encapsulation, impregnation
+ Bonding, sealing, covering, filling up empty spaces
+ Protecting against moisture, shocks and vibrations, harsh environments
+ Increasing thermal dissipation

In accordance with industrial environmental programs and directives, all grades are free of halogens and volatile organic compounds (VOCs). Formulations comply with the Restriction of Hazardous Substances (RoHS) Directive. Several systems are UL approved.

Our products are manufactured in our global production network with sites in the USA, France, Italy, India and China, and are sold in more than 80 countries.



ENVIRONMENT & SAFETY

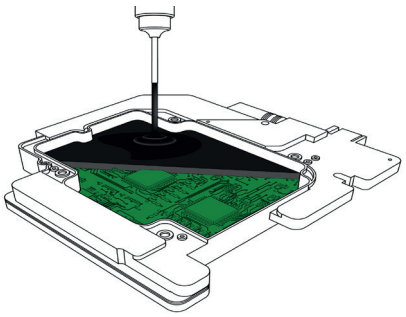
Von Roll's safe, green and clean strategy focusing on products for the future:

+ Safe for the users - No risk to work with the products
+ Green for the planet - Low to no impact on air pollution or global warming
+ Clean for the local environment - Low to no wasted chemicals

PROCESSES FOR ELECTRONIC INSULATION AND PROTECTION

Atmospheric Potting

Atmospheric potting is used when easy workability and a simple process are needed, and the geometry of the potted parts is not too complex. This process requires mainly a low mix viscosity and an easy-to-handle mixing ratio between resin and hardener, since the mixing is often done manually.



Vacuum Potting

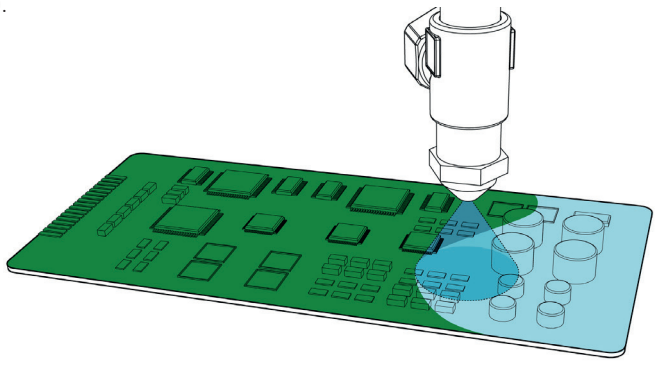
Vacuum potting is the standard casting process. Vacuum potting is often combined with slightly higher process temperatures to enable a smooth and stable process – the main benefits for vacuum casting is the air-free potting, better wetting and adhesion on the substrates and a higher stability in mixing quality.

Atmospheric Dipping

Dipping is the most common impregnation process for any kind of low-voltage electrical components, such as motors, generators or transformers. It is highly versatile and seems very easy. Nevertheless, the resin choice is always crucial 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.).

Spray - Conformal Coating

Coating serves mainly as protection of fragile or exposed components. The selection of the best-suited coating process depends on the required varnish and its properties. We offer several coatings with different colors and chemical properties that are ideally suited for all kind of processes (Brushing, Spraying or Dipping).



AUTOMOTIVE

Capacitors

Potting

- Damival® U510
- Damival® U512
- Damival® 13524

Battery Systems

Potting

- Damival® U510
- Damival® E112
- Damival® U602

Conformal Coating

- Synthite® AC 43
- Damitron® UVC-80
- Synthite® AC 46-1

Inverter & Converter

Potting

- Damival® U512
- Damival® U513
- Damival® E112

Sensors & Electronic Control Units (ECU's)

