

Composites

We Enable Energy

As one of the oldest industrial companies in Switzerland, founded in 1803, we focus on products for power generation, 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, process equipment, tests and services for the electro-technical 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 smaller and more efficient machines.

Customers enjoy the following benefits:

- » One single source for all insulating materials
- » Proven compatibility for system components
- » Testing at Von Roll of both materials and systems
- » Manufacturing technology and equipment
- » Consulting in application engineering
- » Training in insulation materials and systems

Focusing on composites, we are the recognized experts in processing various substrates and resins. With our specially developed composite laminate product range, customers enjoy additional benefits:

- » Compliance with all international standards
- » Extreme mechanical load-bearing capacity
- » Excellent dielectric properties
- » High thermal and corrosion resistance
- » Lightweight
- » Environmentally friendly

Von Roll provides a comprehensive spectrum of semi-finished and machined composite laminated products for electro-technical and industrial applications. Due to their outstanding properties, composite materials are increasingly being used to substitute other materials such as metals.

From mica to glass, synthetic fibers or natural reinforcement materials, and from polyester to high temperature-resistant resin systems, Von Roll offers an almost infinite range of customized products.

Typical applications include electrical insulation, paper machines, medical equipment, pumps, cardboard folding, pallets for PCB soldering, electrical testing, ballistic protection and thermal protection.

This wide variety of attributes, combined with the experience and technology of our machining centers, allows us to offer you the perfect solution for your application. We can supply machined parts from customers' drawings, ready-made to be incorporated in many types of applications.

Composite laminates are materials made up of reinforcement layers impregnated with various types of appropriate resins and then cured under heat and pressure.

Various types of reinforcement materials are used, such as:

- » Cellulose paper, mica paper
- » Fabrics: cotton, glass, carbon, synthetic fiber fabrics (e.g. aramid, PAN)
- » Glass mats

The most commonly used types of resin are:

- » Polyester
- » Epoxy
- » Phenolic
- » Polyimide
- » Silicone
- » Melamine
- » Vinylester
- » Cyanatester

The selection and adapted formulation of resins, and the way in which they are combined with the various reinforcement layers available, enable a wide range of industrial composites to be created, each with different mechanical, electrical and thermal properties.

Composite materials are available in different forms:

- » Prepregs
- » Sheets and plates
- » Tubes and cylinders
- » Round and threaded rods
- » Machined parts



Mica Laminates

Mica is a mineral raw material with outstanding dielectric, thermal and physical properties. Von Roll developed the technique of converting high-grade sheet mica into mica paper under the registered trade name SAMICA® based either on muscovite or phlogopite. SAMICA® is then impregnated with an appropriate bonding resin and heat-pressed to be consolidated into SAMICANITE® laminates.

The various types of paper and the different resins and fillers enable Von Roll to achieve the particular properties of mica paper laminates, which are characterized by excellent electrical, mechanical and thermal properties.

Applications range from electrical engineering to induction ovens, from the automotive industry and commutators for DC industrial or traction motors to household appliances industry such as microwave ovens. Von Roll supplies various state-of-the-art products from mica paper sheets and tubes up to ready-to-use machined parts.

The following table provides a general overview and some highlights of our mica laminates:

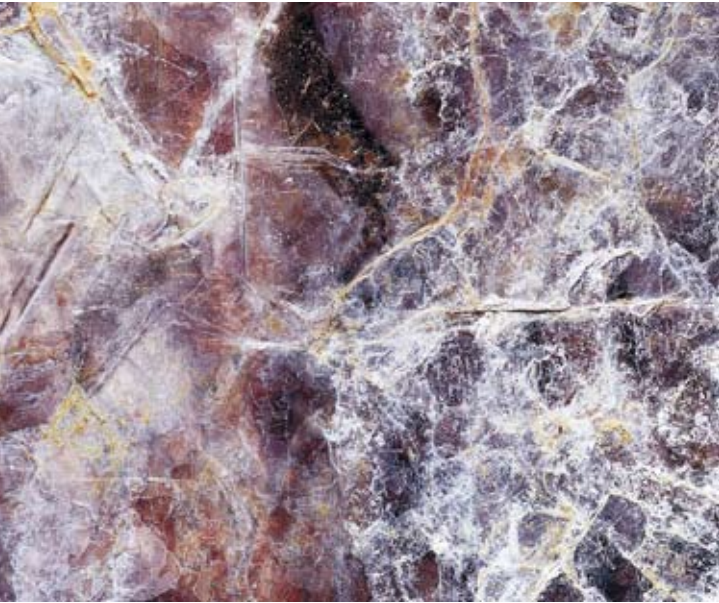
Product Name	Type	Matrix	Rein- forcement	Standards	Heat resis- tance °C	Sheet size Thicknesses mm	Highlights	Main applications
Rigid								
Commutator SAMICANITE®	41120	epoxy	muscovite	IEC 60371-3-1 P13	155°C	1000 x 600 0.3 to 2	exudation temperature above 300°C, tight thickness tolerances	traction motors
Commutator SAMICANITE®	41210	epoxy	muscovite	IEC 60371-3-1 P9	155°C	1000 x 600 0.3 to 2	exudation temperature above 200°C, tight thickness tolerances	small and average-size traction motors
Heater SAMICANITE®	41610	silicone	muscovite	IEC 60371-3-3 HP 5	600°C	1200 0/+2 x 1000 0/+2 0.2 to 2.0	excellent thermal properties UL94 V-0	heating resistance supports and insulation in household and industrial appliances
Heater SAMICANITE®	41620	silicone	phlogopite	IEC 60371-3-3 HP 5	600°C	1200 0/+2 x 1000 0/+2 2.0 to 60	excellent thermal properties UL94 V-0	heating resistance supports and insulation in household and industrial appliances
PAMITHERM®	41140	silicone	muscovite	–	450 up to 800°C	1200 0/+2 x 1000 0/+2 2.0 to 60	excellent fire resistance M0 F0	thermal and mechanical parts insulating platens
Flexible								
Flexible SAMICANITE®	41220	silicone	muscovite	IEC 60371-3-3 HP 5	180°C	1200 0/+2 x 1000 0/+2 2.0 to 2.0	flexible, good electrical properties	thermal and electrical shield in heating and industrial appliances
MIGLASIL® range	362.50	silicone	phlogopite	–	up to 1200°C	rolls of 25000 x 1000/0.27 and 0.40 sheets 570 x 1020 or 1500 x 1000 0.70/1.0/1.5/2.0 thick	pure mica + silicon binder	thermal and electrical shield in heating and industrial appliances
	368.90-10	silicone	phlogopite, glass	–	up to 1200°C	rolls of 25000 x 1000 thickness: 0.31	pure mica + silicon binder + one layer of glass fabric	thermal and electrical shield in heating and industrial appliances
	368.90-50	silicone	phlogopite, glass	–	up to 1200°C	rolls of 25000 x 1000 thickness: 0.62	pure mica + silicon binder + two layers of glass fabric	thermal and electrical shield in heating and industrial appliances

Glass Fabric Laminates

Glass fabric laminates are manufactured using high-pressure techniques and are characterized by extremely high mechanical strength and outstanding electrical and thermal properties.

All VETRONITE® laminates are made of glass fabric bonding with an appropriate resin system.

In selecting a VETRONITE® grade, various electrical, thermal and mechanical constraints have to be considered, as well as other properties such as expected life span, health and safety and environmental factors.



Mica



Glass fabric laminate



Glass Fabric Laminates

The following table shows the comparative values for different grades of VETRONITE®:

