



SUNLITE®

Multiwall Polycarbonate Sheet

Technical & Installation Guide



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Also available, Palram Polycarbonate Profiles for SUNLITE Multi Wall Sheets.

This guide is available in print from your Authorized Palram Dealer, or in downloadable PDF format at:

<http://www.PalramAmericas.com/Downloads>

Note that not all profiles in the catalog are in stock. Contact your Authorized Dealer or Palram for more details



Introduction

This manual provides basic guidelines for selecting, handling and installing Sunlite sheets. Due to their hollow core, preliminary preparation and additional care are required before the actual installation. Please note these guidelines before starting and follow them carefully. Please also note that the aluminum and other profiles used as examples in this installation guide are available from third parties.

Light Transmission* (LT) and Solar Heat Gain Coefficient (SHGC)*

The table below shows values for Palram's complete portfolio of Sunlite Multi Wall products, listed by thickness/configuration and color.

Structure	Standard Colors											Multi-Layered				Solar Smart™ Selective Solar Control Technology													
	Clear		Bronze		White Opal		White Diffuser		Green**		Blue**		Bronze/Opal		Solar Guard (Solar Control/Opal)		Solar Metallic Reflective				Infra-Red Reflective				Selective See Through Smart Green				
	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC	LT%	SHGC			
Twin wall 4mm	82%	0.83	35%	0.48	30%	0.30			35%	0.54	30%	0.71																	
Twin wall 4.5mm	82%		35%		30%				35%		30%																		
Twin wall 6mm	80%	0.82	35%	0.55	20%	0.24		0.24	35%	0.51	30%	0.66			30%	0.41	30%	0.41											
Twin wall 8mm	80%	0.81	35%	0.47	18%/35%	0.30/0.35		0.35	35%		30%	0.67			0.39	25%	0.36	45%	34	60%	0.55								
Twin wall 10mm	79%	0.81	35%	0.55	30%	0.40			35%	0.59	30%	0.68			0.35	25%	0.36				60%								
Triple wall 8mm	76%		35%		48%				35%		30%					25%													
Triple wall 10mm	76%		35%		48%				35%		30%					25%													
Triple wall 16mm	76%	0.77	35%	0.58			48%	0.53	35%		30%	0.66			0.35	25%	0.36												
X-Lite 16mm	60%	0.61	25%	0.49		0.40	38%		35%	0.49	0.51				0.29	18%	0.25	30%	25										
V-Structure 20mm	63%																												
X-Lite 25mm	60%	0.65	25%	0.42	15%	0.32							10%	0.22	5%	0.22	20%			20%	16					42%	35		
X-Lite 32mm	58%	0.66	20%	0.42	15%								10%	0.30	5%	0.22	20%			20%	16					42%	35		
X-Lite 35mm	57%	0.59	20%	0.36	15%								10%	0.30	5%	0.22	20%			20%	16					42%	35		
X-Lite 40mm	57%	0.52	20%	0.36	15%																								

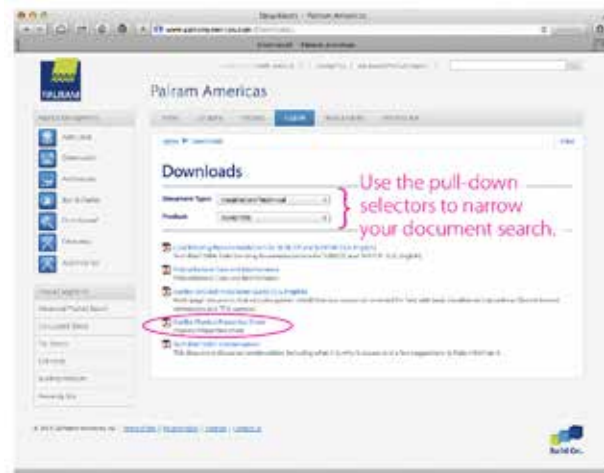
*ASTM D-1003 **Blue, Green and Solar Control sheets are produced per order.

Insulating Properties

Structure	U value	R value
Twin wall 4mm	0.67	1.49
Twin wall 4.5mm	0.65	1.54
Twin wall 6mm	0.62	1.61
Twin wall 8mm	0.58	1.72
Twin wall 10mm	0.53	1.89
Triple wall 8mm	0.51	1.96
Triple wall 10mm	0.48	2.08
Triple wall 16mm	0.42	2.36
X-Lite 16mm	0.37	2.7
V-Structure 20mm	0.33	3.03
X-Lite 25mm	0.3	3.33
X-Lite 32mm	0.28	3.57
X-Lite 35mm	0.26	3.85
X-Lite 40mm	0.24	4.17

Typical Physical Properties

A detailed overview of Sunlite physical properties can be downloaded at:
<http://www.PalramAmericas.com/Downloads/>



Chemical Resistance & Compatible Sealants

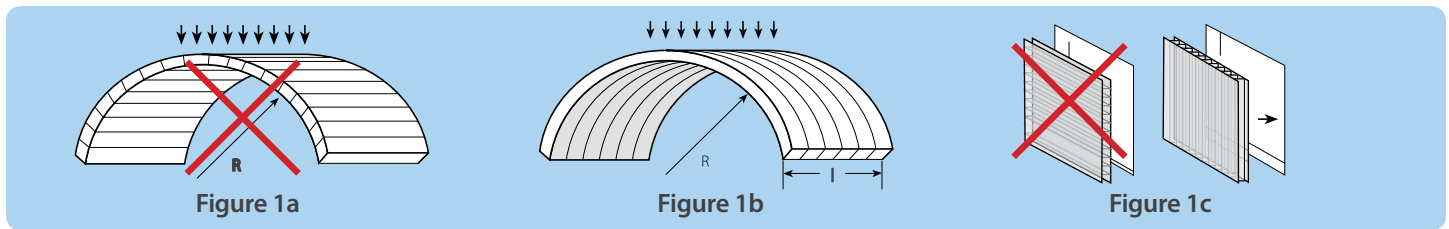
Sunlite has good resistance to many chemicals. Some chemicals may harm the Sunlite sheets. Detailed information about these materials can be found in Palram’s “Chemical Resistance of Polycarbonate Sheets” brochure. Please contact your Palram dealer when in doubt about any material or chemical.

When choosing adhesives or sealants to be used during installation of Sunlite sheets, please consult Palram’s brochure “Recommended Adhesives and Sealants for Polycarbonate Products”, which is available on Palram’s website (www.PalramAmericas.com/sealants).

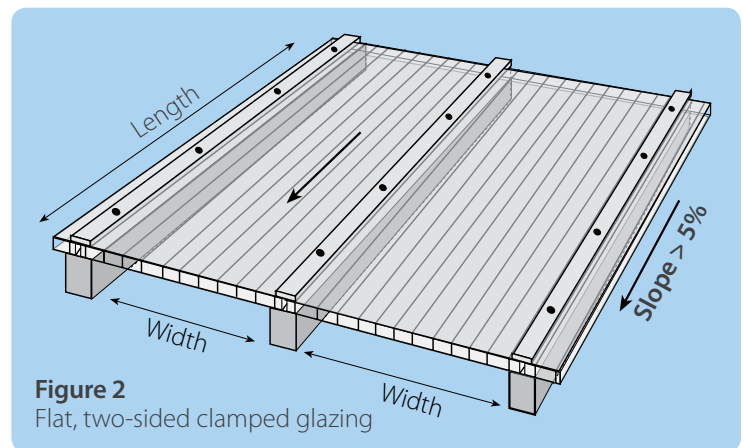
For use of any adhesive or sealant not listed in the above brochure, consult with your Palram dealer to get his approval. Failure to do so will void any and all warranties.

