

# ***TUFNOL Grade 6F/45***

## ***Cotton fabric based epoxy laminate***

Resin: Modified epoxy resin.  
Reinforcement: Cotton fabric (fine weave)

Description: Grade 6F/45 is made with a specially modified epoxy resin system, which provides outstanding electrical performance, plus the benefits of a fine weave cotton fabric reinforcement. It has very high resistance to electrical tracking, and its dielectric strength, insulation resistance and water absorption are comparable with those of many glass laminates. It is mechanically strong, with good wear performance and is resistant to a wide range of chemicals. Grade 6F/45 can be readily machined to fine tolerances and gives a superb machined finish.

Typical uses: This versatile grade is used for a very broad range of applications, where precision and a high quality machined finish need to be combined with electrical or mechanical performance. It is used for rotor blades in compressors, slip ring assemblies in helicopters, windshield components on commercial aircraft, high vacuum components, slot wedges, coil supports in turbine generators, labyrinth seals, insulating gears in scientific instruments, electrical mounting plates and large electrical terminal blocks. It is also used in certain processing applications involving contact with foodstuffs.

Types available: Natural colour is available in all sections. Moulded square and rectangular tube, angle and channel sections are subject to special enquiry.

### **SHAPES AND SIZES**

#### Sheet

Thickness: 0.8 to 76.2mm (1/32" to 3")  
Sheet Sizes: 1200 x 1200mm approx.  
1525 x 1200mm approx.  
For guaranteed minimum sheet sizes, refer to TUFNOL Ltd. For 1525 mm long sheets, minimum order quantities may apply.

#### Round Rod

Diameter: 9.5 to 50.8mm (3/8" to 2")  
Lengths approx: 1170 mm

#### Round Tube

Inside diameter: 9.5 to 203.2mm (3/8" to 8")  
Outside diameter: 12.7 to 228.6mm (1/2" to 9")  
Wall thickness must be less than inside diameter.  
Length approx: 1170 for o.d. up to 120.6  
584 for o.d. 101.6 to 228.6

#### Rectangular Bar

Sizes 9.5 x 9.5mm to 76.2 x 88.9mm  
(3/8" x 3/8" to 3" x 3 1/2")  
Length approx: 1170mm

#### Rectangular Tube

Subject to special enquiry.  
Internal size: 9.5 x 9.5mm to 69.8 x 69.8mm  
(3/8" x 3/8" to 2 3/4" x 2 3/4")  
Lengths approx: 1170mm

#### Channel

Cut from rectangular tube and subject to special enquiry. Deduct 3.2mm from relevant internal dimension to allow for tool cut.

#### Angle

Subject to special enquiry.  
Outside size: 6.3 x 9.5mm to 149.2 x 149.2mm  
(1/4" x 3/8" to 5 7/8" x 5 7/8")  
Wall thickness 1.6 to 9.5mm (1/16" to 3/8")  
Length approx 1170mm

#### Hexagon Bar

Across flats : 0.445" to 1.100"  
(11.3 to 28.0mm)  
The across flats dimensions are machined to suit Metric, Whitworth or other standard hexagon sizes.  
Length approx: 1170mm

# TUFNOL Grade 6F/45

## SPECIFICATIONS

### BRITISH STANDARDS

Sheet	BS EN 60893 Type EP CC 301
Round Rod	BS 61212-3-3 Type EP CC 41
Rectangular Bar	BS6128 Part 4 Type EP CC 41
Hexagon Bar	BS6128 Part 6 Type EP CC 61
Round Tube	BS61212-3-2 Type EP CC 31
Rectangular Tube	BS6128 Part 13 Type EP CC 131

## APPROXIMATE WEIGHTS

### Sheets

Sheet size 1220 x 1220 approx.  
Approx. weight in kg = 2.10 x thickness in mm

Sheet size 1600 x 1220 approx.  
Approx. weight in kg = 2.76 x thickness in mm

Due to slight variations in density and nominal dimensions, weight cannot be calculated precisely.

### Weight Formulae

#### Cut pieces:

$$\text{Weight in kg} = \frac{1.40 \times \text{Length} \times \text{Width} \times \text{Thickness (all in mm)}}{1,000,000}$$

#### Rod

$$\text{Weight in kg} = \frac{1.07 \times \text{Dia}^2 \times \text{Length (all in mm)}}{1,000,000}$$

#### Tube

$$\text{Weight in kg} = \frac{1.07 \times (\text{o.d.}^2 - \text{i.d.}^2) \times \text{Length (all in mm)}}{1,000,000}$$

## PHYSICAL PROPERTIES OF GRADE 6F/45

### SHEET

PROPERTY	TYPICAL RESULT	UNITS
Cross breaking strength	170	MPa
Impact strength, notched, Charpy	4.6	kJ/m <sup>2</sup>
Compressive strength, flatwise	290	MPa
Compressive strength, edgewise	190	MPa
Resistance to flatwise compression	1.5	%
Shear strength, flatwise	100	MPa
Water Absorption 1.6mm thk.	30	mg
3mm thk.	35	mg
6mm thk.	45	mg
12mm thk.	55	mg
Electric strength, flatwise in oil at 90°C		
1.6mm thk.	15	MV/m
3mm thk.	12	MV/m
6mm thk.	10	MV/m
12mm thk.	8.0	MV/m
Electric strength, edgewise in oil at 90°C	80	kV
Insulation resistance after immersion in water	3x10 <sup>11</sup>	ohms
Loss tangent at 1 MHz	0.040	-
Permittivity at 1 MHz	4.3	-
Comparative tracking index	800	-
Relative density	1.36	-
Maximum working temperature*		
continuous	130	°C
intermittent	150	°C
Thermal classification	Class B	-
Thermal conductivity through laminae	0.36	W/(mK)
Thermal expansion in plane of laminae	1.8	x10 <sup>-5</sup> /K
Specific heat	1.5	kJ/(kgK)

Test methods as BS EN 60893, where applicable.

### ROUND TUBES

PROPERTY	TYPICAL RESULT	UNITS
Axial compressive strength	180	MPa
Cohesion between layers	130	MPa
Water absorption	1.2	mg/cm <sup>2</sup>
Insulation resistance after immersion in water	1x10 <sup>10</sup>	ohms
Loss tangent at 1 MHz	0.04	-
Permittivity at 1 MHz	4.0	-
Axial electric strength in oil at 90°C	75	kV
Radial electric strength in oil at 90°C		
1.6 wall	13	MV/m
3.0 wall	10	MV/m
Relative density	1.35	-

Test methods as BS 61212-2.

### ROUND RODS

PROPERTY	TYPICAL RESULT	UNITS
Flexural strength	170	MPa
Water absorption	1.3	mg/cm <sup>2</sup>
Insulation resistance after immersion in water	1x10 <sup>10</sup>	ohms
Axial electric strength in oil at 90°C	80	kV
Relative density	1.35	-

Test methods as BS 61212-2.

\*Users of highly stressed components at temperatures approaching the maximum are recommended to seek further advice from TUFNOL Ltd.

The information in this leaflet is believed to be correct, but completeness and accuracy are not guaranteed. The user shall be fully responsible for determining the suitability of products for the intended use. TUFNOL is a Registered Trade Mark.

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A full machining service is available for this and many other engineering plastics and composites.

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