

TECHNICAL MANUAL

Multiwall sheets made from polycarbonate

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1 PRODUCT IDENTIFICATION

IMPEX[®] MULTIWALL is the brand name for extruded multiwall polycarbonate sheets from POLYCASA.

The IMPEX[®] MULTIWALL programme offers solutions to both indoor and outdoor applications.

IMPEX[®] MULTIWALL is a lightweight sheet, quite easy to transport, handle and install.

IMPEX[®] MULTIWALL is virtually unbreakable and can resist hailstorms and have outstanding impact performance over a wide temperature range and prolonged outdoor exposure.

The flute structure provides the sheet with an air-insulating gap which is an important regulatory requirement in many countries for thermal insulation.

The span capabilities are excellent and vary with the thickness of the sheet being used.

IMPEX[®] MULTIWALL sheets offer excellent aesthetic and optical properties with a range of clear and translucent colours.

The fire performance of IMPEX[®] MULTIWALL is outstanding as polycarbonate make almost no contribution to the growth of a fire by spreading the flames.

IMPEX[®] MULTIWALL sheets are UV-protected by co-extrusion, giving excellent durability to outdoor weathering.

POLYCASA offer a 10 year warranty for light transmission and against discolouration.

IMPEX[®] MULTIWALL's specific properties make this product an ideal fit for building, construction, packaging, advertising and lighting applications.

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2 CHARACTERISTICS

- Lightness
- Thermal insulation
- High solidity
- High resistance to shocks
- Extensive span capabilities
- Good chemical resistance
- Transparent
- Resistance to UV-rays
- Fire resistance, conforming to European standards
- Resistance to extreme temperature variations (-40°C up to +120°C)
- Aesthetic quality
- 10 year warranty for optical and mechanical properties, and for resistance to hail on materials 10 mm and above

3 APPLICATIONS

Building and construction

Roofing

Cladding

Skylights

Domes

Garden buildings

Vaults

Suspended ceilings

Glasshouses

Partitions

Industrial roofs

Sunrooms

Swimming pools

Conservatory roofing

Shopping centre roofing

Railway/metro stations

Football stadiums

Greenhouses

Farm buildings

Packaging

Boxes

Pallet shields

Protective covers for fragile items

Advertising

Illuminated signs

Advertising panels

Lighting

Lamp optics

Neon signs

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4 TECHNICAL INFORMATION

4.1 Resistance to Chemicals

IMPEX[®] MULTIWALL sheets perform very well upon exposure to most chemicals. They are not attacked by many inorganic and organic acids, oxidizing and reducing salts, by acid and basic salines, fats, detergents, aliphatic hydrocarbons, alcohols and lubricating oils.

They can be decomposed by certain solvents, by aqueous and alcoholic alkaline solutions, by gaseous ammonia and amines and after prolonged exposure to water at temperatures of over +60°C. The chemical stability of polycarbonate depends above all on the concentration of the chemical agents and on exposed temperature.

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The tests have been carried out by manufacturers of granulated polycarbonate raw materials.

Chemical resistance

Acetic acid, 10%	+	Heptane	+
Acetone	-	Hexane	+
Alkaline Solutions	-	Hydrochloric Acid, concentrated	-
Ammonia	-	Hydrochloric Acid, 20%	+
Ammonium Sulphate, saturated aqueous solution	+	Hydrofluoric Acid, concentrated	-
Benzene	-	Hydrogen Peroxide, 30%	+
Benzoic acid	-	Methane	+
Boric Acid	+	Methyl Alcohol	-
Butyl Acetate	-	Methyl Ethyl Ketone	-
Butyl Alcohol	+	Methylene Chloride	-
Chlorine Gas, humid	-	Nitric Acid, 10%	+
Chromic Acid, 20%	+	Ozone	+
Citric acid, 10%	+	Perchloric Acid, 10%	+
Cresol	-	Perchloro Ethylene	-
Cyclohexanone	-	Phosphoric Acid, concentrated	+
Dibutyl Phtalate	-	Potassium Permanganate, 10% in water	+
Diethyl Ether	-	Propane	+
Diethylene Glycol	+	Propionic Acid, concentrated	-
Dimethyl Formamide	-	Sodium Carbonate, saturated aqueous solution	+
Dioctyl Phtalate	-	Tetrachloro Ethane	-
Ethyl Alcohol	+	Tetraline	-
Ethylene Glycol	+	Xylol	-
Gasoline (aromatic free)	+		
+ resistant	-	does not resist	

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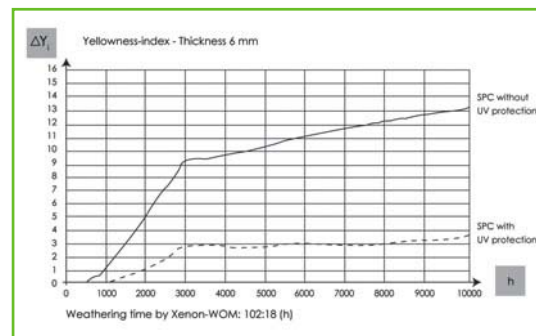
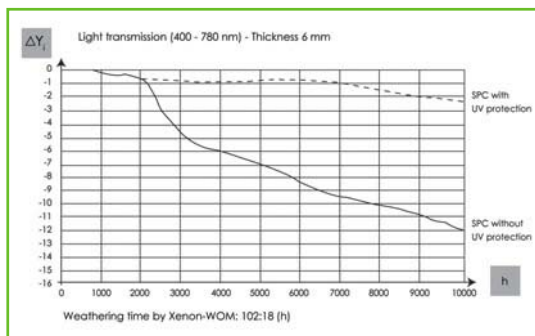
4.2 UV protection

Solar radiation has a harmful component by UV rays which initiate degradation of many polymeric materials including polycarbonate. This depends on geographic locations, seasons, etc.

