TUFFAK® F - FLAME RETARDANT POLYCARBONATE SHEET

EUROPE

TUFFAK F polycarbonate sheets meet UL 94 V0 ratings from 1-12 mm thickness. It offers excellent UL94 fire rating, high optical clarity, outstanding impact strength, safe and easy fabrication and handling.

PLASKOLITE Polycarbonate Flame Retardant Sheet is produced according to the ISO 11963:2012 and EN 16240:2013 standards. This product can be used in a wide variety of interior and exterior applications, such as buildings, automotive and safety.

TYPICAL PROPERTIES*

Property	Test Method	Units	Values
General			
Density	ISO 1183	gr/cm^3	1.2
Water Absorption, 24 hours	ISO 62 (1)	%	0.15
Mechanical			
Tensile Strength at Yield	ISO 527-2	MPa	60
Elongation at Yield	ISO 527-2	%	6
Elongation at Break	ISO 527-2	%	> 100
Tensile Modulus	ISO 527-2	MPa	2300
Flexural Strength	ISO 178	MPa	90
Flexural Modulus	ISO 178	MPa	2300
Impact Resistance (Charpy unnotched)	ISO 179/1fu	kJ/m^2	No Break
Impact Resistance (Izod notched)	ISO 180/1A	kJ/m^2	> 65
Optical			
Refractive Index	ISO 489		1.585
Light Transmission (thickness dependent)	ASTM D1003	%	81-90
Haze (3 mm transparent sheet)	ASTM D1003	%	< 1
Thermal			
Vicat Softening Temp.(50N)	ISO 306	°C	144
Heat Deflection Temp. (1.82 MPa)	ISO 75-1	°C	130
Coeff. of Linear Thermal Expansion (0-50OC)		m/m°C	6.5
Thermal Conductivity	ASTM C177	W/mK	0.2
Maximum Continuous Service Temp.		°C	85
Maximum Short Time Service Temp.		°C	120
Minimum Continuous Service Temp.		°C	-25
Minimum Short Time Service Temp.		°C	-40
Electrical			
Dielectric Constant (50Hz)	DIN 53483	-	3.0
Dissipation Factor tanδ (100Hz)	DIN 53483	-	0.0006
Dissipation Factor tanδ (1 MHz)	DIN 53483	-	0.009
Volume Resistivity	IEC 60093	Ohm·cm	>10^{14}
Surface Resistivity	IEC 60093	OHM	>10^{15}

*Typical properties are not intended for specification purposes

DIMENSIONS

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Thickness, mm	Width, mm	Length, mm
1.0-12.0	1000, 1220 and 2050	600 – 6000

Sheets are also available cut-to-size according to customer requirements.

TOLERANCES FOR DIMENSIONS

Sheet Thickness, mm	Thickness Tolerances, %	Width Tolerances, mm	Length Tolerances, mm	Diagonal Tolerances, mm	Flatness Tolerances
<1.5	± 8	Sheets cut in production: -0.0 / +3.0 Sheets cut to size: ± 0.50	Sheets cut in production (length < 4000 mm.): -0.0 / +3 Sheets cut in production (length ≥4000 mm.): -0.0 / +0.1% of length Sheets cut to size: ± 0.50	Sheets cut in production: Length < 4000 mm - ≤ 2 Length ≥ 4000 mm - ≤ 4 Sheets cut to size: ≤ 0.5	Max allowed bowing - 0.5% from linear dimensions. Max allowed bowing across the width of the sheet - ≤ 5 mm per meter of width. Max allowed bowing along the length of the sheet - ≤ 5 mm per meter of length.
≥ 1.5, < 2.0	± 4				
≥ 2.0, ≤ 12.0	± 3				

DEFINITIONS

SHRINKAGE

After heating, polycarbonate sheets will shrink during the cooling process. The shrinkage is higher in the extrusion direction. This characteristic of TUFFAK should be taken into account when planning the final sheet's dimensions.

