

Specification

NEMA: FR-4

U.L. LISTED: N

DESCRIPTION: NEMA FR-4 is a woven glass fabric combined with halogenated epoxy resin system. It is produced to printed circuit board quality standards. It is flame retardant, and meets the requirements of MIL-I-24768/27, Type GEE-F.

TYPICAL PROPERTIES

		UNITS	VALUE		
			Thickness Tested		
			0.0625"	0.125"	0.500"
PHYSICAL PROPERTIES					
Specific Gravity <i>(ASTM D792)</i>		-			1.80
Rockwell Hardness <i>(ASTM D785)</i>	0.250" Build-up	M Scale	100		
Moisture Absorption <i>(ASTM D570)</i>	Condition A	%	0.10		
Flexural Strength <i>(ASTM D790)</i>	Condition A LW / CW	psi <i>(Mpa)</i>	80,000 / 60,000 <i>(551.6) / (413.7)</i>		
Flexural Modulus <i>(ASTM D790)</i>	Condition A LW / CW	kpsi <i>(Gpa)</i>	2,700 / 2,400 <i>(18.6) / (16.5)</i>		
Tensile Strength <i>(ASTM D638)</i>	Condition A LW / CW	psi <i>(Mpa)</i>		50,000 / 40,000 <i>(344.7) / (275.8)</i>	
Izod Impact Strength <i>(ASTM D256)</i>	Condition A LW / CW	ft-lb/in <i>(J/cm)</i>			
	Condition E-48/50 LW / CW	ft-lb/in <i>(J/cm)</i>			15.00 / 12.00 <i>(8.01) / (6.41)</i>
Compressive Strength <i>(ASTM D695)</i>	Condition A Flatwise	psi <i>(Mpa)</i>			70,000 <i>(482.6)</i>
Bonding Strength <i>(ASTM D229)</i>	Condition A	lb <i>(kg)</i>			2,200 <i>(997.9)</i>
Shear Strength <i>(ASTM D732)</i>	Condition A Perpendicular	psi <i>(Mpa)</i>	22,000 <i>(151.7)</i>		

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TYPICAL PROPERTIES (continued)

	UNITS	VALUE		
		Thickness Tested		
		0.0625"	0.125"	0.500"
THERMAL PROPERTIES				
Temperature Index ¹ <i>(UL Bulletin 746b)</i> Electrical / Mechanical	°C	130 / 140		
Coefficient of Thermal Expansion <i>(IPC-TM 650-2.4.24)</i> X-axis / Y-axis	" / °C x10 ⁻⁶	10.0 / 12.0		
Tg by DMA	°C	127		
Flammability Vertical Condition A <i>(UL Bulletin 94)</i>	Class	V-0		
ELECTRICAL PROPERTIES				
Dissipation Factor @ 1 MHz <i>(ASTM D150)</i> Condition A	-			
	Condition D-24/23	-	0.025	
Relative Permittivity @ 1 MHz <i>(ASTM D150)</i> Condition A	-			
	Condition D-24/23	-	4.80	
Breakdown Voltage <i>(ASTM D149)</i> Condition A	kVolts	65		
	Condition D-48/50	kVolts	54	
Electric Strength <i>(ASTM D149)</i> Condition A	Volts/mil <i>(kV/cm)</i>	670 <i>(263.8)</i>		
	Condition D-48/50	Volts/mil <i>(kV/cm)</i>	650 <i>(255.9)</i>	
Arc Resistance <i>(ASTM D495)</i> Condition A	sec	120		
Comparative Tracking Index <i>(ASTM D3638)</i>	Volts	150		

¹ This temperature is a recommendation only, and based upon experience in various applications. The maximum operating temperature is dependent upon the application and should be investigated prior to use.

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.