

SAFEGUARD PC PREMIUM QUALITY POLYCARBONATE



SAFEGUARD PC - Premium Quality Polycarbonate Rod, Sheet and Tube is an engineering **SEE THROUGH** material. Tough, easy to handle and easily fabricated to almost any shape, **SAFEGUARD PC** is unique for its impact strength and shock load resistance.

SAFEGUARD PC is light weight and well proven in situations that require a see through product in Precision Engineering, Architectural Glazing, Process Machine Guarding, General Manufacturing and Industrial applications.



Machine Guards

PRODUCT RANGE

SAFEGUARD

General purpose polycarbonate sheet, rod and tube for high performance engineering applications that require clarity and high impact resistance.

SAFEGUARD UVX

Manufactured with UV protective coatings on both sides, Safeguard UVX offers excellent weathering properties, whilst maintaining high clarity and impact resistance.

SAFEGUARD HARD

Manufactured with a unique hard coat surface which is applied to both sides, Safeguard Hard provides excellent scratch, chemical and graffiti resistant properties.



Noise Control Enclosures

FEATURES

- **SHOCK RESISTANT** - Virtually unbreakable, Safeguard PC's impact strength is 250 times stronger than glass and 30 times stronger than acrylic, making it the ideal material for shock resistant applications.
- **OH&S COMPLIANT** - Ideal for vision panels, machine guards and acoustic enclosures, Safeguard PC sheet is an excellent choice for applications where safety and protection is of utmost importance.
- **THERMALLY STABLE** - Safeguard PC is scarcely influenced by sudden changes in temperature and humidity, exhibiting a continuous service temperature range of -60° C to 130° C.
- **HIGH ELECTRICAL RESISTANCE** - With excellent electrical insulation properties, Safeguard PC is highly suitable for use in parts of electrical instruments, switchboards and equipment where insulation, shock resistance and transparency is needed.
- **LIGHT WEIGHT & EASY TO PROCESS** - Safeguard PC is easy to handle being 1/2 the weight of glass and only 1/7 that of steel. It is easily machined by a variety of processes including cutting, routing, drilling, cold bending and can also be heat formed, printed and painted.
- **OPTICAL CLARITY** - Displaying excellent clarity, Safeguard PC has a light transmission ranging from 82 to 90% depending on the thickness.
- **FLAME RETARDANT** - All Safeguard PC products have excellent flame retardant properties and are generally classified as "self-extinguishing". In addition, all Safeguard PC products do not generate poisonous gasses when exposed to fire.

SAFEGUARD PC...

Working with SAFEGUARD PC

All **SAFEGUARD PC** products can be effectively machined using standard metal and woodworking equipment. For best results we recommend the use of carbide tipped tools.

MACHINING

- 1. Protective Film** - Safeguard PC sheets are supplied with a pressure sensitive protective film to prevent damage during transport, machining and fabrication. Once the finished item is installed, removal of the film is required. Prolonged exposure to direct sunlight and weathering will affect the release characteristics of the film.
- 2. Cutting** - A table, circular or panel saw can effectively cut Safeguard PC sheet. A circular blade with a carbide tip, utilising the “triple chip” tooth design is recommended. Hand and power saws can also be used, utilising fine pitch saw blades. For thinner gauge sheet, guillotining or punching can also be adopted.
- 3. Drilling** - Use standard high speed steel drill bits, regulating the pressure and speed until a continuous spiral chip is observed. Keep an eye on possible overheating and fusion. Recommended drill speed is between 800 and 1500 rpm.
- 4. Routing** - To achieve curved or irregular shapes, routing is an excellent option. The use of fluted, carbide tipped or high speed steel router bits (6 to 10mm) is recommended at speeds of 20,000 to 25,000 rpm. All sheets must be fed against the rotation of the router bit and at a moderate feed speed to avoid vibration and cracking.
- 5. Cooling** - The application of coolant is generally not required. However where localised overheating occurs; cooling can be undertaken by the use of clean water or oil free compressed air. No oils or metal cutting solutions should be used.
- 6. Punching** - Safeguard PC sheet can be effectively punched using a sharp shearing tool with a wedge angle not exceeding 45° and a clearance between the tool and the cutting surface of 0.01 to 0.03mm.