Brand names	Units	Test methods	VETRONITE® EGS 102	VETRONITE® EGS 103	VETRONITE® EGS 619		VETRONITE® FR-5 HF CTI 600M	VETRONITE® G-11	VETRONITE® EGS T-23	VETRONITE® MGS	VETRONITE® PGS	VETRONITE® SGS	VETRONITE® POLYIMID 64160
Composition													
Matrix			Epoxy	Epoxy	Epoxy		Epoxy	Epoxy	Epoxy	Melamine	Phenolic	Silicone	Polyimid
Reinforcement			Glass fabric	Glass fabric	Glass fabric		Glass fabric	Glass fabric	Glass fabric	Glass fabric	Glass fabric	Glass fabric	Glass fabric
Standards	NEC 60893 NEMA LI-1 DIN 7735 (for info)		EP GC 201 G-10 HGW 2372	EP GC 203 G-11 HGW 2372.4	EP GC 202 FR-4 HGW 2372.1		EP GC 204 FR-4 HGW 2372.2	EP GC 203/208 G-11 HGW 2372.4	EP GC 203/208 G-11 HGW 2372.4	MF GC 201 G-5 HGW 2272	PF GC 201 G-3 2072	SI GC 202 G-7 2572	PI GC 301 – –
Color			green	light beige	light green		red	yellow brown	yellow brown	white	brown	white	brownish red
Form of delivery (mm)			1170 x 1070 0.2 to 150	1170 x 1070 0.2 to 100	1170 x 1070 0.2 to 150		1170 x 1070 0.2 to 100	1170 x 1070 0.2 to 150	1170 x 1070 0.2 to 150	1170 x 1070 0.2 to 20	1170 x 1070 0.2 to 20	1170 x 1070 0.2 to 50	1250 x 1250 0.35 to 38
Mechanical characteristics													
Flexural strength at 23°C flatwise	MPa	ISO 178	450	400	450		450	500	450	300	400	150	400-450
Flexural strength at 150°C flatwise	MPa	ISO 178	–	200	–		300	400	350	–	–	–	–
Flexural strength at 200°C flatwise	MPa	ISO 178	–	–	–		–	–	–	–	–	–	300
Edgewise notched impact strength Charpy	kJ/m²	ISO 179	55	55	55		60	65	60	35	60	50	70
Tensile strength // at 23°C	MPa	ISO 527	300	300	300		330	375	330	200	250	130	300
Compressive strength at 23°C flatwise	MPa	ISO 604	420	400	420		550	550	500	500	450	450	450
Electrical characteristics													
Insulation resistance (after immersion in water)	Ohm	IEC 60167	1E+12	1E+12	1E+12		1E+11	1E+12	5E+12	1E+8	1E+9	1E+12	1E+12
Edgewise breakdown voltage (taper pin electrodes)	kV	IEC 60243-1	80	80	80		75	80	80	45	20	75	60
Flatwise breakdown voltage	kV/mm	IEC 60243-1	18	20	18		15	20	18	6	6	8	10
Comparative tracking index	V	IEC 60112	350	180	200		600M	500	200	600	200	600	200
Physical characteristics													
Density	g/cm³	ISO 1183	1.85	1.85	1.92		1.99	1.90	1.90	1.95	1.90	1.85	1.90
Water absorption	%	ISO 62	0.05	0.06	0.05		0.05	0.04	0,04	1.00	0.20	0.10	0.25
Temperature index	°C	IEC 60216	130	155	130		180	180	180	130	120	220	180
Coefficient of linear expansion //	10-6/K	VDE 0304/VSM 77110	15	15	15		15	15	15	10	15	12	15
UL files			E47629		E47629								
Highlights			low temperatures and high humidity	mechanical and electrical applications at high temperatures	high mechanical, electrical and elec-tronics applications		low smoke emis-sion and toxicity tracking resistant	excellent mechanical properties at high temperatures	high mechanical properties at high temperatures	high tracking and arc resistance	aeronautics approved ATS1000.001 / FAR25853	high temperatures up to 220 °C	high mechanical high temperature

All grades are RoHS-compliant

Synthetic Fiber Laminates

Synthetic fiber laminates are made without glass and are manufactured using high-pressure techniques. They are characterized by extremely high mechanical strength, a low friction coefficient and excellent abrasion resistance.

Synthetic fiber laminates are used to make slides and vanes in high-performance compressors, compressed air motors and pumps, glide rods and friction discs – as well as operating rods in SF-6 circuit breakers, and wherever a high modulus of elasticity in tension is required.

Product name	Resin and reinforcement	Sheet size (mm)	Thickness range (mm)	Heat resistance	Applications	Highlights
ACG 600 T23	epoxy and synthetic fabric	1150 x 1000 2050 x 1000	2.0 to 120	200 °C	slides	Good slide & wear resistance
AR 600 P 01	phenol and aramid fabric	1150 x 1000 2050 x 1000	2.0 to 50	180 °C	slides	Good slide & wear resistance together with high mechanical resistance, low density
AR 600 T23	epoxy and aramid fabric	1150 x 1000 2050 x 1000	2.0 to 50	200 °C	slides	Good slide & wear resistance together with high mechanical resistance, low coefficient of linear expansion, low density
POLYFIBRITE®	epoxy and polyester fabric	1170 x 1070 2070 x 1070	2.0 to 50	150 °C	switchgears	Resistant in SF-6 environment, good electrical properties, low density