Positioning the Sheets

1. Sunlite sheets should be installed with the rib channels sloping downwards (Figs. 1b, 1c, 2). That orientation will reduce accumulation of dirt inside the sheet and ease gravity drainage of any condensation moisture.

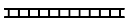
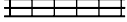




2. Sheets should be installed with the adjoining edges connected by a glazing profile suited to the glazing system.
3. For sheets installed in the flat, horizontal position, (roofs, overhead skylights), a minimum slope of 5% is imperative, with 10% and above preferable. Steeper slopes offer better rainwater drainage and self-cleaning, and reduce the risk of water and dirt infiltration through the connectors and fastening screws. Steeper slopes also help to diminish the visual effect of sheet deflection caused by loading.
4. Length dimension is defined as parallel to the ribs, while width will always be perpendicular to the ribs.



Arching Radius

Sunlite sheets may be cold bent or curved up to their minimum permitted radius, using polycarbonate’s natural tolerance for cold forming with no need for thermal processing. Curving Sunlite sheet beyond this minimum permitted radius induces undue stresses and strains in the glazing sheet, causing premature failure and will void the warranty.

Structure	Thickness		Minimal Cold Bending Radius		
	mm	inch	mm	feet	inch
 Twin Wall	4	5/32	700	2.30	28
	6	1/4	1,050	3.40	41
	8	5/16	1,400	4.60	55
	10	3/8	1,750	5.70	69
 Triple Wall	8	5/16	1,760	5.80	69
	10	3/8	2,200	7.20	87
	16	5/8	2,800	9.20	110
 X-Lite	16	5/8	3,000	9.80	118
	25	1	5,000	16.40	197
 V-Structure	32	1 1/4	6,400	21.00	252
	35	1 3/8	7,000	23.00	276

Wind and Snow Load Calculation

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.

Conversion of Wind Velocity Values into Wind (or Static) Pressure

Property	Units	Wind Strength Level			
		Moderate	Strong	Storm	Hurricane
Wind velocity	mph	<25	26 - 50	51 - 75	75+
Static pressure	kg/m ²	<8.5	9.0 - 33	34 - 73	73+
	psf	<1.75	1.8 - 6.75	7 - 15	15+

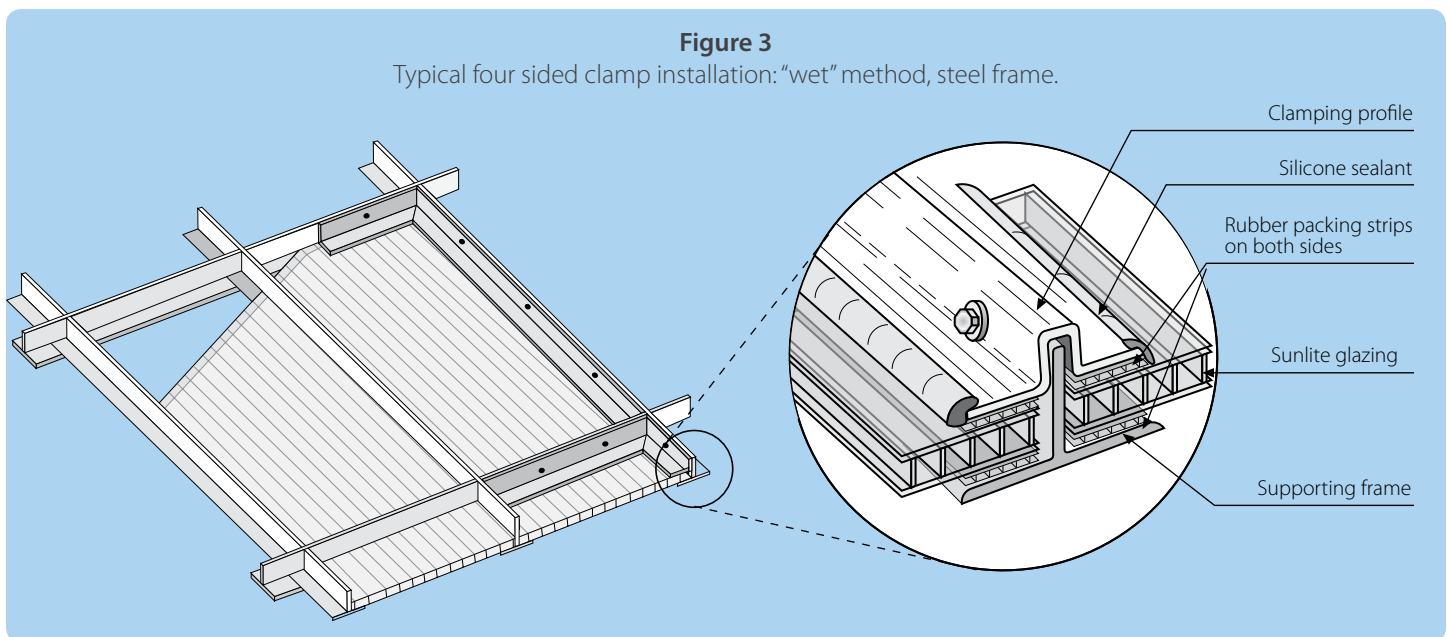
Snow Load: Snow load from accumulated snow cannot be disregarded. Both structure and glazing should be suitable for this extra weight. In snow-bound areas, Suntuf or SunSky single wall corrugated polycarbonate glazing is often preferable for roofing purposes. Please consult with your Palram distributor.

Indicative snow load	per 1.0 cm (0.4 inch) of height or thickness
Fresh, fine, fluffy snow	from 0.8 to 1.9 kg/m ² (0.16-0.39 psf)
Wet, watery, compacted snow	from 2.0 to 8.0 kg/m ² (0.41-1.64 psf)

Spacing and Load Calculations for Different Methods of Installation

1. Four Sides Clamp or Frame


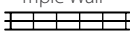

This method utilizes comparatively small, separate glazing elements, cut from larger sheets. Sunlite is put inside a four-sided frame or supporting structures, and clamped on all sides. Clamping is done by plastic, wood or metal clamping profiles, with or without rubber sealing strips, and fastened by nails, screws or bolts to the supporting frame. The frame itself can be made of wood or metal, according to the design.



The table on top the next page presents the recommended center-to-center spans, for each type of Sunlite sheet at various wind or snow loads.

Maximum Recommended Distances Between Centers- Shorter Spans (width)

Under different ratios and loads for four sides clamped / framed flat glazing.

