

TECHNICAL DATA SHEET (TDS)

G10 / FR4 Epoxy Glass

PRODUCT IDENTIFICATION

- **Product Name:** G10 / FR4 Epoxy Glass
- **Material Type:** Woven Glass Cloth Reinforced Epoxy Resin
- **Details:**
 - **Company:** MISCO Australia
 - **Address:** 89-91 Licola Crescent, Dandenong South, VIC 3175
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 - **Website:** www.misco.net.au
- **TDS Number:** MISCO – TDS - 007
- **TDS Date:** 01/12/2024
- TDS Version: 1

PRODUCT DESCRIPTION G10 / FR4 Epoxy Glass Sheet is a high-performance glass-reinforced epoxy material designed for electrical insulation and mechanical stability. The FR4 variant includes a flame-retardant additive, making it suitable for applications requiring UL 94 V-0 certification. These materials offer excellent electrical properties, resistance to moisture, and durability across a wide temperature range. FR4 variant is manufactured using a halogen-free flame-retardant system. Complies with UL 94 V-0 under UL File E344098 and meets IEC 61249-2-21 halogen-free requirements.

NEMA GRADE

NEMA Grade: NEMA Grade: G10 / FR4 (ANSI/NEMA FR-4)

CLASS

Class: Class: E (IEC 60085) – Electrical Insulating Rigid Material

MILITARY SPECIFICATIONS AND TYPE

Complies with MIL-I-24768/2 (G10) and MIL-I-24768/27 (FR4)

KEY PROPERTIES

- High dielectric strength and electrical insulation
- Flame retardant (FR4 = UL 94 V-0)
- Strong mechanical performance (flexural, tensile, compressive)
- Low moisture absorption
- Good dimensional and thermal stability
- Machinable and bondable

APPLICATIONS

- Printed Circuit Boards (FR4)
- Transformer insulation panels and structural components
- Aerospace and defence electronics
- Switchgear and switchboard insulation
- High-voltage barrier and support panels
- Industrial control systems and automation

SPECIFICATIONS

Product Form: Sheet, CNC parts, blanks

Standard Colours: Green (Natural), custom on request

Sheet Sizes: 1020 x 1220 mm (others available)

Rod Diameters: Available upon request

Tube Dimensions: Not standard (contact for FR4 tube options)

Thickness Range: 0.3 mm to 50 mm.

Compliance: RoHS, REACH, UL 94, Halogen-Free.

Manufactured to: NEMA, IEC, ASTM standards.

UL File: E344098 – Certified under UL 94 V-0 flame classification for FR-4 epoxy glass material (complies with ANSI/NEMA FR-4 and MIL-I-24768/27, HC-FR-4 type)

TOLERANCES ON SHEET THICKNESS

Nominal Thickness (mm)	Tolerance (\pm mm)
0.3 – 1.5	\pm 0.10
1.6 – 3.0	\pm 0.15
3.1 – 6.0	\pm 0.20
6.1 – 12.0	\pm 0.30
12.1 – 25.0	\pm 0.50
25.1 – 50.0	\pm 0.75

Note: Tolerances apply to standard flat sheets. Closer tolerances or calibration services may be available on request.

MECHANICAL PROPERTIES

Property	Test Method	Typical Value
Density	ASTM D792	\sim 1.8 g/cm ³
Flexural Strength	ASTM D790	\geq 400 MPa
Compressive Strength	ASTM D695	\geq 450 MPa
Tensile Strength	ASTM D638	\geq 250 MPa
Shear Strength	ASTM D732	\geq 130 MPa
Impact Strength (Notched Izod)	ASTM D256	\geq 90 kJ/m ²
Rockwell Hardness	ASTM D785	M Scale \geq 100
Modulus of Elasticity	ASTM D790	\sim 17,000 MPa (typical)

ELECTRICAL PROPERTIES

Property	Test Method	Typical Value
Dielectric Strength	ASTM D149	≥ 18 kV/mm
Dielectric Constant (1 MHz)	ASTM D150	~4.6
Dissipation Factor (1 MHz)	ASTM D150	≤ 0.02
Volume Resistivity	ASTM D257	≥ 10 ¹² Ω·cm
Surface Resistivity	ASTM D257	≥ 10 ¹² Ω/sq
Arc Resistance	ASTM D495	≥ 180 seconds (typical)
Comparative Tracking Index (CTI)	IEC 60112	≥ 175 (G10) / ≥ 250 (FR4 typical)

THERMAL PROPERTIES

Property	Test Method	Typical Value
Thermal Conductivity	ASTM E1530	~0.29 W/m·K
Glass Transition Temperature (T _g)	ASTM E1545	≥ 130°C
Continuous Operating Temperature	—	-50°C to +140°C
Short-Term Peak Temperature	—	~160°C (application-dependent)
Coefficient of Thermal Expansion	ASTM E831	~10 × 10 ⁻⁶ /°C
Flammability Rating (FR4 only)	UL 94	V-0

CHEMICAL RESISTANCE

G10 / FR4 exhibits excellent resistance to a broad range of industrial chemicals in both electrical and mechanical service environments.

