

TECHNICAL DATA SHEET

FR-4

FR-4 glass epoxy is a popular and versatile high-pressure thermoset plastic laminate with good strength to weight ratio. With near zero water absorption, FR-4 is most commonly used as an electrical insulator possessing considerable mechanical strength. "FR" is an abbreviation for Flame Retardant, and Type "4" indicates woven glass reinforced epoxy resin. The material is known to retain its high mechanical values and electrical insulating qualities in both dry and humid conditions. These attributes, along with good fabrication characteristics offer many options for a wide variety of electrical and mechanical applications.

Benefits

Electrically insulative
 Can be fabricated
 Good strength to weight ratio
 Near zero water absorption

Applications

Printed circuit boards (PCB)
 Electrical insulation
 Relays
 Switches
 Standoffs
 Busbars

SHAPES AVAILABLE



FR-4 Glass Epoxy Technical Product Information

Property	Units	Value	Condition
Tg, min. (DSC)	°C	135	
CTE x-axis	ppm/°C	14	Ambient to Tg
CTE y-axis	ppm/°C	13	Ambient to Tg
CTE z-axis	ppm/°C	175	Ambient to 288 °C
Solder Float, 288 °C	seconds	>120	Condition A

Electrical Properties

Property	Units	Value	Condition
Permittivity (DK) max.		4.7	C-24/23/50
@ 500 Mhz		4.35	
@1 GHz (HP4291)		4.34	
Loss Tangent (DF), max. @			
1 MHz (2 Fluid Cell)		0.020	
500 Mhz		0.017	
1 GHz (2 Fluid Cell)		0.016	
Surface Resistivity, min.	megohms	2 X 10 ⁵	Condition F
		1 X 10 ⁸	E-24/125
Volume Resistivity, min.	min.	8 X 10 ⁷	Condition F
	megohm-cm	2 X 10 ⁷	E-24/125
Dielectric Breakdown, min	kV	55	D-48/50
Arc Resistance, min.	seconds	100	

Physical Properties

Property	Units	Value	Condition
Peel Strength, 1 oz.	lb./in.	9.0	Condition A
		9.0	After Thermal Stress
		9.0	E-1/125
Flexural Strength - LW	psi	80000	Condition A
Flexural Strength - CW	psi	60000	Condition A
Warp & Twist	%	0.5	Condition
Flammability		V-0	UL94
Moisture Absorption	%	< 0.25	D-24/23
Tensile Strength - LW	psi	50000	Condition A
Tensile Strength - CW	psi	40000	Condition A
Tensile Modulus (Young's) - LW	psi	3.5 X 10 ⁶	Condition A
Tensile Modulus (Young's) - CW	psi	3.0 X 10 ⁶	Condition A
Flexural Modulus (Taylor's) - LW	psi	2.7 X 10 ⁶	Condition A
Flexural Modulus (Taylor's) - CW	psi	2.4 X 10 ⁶	Condition A
Poisson's Ratio - LW		0.136	Condition A
Poisson's Ratio - CW		0.118	Condition A

NOTE: The information contained herein are typical values intended for reference and comparison purposes only. They should NOT be used as a basis for design specifications or quality control. Contact us for manufacturers' complete material property datasheets. All values at 73°F (23°C) unless otherwise noted.

Epoxy Glass Laminated Sheets (Fibre Glass Sheets)

Epoxy Glass Sheets are manufactured from non- modified epoxy resin and specially treated fibre glass cloth suitable for use at elevated temperature.

Epoxy Glass Sheets are laminated under controlled heat and specified hydraulic pressure to give a compact laminate which is characterized by high dielectric strength, excellent mechanical and thermal properties and good flexural strength “Specific” Epoxy Sheets are resistant to weathering, humidity and many chemicals. These Epoxy Glass Sheets have low thermal conductivity and excellent fire retardant properties.

Due to good merchantability combined mechanical strength of Epoxy Glass sheets, it is suited for wedging applications. Epoxy Glass Sheets are also machined to demanding tolerances and have **found application in**

- Electro-magnets as interlayer insulation;
- Switchgears as terminal plates;
- Separators for air blast tubes and air chambers with numerous linkages;
- Connection rods and leavers.
- Epoxy Glass Laminated Sheets Rods / tubes are widely used as rod bolts in transformers-stacks, capacitors, transformers, mounting rods and circuit breaker shafts.

Epoxy glass Sheets are generally available in **standard sizes** of: 1000mm x 1000mm in thickness from 0.25mm onwards

Special Sizes upto a Maximum of :1600mm x 1250mm can be manufactured upon request.

Typical values of 3mm (1/8 inch) thick Epoxy glass Sheet.

Properties	Unit	Value
Dielectric Parallel to lamination	KV/MM	42
Perpendicular to lamination		16
Compressive Strength	N/Sq.mm	350
Dielectric Constant (max.)		5.2
Tensile Strength	N/Sq.mm	250
Shear Strength	N/Sq.mm	100
Thermal Class		F
Specific Gravity		1.8 ± 1
Water Absorption (max)	%	0.15