



ELECTRIC INSULATING MATERIALS AND SYSTEMS

PRODUCT CATALOGUE





About company

Electroizolit chemical plant founded in 1938, from the very outset was intended to produce electric insulating materials necessary for rapidly developing industries of electrical and power engineering.

Over the years of its history, Electroizolit has been constantly developing and widening the range of its products thus frequently being a production leader of numerous electric insulating materials and systems.

Our main products include electric insulation materials intended for insulation systems used in turbo and hydro generators, high voltage electric machines, traction motors and DC motors, low voltage electric machines, cable industry, etc.

Special division of Electroizolit producing parts from solid insulation materials makes it possible to manufacture electric insulation and structural parts for further use by electric machine building enterprises, carriage-building works, metallurgical plants and other producers.

The company has accumulated vast expertise and competence in scientific research and development of new electric insulating materials and insulation systems

based on them. Our innovative insulation systems applied at the enterprises of Zheldorremmash RZD (carriage-repairing works of Russian Railways) proved performance reliability and manufacturability of the products.

Nowadays Electroizolit produces more than 1000 products thus ensuring the deliveries of wide range of insulation materials to the main consumers of the industry. Taking into account some materials obtained from other producers we are able to deliver essentially complete spectrum of electric insulating materials. Consequently, we here gain a great advantage as our customers who produce or repair electrical products have a good chance to use complete insulation systems developed and supplied from one source instead of combining separate products from different producers. This way the customers enjoy the warranty for complete electric insulation.

Along with electric insulation materials the company put into production such products as unsaturated polyester resins which are widely used in manufacturing glass-fiber structures, fire resistant composites, organic concrete, and artificial stone.

The company's products enjoy great demand not only in Russian Federation but abroad as well. Continual improvement of the technologies is reflected in quality management system meeting requirements of ISO 9001 implemented in 1999 and environmental management system meeting requirements of ISO 14001.

Thanks to the achieved results, professionalism and responsibility of the company's staff Electroizolit enjoys a reputation as a reliable partner, confidently looking to the future.



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Electric Insulating Varnishes, Resins, Enamels, Compounds, Sealants

IMPREGNATING VARNISHES FOR WINDINGS OF ELECTRICAL MACHINES

Trademark	Composition		Thermal class (°C)	Guaranteed shelf life (months)
	Chemical basis	Solvents		
FL-98 GOST 12294-66	Modified glyptal	Mineral spirit, xylene (solvent)	130	6
ML-92 GOST 15865-70	Modified glyptal	Mineral spirit, xylene	130	12
GF-95 GOST 8018-70	Modified glyptal	Mineral spirit, xylene (solvent)	130	12
FA-97 TU 05758799-179-2013	Modified glyptal	Mineral spirit, xylene	130	6
PE-9180 TU 2311-127-05758799-2004	Epoxy polyester	Toluene, ethyl cellosolve	155	6
ELIMPREG®-9153M TU 2311-072-05758799-2002	Modified oligoimide alkyd	Xylene, mineral spirit	155	12
ELIMPREG®-993EP TU 2311-061-05758799-01	Modified epoxy polyester	Xylene, butanol	155	6

Main Specifications

Parameter	Unit	FL-98	ML-92	GF-95	FA-97	PE-9180	ELIMPREG®	
							9153M	993PE
Content of nonvolatile matter	%	50-54 (2g/2h/ 130°C)	50-55 (2g/1h/ 120°C)	46-52 (2g/2h/ 130°C)	50-60 (2g/2h/1 50°C)	50-55 (2g/3h/ 130°C)	55-60 (2g/1h/ 150°C)	55-65 (2g/2h/ 130°C)
Viscosity measured by viscosimeter B3-246 (cup nozzle diameter 4 mm) at 20.0±0.5°C	s	35-60	25-50	30-50	40-100	30-60	40-90	40-110
Drying time for varnish film, to degree 3, at								
105-110 °C		-	60	120	-	-	-	-
120 °C	minute	120	-	-	120	-	-	-
130 °C		-	-	-	-	-	40	-
140 °C		-	-	-	-	-	-	120
160 °C		-	-	-	-	30	-	-
Drying ability in thick layer, at								
120°C	h	16	16	-	-	-	-	-
130 °C		-	-	-	-	-	6	-
140°C		-	-	-	-	-	-	6
155°C		-	-	-	-	16	-	-
Dielectric strength, at								
15-35 °C; 45-75%		75	70	70	70	80	80	80
120°C		-	-	45	-	-	-	-
130 °C	MV/m	40	40	-	-	-	60	-
155°C		-	-	-	-	40	45	40
180°C		-	-	-	-	-	-	-
24 h (23°C) 93%; M (15-35)°C (45-75)%		45	30	25	40	40	50	35
Volume resistivity, at								
15-35 °C; 45-75%		1·10 ¹²	1·10 ¹²	1·10 ¹²	-	1·10 ¹²	5·10 ¹²	1·10 ¹²
130 °C		1·10 ⁸	1·10 ⁹	-	-	-	3·10 ⁸	-
155°C	Ω·m	-	-	-	-	1·10 ⁸	1·10 ⁸	1·10 ⁸
180 °C		-	-	-	-	-	-	-
24 h (23°C) 93%; M (15-35)°C (45-75)%		1·10 ¹¹	5·10 ¹⁰	1·10 ¹⁰	-	1·10 ¹²	1·10 ¹¹	1·10 ¹¹
Cementing capacity, at								
15-35 °C; 45-75%	N	-	-	-	-	300	-	330
155 °C		-	-	-	-	60	-	-
180 °C		-	-	-	-	-	-	-

IMPREGNATING COMPOUNDS FOR WINDINGS OF ELECTRICAL MACHINES

Trademark	Composition	Application	Thermal class (°C)	Guaranteed shelf life (months)
ELPLAST®-155 ID TU 2257-101-05758799-2003	Chemical basis: unsaturated oligoesterimide Diluent: oligoesteracrylate	For impregnation of windings of electrical machines, including traction motors, manufactured using wiring with enamel or glass fiber insulation and wiring insulated with mica tapes. Type A - dip or VPI methods Initiator: modification I - 50% solution of cumene peroxide in dibutylphthalate; modification II - 50% solution of cumene peroxide and tert-butylperbenzoate in dibutylphthalate (during storage at t<15°C). Type B - impregnation by droplets (spray) method. Initiator: modification I - 50% solution of tert-butylperbenzoate in dibutylphthalate.	155	12 (without initiator) 6 (with added initiator) for type A
ELPLAST®-180 ID TU 2257-068-05758799-2002	Chemical basis: unsaturated oligoesterimideisocyanurate Diluent: oligoesteracrylate	For impregnation of windings of electrical machines, including traction motors, manufactured using wire with an enamel or glass fiber insulation and wiring, insulated mica tapes Initiator: modification I - 50% solution of cumene peroxide in dibutylphthalate; modification II - 50% solution of cumene peroxide and tert-butylperbenzoate in dibutylphthalate (during storage at t<15°C).	180	12 (without initiator)
ELPLAST®-220 ID TU 2257-082-05758799-2007	Chemical basis: unsaturated oligoesterimideisocyanurate Diluent: Oligoesteracrylate	For impregnation of windings of electric machines including high voltage ones. Initiator: modification I - 50% solution of cumene peroxide in dibutylphthalate; modification II - 50% solution of cumene peroxide and tert-butylperbenzoate in dibutylphthalate (during storage at t<15°C)	220	12 (without initiator) 6 (with added initiator)

Delivered as two-component system; to be mixed in the proportion of 100 parts of the compound by weight to 2 parts of the initiator by weight.
Compounds with added initiator are delivered on order.

Main Specifications

Parameter	Unit	ELPLAST®-155 ID		ELPLAST®-180 ID	ELPLAST®-220 ID
		A	B		
Viscosity measured by viscometer B3-246 (cup nozzle diameter 4 mm) at 20.0±0.5°C	S	40-100	40-100	20-40 at 50±2 °C	<60 at 50±2 °C
Gel time, at 130 ± 2 °C 150 ± 2 °C	minute	20 -	10 -	- 10	- 10
Drying capacity in thick layer, at 130 ± 2 °C 150 ± 2 °C	minute	30 -	20 -	- 30	- 30
Cementing capacity, at M (15-35) °C 45-75% 155 °C < 20% 180 °C < 20%	N	300 100 -	300 100 -	392 - 196	250 - 125
Volume resistivity, at M (15-35) °C 45-75% 155 °C < 20% 180 °C < 20% 24 h (23°C) 93%; M (15-35)°C 45-75%	Ω·m	1·10 ¹² 5·10 ⁹ - 1·10 ¹¹	1·10 ¹² 5·10 ⁸ - 1·10 ¹¹	1·10 ¹³ - 5·10 ⁸ 5·10 ¹¹	5·10 ¹² - 5·10 ⁸ 1·10 ¹¹
Dielectric strength*, at (15-35)°C transformer oil 24 h (23°C) 93%; M (15-35)°C 45-75%	MV/m	22 20	22 20	25 20	22 15
Viability of the compound with added initiator at 15-35 °C, without re-adding	month	6	3	6 at 20.0±0.5°C 30 days at 50±2°C	6 at 20.0±0.5°C 30 days at 50±2°C

* is determined for sample thickness of 1.0±0.1 mm

COMPOUNDS FOR FILLING AND SEALANTS

Trademark	Chemical basis	Thermal class (°C)	Application	Guaranteed shelf life (months)
EKZ (filling compound) TU 05758799-094-2003	Composition based on epoxy resins, mineral filler and hardener	120	For sealing coils, DC and AC reactors, transformers, electromagnets, etc. Supplied complete with a hardening agent	6
Sealant EPIZAM®-0020 TU 2312-107-05758799-2006	Composition of low-molecular epoxy dian resin, mineral filler, plasticizer, and latent hardener	155	To fill voids, leaks, cracks in various parts and components of electrical machines and apparatus, for sealing solder seats of conductors of the armature winding in the collector plates and their interface with micanite cone in DC machines in order to provide protection against penetration of moisture, dust, mineral oils	6
Sealant EPIZAM®-0014 TU 2312-107-05758799-2006	Composition of epoxy dian and epoxy novolac resins, mineral filler, plasticizer, and latent hardener	180	To fill voids, leaks, cracks in various parts and components of electrical machines and apparatus, for sealing solder seats of conductors of the armature winding in the collector plates and their interface with micanite cone in DC machines in order to provide protection against penetration of moisture, dust, mineral oils	6

Main Specifications

Parameter	Unit	EKZ	EPIZAM®-0014	EPIZAM®-0020
Appearance		Homogeneous viscous mass of dark color with no visible lumps and grains of filler	Homogeneous viscous plastic paste-like mass	Homogeneous viscous plastic paste-like mass
Volume resistivity at 15-35°C; 45-75% 24 h (23°C) 93%; M (15-35)°C 45-75%	Ω·m	1·10 ¹² 1·10 ¹¹	- -	- -
Curing time at 140±2°C	h	-	2	2
Water absorption at (15-35)°C/24h	%	-	0.5	05
Arc resistance	s	-	11.2	7.5

OTHER VARNISHES AND RESINS

Trademark	Composition		Thermal class (°C)	Guaranteed shelf life (months)
	Chemical basis	Solvents		
GF-1350 (resin) TU 2226-078-05758799-2002	Glyptal	-	130	3
PE-970 TU 2311-086-05758799-2002	Epoxy polyester	Ethyl cellosolve, toluene	155	4
EP-9158 TU 2311-129-05758799-2004	Modified epoxide	Methylethylketone, toluene	155	6
TFP-18 (resin) TU 2226-109-05758799-2003	Polyester	-	155	6
Hardener SG-2 (resin) TU 2225-106-05758799-2003	Polyester	-	-	12

Main Specifications

Parameter	Unit	GF-1350	PE-970	PE-9158	TFP-18	SG-2
Content of nonvolatile matter	%	-	58-62 (2g/3h/150°C)	63-67 (2g/0.5h/155°C)	-	-
Viscosity measured by viscosimeter B3-246 (cup nozzle diameter 4 mm) at 20.0±0.5 °C	c	-	35-55	10-30	-	-
Softening temperature according to Kremer-Sarnov method	°C	104	-	-	73-90	-
Drying capacity in thick layer at 150°C	h	-	3-8	-	-	-
Melting temperature	°C	-	-	-	-	90-120
Gel time, at 150°C	c	-	-	100-600	120-300 (at 250°C)	-
Dielectric strength, at 15-35 °C; 45-75% 130°C after 24 h (23°C) 93%	MV/m	-	70 45 40	-	-	-
Solubility of resin in alcohol-toluene mixture (1:1)	%	40	-	-	-	-
Acid number	mg KOH/g	-	-	-	-	320±20

