



 **POLYSHADE**[®]
POLYCARBONATE SHEETS

INSTALLATION GUIDE

 **CANADA**
PLASTICS & BELTING
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WELCOME

Headquartered in Toronto, **Canada Plastics & Belting Inc.** specializes in Distribution of Industrial Products & Supplies to the Plastics Flexible Packaging, Converting, Flexographic, Textile and Screen Printing Industry.

Canada Plastics & Belting Inc. is a leading supplier of Premium grade **Polyshade Polycarbonate sheets**, with years of experience and knowledge of applications to call upon. It is our company policy to offer the best quality products possible at competitive prices and to provide a first class delivery service to our customers.

Polyshade is a premium grade of Polycarbonate Sheet that is suitable for many different applications. Polyshade solid & hollow polycarbonate sheets are commonly used for greenhouse & sunroom construction, commercial roofing, patio covers, hurricane protection, swimming pool enclosures, & more.

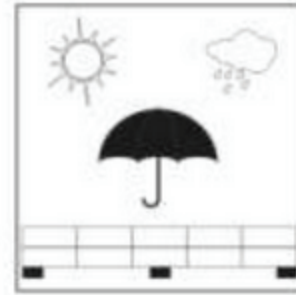
THE INSTALLATION GUIDE

The following installation guide provides general information for handling, prepare and installing Polycarbonate sheets. Please read this manual very carefully before starting to avoid unnecessary damage.