Structure	Thickness	Wind/snow uniform loads		Distance between centers (shorter span) according to ratio a:b					
				Ratio 1:1		Ratio 1.5:1		Ratio > 1.5:1	
				mm	Inch	mm	Inch	mm	Inch
 Twin Wall	6	50	10	900	36	700	28	500	20
		80	16	700	28	500	20	350	14
		100	20	500	20	400	16	-	-
		120	25	400	16	300	12	-	-
	8	50	10	1150	45	900	36	600	24
		80	16	1000	40	800	28	480	19
		100	20	900	36	650	22	450	18
		120	25	750	30	600	20	-	-
	10	50	10	1250	50	1000	40	750	30
		80	16	1200	47	900	30	550	22
		100	20	1100	43	800	24	500	20
		120	25	950	37	700	21	450	18
 Triple Wall	8	50	10	1200	47	950	38	650	26
		80	16	1050	42	750	29	510	20
		100	20	950	37	650	22	470	18
		120	25	900	38	650	22	480	19
	10	50	10	1275	51	1050	41	800	32
		80	16	1225	49	900	32	600	24
		100	20	1125	44	750	26	550	22
		120	25	900	38	650	22	480	19
	16	50	10	1500	59	1200	47	1100	43
		80	16	1300	52	1100	43	1000	41
		100	20	1200	47	1050	41	900	36
		120	25	1100	43	950	37	850	33
16	50	10	1550	61	1250	49	1150	45	
	80	16	1350	53	1150	45	1050	41	
	100	20	1240	49	1080	42	950	37	
	120	25	1130	44	980	38	900	35	
25	50	10	2100	83	1700	67	1400	55	
	80	16	1950	76	1600	63	1650	53	
	100	20	1800	70	1500	59	1300	51	
	120	25	1650	65	1400	55	1250	49	
 X-Lite	32	50	10	2100	83	1850	73	1500	59
		80	16	2100	83	1700	67	1400	55
	32	100	20	2000	78	1600	63	1350	53
		120	25	1850	73	1500	59	1300	51
35	50	10	2100	83	1875	74	1525	60	
	80	16	2100	83	1725	68	1425	56	
35	100	20	2025	79	1652	64	1375	54	
	120	25	1875	74	1525	60	1325	52	

Notes:

1. Sunlite 4mm twin-wall is not recommended for constructive applications and is therefore excluded.
2. Data in table according to load tests on typical multiwall sheets and additional extrapolations.
3. Recommended spans are calculated on the basis of 1/20 maximum deflection (5%) of sheet's width (In this case crosswise, perpendicular to the rib channels).
4. A Sunlite glazing sheet may withstand even higher loads without buckling, however, excessive lateral shortening, created by higher deflection, may cause the edges to slip out of their supports (pop-out).

2. Two-Sided Clamped Glazing

This is a simpler glazing system to install, requiring no mid-sheet fastening, using long glazing sheets, and held in place by two glazing profiles on both longitudinal edges. It is not as strong, and permitted width is limited (the width direction of a multi-wall sheet is more vulnerable to loads, span-wise, especially the thinner, square ribbed 6, 8 and 10 mm sheets).

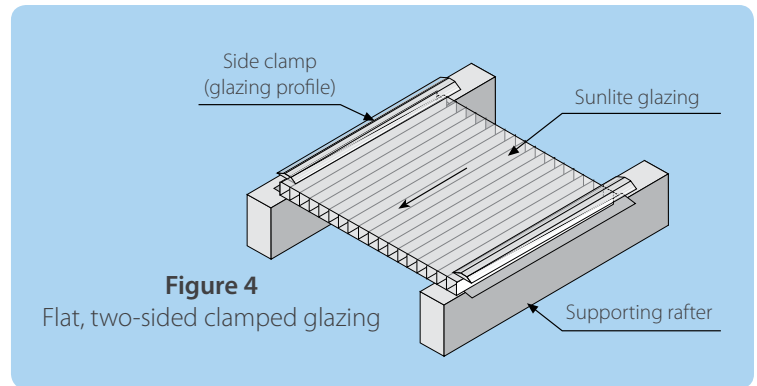


Figure 4
Flat, two-sided clamped glazing

Maximum Width of Sunlite Sheets in Two Sides Clamped Flat Glazing

Uniform Load		Structure																			
		Twin Wall				Triple Wall				X-Lite											
Kg/m ²	psf	6		8		10		8		10		16		16		25		32		35	
		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
50	10	450	18	540	21	680	27	575	19	700	25	990	39	1100	44	1250	50	1200	48	1200	48
80	16	320	13	430	17	500	20	450	15	525	18	900	36	1050	41	1100	43	1000	38	950	38
100	20	-	-	400	16	450	18	400	14	475	17	800	32	1000	35	1050	41	950	37	875	35
120	25	-	-	-	-	400	16	-	-	425	14	700	28	975	38	1000	40	900	36	800	32

Notes:

The notes attached to the previous table (Maximum Recommended Distances) also apply here.

3. Two-Sided Clamped Arched Glazing

1. Sunlite sheets can be curved into arches within the permitted radius (see "Arching Radius" on page 3) without damaging their mechanical performance. Moreover, internal stresses induced by curving give the sheets extra strength and rigidity in both directions, like pre-stressed concrete elements.

2. Rigidity and support spans increase as the curve radius is reduced (down to the minimal permitted radius). Shallow curving should be considered to be similar to flat panels, while a deep curve significantly adds to the bridging ability.

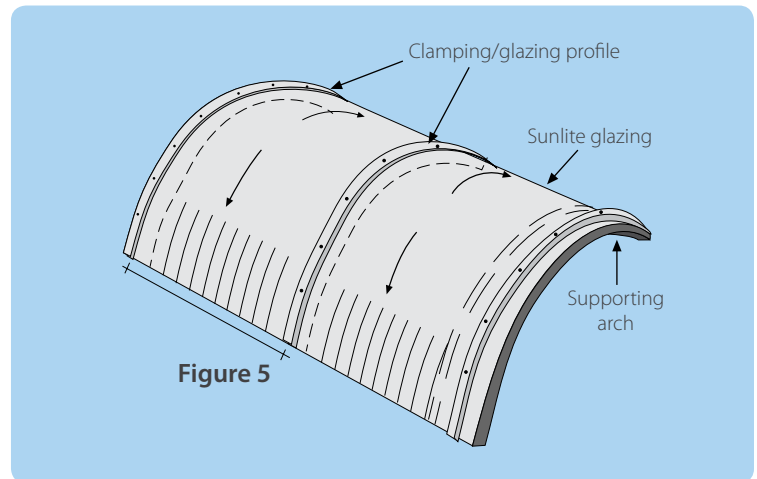
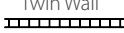




Figure 5

The table in the next page shows the growing rigidity from the curving of Sunlite, at various uniform loads.

Maximum Recommended Spans between Arched Supports

According to radius of curve and load for two sides clamped glazing.