Varnishes for Prepregs

Trademark	Composition		Application	Guaranteed shelf life (months)
	Chemical basis	Solvents		
MA-401 TU 2311-100-05758799-2003	Polymerized linseed oil	Mineral spirit	For manufacturing insulating varnished fabrics, tubes	3
LBS-1 GOST 901-78	Resol phenol formaldehyde resin	Ethyl alcohol	For manufacturing laminates and adhesives	3
LBS-1 (I) TU 05758799-144-2006	Resol phenol formaldehyde resin	Isopropyl alcohol	For manufacturing laminates and adhesives	3
LBS-16 GOST 901-78	Resol phenol formaldehyde resin	Ethyl alcohol	For manufacturing laminates and adhesives	15 days
LBS-16 (I) TU 05758799-144-2006	Resol phenol formaldehyde resin	Isopropyl alcohol	For manufacturing fiber-glass plastic goods	15 days
FL-5111 TU 2311-083-05758799-2002	Resol phenol formaldehyde resin	Ethyl alcohol	For manufacturing plastic laminates	3
FL-9107 I TU 2311-080-05758799-2002	Resol phenol formaldehyde resin	Ethyl alcohol	For manufacturing plastic laminates	1
EP-5122 TU 2311-085-05758799-2002	Epoxy phenol formaldehyde resine	Ethyl alcohol	For manufacturing plastic laminates	5 days

Main Specification

Parameter	Units	MA-401	LBS-1 LBS-1(I)	LBS-16	LBS-16 (I)	FL-5111	FL-9107 I	PE-5122
Resin content	%	58-62 (2g/3h/ 140°C)	50-60 (1g/2,3h/ 100°C)	65-75 (1g/2,3h/ 100°C)	65-75 (1g/2,3h/ 100°C)	55-65 (1g/2,3h/ 100°C)	59-65 (1g/2,3h/ 100°C)	57-63 (1g/2,3h/ 100°C)
Viscosity measured by viscosimeter B3-246 (cup nozzle diameter 4 mm) at 20.0±0.5 °C	s	30	-	40-75 nozzle Ø 6 mm	100-200 nozzle Ø 6 mm	30-100	60-140	-
Gel time, at 160±2 °C	c	-	50-120 at 150°C	70-110	70-110	60-110	45-80	260-480 at 150°C
Drying time for varnish film to degree 3, at 130°C	minutes	30	-	-	-	-	-	-
Volume resistivity, at 15-35°C; 45-75%	Ω·m	1·10 ¹⁰	-	-	-	-	-	-

Top coatings and varnishes

Trademark	Composition		Thermal class (°C)	Application	Guaranteed shelf life (months)
	Chemical basis	Diluent			
EPIMAL®-992 (red-brown, pale green, green) EPIMAL®-992З (blue) EPIMAL®-992P (red-brown, pale green)	Suspension of pigments and fillers in epoxy polyester varnish with the addition of melamine formaldehyde resins and special additives	Xylene	155	For coating the frontal parts of sections of coils and other parts of electrical machines, permanent painting non wire-wound resistors and other electronic components. Top coatings Epimal 992 Э фкы®-992З feature high elasticity, resistance to thermal cycling. Epimal®-992P features high thixotropy. Top coatings Epimal®-992П are resistant to molten solder.	6
EPIMAL®-992П (blue) TU 2312-002-05758799-2004	Suspension of pigments and fillers in epoxy polyester isocyanurate modified varnish with the addition of melamine resins and special additives	Ethyl cellosolve			
EPIMAL®-9111 (red-brown, gray, green, pale green) TU 2312-025-05758799-2004	Suspension of pigments and fillers in epoxy polyester varnish with the addition of melamine resins and special additives	Xylene	155	For coating the windings of electrical machines and other items of electrical equipment, including power circuits in electric locomotives, subjected to surface flashover arc. Weatherproof	6
EPIMAL®-9114 (red-brown, green) TU 2312-057-05758799-2004	Suspension of pigments and fillers in epoxy polyester isocyanurate varnish	Ethyl cellosolve, toluene	180	For coating the windings of electric machines and apparatus, permanent non wire-wound resistors and other electronic components. Weatherproof	6
EPIMAL®-9155 (red-brown, gray, green) TU 2312-138-05758799-2006	Suspension of pigments and fillers in epoxy polyester varnish	Xylene, mineral spirit	155	For coating the windings of electrical machines, apparatus, parts and components of electrical equipment including power circuits and electric locomotives (air dried)	6
KO-983 (red-brown) TU 2312-125-05758799-2004	Suspension of pigment in organic-silicon varnish	Toluene, xylene	180	For protective coatings and repairing coatings of the parts of electrical machines (cold drying). Delivery includes: 0.9 g of catalyst per 100 g of enamel	6
KO-976 (red-brown) TU 2312-122-05758799-2004	Suspension of pigment in organic-silicon varnish	Toluene, xylene	180	For coating the windings of electrical machines (hot drying). Delivery includes: desiccant, catalyst - 0.7 g of each per 100 g of enamel	6
Varnish EPILAK®-9179 TU 2311-050-05758799-00	Epoxy polyester	Xylene	155	Moisture protection for electronic components and electrical and electronics equipment units with PCBs, electrical insulation coatings for various surfaces.	6
Epoxy polyester varnish EF-035 TU 2311-165-05758799-2010	Epoxy polyester	Xylene	-	For manufacturing electrical insulation and composite materials	

Main Specifications

Trademark	Content of nonvolatile matter (%)	Viscosity measured by viscosimeter B3-246 (cup nozzle diameter 4 mm) at 20.0±0.5 °C	Drying time for coating, to degree 3, at			Volume resistivity (Ω·m), at		Dielectric strength (MV/m), at		Coating hardness measured with pendulum device of TML type (conventional units)	Coating thermoelasticity (h)	Oil resistance (N)	Arc resistance (s)	Tropic resistance (years)
			20.0±0.5 °C (h)	155 °C (minutes)	200 °C (minutes)	15-35 °C; 45-75%	24h (23 °C); 93% M (15-35 °C); 5-75%	15-35 °C; 45-75%	24h (23 °C); 93% M (15-35 °C); 45-75%					
EPIMAL®-992	52-60	60-90	-	10	4	1·10 ¹²	1·10 ¹¹	60	50	0.6	-	-	-	-
EPIMAL®-9923	55-65	60-90	-	10	4	1·10 ¹²	1·10 ¹¹	60	50	0.6	-	-	-	-
EPIMAL®-992P	55-65	60-90	-	10	4	1·10 ¹²	1·10 ¹¹	60	50	0.6	-	-	5.0 pale green	-
EPIMAL®-992Π	62-66	120-180	-	10	4	1·10 ¹²	1·10 ¹¹	60	50	0.6	-	-	-	-
EPIMAL®-9111	55-65	120-160	4	-	-	1·10 ¹¹	1·10 ⁸	30	10	-	5 at 150 °C	98 at 150°C	3.0 - gray, red brown; 4.5 - pale green	In conditions T2-2
EPIMAL®-9114	55-65	60-150	-	-	1 h at 180°C	1·10 ¹²	1·10 ¹¹	50	40	0.6	50 at 180 °C	-	3.0 - red brown; 8 - green	In conditions T1-2
EPIMAL®-9155	55-65	80-160	4	-	-	1·10 ¹²	1·10 ¹¹	40	30	-	10 at 150 °C	98 at 150°C	3.0 - gray, red brown; 4.2 - green	In conditions T2-2
Enamel KO-983	67-73	40-140	24	-	-	1·10 ¹²	1·10 ⁹	50	-	-	100 at 200 °C	50	-	-
Enamel KO-976	67-73	40-140	-	-	30	1·10 ¹²	1·10 ¹⁰	50	25	-	48 at 200 °C	80	-	-
Varnish EPILAK®- 9179	32-36	15-25	-	30 at 60°	-	1·10 ¹²	1·10 ¹¹	65	60	0.5	-	-	-	-
Varnish EF-035	53-57	120-200	24	-	-	-	-	-	-	0.2	-	-	-	-

NOTE: Track resistance is specified for the following enamels:
 EPIMAL®-9111 exposed to 175V (group D): 50 drops;
 EPIMAL®-9155 exposed to 175V : 100 drops;
 EPIMAL®-9114 exposed to 380V (group C): 50 drops.

Varnishes for Enameling Wires (Specifications)

Trademark	Composition		Thermal class (°C)	Content of nonvolatile matter %)Viscosity measured by viscosimeter B3-246 (cup nozzle diameter 4 mm), at 20.0±0.5 °C (s)	Guaranteed shelf life (months)
	Chemical basis	Solvents				
PE-943 A TU 16-K71-074-90	Polyester	Cresol, solvent	130	32-36 (1g/45min/200°C)	90-180	6
Elizvan® 130/31 Elizvan® 130/34 TU 2311-149-05758799-2008	Polyester	Cresol, solvent	130	29-33 32-36 (1g/45 min/200°C)	60-120 120-160	6
PL-955 "O" TU 16.K71-192-93	Polyester-imide	Cresol, solvent	155	30-34 (1g/2.5h/200°C)	90-180	6
PI-155A PI-155B TU 2311-022-05758799-2008	Polyester-imide cresol free	Ethylcarbitol, solvent	155	45-49 38-42 (1g/1h/180°C)	95-180 40-45	6
Elizvan® 155/23 Elizvan® 155/29 Elizvan® 155/35 TU2311-130-05758799-2005	Modified polyester	Cresol, solvent	155	21-25 28-30 33-37 (1g/45min/200°C)	15-25 50-80 90-180	6
Elizvan® 155A TU 05758799-143-2006	Modified r Polyeste-	Cresol, solvent	155	33-37 (1g/45min/200°C)	90-180	6
Elizvan® 155T TU 05758799-147-2007	Modified polyester	Cresol, solvent	155	36-40 (1g/45min/200°C)	150-180	6
Elizvan® 155U TU 05757799-172-2012	Modified polyester	Cresol, solvent	155	34-38 (1g/45min/200°C)	120-180	6
Elizvan® 180F TU 2311-152-05758799-2008	Polyester-imide	Cresol, solvent	180	36-40 (1g/45min/200°C)	120-160 (23.0±0.5)°C	6
PAI-200A PAI-200B TU 2397-020-05758799-2008	Polyamide-imide cresol free	N-methylpyrrolidone, xylene, solvent	200	24-28 21-23 (3g/1h/180°C)	100-200 (nozzle Ø 6mm) 150-250	6
Technological lubricant for enameled wires TU 0258-118-05758799-2004	Paraffin solution	Mixture: mineral spirit, n-butanol		paraffin content: 0.3-1.5%	Density: 0.780-0.790 g/cm ³	6

Wire Specifications

Varnish trademark	Range of recommended wire size (mm)	Breakdown voltage (V)	Heat shock (°C)	Cut-through temperature (°C)	Mark of enamel wires	Note
PE-943 A	0.06-2,5	6000-9000	160x6d	200	PETV-1,2	Solderable at 460 °C/3s
Elizvan®130/31	0.16-0.30	4900-10200	160x6d	200	PETV-1,2	Solderable 460 °C/3s
Elizvan®130/34	0.30-2.00					
ПЛ-955 "0"	0.2-2.5	8000/10000	200x5d	240	PET-155 PETM-155	Solderable 460° C/3s
PI-155A	0.2-1.6	5300-8000	200x4d	300	PET-155	
PI-155B	0.2-0.6	4000-7000	200x3d	300	PETM-155	
Elizvan® 155/23	0.060-0.071	4900-10000	200x5d	>240	PET-155	
Elizvan® 155/29	0.16-0.30				PETV-1,2	
Elizvan® 155/35	0.30-1.00					
Elizvan® 155A	0.5-2.5	2700-6400	175x5d	>240	PEEA-130 PEEA-155	For aluminium wires
Elizvan® 155T	1.0-2.0	4900-10000	200x5d	>240	PET-155 PETV-1,2	
Elizvan® 155U	0.3-1.0	6000-10000	4xd	>240	PET-155 PETV-1,2	With improved thermal, mechanical properties
Elizvan® 180F	0.3-1.0	5000-9800	200x2d	300	PET-180 PETD-180 PEEI-2-180	Freon resistant
PAI-200A	0.4-2.0	5000-10000	300x1d	400	PETD-180	Freon resistant
PAI-200B				400	PET-200	

Varnished Fabrics, Glass Fabrics, Prepregs

Varnished fabrics, glass fabrics					
Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
Varnished fabric TU 16-90I37.0012. 002TU	Roll width (600-1100 mm) ±2.5%	Silk fabric, oil binder	105	Used as flexible insulating material in electrical machines and apparatus - LSHMS can be used within transformer oil; features high dielectric properties - LKMS can be used within transformer oil; features high elasticity and dielectric properties	6
LSHM, LSHMS	Thickness 0.06-0.15 mm				
LKM, LKMS	Thickness 0.10-0.15 mm	Nylon fabric, oil binder			
VARNISHED GLASS FABRIC LSM, LSMM TU 16-90I37.0003. 003TU	Roll width (690-1140 mm) ±2,5%, Thickness 0.15-0.20 mm	Glass fabric, oil binder	120	Used as flexible insulating material in electrical machines and apparatus. LSMM is oil resistant	6
VARNISHED GLASS FABRIC LSM-1 TU 3491-079-05758799-2002	Roll width (690-1140 mm) ±2,5%, Thickness 0.15-0.20 mm	Glass fabric, oil binder	120	Used as flexible insulating material in electrical machines and apparatus for manufacturing electrical engineering composite materials	6
LSP-1	Thickness 0.12-0.17 mm	Glass fabric, polyester binder	155		
LSK-1	Thickness 0.12-0.20 mm	Glass fabric, silicon binder	180		
VARNISHED GLASS FABRIC LSKL TU 16-90I37.0003. 003 TU	Roll width 10; 15; 20; 25; 30 mm Thickness 0.12-0.15 mm	Glass fabric, silicon binder	155	Used as flexible insulating material in electrical machines and apparatus, features adhesiveness	6
VARNISHED GLASS FABRIC LSTR TU 3491-075-05758799-2002	Roll width (800-1000) mm, Rollers width 20, 23, 25 mm Thickness 0.6; 0.8; 0.0 mm	Glass fabric, thermosetting binder	155	Used as flexible insulating material in electrical machines and apparatus. It features self-sealing ability forms monolithic glue isolation during heat treatment	3