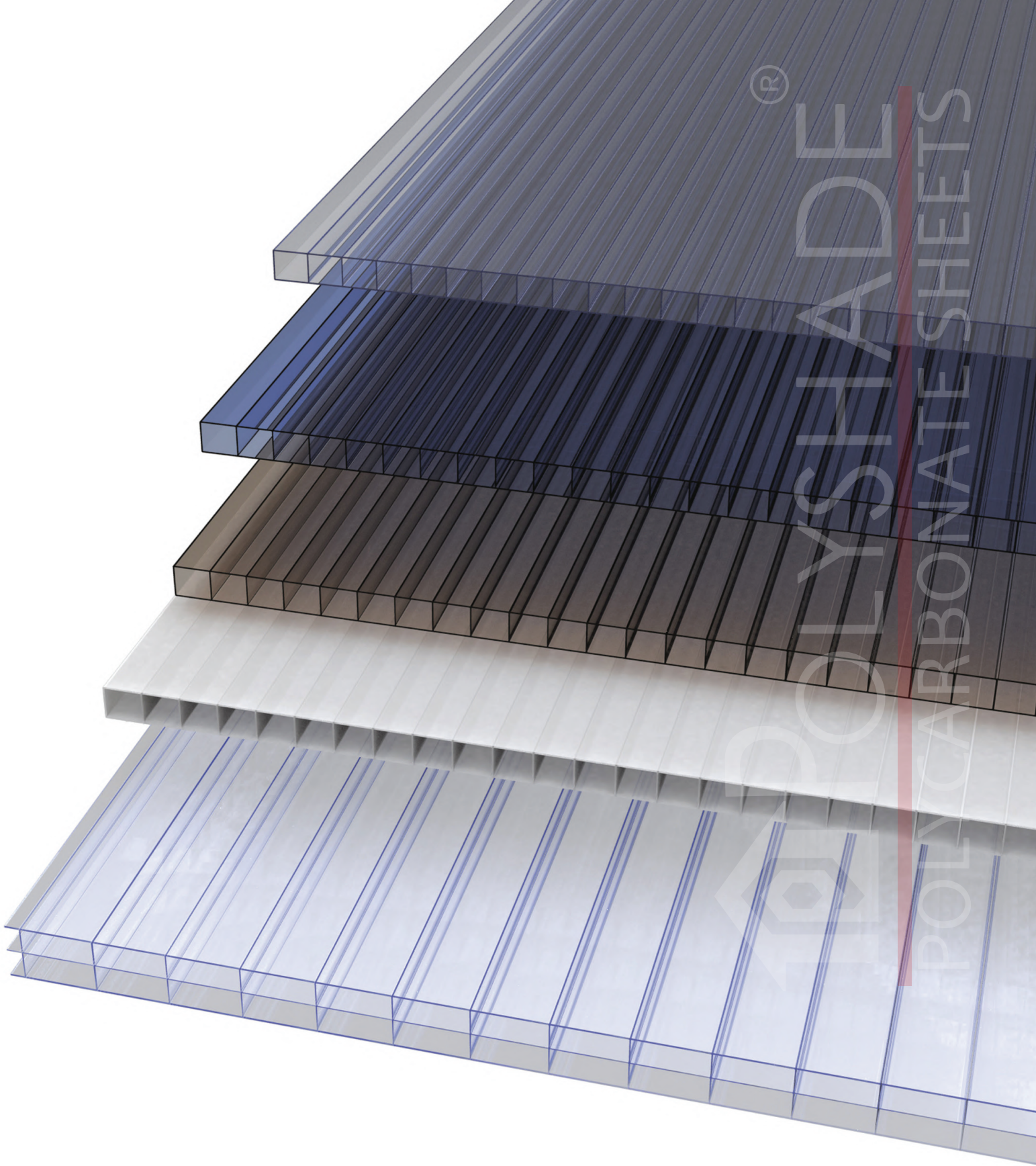


HANDLING AND STORAGE

- 1** PC sheets should be transported and stored horizontally, on a flat, secure pallet whose dimensions are equal to or larger than the sheets themselves. The sheets must be secured and fastened to the pallet during transportation. It is possible to stack the sheets with the longer sheets at the bottom and the shorter on top, leaving no unsupported overhang.
- 2** While moving a pallet with a forklift, always use forks as long as the sheets' width. Shorter forks on a wider pallet may cause damage to the sheets.
- 3** PC sheets has the factory watertight film. The film should be taken off as close to the actual time of installation as possible. Storage of the sheets should be in a covered, dry, ventilated place, away from direct sunlight and rain.
- 4** Avoid leaving the sheet pallet in the rain, even if still wrapped, for extended periods, as water may condense inside the hollow channels. Extended exposure to direct sunlight may cause heat buildup, softening the protective film, fusing it to the sheet face, making the removal process difficult or impossible.
- 5** Avoid leaving the sheets stored unwrapped, with their ends open, for more than a few days, as dust may collect inside the hollows.
- 6** Never cover the pallet with, or place on the pallet, materials that collect heat or are good heat conductors (e.g. dark objects, metal profiles or pipes, steel sheets etc.) They may collect and deliver excess heat, and damage the sheets.
- 7** When necessary to store the pallet in the open, cover it with a white opaque polyethylene sheet, cardboard, or any other insulating material, taking care to cover the pallet completely.



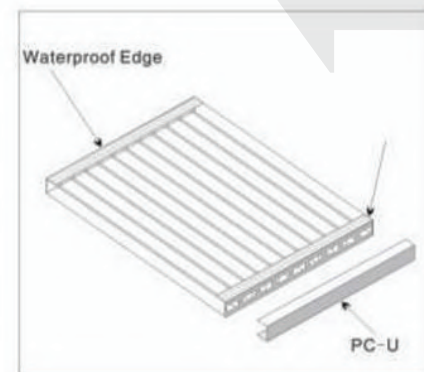
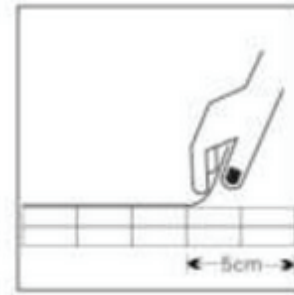
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PREPARATIONS PRIOR TO INSTALLATION