Structure	Thickness	Sheet curvature radius		Recommended (center-to-center) distance between supporting arches according to wind/snow loads below															
				50 Kg/m ²		10 psf		80 Kg/m ²		16 psf		100 Kg/m ²		20 psf		120 Kg/m ²		24.6 psf	
				mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
Twin Wall 	6	1050	41	2000	79	1730	68	1420	56	1020	40								
		1500	59	1470	58	1090	43	890	35	660	26								
		1800	71	1140	45	860	34	690	27	580	23								
		2200	88	810	32	690	27	-	-	-	-								
		2800	110	500	20	350	14	-	-	-	-								
		4000	158	500	20	350	14	-	-	-	-								
	6000	236	500	20	350	14	-	-	-	-									
	8	1400	55	1650	65	1450	57	1320	52	1170	46								
		1800	71	1420	56	1270	50	1070	42	890	35								
		2200	88	1090	43	890	35	710	28	600	24								
		2800	110	840	33	620	19	450	18	-	-								
		4000	158	600	24	500	19	-	-	-	-								
		6000	236	570	23	480	19	-	-	-	-								
	10	1750	69	1630	68	1420	56	1170	46	1020	40								
		2200	88	1320	52	960	38	810	32	660	26								
		2800	110	890	35	650	26	600	24	550	22								
		4000	158	750	29	550	22	500	20	450	18								
		6000	236	700	27	520	21	500	20	420	18								
Triple Wall 	8	1760	70	1320	52	1170	46	980	39	750	30								
		2200	87	1025	41	780	31	580	23	520	21								
		2800	110	750	30	570	23	400	16	-	-								
	10	4000	158	500	20	450	18	-	-	-	-								
		6000	236	480	19	400	16	-	-	-	-								
		2200	88	1220	48	880	35	720	29	580	23								
16	2800	110	780	31	580	23	500	20	450	18									
	4000	158	620	25	500	20	450	18	400	16									
	6000	236	550	22	450	18	400	16	-	-									
X-Lite 	16	2800	118	1850	73	1650	65	1450	57	1200	48								
		4000	158	1450	57	1220	48	940	37	850	34								
		6000	236	1050	42	1000	40	850	34	800	32								
25	3000	120	1750	69	1600	63	1500	59	1400	55									
	5000	200	1350	53	1200	47	1100	43	1000	39									
	5000	197	1650	64	1450	57	1400	55	1350	53									
32	6000	236	1550	61	1350	53	1300	51	1250	49									
	6400	252	1650	64	1550	61	1350	53	1300	51									
	8000	315	1550	61	1450	57	1250	49	1200	47									
35	7000	276	1650	65	1550	61	1350	53	1300	51									
	8200	322	1550	61	1450	57	1250	49	1200	47									

Notes:

1. A hyphen sign in the table (-) means that the sheet cannot be used at the relevant range.
2. Generally a span of less than 600 mm (24 in.) is impractical for this installation configuration.
3. The lowest radius dimension (first in the column) appearing in the table, for each type of sheet, is the minimum permitted cold bending radius of that specific type.

4. "Roofing & Cladding" Installation Method

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. Sunlite 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 Sunlite 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" installation systems. The connecting elements (made of aluminum, sheet metal or plastic- rigid PVC or polycarbonate) are designed as connectors, not as load supporting members. They connect the sheets to each other, achieving one unified watertight exterior shell. Additional strength and rigidity achieved through them is an added bonus.

Basic inverted "H" polycarbonate connecting profile

An old and simple form enabling a lengthwise (side by side) connection between twin / multiwall sheets. It is sometimes 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). This connecting method is practically inappropriate for the thicker Sunlite panels.

1. "Dry" method: 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.
2. "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 weatherproofing at shallower slopes than the "dry" system, but is very difficult to install properly and cleanly (Figure 7).

Notes:

1. *The connector itself is not fixed to the purlins.*
2. *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.*

Two-part polycarbonate connecting profile, which is made of:

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.

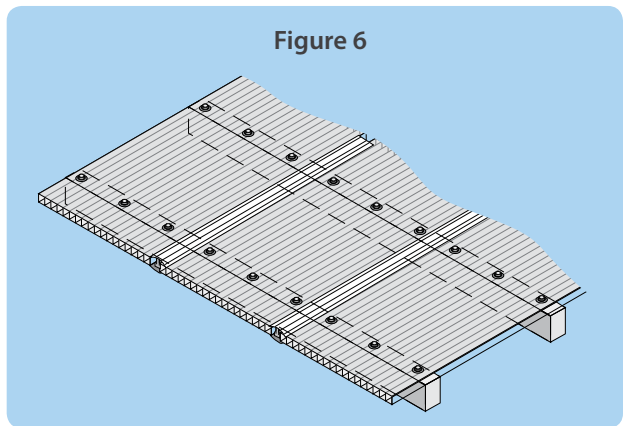


Figure 6

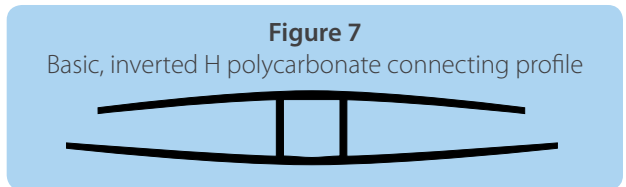


Figure 7

Basic, inverted H polycarbonate connecting profile

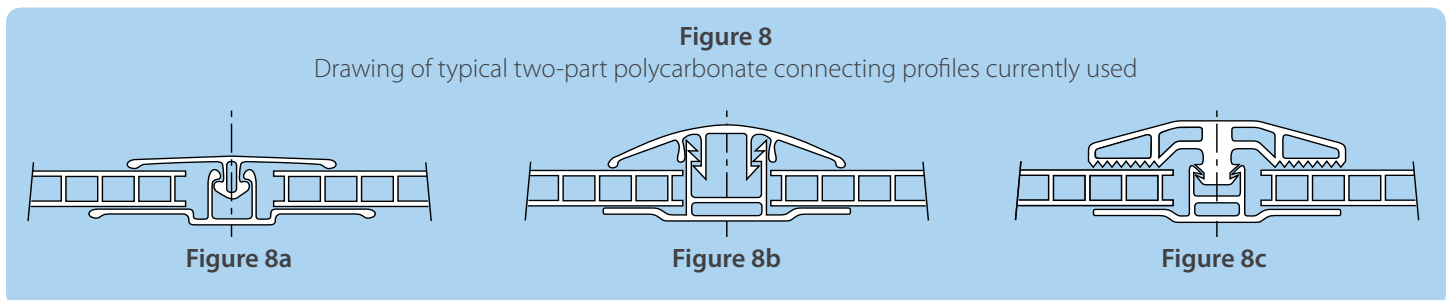


Figure 8

Drawing of typical two-part polycarbonate connecting profiles currently used

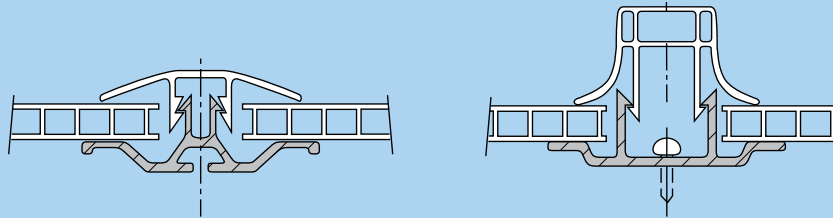
Figure 8a

Figure 8b

Figure 8c

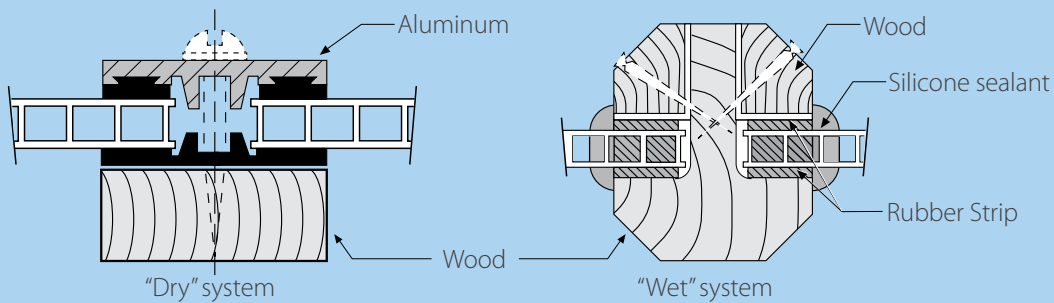
Combination of metal and plastic two-part connecting profile offers added strength and rigidity. The lower part of the profile is made of metal- (mostly aluminum), and the upper part is made of plastic (rigid PVC or polycarbonate), clipped on top of the metal profile, pressing on the edges of the two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