Conformal Coating

- Synthite® AC 46-1
- Damitron® UVC-80
- Synthite® AC 43

Potting

- Damival® E110
- Damival® U602
- Damival® 13522

Ignition Coils

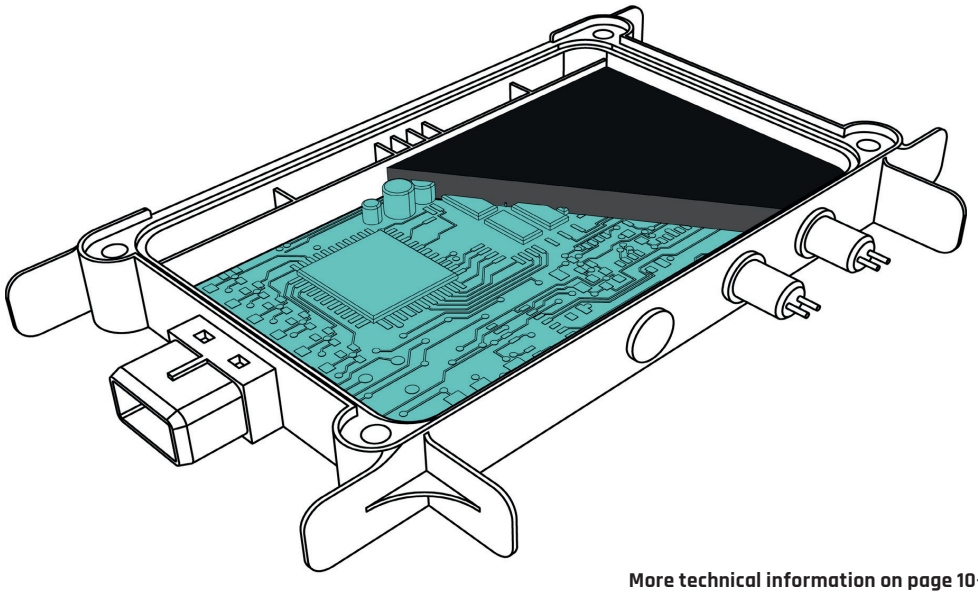
Potting

- Dolphon® 1037

Charging Systems

Potting

- Damival® E110
- Damival® U602
- Damival® U510



More technical information on page 10-11.

INDUSTRIAL ELECTRONICS

Electronic Units

Potting

- Damival® U513
- Damival® U602
- Damival® U510

Conformal Coating

- Synthite® AC 46-1
- Damitron® UVC-80
- Synthite® AC 43

Sensors

Potting

- Damival® E110
- Damival® U602
- Damival® U510

Conformal Coating

- Synthite® AC 46-1
- Damitron® UVC-80
- Synthite® AC 43

Inverter/ Converter

Potting

- Damival® U513
- Damival® E112
- Damival® E100

Wire harness/ Connectors

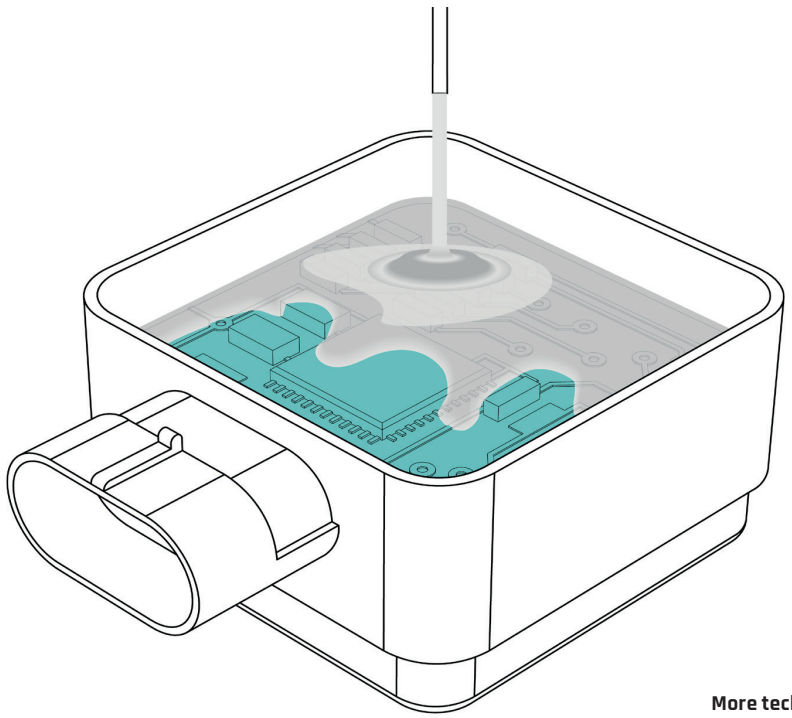
Potting

- Damival® 13524
- Damival® U602

Capacitors

Potting

- Damival® U510
- Damival® U512
- Damival® 13524



More technical information on page 10-11.