- 1** Ensure smaller thermal expansions by installing sheets - especially colored sheets - at ambient temperatures of 10-25 deg. °C (50-77 deg. °F). It is generally recommended to avoid installing sheets at colder or hotter temperatures.
- 2** Peel off the protective film at both open ends of the sheet (the width sides) to about 50-80 mm (2.5-3 in.) from the edges of the sheet, to enable taping of the aluminum sealing tape. If a factory installed temporary seal is taped over the open ends, it should be removed prior to the installation of the aluminum tape. Tape the sealing tape straight along the open-end side, so it will cling well and evenly to both sides of the sheet, making sure that all the open ends of the rib channels are properly sealed.
- 3** Peel off the masking along the edges of length sides, both sides of the sheet, for about 50-80 mm (2.5-3.5 in.) from the edges, preparing the sheet for the insertion into the connecting profiles or the glazing frame.
- 4** Remove the underside masking just prior to the actual installation on the roof. Premature removal of protective film may result in damage to the sheet during handling.
- 5** Remove the upside, exterior protective film as soon as the installation of the whole glazed area is completed, or very short time afterwards. Failing to do so, exposing the protective film to direct sunlight, may fuse it to the sheet's face and cause difficulties in removal, due to deterioration of the film, and void the warranty.
- 6** Ensure the use of the proper type of sealing tape according to the application used, verifying that the prepared sheets are mounted correctly. Please note: In case of curved installation, where both open ends are situated at the bottom, apply the ventilated tape on both ends. Take care to protect the sealing tapes at both ends from mechanical damage by inserting the edges into aluminium profiles, or cover them with polycarbonate U-shaped profiles.



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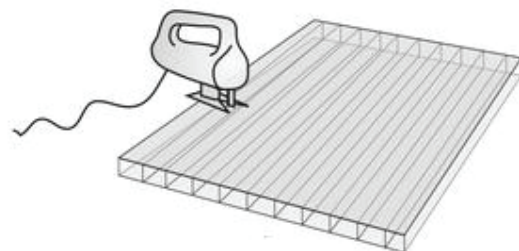
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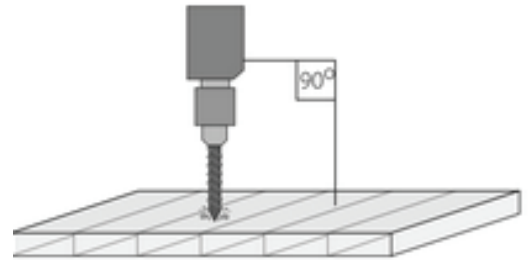
CUTTING

- 1** PC sheets can be cut with standard wood or metal workshop equipment. Saw blades designed especially for plastic yield best results. A circular saw (fixed or portable, with small teeth suited for hardwood), rotating at high speed, band saw or a jigsaw (best for short, complex cuts) can all be used, taking care to advance the blade slowly. A hand and hacksaw may also be used for local cutting.
- 2** Always support the sheet in the vicinity of the cut and clean (with compressed air and/or by a vacuum cleaner) the dust and debris generated by the cutting. Running clean compressed air through the hollow channels, blowing away sawdust and shavings inside is a good practice.
- 3** Sheets of low and intermediate thickness, with modest dimensions, can be cut (taking the appropriate precautions) with a short, thin, sharp blade. A special cutting-wire hand tool may also be used, to make lengthwise cuts.



DRILLING

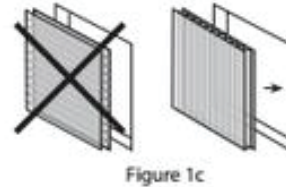
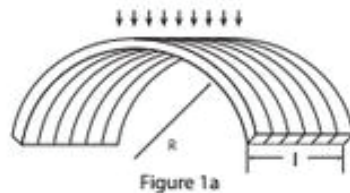
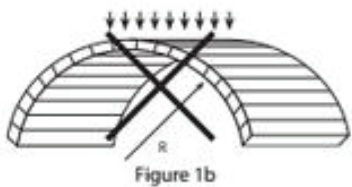
- 1 Drilling can be carried out with drill bits intended for metal. When pre-drilling for a fastening screw, the hole's diameter should be 2 mm larger than that of the screw used. As when cutting, always support the sheet in the vicinity of the place being drilled, and clean away the sawdust and shavings, both on and inside the sheet.
- 2 Special attention must be given to drill all the required holes perpendicular to the face of the sheet.
- 3 Though drilling the sheet for fastening is a common way of installation, it is recommended to be used mostly in plain, economy-oriented projects, and used sparingly elsewhere.