Figure 9
Description of Typical Two-Part Plastic & Metal Connecting Profiles Currently Used



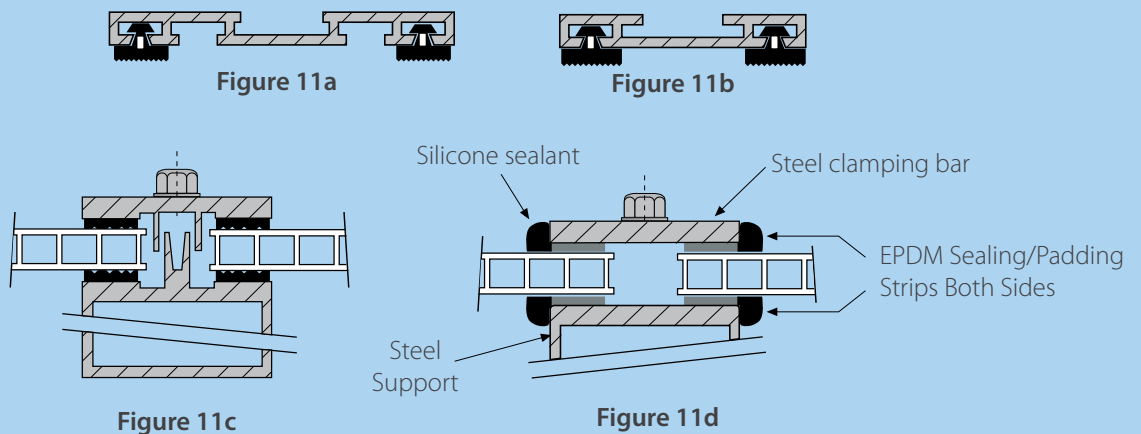
Wood connecting profiles developed from wooden window frames, support the installed Sunlite sheets. They are usually used together with the “wet” system, with rubber packing strips and silicone sealant. Lengths are generally limited by the nature of wood. If long, laminated wooden rafters are used, they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

Figure 10
Description of Typical Two-Part Wood Connecting Profiles Currently used in the Market



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 11
Typical Two-Part Metal System Connecting Profiles Currently Used



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 (20 in.) apart.
3. Along the edge purlin, the fastening screws should be inserted about 300 mm (12 in.) apart.
4. A hole must be pre-drilled into each screw location. The diameter of that hole should be 2 mm (5/64 in.) larger than that of the screw, to allow for thermal expansion movements. In case of dark colored sheets, pre-drill 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 over tightening, 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.

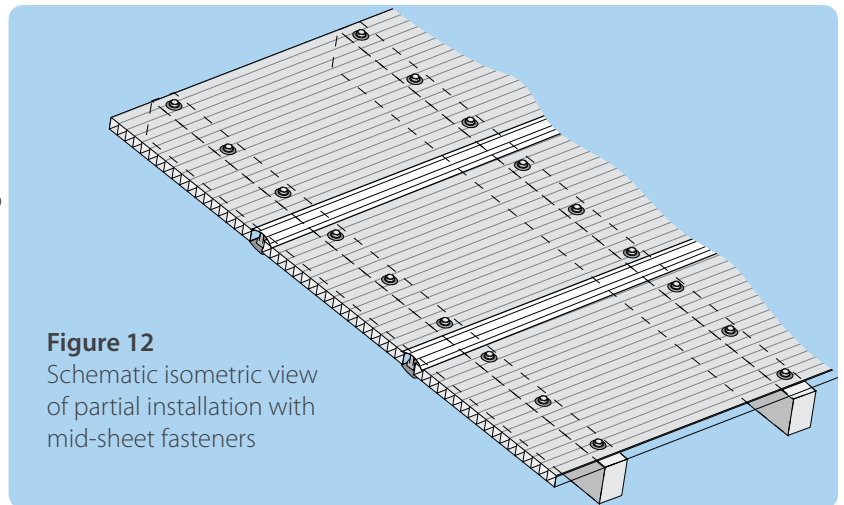


Figure 12
Schematic isometric view of partial installation with mid-sheet fasteners

Figure 13

Typical installation screws and obligatory washers

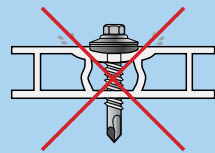


Figure 13a
Incorrect - Over tightening

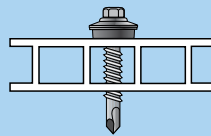


Figure 13b
Correct

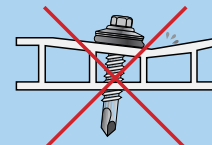


Figure 13c
Incorrect - Non-perpendicular drilling and insertion

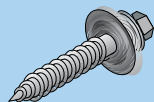


Figure 13d
Self-tapping screw

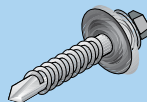


Figure 13e
Self-drilling screw

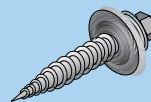


Figure 13f
Wood screw

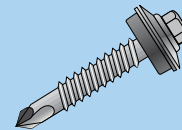


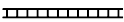
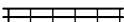

Figure 13g
Palram special washer/gasket

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, 19mm (3/4 in.) diameter, with a specially shaped integral rubber gasket, EPDM (see Palram special washer/gasket fig. 13g). 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 Sunlite sheets unless required otherwise.

Palram recommends perforating Sunlite for fastening as little as possible, and prefers the use of clamped edge installation. Palram recommends that the use of fastening screws in a glazing system should be limited to economical, price conscious projects only. Two or four-sided clamped glazing is the preferred choice.

Design spans between supporting purlins according to designated loads for the roofing and cladding method.

