

# ***Kite Brand TUFNOL***

## ***Paper based laminate***

**Resin:** Phenolic resin.  
**Reinforcement:** Kraft paper

**Description:** Kite Brand TUFNOL is a first class electrical insulating material with good dielectric strength and high insulation resistance (tested after immersion in water for 24 hours). It has low moisture absorption and good mechanical strength, although its impact strength is lower than that of most other grades of TUFNOL. Kite Brand sheet meets British Standard BS EN 60893 (IEC60893) Type PF CP 206 which has superceded BS 2572 Type P3, a standard which was widely used in the electrical industry for many years. Kite is readily machined and can be hot punched in thicknesses up to 3.2mm (1/8").

**Typical Uses:** Kite Brand is the most widely used of all TUFNOL grades, wherever a good quality general purpose electrical insulation material is required. It is used for a multitude of different purposes at low, medium and high voltages, including such items as terminal boards, mounting panels, tag strips, coil formers, insulating sleeves and bushes, busbar supports, tool and instrument handles, coil supports, insulated enclosures, brush holders, insulating spacers and special purpose plugs and sockets. Paper based components are not normally used for items where optimum wear resistance is required.

**Types available:** Sheet and all hollow sections (e.g. tube) are available in natural colour and in black. (Where solid sections are required, such as round rod and square bar, Swan Brand TUFNOL is used.)

### SHAPES AND SIZES

#### Sheet

**Thickness:** 1.0 to 25.4mm (0.040" to 1")  
 Thicknesses below 1.0 mm are available with a special matt finish surface only.

**Sheet Sizes:** 1220 x 1220mm approx.  
 1525 x 1220mm approx.  
 For guaranteed minimum sheet sizes, refer to TUFNOL Ltd. For 1525 mm long sheets, minimum order quantities may apply.

#### Round Tube

**Inside diameter:** 3.2 to 203.2mm (1/8" to 8")  
**Outside diameter:** 6.3 to 228.6mm (1/4" to 9")  
 Wall thickness must be less than inside diameter.  
**Length approx** 584 for o.d. up to 15.1mm  
 1200 for o.d. 9.5 to 120.6  
 584 for o.d. 101.6 to 228.6

#### Rectangular Tube

**Internal size:** 4.8 x 4.8mm to 63.5 x 76.2mm  
 (3/16" x 3/16" to 2 1/2" x 3")  
**Lengths approx:** 584mm for size 9.5 x 9.5 or smaller  
 1200mm for sizes larger

#### Channel

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

#### Angle

**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** 1200mm

**Solid profiles** See Swan Brand TUFNOL

**SPECIFICATIONS**

**BRITISH STANDARDS**

Sheet	BS EN 60893-3-4 Type PF CP 206
Round Tube	BS EN 61212-3-2 Type PF CP 32
Rectangular Tube	BS6128 Part 13 Type PF CP 131

**ADMIRALTY**

Sheet	NES 2053
Round Tube	NES 2054

**NEMA\***

Sheet	Nema LI-1-1989 Type XXX
Round Tube	Nema LI-1-1989 Type XXX

**MIL\***

Sheet	MIL-I-24768
Round Tube	MIL-I-24768

\*Certification to these standards is subject to special enquiry. Standard quality testing is to British Standards.

**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:

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

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 KITE BRAND**

**SHEET**

PROPERTY	TYPICAL RESULT	UNITS
Cross breaking strength	175	MPa
Impact strength, notched, Charpy	2.7	kJ/m <sup>2</sup>
Compressive strength, flatwise	350	MPa
Compressive strength, edgewise	200	MPa
Resistance to flatwise compression	1.2	%
Shear strength, flatwise	105	MPa
Water absorption	1.6mm thk. 39	mg
	3mm thk. 47	mg
	6mm thk. 56	mg
	12mm thk. 70	mg
Electric strength, flatwise in oil at 90° C		
	1.6mm thk. 14.5	MV/m
	3mm thk. 13	MV/m
	6mm thk. 8.8	MV/m
	12mm thk. 6.1	
Electric strength, edgewise in oil at 90°C	55	kV
Insulation resistance after immersion in water	1x10 <sup>10</sup>	ohms
Loss tangent at 1 MHz	0.037	-
Permittivity at 1 MHz	5.1	-
Relative density	1.36	-
Maximum working temperature**		
	90	°C
	120	°C
Thermal classification	Class E	-
Thermal conductivity through laminae	0.26	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 60893-2, where applicable.

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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