TECHNICAL MANUAL

Macrolux® Multiwall
POLYCARBONATE SHEETS

POLYCARBONATE MULTIWALL SHEETS

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ENG

SUMMARY

MACROLUX® MULTIWALL

Introduction:

MACROLUX® MULTIWALL sheets are made of polycarbonate, a material that has a very high impact resistance and which possesses a high transparency.

MACROLUX® MULTIWALL sheets offer a high degree of protection against weather agents and offer maximum freedom regarding design.

Further advantages, such as heat insulation and the natural lightness of the material result respectively in energy saving and in reduced structural costs.

The multiwall sheets are mainly used in the following contexts:

- Roofing and translucent walls in industrial buildings (skylights, sheds, garage doors, glass walls, double ceilings, curtain walls etc.).
- Roofing for malls (domes, tunnels, walking passages, trolley roofing etc.), roofing for car washing stations, cantilever roofs for bus stations, car-parking areas etc.
- Roofing and walls in sports building, (Safety glass walls, protective barriers for sport fields, coverings for stadiums, swimming pools, etc.).
- Residential buildings (roofs for winter gardens, verandas, gazebos, cantilever, roofs, etc.).
- Agricultural usage (roofing and walls for greenhouses, windows for stables, etc.).

This manual contains the main features of the multiwall sheets, instructions for assembling and the necessary warnings for a correct installation.

IMPORTANT: *Reserves may arise with the purchase of MACROLUX® sheets, please check with our commercial offices regarding the commercial sales terms.*

IMPORTANT: *The information contained in this manual has been gathered to assist our clients during the planning and installation phases. They have been drafted on the basis of our best knowledge and they may vary without any obligation of a previous warning.*
The data must be regarded as non-binding information and they do not exonerate our clients from carrying out their own controls in order to establish whether the materials are suitable for the intended use.
The user shall get in touch with Koscon Industrial S.A., when in doubt or should a problem arise before a project is carried out.

For any informations or suggestion, please contact:

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1 POLYCARBONATE PROPERTIES

Polycarbonate is a thermoplastic polymer endowed with excellent mechanical and physical characteristics. Thanks to its ductility and durability it is used, for example, in the production of CDs and DVDs. Thanks to its resistance, it is used in the automotive, aeronautical, and ballistic industry (plane windows, car headlights, anti-revolt shields and helmets etc.) All these, together with its high transparency, makes polycarbonate a suitable material for the building industry.

1.1 Technical data about polycarbonate

Mechanical characteristics		Value	Unit	Regulation
Yield stress (50 mm/min)		63	MPa	ISO 527
Stress at break (50 mm/min)		70	MPa	ISO 527
Yield strain (50 mm/min)		6	%	ISO 527
Strain at break (50 mm/min)		120	%	ISO 527
Tensile modulus of elasticity (1 mm/min)		2350	MPa	ISO 527
Strenght Impact characteristics		Value	Unit	Regulation
Stress impact Charpy (V notch)	+23 °C	75	kJ/m^2	ISO 179/1eA
	-30 °C	15	kJ/m^2	ISO 179/1eA
Stress impact Izod (notch)	+23 °C	70	kJ/m^2	ISO 180/1A
	-30 °C	12	kJ/m^2	ISO 180/1A
Physical characteristics		Value	Unit	Regulation
Density		1,2	g/cm^3	ISO 1183
Water absorption (23°C; saturazione)		0,35	%	ISO 62
Assorbimento humidity (23°C; 50% RH)		0,15	%	ISO 62
Permeability to steam (23°C;85% RH;0,1mm)		15	g/(m^2 24h)	ISO 15106-1
Thermal characteristics		Value	Unit	Regulation
Linear thermal expansion (23°C÷55°C)		0,65	10^{-4}/K	ISO 11359-2
Thermal conductivity		0,20	W/(m K)	ISO 8302
Softening temperature VICAT (50N; 120°C/h)		145-149	°C	ISO 306

1.2 Comparison with other products

If it is compared to other plastic materials which are commonly used in building and with glass, polycarbonate is better as for many characteristics:

Characteristics	Unit	PC	PMMA	PVC	PET	GRP	Glass
Density	g/cm^3	1,20	1,19	1,38	1,33	1,42	2,50
Resilience	kJ/m^2	30	2	4	3	1,2	-
Elastic module	N/mm^2	2.350	3.200	3.200	2.450	6.000	70.000
Linear thermal expansion	1/°C	6,5 x 10^{-5}	7,0 x 10^{-5}	6,7 x 10^{-5}	5,0 x 10^{-5}	3,2 x 10^{-5}	0,9 x 10^{-5}
Thermal conductivity	W/m K	0,20	0,19	0,13	0,24	0,15	1,3
Highest service temperature	°C	120°	90°	60°	80°	140°	240°
Transparency to UV rays	%	4	40	na	Na	19	80
Fire behaviour characteristics	-	Very well	Flamm.	Flamm.	Flamm.	Flamm.	Fireproof
Resistance to aging	-	Good	Very well	Poor	Poor	Good	Excellent
Compatibility with chemicals	-	Good	Good	Poor	Good	Good	Very Well

2 AVAILABLE VERSIONS
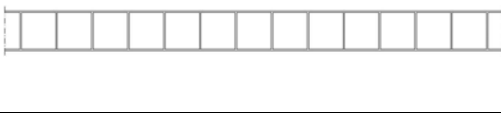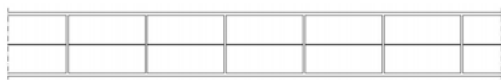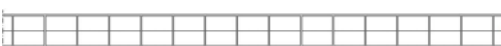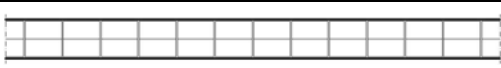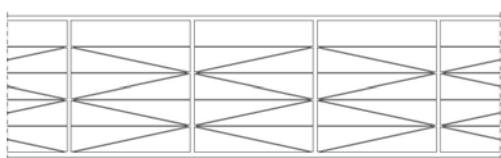
MACROLUX® MULTIWALL sheets are manufactured in a wide range of versions and they can fit every project requisite.

BASE VERSION	LL	UV protected sheets on 1 side.
AVAILABLE VERSIONS FOR THE SOLAR CONTROL	HS	Reflective sheets with a special surface treatment that allow to effectively reflect much of the infrared radiation.
	ATHERMIC	Dual colour sheets that serve the dual purpose of reducing heat gain inside the room and shielding the interior to stop too much light getting in.
	IR	Traslucent sheets that combines the absorbing and reflective properties, reducing the amount of infrared radiation, responsable of the "green house effect".
ADDITIONAL "UV" TREATMENTS	NO UV	Sheets not protected from the effect of UV rays.
	XL	UV protected sheets on 2 sides.
	PLUS	Sheets with increate, extra strong protection from UV rays.
OTHER TREATMENTS	MINDEW	Sheets with treatment on the inside to stop condensation dripping off the surface and falling into the room.
	ANTISTATIC	Sheets with treatment which reduces the static electricity surface, minimizing the effect of attracting dust.
For further informations about uses and availability please check our documentation.		