Maximum Recommended Spans between Support Purlins - Flat / Slightly Curved Roofing/Glazing

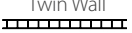
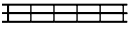
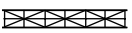
Structure	Thickness	Distance (center-to-center) between supporting purlins - according to wind/snow loads below							
		50 Kg/m ²	10 psf	80 Kg/m ²	16 psf	100 Kg/m ²	20 psf	120 Kg/m ²	25 psf
		mm	Inch	mm	Inch	mm	Inch	mm	Inch
	6	900	36	800	32	650	26	500	20
 Twin Wall	8	1150	46	1000	40	850	34	650	26
	10	1250	50	1150	46	1050	42	900	36
 Triple Wall	8	1120	44	970	38	820	32	620	25
	10	1220	48	1125	45	1020	41	870	35
	16	1600	64	1450	58	1250	50	1130	45
	16	1650	65	1500	59	1300	51	1180	46
 X-Lite	25	1850	74	1700	68	1550	62	1425	56
	32	2050	82	1900	76	1750	69	1600	63
	35	2075	82	1925	76	1775	70	1625	64

Notes:

- Span calculation is based on general professional know-how, previous experience & specialized expertise with this type of products.
- Spans depicted are drawn from loading tests and extrapolations based on L/20 deflection (5%) at the specific span and load using continuous multi-span supports. The values refer to mid-spans. Edge-spans (lower & upper ends) should be approximately 20% smaller.
- Sunlite panels can withstand higher loads and/or wider spans without failure. However the involved deflections will exceed L/10 (10%) of the span, which is unacceptable in most cases.

Curving Sunlite sheets gives them higher strength and rigidity, as in the case of two-sides clamping described in the next page.

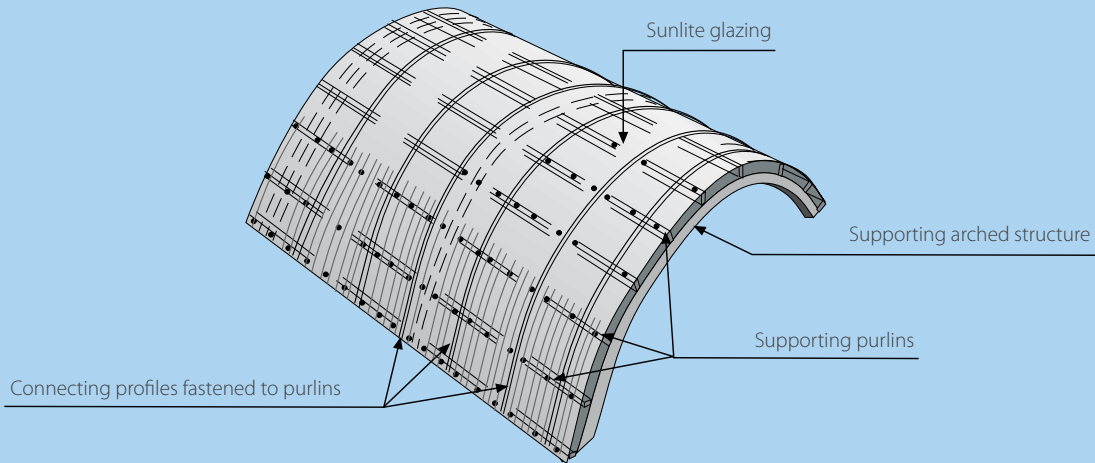
Maximum recommended distances between support purlins for curved roofing/cladding, according to curvature radius & load.

Structure	Thickness sheet curvature radius			Recommended (center-to-center) Distance between supporting arches according to wind/snow loads below							
				50 Kg/m ² 10 psf		80 Kg/m ² 16 psf		100 Kg/m ² 20 psf		120 Kg/m ² 24.6 psf	
	mm	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
Twin Wall 	6	1050	41	2000	79	1730	68	1420	56	1020	40
		1500	60	1570	62	1570	62	1200	48	1200	48
		1800	72	1420	56	1420	56	1150	46	1150	46
		2200	86	1380	55	1380	55	1150	46	1150	46
		2800	110	1260	50	1260	50	1100	44	1100	44
		4000	158	1150	46	900	36	850	34	780	31
	6000	236	900	36	800	32	650	26	500	20	
	8	1400	55	1570	62	1570	62	1570	62	1570	62
		1800	72	1880	74	1420	56	1420	56	1420	56
		2200	86	1730	68	1380	55	1380	55	1380	55
		2800	110	1470	58	1470	58	1250	50	1100	43
		4000	158	1250	50	1150	46	1050	40	900	32
		6000	236	1150	46	1000	40	850	34	650	26
	10	1750	69	1885	74	1885	74	1885	74	1885	74
		2200	88	1725	68	1725	68	1725	68	1725	68
		2800	110	1470	58	1470	58	1250	50	1100	43
		4000	158	1250	50	1150	46	1050	40	900	32
		6000	236	1150	46	1000	40	850	34	650	26
Triple Wall 	8	1760	70	1420	55	1420	55	1380	53	1380	56
		2200	86	1380	53	1380	53	1380	53	1250	49
		2800	110	1380	53	1380	53	1250	49	1070	42
		4000	158	1150	46	1050	42	1050	42	750	30
		6000	236	1100	44	960	38	825	33	625	25
	10	1800	72	1885	74	1885	74	1885	74	1885	74
		2200	86	1725	68	1725	68	1725	68	1725	68
		2800	110	1750	69	1750	69	1750	69	1465	58
		4600	158	1570	62	1570	62	1260	50	1260	50
		6000	236	1260	50	1180	47	1075	42	900	36
16	2800	110	2100	83	2050	81	2000	79	1950	77	
	4000	158	1750	69	1700	67	1650	65	1600	63	
	6000	236	1600	63	1400	56	1250	50	1150	46	
16	3000	118	2125	84	2075	81	2025	79	1975	77	
	4000	158	1800	71	1750	69	1700	67	1650	65	
	6000	236	1600	63	1400	56	1250	50	1150	46	
X-Lite 	25	5000	197	1300	90	2050	80	1770	70	1500	59
		6000	237	2100	69	1850	73	1570	62	1300	51
	32	6400	252	2200	86	2050	80	1770	67	1500	59
		8000	315	2100	82	1950	76	1670	65	1400	55
	35	7000	276	2200	86	2050	80	1770	67	1500	59
		82000	323	2100	82	1950	76	1670	65	1400	55

Notes:

1. Sunlite 4mm twin-wall is not recommended for constructive applications and is therefore excluded.
2. The specified spans are based on L/20 deflection (5%) at the specific span and load, using continuous multi-span supports. The values refer to mid-spans. Edge-spans (lower & upper ends) should be approximately 15-20% smaller.
3. Spans depicted in all but the largest radii (6.00-8.00 m) derive from division of a full 180° barrel vault of the specific radius into equal size sectors. (For instance - an arch of 1.10m radius is divided into 2 equal parts of 1.73 m length. An arch of 1.50 m radius is divided into 3 parts each 1.57 m long, and so on.)
4. Curved Sunlite is more rigid and allows for a much wider span than in flat installation, especially in smaller radii. Rigidity and strength are reduced as the radius is increased (for same type of panel). A lightly curved panel behaves almost the same as a flat one.

Figure 14
Schematic description of standard curved roofing in a vault



General Notes for Structural Design

1. The recommended support spacing, as specified in the load/span tables, should not supersede the requirements of local structural and construction codes. The final values are to be dictated by actual conditions on site and engineering design.
2. The end spans, i.e. the distance between the edge support (or purlin) and the first internal purlin should be up to 80 percent of the commonly recommended span for this load and type of sheet, or the value dictated by the design engineer.

