

## Laminated Sheet Grades

### Grades of Laminated Sheet

NEMA Grade	General Characteristics	Base Materials
X	Primarily intended for mechanical applications where electrical properties are of secondary importance. Not recommended for high humidity applications.	Paper, Phenolic Resin
XX	Suitable for general electrical insulating requirements. Good machinability.	Paper, Phenolic Resin
XXX	Excellent electrical insulating properties in high humidity applications. Has minimum coldflow characteristics.	Paper, Phenolic Resin
C	Made from cotton fabric weighing over four ounces per square yard. Has high impact strength and resiliency. Not generally recommended for electrical applications.	Cotton Cloth, Phenolic Resin
CE	Same cotton fabric as grade C. Suitable for applications requiring good moisture resistance, high impact strength and good electrical properties	Cotton Cloth, Phenolic Resin
L	Made from fine weave cotton cloth. Suitable for machining and mechanical applications, has high density and good moisture resistance. Not recommended for electrical applications.	Cotton Cloth, Phenolic Resin
LE	Made from fine weave cotton cloth. Suitable for electrical applications requiring good moisture resistance and machining properties.	Cotton Cloth, Phenolic Resin
G-5	High mechanical strength with good arc resistance. Excellent electrical properties under dry conditions. Good dimensional stability.	Glass Cloth, Melamine Resin
G-9	Similar to grade "G-5" but with better electrical properties under wet conditions.	Glass Cloth, Melamine Resin
G-10	Extremely high mechanical strength (flexural, impact and bonding) at room temperature. Good dielectric loss and electrical strength properties under both dry and humid conditions.	Glass Cloth, Epoxy Resin
G-11	Similar to grade G-10 but has high retention of flexural strength at elevated temperatures.	Glass Cloth, Epoxy Resin
N-1	Excellent electrical properties under high humidity conditions. Good impact strength, but subject to flow or creep under load, especially at temperatures higher than normal.	Nylon Cloth, Phenolic Resin
FR-1 thru FR-5	Various paper and glass cloth based laminates formulated to have a flame resistance of at least Class I when tested in accordance with NEMA test method 7.11	Paper, Glass Cloth, Phenolic and Epoxy Resins

### Some Typical Uses for Laminated Sheet

Bushings  
 Gears  
 Bearings  
 Pulleys  
 Spacers  
 Gaskets  
 Wear Blocks  
 Terminal Boards  
 Slip Rings  
 Rotor Vanes  
 Insulators  
 Thrust Washers  
 Arc Shutes  
 Coil Forms  
 Antenna Bases

### Sheet Sizes

36" x 48"  
 48" x 48"  
 48" x 96"  
 Special sizes available

- Close tolerance sanding
- Cut to size
- Fabrication per print

# Laminated Rods-Ground from sheet

## Rolled rods also available

GRADES						
	XXX	CE	LE	G-5 & G-9	G-10	G-11
<b>FEATURES</b>	Electrical insulation, high humidity resistance, good dimensional stability, good machining.	Good acid resistance, low voltage, low frequency electrical performance, high impact strength, good mechanical properties.	High mechanical and electrical strength, good appearance, good machining qualities, moisture resistance.	High mechanical strength, high arc and heat resistance, self extinguishing, excellent electrical properties under dry and humid conditions.	High flexural, impact and bond strength at room temperatures, good electrical properties under dry and humid conditions.	High mechanical strength at temperatures up to 150° C, self extinguishing, retains 50% of its flexural strength at elevated temperatures.
<b>DIAMETERS</b> Sizes other than standard can be furnished on request	1/16 9/16 3/32 5/8 1/8 3/4 5/32 7/8 3/16 1" 7/32 1 1/8 1/4 1 1/4 9/32 1 3/8 5/16 1 1/2 3/8 7/16 1/2	1/16 1" 3/32 1 1/8 1/8 1 1/4 5/32 1 3/8 3/16 1 1/2 7/32 1 5/8 1/4 1 3/4 9/32 2" 5/16 2 1/4 3/8 2 1/2 7/16 2 3/4 1/2 3" 9/16 3 1/4 5/8 3 1/2 3/4 3 3/4 7/8 4"	1/16 1" 3/32 1 1/8 1/8 1 1/4 5/32 1 3/8 3/16 1 1/2 7/32 1 5/8 1/4 1 3/4 9/32 2" 5/16 2 1/4 3/8 2 1/2 7/16 2 3/4 1/2 3" 9/16 3 1/4 5/8 3 1/2 3/4 3 3/4 7/8 4"	1/16 9/16 3/32 5/8 1/8 3/4 5/32 7/8 3/16 1" 7/32 1 1/8 1/4 1 1/4 9/32 1 3/8 5/16 1 1/2 3/8 1 5/8 7/16 1 3/4 1/2 2"	1/16 1" 3/32 1 1/8 1/8 1 1/4 5/32 1 3/8 3/16 1 1/2 7/32 1 5/8 1/4 1 3/4 9/32 2" 5/16 2 1/4 3/8 2 1/2 7/16 2 3/4 1/2 3" 9/16 3 1/4 5/8 3 1/2 3/4 3 3/4 7/8 4"	1/16 9/16 3/32 5/8 1/8 3/4 5/32 7/8 3/16 1" 7/32 1 1/8 1/4 1 1/4 9/32 1 3/8 5/16 1 1/2 3/8 1 5/8 7/16 1 3/4 1/2 2"
<b>TOLERANCE</b>	All diameters ±.001. Closer tolerance quoted on request.	1/16" to 1 1/4" diameter inclusive ±.001, 1 3/8" diameter and over ±.003. Closer tolerance quoted on request.	1/16" to 1 1/4" diameter inclusive ±.001, 1 3/8" diameter and over ±.003. Closer tolerance quoted on request.	1/16" to 1 1/4" diameter inclusive ±.001, 1 3/8" diameter and over ±.003. Closer tolerance quoted on request.	1/16" to 1 1/4" diameter inclusive ±.001, 1 3/8" diameter and over ±.003. Closer tolerance quoted on request.	1/16" to 1 1/4" diameter inclusive ±.001, 1 3/8" diameter and over ±.003. Closer tolerance quoted on request.
<b>LENGTH</b>	4 foot nominal. Special lengths quoted on request.	4 foot nominal. Special lengths quoted on request.	1/2" diameter and under — 8 foot nominal. Over 1/2" diameter — 4 foot nominal. Special lengths quoted on request.	4 foot nominal. Special lengths quoted on request.	4 foot nominal. Special lengths quoted on request.	4 foot nominal. Special lengths quoted on request.
<b>COLOR</b>	Natural. Black is often available at no additional charge.	Natural. Black is often available at no additional charge.	Natural. Black is often available at no additional charge.	Natural color only.	Natural color only.	Natural color only.
<b>SPECIFICATIONS</b>	Grade XXX phenolic rod meets or exceeds all requirements of Federal Specifications Mil-P-15035, L-P-513a, Type PBE, as revised.	Grade CE phenolic rod meets or exceeds all requirements of Military Specification Mil-P-15035, Type FBG.	Grade LE phenolic rod meets or exceeds all requirements of Military Specification Mil-P-15035, Type FBE.	Grade G-5 glass melamine rod meets or exceeds all requirements of Military Specification Mil-P-15037, Type GMG. Grade G-9 glass melamine rod meets or exceeds all requirements of Military Specification Mil-P-15037, Type GME.	Grade G-10 glass epoxy rod meets or exceeds all requirements of Military Specification Mil-P-18177, Type GEE.	Grade G-11 glass epoxy rod meets or exceeds all requirements of Military Specification Mil-P-18177, Type GEB.