Main Specifications

Trademark	Thickness (mm)	Maximum deviation (mm)	Specific breaking load under tensile stress (N/cm)			Average breakdown voltage across the electrodes \varnothing 6 mm (kV)						Volume resistivity ($\Omega \cdot m$)						
			On samples cut			at (15-35) $^{\circ}$ C 45-75%		105 $^{\circ}$ C	120 $^{\circ}$ C	155 $^{\circ}$ C	180 $^{\circ}$ C	after exposing at 23 $^{\circ}$ C, 93% during 96 h	15-35 $^{\circ}$ C, 45-75%	105 $^{\circ}$ C	120 $^{\circ}$ C	155 $^{\circ}$ C	180 $^{\circ}$ C	after exposing at 23 $^{\circ}$ C, 93% during 96 h
			along the warp	across the warp	angle 43-45 $^{\circ}$ to the warp	before bending	after bending											
LSHM	0.08	± 0.01	22	15	15	5.5	3.0	3.0	-	-	-	2.0	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.10	± 0.01	24	17	17	6.6	4.2	4.2	-	-	-	3.0	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.12	$+0.01$ -0.02	25	18	18	8.0	6.0	5.0	-	-	-	3.7	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.15	$+0.01$ -0.02	30	22	22	9.3	6.6	5.6	-	-	-	4.1	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
LSHMS	0.06	± 0.01	18	11	11	3.2	-	1.0	-	-	-	-	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.10	± 0.01	24	17	17	7.0	5.1	4.8	-	-	-	3.2	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.12	$+0.02$ -0.01	25	18	18	9.0	6.6	5.4	-	-	-	4.1	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.15	$+0.01$ -0.02	30	22	22	9.8	7.5	7.2	-	-	-	4.6	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
LKM	0.10	± 0.01	24	17	17	6.0	4.2	4.2	-	-	-	2.6	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.12	± 0.01	25	18	18	7.5	5.4	4.8	-	-	-	3.0	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.15	$+0.01$ -0.02	30	22	22	8.5	6.6	5.4	-	-	-	3.7	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
LKMS	0.10	± 0.01	24	17	17	6.5	5.0	4.4	-	-	-	2.8	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.12	$+0.02$ -0.01	25	18	18	9.0	6.6	5.0	-	-	-	4.0	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
	0.15	$+0.01$ -0.02	30	22	22	9.8	7.5	6.6	-	-	-	4.6	$1 \cdot 10^{11}$	$1 \cdot 10^7$	-	-	-	$1 \cdot 10^8$
LSM	0.15	$+0.02$ -0.01	105	-	-	6.0	3.9	-	3.6	-	-	4.0	$1 \cdot 10^{11}$	-	$1 \cdot 10^8$	-	-	$1 \cdot 10^{10}$
	0.17	$+0.02$ -0.01	130	-	-	6.3	4.5	-	4.1	-	-	4.0	$1 \cdot 10^{11}$	-	$1 \cdot 10^8$	-	-	$1 \cdot 10^{10}$
	0.20	± 0.02	150	-	-	7.0	4.7	-	4.6	-	-	4.5	$1 \cdot 10^{11}$	-	$1 \cdot 10^8$	-	-	$1 \cdot 10^{10}$
LSMM	0.17	$+0.02$ -0.01	130	-	-	7.2	4.5	-	4.5	-	-	4.0	$1 \cdot 10^{11}$	-	$1 \cdot 10^8$	-	-	$1 \cdot 10^{10}$
	0.20	± 0.02	150	-	-	8.3	4.6	-	5.0	-	-	4.5	$1 \cdot 10^{11}$	-	$1 \cdot 10^8$	-	-	$1 \cdot 10^{10}$
LSM-1	0.15	$+0.03$ -0.02	105	-	-	5.4	3.6	-	3.6	-	-	2.4	$1 \cdot 10^{11}$	-	$1 \cdot 10^8$	-	-	$1 \cdot 10^9$
	0.17	$+0.03$ -0.02	130	-	-	6.0	4.2	-	4.1	-	-	3.0	$1 \cdot 10^{11}$	-	$1 \cdot 10^8$	-	-	$1 \cdot 10^9$
	0.20	$+0.04$ -0.03	150	-	-	6.7	4.4	-	4.6	-	-	3.4	$1 \cdot 10^{11}$	-	$1 \cdot 10^8$	-	-	$1 \cdot 10^9$
LSP-1	0.12	± 0.02	90	-	-	6.0	3.5	-	-	3.1	-	2.1	$1 \cdot 10^{10}$	-	-	$1 \cdot 10^7$	-	$1 \cdot 10^8$
	0.15	$+0.03$ -0.02	105	-	-	7.9	4.4	-	-	3.7	-	3.3	$1 \cdot 10^{10}$	-	-	$1 \cdot 10^7$	-	$1 \cdot 10^8$
	0.17	$+0.03$ -0.02	130	-	-	9.0	5.0	-	-	4.2	-	3.5	$1 \cdot 10^{10}$	-	-	$1 \cdot 10^7$	-	$1 \cdot 10^8$
LSK-1	0.12	$+0.03$ -0.02	90	-	-	6.5	2.5	-	-	-	3.3	3.6	$1 \cdot 10^{12}$	-	-	-	$1 \cdot 10^9$	$1 \cdot 10^{11}$
	0.15	$+0.03$ -0.02	105	-	-	8.0	4.0	-	-	-	4.5	4.8	$1 \cdot 10^{12}$	-	-	-	$1 \cdot 10^9$	$1 \cdot 10^{11}$
	0.17	± 0.03	130	-	-	8.8	4.3	-	-	-	4.8	5.4	$1 \cdot 10^{12}$	-	-	-	$1 \cdot 10^9$	$1 \cdot 10^{11}$
	0.20	± 0.03	150	-	-	9.6	4.8	-	-	-	5.5	6.0	$1 \cdot 10^{12}$	-	-	-	$1 \cdot 10^9$	$1 \cdot 10^{11}$
LSKL	0.12	$+0.02$ -0.01	90	-	-	0.8	-	-	-	-	-	-	$1 \cdot 10^{10}$	-	-	-	-	-
	0.15	± 0.02	105	-	-	0.9	-	-	-	-	-	-	$1 \cdot 10^{10}$	-	-	-	-	-
LSTR	0.16	$+0.02$	70	-	-	6.5	-	-	-	-	-	-	-	-	-	-	-	-
	0.18	$+0.02$	130	-	-	6.5	-	-	-	-	-	-	-	-	-	-	-	-
	0.20	$+0.02$	130	-	-	6.5	-	-	-	-	-	-	-	-	-	-	-	-

Prepregs

Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
GLASS FABRIC IMPREGNATED PS-IF/EP, PSS-IF/EP TU 3491-133-05758799-2005	Roll width: 940±20 mm, 980±20 mm	Glass fabric, epoxy phenol formaldehyde binder	–	For manufacturing parts by hot pressing	from may to September 1 month during the rest time of year 2 month
GLASS FABRIC bakelized TVFE-2 TU 3491-136-05758799-2005	Roll width: 940±20 mm, 980±20 mm	Glass fabric, phenol formaldehyde binder	–	For manufacturing heat resistant parts by hot pressing	3
VARNISHED GLASS FABRIC TOP COATING TU 2296-112-05758799-2003	Roll width: 900-1070 mm	Glass fabric, insulation varnish	–	For industrial applications. Used outside of living quarters, for heat insulation of pipelines	18
Tape LSPK-110 TU05758799-163-2010	Paper in small rolls, roll width: 35±1 mm, Paper wound on rigid spool Ø 36 mm, roll width: 900±10 mm Thickness: 0.100; 0.125 mm	Glass fabric, compound	130	For parts of turbo and hydro generators	3
Tape ELPREG®-LES-P TU 05758799-166-2010	Paper wound on rigid spool Ø 36 mm, roll width: 20±1 mm or 30±1 mm. Thickness 0.100 ± 0.020 mm; 0.200 ± 0.025 mm	Glass fabric, compound	155	For interturn insulation and housing insulation in electrical machines and apparatus	12
FABRIC IMPREGNATED TP-9	Roll width: 850-1050 mm	Cotton fabric, impregnated with bakelite varnish, graphite added	–	For the manufacture of molded articles	3

Main Specifications

Parameter	Unit	PS-IF/EP	PSS-IF/EP	TVFE -2	Varnished glass-coating tissue	LSPK -110	ELPREG®- LES-P	TP-9
Content:								
– binder	%	40-50	38-50	35-42	5	25-40	10-25	50±2
– volatile substances		3.0	3.0	8-15	8	3	3	7
– soluble resin		90	90	21-35	–	–	–	85

Laminates, Wound Products

Fabric based laminates

Trademark	Sizes		Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
FABRIC BASED LAMINATE A, B GOST 2910-74 TU 05758799-014-96 (for thicknesses above 50.0 mm)	Thickness: 0.5-50 mm Thickness: 60-100 mm Sheet size: for thicknesses up to 40.0 mm: 1030x1580±50 mm; for thicknesses above 40.0 mm: (800-980) x (1450-1500) mm		Cotton fabric, phenol formaldehyde binder	105	For manufacturing electric insulating parts, for operating in transformer oil in open air with normal relative humidity 45-75% at temperature 15-35°C and frequency 50 Hz	18
STRUCTURAL FABRIC-BASED LAMINATE PTK GOST 5-78	Thickness: 0.5-80.0 mm Sheet size: for thicknesses up to 40.0 mm: 1030x1580 ±50 mm; for thicknesses above 40.0 mm: (800-980) x (1450-1500) mm		Cotton fabric, phenol formaldehyde binder	105	For manufacturing gears, worm gears, bushings, friction bearings, rings	36
STRUCTURAL FABRIC BASED LAMINATE PT GOST 5-78	Thickness: 0.5-80.0 mm Sheet size: for thicknesses up to 40.0 mm: 1030x1580 ±50 mm; for thicknesses above 40.0 mm: (800-980) x (1450-1500) mm		Cotton fabric, phenol formaldehyde binder	105	For manufacturing the same parts as above PTK laminate yet operating at lower loads	36
STRUCTURAL FABRIC BASED LAMINATE PTG-2 TU 05758799-168-2011	Thickness: 0.4-2.0 mm Sheet size: 1030x1580 ±50 mm (800-980) x (1450-1500) mm		Cotton fabric, phenol formaldehyde binder	105	For manufacturing sealing washers in water pumps	18
Asbestos fabric based laminate B, G GOST 5-78	Type B	Thickness: 5.0-35.0 mm Sheet size: 1030x1580 ±50 mm	Asbestos fabric, phenol formaldehyde binder	105	Use as a heat-insulating material, and also for manufacturing of breaking and other friction devices, gaskets, details, mechanical clutch and other technical details	36
	Type G	Thickness: 30.0-110.0 mm Sheet size: (550-1030)x(1450-1500) ±50 mm				

Main Specifications

Parameter	Unit	FABRIC BASED LAMINATE		PTK	PT	PTG-2	Asbestos fabric based laminate	
		A	B				B	G
Breaking stress in bending; bending normal to layers	MPa	90	100	152	142	–	90	83
Breaking stress in tension	MPa	35	45	–	–	–	–	–
Breaking stress in compression; compression normal to layers	MPa	–	–	160	155	130	–	–
Charpy impact strength of samples without cuts	kJ/m ²	samples with small cut 7.8	samples with small cut 7.8	36	36	25	26	24
Water absorption, for sheets thickness of 3.5 mm	%	–	–	0.7	0.7	1.2	2.0	2.0
	mg	166	255	–	–	–	–	–
Volumetric resistivity after exposure to 24h/23°C/93%, for sheet thickness of up to 8.0 mm	Ω·m	1·10 ⁶	1·10 ⁶	–	–	–	1·10 ⁴	–
Breakdown voltage applied parallel to layers (one min test) in M 90°C conditions, transformer oil	kV	15	15	–	–	–	–	–
Density	kg/m ³	1300-1450	1300-1450	1300-1400	1300-1400	1350-1450	1500-1700	–