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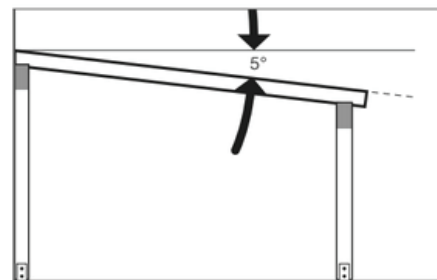
POSITIONING THE SHEETS

PC sheets should be installed with the rib channels sloping downwards (Figs. 1a, 1c, 2). That orientation will prevent dirt of getting inside the sheet and will provide ease gravity drainage of condensation moisture that could potential build up inside.



Sheets should be installed with the adjoining edges connected by a glazing profile suited to the glazing system.

For sheets installed in horizontal and flat positions (i.e. roofs, skylights), a minimum slope of 5 % is imperative but 10 % and above preferable. Steeper slopes offer better rainwater drainage and self- cleaning. They also help to diminish the visual effect of sheet deflection caused by adding addition weight.



Arching Radius - sheets may be cold bent, or curved up to their minimum permitted radius, using polycarbonate's natural properties, without need of a thermal process.

Radius of sheet curvature and recommended distance between supports:

Product	Thickness	Radius of Sheet Curvature		Maximum recommended distance (center-to-center) between support purlins according to wind-snow loads below									
				mm		in.		mm		in.			
				Uniform wind/snow loads									
	mm	mm	in.	kg/m ²	psf	kg/m ²	psf	kg/m ²	psf	kg/m ²	psf		
Twin Wall	6	1050	41	1730	68	1730	68	1730	68	1730	68	1730	68
		1500	60	1570	61	1570	62	1200	48	1200	48	1200	48
		1800	72	1420	56	1420	56	1150	46	1150	46	1150	46
		2200	86	1380	55	1380	55	1150	46	1150	46	1150	46
		2800	110	1260	50	1260	50	1100	44	1100	44	1100	44
		4000	158	1150	46	900	36	850	34	780	31	780	31
	8	1400	55	1570	62	1570	62	1570	62	1570	62	1570	62
		1800	72	1880	74	1420	56	1420	56	1420	56	1420	56
		2200	86	1730	68	1380	55	1380	55	1380	55	1380	55
		2800	110	1470	58	1470	58	1250	50	1100	43	1100	43
		4000	158	1250	50	1150	46	1050	40	900	32	900	32
	10	6000	236	1150	46	1000	40	850	34	650	26	650	26
		1750	69	1885	74	1885	74	1885	74	1885	74	1885	74
		2200	86	1725	68	1725	68	1725	68	1725	68	1725	68
		2800	110	1750	69	1750	69	1750	69	1450	57	1450	57
	6000	4000	158	1570	62	1400	56	1250	50	1250	50	1250	50
		6000	236	1260	50	1200	48	1100	43	925	37	925	37

Local building codes and standards in most countries provide details for required design loads, which should be consulted before installation. The information below is provided for general reference.



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INSTALLATION METHODS

This is a simpler, more practical method, resembling the one used for single-wall, corrugated plastic (or metal) sheets. It employs longer strips, with wider dimension. Length is as long as possible without excess deformation by thermal expansion.

PC sheets are laid on top of the purlins, with rib channels directed down the slope, perpendicular to the purlins. Span between purlins is determined by the load and deflection characteristics of the specific PC sheet.



- 1 The sheets are connected to each other by long connecting elements.
- 2 The wide variety of these connection methods falls into two main categories: “wet” or “dry”. The connecting elements (made of aluminum, sheet metal or plastic- rigid materials) are designed as connectors, not as load supporting members. They connect the sheets to each other, achieving one unified watertight exterior shell.