Synthetic fiber laminate

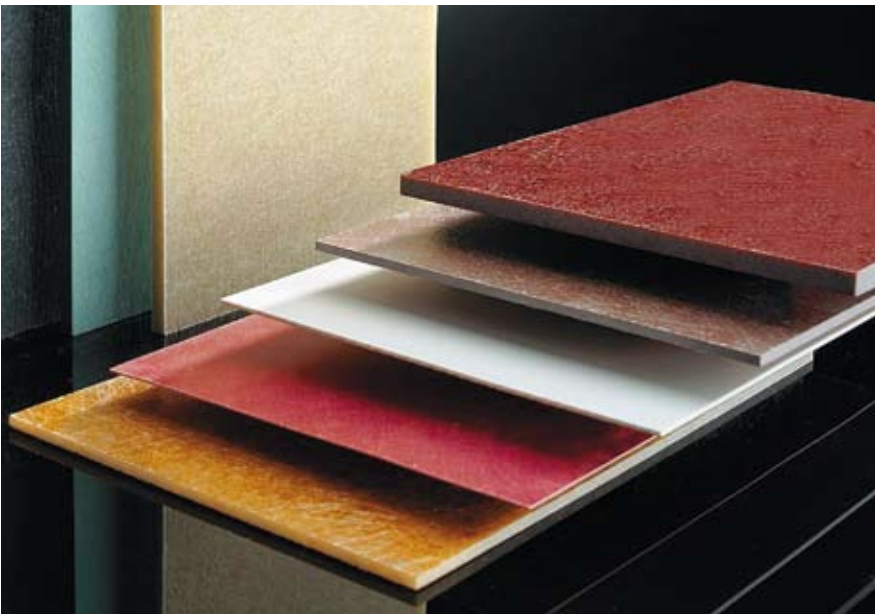
Glass Mat Laminates

Glass mat laminates are manufactured using low-pressure techniques and are characterized by using mainly glass mat or chopped glass as a reinforcement material bonded with a polyester or epoxy resin system. Fillers and other chemical additives are also added to create the required combination of properties. All glass mat laminates may be identified under the two registered trademarks of DELMAT® and DURAPOL®.

To select the appropriate grade of DELMAT® and DURAPOL® laminate, various electrical and mechanical requirements have to be taken into account as well as expected life span or safety factors.



Glass mat laminate



Glass mat laminate



Glass Mat Laminates

The following table shows the comparative values for a (not exhaustive) list of DELMAT® and DURAPOL® grades which have been tested in our laboratories and have been successfully used.