IMPEX® MULTIWALL sheets are protected against UV-rays by a protection layer on the side exposed to solar radiation. The co-extruded polycarbonate layer enriched with additives allows protection against harmful UV-rays.

POLYCASA warrants protection against weathering for 10 years, covering discolouration, loss of light transmission and loss of strength. However proper installation and good maintenance ensure an even longer period for product life.

Changes in the Yellowness-index and Light Transmission under artificial weathering (Xenon-lamp).



The UV-protected side of the sheet is shown by the printed film IMPEX® MULTIWALL.

In case the protective film is removed before installation it is still possible to identify the UV-protected side:

Side marking: In order to ensure the full traceability of our production and the follow-up of quality issues, sheets are ink-printed every meter. This marking is shown on the UV-protected side.

Visual control: On clear sheets the edge of the upper skin has a bluish tint. On coloured sheets, the partition lines are more visible on the UV protected side.

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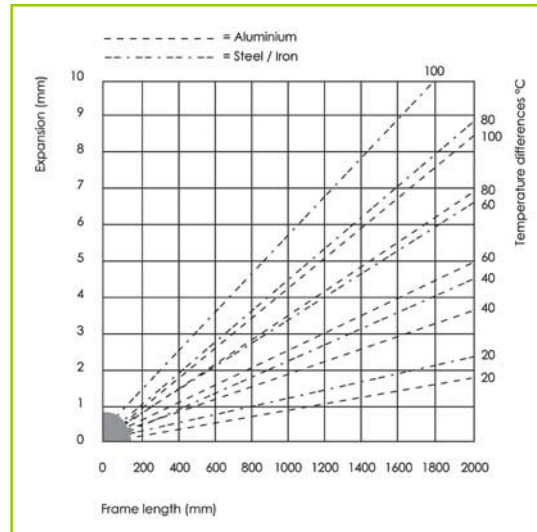
4.3 Thermal properties

Linear expansion differences of steel/iron and aluminium: with respect to SPC sheets on heating is 0.065 mm/m.°C.

Using IMPEX[®] MULTIWALL sheets with other materials, these different expansions on heating are to be taken into consideration.

Example:

A transparent pane made from IMPEX[®] MULTIWALL sheets is to be put into an aluminium frame. The dimensions are 1200 x 1800 mm. The temperature range is -20°C to +80°C (a difference of 100°C). If installation of the pane takes place at +20°C, we must in this case allow for a temperature difference of +60°C (+20°C to +80°C). For the frame length of 1200 mm we have, according to the chart, for aluminium an expansion of 3 mm, and for the frame length of 1800 mm, 4.5 mm to be provided for the expansion of the IMPEX[®] MULTIWALL sheet. For the temperature difference of 40°C (+20°C to -20°C) there is a shrinkage of 2 mm to be taken into account for the frame length of 1800 mm, over the whole frame. (The given values are minimums and should not be less than specified).



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4.4 Acoustical properties

IMPEX[®] MULTIWALL sheets offer sound insulating properties due to material stiffness, light weight and low visible density. According to DIN 52210-75, the maximum sound transmission of IMPEX[®] MULTIWALL is:

Sound insulation values for IMPEX[®] MULTIWALL

From SPC 4 to SPC 8	18 dB
From SPC 10 to SPC 16	20 dB
From SPC 20 to SPC 32	22 dB

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4.5 Impact strength

IMPEX® MULTIWALL sheet has outstanding impact performance over a wide temperature range, of -40°C to +120°C and also after prolonged outdoor weathering exposure.

IMPACT TEST: According to Norm SIA V280 (1996) test n° 9

Description: Shoot PA-balls at different areas of the cooled sheet.

Measure the different speeds till a break appears on the sheet.

Data: Diameter of the Polyamide 66 -balls: 40 mm

Average weight of the balls: 38,5 g

Samples size: 800 mm x 1000 mm

Before the shooting starts the sheet is covered with ice-chips for 3 minutes.

Results

IMPEX® MULTIWALL 10				
Speed m/s	Appearance	Depression: Ø mm	Depth mm	Result
15	No change			Dense
20	Little depression			Dense
30	Contained deformation	19	2,8	Dense
50	Contained deformation	22	5,7	Dense
70	Contained deformation	32	8,9	Dense
90	Break on the top layer			Leak

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IMPEX® MULTIWALL 16

Speed m/s	Appearance	Depression: Ø mm	Depth mm	Result
15	No change			Dense
20	Little depression			Dense
30	Contained deformation	25	0,9	Dense
50	Contained deformation	33	5,8	Dense
70	Contained deformation	35	8,4	Dense
90	Contained deformation	45	12	Dense
116	Break on the top layer			Leak

IMPEX® MULTIWALL 25

Speed m/s	Appearance	Depression: Ø mm	Depth mm	Result
15	No change			Dense
20	Little depression			Dense
30	Contained deformation	31	1,1	Dense
50	Contained deformation	43	6,3	Dense
70	Contained deformation	64	9	Dense
90	Contained deformation	66	15	Dense
110	Contained deformation	70	21	Dense
125	Break on the top layer			Leak

