Spaulding COMPOSITES INC ENGINEERING DATA SHEET
GRADE: SPAULDITE® G-11CR LAMINATE SHEET

Spauldite® Grade G-11CR is a closely controlled glass fibre fabric reinforced epoxy high pressure laminate. Grade G-11CR was developed for use as insulation and structural members in super conduction magnets at Cryogenic temperatures. In fusion reactor applications, neither electrical or mechanical properties are significantly changed after a dose of 2 X 10^8 rads. Grade G-11CR exceeds the requirements of NEMA Grade G-11, MIL-P-18177 Type GEB and Federal Specification LP 509 Type IV, Grade G-11.

MAJOR FEATURES

- Completely Characterized at Cryogenic Temperatures by NIST, Los Alamos and ORNL
- Mechanical Properties Significantly Better at Cryogenic Temperatures than at Ambient
- Used Successfully in Super-Conducting Cryogenic Generators.

APPLICATIONS

Grade G-10CR is used as structural supports, spacers, thermal and electrical insulation for superconducting magnets and generators used in magnetic fusion energy, reactors, energy storage coils, magnetic hydrodynamic power generation, high energy particle accelerators and cryostats in the from of supports and covers.

ELECTRIAL CHARACTERISTICS

Grade G-11CR has good electrical properties over a wide range of temperatures.

MECHANICAL CHARACTERISTICS

Grade G-11CR has significantly better mechanical strengths at low temperatures over ambient. In general, G-11CR has better strength characteristics than most other G-11 and G-10 laminates.

FABRICATION

Grade G-11CR can be fabricated using techniques such as drilling, threading, tapping, routering, milling, grinding, sanding and sawing. It fabricates similar to conventional NEMA G-11 type laminates. Carbide and diamond tooling is recommended using water coolant where possible.

STANDARD SHEET SIZE[1]: 48" X 36"
48" X 48"

COLOR: NATURAL

THICKNESS: .015" – 4.000"

PROPERTY CHARACTERISTICS

PROPERTY	ASTM TEST METHOD	CONDITIONING & TYPE OF TEST	THICKNESS INCHES	AVERAGE TYPICAL VALUES		REFERENCE VALUES	
				ENGLIGH	SI	ENGLISH	SI
ELECTRICAL							
Dielectric Breakdown (Parallel-Taper Pin)	D-229	A D-48/50	.125	95 kV 92 kV	95 kV 92 kV	≥50 kV ≥45 kV	≥50 kV ≥45 kV
Dissipation Factor (1 MHz)	D-150	A D-24/23 D-48/50	.125	.016 .017 .018	.016 .017 .018	≤0.025 ≤0.030 ≤0.040	≤0.025 ≤0.030 ≤0.040
Permittivity (1 MHz)	D-150	A D-24/23	.125	5.1 5.1	5.1 5.1	≤5.2 ≤5.4	≤5.2 ≤5.4

[1] Contact Customer Service for availability of additional sheet sizes.

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		D-48/50		5.2	5.2	≤5.8	≤5.8
Surface Resistance	D-257	C-96/35/90	.125	5 X 10^5 MΩ	5 X 10^5 MΩ	≥1.0X 10^5 MΩ	≥1.0X 10^5 MΩ
Volume Resistivity	D-257	C-96/35/90	.125	6 X 10^6 MΩ-cm	6 X 10^6 MΩ-cm	≥1.0 X 10^5 MΩ-cm	≥1.0 X 10^5 MΩ-cm
MECHANICAL							
Bonding Strength	D-229	A D-48/50	.500 .500	2,000 lbs 1,900 lbs	8.90 kN 8.45 kN	≥1,600 lbs ≥1,500 lbs	≥7.12kN ≥6.67kN
Compressive Strength (Edgewise)	D-229	A Lengthwise Crosswise	 .125 .125	 67.0 ksi 48.0 ksi	 461.9 MPa 330.9 MPa	 ≥55.0 ksi ≥43.0 ksi	MPa ≥379.2 ≥296.5
Compressive Strength (Flatwise)	D-229	A	.125	84.0 ksi	579.2 MPa	≥60.0 ksi	MPa ≥413.7
Flexural Strength (Flatwise)	D-229	A Lengthwise Crosswise	 ≤.125 ≤.125	 93.0 ksi 69.0 ksi	 641.2 MPa 475.7 MPa.	 ≥67.0 ksi ≥55.0 ksi	MPa ≥461.9 ≥379.2
Flexural Strength (Flatwise)	D-229	A Lengthwise Crosswise	 .125-.500 .125-.500	 85.0 ksi 65.0 ksi	 586.1 MPa 448.2 MPa	 ≥62.0 ksi ≥50.0 ksi	MPa ≥427.5 ≥344.7
Flexural Strength (Flatwise)	D-229	A Lengthwise Crosswise	 ≥.500 ≥.500	 77.0 ksi 60.0 ksi	 530.9 MPa 413.7 MPa	 ≥55.0 ksi ≥45.0 ksi	MPa ≥379.2 ≥310.3
Flexural Strength (Flatwise)	D-229	E-1/150:T-150	.125	55.0 ksi	379.2 MPa	≥33.5 ksi	≥231.0MPa
Izod Impact Edgewise Notched	D-229	A Lengthwise Crosswise	 .125 .125	 18.0 9.5	 .957 J/mm .505 J/mm	 ≥12.0 ≥7.0	 ≥.638 J/mm ≥.372 J/mm
Tensile Strength	D-229	A Lengthwise Crosswise	 .125 .125	 65.0 ksi 48.0 ksi	 448.2 MPa 330.9 MPa	 ≥50.0 ksi ≥35.0 ksi	MPa ≥344.7 ≥241.3
Interlaminar Shear Strength	D-2733	A	.125	6.4 ksi	44.1 MPa	≥4.0 ksi	≥27.6 MPa
PHYSICAL							
Density	D-792	A	-	.072 lbs/in^3	1.98 g/cm^3	NR	NR
Water Absorption	D-229	D-24/23	.125	.06%	.06%	≤.15%	≤.15%