Optically Clear Safety Guards

- 7. Laser & Water Jet Cutting** - Laser cutting of Safeguard PC sheet is possible with or without film. Pre-drying of sheet is recommended to avoid bubbling. Thicknesses greater than 2.0mm may be subject to edge discolouration.

Water Jet cutting is also a viable alternative to traditional cutting methods.

FABRICATING

- 8. Cold Forming & Folding** - With the exception of Safeguard Hard, all Safeguard PC sheets to 6mm thickness can be cold formed to a minimum radius of 150 times the sheet thickness. For smaller radii, thermoforming is recommended.

Cold folding tight angles is also easily achieved using traditional metal folding equipment. Typically, all sheets will need to be over stretched by 25° to accommodate the relaxation of material following the cold folding process. Refer to Table 1 for recommended forming parameters.
- 9. Cementing** - Cementing joints using a pure solvent like methylene chloride (MDC) is the simplest way of bonding Safeguard PC to itself. To fill larger voids or irregular surfaces, thicker more viscous cement can be achieved by dissolving 10 to 15% of Safeguard PC shavings within the base solvent.

Safeguard PC parts can be bonded to each other or other materials such as metals, by using industrial adhesives suitable for polycarbonates. Two part epoxies, urethanes, and silicone rubber products are generally available. Careful consideration to the application must be given to ensure the selected adhesive meets the temperature, mechanical, elasticity, aesthetic and processing requirements of the application.

...application solutions, custom engineering.

10. Pre-Drying for Vacuum & Drape Forming - We recommend pre-drying Safeguard PC sheets prior to any vacuum, drape or heat forming process. Failure to pre-dry will lead to the formulation of bubbles during the heating process which will adversely affect the optical appearance of the sheet. A circulating air oven operating between 120° to 125° C is required. Drying times will vary according to sheet thickness – 3.0mm 7 hours, 4.5mm 15 hours and 6.0mm 22 hours. Shrinkage between 3 to 6% can be expected.

11. Heat Bending - Safeguard PC sheets can be bent within a heat temperature range of 160° to 200° C by means of pipe heaters or strip heaters that are generally used for bending PVC or Acrylic. Pre-drying is not required for a material thickness of 3.0mm or less. For thicker gauges, pre-drying can be avoided by back routing or V-grooving the sheet.

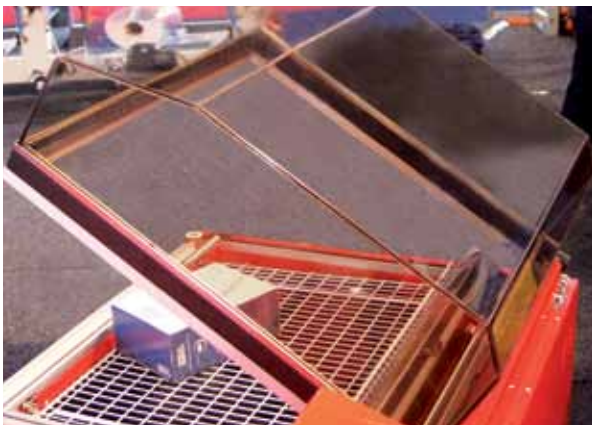
12. Mechanical Fastening - Mechanical fasteners such as aluminium rivets, machine screws and bolts can be used to join Safeguard PC to other products. When pre-drilling, drill oversize to allow for ample clearance since the hole will shrink more than the fastener under thermal contraction. A tight fit will cause surface cracks and possible material failure.

Whilst fastening, ensure the use of washers or rubber strips are used to distribute the load. Edge distance dimensions must be greater than 2 x the diameter of the hole and for smaller holes never less than 6mm from the edge of the sheet.

13. Finishing - Safeguard PC can be successfully edge finished using a hand planer (carbide or high speed steel blade at a minimum of 6000rpm) or an edge finishing machine. Care should be taken not to remove too much material on each pass to avoid cracking. If smoother edges or surfaces are required, wet sanding using a fine grit sand paper is recommended.

Polished edges and surfaces can also be achieved by using a solvent such as methylene chloride. Upon sanding away any machining marks, dip a cloth in the solvent and carefully wipe the required edges.