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5 LOADING CHARACTERISTICS

In order to determinate the required dimensions for plates made from IMPEX[®] MULTIWALL sheets fixed on all sides, the following factors are to be taken into consideration:

5.1 Coefficient of thermal expansion

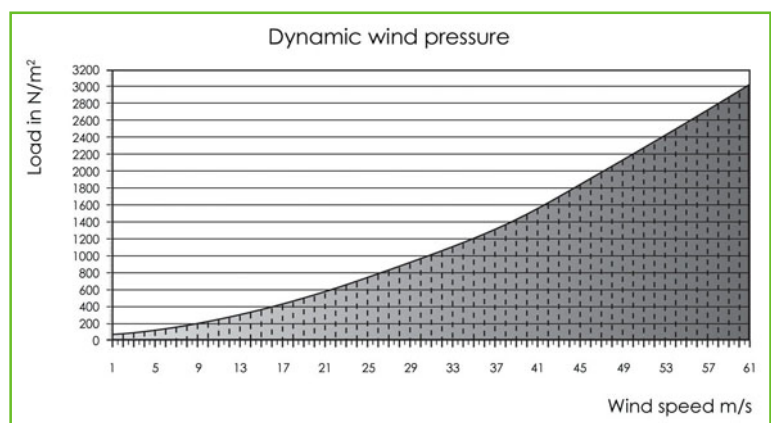
$65 \times 10^{-6} \text{ K}^{-1}$ corresponding to 0.065 mm per m length and 1°C change of temperature inside width of the frame. The frames can be made of plastic, wood or metal. It is recommended to equip the frame rebate with a relatively dense material. For a defined edge length of the sheet, the frame must accommodate the following amounts.

Edge length	Addition by:
500 mm	3 mm
1000 mm	5 mm
1500 mm	7 mm
2000 mm	10 mm
3000 mm	15 mm

Depth of rebate: The rebate should be approx. 25 mm deep.

5.2 Wind loading

A permissible deflection of the sheet of 50 mm per edge length is acceptable.



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5.3 Snow loading

Snow loading on roof or sidewall glazing shall be equivalent to a uniform load, the vertical load per square meter of the horizontal projection of the pane.

The load of snow on a horizontal or weakly tilted cover must be considered as an uniformly distributed load, perpendicular to the cover. Norms of constructions define the tolerable snow load by the construction. The density of snow can vary 0,07 to 0,3. In certain climatic conditions snow can be charged with water. It is therefore preferable to evacuate a volume of fresh snow in order to avoid all overcharge.

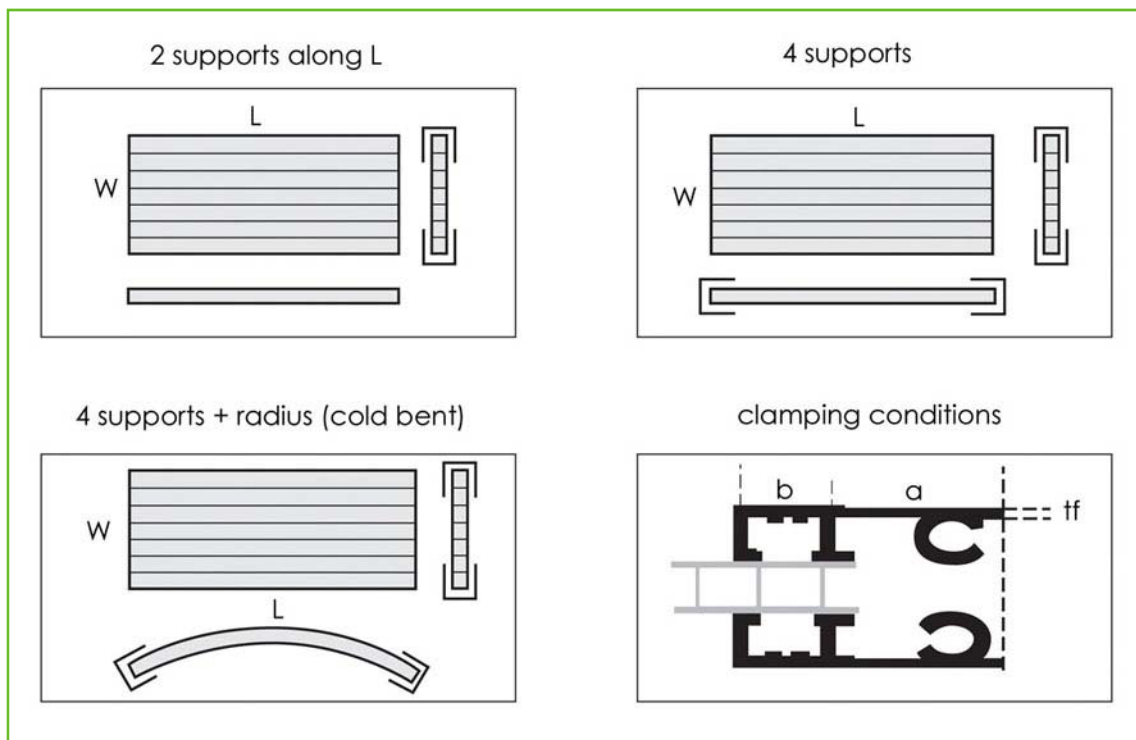
Example

Thickness	Load N/m ²	
	Fresh snow	Wet snow
20 cm	140	600
50 cm	350	1500
100 cm	700	3000