Glass-cloth-base laminates

Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
Glass-cloth-base laminate STEF*, STEF-I GOST 12652-74	Thickness: STEF-U: 0.35-100 mm STEF-T: 0.2; 0.3 mm STEF: 1.5-50 mm STEF-I: 0.5-50 mm Sheet size: for thicknesses up to 50.0 mm: 1030x1580 ±50mm; for thicknesses above 50.0 mm: (950-1000) x (1450-1500) mm	Glass fabric, epoxy phenolic binder	155	For manufacturing electric insulation parts, operating in open air with: - normal relative humidity at 15-35°C, 45-75% and voltage over 1000 V; - higher humidity at 93±2% , 40±2°C at voltage of up to 1000 V and frequency 50 Hz. Feature high mechanic strength at moderate temperature, high stability of electric properties in higher humidity STEF-I features more homogeneous inner and surface structure ST-ETF features higher heat resistance	18
STEF-U TU 16-89179.0066 002TU					30
STEF-T TU 05758799-028-97					30
ST-ETF GOST 12652-74	Thickness: 0.35-50 mm Sheet size: 1030 x 1580 ±50mm	Glass fabric, epoxy phenolic binder	180		18
ELIZLAM® 225 TU 2296-103-05758799-2003	Thickness: 0.35-50 mm Sheet size 1030 x 1580 ±50mm	Glass fabric, epoxy binder	180	For insulation of electric machines	30
GLASS-CLOTH-BASE STEB GOST 12652-74	Thickness: 1.5-50 mm Sheet size: 1030 x 1580 ±50 mm	Glass fabric, brominated epoxy binder	140	For manufacturing electric insulating parts, operating in open air at: - normal relative humidity at 15-35°C, 45-75% , voltage over 1000 v, frequency 50 Hz; - increased relative humidity at 40±2°C, 93±2%, voltage of up to 1000 V and frequency 50 Hz. Reduced inflammability	18
STRUCTURAL GLASS-CLOTH-BASE LAMINATE KAST-V GOST 10292-74	Thickness: 0.5-90.0 mm Sheet size: 930±20 x 1430±20 mm Thickness: up to 50 mm Sheet size: 1000 x 2000 mm	Glass fabric, modified-phenol formaldehyde binder	-	Used as structural and heat protective material	36
GLASS-CLOTH-BASE LAMINATE STEF-P STEF-PV (waved) TU 16-503.168-78	Thickness: STEF-P: 0.2-5.0 mm STEF-PV: 0.4-1.0 mm Sheet size: 930±20 x 1430±20 mm	Glass fabric epoxy phenol formaldehyde binder	155	STEF-P is a semiconductor material for sealing stator windings of hydro generators STEF-PV is a semiconductor material for sealing windings in stator grooves of high voltage electric machines	21 18
Glass-cloth-base laminate PSK PSK-A PSK-K TU 2296-098-05015227-2005	Thickness 62.0 mm Sheet size: (820x1480)±50 mm	Material based on silica cloth, impregnated with bakelite varnish	short in time up to 1000	Used for manufacturing details, which are working short in time in conditions of high temperatures. Have high thermal stability	12
STRUCTURAL GLASS-CLOTH-BASE LAMINATE VFT-S	Thickness 1.0-35.0 mm Sheet size: (820x1480)±50 mm	Material based on modified phenol formaldehyde binder and structural glass fabric	-	Used as a constructional material with high moisture resistance and heat resistance	36

Main Specifications

Parameter	Unit	STEF -			ST-ETF	ELIZLAM® 225	STEB	STEF -		KAST-V	PSK	PSK-A	PSK-K	VFT-S	
		U	I	T				P	PV						
Breaking stress in bending; bending normal to layers at 15-35°C, 45-75% , at 180°C	MPa	350	350	-	350	350	350	225	-	-	127	196	120	-	
		-	-	-	140	140	-	-	-	-	-	-	-	-	
Breaking stress in tension	MPa	220	220	180	220	220	220	-	-	-	-	-	-	-	
breaking strength, in warp direction: for thickness of 1.5 mm, for thickness of 3.0 mm, in weft direction: for thickness of 1.5 mm, for thickness of 3.0 mm.	MPa	-	-	-	-	-	-	-	-	299	-	-	-	-	
		-	-	-	-	-	-	-	-	284	-	-	-	-	
		-	-	-	-	-	-	-	-	-	157	-	-	-	-
		-	-	-	-	-	-	-	-	-	152	-	-	-	-
Charpy impact strength, samples with small cuts: samples without small cut: in warp direction for thickness of for 3.0 mm: in weft direction: for thickness 3.0 mm	kJ/m ²	50	50	-	50	50	50	-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	-	88	-	-	-	88	
		-	-	-	-	-	-	-	-	64	-	-	-	64	
Breakdown voltage applied parallel to layers (one minute test) in M 90°C conditions, transformer oil	kV	35	35	3 normal to layers	35	35	35	-	-	-	-	-	-	-	
Electric strength, voltage applied normal to layers (one minute test) at M (90 °C), transformer oil, for thickness of 1.5 mm for thickness of 3.0 mm	kV/mm	13.1	13.1	-	13.1	13.1	13.1	-	-	-	-	-	-	-	
		11.5	11.5	-	11.5	11.5	11.5	-	-	-	-	-	-	-	
Volumetric resistivity after exposure 24h/23°C/93%, for sheets of up to 8.0 mm	Ω·m	1·10 ¹⁰	1·10 ¹⁰	1·10 ¹²	1·10 ¹⁰	1·10 ¹⁰	5·10 ¹⁰	-	-	-	-	-	-	-	
Volumetric resistivity, normal to layers	Ω·cm	-	-	-	-	-	-	1·10 ³ - -1·10 ⁶	1·10 ³ - -3·10 ⁵	-	-	-	-	-	
		-	-	-	-	-	-	1·10 ¹ - -9·10 ³	1·10 ¹ - -9·10 ³	-	-	-	-	-	
Inflammability (burning time)	s	-	-	-	-	-	5	-	-	-	-	-	-	-	
Water absorption for thickness of 1.5 mm for thickness of 3.5 mm	mg	19	19	for thickness of 0.2-0.3 30	19	19	19	-	-	-	-	-	-	-	
	%	23	23		23	23	23	-	-	1,9	-	-	-	-	
		-	-	-	-	-	-	-	-	1,7	-	-	-	-	
Density	kg/m ³	1700-1900	1600-1900	1910-1950	1700-1900	1700-1900	1750-2050	1600-1900	1600-1900	1850	1600-1800	1650-1800	1600-1800	He более 1850	

NOTE: Parameters of STEF are presented in the table of STEF-I

Wound products

Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
bakelized-paper TUBES GOST 8726-88	Inner diameter: 8-1300 mm Wall thickness: 2.0-25 mm Length: 200-1200 mm (Length: 200-950 mm for tubes with ext. diameter 8-30 mm)	Winding electric insulating paper, phenol formaldehyde binder	120	For operation in transformer oil and open air at 15-35 °C, 45-75% and frequency 50 Hz	18
glass epoxy phenol formaldehyde cylinders TSSEF GOST12496-88	Inner diameter: 105-600 mm Wall thickness: 3.0-20 mm Length: 650-1000 mm	Glass fabric, epoxy phenol formaldehyde binder	155	Electric insulating material for electric machines and apparatus	18
GLASS EPOXY PHENOLIC TUBES TSEF GOST 12496-88	Inner diameter: 10-100 mm Wall thickness: 2.0-20 mm Length: 650-1000 mm (Length: 650-950 mm for tubes with ext. diameter 10-30 mm)				
ELECTRIC INSULATING MATERIAL REM® TU 2296-155-05758799-2008	Roll thickness: 0.2, 0.25, 0.3, 0.5, 0.8 mm Length more then 10 m	Glass fabric, epoxy phenolic binder	155	Used as glass-cloth based insulating laminate for cylinders with small diameter	21
HEAT RESISTANT CYLINDERS AND TUBES TSS-ETF TS-ETF TU 2296-156-05758799-2008	TSS-ETF: external diameter 105-550 mm Wall thickness: 4-10 mm Length: 650-950 mm TS-ETF: external diameter 10-100 mm Wall thickness: 2-10 mm Length: 650-850 mm	Glass fabric, epoxy phenolic binder	180	Electric insulating material for electric machines and apparatus	18

Main Specifications

Parameter	Unit	Bakelized paper tubes	TSEF tubes	Cylinders TSSEF	REM®	TSS-ETF TS-ETfV
Breaking stress in static bending, at 15-35 °C, 45-75%, at 150±2 °C	MPa	100 –	200 –	200 –	– –	250 125
Breaking stress in compression; axial compression, at 15-35°C, 45-75%	MPa	40	100	–	–	–
Breaking stress in tension at 15-35°C, 45-75%	MPa	–	–	–	180	–
Breaking stress in shear at 15-35 °C, 45-75%	MPa	–	–	–	–	–
Volumetric resistivity at 15-35 °C, 45-75% after exposure 24h/23°C/93%	Ω·m	5·10 ¹⁰ 5·10 ⁷	5·10 ¹⁰ 1·10 ⁹	5·10 ¹⁰ 1·10 ⁹	– –	– –
Testing voltage, applied parallel to layers, at M (90°C), transformer oil, during 1 minute during 5 minutes	kV eff	25 –	15 –	15 –	– –	– –
Testing voltage, applied normal to layers, at M (90°C), transformer oil, during 1 min during 5 min for wall thickness of 2-10 mm	kV eff	25 –	15 –	15 –	– –	– –
Breakdown AC voltage 50 Hz, applied parallel to layers, transformer oil at 90°C	kV eff.	–	–	–	–	18
Electric strength, AC voltage 50 Hz applied normal to layers in open air	kV/mm	–	–	–	20	–
Dielectric loss tangent at 50 Hz frequency, at 15-35°C, 45-75%		0.025	–	0.025	–	–
Density	kg/m ³	1050	1450	1500	1400	1600-1800

Paper-cloth-base laminates

Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
POLYESTER-CLOTH-BASE LAMINATE TU 16-503.224-82	Thickness: 0.5-50.0 mm Sheet size: (450-950) x (700-1480) mm	Polyester paper, epoxy phenol formaldehyde binder	150	For manufacturing electric equipment parts, operating in open air at 15-35°C, 45-75%, as well as at 40±2°C, 93±2% without additional water proofing varnish coating	18

Main Specifications

Parameter	Unit	PAPER-LAMINATE LG
Breaking stress in static bending, bending normal to layers	MPa	80
Breaking stress in tension	MPa	60
Volumetric resistivity after exposure 24 h/23°C/93%, for sheets thickness: - up to 2 mm - up to 4 mm - up to 8 mm	Ohm·m	— — 5·10 ⁸
Breakdown voltage applied parallel to layers (one minute test) in M 90°C conditions, transformer oil	kV	30
Density	kg/m ³	1250-1350

Profile glass plastics

Profile glass plastics					
Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed self life (monyhs)
SPP-BID TU 16-503.170-78	Supplied as bars with various cross-section shapes: rectangular, trapezoidal, circle, semicircle, segment. Length: min 1500 mm. Size, cross section shape are to be specified when placing order. Section size: height: 2.0-6.0 mm, width: 4.2-16.0 mm	Glass roving, polyesterimide binder	180	As groove wedges in electrical machines	18
SPP-E TU 2296-051-05758799-00	Supplied as bars with various cross-section shapes: rectangular, trapezoidal, circle, semicircle, segment. Length: min 1500 mm. Size, cross section shape are to be specified when placing order. Section size: height: 2.5-15.0 mm, width: 3.7-30.0 mm	Glass roving, epoxy binder	155	As groove wedges in electrical machines	12
SPP-EU TU 16-503.180-78	Supplied as bars with length of 1500±50 mm Section size: height: 3.0-6.0 mm width: 10.0-16.0 mm	Glass roving, epoxy binder	155	As groove wedges in electrical machines, including traction motors for main-line electric and diesel locomotives	18

Main Specifications					
Parameter	Unit	SPP-BID	SPP-E	SPP-EU	
Breaking stress in tension	MPa	580	–	–	
Breaking stress in static bending, – across the fiber – along the fiber, at 140±3 °C	MPa	900 –	900 –	900 120	
Impact strength, across the fiber	kJ/m ²	250	350	350	
Water absorption, not more	%	0.7	0.4	0.2	
Surface resistivity at 15-35 °C, 45-75%	Ω	1·10 ¹²	1·10 ¹³	1·10 ¹³	
Cut strength at 140±3 °C – strength category 50 – strength category 40 – strength category 30 (strength category is to be specified when placing order)	MPa	– – –	– – –	50 45±5 35±5	