Sheet Thickness, mm	Standard Grade	
	Shrinkage M.D**, %	Shrinkage T.D**, %
≥ 1.80, < 2.30	6 – 7	0.5
≥ 2.30, < 3.50	5 – 6	0.5
≥ 3.50, < 4.00	3 – 4	0.5
≥ 4.00, < 6.00	2 – 3	0.5
≥ 6.00	2	0.5

* M.D. – Machine (extrusion) direction

** T.D. – Transverse (perpendicular to extrusion) direction

FIRE TEST PERFORMANCE

TUFFAK F extruded polycarbonate sheets meet UL94 V0 standards from 1-12 mm thickness.

ENVIRONMENTAL STRESS CRACKING

Environmental Stress Cracking (ESC) is a result of the combination of stress and exposure to chemicals. The level of stress needed for ESC is lower than the normal failure mechanical stress failure of polycarbonate in a chemical- free environment. Stresses can be created during forming and fabrication

and can be controlled by an annealing process. Stresses can be created also by improper installation. Cold bent sheets under permanent induced stress or sheets under periodic stress (fatigue) are also susceptible to ESC.

GENERAL GUIDELINES

STORAGE

TUFFAK F sheets must be stored with their original protective masking in a dry, shady and well-ventilated area, with NO EXPOSURE to direct sunlight, wind, dirt or hard objects. Avoid storage in areas with excessive heat or aromatic cleaning solvents.

Sheets should be stored horizontally on their delivery pallets placed on a soft material (such as cardboard) to prevent damage. DO NOT store sheets under flexible PVC coverings, as flexible PVC is not compatible with polycarbonate and can cause serious damage to the sheets.

PROTECTIVE FILM

TUFFAK F sheet is protected by a fully recyclable polyethylene (PE) film. Keep this film in position and remove it immediately after installation. Sharp objects, sharp particles or even small chips can penetrate the protective PE masking, and damage the surface therefore always place TUFFAK® on a clean smooth surface.

TUFFAK F protective film is suitable for thermoforming. High-heat deep-draw thermoforming applications can cause the PE film to adhere more strongly. Printed film must be removed before thermoforming, to avoid transfer of the ink to the sheet's surface.

CLEANING & MAINTENANCE

Cleaning may be needed after fabrication, before sensitive processes such as vacuum metallization, printing or for maintenance during use.

Polycarbonate sheets will have a longer and more effective service life by cleaning with warm soapy water using a mild liquid dish soap. If any dirt remains, gently wipe off with a soft cloth.

- Commercial liquid cleaners may not be compatible with polycarbonate and are not recommended.
- Sponges, squeegees, brushes or sharp instruments should not be used for cleaning sheets as they can damage the protective UV coating and/or causes scratches in the sheet surface.

ENVIRONMENTAL ADVANTAGES

TUFFAK F sheets are environmentally friendly. The sheets are fully recyclable. They do not contain any toxic materials or heavy metals which may cause environmental damage or health risks. Ozone Depleting Substances (ODP) are not used in the manufacturing process of TUFFAK sheets. They do not release pollutant substances into the environment during manufacturing. TUFFAK F sheets do not produce toxic or corrosive gases upon burning and fires can be extinguished with water.

TUFFAK sheets can be used for energy recovery and chemical or mechanical recycling.

TUFFAK scrap is not classified as hazardous waste, small amounts can be disposed as household refuse. Large quantities should be disposed by recycling.

FABRICATION

TUFFAK F sheets can be cut, sawn, drilled, milled and bent using standard workshop equipment for wood or metal. However, it is always recommended to use specific tools specially designed for plastics.

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Machining, Assembling, Forming, Glazing and Signage Installation recommendations TUFFAK® Fabrication Guide.

COLD BENDING:

TUFFAK F sheets are ductile and can be cold-bend in a straight line.
When cold bending TUFFAK sheets, a plastic permanent form is induced in the bending line, this causes a reduction of the mechanical properties in the bent area.
Also, plastic deformation causes frozen-in internal stresses that reduce the chemical resistance of the sheet in the bent area and increase the susceptibility to ESC attack. Annealing may cause a partial improvement of the mechanical and chemical resistance.
For TUFFAK sheets up to 6 mm, the recommended minimum bend angle is 90°. For higher thicknesses, up to 12 mm, the recommended minimum bend angle is 135°.
Hard coated sheets cannot be bend.

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