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5.4 Conditions of supports





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5.5 Loading capacity (Figures per thickness available in appendix)

SUPPORTS	Cond.		SPC 4	SPC 6	SPC 10	SPC 16	SPC 20	SPC 25
2 supports								
along L			Fig. 1	Fig. 10	Fig. 19	Fig. 28	Fig. 37	Fig. 46
L in meter								
4 supports	Length	L=1	Fig. 2	Fig. 11	Fig. 20	Fig. 29	Fig. 38	Fig. 47
		L=1,5	Fig. 3	Fig. 12	Fig. 21	Fig. 30	Fig. 39	Fig. 48
		L=2	Fig. 4	Fig. 13	Fig. 22	Fig. 31	Fig. 40	Fig. 49
		L=3 and +	Fig. 5	Fig. 14	Fig. 23	Fig. 32	Fig. 41	Fig. 50
R in mm								
Cold bent	Bending Radius	667	Fig. 6					
		1000	Fig. 7	Fig. 15				
		1500	Fig. 8	Fig. 16				
		1667			Fig. 24			
		2000	Fig. 9	Fig. 17	Fig. 25			
		2500		Fig. 18				
		2667			Fig. 26	Fig. 33		
		3000						
		3300					Fig. 42	
		3500			Fig. 27	Fig. 34		
		4000					Fig. 43	
		4200						Fig. 51
		4500				Fig. 35	Fig. 44	
		5000						Fig. 52
		5300						
		5500					Fig. 36	Fig. 45
6000							Fig. 54	
7000								

 Minimum bending radius

 Equivalent to "4 supports plane"

Other conditions of supports, contact us:

- 2 supports parallel to W
- multi-supports parallel to W

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6. USER GUIDE INFORMATION

6.1 Installation

When IMPEX® MULTIWALL has just been installed, the printed polyethylene film on the UV-protected side as well as the plain polyethylene film on the inner side will be removed.

In order to prevent condensation developing inside the flutes, we recommend IMPEX® MULTIWALL sheets be sealed with plain aluminium tape for the upper sealing and with micro-perforated aluminium tape for the bottom sealing. In the latter one we also recommend to use profiles which allow good ventilation and drainage.

The use of silicone putties should be avoided, as most of them are not compatible with polycarbonate, increasing the risk of chemically damaging the sheets. We also strongly advise against the use of PVC gaskets. Most of them will cause damage to the sheets because of plasticizer migrations. The use of EPDM gaskets is recommended.

When installing IMPEX® MULTIWALL sheets, do not walk on the sheet.

Install IMPEX® MULTIWALL sheets with the flutes towards the watershed direction.

Take account for rebate fittings of the coefficient of thermal expansion, which is equal to 6.7×10^{-5} mm °C. The total play corresponds to 3 mm/m.

The sheet holding should not be less than 18 mm.

The rebate depth takes account of the sheet holding, the usual play for thermal expansion and the fitting tolerances. It corresponds to the following values:

Distances between rabbets	Minimum rebate depth
0 to 1,000 mm	20 mm
1,000 to 2,500 mm	25 mm
More than 2,500 mm	30 mm

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6.2 Cutting

The following precautions are needed when cutting IMPEX® MULTIWALL sheets:

Make sure the sheets are in a perfectly flat position and use sharp cutting tools. The following table shows the kinds of tools to be used for sheets up to 20 mm thickness.

Tool	Slot pitch (mm)	Speed (revs. per minute)
Light metal-cutting high speed band saw	2	1,200
Light metal-cutting high speed circular saw	2-3	3,000
Fire-toothed circular saw	10	4,000-5,000
Diamond circular saw	10	3,000

For hand cutting (especially for 4 and 6 mm thicknesses) use Stanley-type blades.

To get rid of any shaving left in the flutes after cutting, use an appropriate air compressed vacuum cleaner. While cutting IMPEX® MULTIWALL sheets, make sure no overheating develops. This would possibly deform the sheets. If necessary cool the tools during the cutting process accordingly, and prevent moisture development.

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6.3 Storage

For outdoor storage, pallets of IMPEX[®] MULTIWALL sheets should be stored on a flat and dry ground with adequate ventilation, protected from direct sunlight and rain (condensation risk).

For indoor storage without pallets, sheets should not be horizontally piled up for more than 2 meters. Vertical storage is possible only if the shelves are perfectly straight. If not permanent deformation will develop.

Before moving any pallet make sure that the lifting ropes are well but not too tightly attached to the sheets. If not this may damage the top sheets of the pallet.

For all 2,100 mm wide sheets and lengths of more than 7,000 mm, do not use short forklift trucks. The risk is high to bend the pallet when it is moved and results in the pallet nails protruding due to distortion and entering the bottom sheets on the pallet.

6.4 Drilling

For drilling action use conically headed high-speed metal drills (1,000 to 1,500 revs. per minute).

Holes should be drilled at a distance of at least 10 mm from the sheet edges. Make sure that the diameters of the holes are larger than those of the screws (i.e. 10-12 mm for 6 mm screws). This will allow thermal expansion without any risk.

6.5 Cleaning

Never use watery solutions that may contain abrasives or aggressive solvents.

