HANNA RUBBER COMPANY

Specification Sheet

G-10/FR4 Sheets

G-10/FR-4 is a thermosetting industrial laminate consisting of a continuous filament glass cloth material with an epoxy resin binder. It has characteristics of high strength, excellent electrical properties and chemical resistance not only at room temperature but also under humid or moist conditions.

- aka G10/FR4, G-10/FR4, FR4 Glass-Epoxy Laminate Sheets
- G-10/FR-4 glass epoxy laminate meets the specifications of Mil-I-24768/27
- G-10 & FR-4 also meet LP 509 & MIL P 18177 Type GEE
- **Maximum Continuous Operating Temperature:** 285°F

Features and Benefits

- Dimensional stability
- Outstanding insulating properties
- Moisture resistant
- Tremendous electrical properties
- Meets Mil-I-24768/27 (GEE-F)
- aka G10/FR4, G-10/FR4, FR4 glass-epoxy laminate sheets

Properties	NEMA grade reinforcement~ resin binder	G-10/FR4 glass~ epoxies	X paper~ phenolic	C, CE canvas~ phenolic	L, LE linen~ phenolic
Tensile Strength					
lengthwise, PSI		40,000	20,000	9,500	12,500
crosswise, PSI		35,000	16,000	7,500	8,750
Compressive Strength					
flatwise, PSI		60,000	36,000	37,000	37,000
edgewise, PSI		35,000	19,000	23,500	25,000
Flexural Strength					
lengthwise, PSI		55,000	25,000	17,000	15,000
crosswise, PSI		45,000	22,000	15,000	13,750

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Website:
www.hannarubber.com

Properties	NEMA grade reinforcement~ resin binder	FR4 glass~ epoxies	X paper~ phenolic	C, CE canvas phenolic	L, LE linen~ phenolic
Modulus of Elasticity in flex					
lengthwise, PSI x 10^6		2.7	1.8	.95	1.05
crosswise, PSI x 10^6		2.2	1.3	.85	.85
Shear Strength, PSI		19,000	12,000	11,500	11,750
IZOD Impact					
flatwise, ft lb per inch of notch		7	4	3.2, 2.3	2.5, 1.8
edgewise, ft lb per inch of notch		5.5	0.5	1.9, 1.4	1.1, 1
Rockwell Hardness M scale		110	110	104	105
Specific Gravity		1.82	1.36	1.35	1.34
Coefficient of Thermal Expansion					
cm/cm/ deg C x 10^{-5}		.9	6	2	2

Properties	NEMA grade reinforcement~ resin binder	FR4 glass~ epoxies	X paper~ phenolic	C, CE canvas phenolic	L, LE linen~ phenolic
Water Absorption					
.062" thick, % per 24 hrs		0.25	6	4.4, 2.2	2.5, 1.95
.125" thick, % per 24 hrs		0.15	3.3	2.5, 1.6	1.6, 1.3
.500" thick, % per 24 hrs		0.10	1.1	1.2, 0.75	0.9, 0.7
Dielectric Strength, volt/mil					
perpendicular to laminations; short					
.062" thick		500	700	200\500	200\500
.125" thick		400	500	150\360	150\360
Dissipation Factor					
condition A, 1 megacycle		0.025	0.06	0.1, .055	0.1, .055
Dielectric Constant					
condition A, 1 megacycle		5.2	6	- , 5.8	- , 5.8

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Insulation Resistance					
Condition: 96 hours at 90% relative humidity (in mega ohms)		200,000			
Flame Resistance					
Underwriter Labs, Classification		94V-0	94HB	94HB	94HB
Bond Strength, in lbs		2,000	700	1,800	1,600
Max Continuous Operating Temperature					
Approximate degrees F		285	285	265	265
Sheet Mil Spec: Mil-I-24768 / _ _		27	12	14	13
Types		GEE-F	PBM	FBG	FBE

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