Product Description

Acculam® Epoxyglas G10/ FR4, is a laminate sheet comprised of a flame retardant epoxy resin and a woven fiberglass substrate. This grade qualifies to NEMA FR4 and MIL-I-24768/27.

Typical Applications

This material has high mechanical strength and excellent electrical insulating qualities in both dry and humid conditions. These attributes along with good fabricating characteristics allow this grade to be used in a wide variety of electrical and mechanical applications.

Typical Properties	Typical Value	Units
Physical Data		
Specific Gravity/Density	1.85	g/cm³
Water Absorption -.125"	< .10	%
Temperature Index	140 \ 284	°C \ °F
Rockwell Hardness	110	M scale
Bond Strength	> 2,200 \ 1,000	lbs \ kgs
Flexural Strength-LW-A-.125"	> 65,000 \ 448	PSI \ MPa
Flexural Strength-CW-A-.125"	> 50,000 \ 345	PSI \ MPa
Izod Impact Strength-LW	> 10	ft-lbs/in
Izod Impact Strength-CW	> 8	ft-lbs/in
Compressive Strength-Flatwise	> 60,000 \ 415	PSI \ MPa
Electrical Data		
Dielectric Breakdown-A	> 50	kV
Dielectric Breakdown-D48/50	> 50	kV
Permittivity-A	4.8	
Permativity-D24/23	4.8	
Dissipation Factor-A	0.017	
Dissipation Factor-D24/23	0.018	

Accurate Plastics, Inc. ~ Sheet Comparative Data Chart

THERMOSET INDUSTRIAL LAMINATE PROPERTIES
Engineering Values (MIN unless noted)

Properties	Nema Grades	G10, FR4	G10	G11, FR5	G11	G3	G5, G9	G7	GPO 1	GPO 3	X	XX	XXX	C, CE	L, LE
	reinforcements	glass cloth	glass cloth non FR	glass cloth	glass cloth non FR	glass cloth	glass cloth	glass cloth	glass mat	glass mat	paper	paper	paper	canvas	linen
	resin binders	epoxy	epoxy	epoxy HT	epoxy HT	phenolic	melamine	silicone	polyester	polyester	phenolic	phenolic	phenolic	phenolic	phenolic
Tensile Strength															
lengthwise, PSI		40,000	40,000	40,000	40,000	23,000	37,000	23,000	8,000	8,000	20,000	16,000	15,000	9,000	12,500
crosswise, PSI		35,000	35,000	35,000	35,000	20,000	30,000	18,000	----	----	16,000	13,000	12,000	7,000	8,750
Compressive Strength															
flatwise, PSI		60,000	68,000	60,000	60,000	50,000	70,000	45,000	30,000	30,000	36,000	34,000	32,000	39,000	37,000
edgewise, PSI		35,000	35,000	35,000	35,000	17,500	25,000	14,000	----	----	19,000	23,000	25,500	24,500	25,000
Flexural Strength - .125"															
lengthwise, PSI		55,000	55,000	55,000	55,000	20,000	55,000	20,000	18,000	18,000	25,000	15,000	13,500	17,000	16,500
crosswise, PSI		45,000	45,000	45,000	45,000	18,000	35,000	18,000	----	----	22,000	14,000	11,800	16,000	14,000
Modulus of Elasticity - Flexural															
lengthwise, kPSI		2,700	2,700	2,800	2,800	1,500	2,500	1,400	1,200	1,200	1,800	1,400	1,300	1,000	1,000
crosswise, kPSI		2,200	2,200	2,300	2,300	1,200	2,200	1,200	1,000	1,000	1,300	1,100	1,100	900	850
IZOD Impact															
lengthwise, ft-lb/in of notch		7.0	7.0	7.0	7.0	6.5	7.0	6.5	8	8	0.55	0.40	0.40	2.1 / 1.6	1.35 /1.25
crosswise, ft-lb/in of notch		5.5	5.5	5.5	5.5	5.5	5.5	5.5	----	----	0.50	0.35	0.35	1.9 / 1.4	1.1/ 1.0
Rockwell Hardness M scale		110	111	114	112	100	120	100	100	100	110	105	110	104	105
Specific Gravity		1.85	1.80	1.85	1.80	1.65	1.90	1.68	1.80	1.85	1.36	1.34	1.32	1.36	1.34
Bond Strength, in lbs.		2,000	2,000	1,600	1,600	850	1,700	650	850	850	700	800	950	1,800	1,600
Coefficient of Thermal Expansion cm/cm-°C X 10^{-5}		1.0	0.9	1.0	0.9	1.8	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Water Absorption															
.062" thick, % per 24 hrs		0.25	0.25	0.25	0.25	2.70	0.80	0.55	1.00	0.60	6.00	2.00	1.40	4.4 / 2.2	2.5 / 1.95
.125" thick, % per 24 hrs		0.15	0.15	0.15	0.15	2.00	0.70	0.35	0.70	0.50	3.30	1.30	0.95	2.5 / 1.6	1.6 / 1.3
.500" thick, % per 24 hrs		0.10	0.10	0.10	0.10	1.50	0.40	0.20	0.35	0.25	1.10	0.55	0.45	1.2 / .75	0.9 / 0.7
Dielectric Strength, volt/mil perpendicular to laminations; Step by Step															
.062" thick		450	450	450	450	500	350	350	370	400	500	500	450	300	300
.125" thick		350	350	350	350	450	275	250	----	----	360	360	320	220	220
Dissipation Factor condition A, 1 megacycle-max		0.025	0.025	0.025	0.025	--	0.017	0.003	0.03	0.03	----	0.045	0.038	----	0.055
Dielectric Constant condition A, 1 megacycle-max		5.2	5.2	5.2	5.2	----	7.80/7.20	4.2	4.3	4.3	----	----	----	----	----
Insulation Resistance Megaohms at Condition C		200,000	200,000	200,000	200,000	----	10,000	100,000	----	----	----	60	1000	----	----
Arc Resistance - Sec.		----	----	----	----	----	180	180	100	150	----	----	----	----	----
Temp Index .062" and over		130	130	170	170	140	---	170		120	130	140	140	115	115
Electrical - °C		140	140	180	180	170	140	220		140	130	140	140	125	125
Mechanical - °C															
Mil-I-24768		27	2	28	3	18	8 / 1	17	4	6	12	11	10	16, 14	15, 13
MIL - Type		GEE-F	GEE	GEB-F	GEB	GPG	GMG/GME	GSG	GPO N-1	GPO N-2	PBM	PBG	PBE	FBM/FBG	FBI/FBE