Brand names	Units	Test methods	DELMAT® Polyester 68010 GPO-3	DELMAT® Polyester 68020	DELMAT® Polyester 68200	DURAPOL® F200 SMC		DELMAT® Polyester 68030	DELMAT® Polyester 68420	DELMAT® Polyester 68160	DELMAT® Polyester 68170	DURAPOL® M600 SMC	DELMAT® Epoxy 68660	DELMAT® Epoxy 68690	DELMAT® Roving 68670
Composition															
Matrix			Polyester	Polyester	Polyester	Polyester		Polyester	Polyester	Polyester	Polyester	Polyester	Epoxy	Epoxy	Epoxy
Reinforcement			Glass mat	Glass mat	Glass mat	Chopped glass fibers		Glass mat	Glass mat	Glass mat	Glass mat	Chopped glass fibers + roving	Glass mat	Glass mat	Glass mat + UD roving
Standards	NEC 60893 NEMA LI-1 DIN 7735 (for info)		UP GM 203 GPO-3 Hm 2471	UP GM 203 GPO-3 Hm 2471	UP GM 203 GPO-3 Hm 2471	UP GM 203 GPO-3 –		UP GM 204/205 GPO-2 Hm 2472	UP GM 202 GPO-2 Hm 2471/2	UP GM 201 – Hm 2471	UP GM 201 – Hm 2471	UP GM 205 – –	EP GM 305 – –	EP GM 204 – –	– – –
Color			red RAL 3003	white RAL 9001	gray RAL 7035	red RAL 3018 gray RAL 7035 white RAL 9001		brown RAL 8011	red RAL 4002	beige RAL 1002	beige RAL 1001	green RAL 6019	natural	red	natural
Form of delivery (mm)			2000 x 1000 0.80 to 60	2000 x 1000 0.80 to 60	2000 x 1000 0.80 to 60	2000 x 1250 40 to 60		2000 x 1000 0.80 to 60	2000 x 1000 0.80 to 60	2000 x 1000 0.80/1.60	2000 x 1000 0.80 to 60	2000 x 1250 4 to 60	see data sheet 3 to 102	see data sheet 3 to 53	see data sheet
Mechanical characteristics															
Flexural strength at 23°C flatwise	MPa	ISO 178	160	130	130	130		250	210	100	200	250	400	400	600
Flexural strength at 130°C flatwise	MPa	ISO 178	95	70	70	70		150	–	–	–	–	–	–	–
Flexural strength at 155°C flatwise	MPa	ISO 178	–	–	–	–		–	120	–	–	120	200	200	300
Edgewise notched impact strength Charpy	J/cm²	ISO 179 3C	4.7	4.7	4.7	4.7		6	5	–	5	12	15	7	40
Tensile strength // at 23°C	MPa	ISO 527	100	70	70	70		150	100	70	85	150	250	250	500
Compressive strength at 23°C flatwise	MPa	ISO 604	280	260	230	220		400	160	100	250	400	500	450	350
Electrical characteristics															
Insulation resistance (after immersion in water)	MOhm	IEC 60167	10³	10³	10³	10⁵		10⁴	10⁴	5.10²	5.10²	10⁵	10⁵	10³	10⁴
Edgewise breakdown voltage (taper pin electrodes)	kV	IEC 60243-1	80	60	60	80		60	40	60	60	60	60	50	50
Flatwise breakdown voltage	kV/mm	IEC 60243-1	12	12	12	10		9	11	14	12	12	13	13	9
Comparative tracking index	V	IEC 60112	600	600	600	600		450	500	500	500	500	600	300	600
Physical characteristics															
Density	g/cm³	ISO 1183	1.8 +/-0.1	1.8 +/-0.1	1.8 +/-0.1	1.8 +/-0.1		1.8 +/-0.1	1.8 +/-0.1	1.6 +/-0.1	1.7 +/-0.1	1.9 +/-0.1	1.9 +/-0.1	1.9 +/-0.1	1.9 +/-0.1
Water absorption	%	ISO 62	0.3	0.4	0.4	0.1		0.5	0.1	1	0.3	0.1	0.1	0.1	0.1
Temperature index		IEC 60216	155	155	155	155		155	155	200	210	155	180	180	180
Coefficient of linear expansion	10-6 /K		20	20	20	20		20	20	20	20	20	15	15	15
UL files			E 70284	E70284						E 70284	E 70284		E 70284		
Highlights			halogen-free M1 94V-0	halogen-free M1 94V-0	halogen-free	mechanical 94V-0		mechanical flame-retardant	mechanical flame-retardant	flexible	dimensionally stable by high temperature	dimensionally stable halogen-free 94V-0	mechanical resistant to solvents	mechanical flame-retardant halogen-free 94V-0	mechanical resistant to chemicals

All grades are RoHS-compliant

Threaded Rods

Threaded rods and nuts known as DELGLAS® are machined from a special quality of epoxy glass laminate. They offer excellent resistance to humidity, sea water corrosion and chemical agents. DELGLAS® fastenings are well adapted for use in oil and in other dielectric liquids and operate at both very low and high temperatures (up to 180°C). In addition, they display high dielectric strength and very good tracking resistance. Rods are mainly used for the manufacture of cylinders and rollers.

Tensile strength of threads in Newton meter (Nm)	Nuts H = 1 D		Nuts H = 1.5 D		Nuts H = 2 D	
	23°C	155°C	23°C	155°C	23°C	155°C
Threaded rods with flats 68860						
M8	4800	2900	7300	4300	9800	5700
M10	8100	5000	12000	7500	15400	10400
M12	12900	7500	18500	11500	24800	14800
M16	24200	14300	33800	21300	42200	26500
M20	37800	23300	52800	32100	67900	40300
Threaded rods without flats 68860						
M8	6000	3000	9000	4500	10000	6600
M10	9000	5000	15000	8000	18000	11600
M12	14500	7500	22000	12000	28000	17000
M16	25000	15000	38000	21500	46500	29000
M20	40000	25000	57000	36000	75000	44500

Torque strength at rupture in Newton meter (Nm)	With flat		Without flat 20°C
	unlocked	locked	
Threaded rods – non-lubricated, with Nuts H = 2 D			
M8	10	19	10
M10	16	37	20
M12	32	60	35
M16	82	110	85
M20	148	162	150



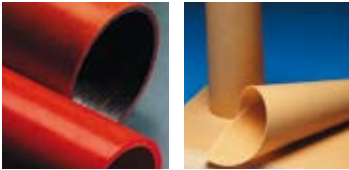
Cotton and Paper Laminates

Known under the trademark CANEVASITE®, the range of phenolic cotton laminates comprises several grades, each having specific properties and most of which are remarkable for their abrasion resistance and wear properties as well as good level of flexibility and very low level of water absorption. Machined parts made from CANEVASITE® substantially extend the life of machines and mechanically stressed components, thereby resulting in excellent cost savings.