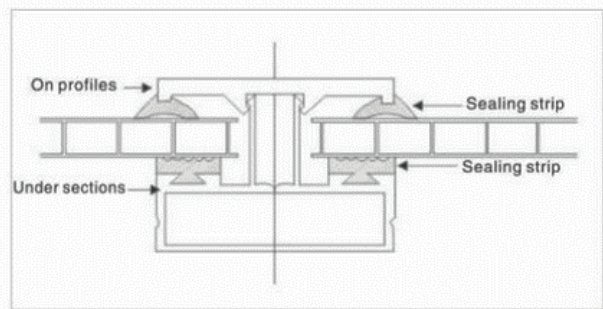


A BASIC INVERTED “H” POLYCARBONATE CONNECTING PROFILE

An old and simple form enabling a lengthwise (side by side) connection between twin wall sheets. It is sometime offered with a specific size profile for each sheet thickness, or in versatile, more flexible design enabling the use of one profile with 2 consecutive thicknesses (4-6 & 8-10 “H” profiles).

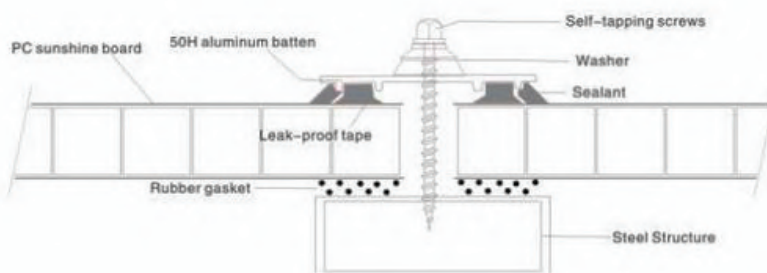
“DRY” METHOD (NO SEALANT USED)

The edges on both sides are inserted into the profile, holding the sheets by “dry” mechanical friction, with the sheets on both sides fastened to the structure, along the purlins, by fixing screws, about 500-600 mm (20-24 inches) apart.



“WET” METHOD

Both the profile channels are half-filled with silicone, which acts, after installation and curing, both as sealer and adhesive. It may offer better weather-proofing at shallower slopes, than the “dry” system, but is very difficult to install properly and cleanly. Also, must pay closer attention to check sealant chemical properties before using it, absolutely not allowed to have amines, benzoic acid, alkaline silicone components - these components will corrode the sheet, and then cause the sheet to crack.



Notes:

- The connector itself is not fixed to the purlins.
- Both systems are basic and disclose several shortcomings: difficult and bothersome installation, plain looks, weak and imperfect connection and sealing. Installation may prove to be lengthy and messy for inexperienced hands. They are, however, considered the cheapest.
- We would limit the use of “H” connector system to vertical, short sheets, as in wall cladding or windows.



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A TWO-PART POLYCARBONATE CONNECTING PROFILE

- 1 A lower base profile, usually the more rigid of the two, on which the edges of the adjoining sheets are placed. Usually the base profile is fastened to the purlins by screws through the middle, with both edges free, letting the sheets slide easily due to the thermal expansion and contraction process.
- 2 The upper part, usually more flexible than the base, clips on the base profile by hand pressure, holding both sides of the adjoining sheets in place by mechanical pressure.

This type is easier to install, more reliable in holding the sheets and sealing the connection. It is used, mostly, in “dry” installation, but could be assisted by silicone on the upper and lower profile. “Wet” installation like this is difficult to keep clean during installation and with long sheets may lose its effectiveness due to excessive expansion.

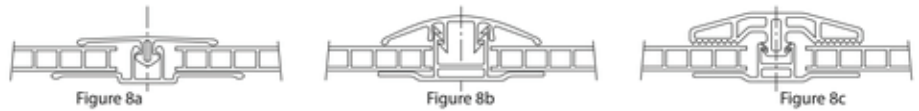


Figure 1. Drawing of typical two-part polycarbonate connecting profiles currently used

COMBINATION OF METAL AND PLASTIC TWO-PART CONNECTING PROFILE

Combination of metal and plastic two-part connecting profile offers added strength and rigidity. The lower part of the profiles made of metal- (mostly aluminum), and the upper part is made of plastic (rigid PVC or polycarbonate), clipped on top of the metal profile, pressing on the edges of the two adjoining sheets.



Figure 2. Depiction of Typical Two-Part Plastic and Metal Connecting Profiles Currently Used

WOOD CONNECTING PROFILES

Wood connecting profiles, developed from wooden window frames, support the installed PC sheets. They are usually used together with the “wet” system, with rubber packing strips and silicone sealant. Lengths are generally limited by the nature of wood. If long, laminated wooden rafters are used, they usually come with one or more of the other connecting solutions below.

