

Specification

Electrical Insulating Laminates

Our laminates offer a superior combination of electrical and mechanical properties - properties such as dielectric strength, flame resistance, arc and track resistance, high flexural and impact strength. These fiberglass-reinforced polyester thermoset sheets will not melt under heat and have excellent overall electrical properties.

Among the property advantages of these laminates are:

Electrical Insulation

Insulating laminates have inherently good dielectrics. The various grades of the laminates featured here have been engineered to maximize the specific properties required for a wide range of electrical and electronic applications.

Flame Resistance

Flame resistance meeting UL 94V-0 specifications is available in combination with a variety of properties.

Mechanical Strength

These high-impact fiberglass-reinforced polyester laminates won't shatter. Rigid laminates provide structural support as they insulate. Flexible laminates are available for applications which require a minimum bend radius of $\frac{3}{4}$ " diameter.

Custom Grades

Custom grades of laminates and colors are available. Please contact us for more information.

Grade	Part Number	Temp. Index Electrical/Mechanical	Property Highlights
TSF	1312	130°C/130°C	NEMA GPO-1. Economical, general-purpose laminate.
T-180	1360	160°C/160°C	NEMA GPO-1. High strength, high heat resistance.
UTS	1478 141	130°C/160°C 130°C/130°C	NEMA GPO-2. Highly flame resistant. Meets UL 94V-0.
UTR	1494	130°C/160°C	NEMA GPO-3. UL-recognized. Flame resistant, arc and track resistant.
1580	1580	120°C/140°C	NEMA GPO-3. UL-recognized. Highly flame resistant. Meets UL 94V-0. Combines high arc and track resistance, in thicknesses of .025" to $\frac{3}{32}$ ".
SG-200	1906	210°C/210°C	High heat resistance. Excellent retention of physical and electrical properties at elevated temperatures.
FHT	1800	190°C/190°C ($\frac{1}{32}$ " 200°C/200°C ($\frac{1}{16}$ "	Highly flexible. Excellent dielectric strength. High heat resistance. In $\frac{1}{32}$ " and $\frac{1}{16}$ " thicknesses. For 220°C systems for dry-type transformers.

Laminates Properties - Typical Average Values*

	UNIT	ASTM/ UL Number	Grade TSF	Grade UTS	Grade UTR	Grade 1580	Grade SG-200	Grade FHT	Grade T-160	
General Information										
Part Number	–	–	1312	1478	141	1494	1580	1906	1800	1360
Standard Color	–	–	Brown	Red	Red	Red	White	Natural/Tan	Natural/Cream	White
Mechanical Properties										
NEMA Grade Li 1-1989			GPD-1/GPD-1P	GPD-2/GPD-2P	GPD-2	GPD-3	GPD-3	GPD-1	–	GPD-1
Military Specification	–	–	–	L-P 509/GPD-2	–	–	–	–	–	–
Tensile Strength	Psi	D638	9,400	8,900	8,000	8,000	8,400	12,500	10,500	14,000
Flexural Strength	Psi	D790	22,300	24,600	18,000	22,100	24,600	29,000	–	29,000
Compressive Strength	Psi	D695	38,900	39,000	30,000	33,100	31,200	36,000	14,000	56,000
Shear Strength	Psi	D732	13,400	13,400	14,000	11,600	12,000	11,100	–	–
IZOD Impact Strength (notched)	ft.lb./in.	D256	8	10.7	8.0	8.9	8.9	12	10	12
Water Absorption	% by wt.	D570	0.3	0.6	0.8	0.4	0.2	0.3	1.1	0.3
Specific Gravity	–	D792	1.78	1.8	1.8	1.81	1.83	1.7	1.6	1.9
Electrical Properties										
Electrical Strength – Perpendicular S/T in air	Vpm	D149	417	433	300	450	425	500	450	270
Electrical Strength – Perpendicular S/T in oil	Vpm	D149	493	567	–	584	577	625	570	412
Arc Resistance	Sec.	D495	127	130	130	180	181	120/180**	139	140
IEC Track Resistance (CTI) @ 3 mm thickness	V.	UL746A	600+	600+	600+	600+	500+	500+	500+	–
Dissipation Factor, 60 Hz	–	D150	0.0095	0.011	0.05	0.013	0.011	0.037	0.070	–
Dissipation Factor, MHz	–	D150	0.010	0.010	–	0.010	0.010	0.13	0.033	–
Insulation Resistance	Ohm x 10 ¹²	D257	2.4	270	–	3.1	823	145	–	–
Flame Resistance Properties										
UL Subject 94	–	UL94	HB	VO	VO	> 0.94" VO thickness < 0.93" HB	VO	HB	HB	–
UL Hot Wire Ignition	Sec.	UL746A	–	300+	–	–	300+	0.028 in./35 0.058 in./39	0.028 in./49 0.058 in./102	–
UL High Amp Ignition	# Exposure	UL746A	–	200+	–	–	200+	200+	200+	–
UL Standard 723 Flame Spread	–	E84	–	–	–	–	–	–	–	–
Oxygen Index	%D ₂	D2863	21.8	36	–	35	39	21.8	21.8	–
Ignition Time	Sec.	–	–	81	75	85	84	–	–	–
Burn Time	Sec.	–	–	48	85	49	23	–	–	–
Thermal Properties										
Coefficient of Thermal Expansion	In/In/°C x 10 ⁻⁵	D696	2.2	2	2	2	2	2	2	–
Thermal Conductivity	BTU/HR/Ft ² /In/°F	C177	1.8	1.8	–	1.9	1.9	1.7	1.7	–
UL Temperature Index									0.028 in./190 0.058 in./200	–
– Electrical	°C	UL 746B	130	130	130	130	120	210	0.028 in./190	–
– Mechanical	°C	UL 746B	130	160	130	160	140	210	0.058 in./200	–
UL Recognition File Number	–	–	E23525	E81928	E23525	E81928	E81928	E81928	E81928	–
UL Classification Number	–	–	E23525	E81928	E23525	E81928	E81928	E81928	E81928	–

* Typical average values for testing 0.063" thick material. Values will vary somewhat from thickness with a material grade.

The data within this document is for reference only. Values above are typical for this grade of material.

It is the responsibility of the end user of this information to validate the data in this document. K&E Plastics, Inc. assumes no liability for the use of this data. Users are urged to contact K&E Plastics, Inc. to determine if the Specification has been revised.