CONSUMER GOODS

White Goods Control Boards

Potting

- Damival® E110
- Damival® U602
- Damival® U512

Conformal Coating

- Synthite® AC 46-1
- Damitron® UVC-80
- Synthite® AC 43

White Good Sensors

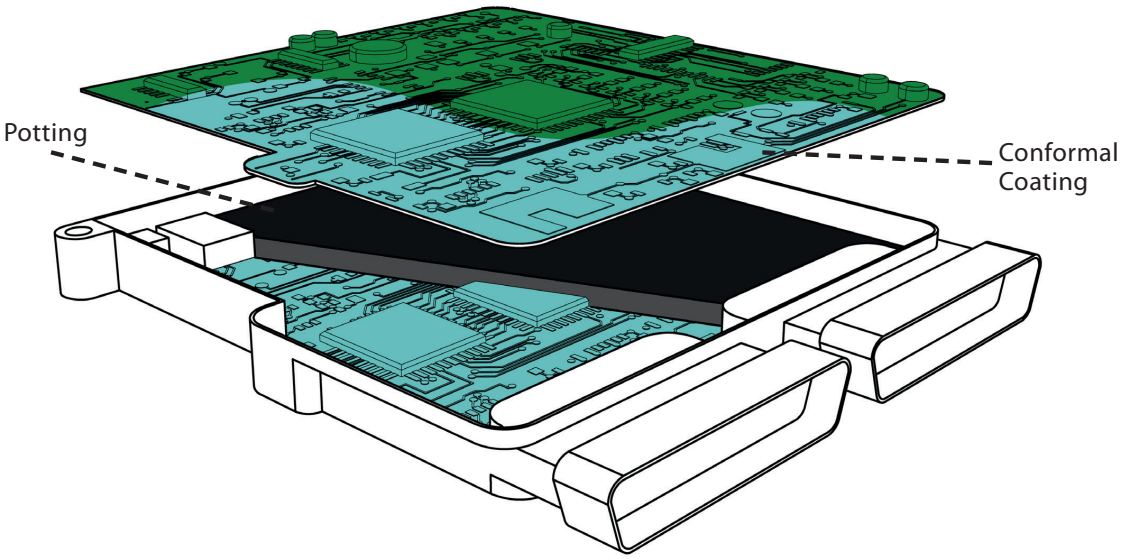
Potting

- Damival® E110
- Damival® U602
- Damival® U510

Handheld Moisture

Potting

- Synthite® AC 46-1
- Damitron® UVC-80
- Synthite® AC 43



More technical information on page 10-11.

POTTING SYSTEM OVERVIEW

Epoxy Potting Systems

Epoxy potting chemistry shows in general very good thermal properties and superior adhesion to metal and duroplastic materials. Due to the latency of the systems a long and secured processing time is given. Fast curing is possible as well as fast curing at elevated temperatures. The typical operating temperature is very wide, ranging from -60°C to 180°C for ambient curing epoxy systems and wider more broad when using hot curing epoxy systems. Typical applied processes are atmospheric and vacuum potting.