PARTICULAR COLOURS	BICOLOR	Sheets made with a special method to produce one color on the inside and a different color on the outside.
For the colours availability please check our documentation.		

3 AVAILABLE SECTIONS

MACROLUX® MULTIWALL sheets are produced in a wide range of sections.

Description	Structure	Thick. (mm)	Section
2 walls structure	2W	4 6 8 10	
3 walls structure	3W	16	
3 walls structure "square"	3Q	6 8 10	
3 walls structure with external wall reinforced	3W MACROFORT	10	
4 walls structure	4W	6 8 10	
5 walls structure	5W	16 20 25	
5 X walls structure	5X	16	
7 walls structure	7W	16 20 25	
10 walls structure	10W	50 55 60	
10 X walls structure	10X	16 20 25 32 35 40	
For further informations about uses and availability please check our documentation.			

4 TECHNICAL DATA

4.1 Light transmission

A correct technical planning regarding light requires control of the amount of light needed within any given structure. It is therefore evident how important it is to use sheets with a correct light transmission. In our product range other colours are available upon demand of the customer. The light transmission values for MACROLUX® MULTIWALL sheets in the various colours and versions are listed below:

Light Transmission "LT" (%)												
Nr. walls	Thick. (mm)	Weight (g/m²)	LL									
			Cristal (0010)	Bronze (0024)	Opal (0037)	Opal 0299	Green (0422)	Blue (0522)	Gray (0650)	White (0310)	Opale (0309)	White / Gray (0691)
2W	4	800	82	25	64	-	-	30	25	10	70	-
	6	1300	82	25	60	-	40	30	25	10	70	-
	8	1500	81	25	60	-	-	30	25	10	70	-
	10	1700	81	25	54	-	40	30	25	10	65	-
3W	16	2700	72	25	40	-	-	30	25	10	50	-
3Q	6	1300	75	23	60	-	55	30	25	-	70	-
	8	1500	75	23	60	-	-	30	23	-	70	-
	10	1700	75	23	56	-	-	30	-	-	65	-
3W MACROF.	10	3100	74	-	66	-	-	-	-	-	-	-
4W	6	1300	70	-	-	-	-	-	-	-	-	-
	8	1500	70	-	-	-	-	-	-	-	-	-
	10	1750	69	-	-	57	-	-	-	-	-	-
5W	16	2700	66	25	46	-	-	30	25	10	50	-
	20	3000	60	20	40	-	-	25	20	10	50	-
	25	3300	60	20	35	-	-	25	20	10	35	-
5X	16	2500	62	20	35	-	-	25	-	8	-	-
7W	16	2500	55	-	31	-	-	-	-	-	-	-
	20	3100	54	-	27	-	-	-	-	-	-	-
	25	3300	50	-	24	-	-	-	-	-	-	-
10W	50	5000	-	-	-	-	-	-	-	-	-	-
	55	5200	36	-	-	-	-	-	-	-	-	-
	60	6000	31	-	-	-	-	-	-	-	-	-
10X	16	2800	48	-	28	-	-	-	-	-	-	-
	20	3200	41	-	26	-	-	-	-	-	-	-
	25	3400	38	18	17	-	-	-	-	-	-	-
	32	3700	34	-	10	-	-	13	-	-	33	-
	35	3800	32	-	9	-	-	-	-	-	-	-
	40	4300	28	-	7	-	-	-	-	-	-	-

Nr. walls	Thick. (mm)	Weight (g/m^2)	HS Reflect/Opal (0305)	HS Reflect/Cristal (0390)	IR Green (0430)	IR Gold/Cristal (0810)	IR Gold/Opal (0809)	ATHERMIC Gray (0777)	ATHERMIC Gray/Opal (0737)	ATHERMIC Blue/Opal (0537)	ATHERMIC Bronze/Opal (0237)
2W	4	800	-	-	-	-	-	-	-	-	-
	6	1300	-	-	-	-	-	40	-	-	-
	8	1500	65	-	-	-	-	35	-	-	-
	10	1700	65	-	-	-	-	35	-	-	-
3W	16	2700	60	-	65	-	-	25	30	-	-
3Q	6	1300	65	-	-	-	-	35	50	50	35
	8	1500	65	-	67	-	-	35	45	-	30
	10	1700	65	-	65	-	-	35	45	45	30
3W MACROF.	10	3100	-	-	-	-	-	-	-	-	-
4W	6	1300	-	-	-	-	-	-	-	-	-
	8	1500	-	-	-	-	-	-	-	-	-
	10	1750	-	-	-	-	40	-	43	-	-
5W	16	2700	55	-	-	48	-	25	25	25	-
	20	3000	55	-	-	-	-	25	25	25	-
	25	3300	50	-	-	40	-	20	20	20	12
5X	16	2500	-	-	54	43	-	-	25	25	15
7W	16	2500	-	-	-	-	-	-	-	-	-
	20	3100	-	-	-	-	-	-	-	-	-
	25	3300	-	-	-	-	-	-	-	-	-
10W	50	5000	-	-	-	-	-	-	-	-	-
	55	5200	-	-	-	-	-	-	-	-	-
	60	6000	-	-	-	-	6	-	-	-	-
10X	16	2800	-	-	-	36	-	20	-	-	-
	20	3200	-	-	-	-	-	-	-	-	-
	25	3400	-	-	-	-	-	-	-	-	-
	32	3700	15	-	-	26	13	-	6	6	-
	35	3800	-	-	-	17	-	-	-	-	-
	40	4300	-	-	-	-	-	-	-	-	-

NOTES: *the values reported derives from internal proofs (according to the european norm ASTM D1003) or from test made by certified International laboratories/Institutes (according to the european norms EN 410, EN 14500, …) .*
Koscon Industrial S.A. reserves the right to modify these values without prior notice.

4.2 Solar control

4.2.1 Solar factor ("G" value)

Incident energy

En. released outside (Ae)

Reflected energy

Absorbed energy

En. released inside (Ai)

Direct energy (TD)
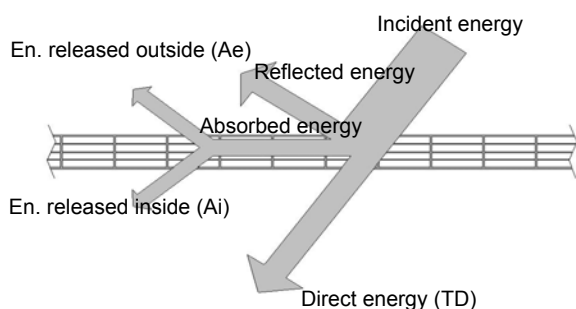
TS = TD + Ai

Controlling the amount of solar energy which is transmitted into a structure is an essential parameter for environment comfort. To this aim, specific products have been designed (HeatShield, Athermic and Athermic/Opal), which can perceptibly reduce the energy amount. The G-value is the percentage ratio of the solar energy which passes through the sheet (TS) and the incident energy; the energy transmitted by the sheet is the sum of the direct energy (TD) and of the energy which the sheet re-emits toward the interior of the structure (Ai).