Use regularly non-alkaline liquid soaps, warm but not hot water and soft sponges only.

If necessary repeat the operation several times.

Rinse with warm water and dry with soft fabrics with the same care.

Small scratches and superficial marks of abrasion can be eliminated with polish-type paste, dabbed on the sheets to then be removed with warm water or light detergents.

Greasy taints as well as fresh painting marks can also be eliminated by quickly dabbing alcohol, petrol or very light solvents on the sheets. A generous rinse with warm detergent water is then immediately required.

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7. APPENDIX: LOADING CAPACITIES

7.1 Loading characteristics - IMPEX[®] MULTIWALL 4

Snow and wind (kN/m²)

Product name: **IMPEX[®] MULTIWALL 4**
weight: 900 g/m²

Conditions maximum displacement (d) 50 mm
maximum pop out (p) 15 mm

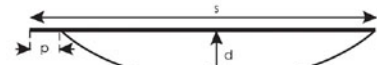


Fig. 2: SPC 4 • 4 supports • L=1

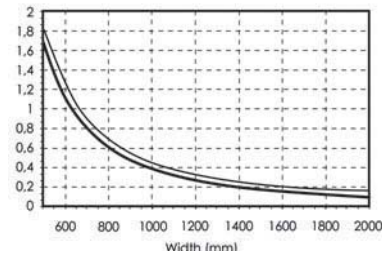


Fig. 4: SPC 4 • 4 supports • L=2

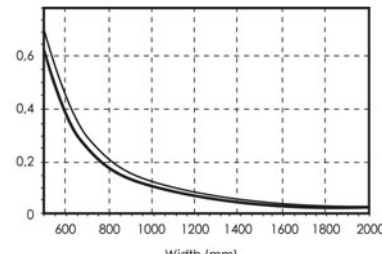


Fig. 6: SPC 4 • cold bent • R=667mm

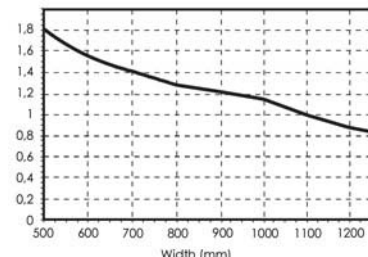


Fig. 8: SPC 4 • cold bent • R=1500mm

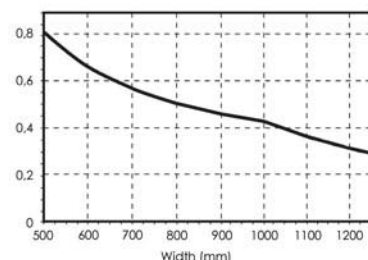


Fig. 1: SPC 4 • 2 supports//L

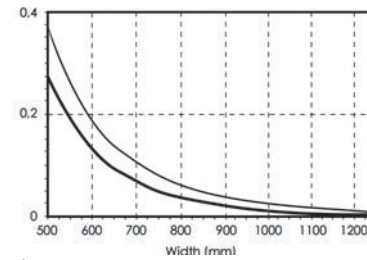


Fig. 3: SPC 4 • 4 supports • L=1,5

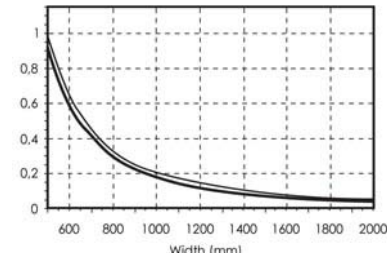


Fig. 5: SPC 4 • 4 supports • L=3 and +

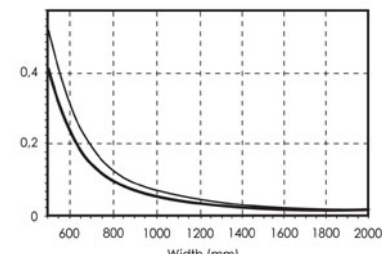


Fig. 7: SPC 4 • cold bent • R=1000mm

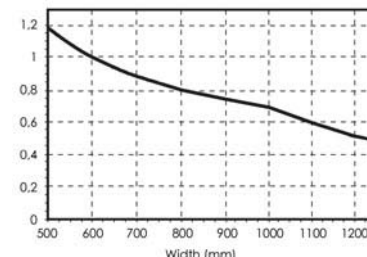
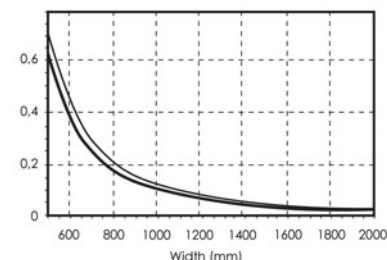


Fig. 9: spc 4 • cold bent • R=2000mm



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7.2 Loading characteristics - IMPEX[®] MULTIWALL 6

Snow and wind (kN/m²)

