

Composite Plastics

	X	XP	XX	XXX	CE	LE	G-7	G-9	G-10	G-11
Base Material	Paper	Paper	Paper	Paper	Cotton Fabric	Fine-weave Cotton	Glass Fabric	Glass Fabric	Glass Fabric	Glass Fabric
Resin	Phenolic	Phenolic	Phenolic	Phenolic	Phenolic	Phenolic	Silicone	Melamine	Epoxy	Epoxy
Military specification			MIL-P-3115	MIL-P-3115	MIL-P-15035	MIL-P-15035	MIL-P-997	MIL-P-15037	MIL-P-18177	MIL-P-18177
MIL-spec type	.....	.....	PBG	PBE	FBG	FBE	GSG	GME	GEE	GEB
Tensile strength										
Lengthwise	20,000	12,000	16,000	15,000	12,000	13,500	23,000	50,000	45,000	45,000
Crosswise	16,000	9,000	13,000	12,000	9,000	9,500	18,500	40,000	40,000	40,000
Compressive strength (psi)										
Flatwise	36,000	25,000	34,000	32,000	39,000	37,000	45,000	75,000	60,000	60,000
Edgewise	19,000	.....	23,000	25,000	24,500	25,000	14,000	35,000	.....	.....
Flexural strength, min for 1/8 - in specimen (psi)										
Lengthwise	25,000	14,000	15,000	13,500	17,000	15,000	20,000	55,000	50,000	50,000
Crosswise	22,000	12,000	14,000	11,800	14,000	13,500	18,000	35,000	40,000	40,000
Modulus of elasticity, flexural										
Lengthwise	1,800 m	1,200 m	1,400 m	1,300 m	900 m	1,000 m	1,400 m	1,700 m	.....	.....
Crosswise	1,300 m	900 m	1,100 m	1,000 m	800 m	850 m	1,200 m	1,500m	.....	.....
Shear strength (psi)	12,000	8,000	11,000	10,000	11,000	11,500	17,000	25,000	19,000	19,000
Izod impact, min (ft-lb per in. of notch)										
Flatwise	0.55	.....	0.40	0.40	1.6	1.3	6.5	13.0	7.0	7.0
Edgewise	0.50	.....	0.35	0.35	1.4	1.0	5.5	8.0	5.5	5.5
Hardness, Rockwell (M - scale)	110	95	105	110	105	105	100	120	110	110
Specific gravity	1.36	1.33	1.34	1.32	1.33	1.33	1.68	1.90	1.82	1.82
Coefficient of thermal expansion (per deg C)	2×10^{-5}	2×10^{-5}	2×10^{-5}	2×10^{-5}	2×10^{-5}	2×10^{-5}	.....	1×10^{-5}	.....	.....
Water absorption, max in 24 hr (%)										
1/16 in	6.00	3.60	2.00	1.40	2.20	1.95	0.55	0.80	0.35	0.35
1/2 in.	1.10	.....	0.55	0.45	0.75	0.70	0.20	0.40	0.10	0.10
Dielectric strength, perpendicular to lamination, short-time test (v/mil)										
1/16 in	700	650	700	650	500	500	400	400	500	500
1/8 in.	500	470	500	470	360	360	350	350	.....	.....
Dissipation factor, max 1 mc, ASTM D-150, Condition A	0.06	0.06	0.045	0.038	0.055	0.055	0.003	0.020	0.025	0.025
Dielectric constant, max 1 mc, ASTM D-150, Condition A	6.0	6.0	5.5	5.3	5.5	5.8	4.2	7.5	5.2	5.2
Insulation resistance, 96 hr, 90 percent RH, 95 (megohms)	.....	.....	60	1000	.....	30	2500	100	200,000	200,000
Bonding strength, min (lb)	700	1000	800	950	1800	1600	650	1700	2000	1600
Thermal conductivity (cal-cm/sec-sq cm-deg C)	7×10^{-4}	7×10^{-4}	7×10^{-4}	7×10^{-4}	7×10^{-4}	7×10^{-4}	7×10^{-4}	7×10^{-4}	.....	.....
Maximum operating temp. °F.	285	285	285	285	265	265	465	285	285	300

Machine Design, June 16, 1966