Composite Materials Based on Mica, Mica Papers, Polymer Films, Cardboard

Composite materials based on mica papers

Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
MOLDING MICA-PLASTIC REINFORCED SHEETS TU 3492-146-05758799-2007 FIFP-TPL, FIFP-APL, FIP-APL FIFK-TPL, FIFK-T, FIFK-TPM, FIFK-APM	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm	Mica-plastic sheets, glass fabric, PET-E film or polyimide (PM) film, polyester or silicone binder	155 (on polyester binder)	As formed when heated material in electrical machines and apparatus, for making collector sleeves	6
	Thickness: 0.25 mm				
	Thickness: 0.25; 0.30 mm				
MICA-PLASTIC COLLECTOR REINFORCED KIFE®-A TU 3492-151-05758799-2008 MICA-PLASTIC COLLECTOR KIFE® TU 3492-164-05758799-2010	Sheets length: 860±20 mm, sheet width: from 500 to 680 mm Thickness: 0.7; 0.8; 0.85; 0.9; 1.0; 1.05; 1.1; 1.15; 1.2; 1.3; 1.4; 1.5 mm	Mica-plastic sheets, glass fabric, epoxy binder	155	As commutator segment insulation in electrical machines	6
	Sheets length: 860±20 mm, sheet width: from 500 to 680 mm Thickness: 0.4; 0.5; 0.55; 0.6; 0.7; 0.8; 0.85; 0.9; 1.0; 1.05; 1.1; 1.15; 1.2; 1.3; 1.4; 1.5 mm	Mica-plastic sheets, epoxy binder			
MICA-PLASTIC COLLECTOR KIFE®-H TU 05758799-178-2013	Sheets length: 860±20 mm, sheet width 670±20 mm Thickness: 0.4; 0.5; 0.55; 0.6; 0.7; 0.8; 0.85; 0.9; 1.0; 1.05; 1.1; 1.15; 1.2; 1.3; 1.4; 1.5 mm	Mica-plastic sheets, epoxy binder	180	As commutator segment insulation in electrical machines	6
GLASS MICA-PLASTIC COMPOSITE TU 3492-124-05758799-2004 GIP-TS(v) GIP-T-LSP(v) GIK-TS(v) GIK-T-LSK(v)	Sheets length: 860±20 mm, sheet width: from 500 to 680 mm	Mica-plastic sheets, glass fabric, glass net, glass fabric, polyester-epoxy or silicon binder	155	Slot and inter phase insulation in electrical machines	6
	Thickness: 0.25; 0.3; 0.35; 0.40; 0.45 mm				
	Thickness: 0.43 mm				
	Thickness: 0.25; 0.3; 0.35; 0.40; 0.45; 0.50 mm		180		2
	Thickness: 0.35; 0.43 mm				
GLASS MICA-PLASTIC FILM WATER PROOFING TU 3492-117-05758799-2004 GIP-T-SPL(v) GIP-LSP-PL(v) GIK-T-SPL(v) GIK-LSK-TT-PL(v)	Sheets length: 860±20 mm, sheet width: from 500 to 680 mm	Mica-plastic paper, glass fabric, glass net, PET-film, glass fabric, polyester-epoxy or silicon binder	155	Slot and inter phase insulation in electrical machines	6
	Thickness: 0.25; 0.3; 0.35; 0.40 mm				
	Thickness: 0.35; 0.4; 0.45; 0.5 mm				
	Thickness: 0.25; 0.32 mm		180		2
	Thickness: 0.45; 0.5 mm				
MICA FLEXIBLE HIGH TEMPERATURE RESISTENT GSKV TU 3492-070-05758799-2002	Sheets length: 860±20 mm, sheet width: from 500 to 680 mm Thickness: 0.1; 0.15; 0.2; 0.25; 0.3; 0.4; 0.5; 0.6; 0.7; 0.8; 0.9; 1.0 mm	Mica paper, glass fabric, silicon binder	to 600	Slot and inter phase insulation in electrical machines	3
Mica flexible TU 16-91102.0165.002 TU G1SK G2SK	Sheets length: 860±20 mm, sheet width: from 500 to 680 mm Thickness: 0.1 mm	Mica paper, glass fabric, silicon binder	155	As slot and inter turn insulation in electrical machines and apparatus	6
	Thickness: 0.2; 0.3 mm				
GLASS MICA FILM FLEXIBLE COMPOSITE GSP-T-PL TU 3492-069-05758799-2002	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm Thickness: 0.2; 0.25; 0.3; 0.35; 0.4; 0.43; 0.5 mm	Mica paper, glass fabric, PET-E film, epoxy polyester binder	155	Slot and inter phase insulation in electrical machines and apparatus	6
MICA-PLASTIC GIP-2PL	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm Thickness: 0.5 mm	Mica paper, glass fabric, PET-E film, epoxy polyester binder	155	Slot and inter phase insulation in electrical machines and apparatus	6

Main Specifications

Trademark	Thickness (mm)	Percentage of components (%)			Break down voltage at 15-35°C, 45-75% (kV)		Electric strength (kV/mm)			Tear resistance (N)	
		Nonorganic substances	binder	volatile matter	before bending, average	after bending, average	at 15-35 °C, 45-75%		at 600°C	average	min
							before bending	after bending			
FIFP-TPL	0.25-0.3	70	–	–	–	–	45	–	–	–	–
FIP-APL, FIFP-APL	0.25	65	–	–	–	–	45	–	–	–	–
FIFK-T	0.25	68	–	–	–	–	27	–	–	–	–
FIFK-TPL	0.25-0.3	75	–	–	–	–	45	–	–	–	–
FIFK-APM	0.25	80	–	–	–	–	50	–	–	–	–
FIFK-TPM	0.25	80	–	–	–	–	50	–	–	–	–
GIP-TS(v)	0.25	68	15-30	2.0	4.2	3	–	–	–	–	–
	0.3	68	15-30	2.0	5.5	3.8	–	–	–	–	–
	0.35	68	15-30	2.0	6.0	4.4	–	–	–	–	–
	0.40	68	15-30	2.0	7.1	5.2	–	–	–	–	–
	0.45	68	15-30	2.0	8.0	5.6	–	–	–	–	–
GIK-TS(v)	0.25	68.5	13-30	1.5	4	2.3	–	–	–	–	–
	0.3	68.5	13-30	1.5	5	2.8	–	–	–	–	–
	0.35	68.5	13-30	1.5	5.6	3.3	–	–	–	–	–
	0.40	68.5	13-30	1.5	7.0	4.4	–	–	–	–	–
	0.45	68.5	13-30	1.5	8.0	4.8	–	–	–	–	–
	0.5	68.5	13-30	1.5	8.0	4.8	–	–	–	–	–
GIP-T-LSP(v)	0.43	55-75	–	2.5	11	8.6	–	–	–	290	200
GIK-T-LSP(v)	0.35	70-90	–	1.5	5.6	3.3	–	–	–	220	160
	0.43	70-90	–	1.5	11	7.2	–	–	–	290	200
GIP-T-SPL(v)	0.25	60	13-25	1.5	4.2	3	–	–	–	–	–
	0.3	60	13-25	1.5	6.5	4	–	–	–	–	–
	0.35	60	13-25	1.5	7	4.5	–	–	–	–	–
	0.40	60	13-25	1.5	8.7	6.0	–	–	–	–	–
GIK-T-SPL(v)	0.25	70	12-24	1.5	3.5	2,1	–	–	–	–	–
	0.32	70	12-24	1.5	7.3	5,2	–	–	–	–	–
GIP-LSP-PL(v)	0.35	50	–	1.5	11	9.5	–	–	–	130	100
	0.4	50	–	1.5	14	11.3	–	–	–	130	100
	0.45	50	–	1.5	14.5	11.5	–	–	–	130	100
	0.5	50	–	1.5	15	11.7	–	–	–	130	100
GIK-LSK-TT-PL(v)	0.45	70-90	–	2.5	11	8.2	–	–	–	110	80
	0.5	70-90	–	2.5	11.5	8.4	–	–	–	200	150
GSKV*	0.1-0.15	–	–	–	–	–	15	8	10	–	–
	0.2-1.0	–	–	–	–	–	22	10	12	–	–
G1SK**	0.1; 0.15	–	25-45	2	–	–	20	13	–	–	–
G2SK**	0.2; 0.3	–	25-45	2	–	–	28	21	–	–	–
GSP-T-PL	0.2-0.25	50	–	1.5	8.0	6.5	–	–	–	170	150
	0.3	50	–	1.5	8.0	6.5	–	–	–	200	170
	0.35	50	–	1.5	8.7	7.0	–	–	–	200	170
	0.4	50	–	1.5	9,8	7.5	–	–	–	200	170
	0.43	50	–	1.5	11.2	7.8	–	–	–	200	170
	0.5	50	–	1.5	12.5	8.3	–	–	–	200	170
GIP-2PL	0.500	–	–	1	–	–	40	30	–	250	–

* For GSKV product the parameter "Mass loss after calcination" is specified: 19%.

** For G1SK and G2SK products the parameter "Mica content" is specified 30%.

Trademark	Thickness (mm)	Total shrinkage (%)		Electric strength at 15-35 °C, 45-75% (kV/mm)	Binder content (%)	Delamination (%)
		at 15-35 °C with pressure increase up to 80 MPa and under this pressure with further temperature increase up to 180°C	including: shrinkage under pressure of 80 MPa with temperature increase from 15-35°C to 180 °C			
KIFE®-A	0.7-1,5	7	1	22	9	1
KIFE®-H	0.4-0.7	12.8	2	22	7.5	1
	0.8-1.5	7	1	22	7.5	1
KIFE®	0.4-0.7	12.8	2	22	7.5	1
	0.8-1.5	7	1	22	7.5	1

Composite materials based on natural mica					
Trademark	Size	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
PLATE MICA GOST 6121-75	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm	Phlogopite mica or muscovite , glyphthalic binder	130	Used in electric machines and apparatus as electric insulating gaps and washers	3
PFG, PMG	Thickness: 0.15; 0.5; 0.6; 0.7; 0.8; 0.9; 1.0; 1.5; 2.0; 3.0; 5.0 mm				
PFK		Phlogopite mica, silicon binder	180		
PLATE MICA TU 05758799-060-01	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm	Mica phlogopite or muscovite, glyphthalic binder	130	Used in electric machines and apparatus as electric insulating gaps and washers	3
PFG, PMG	Thickness: 0.15; 0.20; 0.30; 0.40 mm				
PFK	Thickness: 0.20; 0.30; 0.40 mm	Mica phlogopite, silicon binder	180		
Molding micanite TU 3492-097-05758799-2003	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm	Mica phlogopite or muscovite, mica paper, glyphthalic binder	130	Used as insulation material for hot molding production of commutator sleeves, bushes, tubes, cylinders	6
FMG-SB, FFG-SB, FMGA-SB, FFGA-SB	Thickness: 0.25; 0.3; 0.35; 0.40; 0.45; 0.5; 0.6; 0.7; 0.8; 0.9; 1.0; 1.5 mm				
FMP-SB, FFP-SB, FMFA-SB, FFFA-SB	Thickness: 0.25; 0.30; 0.35; 0.40; 0.45; 0.50; 0.6; 0.7; 0.8; 0.9; 1.0; 1.5 mm	Mica phlogopite or muscovite, mica paper, polyester binder	155		
FMK-SB, FFK-SB, FFKA-SB	Thickness: 0.25; 0.3; 0.35; 0.4; 0.45; 0.5 mm	Mica phlogopite or muskovite, mica paper, silicon binder	180		
Molding micanite GOST 6122-75	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm	Mica phlogopite or muskovite, glyphthalic binder	130	Used as insulation material for hot molding production of commutator sleeves, bushes, tubes, cylinders	6
FFG, FMG, FFGA, FMGA	Thickness: 0.15; 0.2; 0.25; 0.3; 0.35; 0.4; 0.45; 0.5; 0.6; 0.7; 0.8; 0.9; 1.0; 1.5 mm				
FFP, FMP, FFPA, FMFA		Mica phlogopite or muscovite, polyester binder	155		
FFK, FMK, FFKA		Mica phlogopite or muscovite, silicon binder	180		
MICAFOLY GOST 3686-77	Sheets length: 860±20 mm, sheet width: from 500 to 680 mm	Mica phlogopite or muskovite, glass fabric, silicon binder	180	Used as insulation material for insulating coils of electric machines; as material for hot molding production of solid shaped goods, such as sleeves, bushes, tubes, cylinders	9
MFK-T, MMK-T	Thickness: 0.2; 0.25; 0.3 mm				

Composite materials based on natural mica

Trademark	Size	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
Flexible micanite GOST 6120-75	Sheets length: 860±20 mm, sheet width from 500 to 680 mm	Mica phlogopite or muscovite, oil-glyphthalic binder	130	Slot insulation in electrical machines, banding insulation of anchors, flexible seal in excitation coils	3
GFS, GMS	Thickness: 0.15; 0.2; 0.25; 0.3; 0.35; 0.4; 0.45; 0.5 mm				
GFK	Thickness: 0.15; 0.2; 0.25; 0.3; 0.35; 0.4; 0.45; 0.5 mm				
GME TU 05758799-142-2006	Thickness: 0.20 mm	Mica muscovite, epoxy polyester binder	155		
Flexible glass micanite GOST 8727-78	Sheets length: 860±20 mm, sheet width: from 500 to 680 mm	Mica phlogopite, glass fabric, oil-glyphthalic binder	130	Slot insulation in electrical machines, banding insulation of anchors	3
GFS-T, GFS-TT	Thickness: GFS-T, GFK-T: 0.22; 0.25; 0.3; 0.5 mm GFS-TT: 0.25; 0.3; 0.35; 0.4; 0.5; 0.6 mm				
GFK-T, GFK-TT	GFK-TT: 0.2; 0.25; 0.3; 0.35; 0.4; 0.5; 0.6 mm	Mica phlogopite, glass fabric, silicon binder	180		6
GLASS MICANITE FLEXIBLE TU 05758799-005-95	Sheet length (860±20) mm and width from 500 to 680 mm	Mica muscovite, glass fabric, oil-glyphthalic binder	130	Slot insulation in electrical machines, banding insulation of anchors	3
GMS-TT	Thickness: 0.25; 0.3; 0.35; 0.4; 0.5; 0.6 mm				
GMK-TT	Thickness: 0.2; 0.25; 0.3; 0.35; 0.4; 0.5 mm				
MICA TAPE LFS-TT TU 137.0148.07-94 GOST 4268-75	Rolls: Ø 100±10 mm with width from 15 to 860 mm, wound on rigid sleeve Ø 30 mm Thickness: 0.1; 0.13; 0.15; 0.17; 0.21 mm	Mica phlogopite, glass fabric, oil-glyphthalic binder	130	Interturn and housing insulation in electrical machines	3 (according to TU) 4 (according to GOST)
MICA TAPE LFK-TT GOST 4268-75		Mica phlogopite, glass fabric, silicon binder	180		12
MICA TAPE LMK-TT TU 05758799-008-95 for thickness 0.10; 0.17; 0.21 mm; GOST 4268-75 for thickness 0.13; 0.15 mm	Rolls and rollers Ø (100±10) mm and width from 15 to 860 mm, wound on a rigid sleeve Ø not less 30 mm	Mica muscovite, glass fabric, silicon binder	180	Interturn and housing insulation in electrical machines	12

