Thermoset Materials Data Sheet

Mechanical	ASTM Test Method	G10, FR4 (MIL-I-24768/2, MIL-I-24768/27, MIL-P-18177 GEE, MIL-P 18177 GEE-F, LP-509) Glass Cloth Reinforced Epoxy G10	G5, G9 (MIL-I-24768/5, MIL-I-24768/1, LP-509) Glass Cloth Reinforced Melamine	G7 (MIL-I-24768/17, LP-509) Glass Cloth Reinforced Silicone	G11, FR5 (MIL-I-24768/3, MIL-I-24768/28, MIL-P-18177 GEB, MIL-P-18177 GEB-F, LP-509) Glass Cloth Reinforced Epoxy G11	Grade X Phenolic (MIL-I-24768/12) Paper Phenolic X	Grade XX Phenolic (MIL-I-24768/11) Paper Phenolic XX	Grade XXX Phenolic (MIL-I-24768/10) Paper Phenolic XXX	Grade C and CE Phenolic (MIL-I-24768/16, MIL-P-15035 FBM, MIL-I-24768/14, MIL-P-15035 FBG) Canvas Phenolic	Grade L and LE Phenolic (MIL-I-24768/15, MIL-P-15035 FBI, MIL-I-24768/13, MIL-P-15035 FBE) Linen Phenolic	Units
Strength to Weight Ratio	-	-	-	-	-	-	-	-	-	-	ksi
Specific Gravity @73 F	D792	1.82	1.9	1.68	1.85	1.36	1.34	1.32	1.35	1.34	-
Tensile Strength @73 F, (ult)/(yld)	D638	40,000	37,000	23,000	43,000	20,000	16,000	15,000	9,500	12,500	psi
Tensile Modulus of Elasticity @73 F	D638	-	-	-	-	-	-	-	-	-	psi
Tensile Elongation at Break @73 F	D638	-	-	-	-	-	-	-	-	-	%
Flexural Strength @73 F	D790	55,000	55,000	23,000	75,000	25,000	15,000	13,500	17,000	15,000	psi
Flexural Modulus of Elasticity @73 F	D790	2,700,000	2,500,000	1,400,000	2,700,000	1,800,000	1,400,000	1,300,000	950,000	1,050,000	psi
Shear Strength @73 F	D732	19,000	20,000	17,000	19,000	12,000	11,000	10,000	11,500	11,750	psi
Comprehensive Strength, (% Deformation) @73 F	D695	60,000 (10)	70,000 (10)	45,000 (10)	63,000 (10)	36,000 (10)	34,000 (10)	32,000 (10)	37,000 (10)	37,000 (10)	psi
Comprehensive Modulus of Elasticity @73 F	D695	-	-	-	-	-	-	-	-	-	psi
Hardness, Rockwell, Scale as noted @73 F	D785	M110	M120	M100	M115	M110	M105	M110	M104	M105	-
Hardness, Durometer, Shore D @73 F	D2240	-	-	-	-	-	-	-	-	-	-
Izod Impact, (Notched) @73 F	D256 Type A	7	12	8.5	12	4	1.3	1	3.2/2.3	2.5/1.8	ft-lb/in of notch
Coefficient of Friction, (Dry vs Steel) Dynamic	-	-	-	-	-	-	-	-	-	-	-
Limiting PV, (with 4 to 1 factor of safety applied)	-	-	-	-	-	-	-	-	-	-	psi-ft/min
Thermal	**ASTM Test Method**	**Glass Cloth Reinforced Epoxy G10**	**Glass Cloth Reinforced Melamine**	**Glass Cloth Reinforced Silicone**	**Glass Cloth Reinforced Epoxy G11**	**Paper Phenolic X**	**Paper Phenolic XX**	**Paper Phenolic XXX**	**Canvas Phenolic**	**Linen Phenolic**	**Units**
Coefficient of Linear Thermal Expansion @73 F	E-831 (TMA)	-	-	-	-	-	-	-	-	-	in/in/F
Heat Deflection Temperature @264 psi	D648	-	-	-	-	-	-	-	-	-	F
Tg-Glass transition termperature, (Amorphous)	D3418	-	-	-	-	-	-	-	-	-	F
Melting Point, (VS=Vicat Softening Temp.)	D3418	-	285	-	-	-	-	-	-	-	F
Continuous Service Temperature in Air, (Max.)	-	285	-	465	285	285	285	285	265	265	F
Thermal Conductivity	-	-	-	-	2	-	-	-	-	-	BTU-in / hr-ft2-C
Electric	**ASTM Test Method**	**Glass Cloth Reinforced Epoxy G10**	**Glass Cloth Reinforced Melamine**	**Glass Cloth Reinforced Silicone**	**Glass Cloth Reinforced Epoxy G11**	**Paper Phenolic X**	**Paper Phenolic XX**	**Paper Phenolic XXX**	**Canvas Phenolic**	**Linen Phenolic**	**Units**
Dielectric Strength, Short Term	D149	400	350	350	900	500	500	470	150/360	150/360	Volts/mil
Volume Resistivity	D257	-	-	-	-	-	-	-	-	-	ohm-cm
Dielectric Constant @10E6 Hz	D150	5.2	7.1	4.2	4.5	6	5.5	5.3	-, 5.8	-, 5.8	-
Dissipation Factor @10E6 Hz	D150	0.025	0.017	0.003	0.022	0.06	0.045	0.038	0.10, 0.055	0.10, 0.055	-
Flammability @3.1 mm unless noted	UL94	V-0	V-0	V-0	HB	HB	HB	HB	HB	-	-
H2O	**ASTM Test Method**	**Glass Cloth Reinforced Epoxy G10**	**Glass Cloth Reinforced Melamine**	**Glass Cloth Reinforced Silicone**	**Glass Cloth Reinforced Epoxy G11**	**Paper Phenolic X**	**Paper Phenolic XX**	**Paper Phenolic XXX**	**Canvas Phenolic**	**Linen Phenolic**	**Units**
Water Absorption, Immersion, 24 hours	D570(7)	0.1	0.4	0.15	0.1	1.1	0.55	0.45	1.2, 0.75	0.9, 0.7	% by weight
Water Absorption, Saturation	D570(7)	-	-	-	-	-	-	-	-	-	% by weight