"G" Value (%)						
Nr. walls	**Thick. (mm)**	**Weight (g/m²)**	LL			
			Cristal (0010)	**Bronze (0024)**	**Opal (0037)**	**Opal (0299)**
2W	4	800	87	68	64	-
	6	1300	85	68	64	-
	8	1500	85	63	62	-
	10	1700	81	63	61	-
3W	16	2700	72	53	52	-
3Q	6	1300	85	67	63	-
	8	1500	84	63	62	-
	10	1700	78	63	59	-
3W MACROFORT	10	3100	76	-	57	-
4W	6	1300	83	-	-	-
	8	1500	82	-	-	-
	10	1750	69	-	63	63
5W	16	2700	64	52	54	-
	20	3000	64	45	46	-
	25	3300	64	43	43	-
5X	16	2500	64	53	48	-
7W	16	2500	-	-	-	-
	20	3100	-	-	-	-
	25	3300	-	-	-	-
10W	50	5000	-	-	-	-
	55	5200	-	-	-	-
	60	6000	-	-	-	-
10X	16	2800	53	-	46	-
	20	3200	53	-	46	-
	25	3400	51	-	43	-
	32	3700	51	-	38	-
	35	3800	50	-	37	-
	40	4300	50	-	37	-

			HS		IR			ATHERMIC			
"G" Value (%)											
Nr. walls	**Thick (mm)**	**Weight (g/m²)**	**Reflect/ Opal (0305)**	**Reflect/ Cristal (0390)**	**Green (0430)**	**Gold/ Cristal (0810)**	**Gold/ Opal (0809)**	**Gray (0777)**	**Gray/ Opal (0737)**	**Blue/ Opal (0537)**	**Bronze/ Opal (0237)**
2W	4	800	-	-	-	-	-	-	-	-	-
	6	1300	-	-	-	-	-	-	-	-	-
	8	1500	-	-	-	-	-	-	-	-	-
	10	1700	57	-	-	-	-	44	-	-	-
3W	16	2700	49	-	-	-	-	36	-	-	-
3Q	6	1300	-	-	-	-	-	-	-	-	-
	8	1500	58	-	-	-	-	-	-	-	-
	10	1700	56	-	-	-	-	-	-	-	-
3W MACROFORT	10	3100	-	-	-	-	-	-	-	-	-
4W	6	1300	-	-	-	-	-	-	-	-	-
	8	1500	-	-	-	-	-	-	-	-	-
	10	1750	-	-	-	-	50	43	47	-	-
5W	16	2700	46	-	45	45	37	33	48	-	-
	20	3000	-	-	-	-	-	-	-	-	-
	25	3300	40	-	-	-	-	36	43	-	-
5X	16	2500	46	-	45	45	37	35	41	-	-
7W	16	2500	-	-	-	-	-	-	-	-	-
	20	3100	-	-	-	-	-	-	-	-	-
	25	3300	-	-	-	-	-	-	-	-	-
10W	50	5000	-	-	-	-	-	-	-	-	-
	55	5200	-	-	-	-	-	-	-	-	-
	60	6000	-	-	-	-	-	-	-	-	-
10X	16	2800	-	-	-	43	-	-	-	-	-
	20	3200	-	-	-	-	-	-	-	-	-
	25	3400	-	-	-	-	-	-	-	-	-
	32	3700	37	43	-	33	23	-	35	-	-
	35	3800	-	-	-	-	-	-	-	-	-
	40	4300	-	-	-	-	-	-	-	-	-

NOTES: the values reported in the table come from estimations based on internal tests or from tests made by certified international laboratories/institutes (according to the european norms EN 410, EN 14500, …) .
Koscon Industrial S.A. reserves the right to modify these values without prior notice.

4.2.2 Shading coefficient

The shading coefficient (SC) represents the ratio between total energy, which passes through the polycarbonate sheet, and the total solar energy, which passes through a clear monolithic glass with a 3 mm thickness.

Nr. walls	Thick. (mm)	Weight (g/m²)	LL			
			Cristal (0010)	Bronze (0024)	Opal (0037)	Opal (0299)
2W	4	800	1,00	0,78	0,74	-
	6	1300	0,97	0,78	0,74	-
	8	1500	0,97	0,72	0,71	-
	10	1700	0,92	0,72	0,70	-
3W	16	2700	0,83	0,61	0,60	-
3Q	6	1300	0,97	0,77	0,72	-
	8	1500	0,96	0,72	0,71	-
	10	1700	0,90	0,72	0,68	-
3W MACROF.	10	3100	0,87	-	0,66	-
4W	6	1300	0,95	-	-	-
	8	1500	0,94	-	-	-
	10	1750	0,79	-	0,72	0,72
5W	16	2700	0,74	0,60	0,62	-
	20	3000	0,74	0,52	0,53	-
	25	3300	0,74	0,49	0,49	-
5X	16	2500	0,74	0,61	0,55	-
7W	16	2500	-	-	-	-
	20	3100	-	-	-	-
	25	3300	-	-	-	-
10W	50	5000	-	-	-	-
	55	5200	-	-	-	-
	60	6000	-	-	-	-
10X	16	2800	0,61	-	0,53	-
	20	3200	0,61	-	0,53	-
	25	3400	0,59	-	0,49	-
	32	3700	0,59	-	0,44	-
	35	3800	0,58	-	0,43	-
	40	4300	0,58	-	0,43	-

"SC" Value (%)

Nr. walls	Thick. (mm)	Weight (g/m²)	HS		IR			ATHERMIC			
			Reflect/Opal (0305)	Reflect/Cristal (0390)	Green (0430)	Gold/Cristal (0810)	Gold/Opal (0809)	Gray (0777)	Gray/Opal (0737)	Blue/Opal (0537)	Bronze/Opal (0237)
2W	4	800	-	-	-	-	-	-	-	-	-
	6	1300	-	-	-	-	-	-	-	-	-
	8	1500	-	-	-	-	-	-	-	-	-
	10	1700	0,66	-	-	-	-	0,51	-	-	-
3W	16	2700	0,56	-	-	-	-	0,41	-	-	-
3Q	6	1300	-	-	-	-	-	-	-	-	-
	8	1500	0,67	-	-	-	-	-	-	-	-
	10	1700	0,64	-	-	-	-	-	-	-	-
3W MACROFORT	10	3100	-	-	-	-	-	-	-	-	-
4W	6	1300	-	-	-	-	-	-	-	-	-
	8	1500	-	-	-	-	-	-	-	-	-
	10	1750	-	-	-	-	0,58	0,49	0,54	-	-
5W	16	2700	0,53	-	0,52	0,52	0,43	0,38	0,55	-	-
	20	3000	-	-	-	-	-	-	-	-	-
	25	3300	0,50	-	-	-	-	0,41	0,49	-	-
5X	16	2500	0,53	-	0,52	0,52	0,43	0,40	0,47	-	-
HC	16	2500	-	-	-	-	-	-	-	-	-
7W	16	2500	-	-	-	-	-	-	-	-	-
	20	3100	-	-	-	-	-	-	-	-	-
	25	3300	-	-	-	-	-	-	-	-	-
10W	50	5000	-	-	-	-	-	-	-	-	-
	55	5200	-	-	-	-	-	-	-	-	-
	60	6000	-	-	-	-	-	-	-	-	-
10X	16	2800	-	-	-	0,49	-	-	-	-	-
	20	3200	-	-	-	-	-	-	-	-	-
	25	3400	-	-	-	-	-	-	-	-	-
	32	3700	0,43	0,49	-	0,38	0,26	-	0,40	-	-
	35	3800	-	-	-	-	-	-	-	-	-
	40	4300	-	-	-	-	-	-	-	-	-