Main specifications

Trademark	Electric strength at 15-35 °C, 45-75% (kV/mm)									Percentage of components (%)			
	Thickness, mm	0.15-0.25	0.3	0.35	0.4	0.45	0.5	0.6	0.7-1.0	1.5	binder	mica	volatile matter
PFG	34	21	21	21	–	21	18	16	–	–	8-20	80-92	–
PMG	34	21	21	21	–	21	18	16	–	–	8-20	80-92	–
PFK	34	21	21	21	–	21	18	16	–	–	9-18	82-91	–
PFK according TU	34	21	21	21	–	–	–	–	–	–	6-14	86-94	–
FMG-SB; FMG	41	36	36	36	36	36	30	30	30	30	14-20	80-86	1
FMGA-SB; FMGA	41	36	36	36	36	36	30	30	30	30	8-14	86-92	1
FMP-SB; FMP	41	36	36	36	36	36	30	30	30	30	12-20	80-88	1
FMPA-SB; FMPA	41	36	36	36	36	36	30	30	30	30	7-12	88-93	1
FMK-SB; FMK	41	36	36	36	36	36	30	30	30	30	18-33	67-82	1
FFK-SB; FFK	36	31	31	31	31	31	25	25	25	25	16-31	69-84	1
FFKA-SB; FFKA	36	31	31	31	31	31	25	25	25	25	9-16	84-91	1
FFG-SB; FFG	36	31	31	31	31	31	25	25	25	25	14-20	80-86	1
FFGA-SB; FFGA	36	31	31	31	31	31	25	25	25	25	8-14	86-92	1
FFP-SB; FFP	36	31	31	31	31	31	25	25	25	25	12-20	80-88	1
FFPA-SB; FFPA	36	31	31	31	31	31	25	25	25	25	7-12	88-93	1
MFK-T	20	18	–	–	–	–	–	–	–	–	20-36	45	2
MMK-T	20	18	–	–	–	–	–	–	–	–	20-36	45	2
GFS	24	23	23	23	23	23	–	–	–	–	10-25	75-90	5
GMS	28	24	24	24	24	24	–	–	–	–	10-25	75-90	5
GME	28	–	–	–	–	–	–	–	–	–	10-25	75-90	5
GFK	24	22	22	22	22	22	–	–	–	–	12-31	69-88	5
GFS-T	20	20	–	17	–	17	17	–	–	–	13-25	50	4
GFS-TT	18	18	18	17	–	17	17	–	–	–	15-30	40	4
GMS-TT	18	18	18	17	–	17	–	–	–	–	15-30	40	4
GFK-T	20	20	–	17	–	17	17	–	–	–	20-36	45	2
GFK-TT	18	18	18	17	–	17	17	–	–	–	20-36	35	2
GMK-TT	18	18	18	17	–	17	–	–	–	–	20-36	35	2

Main specifications

Trademark	Electrical strength, a 15-35 °C, 45-75% (kV/mm)					Percentage of components (%)						
	for width (mm)					Mica \geq					binder	volatile matter
	0.1	0.13	0.15	0.17	0.21	0.1	0.13	0.15	0.17	0.21		
LFS-TT	23	23	22	20	14	40	40	40	35	30	15-30	1.5 (according TU) 3.0 (according GOST)
LFK-TT	24	23	22	19	13	35	35	35	35	25	17-33	1*
LMK-TT	24	23	20	19	13	30	35	35	30	25	17-33	1

* Less than 1% mica for LFK-TT mica tape (oven drying)

Unimpregnated mica tapes

Trademark	Thickness (mm)	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)	
UNIMPREGNATED MICA TAPES TU 16-503.030-2007 LSKN-135-SPI	0.11	Mica paper, glass fabric, PET-E film, composition from natural rubber	130, 155, 180 depending on impregnation composition	Housing insulation in high voltage electric machines, traction motors, manufactured by vacuum-pressure impregnation process	6	
	LSKN-160-TT	0.13				Mica paper, glass fabric, composition from natural rubber
	LSKO-180-T	0.13				Mica paper, glass fabric, composition from natural rubber, silicon binder
SEMIIMPREGNATED MICA TAPES TU 3492-132-05758799-2007	ELPOR®-155-TPI	0.10; 0.13	155	Housing insulation in high voltage electric machines, traction motors, manufactured by vacuum-pressure impregnation process	12	
		ELPOR®-180-TT	0.10; 0.13			155, 180
	ELPOR®-180-TPM	0.13	180			
	ELPOR®-220-TT	0.10; 0.13	220			
	ELPOR®-220-TPM	0.13	220			
	ELPOR®-PI	0.10; 0.13	Mica paper, glass fabric, PET-E film, modified epoxy binder			130, 155, 180, depending on impregnation composition

NOTE: Tapes are available in rolls $\varnothing 100 \pm 10$ mm with width from 15 to 870 mm, wound on rigid reel min $\varnothing 30$ mm

Main specifications

Trademark	Thickness (mm)	Percentage of components		Mass loss after calcination (g/m ²)	Accelerant content (%)	Average electric strength at 15-35 °C, 45-75% (kV/mm)	Specific breaking load in tension, at 15-35 °C, 45-75% (N/cm)	Surface density (g/m ²)
		Binder (%)	Volatile matter (%)					
LSKN-135-SPI	0.11	–	0.5	7±3	0.2-0.4	30	160	138±14
LSKN-160-TT	0.13	–	0.5	6.5±2.5	0.2-0.4	10	250	160±17 15
LSKO-180-T	0.13	–	0.5	5.5±2.5	0.2-0.4	15	100	180±10 25
ELPOR®-155-TPI	0.10	13±3	2.0	–	–	55	120	138±16, 201±17* or 179±18
	0.13	13±3	2.0	–	–	40	150	
ELPOR®-180-TT	0.10	13±3	2.0	–	–	20	140	138±16 170±18
	0.13	13±3	2.0	–	–	15	200	
ELPOR®-180-TPM	0.13	13±3	2.0	–	–	50	150	180±20* or 172±20
ELPOR®-220-TT	0.10	13±3	2.0	–	–	20	140	138±16 170±19
	0.13	13±3	2.0	–	–	15	200	
ELPOR®-220-TPM	0.13	13±3	2.0	–	–	50	150	180±20* or 172±20
ELPOR®-PI	0.10	13±3	2.0	–	–	55	120	138±16, 201±17* or 179±18*
	0.13	13±3	2.0	–	–	40	150	

* Surface density shows different values depending on the materials used.

Impregnated mica tapes

Trademark	Thickness (mm)	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
GLASS MICA TAPE TU 3492-157-05758799-2008 LSEP-934-TPI	0.08; 0.10; 0.11; 0.13	Mica paper, glass fabric, PET-E film*, epoxy polyester binder	155	Interturn and housing insulation in traction motors, interturn insulation in large high voltage electric machines	5
LSEP-934-SPI	0.13				
GLASS MICA TAPE LSU TU 16-90 179.0168.002 TU	0.10; 0.13	Mica paper, glass fabric, PET-E film, epoxy polyester binder			12
GLASS MICA TAPE TU 16-91 102.0168.001 TU LSK-110-ST	0.11 – 0.20	Mica tape, glass fabric, PET-E film, epoxy compound	130	Interturn and housing insulation in large high voltage electric machines and in traction motors	3
LSK-110-TT	0.11 – 0.20				
LSK-110-TPI	0.08 – 0.15				
LSK-110-SPI	0.10 – 0.13				
LSK-SS	0.15; 0.17	Mica paper, glass fiber, silicon binder	180		6
ELIZTERM®-155-TPI TU 3492-120-05758799-2004	0.08; 0.10; 0.11; 0.13	Mica paper, glass fabric, PET-E film, polyestermide compound	155	Interturn and housing insulation in high voltage electric machines and in traction motors	12
ELIZTERM®-180-TT ELIZTERM®-180-TPM TU 3492-128-05758799-2007	0.10; 0.11; 0.13; 0.17	Mica paper, glass fabric, PM film**, polyestermide compound	180	Housing insulation in electric machines and in traction motors	12
ELIZTERM®-220-TT ELIZTERM®-220-TPM TU 05758799-159-2009	0.10; 0.11; 0.13; 0.17		220		
LSKV TU 16-503.198-80	0.08; 0.10; 0.12	Mica tape, glass fabric, silicon binder	to 600	Interturn and housing insulation in electric machines and apparatus	3
LSK-T	0.12	Mica paper, glass fabric, silicon binder	180	As insulation of pole coils of DC machines	6
LSK-TT TU 3492-056-05758799-00	0.15; 0.17				
LSKO-PM TU 16-91 179.0168.005 TU	0.11; 0.13; 0.15; 0.17	Mica paper, glass fabric, polyimide film, silicon binder	180	Housing insulation in electric machines operating under severe service conditions	4
LSE-PM, LSE-PM-A TU 3492-053-05758799-2002	0.11; 0.13	Mica paper, glass fabric, polyimide film, epoxypolyester binder	180	Housing insulation in electric machines operating under severe service conditions	6
GLASS MICA-PLASTIC TAPE LIKO-TT TU 16-89 179.0190.001 TU	0.15; 0.17; 0.19; 0.21	Mica paper, glass fabric, silicon binder	180	Housing insulation in electric machines and apparatus	6

* PET-E film: poly ethelenetherephthalate film

** PM film: polyimide film

NOTE: Tapes are available in rolls $\varnothing 100 \pm 10$ mm with width from 15 to 870 mm, wound on rigid reel min $\varnothing 30$ mm

Main specifications

Trademark	Thickness (mm)	Percentage of components (%)			Average electric strength at (15-35 °C, 45-75% kV/mm)	Breakdown voltage in selected points at 15-35°C, 45-75% (kV)	Specific breaking load in tension (N/cm)
		Mica	Binder	Volatile matter			
LSEP-934-TPI	0.08; 0.10;	30	25-33	1.3-4.0	45	3.5	60
	0.11	30	25-33	1.3-4.0	45	3.5	60
	0.13	30	25-33	1.3-4.0	45	3.5	100
LSEP-934-SPI	0.13	30	25-33	1.3-4.0	42	3.5	72
LSU	0.10	25	25-35	1.5	35	–	80
	0.13	25	25-35	1.5	45	–	130
LSK-110-TPI	0.08	30	23-35	2	49	1.4	60
	0.09	30	23-35	2	43	1.4	60
	0.10	30	23-35	2	45	1.4	72
	0.11	30	23-35	2	38	1.4	120
	0.13	30	23-35	2	30	1.4	120
	0.15	30	23-35	2	26	1.4	120
LSK-110-SPI	0.10	30	23-35	2	42	1.4	72
	0.11	30	23-35	2	38	1.4	72
	0.13	30	23-35	2	30	1.4	72
LSK-110-ST	0.11	28	30-40	2	24	1.2	110
	0.13	28	30-40	2	20	1.2	190
	0.15	28	30-40	2	18	1.2	190
	0.17	28	30-40	2	15	1.2	190
	0.20	30	35-45	2	29	1.7	190
LSK-110-TT	0.11	28	30-40	2	24	1.2	120
	0.13	28	30-40	2	20	1.2	240
	0.15	28	30-40	2	18	1.2	240
	0.17	28	30-40	2	15	1.2	240
	0.20	30	35-45	2	29	1.7	240
LSK-SS	0.15	20	25-40	2	12	1.2	145
	0.17	20	25-40	2	11	1.2	145
ELIZTERM®-155-TPI	0.08	30	25-30	2	60	4.0	70
	0.10	30	25-30	2	55	4.0	120
	0.11	30	25-30	2	50	4.0	120
	0.13	30	25-30	2	50	4.0	150
ELIZTERM®-180-TT	0.10; 0.11	30	25-30	2	30	2.5	140
	0.13; 0.17	30	25-30	2	25	2.5	240
ELIZTERM®-180-TPM	0.10; 0.11	–	23-27	2	70	–	90
	0.13;	–	23-27	2	50	–	150
	0.17	–	23-27	2	45	–	150
ELIZTERM®-220-TT	0.10; 0.11	30	25-30	2	30	2.5	140
	0.13; 0.17	30	25-30	2	25	2.5	240
ELIZTERM®-220-TPM	0.10; 0.11	–	23-27	2	70	–	90
	0.13;	–	23-27	2	50	–	150
	0.17	–	23-27	2	45	–	150
LSKV*	0.08-0.12	80*	–	2	14/7 at 600°C	–	–
LSK-T	0.12	27	25-45	0.2-1.8	15	0.6	80
LSK-TT	0.15; 0.17	27	20-40	0.2-1.8	12	0.6	120
LSKO-PM	0.11	–	20-35**	1.5	40	–	90
	0.13	–	30-50**	1.5	45	–	100
	0.15	–	30-50**	1.5	30	–	100
	0.17	–	15-30**	1.5	30	–	100
LIKO-TT	0.15; 0.17	20	20-40	2	14	1.4	130
	0.19; 0.21	20	20-40	2	10	1.4	130
LSE-PM	0.11	–	18-28	1.8	45	–	80
	0.13	–	18-28	1.8	45	–	100
LSE-PM-A	0.11	–	12-18	1.5	45	–	80
	0.13	–	12-18	1.5	45	–	100

* For LSKV product the parameter "Inorganic substance content" is specified: 80%.