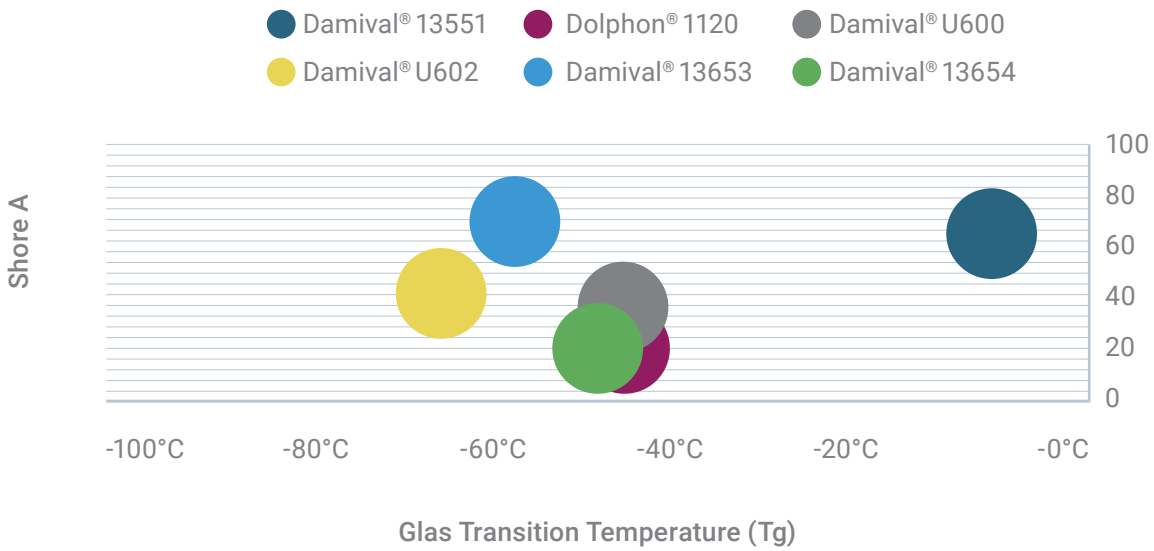
Polyurethane Potting Systems

Polyurethane potting chemistry offers many possibilities of use due to the low mix viscosity and easy processing. The adhesion properties are especially good for thermoplastics and duroplastics. In combination with thermoplastic, the polyurethane resin can also be used for large volumes due to the low exothermic reaction. The flexibility and crack resistance at medium and low temperatures make this type of potting resins very suitable for pressure sensitive devices. Typical applied processes are Atmospheric and Vacuum potting.

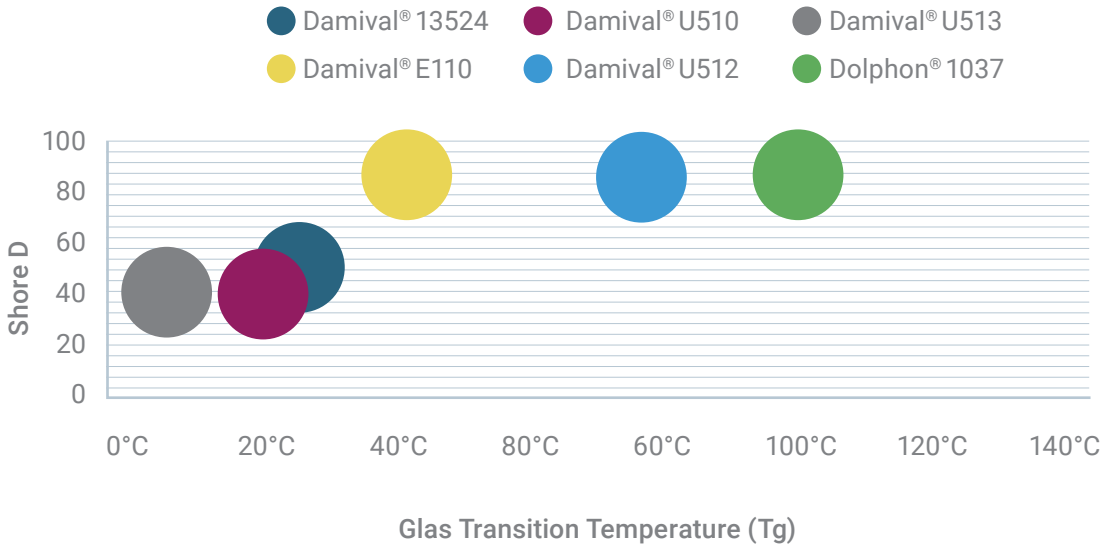
Polybutadiene Potting Systems

Polybutadiene potting chemistry shows a very high flexibility, and is therefore perfectly suited for materials with different thermal expansion coefficients like metal to plastics encapsulation. The adhesion properties are generally very good on thermoplastics and duroplastics – some types are also usable for metals. The typical operating temperature is very wide, ranging from -60°C to 150°C without showing stress to the potted parts. In many of applications, polybutadiene potting resins can also replace silicones. Typical applied processes are atmospheric and vacuum potting.