Values determined by the following calculation SC = (1,15 x G)/100 where:

SC = *shadow coefficient*
G = *solar factor (G-value)*

4.3 Thermal insulation

The thermal insulation value measures the resistance which the sheet opposes to the passage of energy in form of heat. The extremely low value for the MACROLUX® MULTIWALL sheets constitutes a solution which is rich in advantages, since it lowers dispersion to a minimum outside the structure where heat is propagated by heating implants, or, symmetrically, it does not permit external heat to enter into an air conditioned space.

The values achievable with simple sheets are as follows:

Structure	Thickness (mm)	Weight (g/m^2)	U value (W/m^2K)
2W	4	800	3.9
	6	1300	3.5
	8	1500	3.2
	10	1700	3.0
3W	16	2700	2.2
3Q	6	1300	3.4
	8	1500	3.0
	10	1700	2.7
3W MACROFORT	10	1700	2.7
4W	6	1300	3.1
	8	1500	2.8
	10	1750	2.5
5W	16	2700	1.9
	20	3000	1.7
	25	3300	1.6
5X	16	2500	2.0
7W	16	2500	1.8
	20	3100	1.6
	25	3300	1.4
10W	50	5000	0.9
	55	5200	0.8
	60	6000	0.8
10X	16	2800	1.6
	20	3200	1.5
	25	3400	1.3
	32	3700	1.0
	35	3800	1.1
	40	4300	1.0

NOTES: *the values reported derives from internal proofs or from test made by certified International laboratories/Institutes (according to the european norms EN 673, EN 10077, …)*
Koscon Industrial S.A. reserves the right to modify these values without prior notice.

The measuring system of the U value can be also expressed in [Kcal/h m^2°C] (1 Kcal/h m^2°C = 0,859 W/m^2 K).

4.3.1 Energy saving

The extremely convenient thermal insulation value of the MACROLUX® MULTIWALL sheet enables the user to obtain relevant savings on operating costs, both in heated and in air-conditioned spaces. Investment in polycarbonate sheet pays itself back in few years, also, it is a noticeable benefit for the environment, as pollution is reduced.

A simple evaluation of the saving, which, although calculated on general terms, is realistic, can be made thanks to the following parameters:

U_1 = thermal insulation value in W/m^2K for solution 1
U_2 = thermal insulation value in W/m^2K for solution 2

The amount of saved fuel can be calculated thanks to the following formula:

$$Q = \frac{\Delta U \times S \times \Delta T° \times D}{\eta \times P_t}$$

Where:

ΔU = U_1 - U_2 difference between thermal insulation for the two compared solution
S = intervention surface in m^2
$\Delta T°$ = average difference in temperature between external and internal space during the period in which the system is used
D = duration of the period in which the system is used (in sec/1000 for W/m^2K, in h for $kcal/m^2°C$)
P_t = calorific power of the fuel
η = system output (usually between 0,6 e 0,8)

Fuel	Calorific power	
Carbon	33.900 kJ/kg	8.100 kcal/kg
Coke	29.300 kJ/kg	7.000 kcal/kg
Fuel oil	41.000 kJ/kg	9.800 kcal/kg
Heating diesel oil	43.100 kJ/kg	10.300 kcal/kg
Methane	35.870 kJ/m³	8.570 kcal/m³
Heating gas	16.240 kJ/m³	3.880 kcal/m³

EXAMPLE: *Calculate the fuel saving achieved by substituting a 4 mm glass panel (U1=5,8 W/m^2K with a 16 mm polycarbonate sheet 10X (U2=1,7 W/m^2K.*
ΔU = $U_1 - U_2 = 5,8 - 1,7 = 4,1 W/m^2K$
S = 200 m^2
$\Delta T°$ = 15°C
D = 180 days x 10 h/d x 3.600/1.000 = 6.480 sec/1.000 (1.800 h)
P_t = 16.240 kJ/kg (Gas)
η = 0,7

m^3 saved Gas = (4,1 x 200 x 15 x 6.480) / (16.240 x 0,7) = 7.011 m^3/year

Saving = 7011 m^3/year x 0,8 €/m^3 = 5.609 €/year

4.3.2 Condensation control

Condensation forming is certainly to be avoided. The dew point, that is the temperature at which condensation begins, is influenced by many parameters: external temperature, internal temperature, relative humidity, thermal insulation of the wall.