14. Cleaning - Wash down with warm clean water and soft cloth, after rinsing away excess dust and dirt. For information on difficult to remove items, contact your nearest supplier.



Machine Enclosures

SAFEGUARD PC Sheet can be cold formed using standard metal folding equipment.

Sheet Thickness	Bend Radius	Max Degree of Bend
1 to 2 mm	2 mm	90°
3 to 4 mm	3 mm	90°
5 to 6 mm	4 mm	60°

Table 1

Glazing Hints for Glass Replacements and Machine Guards

GLAZING CHANNELS - Safeguard PC sheets can be successfully installed using either a wet or dry gasket system. As PVC is not compatible with Safeguard PC, we recommend the use of EPDM or rubber gaskets. All glazing channels must be clean, free of burrs and swarf. Glazing pocket depth must facilitate thermal expansion, sheet size and possible loads. The values detailed in the following table, can be used as a guide.

Panel Size mm	Panel Thickness mm	Edge Engagement mm	Expansion Clearance mm	Total Glazing Pocket Depth mm
600 x 600	3.0	8.0	2.0	10.0
900 x 1200	4.5	13.0	3.0	16.0
1220 x 1520	6.0	16.0	5.0	21.0

NB: Based on 1.92 Kpa design load

SPANNING PARAMETERS - For internal applications, the following table provides recommended spanning dimensions of Safeguard PC sheet when framed on all sides. For applications subject to windload, please contact your local Safeguard PC Distributor.

Panel Size mm	Recommended Panel Thickness Framed all Sides (mm)
600 x 900	3.0
900 x 900	4.5
900 x 1200	6.0
1200 x 1200	6.0

SOUND REDUCTION - Safeguard PC products display exceptional sound reduction properties and even performs better than glass – refer Table 2

Panel Thickness mm	STC Rating	
	Safeguard PC Sheet	Float Glass
3.0	25	23
4.5	29	26
6.0	31	27
10.0	34	30

Table 2

PHYSICAL PROPERTIES OF SAFEGUARD PC

(INDICATIVE VALUES°)

Note: 1 g/cm³ = 1,000 kg/m³; 1N/mm² = 1 Mpa; 1 kV/mm = 1 MV/m.

