

ISOVAL[®] FR4 NEMA

ISOVAL[®] FR4 NEMA is in accordance with the following international standards:

NEMA LI:	G-10
	FR-4
MIL-I-24768/27	GEE-F
IEC 60893:	EP GC 202

Composition

ISOVAL[®] FR4 NEMA is an epoxy glass laminate. The epoxy resin system has a glass transition of approx. 108°C, midpoint value measured by DSC method.

Application

ISOVAL[®] FR4 NEMA is used for electrical and electronic insulation where low moisture absorption and high physical strength is needed. Not recommended for wear applications.

Availability

Thickness:	0,01 – 4,125" Thickness tolerance acc. NEMA L1	0,25 – 104,78 mm Thickness tolerance acc. IEC 60893
Standard sheet size:	125" ±0,6" x 48" ±0,6" (up to 2" thickness) 110" ±0,6" x 48" ±0,6" 36" ±0,6" x 48" ±0,6"	3180 ±10 x 1220 +15/-0 mm (up to 50mm thickness) 2800±10 x 1220 +15/-0 mm 930 +0/-15 x 1220 +15/-0 mm (in pairs of 3 laminates)
Colour:	green.	

Machined parts and cuttings, other sheet sizes and thicknesses are also available upon request.

Machining Recommendation

Due to the strength and hardness of the laminate and the high glass content, the tools used can be subject to a great degree of abrasion. We therefore advise that only diamond carbide tipped tools and high-speed machinery are used.

All information given here is based on currently available facts and on the results of experiments performed with all due care in our laboratories. It does not in any way reduce the responsibility of the user for carrying out further tests in order to ensure successful processing and use in specific applications.

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TECHNICAL DATA

Values in the table are mean values of our production. Values according to the standards are guaranteed.

Properties	Norm	Unit	Value
Minimum breakdown voltage at 90°C in oil parallel to laminations	D229	kV	
- A condition			45
- D-48/50			40
Maximum dissipation factor at 1MHz, 0.188" 3,0 mm	D229	-	
- A condition			0.025
- D-24/23			0.035
Maximum permittivity at 1MHz, 0.188" 3,0 mm	D229	-	
- A condition			5.2
- D-24/23			5.4
Min. Flexural strength, 0.5" 12,7 mm	D229	ksi	
- lengthwise / crosswise			45 / 35
Minimum bonding strength, 0.5" 12,7 mm	D229	lb	
- A condition			2000
- D-48/50			1600
Max. water absorption, 0.5" 12,7 mm	D229	%	0.10
Flammability	UL94	class	
- Thickness 0.031 - 0.118" 0,8 - 3,0 mm			V-1
- Thickness ≥ 0.118" ≥ 3,0 mm			V-0
Minimum Izod impact strength, 0.5" 12,7 mm	D229	Ft-lb/in (notch)	7 / 5.5
- E-48/50: lengthwise /crosswise			
Flexural strength	ISO 178	MPa	400
Charpy impact strength or Izod impact strength parallel to laminations	ISO 179	kJ/m ²	42
Electric strength at 90°C in oil perpendicular to laminations (3 mm)	IEC 243	kV/mm	10,2
Breakdown voltage at 90°C in oil parallel to laminations	IEC 243	kV	45
Insulation resistance after immersion in water	IEC 167	MΩ	5 x 10 ⁴
Density	ISO 1183/A	g/cm ³	approx. 2,0
Tensile strength	ISO 527	MPa	320
Compressive strength			
- parallel to laminations	ISO 604	MPa	250
- perpendicular to laminations			500
Comparative tracking index	IEC 60112	-	CTI 200
Thermal endurance	IEC 60216	TI	140 (mechanical)

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