The DELLITE® range encompasses a group of cellulose paper-based laminates that are either phenolic or epoxy-bonded. All of these laminates comply with precise standards and/or specific requirements such as flame retardancy or a high frequency of high-tension resistance. Besides the well-known standard grades, we offer several special grades.



Cotton and paper laminates



Cotton and Paper Laminates

Brand names	Units	Test methods	CANEVASITE® F18 C6	CANEVASITE® FF-5964	CANEVASITE® FF-PTFE		CANEVASITE® VRI BAT	CANEVASITE® F18 V0 HF	DELLITE® POT IV - N1	DELLITE® 2063 V0
Composition										
Matrix			Phenolic	Phenolic	Phenolic + Teflon		Phenolic	Epoxy	Phenolic	Phenolic
Reinforcement			Cotton fabric	Cotton fabric	Cotton fabric		Cotton batiste fabric	Cotton fabric	Paper	Paper
Standards	NEC 60893 NEMA LI-1 DIN 7735 (for info)		PF CC 201 – HGW 2082	PF CC 204 LE HGW 2083.5	PF CC 204 – HGW 2083.5		PF CC 305 – –	– – –	PF CP 206 XXXPC HP 2062.8	PF CP 205 FR-2 HP 2062.9
Color			black	brown	light beige		brown	red	yellow brown	light brown
Form of delivery (mm)			1000 x 1000 0.3 to 100	1150 x 1050 0.2 to 10	1150 x 1050 0.2 to 10		1000 x 1000 0.2 to 100	2000 x 1000 2.0 to 50	1170 x 1070 0.3 to 10	1070 x 1070 0.3 to 10
Mechanical characteristics										
Flexural strength at 23°C flatwise	MPa	ISO 178	130	130	135		135	110	140	120
Edgewise notched impact strength Charpy	kJ/m²	ISO 179	14	–	–		–	10	4.5	4
Tensile strength // at 23°C	MPa	ISO 527	82	85	80		85	70	100	70
Compressive strength at 23°C flatwise	MPa	ISO 604	270	300	250		340	250	–	–
Electrical characteristics										
Insulation resistance (after immersion in water)	Ohm	IEC 60167	–	1E+11	–		–	1E+8	1E+10	1E+11
Edgewise breakdown voltage (taper pin electrodes)	kV	IEC 60243-1	–	12	–		15	10	50	35
Flatwise breakdown voltage	kV/mm	IEC 60243-1	–	2	–		2.25	5	10	10
Comparative tracking index	V	IEC 60112	–	150	–		–	600	250	200
Physical characteristics										
Density	g/cm³	ISO 1183	1.37	1.34	1.45		1.30	1.50	1.34	1.39
Water absorption	%	ISO 62	0.73	1.40	1.25		0.60	1.00	1.20	0.65
Temperature index (TI)	°C	IEC 60216	120	120	120		120	150	120	105
Coefficient of linear expansion	10-6/K	VDE 0304/VSM 77110	18	18	18		–	25	20	20
Highlights			non abrasive	good wear resistance for lamellas in air motors	self-lubricating features		excellent mechanical properties suitable for fine machining	mechanical and electrical applications UL94V-0	special grade for potentiometer	flame-retardant cold punchable UL94V-0

All grades are RoHS-compliant

Specialties

Von Roll offers a variety of composites based on various reinforcement materials – aramid, carbon, cotton and glass fabric – and resin systems that are manufactured in a special process.

U or L profiles, machined components, strips, rolls or full-size sheets for use in different areas of large generators.

- » Lengths of more than 150 meters, depending on thickness range of 0.3 to 3 millimeters
- » Long strips up to 10 meters length and width up to 1000 millimeters

Different compositions are possible:

- » Vetronite 64170, insulating
- » Vetronite 432.10-01, conductive
- » Vetronite 69090 inclusive Nomex – Teflon optional
- » Shaped Nomex
- » Polyfibrite