Positioning of Clamping Profiles and Fastener Location

1. Using the four-sided clamped glazing system, the support bars should be underneath (or inside), and the glazing clamps on top (or outside). Sunlite must be installed with the clamping profiles covering all four edges of the sheet. (These are load-bearing elements, which connect the glazing to the supporting structure, transferring loads from the glazing to it.)
2. Using the two-sided clamped glazing system, the support bars (and glazing clamps) should be installed covering the two longitudinal edges of the sheet, parallel to the rib channels. Again, these are load-bearing elements, connecting the glazing to the supporting structure, transferring loads from the glazing to it.
3. Using the roofing/cladding method, glazing connectors (of any version) should be installed on both long sides of each sheet (parallel to the rib channels). Their main duty is connecting adjoining sheets. They may assist transferring loads to the structure, but here the fastening screws transfer most of the load to the supporting structure (the purlins). The screws, with their metal washer and rubber gaskets, should be inserted along the length of the supporting purlins, about 500-600 mm (20-24 in.) apart and 300-400 mm (12-16 in.) at the edge purlin. When using metal glazing connectors, they are positively fastened to the purlins.

When using polycarbonate connecting-profiles, some types are fastened and others do not. In that case, the fastening screws will be placed on both sides of the connector, about 200-250 mm (8-10 in.) on each side.

Preparation for Glazing

Determination of Rabbet Depth and Thermal Expansion Allowance

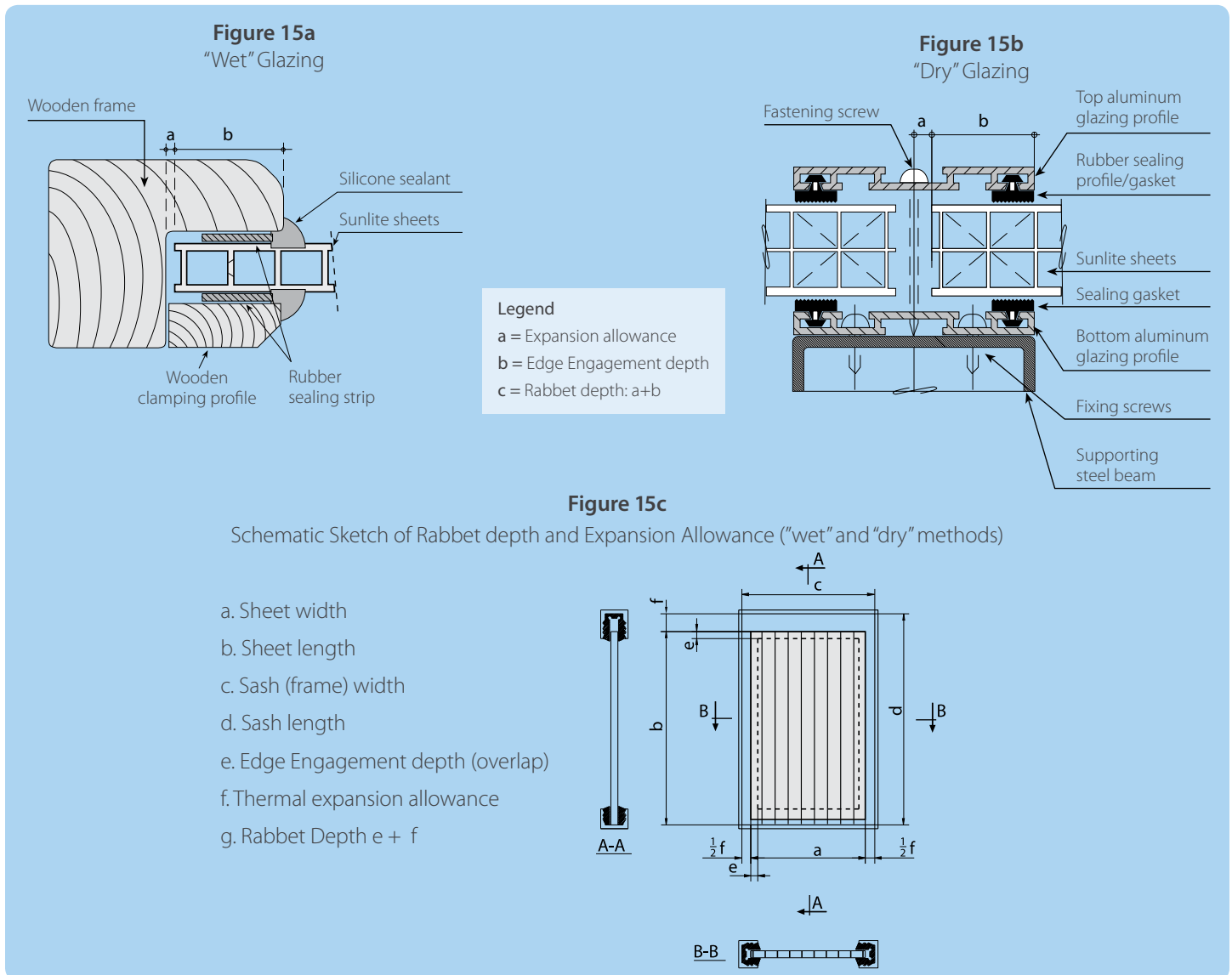
These parameters depend on the Sunlite sheet dimension, and relate to the four sides of the sheet (four-sides clamping system), or to the two edges parallel to the rib channels (two-sides clamping system).

1. Allowance for expansion

Sunlite expands about 3mm for every meter (1/8 in. per 3 1/3 ft.) of length (or width) for a service temperature range of about 50°C (90°F), the practical working range in most cases. For a sheet of 1.00 m (or 40 in.) wide, 1.50m (60 in.) long, a net allowance of 3 mm (width) and 5mm (length) should in theory suffice. We recommend doubling this allowance for practical reasons. Allowance should be divided between both sides of the sheet. When the ends of panels are protected by a recessed 'U' channel, allow suitable internal space for thermal expansion.

2. Edge Engagement: (the overlap of the glazing over its frame).

3. Rabbet Depth: (expansion allowance + edge engagement). Palram recommends a rabbet depth of at least 20 mm (0.8 in.) for widths up to 1.0 m (40 in.) and a depth of 25-30 mm (1.0 - 1.2 in.) for wider spans.



Preparations Prior to Installation

1. Ensure smaller thermal expansions by installing sheets - especially colored sheets - at ambient temperatures of 10-25° C (50-77° 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 80-100 mm (3.5-4 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 at both sides of the sheet, for about 80-100 mm (3.5-4 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 would expose the protective film to direct sunlight that may fuse it to the sheet's face. This will result in difficulty to remove the protective film due to deterioration of the film, and ultimately void the warranty.

