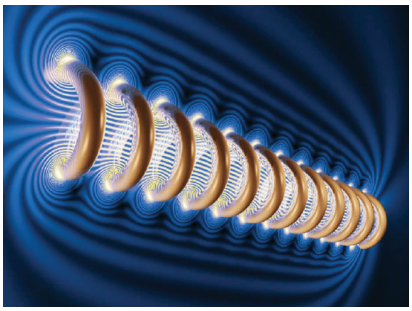
THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

Rigid Composite Electrical Insulators for Fusion Energy Applications

Insulating composite materials are uniquely suited for withstanding the large mechanical stresses and extreme temperature environments associated with magnetic fields in fusion energy generation. In particular, the growing popularity of easy-to-manufacture electromagnets for commercially-viable fusion generators makes material selection for these crucial composite materials vital for scientists and engineers to understand.

The Gund Company is a custom composites manufacturer that is a leading industry expert in engineered high pressure laminate composites such as NEMA G-10, FR-4, G-11, and now G-15.



NEMA G-10, and its flame-retardant version FR-4, is a strong, durable, and versatile insulating composite material known for its exceptional electrical properties, chemical resistance, and resistance to heat. The high modulus of elasticity and tensile strength of G-10/FR-4 have been proven to withstand mechanical stresses in high voltage applications without degradation making it an ideal choice for many structural and insulating applications in fusion energy generators.

NEMA G-15 by The Gund Company is a next-gen thermoset composite made of woven fiberglass and a unique blend of high-temperature resin binders designed for applications that demand superior performance at elevated temperatures. It maintains a high percentage of mechanical and insulating properties up to 500F allowing it to offer extended application capability beyond typical NEMA grades. G-15 by The Gund Company is a high-temperature high-performance composite ideal for the electromagnetic confinement in fusion generators.

The Gund Company works directly with engineers to design customized solutions for a wide range of critical applications, from next-gen composite materials to specialty molded shapes for extreme heat and mechanical conditions to fit the nuclear energy industry's needs.

Key Characteristics	Test Method	Units	NEMA FR4	NEMA G-12	NEMA G-15
Specific Gravity	--		1.85	1.9	1.81
Water Absorption (0.125")	ASTM D-570	%	0.1	0.01	< 0.6
Operating Temperatue	UL 746-B	°C (°F)	130 (266)	180 (356)	250 (482)
Peak Temperatue			--	--	280 (536)
Flexural Strength LW	ASTM D-790	ksi (Mpa)	80 (552)	70 (486)	> 60 (414)
Flexural Strength CW			70 (483)	62 (425)	> 60 (414)
IZOD Impact Strength LW	ASTM D-229	ft -lb / in	13	11	> 17
IZOD Impact Strength CW			12	10	> 14
Compressive Strength, Flatwise	ASTM D-695	ksi (Mpa)	66 (455)	70(483)	> 60 (414)
Shear Strength (0.125"), A	ASTM D-732	ksi (Mpa)	22 (148)	--	> 20 (138)
Dielectric Breakdown	ASTM D-149	kV	66	50	65
Dielectric Strength	ASTM D-149	V/mil	635	485	> 450
Arc Resistance	ASTM D-495	Seconds	140	--	> 180
Flame Rating	UL94	Class	V-0	V-0[1]	V-0
Thermal Conductivity (23°C)	ASTM E-1461	W/m°C	--	10	0.32
Thermal Expansion (110°C)	ASTM E-228	10^{-6}/°C	15	--	--

[1]G-12 from The Gund Company is V-0 at 0.25" and greater thickness. Below this thickness is HB.

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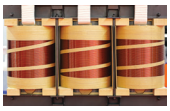
Markets


Electric Vehicles


Electric Motors


Power Generators


Transformers


Switchgear


Electronics


Military/Aerospace


Communications/5G


Medical

Our Expertise Is Your Competitive Advantage

We provide a wide range of material solutions from rigid, glass epoxy composites to high-temperature, silicone sponge.

We take a consultative approach to understanding your application and work with your engineers and buyers to find the material that fits your application. By understanding the most important material properties, we can work to find cost reduction opportunities. Our Application Engineering Teams have decades of material experience and look forward to working with you on your upcoming project.

Material Families:

- **Thermoset Rigid Laminates and Composites**
- **Flexible Laminates, Papers, Films, and Felts**
- **Thermoplastic Materials**
- **Elastomeric Materials**

Our Engineering Capabilities Include:

- **Custom Material Development**
- **Resin Formulation**
- **Laboratory Testing**
- **Comparative Materials Evaluation**

Our Manufacturing Capabilities Include:

- **Compression Molding**
- **Pultrusion**
- **Filament & Convolute Wound Tube**
- **Infusion & B-Stage Composites Lay-up and Molding**
- **Injection Molding**
- **Extrusion of Thermoplastics**

Global Footprint – Local Service