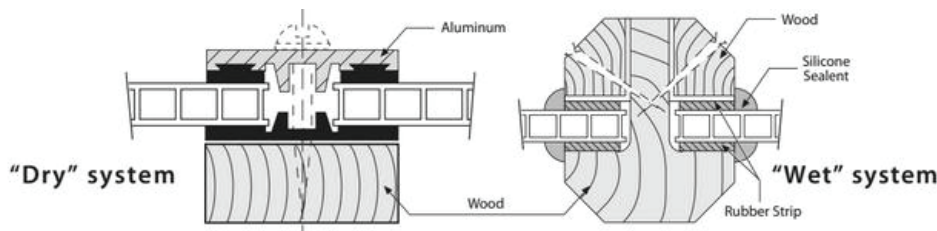


Figure 3. Depiction of Typical Two-Part Wood Connecting Profiles Currently used in the Market

METAL CONNECTING PROFILES

Metal connecting profiles comprise the largest group of connecting profiles. They come in wide variety of designs, are made from aluminum or steel, in “dry” or “wet” systems, and in plain or sophisticated detailing and finish. Some profiles are equipped with built-in drains, EPDM rubber weather strips, concealed fixing screws, and high-end finish, for more luxurious structures.

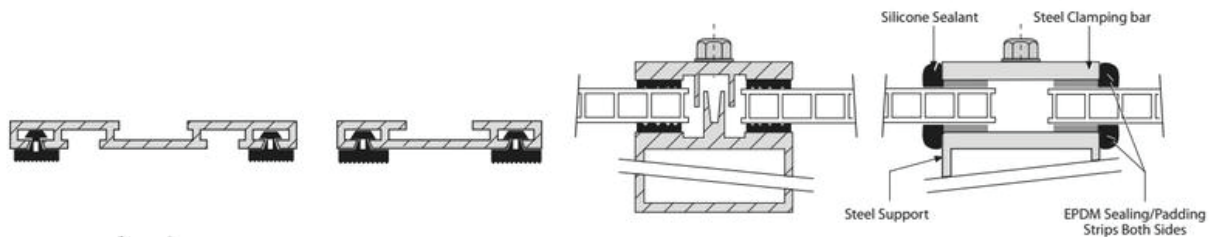


Figure 4. Depiction of Typical Two-Part Metal System Connecting Profiles Currently Used



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MID-SHEET FASTENERS

(Not recommended for D.I.Y Applications)

1 A wider sheet has to be fastened to the supporting structure by additional fastening along its width, as the connectors on both longitudinal sides are not enough to hold the sheet down, against the uplift force it has to withstand.

2 Fastening is usually done by screws, inserted along the supporting internal purlins, spaced about 500mm (20in.) apart.

3 Along the edge purlin, the fastening screws should be inserted about 300 mm (12 in.) apart.

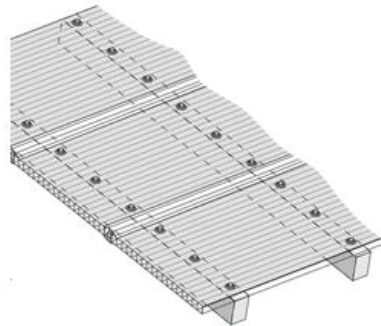


Figure 5. Roof Installation with Mid-sheet Fasteners

4 A hole must be pre-drilled into each screw location. The diameter of that hole should be 2mm larger than that of the screw, to allow for thermal expansion movements. In case of dark colored sheets predrill even larger holes, and use wider fastener washers.

5 An electric screwdriver with an adjustable clutch should be used to tighten the screws. Avoid excess overtightening, which might induce undue internal stresses, causing premature failure and buckling of the sheet. Pay attention to insert the screws perpendicular to the material face, as inclined insertion could damage the sheet and/or result in leaks.