Product name: **IMPEX[®] MULTIWALL 6**
weight: 1300 g/m²

Conditions maximum displacement (d) 50 mm
maximum pop out (p) 15 mm



Fig. 11: SPC 6 • 4 supports • L=1

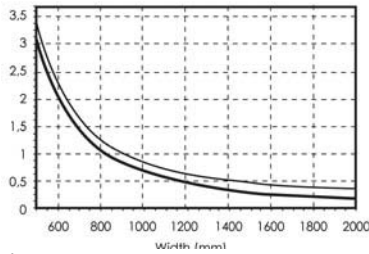


Fig. 13: SPC 6 • 4 supports • L=2

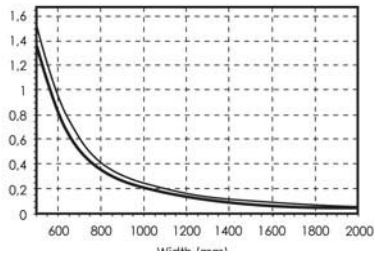


Fig. 15: SPC 6 • cold bent • R=1000mm

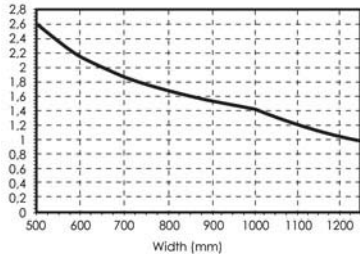


Fig. 17: SPC 6 • cold bent • R=2000mm

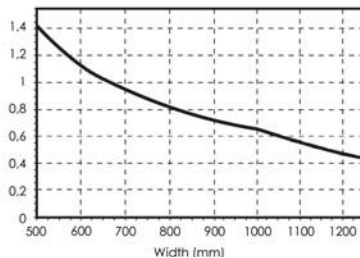


Fig. 10: SPC 6 • 2 supports//L

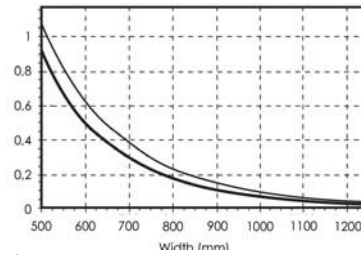


Fig. 12: SPC 6 • 4 supports • L=1,5

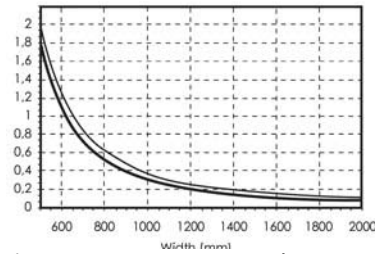


Fig. 14: SPC 6 • 4 supports • L=3 and +

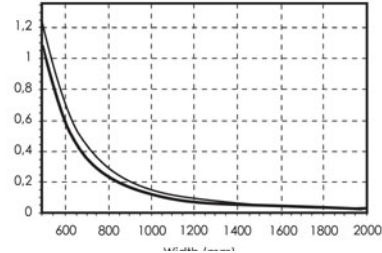


Fig. 16: SPC 6 • cold bent • R=1500mm

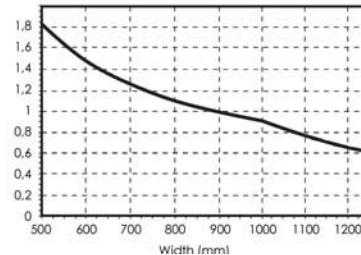
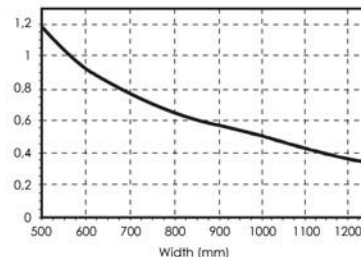


Fig. 18: SPC 6 • cold bent • R=2500mm



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7.3 Loading characteristics - IMPEX[®] MULTIWALL 10

Snow and wind (kN/m²)