In a condition of equality regarding the external and internal conditions, the optimal thermal insulation provided by MACROLUX® MULTIWALL sheets makes condensation forming less likely. The following diagram enables the user to correlate the various parameters. The following diagram enables the user to correlate the various.
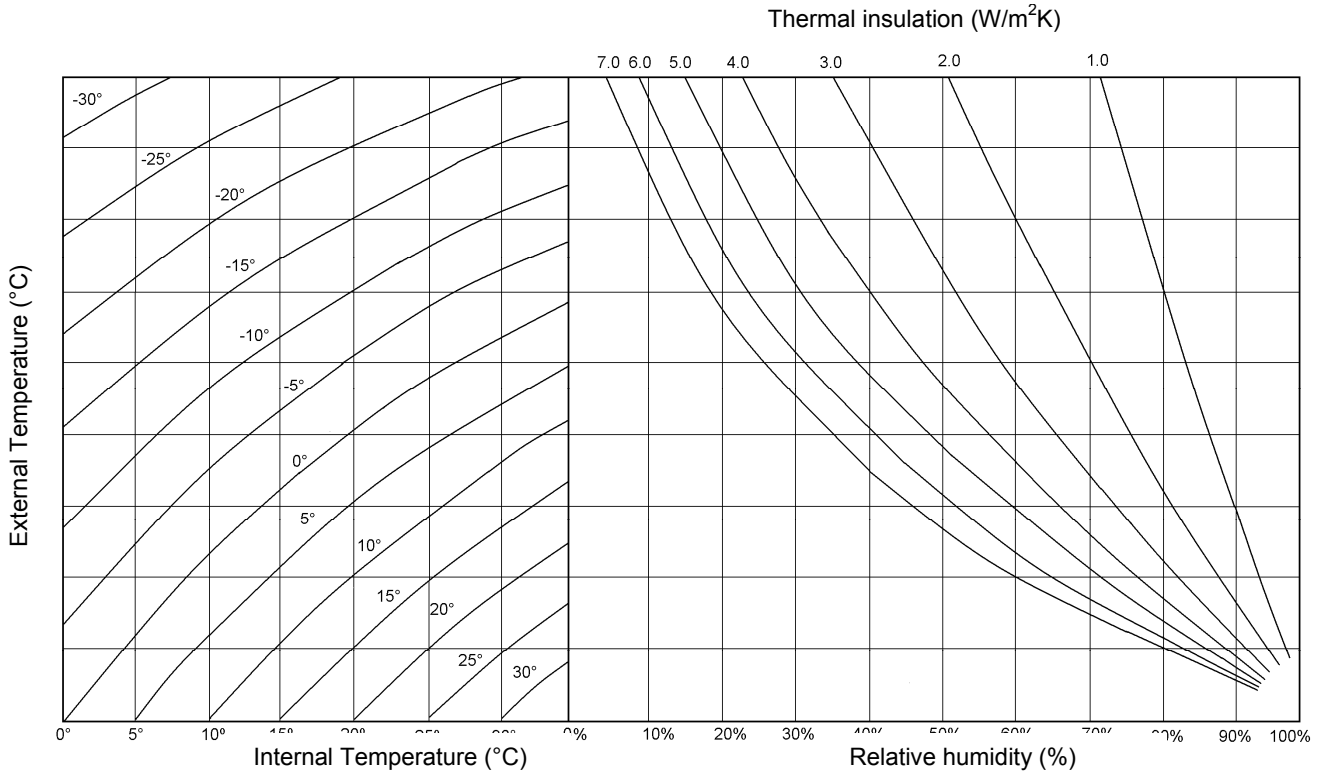
> **EXAMPLE:** *Checking at which outdoor temperature there is formation of condensation, for a simple glass (U1 = 5 W / m2K) and for a sheet of 16 mm thick polycarbonate 5W (U2 = 1.9 W / m2K) , with relative humidity equal to 60 % and an indoor temperature of 20 ° .*
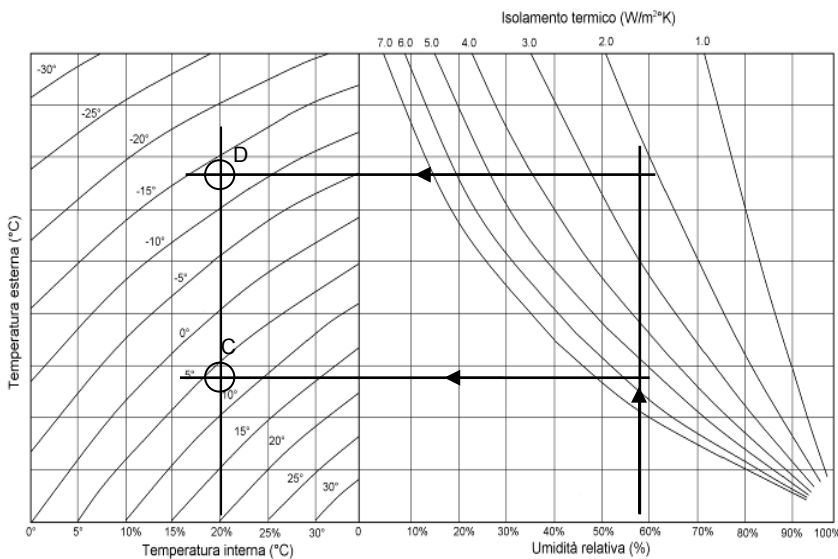
Once the intersection point between the Ur 60% line and the given thermal insulation values (point A and point B), the points (C) and (D) can be found by reading the intersection with the vertical line (internal temperature 20°C).

If a glass is used, condensation appears between 5° e 10°, but if a corresponding polycarbonate sheet were used, condensation would form only if the external temperature were between −15° and −20°C.

The diagram can also be read in the opposite way, if the temperatures and the insulation value are known, the probable condensation forming humidity can be calculated.

4.4 Sound reduction

The sound reduction values relevant to the MACROLUX® MULTIWALL sheet are detailed in the following chart.
They are estimated in a frequency range from 100 up to 3.150 Hz.

Structure	Thickness (mm)	Weight (g/m²)	Rw
2W	4	800	14 dB
	6	1300	15 dB
	8	1500	16 dB
	10	1700	19 dB
3W	16	2700	21 dB
3Q	6	1300	15 dB
	8	1500	16 dB
	10	1700	19 dB
3W MACROFORT	10	1700	21 dB
4W	6	1300	15 dB
	8	1500	16 dB
	10	1750	19 dB
5W	16	2700	21 dB
	20	3000	23 dB
	25	3300	23 dB
5X	16	2500	21 dB
7W	16	2500	21 dB
	20	3100	23 dB
	25	3300	23 dB
10W	50	5000	24 dB
	55	5200	24 dB
	60	6000	25 dB
10X	16	2800	21 dB
	20	3200	23 dB
	25	3400	23 dB
	32	3700	23 dB
	35	3800	23 dB
	40	4300	23 dB

NOTES: *the values reported derives from internal proofs or from test made by certified International laboratories/Institutes (according to the european norms EN 21140-3, DIN 52210-75, EN ISO 717-1…) . Koscon Industrial S.A. reserves the right to modify these values without prior notice.*

4.5 Impact resistance

MACROLUX[®] MULTIWALL sheets have an extremely high impact strength and it is a winning characteristic in comparisons with other materials which are commonly used to make transparent walls (glass, acrylic, etc). This parameter remains unchanged in the temperature range going from – 40°C to +120°C.

Polycarbonate is an extremely ductile and resistant material. It does not show a clear rupture, but during tests an optimal absorption of the impact is evidenced, thanks to the increasing deformation of the sheet.

The resiliency and the rupture energy of the samples, are measured by comparing the difference results of energy of an oscillating pendulum.

Comparison of impact strength, perforation resistance:

Common materials	Charpy unnoteched ISO 179 (kJ/m^2)	Izod notched ISO 180 (kJ/m^2)
Glass	2	-
Toughened glass	10	-
PMMA	15	2
PET	No break	3
PETG	No break	11
Polycarbonate	No break	70

4.6 Hail resistance

When hail falls, the maximum falling speed is relevant to the sphere diameter, in detail, a hailstone, which has a diameter of 20 mm, has a maximum falling speed of 21m/sec.

In order to ensure the resistance to hail which is described in the warranty, MACROLUX[®] MULTIWALL sheets underwent simulation tests in harder condition. Polyamide or steel spheres having a diameter from 5 mm to 40 mm were used, applying speed degrees which were higher than typical hail falls. MACROLUX[®] MULTIWALL sheets did not show relevant ruptures, not even in range-limit conditions.