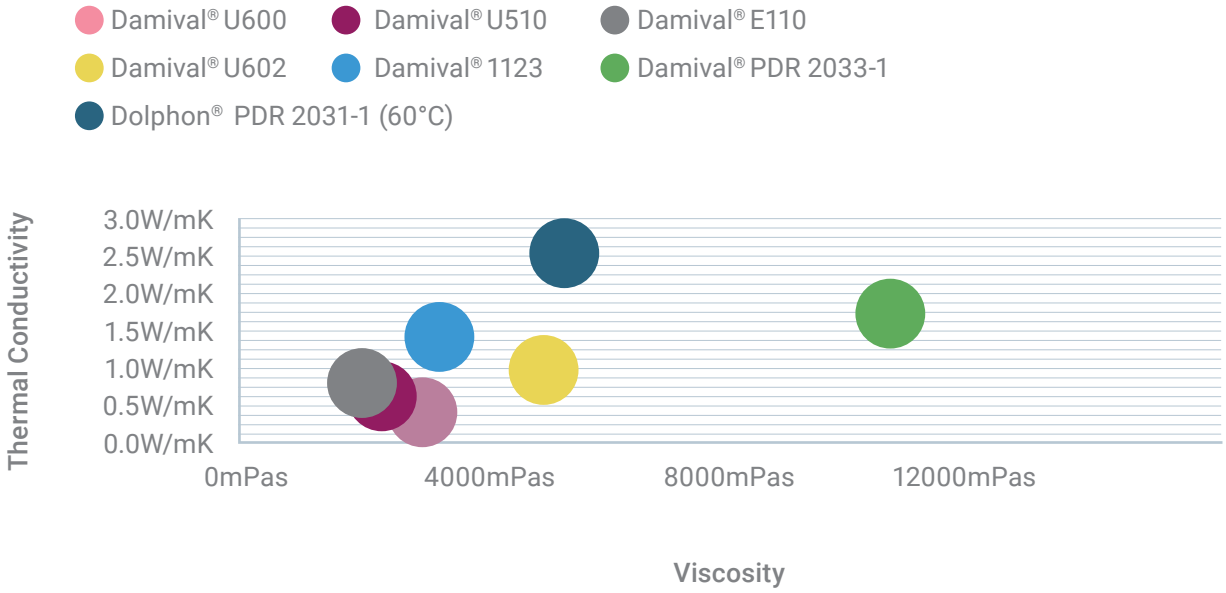
SOFT POTTING SYSTEMS



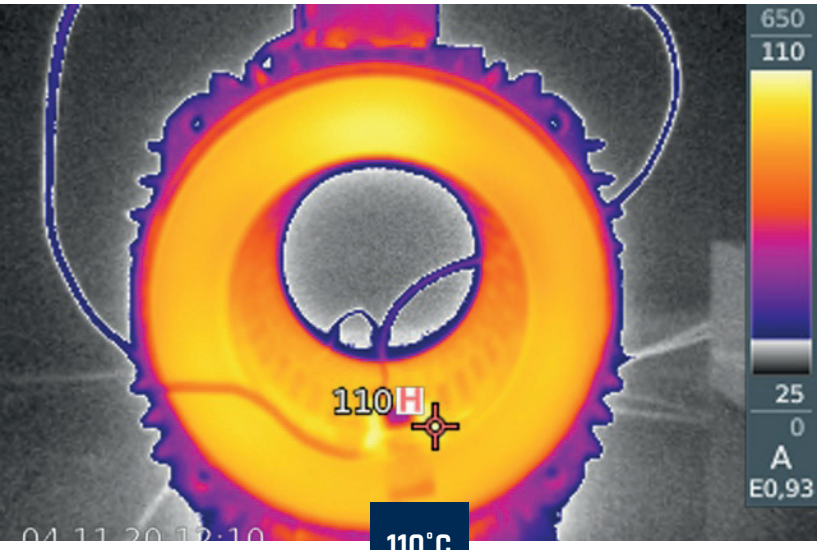
HARD POTTING SYSTEMS



THERMAL CONDUCTIVE SYSTEMS

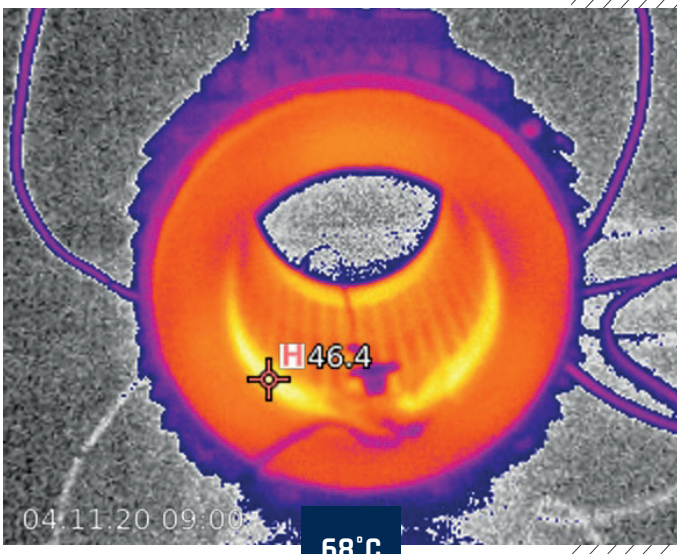


Resin with 0.2W/mK



110°C

DAMIVAL® E112 with 1.3W/mK



68°C

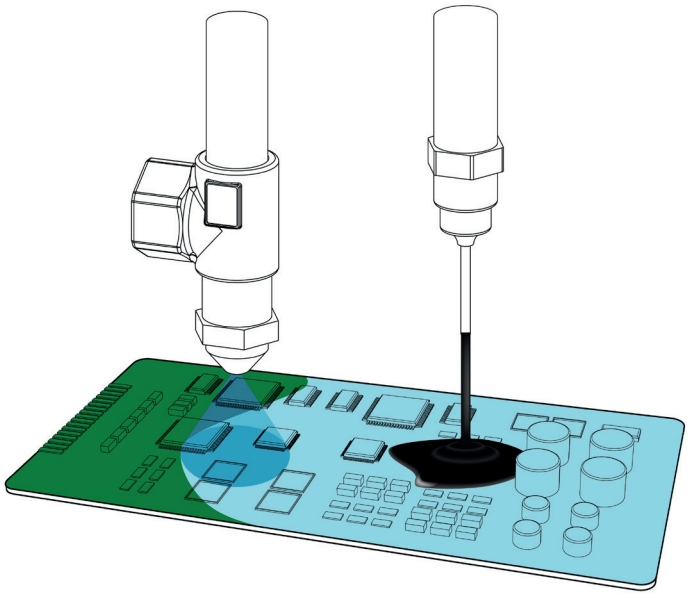
POTTING SYSTEM OVERVIEW

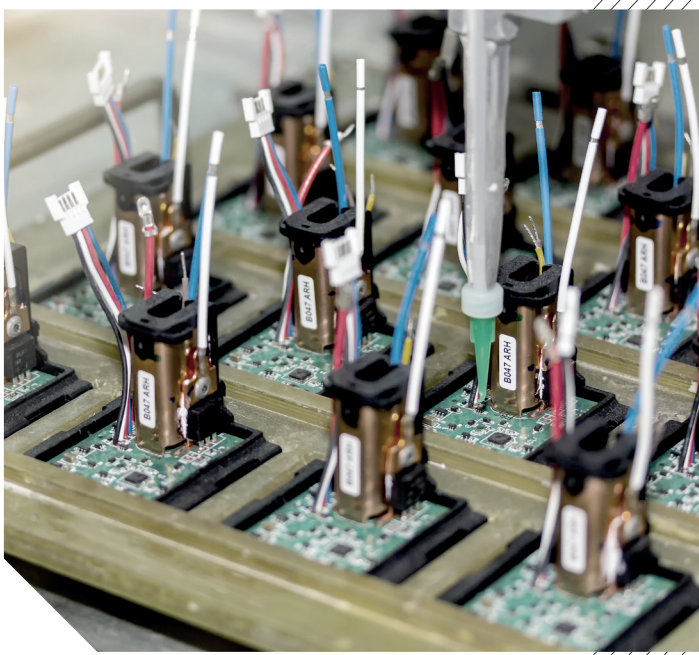
Product Name	Chemistry	Hardness	Mix Viscosity	Operating Temperature	Thermal Conductivity	Main Characteristics
Damival® 13524	PU	D50	200mPas	130 °C	0.4 W/mK	Moderate density, cost efficient
Damival® U510 (1139)	PU	D40	2350mPas	130 °C	0.6 W/mK	Easy to use PU, cost efficient
Damival® U513 (13553)	PU	D40	3000mPas	155 °C	0.8 W/mK	Good adhesion & chemical resistance
Damival® U512 (13518)	PU	D85	2000mPas	130 °C	0.65 W/mK	UL RTI 120, good chemical resistance
Damival® 13551	PU	A70	2300mPas	130 °C	0.8 W/mK	Good adhesion properties
Damival® 13653	PUBD	A75	3000mPas	130 °C	0.3 W/mK	High hydrolysis resistance
Damival® 13203	PU	A75	10700mPas	130 °C	1.7 W/mK	UL 94V0 3mm, very high thermal conductivity
Dolphon® 1120	PUBD	A25	2000mPas	120 °C	0.2 W/mK	Unfilled & translucent
Damival® U600 (1109)	PUBD	A40	3500mPas	120 °C	0.4 W/mK	Very low outgassing and good adhesion
Damival® U601 (13681)	PUBD	A50	3000mPas	150 °C	0.3 W/mK	Possible alternative to silicone. MDI free. High thermal resistance.