Product name: **IMPEX[®] MULTIWALL 10**
weight: 1700 g/m²

Conditions maximum displacement (d) 50 mm
maximum pop out (p) 15 mm

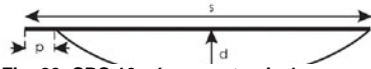


Fig. 20: SPC 10 • 4 supports • L=1

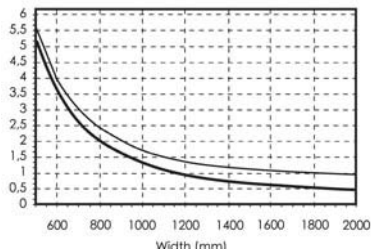


Fig. 22: SPC 10 • 4 supports • L=2

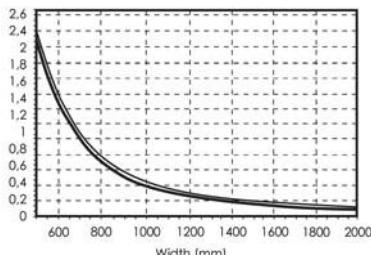


Fig. 24: SPC 10 • cold bent • R=1667mm

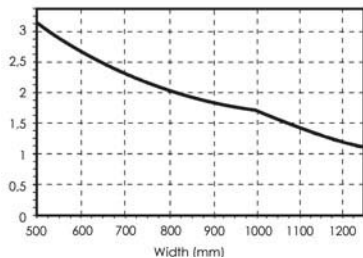


Fig. 26: SPC 10 • cold bent • R=3000mm

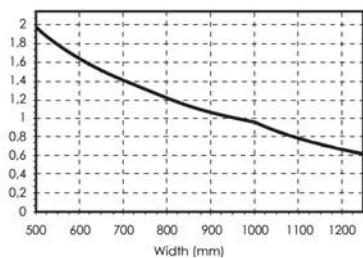


Fig. 19: SPC 10 • 2 supports//L

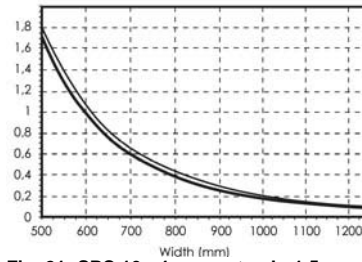


Fig. 21: SPC 10 • 4 supports • L=1,5

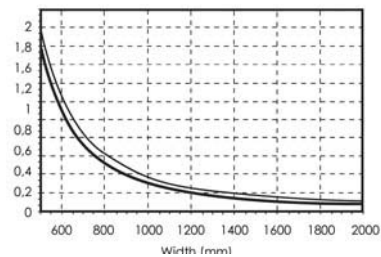


Fig. 23: SPC 10 • 4 supports • L=3 and +

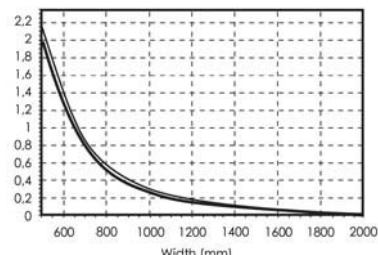


Fig. 25: SPC 10 • cold bent • R=2000mm

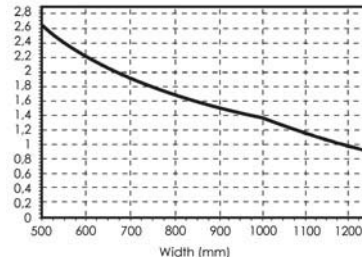
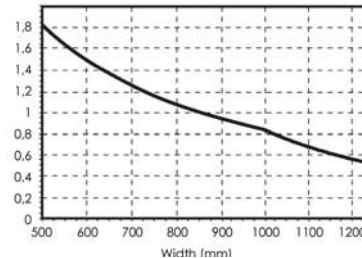


Fig. 27: SPC 10 • cold bent • R=3500mm



TECHNICAL MANUAL

Multiwall sheets made from polycarbonate

7.4 Loading characteristics - IMPEX® MULTIWALL 16

Snow and wind (kN/m²)

Product name: **IMPEX® MULTIWALL 16**
weight: 2700 g/m²

Conditions maximum displacement (d) 50 mm
maximum pop out (p) 15 mm

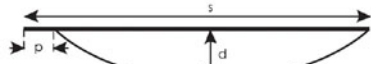


Fig. 29: SPC 16 • 4 supports • L=1

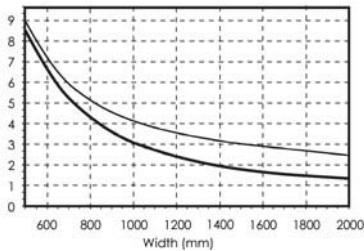


Fig. 31: SPC 16 • 4 supports • L=2

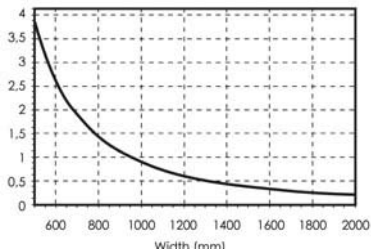


Fig. 33: SPC 16 • cold bent • R=2667mm

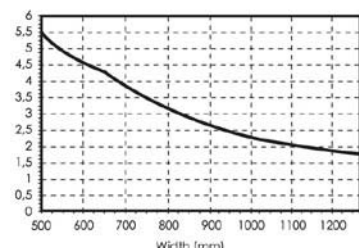


Fig. 35: SPC 16 • cold bent • R=4500mm

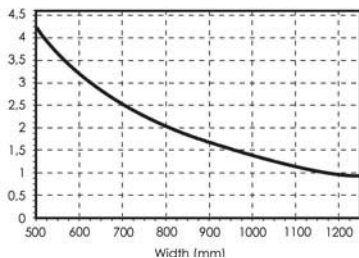


Fig. 28: SPC 16 • 2 supports//L

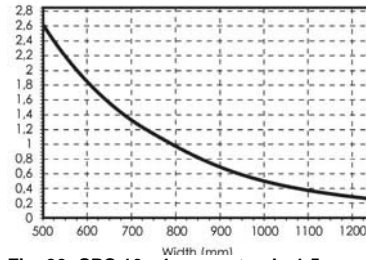


Fig. 30: SPC 16 • 4 supports • L=1,5

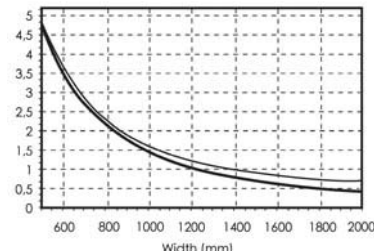


Fig. 32: SPC 16 • 4 supports • L=3 and +

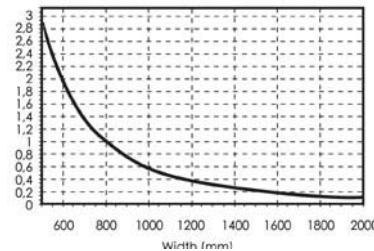


Fig. 34: SPC 16 • cold bent • R=3500mm

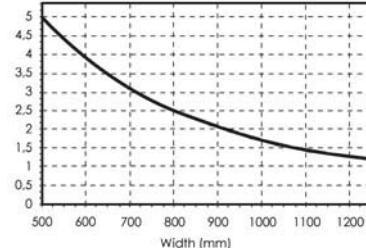
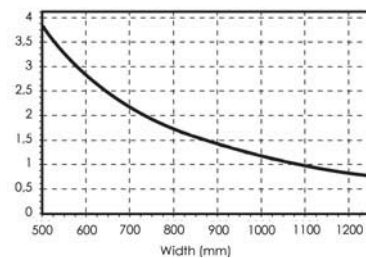