PROPERTIES	TEST METHODS			SAFEGUARD PC	APPLICATIONS
	DIN/*VDE	ASTM *UL	UNITS		
DENSITY					
Water absorption (1):	53479	D 792	g/cm ³	1.20	SAFETY • Safety Barriers • Machine Guards • Machine Enclosures
• after 24/96 h immersion in water of 23°C	53495	D 570	mg	13/23	
• at saturation in air 23°C / 50% RH	-	-	%	0.15	
• at saturation in water of 23°C	-	-	%	0.35	
THERMAL PROPERTIES					VIEWING PANELS • Noise Control Enclosures • Switch gear Cabinets • Scientific Instrumentation • Fork Lifts • Duct Work Sight Panels • Earth Moving Machinery
Melting point	-	-	°C	150	
Glass transition temperature	-	-	°C	-	
Thermal conductivity at 23°C	-	-	°C	-	
Coefficient of linear thermal expansion:					
• average value between 23° and 60°C	-	-	m/(m.K)	65 x 10 ⁻⁶	
• average value between 23° and 100°C	-	-	m/(m.K)	65 x 10 ⁻⁶	
Deflection temperature under flexural load:					
• method A: 1.8 N/mm ²	53461	D 648	°C	135	
Maximum allowable service temperature in air:					
• for short periods (3)	-	-	°C	135	
• continuously: for 5,000/20,000 h (4)	-	-	°C	125/115	
Minimum service temperature (5)	-	-	°C	-60	
Flammability (6)					GLAZING • Bus Shelters • Sports Stadiums • Vandal Protection • Signage
• according to ASTM ("Oxygen Index")	-	D 2863	%	26	
• according to UL 94 (3mm thickness)	-	*94	-	V-2	
MECHANICAL PROPERTIES at 23°C (1) (7)					
Tensile test (8):					
• tensile stress at yield/tensile strength at break (9)	+ 53455	D 638M	N/mm ²	} 65/-	
	++ 53455	D 638M	N/mm ²	}	
• elongation at break (9)	+ 53455	D 638M	%	} >50	
	++ 43455	D 638M	%	}	
• modulus of elasticity (10)	+ 53457	D 638M	N/mm ²	} 2300	
	++ 53457	D 638M	N/mm ²	}	
Compression test (11):					
• 1%-offset yield strength (10)	+ 53454	D 695	N/mm ²	68	
Tensile creep test (8):					
• stress to produce 1% elongation in 1,000 h (σ1/1,000)	+ 53444	D 2990	N/mm ²	} 17	
	++ 53444	D 2990	N/mm ²	}	
Impact strength - Charpy (12)	+ 53453	-	kJ/m ²	no break	
Notched impact strength: - Charpy	+ 53453	-	kJ/m ²	} 20	
	++ 53453	-	kJ/m ²	}	
- Izod	+ -	D 256	kJ/m ² ; J/m	} 9; 90	
	++ -	D 256	kJ/m ² ; J/m	}	
Ball indentation hardness H 358/30 or H 961/30 (13)	+ 53456	-	N/mm ²	120	
Rockwell hardness (13)	+ -	D 785	-	M75	
ELECTRICAL PROPERTIES at 23°C (7)					MACHINED PARTS • Precision Engineering Components • Insulating Parts for Electrical Engineering • Level Indicators • Medical and Pharmaceutical Devices • Components in Contact With Food
Dielectric strength (14)	+ 53481	D 149	kV/mm	} 28	
	++ *0303 T2	D 149	kV/mm	}	
Volume resistivity	+ 53482/	D 257	Ohm.cm	} 1017	
	++ *0303 T3	D 257	Ohm.cm	}	
Surface resistivity	+ 53482/	D 257	Ohm	} 1018	
	++ *0303 T3	D 257	Ohm	}	
Dielectric constant: - at 50Hz	+ 53483/	D 150	-	} 3	
	++ *0303 T4	D 150	-	}	
- at 1 Mhz	+ 53483/	D 150	-	} 3	
	++ *0303 T4	D 150	-	}	
Dissipation factor tan δ: - at 50 Hz	+ 53483/	D 150	-	} 0.001	
	++ *0303 T4	D 150	-	}	
- at 1 Mhz	+ 53483/	D 150	-	} 0.008	
	++ *0303 T4	D 150	-	}	
Resistance to tracking	+ IEC 112/	D 150	-	} CTI 350	
	++ *0303 T1	D 150	-	}	

The suggestions and data presented here are based on information we believe to be accurate and reliable. They are given in good faith, but without guarantee, as the conditions and methods of use of our products are beyond our control. Each user should make his own tests to determine the suitability of our materials and suggestions before adopting them on a commercial scale. This publication is not to be taken as a license to operate under, or recommendation to infringe upon, any patents.

Detailed technical support information is available to assist in all aspects to engineer better applications and correct usage.

DELIVERY PROGRAMS

SAFEGUARD PC SHEET

PRODUCT	THICKNESSES mm	SHEET SIZES	
		2440 x 1220	2440 x 1830
Safeguard PC	1.5, 2.0, 3.0, 4.5, 6, 9.5, 12	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Safeguard UVX	3.0, 4.5, 6.0, 9.5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Safeguard Hard	3.0, 4.5, 6.0, 9.5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

- NB: Colours** - Clear is standard with Opal and tints available on request subject to minimum order quantities.
Sheet Sizes - Special sheet sizes and thicknesses are available on request subject to minimum order quantities.
Cut to Size - The versatility of Dotmar allows Safeguard PC to be offered in custom sizes to avoid wastage. Always know your machined finished or glazing sizes to suit the frame.

SAFEGUARD PC ROD & TUBE

ROD		TUBE		
DIAMETER mm	LENGTH mm	OD mm	WALL THICKNESS mm	LENGTH mm
6.0 to 50.0	3,000	6.3 to 127.0	1.5 to 4.0	3,000
60.0 to 100.0	6,000			

- NB: Colours** - Clear only.
Sheet Sizes - Contact your local Safeguard PC Distributor for available rod and tube sizes.
Cut to Size - Special sizes are available on request subject to minimum order quantities.



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