Figure 16a

Partial or Complete Removal of Protective Film Prior and after Installation

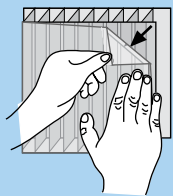


Figure 16b

Installation of Sealing Tape on Open Ends of Sheet

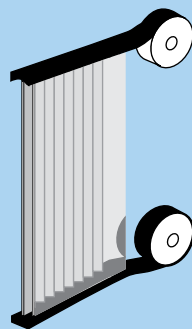
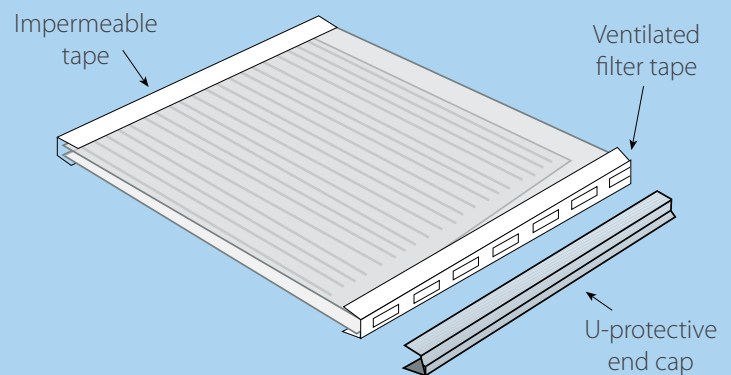


Figure 16c

Installation of Impermeable Tape at Top of the Sheet and Installation of Ventilated Tape at the Bottom of the Sheet



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 covering the edges with aluminum U-profiles, or cover them with polycarbonate U-shaped profiles (Fig-16c).

Glazing Profile

Type of glazing/clamping profile used in the installation of Sunlite sheets, differs according to the glazing system chosen:

1. Framing profiles are similar in concept and detail to those used in fixed glass windows, curtain walls and skylights, made of wood, steel or aluminum, but wider, allowing for the larger edge engagement depth required for Sunlite. The frames are prepared in advance, and glazing is done after they are all in place, along with completion of the other finishing jobs. (See Figure 3).
2. Two and four-sided clamped glazing employ practically the same profiles used for framing, as used in curtain walls and skylights. Almost all are prepared prior to the glazing work, and just the clamps, the rubber packing profiles (and silicone sealant in "wet" glazing) are installed along with or after the glazing is in place.
3. The roofing and cladding glazing installation method installs Sunlite over the supporting skeleton, rafters and purlins. The glazing profiles, which are usually flatter by design, consist of top and bottom parts, made of polycarbonate, rigid PVC or a combination (a bottom aluminum profile and top profile made of polycarbonate, or rigid PVC). Sunlite sheets and their connecting profiles (also acting as glazing profiles) are installed together, advancing step by step. Most profiles are flexible enough to be easily shaped into curves by hand, when installed over curved structures, enabling inexpensive implementation of curved glazing.

Handling and Storage

1. Sunlite sheets should be transported and stored horizontally, on a flat, sturdy pallet whose dimensions are equal to or larger than the sheets themselves. The sheets must be secured and fastened to the pallet during transportation and handling on site. 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. Sunlite sheets leave the factory in packages, wrapped in white, watertight polyethylene. The wrapping 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 core. Extended exposure to direct sunlight may cause heat buildup, softening the protective film, fusing it to the sheet face, making removal 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. Important! 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.

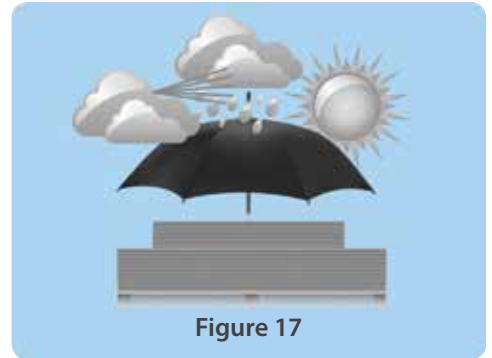
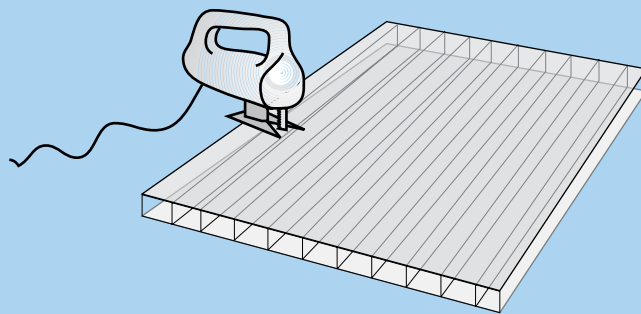


Figure 17

Cutting

1. Sunlite 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. Using a vacuum, or 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.

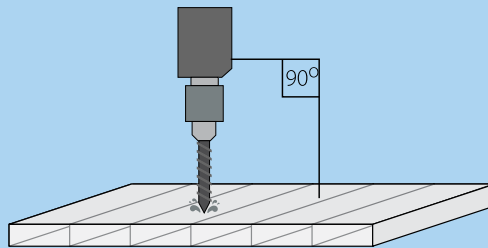
Figure 18
Cutting Sunlite Sheet



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 (5/64 in.) 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.

Figure 19
Drilling Sunlite Sheet



Sealing and Bonding

1. Silicone Sealant: Palram strongly recommends consulting the "Recommended Sealants List" on the Palram Americas website: www.palramamericas.com/sealants
2. Sealant and Weather Strips: Applied in "wet" or "dry" systems. The "Wet" system can use Butyl rubber tape, or simple neoprene or EPDM rubber strips, combined with an approved silicone sealant above.
The "Dry" system uses neoprene or EPDM rubber packing strips (in simpler framing system), or profiled neoprene or EPDM rubber strips inserted into grooves in the metal connecting/framing profiles. Mechanical pressure of the clamping profile on the rubber gasket achieves the sealing, like in glass systems.
3. Sealing the Sheets is done by aluminum impermeable, or ventilated filter sticky tapes, as described in the paragraph "Pre-preparation of the sheet" above. Such specialty tapes can be obtained from the leading tape manufacturers, or through Palram dealers (See figures 16b, 16c).

For alternative materials, please consult with your Palram distributor.

Accessories

Different aluminum or steel glazing profiles, structural elements, sealing materials and other components required for the completion of varied projects appear, in concept, in the sketches in this manual. Such products & materials are usually available through professional suppliers of metals and glazing accessories. Other designated elements like gutters, closures, ridge caps, trimming and flashing, etc. are to be specially fabricated according to specific design.

General Recommendations for Working with Sunlite Sheets

Cleaning

1. Keeping Sunlite 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.

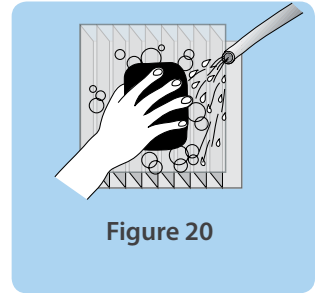
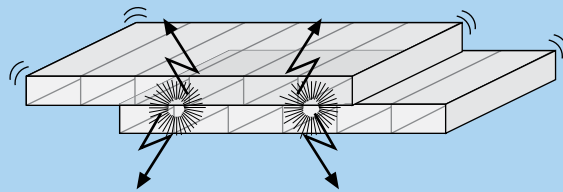


Figure 20

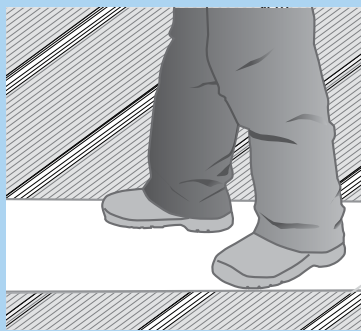
Figure 21
Avoiding Electrostatic Buildup



Safety Measures During Installation and Maintenance

1. When installing Sunlite 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 Sunlite 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.

Figure 22



Warning! Do not step directly on the sheets between the purlins!

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