- **Resistant to:**
 - Oils, greases, and lubricants
 - Most alcohols and aliphatic hydrocarbons
 - Mild acids and alkalis
 - Cleaning solvents (e.g., IPA, acetone)
- **Limited resistance to:**
 - Strong oxidising acids (e.g., nitric, chromic)
 - Prolonged exposure to strong alkalis at elevated temperatures
- **Notes:**
 - Chemical resistance may vary based on concentration, temperature, and exposure duration.
 - Users should test material suitability for specific environments and solvents if critical.

PROCESSING AND MACHINING CONSIDERATIONS

G10 / FR4 epoxy glass sheets can be machined using standard fabrication methods, but care must be taken due to the hardness and abrasive nature of the glass fibre reinforcement.

- **Tooling:**

Use **carbide-tipped** or **diamond-coated tools** for optimal performance and extended tool life.
- **Cutting:**

Perform at moderate feed rates with reduced spindle speeds to prevent overheating and edge chipping.
- **Drilling/Routing:**

Back support is recommended to avoid breakout. Use peck drilling cycles for deep holes.

- **Dust Control:**
Always use **dust extraction systems** or LEV (local exhaust ventilation) during machining. Fine particulate from glass fibre is respirable and should not be allowed to accumulate.
- **PPE Requirements:**
Operators should wear **P2 or equivalent dust masks, safety goggles, and protective gloves** during processing.
- **Finishing:**
Deburr machined parts and clean thoroughly prior to installation or bonding. Avoid excessive heat buildup during polishing or grinding.

SHEET HANDLING BEFORE MACHINING

- Store sheets **flat** in a clean, dry, and well-ventilated area to prevent warping.
- Keep material away from **moisture, direct sunlight, and temperature extremes**.
- Allow sheets to **acclimate to workshop conditions** (typically 24 hours) before machining to minimise dimensional shift.
- Handle using **gloves** to prevent surface contamination from oils or moisture.
- Avoid stacking heavy items on top of thinner sheets to prevent distortion.

ENVIRONMENTAL COMPLIANCE

- **RoHS Compliant:** Does not contain restricted substances above allowable limits.
- **REACH Compliant:** No SVHCs (Substances of Very High Concern) present above threshold.
- **Halogen-Free Options:** Available on request for applications requiring low-halogen or halogen-free materials.
- **Lead-Free:** Contains no intentionally added lead or heavy metals.
- **Asbestos-Free:** Contains no asbestos or hazardous mineral fibres.

SUSTAINABILITY AND ENVIRONMENTAL IMPACT

G10 / FR4 materials are long-lasting, reducing the need for frequent replacement. Their strength, stability, and chemical resistance contribute to overall material efficiency and reduced waste.

- Not biodegradable; dispose of through approved industrial waste channels.
- Not recyclable through standard plastic systems (thermoset).
- RoHS and REACH compliant; halogen-free options available.

SAFETY INFORMATION

This product is considered non-hazardous in its solid form. However, **machining, cutting, sanding, or drilling** can generate airborne dust and fibres that may cause mechanical irritation to the skin, eyes, and respiratory tract.

Key Safety Measures:

- Use **local exhaust ventilation** or dust extraction when machining.
- Wear **P2-rated respirators, safety goggles, and protective gloves.**
- Avoid inhalation or prolonged skin contact with dust.
- Wash hands and exposed skin after handling.

Refer to the corresponding **Safety Data Sheet (SDS)** for full safety and handling instructions: **MISCO SDS – 007**

WARRANTY

MISCO Australia warrants that G10 / FR4 Epoxy Glass Sheets supplied conform to the specifications stated in this Technical Data Sheet at the time of shipment.

This warranty is limited to the replacement of non-conforming material or a refund of the original purchase price, at MISCO Australia's discretion. The warranty does not cover any consequential damages, losses, or liabilities arising from misuse, improper application, machining, storage, or modification of the product after delivery.

Important Note:

It is the customer's responsibility to evaluate the suitability of the material for their specific application. No warranty is expressed or implied for performance in conditions not stated in this document.



DISCLAIMER

*The information provided in this data sheet is intended as a general guide for the use and handling of material. It is based on current knowledge, testing, and is believed to be accurate and reliable as of the date of publication. However, **MISCO Australia** makes no warranties, express or implied, regarding the material's performance, suitability, or fitness for any specific application.*

Users are responsible for determining the material's suitability for their intended purpose, including conducting independent tests and evaluations as necessary. MISCO Australia does not accept any liability for any loss, damage, or injury resulting from the use of this information, the products described, or reliance on the provided recommendations.

Specifications are subject to change without notice as part of MISCO Australia's ongoing product improvement initiatives.

Always refer to the latest version of this data sheet before proceeding with critical applications.

All sales are subject to MISCO Australia's standard terms and conditions of sale.

End of Technical Data Sheet.