Thanks to the co-extrusion system, aging due to UV rays is slowed, and we can guarantee a resistance to hail for 10 years in the terms detailed in the warranty.

4.7 Fire behavior characteristics

Polycarbonate MACROLUX[®] MULTIWALL sheets are certified in many countries all over the word and offer the best fire-reaction characteristics.

Some certifications are relevant to the colour. Our offices will be glad to provide you with certifications and assistance.

4.8 Service temperature range

The characteristics of polycarbonate (mechanical properties, impact strength, etc) are not altered within a large temperature range. MACROLUX[®] MULTIWALL sheets can be used within the following temperature range.

Minimal service temperature:	- 40°C
Maximal service temperature:	+ 120°C

4.9 Bending radius

MACROLUX® MULTIWALL sheets may be cold bended in order to make small trellis works and tunnels. The maximal safety value are listed on the basis of the various section kinds:

| Structure	Description	Minimum Radius
2W	2 walls structure	150 times the thickness of the sheet
3Q	3 walls "square" structure	
5W	5 walls structure	
5X	5 X walls structure	
7W	7 walls structure	
3W MACROFORT	3 walls structure (reinforced external wall)	170 times the thickness of the sheet
3W	3 walls structure	180 times the thickness of the sheet
4W	4 walls structure	200 times the thickness of the sheet
10X	10 X walls structure	250 times the thickness of the sheet (180 times for opal)
10W	10 walls structure	*Not raccomended*
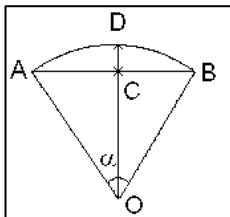
Where:

R = *radius (OD)*
c = *chord (AB)*
f = *arrow (CD)*

Radius can be calculated with the formula:

$$R = \frac{\left(\dfrac{c}{2}\right)^2 + f^2}{2f}$$

IMPORTANT: *Bending radiuses lower than those provided for are not allowed, the sheet would break within a short time due to internal tensions.*
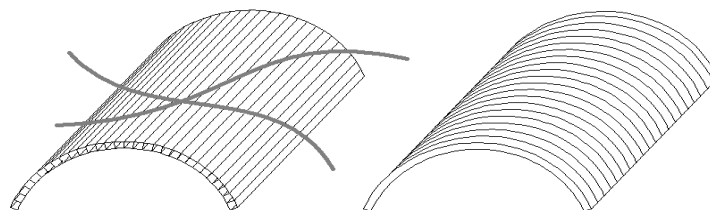
NOT ALLOWED   *ALLOWED*

IMPORTANT: *The cold bending of the sheets must be carried out solely according to the direction of the chambers, a transversal bending is not allowed.*

EXAMPLE: *Calculate the radius of a small trellis work having a maximum external cord of 1.700 mm, a camber of 1/7, and verify its compatibility with a MACROLUX® polycarbonate sheet.*
*The camber f = 243 mm*
The resulting geometrical radius is R = 1.608 mm.
Thanks to this calculation,a 10 mm 2W sheet can be used (minimum radius =10 mm x 150 = 1500mm)

4.10 U.V. protection

In order to prevent a premature aging due to ultraviolet sun radiation, all MACROLUX® MULTIWALL sheets are protected by means of a UV Absorber layer. Co-extrusion makes it possible to apply an uniform layer which filtrates ultraviolet rays.

Trasmittance %
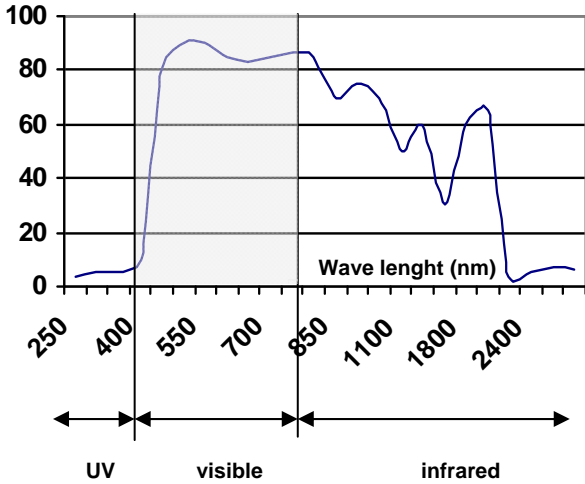
The response to the solar radiation spectrum evidences how a UV-protected polycarbonate sheet can screens the ultraviolet component completely (on average only 4% of the radiation included in the range between 250-380 nanometers can pass through the sheet), while it remains totally transparent to the visible component.

The outstanding characteristic of polycarbonate sheets remains unaltered in time. Constantly repeated laboratory tests allow issuing a warranty for the sheets against the loss of luminosity, yellowing and hailing ruptures.

Please ask our offices for a copy of the warranty and of its extension.

### 4.10.1 Variation of light transmission

Reducing light transmission
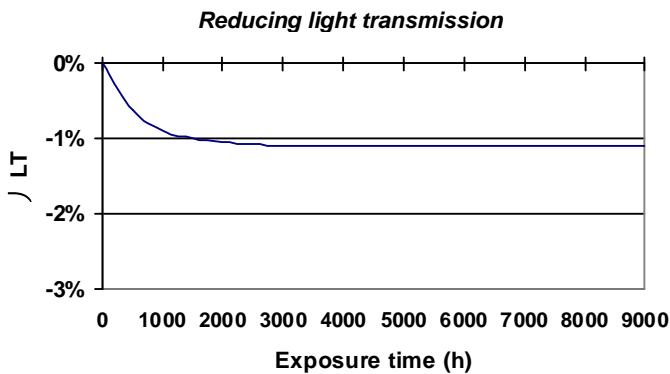
The UV protection limits to the range of a few percentage points the loss of light transmission for MACROLUX® MULTIWALL sheets in the course of time.

The terms and methods used for the evaluation of the loss of light transmission are detailed in the warranty.

As an example, we illustrate here a test for accelerated aging in WOM with a xenon light bulb for 10 mm multiwall sheets.

4.10.2 Yellow index variation (ΔYI)
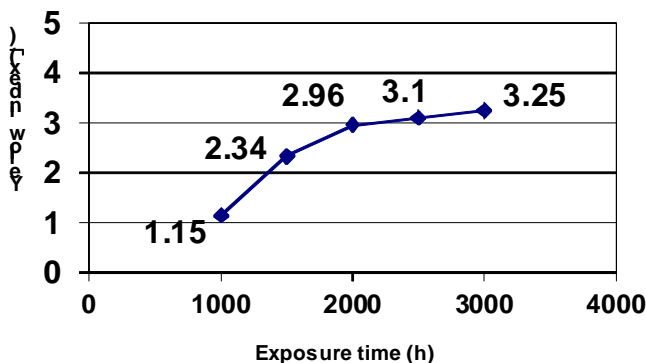
Example of an accelerated aging test in QUV with UVA 340 lamps for 10mm multiwall sheets. The terms and methods for the evaluation of yellow index are detailed in the warranty and in its extension , if one is available.