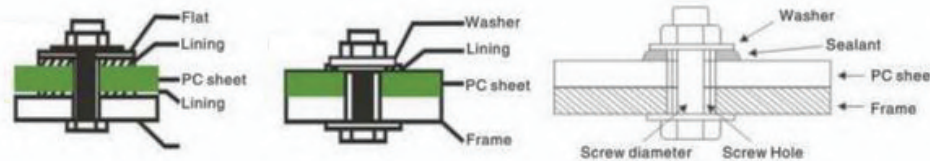


Figure 6. Depiction of proper screw insertion



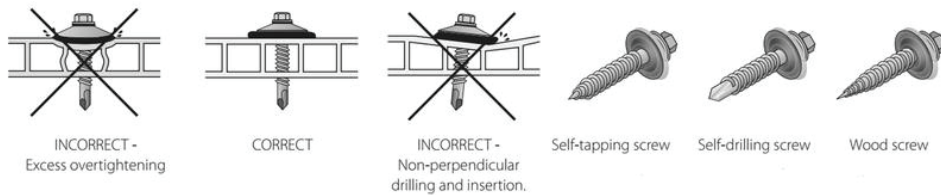


Figure 7. Correct and Incorrect ways of drilling and insertion

6 Use of self-tapping or self-drilling screws is recommended. In case of wooden structures, suitable wood-screws should be used. All the screws should be corrosion resistant, with at least heavy-duty hot-dipped galvanized finish, or stainless steel (if used in an extremely corrosive environment). The screws should be 6 mm (1/4 in.) diameter, with length according to sheet thickness, type of washer and type of supporting structure.

7 Each screw should be fitted with a conical corrosion resistant steel washer, with specifications as the screws above or of aluminum, at least 1 mm (0.04 in.) thick, 25 mm (1 in.) diameter, with a Specially Shaped integral rubber gasket, EPDM. The screw should be tightened carefully, with no distortion of the washer and rubber gasket, or the flat face of the sheet PALRAM will supply the suitable fasteners and washers with the PC sheets unless required otherwise.

8 Screw buttons: Improved performance can be obtained by replacing the washers with special plastic screw buttons, fitted with a suitable rubber gasket, with or without a closing cap. They fit the thickness of each type of sheet (6, 8, 10, 16mm, and possibly 25 mm), differing by sleeve length. Their advantage: the sleeve prevents excessive tightening and local squashing around the screw, and is softer on the sheet, reducing risk of tear or shear around the screw's stem. They also offer a seal between the fastener hole and the open channels of the sheet, preventing possible infiltration of water and dirt into the internal space of the sheet. Screw buttons work with the same screws mentioned above (6 mm, 1/4 in.), maybe a little longer due to the higher thickness of the button.



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WORKING WITH POLYCARBONATE SHEETS



CLEANING

- 1** Keeping PC clean will yield the best long-term results. Self-cleaning by rain is usually sufficient. Local small areas may be washed using diluted mild household detergents. Make sure the detergent contains no abrasives or solvents. Pre-wash with warm water, then wash the stained area with a soft sponge or brush, preferably with hot water, until the stain disappears. Rinse with water and dry with a soft cloth.
- 2** Heavy oil or tar stains can be removed with an isopropyl alcohol watery solution. Rub the area gently with a soft rag. Follow with the treatment depicted above, rinsing with a lot of water.
- 3** Avoid dry cleaning, as the sand and dust particles clinging to the exterior of the glazing may scratch the surface.
- 4** Large areas may be professionally washed by high-pressure water jet, possibly adding a mild compatible detergent, and/or a steam jet.
- 5** Avoid the repeated sliding of sheets over each other, even when still protected by the masking film. This action generates electrostatic charge in the sheet, attracting dirt and dust and hindering cleaning.
- 6** The maximum curving radius should be 175 times thickness of PC Hollow Sheet.
- 7** The maximum curving radius should be 100 times for the thickness of PC Solid sheet with less than 3mm thickness, and it should be more no more than 175 times for the sheets above 3mm thickness.

SAFETY MEASURES during Installation and Maintenance

- 1** When installing PC or doing maintenance work, always consider the sheet to be unfit to support a person's weight. Always use stepping ladders or crawling boards, supported by the roof structural elements, when working on a glazed roof of any kind.
- 2** Never step on PC sheet between the purlins or in the middle of a framed glazing! In emergency, step only on the lines of purlins or of structural framing.
- 3** Never leave the glazing sheets unattended on the roof or at the glazing area, until all the required fastening clamps or screws are secured properly. Throughout the installation process, always ensure that the sheets ready for installation are temporarily secured against sudden wind gusts.