				Units	VETRONITE® 64170	VETRONITE® 69090	VETRONITE® 432.10-01
Mechanical characteristics					Lengthwise results		Thick. 0.8 mm lengthwise
Tensile strength //	ISO 527	R;M/23°C/50%	MPa		400	300	–
Flatwise flexural strength at 23°C	ISO 178	R;M/23°C/50%	MPa		500	above 300	above 550
Flatwise flexural strength at 155°C	ISO 178	R;M/155°C ≤ 20%	MPa		300	above 200	above 275
Flatwise compressive strength at 23°C	ISO 604	R;M/23°C/50%	MPa		400	350	–
Flatwise shearing strength	IEC 60893-2	R;M/23°C/50%	MPa		150	150	–
Electrical characteristics							
Flatwise electric strength (direct test)	IEC 60243	1h/105° C ≤ 20% M/23°C/oil	kV/mm		25	28	N/A
Proof tracking index	IEC 60112	1h/ 105° C ≤ 20% M/23°C/50%	V		400	400	N/A
Volume resistivity	In-house standard	–	kOhm.cm²/cm		1E11	1E11	2 to 20
Surface resistivity	IEC 60093	1h/105° C ≤ 20% M/23°C/50%	kOhm.cm/cm		1E9	1E9	1 to 50
Electrical characteristics							
Density	ISO 1183	R;M/23°C/50%	g/cm³		1.9 +/-0.1	1.7 +/-0.1	1.9 +/-0.1

Doctor Blades for the paper industry

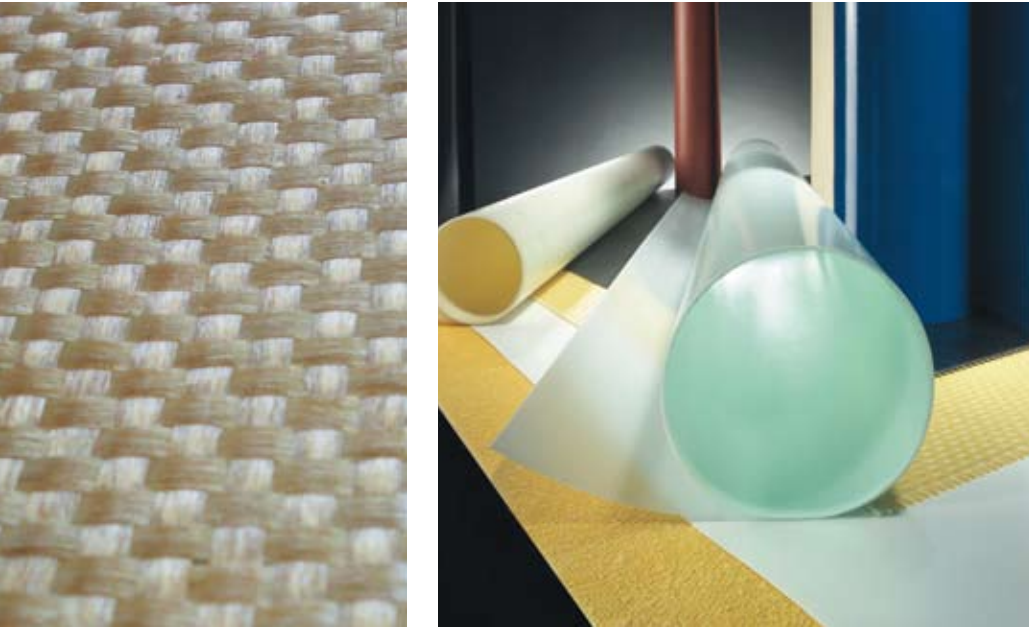
Doctor Blades are thin composite coils designed for use in the paper-making process. Blades are applied on cylinders in order to remove continuously organic/inorganic contaminants. These residues can build up excessively, leading to defects when they are released onto the sheet.

Based on different reinforcement materials: glass, aramid, carbon, cotton and glass, and specific structures: abrasive, graphite and resin systems, Doctor Blades provide the solution to various problems relating to corrosion resistance, temperature resistance, wear, softness for paper machine cylinders.

Doctor Blades products are manufactured in rolls up to 150 meters in length, and in various thicknesses up to 2.8 millimeters. Coils can be chamfered or routed.

Prepregs

Von Roll manufactures and processes semi-finished products – sheets, tubes and molded parts – to the most exacting standards. Prepreg is the “pre-impregnated” material (b-stage) which is impregnated with resin but not yet cured. Von Roll supplies prepregs for many applications (e. g. aviation industry, manufacturers of wind turbine generator equipment). Please consult us for further information.



Prepregs

Tubes and Cylinders

Von Roll is able to supply an extensive range of top quality tubes and cylinders made from various reinforcement materials, such as SAMICA®, glass fabric, glass mat, cotton and paper. Materials are bonding with resin systems such as phenolic, silicone, polyester, epoxy, etc. Depending on the grades, they can be supplied varnished or unvarnished in a very wide range of diameters and lengths, in standard sizes or made specially to customer specifications.