** For LSKO-PM product the parameter "Mass loss after calcination" is indicated.

Composite materials based on polymer films and cardboard

Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)	
Film-glass fabric GTP-2PL TU 3491-110-05758799-2003	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm, Thickness: 0.15; 0.17; 0.20; 0.25; 0.30; 0.35; 0.50 mm	PET-E film*, glass fabric, epoxy polyester binder	155	Slot insulation made by hand in electric machines	3	
IZOFLEX 191 TU 3491-003-00214639-01	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm Thickness: 0.13 0.15; 0.17; 0.2; 0.25; 0.30; 0.35; 0.40; 0.45; 0.50 mm	PET-E film, glass fabric, PET-E film, epoxy rubber composition	155	Slot insulation made by hand in electric machines	12	
IMIDOFLEX TU 3491-003-00214639-01	Sheet length: 860±20 mm, sheet width: from 500 to 680 mm Thickness: 0.13; 0.15; 0.17; 0.20; 0.25; 0.3; 0.35; 0.4; 0.45; 0.5 mm	PM film**, glass fabric, PM film, epoxy rubber composition	180	Slot insulation made by hand in electric machines, cover wedge, interlayer insulation	12	
292	Thickness: 0.2; 0.5; 0.3; 0.35; 0.4; 0.45; 0.5 mm	Glass fabric, PM film, glass fabric, epoxy rubber composition				
Film fulled-board TU 3491-098-05758799-2003	Roll width: 900±10 mm, diameter max 350 mm, wound on the rigid reel with inner diameter 76±1 mm Thickness: 0.17; 0.27; 0.32; 0.45 mm	PET-E film, electric cardboard, polyester binder	120	Slot insulation, cover wedge, interlayer insulation	12	
PEK	Thickness: 0.19; 0.25; 0.32; 0.37 mm	PET-E film, fulled-board, PET-E film, polyester binder	130			
PEK-II	Thickness: 0.15; 0.19; 0.20; 0.23; 0.25; 0.32; 0.37 mm	PM film, PET-E film, epoxy rubber composition	155			
LAVITERM® TU 3491-102-05758799-2003	Roll width max 900 mm, diameter max 350 mm, wound on the rigid reel with inner diameter 76±1 mm Thickness: 0.15; 0.19; 0.20; 0.23; 0.25; 0.32; 0.37 mm	PM film, PET-E film, epoxy rubber composition	155	Slot insulation in stators of induction motors where mechanized process of insulating used; insulation in explosion-proof motors and in compressors of refrigerators	12	
LAVITERM®-1	Thickness: 0.17; 0.19; 0.2; 0.25 0.27; 0.32; 0.37; 0.43; 0.47 mm	PM film, PET-E film, PM film, epoxy rubber composition	180			
LAVITERM®-2	Thickness: 0.11; 0.13; 0.15 mm	PM film, glass fabric, silicone binder	до 230			
POLYIMIDE FILM COMPOSITION TU 3491-099-05758799-2003	Rolls diameter 100±10 mm, width from 15 to 860 mm, wound on the rigid reel with inner diameter min 30 mm Thickness: 0.08; 0.10; 0.13; 0.15 mm	PM film, glass fabric, silicone binder		до 230	Interturn and housing insulation in electric machines and apparatus	3
L-PMK-T	Thickness: 0.11; 0.13; 0.15 mm					
L-PMK-TT	Thickness: 0.11; 0.13; 0.15 mm					

* PET-E film: poly ethelenetherephthalate film

** PM film: polyimide film

Main specifications

Trademark	Thickness (mm)	Percentage of components (%)			Specific breaking load in tension (N/cm)		Elongation at break (%)		Breaking voltage at 15-35°C, 45-75% (kV)	
		Glass fabric	Binder	Volatile matter	in machine direction	across machine direction	in machine direction	across machine direction	before bending	after bending
Film-glass fabric GTP-2PL	0.15-0.20	25-65	30	1.5	200	150	3	2	13	9
	0.25	25-65	30	1.5	300	250	3	2	13	9
	0.30	25-65	30	1.5	350	300	3	2	13	9
	0.35-0.50	25-65	30	1.5	350	300	5	3	13	9
IZOFLEX 191	0.13-0.50	–	–	–	140	100	3	2	10	7
IMIDOFLEX 292	0.13-0.17	–	–	–	120	100	3	2	8	6
	0.20-0.50	–	–	–	120	100	3	2	9	6
IMIDOFLEX 929	0.20-0.50	–	–	–	175	–	3	–	8	5
Film fulled-board PEK	0.17	–	–	–	140	80	2	3	7	7
	0.27	–	–	–	200	150	2	3	8	7
	0.32	–	–	–	210	160	2	3	11	9
	0.45	–	–	–	340	250	2	3	8,5	7.5
Film fulled-board PEK-II	0.19	–	–	–	135	100	2	3	10	8
	0.25	–	–	–	180	150	2	3	10	8
	0.32	–	–	–	280	170	2	3	12	10
	0.37	–	–	–	300	260	2	3	14	11
LAVITERM®-1	0.15	–	–	–	130	–	15	–	11	–
	0.19	–	–	–	170	–	15	–	12	–
	0.20	–	–	–	180	–	15	–	12	–
	0.23	–	–	–	190	–	15	–	13	–
	0.25	–	–	–	200	–	15	–	14	–
	0.32	–	–	–	210	–	15	–	19	–
	0.37	–	–	–	300	–	15	–	22	–
LAVITERM®-2	0.17	–	–	–	170	–	15	–	11	–
	0.19	–	–	–	190	–	15	–	13	–
	0.20	–	–	–	200	–	15	–	13	–
	0.25	–	–	–	210	–	15	–	15	–
	0.27	–	–	–	230	–	15	–	17	–
	0.32	–	–	–	320	–	15	–	20	–
	0.37	–	–	–	340	–	15	–	22	–
	0.43	–	–	–	380	–	15	–	25	–
	0.47	–	–	–	400	–	15	–	27	–
L-PMK-T	0.08	–	–	2	60	–	3	–	6.5	–
	0.10	–	–	2	80	–	3	–	6.5	–
	0.13	–	–	2	100	–	3	–	6.5	–
	0.15	–	–	2	120	–	3	–	6.8	–
L-PMK-TT	0.11	–	–	2	80	–	3	–	7	–
	0.13	–	–	2	100	–	3	–	7	–
	0.15	–	–	2	130	–	3	–	8	–

Composite materials based of polymer films and synthetic papers

Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
FILM-SYNTHOCARDBOARD TU 3491-088-05758799-2002	Rolls width: 900±10 with max diameter 350 mm, wound on a rigid reel with external diameter 76±1 mm; also available in sheets with sizes: from 200 to 900 mm.		155	Slot insulation, cover-wedge, interlayer insulation in dry type transformers	12
51, 51P	Thickness: 51: 0.17; 0.19; 0.23; 0.25; 0.27; 0.30; 0.32; 0.35; 0.37; 0.42 mm; 51P: 0.8; 0.2; 0.25; 0.27; 0.30; 0.33 mm	Polyester paper, PET-E film, polyester binder "P" means additional varnishing			
515, 515P	Thickness: 515: 0.17; 0.19; 0.21; 0.23; 0.25; 0.27; 0.30; 0.32; 0.35; 0.37; 0.47; mm. 515P: 0.21; 0.25; 0.27; 0.35; 0.40 mm	Polyester paper, PET-E film, polyester paper, polyester binder "P" means additional varnishing			

Main specifications

Trademark	Thickness (mm)	Specific breaking load in tension (N/cm)		Elongation at break (%)		Break-down voltage at 15-35 °C, 45-75% (kV)	
		in machine direction	in perpendicular direction	in machine direction	in perpendicular direction	before bending	after bending
FILM-SYNTHOCARDBOARD 51	0.17-0.19	180	180	10	15	11	9
	0.23	200	200	10	15	13	11
	0.25; 0.27	220	230	10	15	15	14
	0.30; 0.32	250	250	10	15	17	15
	0.35; 0.37	300	300	10	15	20	18
	0.42	350	350	10	15	25	20
FILM-SYNTHOCARDBOARD 51П	0.18; 0.2	190	190	10	15	11	9
	0.25; 0.27	250	250	10	15	17	15
	0.30; 0.33	300	300	10	15	20	18
FILM-SYNTHOCARDBOARD 515	0.17	90	100	15	15	8,5	8
	0.19	100	110	15	15	10	9
	0.21	130	140	15	15	10	9
	0.23; 0.25	180	200	15	15	11	9
	0.27	200	220	15	15	13	11
	0.30; 0.32	240	260	15	15	17	15
	0.35; 0.37	280	300	15	15	20	17
	0.47	370	390	15	15	25	18
FILM-SYNTHOCARDBOARD 515П	0.21	140	150	15	15	10	9
	0.25	180	190	15	15	11	9
	0.27	190	210	15	15	12	10
	0.35	240	260	15	15	17	15
	0.40	280	300	15	15	20	17

Electric insulating glass paper

Trademark	Sizes	Composition	Thermal class (°C)	Application	Guaranteed shelf life (months)
GLASS PAPER* TU 05758799-161-2009	Roll width: from 900 mm to 1070, wound on a solid reels with external diameter 76 ± 1 mm.* Thickness 0.13; 0.18; 0.25; 0.38; 0.51; 0.64; 0.76; 1,02; 1,27; 1,51 mm	Roll material unimpregnated	150 180 200 Depending on binder	Intended to replace such materials as elektronit, nomex, asbestos paper and composite materials based on them used in the windings of electrical machines	12
Stekloporopreg					
Steklopreg-1 Stekloporopreg-1	Thickness 0.13; 0.18; 0.25; 0.38; 0.63; 0.76; 1,00; 1,50 mm	Roll material impregnated with insulating compound			
Steklopreg-2 Stekloporopreg-2	Thickness 0.08; 0.13; 0.25; 0.30; 0.38; 0.51 mm				

* Rolls of other diameters are available subject to negotiations with customers.

Main specifications

Trademark	Thickness (mm)	Surface density (kg/m ²)	Binder content (%)	Breaking load in tension (kN/m)	Breakdown voltage (kV)	Elongation at break (%)
Stekloporopreg	0.25	0.27	–	2.1	2	2
Steklopreg-1	0.25	0.4	30	2.1	1.8	–
Stekloporopreg-1	0.25	0.3	10	2.1	1.8	–
Steklopreg-2	0.25	0.44	30	8.7	2	–
Stekloporopreg-2	0.25	0.44	10	8.7	2	–

* Technical characteristics are presented for the same thickness.