Fig. 36: SPC 16 • cold bent • R=5500mm



TECHNICAL MANUAL

Multiwall sheets made from polycarbonate

7.5 Loading characteristics - IMPEX[®] MULTIWALL 20

Snow and wind (kN/m²)

Product name: **IMPEX[®] MULTIWALL 20**
weight: 3200 g/m²

Conditions maximum displacement (d) 50 mm
maximum pop out (p) 15 mm

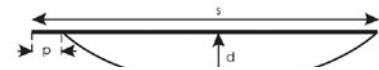


Fig. 38: SPC 20 • 4 supports • L=1

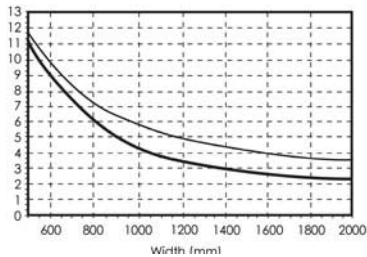


Fig. 40: SPC 20 • 4 supports • L=2

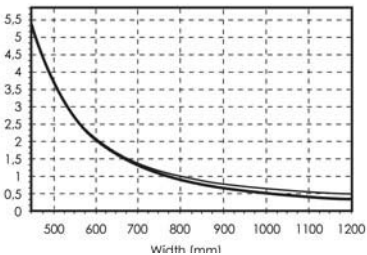


Fig. 42: SPC 20 • cold bent • R=3300mm

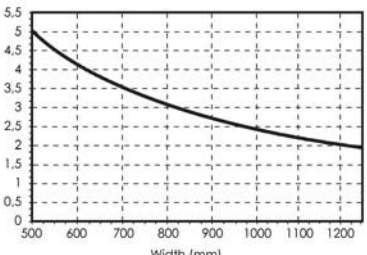


Fig. 44: SPC 20 • cold bent • R=4500mm

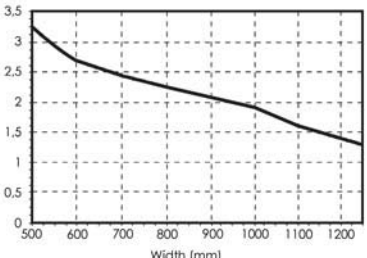


Fig. 37: SPC 20 • 2 supports//L

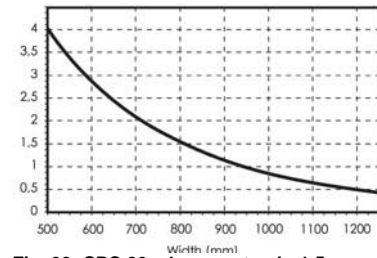


Fig. 39: SPC 20 • 4 supports • L=1,5

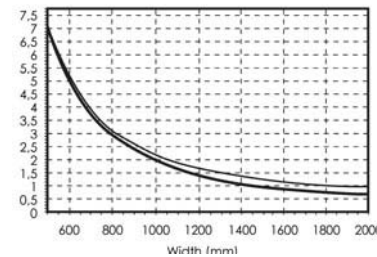


Fig. 41: SPC 21 • 4 supports • L=3 and +

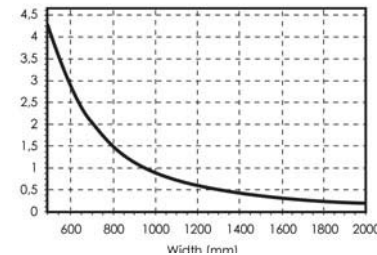


Fig. 43: SPC 20 • cold bent • R=4000mm

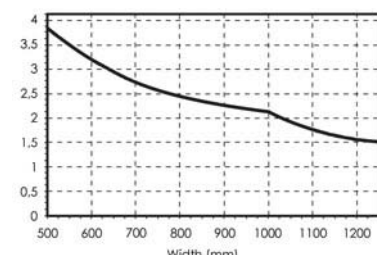
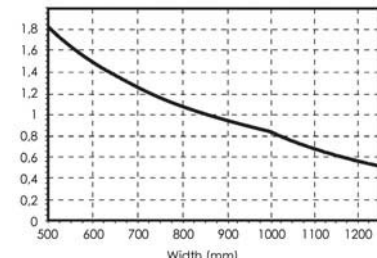


Fig. 45: SPC 20 • cold bent • R=5500mm



TECHNICAL MANUAL

Multiwall sheets made from polycarbonate

8 CLOSING REMARKS

For more details on further processing methods, please contact our technical customer service.

Please note that our technical recommendations are without legal obligation.

The information given in this brochure is based on our knowledge and experience to date.

It does not release the user from the obligation of carrying out own tests and trials, in view of the many factors that may affect processing and application.

They do not imply any legally binding assurance of certain properties or of suitability for a specific purpose.

It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

Technical data of our products are typical ones; the actually measured values are subject to production variations.