SPECIFICATIONS

Mechanical Properties

- Great Impact Performance: 80 times higher than traditional glass and 30 times higher than acrylic sheet
- Great tensile strength and heat resistance
- Great flexibility: up to bending 90 degree angle without rupture

Thermal Properties

- Maximum operating temperature: melting-shaped temperature is 135 C, continues use temperature is 120 C
- Linear expansion coefficient is $7 * 10^{-5}$ cm/cm C (smallest in plastics)
- Embrittlement temperature is -40 C, continues use temperature is -30 C (lowest in plastics)
- Combustibility panels are flame retardant and self - extinguishing with no toxic gases being released

Optical Properties

- Light transmittance is more than 85% - same as glass
- Panels have UV - Protective layer providing protection for long-term outdoor exposure, sunlights and temperature without significant change in optical and mechanical performance

Sound Insulation Properties

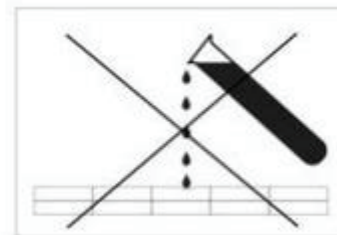
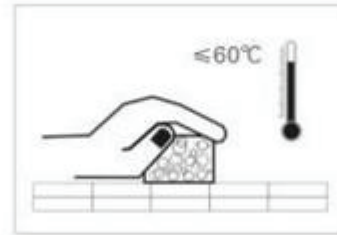
- Sound insulation is 3-4DB - better than glass
- Great noise barrier material (highway noises, industrial and construction noises)

Chemical Resistance Properties

- Great resistance against weak acids, water based solutions and alcohol at room temperature
- Chemical susceptibility: strong acids, benzene, chlorinated hydrocarbons and esters, please pay special attention before using any chemicals

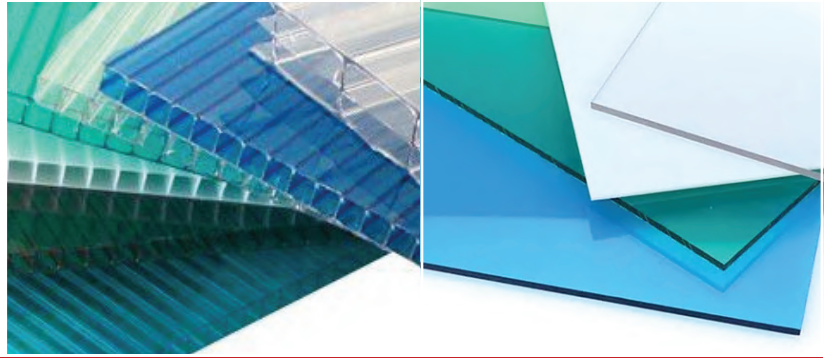
Physical Properties

- Solid sheet is only half of the weight of glass sheet
- Cheaper and lighter than materials such as glass
- Life expectancy minimum 15 years - manufacturer warranty 10 years



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Characteristics	Units	PolyCarbonate Hollow Sheet	PolyCarbonate Solid Sheet
Light Transmission	%	40 ~ 82	88 ~ 92
Impact Strength	J/m	2.1 ~ 2.3	50
Coefficient of Thermal Expansion	mm/m °C	0.065	0.065
Heat Conductivity	W/m ² °C	3.0 ~ 3.9	0.21
Service Temperature	°C	-40% °C ~ + 120 °C	-40% °C ~ + 120 °C
Tensile Strength	n/mm ²	> 60	> 60
Bending Strength	m/mm ²	100	100
Bending Elastic Modulus	mpa	2400	2400
Tensile Stress at Break	mpa	> 65	> 130
Elongation at Break	%	>100	> 130
Sound Insulation Effect	db	20 db decrease for 10mm sheet	35 db decrease for 6mm sheet






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