Recommended Insulation Systems

Insulating systems for low voltage electric motors			
Areas of application	THERMOLITE B	THERMOLITE F	THERMOLITE H
Groove insulation	Composite materials based on films, cardboard and synthetic papers (PEK, PSK)	Composite materials based on films, glass fabric and synthetic papers (isoflex, GTP-2PI, PSK515P)	Composite materials based on films, glass fabric and synthetic papers (Lavitem, Imidoflex)
Interphase insulation	Composite materials based on films, cardboard and synthetic papers (PEK, PSK)		
	Impregnating method		
	Dip or vacuum-pressure	Dip or vacuum-pressure	Stream or drop
Impregnating compositions	Varnishes ML-92, GF-95, FL-98	Compound Eiplast-155ID type A; Elimpreg®-9153M, Elimpreg®-993EP	Compound Eiplast-155ID type B
Groove wedge	Profile glass plastic SPP-E; Glass-cloth-base laminate STEF-U, STEF-I	Profile glass-cloth-base laminate STEF-U, STEF-I	Profile glass plastic SPP-BID; Glass-cloth-base laminate ST-ETF, Elizlam-225
Terminal wires	Electric insulating flexible tubes TV-40	Electric insulating flexible tubes TKR	Electric insulating flexible tubes TKR
Top coating	Top coating enamel Epimal-9111, Epimal-9155	Top coating enamel Epimal-9111, Epimal-9155, EP-992	Top coating enamel Epimal-9114

Electrical insulation systems for traction motors

Areas of application	Termolit F (t.m.)		Termolit H (t.m.)		Termolit C (t.m.)	
	Stator winding: main-pole winding, commutating winding; armature winding	Compensation coil	Stator winding: main-pole winding, commutating winding; armature winding	Compensation coil	Stator winding: main-pole winding, commutating winding; armature winding	Compensation coil
Turn insulation	Resin Rich Mica tape Elizterm-155	Resin Rich	Resin Rich Mica tape Elizterm-180	Resin Rich	Resin Rich Mica tape Elizterm-220	Resin Rich Mica tape Elizterm-220
Inter turn insulation	Impregnated composite material Elpreg-155*	Mica tape Elizterm-155	Impregnated composite material Elpreg-180*	Polymide tape L-PMK-T, Elizterm-180	Impregnated composite material Elpreg-220*	Impregnated composite material Elpreg-220*
Housing insulation	Mica tape Elizterm-155, Compound Elplast-155ID	Mica tape Elizterm-155	LSE-PM, Elizterm-180, Compound Elplast-180ID	Mica tape LSE-PM	LSE-PM, Elizterm-220, Compound Elplast-220ID	Mica tape LSKN-160-TT, Mica tape Elpor-220, Compound Elplast-220ID
Slot insulation	Film-glass fabric GTP-2PI, Izoflex-191, Laviterm I	Imidoflex, Laviterm II			Composite materials based on polyimide film	
Slot wedge	Profile glass plastic SPP-EU	Profile glass plastic * SPP-180U Glass-cloth-base laminate ST-ETF, ELIZLAM 225			Profile glass plastic * SPP-220U	
Band	Glass band tape LSBE-F(u)	Glass band tape LSBE-H(u)	Glass band tape LSBE-H(u)		Glass band tape LSBE-C(u)	
Insulation of commutator segments	Commutator glass plastic KIFE-A	Collector glass plastic KIFE-H	Collector glass plastic KIFE-H		Collector glass plastic KIFE-C*	
Commutator cups	Molding mica FFP, FMP	Molding mica FFK, FMK	Molding mica FFK, FMK		Molding mica, mica plastic	
Terminal wires	Impregnated glass fabric LSKL, glass fabric PS-IF	Impregnated glass fabric LSKL, glass fabric PS-IF	Impregnated glass fabric LSKL, glass fabric PS-IF		Impregnated glass fabric LSKL, glass fabric PS-IF	
Top coating	Top coating enamel Epimal-9111, Epimal 9155	Top coating enamel Epimal-9114	Top coating enamel Epimal-9114		Top coating enamel *	
Structural materials	Glass-cloth-base laminate STEF-U	Glass-cloth-base laminate ST-ETF, ELIZLAM 225	Glass-cloth-base laminate ST-ETF, ELIZLAM 225		Glass-cloth-base laminate *	
Filling of hollows	Electric insulation sealant Episam®-0020	Electric insulation sealant Episam®-0014	Electric insulation sealant Episam®-0014		Electric insulation sealant *	

(F,H,C): thermal classes

* materials under development

(t.m.) – traction motors

Profile parts with standard cross section

Part	Sizes (mm)	Raw material (name, trademark)	Application
Standard section: - rectangular - ring - semi ring - circular segment - circular sector - trapezium - triangle - T-shaped - U-shaped - hexagonal	According to customer's draft: height: 0.5 - 100 width: up to 1000 length: up to 2000 up to \varnothing 20 part height: up to 5 part length: up to 1460 part height: up to 100 part height: up to 1460	Fiber-cloth-base laminate A, B, PT, PTK Glass-cloth-base laminate STEF-U, STEF, STEF-I, ELIZLAM 225, ST-ETF, STEB Paper-cloth-base laminate LG Glass-cloth-base laminate cylinders and tubes TSSEF, TSEF, TSS-ETF, TS-ETF Profile glass plastic SPP-E, SPP-EU, СПП-BID	As insulating and structural parts in electric machines, traction motors, transformers, optional equipment, electrical devices and apparatus. As constructive parts in bearing structures.
Fixings: - bolts - screws - studs - nuts - washes	According to customer's draft		



Parts for turbo-and hydro generators, electrical motors, transformers and high voltage bushings

Part	Sizes (mm)	Raw material (name, trademark)	Application
- panel - plate - gasket - wedge - ring - tube - flange	According to customer's draft	Fiber-cloth-base laminate A, B, PT, PTK Glass-cloth-base laminate STEF-U, STEF, STEF-I, ELIZLAM 225, ST-ETF, STEB Paper-cloth-base laminate LG Glass-cloth-base laminate cylinders and tubes TSSEF, TSEF, TSS-ETF, TS-ETF	As parts in electric machines, transformers, high voltage bushings



Parts for optional electrical equipment, electrical apparatus and devices

Part	Sizes (mm)	Raw material (name, mark)	Application
<ul style="list-style-type: none"> - slab - panel - plate - gasket - partition - support - pull rod - guide - bush - washer 	According to customer's draft	Fiber-cloth-base laminate A, B, PT, PTK Glass-cloth-base laminate STEF-U, STEF, STEF-I, ELIZLAM 225, ST-ETF, STEB Paper-cloth-base laminate LG Glass-cloth-base laminate cylinders and tubes TSSEF, TSEF, TSS-ETF, TS-ETF	Optional electrical equipment: <ul style="list-style-type: none"> - invertors - control boards/panels - high voltage equipment cabinets - high voltage alarm relays - low voltage equipment cabinets - insulating bushings - voltage restrict Low and high voltage electric apparatus and equipment



Equipment parts for metallurgical works

Part	Size (mm)	Raw material (name, trademark)	Application
<ul style="list-style-type: none"> - insertion - plate - collar 	According to customer's draft	Fabric-cloth-base laminate PTK, part blanks of fabric-cloth-base laminate insertions	Rolling mills in metallurgical works
<ul style="list-style-type: none"> - ring - semi ring 		Fabric-cloth-base laminate A, B, PT, PTK	



Unsaturated polyester resins

Trademark	Chemical basis	Application	Gel time, at 25°C (minutes)	Accelerant, 1,5 % CO(II) (%)	Catalyst, Methyl Ethyl Ketone Peroxide (MEKP), %	Viscosity measured by viscosimeter B3-246 (cup nozzle Ø 6 mm), 20°C	Styrene content, %
PN-1 GOST 27952-88	Orthophthalic	General-purpose resin; used as a binder for composites, glass-cloth-base laminates etc.	5-28	4.0	1.6	16-31	30-33
PN-1UT (preaccelerated, thixotropied) TU 2226-096-05758799-2003	Orthophthalic	Used as a binder for manufacturing glass-cloth-base materials to form vertical and angled surfaces	10-30	–	1.5	25-45	30-33
PN-609-21M GOST 27952-88	Orthophthalic (solvent: oligo ester acrylate)	General-purpose resin; used as a binder for composites, glass-cloth-base laminates, premixes etc.	100-200	4.0	1.6	20-32	–
NPS-9101 TU 2226-021-05758799-97	Orthophthalic	Resin for manufacturing goods from polymer concrete and reinforced structural glass-cloth-base laminates	4-30	4.0	1.6	25-65	30-34
NPS-9101/34 TU 2226-021-05758799-97	Orthophthalic	Binder for manufacturing slabs of artificial stones and other composites by vibration compaction	5-15	4.0	1.6	30-40	32-36
NPS-9501 TU 2226-024-05758799-97	Isophthalic	Resin for manufacturing corrosion resistant structural glass-cloth-base laminates using contact forming and winding	8-30	4.0	1.6	20-60	36-40
NPS-9501T (thixotropied) TU 2226-024-05758799-97	Isophthalic	Binder for manufacturing glass-plastic tubes and repairing pipelines by trenchless method	8-15	4.0	1.6	40-70	35-39
NPS-9502 TU 2226-052-05758799-00	Isophthalic	Resin for manufacturing prepregs, premixes and corrosion resistant glass-cloth-base laminates using contact forming and pultrusion methods	4-30	4.0	1.6	15-30	36-40
NPS-9502/38	Isophthalic	Binder for creating corrosion resistant layer of glass-plastic tubes produced using winding method	7-15	4.0	1,6	15-30	37-40
EVS-9133 TU 2226-055-05758799-01	Methacrylated epoxy-diane oligomer	Resin for manufacturing electric insulating and structural glass-cloth-base laminates resistant stable to acid and alkaline media	5-35	8,0	3,2	20-40	33-35
NPS-9119 TU 2226-134-05758799-2008	Terephthalic	Binder for manufacturing corrosion resistant glass-cloth-base laminates and composites	10-30	4,0	1,6	19-26	35-45
NPS-9112 TU2226-095-05758799-2003	Orthophthalic	Resin with low styrene content for manufacturing polymer concrete and artificial stones	4-10	1.4	1.5	40-70	26-29
NPS-9112 «0» (light) TU2226-095-05758799-2003	Orthophthalic	Resin for manufacturing accessories. Colors according to Gardner Scale < 3					
NPS-9177 TU 2257-167-05758799-2010 (accelerated, filled, fire resistant)	Orthophthalic	For manufacturing fire resistant glass-plastic parts using RTM process	18-22	–	1.0	22-26	22-25
NPS-9155-UTG (preaccelerated, thixotropied, fire resistant) TU 2257-160-05758799-2009	Orthophthalic	Bromine containing filled resin for manufacturing fire resistant composite materials. Flammability: category V-0 according to UL 94 standard	15-30	–	1.0	40-60	21-26
Accelerator OK TU 05758799-135-2005	Cobalt octoate solution in styrene	For curing unsaturated polyester resins in the presence of organic peroxides at room temperature	Active cobalt content: 1.2-1.5%, 6.0%, 10.0%.				

NOTE: – Guaranteed shelf life unsaturated polyester resins: 3-4 months

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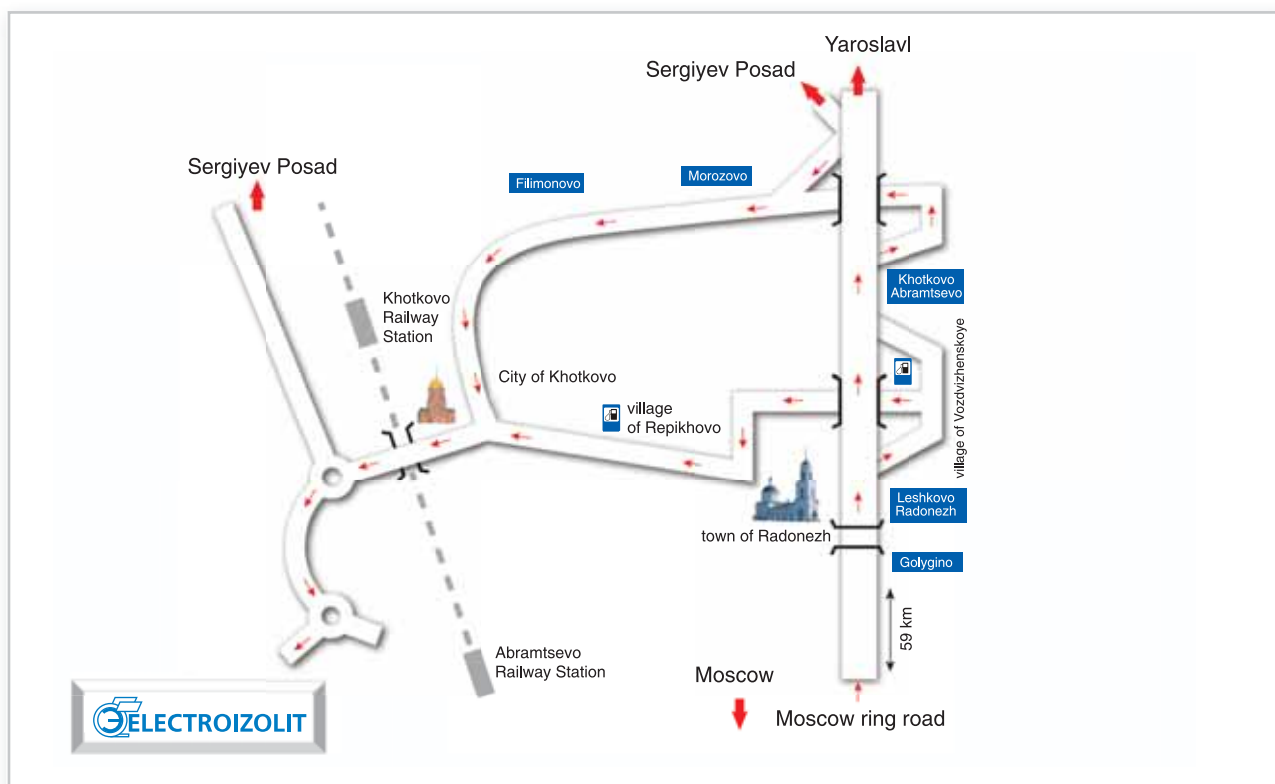
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