4.10.3 Resiliency variation

Several resiliency tests were carried out on MACROLUX® MULTIWALL sheets aged at different times, and they point out the optimal resiliency even after a 3000 hour aging.
The aged material shows ductility anyway.
Example of resiliency of a Multiwall 10 mm sheet:

Aging	Resiliency
0 h	1.108 J/cm^2
1.500 h	1.004 J/cm^2
3.000 h	985 J/cm^2

NOTE: CSTB proof (according norm NF T51-111).

4.11 Heat expansion

Polycarbonate has a high heat expansion value, if compared to the materials which are commonly used for building:

$$\alpha = 0,065 \text{ mm/m } °C (6,5 \times 10^{-5} \text{ 1/K})$$

In order to achieve a correct planning with MACROLUX® multiwall sheets, the maximum planned expansion is to be verified and every technical precaution should be taken to avoid high-level efforts due to fixed constraints on the sheets.

The expected expansion – both for length and for width – can be calculated by means of the following formula:

$$\Delta L = \alpha \times L \times \Delta T°$$

Where:

ΔL is the expected length difference in mm

α is the linear heat expansion coefficient (0,065 mm/m °C)

L is the length of the sheet for the direction regarding which the lengthening in m is calculated

$\Delta T°$ is the estimated temperature difference in centigrade degrees

IMPORTANT: To prevent ruptures due to compression caused by heat expansion, plan for adequate expansion spaces.

EXAMPLE: Calculate the maximal difference in dimension in the situation of maximum temperature change (summer-winter) of a sheet having the following dimensions: width 1.050 mm and length10.000 mm.
Once it has been verified that the minimum winter temperature –20° and that the maximum summer temperature – measured on the sheet surface – is + 60°, the evaluation of the dimension difference is:
$\Delta T = 60 - (-20) = 80°C$
The difference in width is $\Delta L1 = 0,065 \times 1,05 \times 80 = 5,4 \text{ mm}$
The difference in length is $\Delta L2 = 0,065 \times 10,0 \times 80 = 52 \text{ mm}$
Both values must be taken into consideration as project data 1which are necessary for a correct solution.

4.12 Virtual shortening of the sheet

The camber which is a consequence of external loads, causes a curving of the MACROLUX® MULTIWALL sheet's margins, therefore the support area decreases. This "virtual shortening" can compromise the stability even in situations in which the sheet does not undergo an effort which would lead to a rupture.

This diagram enables the user to calculate the virtual shortening of the width, once the deformation camber is known. By intersecting the value of the camber (on the abscissa axis) with the corresponding line of a given length, the value of "virtual shortening" of the sheet (C) can be obtained.
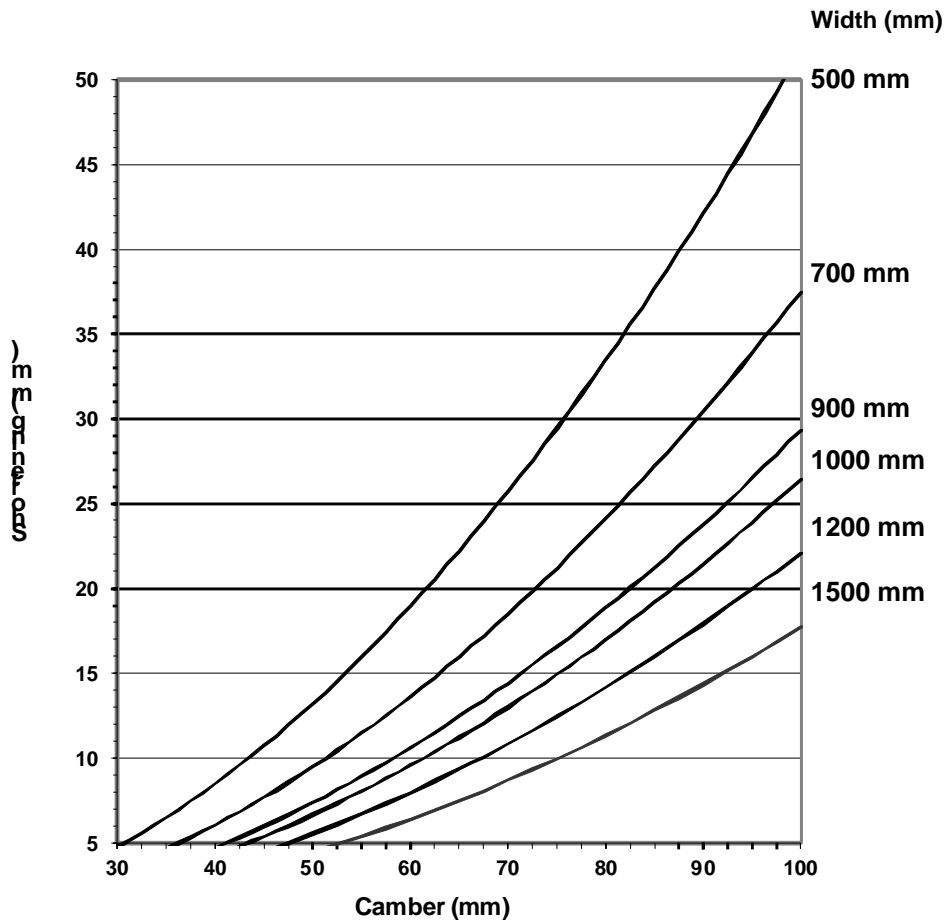
If it is assumed that the sheet has been installed and loaded symmetrically relevant to the centre to centre, the calculated value must be divided between the two bearings:
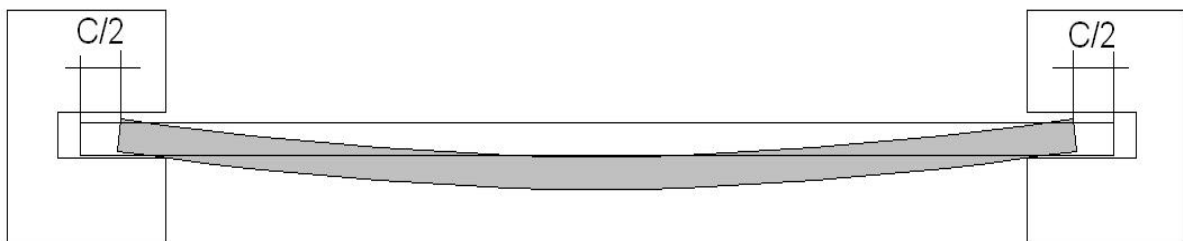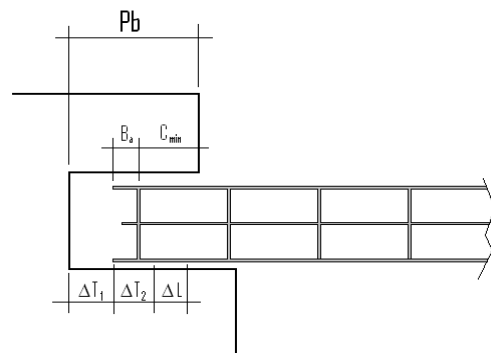
4.13 Sheet clamping