Damival® U602 (13682)	PUBD	A46	5000mPas	150 °C	0.95 W/mK	Good allrounder also possible alternative to silicone. MDI free.
Damival® 13654	PUBD	A25	4000mPas	110 °C	0.35 W/mK	Very low hardness & high tear strength
Damival® E110 (1114)	EP	D85	2000mPas	180 °C	0.8 W/mK	Good thermal shock & crack resistance
Damival® E100 (1107	EP	D45	3000mPas	155 °C	0.9 W/mK	Semi-flexible, high resistance against thermal shocks and cycling
Damival® E112 (1123)	EP	D85	3000mPas	180 °C	1.4 W/mK	Perfect balance between viscosity and thermal conductivity
Dolphon® PDR 2031-1	EP	D90	5300mPas (60 °C)	180 °C	2.2 W/mK	Very high thermal conductivity, low CTE
Dolphon® 1037	EPHC	D85	4500mPas (60 °C)	200 °C	0.7 W/mK	Very good crack resistance
Dolphon® 1220	EPHC	D90	620mPas (90 °C)	200 °C	1.3W/mK	High thermal conductivity, excellent crack resistance, low CTE

PU = Polyurethane Chemistry, EP = Epoxy Ambient Temperature Cure, EPHC = Epoxy High Temperature Cure PUBD = Polybutadiene Chemistry, CTE = Coefficient of Thermal ExpansionMDI = Standard Aromatic Curing Agent for Polyurethane

CONFORMAL COATING SYSTEM OVERVIEW

Product Name	Chemistry	Viscosity @25 °C	Operating Temperature	Main Characteristics
Synthite® AC-43	Alkyd-based	50mPas	180 °C	Air drying coating, easy sprayable, high temperature resistant
Synthite® AC 46	Polyurethane	300mPas	130 °C	UL 94 & UL 746E approved, excellent adhesion, superior chemical and abrasion resistance, easy sprayable
Synthite® AC 46-1	Polyurethane	300mPas	130 °C	UL 94 & UL 746E approved, excellent adhesion, superior chemical and abrasion resistance, easy sprayable, no aromatic solvents
Damitron® UVC-80	Polyurethane - UV curable	200mPas	130 °C	Very fast process times due UV-curing, superior chemical and abrasion resistance, flexible also at low temperatures





Most of our systems are recognized via UL. If you don´t find a system which fulfills your demand – please contact our experts!

TESTING

vonRoll Institute for High-Voltage Insulation

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 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 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

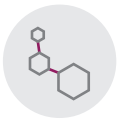
Von Roll is the sole full-range supplier of materials and systems for the insulation of electrical machines as well as high-performance products for various high-tech industries.

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. We offer molded, machined or semi-finished products.

Flexibles
Insulating flexible materials for low-voltage applications.

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 of 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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