Tubes and cylinders are used in various fields of application depending on their specific characteristics and properties. They can be found in circuit breakers, capacitors, dry-type transformers, cylinders for oil-type transformers, resistor banks and rotating machines, as well as in medical appliances. Tubes are used in large quantities for the manufacture of, for example, cage bearing equipment, hydraulic and pneumatic apparatus and various other engineering equipment and as coils/bobbins for the paper, textile and foil production.

Product denomination	NEMA LI 1	IEC 61 212-3-1	Resin	Reinforcement	Inner diameter D min (mm)	Outer diameter D max (mm)	Length D max (mm)
DELLITE® PF CP 21 T	X	PF CP 21	Phenolic	Paper	3.5	1400	2300
DELLITE® PF CP 23 T	XX	PF CP 23	Phenolic	Paper	3.5	1400	2300
CANEVASITE® F24 5964 T	LE	PF CC 21	Phenolic	Cotton	5	1400	1500
CANEVASITE® FF 5964 T	LE	PF CC21	Phenolic	Cotton	5	1400	2200
CANEVASITE® PF CC 22 T	C	PF CC22	Phenolic	Cotton	7	1400	2200
CANEVASITE® VRI-BAT T	–	–	Phenolic	Cotton	2.6	1400	1000
DURATEX® T	–	–	Phenolic	Cotton	7	1400	2200
DURATEX®-D T	–	–	Epoxy+PTFE	Cotton	2.6	1400	1000
VETRONITE® EGS 102 T	G-10	EP GC 21	Epoxy	Glass fabric	3.5	1400	1200
VETRONITE® EGS T 23 T	G-11	EP GC 22	Epoxy	Glass fabric	8	1400	1000
VETRONITE® FR-5 T	FR-5	–	Epoxy	Glass fabric	5	1400	1000
VETRONITE® G-11 T	G-1	EP GC 22	Epoxy	Glass fabric	3.5	1400	1500
VETRONITE® SGS T	G-7	SI GC 21	Silicone	Glass fabric	5	1400	1200
SAMICANITE®-S T	–	SI MP 21	Silicone	Mica paper	8	1400	950
SAMICATHERM® T	–	–	Epoxy	Mica paper	7	1400	950



Tubes and cylinders

Machined Parts

Machining reinforced plastics, such as our high- and low-pressure laminates as well as our tubes, require the appropriate know-how, machines, tools and equipment. In our processing centers we can saw, as well as perform CNC milling, turning, drilling and grinding according to drawings. Our large range of modern equipment allows us to meet any customer requirements (up to 5 axis milling operations).

In all cases, availability and service are key words in the machining of parts. Von Roll's organization makes it possible to offer customers the most efficient and economical service in terms of delivery dates, batch sizes, machining types and tolerance requirements: anytime, anywhere. Finally, combined multi-domestic experience in machining enables Von Roll to provide machining expertise and to adapt data-processing software. Finished parts are made with high precision using customers' drawings on CNC-controlled machining centers. With regards to tolerances and surface roughness, Von Roll is able to produce pieces in accordance with major international standard requirements.

We supply surface treatment and assembling services for our costumers.

Von Roll produces custom-made molded parts from various resin types – phenolic, melamine, epoxy and polyester – and reinforcing materials such as wood dust, cellulose, cotton fabric and glass fibers.



Machined parts

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.



Wires

Insulated round, flat and Litz wires for high-voltage, low-voltage and electronic applications.



Cables

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



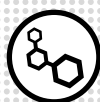
Liquids

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



Flexibles

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



Composites

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



Machines

Processing machines for high-voltage applications. Von Roll supplies a wide range of machinery from coil and bar taping up to VPI (Vacuum Pressure Impregnation) equipment.



Testing

Von Roll provides electrical, thermal and mechanical testing of individual materials as well as complete insulating systems. We are UL-certified.



Training

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

Please contact us or visit our website **www.vonroll.com** for further information:

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About Von Roll

As one of Switzerland's longest-established industrial companies, founded in 1803, Von Roll focuses on products and systems for power generation, motors in the high- and low-voltage sectors, composites and other specialty products for the mechanical engineering. Von Roll is the global market leader in insulation products, systems, process equipment and services and is represented in 18 countries with around 3,100 employees at 32 sites.