The minimum needed value to hold MACROLUX® MULTIWALL sheets within their constraints is a very important parameter for a proper installation. The following elements should be considered:

- The maximum heat expansion (ΔT_1) should be calculated with comparison to the average installation setting. The maximum foreseeable shortening (ΔT_2) should also be calculated.
- The open side (B_a), that is the external part of the width where the sheet is cut and has no closed septum, cannot be considered to the purpose of holding.
- Virtual shortening (ΔL) under a load.
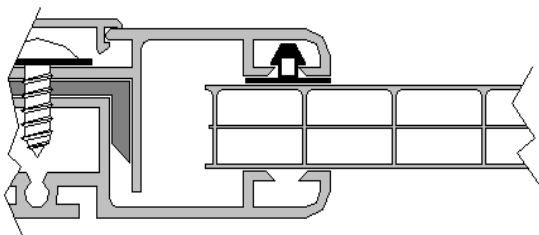- The minimum holding which should be insured amounts to 20 mm (C_{min}).

Particularly, the minimum depth (P_b) of the side holding should be:

$$P_b > max\ (\Delta T_1 + \Delta T_2 + \Delta L\ ;\ C_{min} + B_a)$$

That is:

- *In a situation of maximum shortening the sheet must continue to be constrained.*
- *In a situation of maximum expansion the sheet must not be compressed.*
- *There must be a minimum functional clamping.*

CORRECT CLAMPING
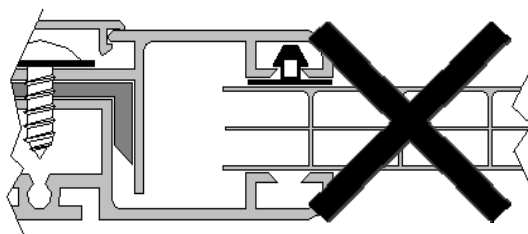
WRONG *SITUATION*

The expansions which take place in the direction of the length can amount to a few centimetres. It is extremely important to evaluate them correctly, so that an adequate situation, where expansion is not hindered and where the holding in the eaves or in the ridge.

4.14 Allowed loads

The loads which the sheets have to withstand are usually wind and snow.
The connection between wind speed and the corresponding pressure load is calculated in the following chart, with the exclusion of edge effects:

	Wind speed		Loads (N/m^2)
The kinetic wind pressure is calculated with the formula: $$q = \frac{V^2}{1.6}$$	km/h	m/sec	
	50	13,9	120 N/m^2
	60	16,7	174 N/m^2
	70	19,4	235 N/m^2
	80	22,2	308 N/m^2
	90	25,0	390 N/m^2
	100	27,8	483 N/m^2
	110	30,6	585 N/m^2
	120	33,3	693 N/m^2
	130	36,1	814 N/m^2
	140	38,9	954 N/m^2
	150	41,7	1.087 N/m^2
	160	44,4	1.232 N/m^2
	170	47,2	1.392 N/m^2
	180	50,0	1.562 N/m^2
	190	52,8	1.742 N/m^2
	200	55,6	1.932 N/m^2

When the external load acting on the structure is calculated, the person in charge of the plan will have to check both the typical climatic conditions of the area where the building shall be built, and the general and detailed characteristics of the structure where polycarbonate is used.

Aerodynamic peculiarities, as well as valleys, constitute a factor of multiplication for external loads (e.g., on the lateral corners of the structure, the wind load has an amplification factor amounting to 2 in valleys, snow accumulation needs to be taken into account).

IMPORTANT: *The calculation of effective loads, of the amplification coefficients, of the safety coefficients fall within the responsibility of the person in charge for the plan. For such calculation, please see the specific regulations in force in each country.*

The diagrams listed here refer to limit rupture conditions (the safety coefficient used is 1,5) with a holding 20 mm.

4.14.1 Sheet fixed on 4 sides (pressure loads)

The charts listed below refer to load values for sheets which have constraints on four sides. Width is to be intended transversally. The chambers and length of measured longitudinally. The charts detail the values concerning the allowed length of a sheet for each width:

Thickness 6 mm
(2W = 1,3 Kg/m² | 3Q = 1,3 kg/m² | 4W = 1,3 kg/m²)

Load (N/m²)	Width (mm)									
	500	600	700	800	900	1.000	1.200	1.400	1.600	1.800
600	6.000	4.270	2.505	1.905	1.450	1.135	935	810	680	545
800	5.250	2.720	1.770	1.340	1.020	890	785	680	575	465
1.000	3.540	1.980	1.405	1.120	905	785	665	570	488	410
1.200	2.970	1.534	1.170	950	789	673	540	460	410	360
1.400	2.470	1.265	975	770	625	545	445	380	340	310
1.500	1.850	1.090	870	680	550	465	380	325	310	290

Thickness 8 mm
(2W = 1,5 Kg/m² | 3Q = 1,5 kg/m² | 4W = 1,5 kg/m²)

Load (N/m²)	Width (mm)									
	500	600	700	800	900	1.000	1.200	1.400	1.600	1.800
600	-	-	4.490	2.840	2.160	1.770	1.310	1.060	875	700
800	-	6.000	3.180	2.200	1.740	1.430	1.080	905	765	615
1.000	-	4.400	2.290	1.720	1.400	1.170	925	780	665	545
1.200	-	3.125	1.920	1.480	1.150	950	750	645	560	475
1.400	6.000	2.285	1.600	1.225	990	820	630	535	475	415
1.600	3.640	1.700	1.250	1.005	820	660	520	455	415	375
1.800	2.115	1.215	940	755	605	500	405	380	360	335
2.000	1.300	780	565	475	405	365	350	335	325	310

Thickness 10 mm
(2W = 1,7 Kg/m² | 3Q = 1,7 kg/m² | 3W Macrofort = 1,7 kg/m² | 4W = 1,75 Kg/m²)

Load (N/m²)	Width (mm)									
	500	600	700	800	900	1.000	1.200	1.400	1.600	1.800
600	-	-	6.000	3.420	2.540	2.070	1.640	1.390	1.145	895
800	-	-	4.815	2.450	1.975	1.710	1.385	1.170	970	780
1.000	-	6.000	2.665	1.995	1.615	1.415	1.210	1.040	865	695
1.200	-	4.720	2.325	1.790	1.490	1.290	1.090	925	780	630
1.400	-	3.315	2.110	1.690	1.400	1.235	1.010	835	705	580
1.600	6.000	2.690	1.850	1.500	1.265	1.115	890	730	625	525
1.800	5.130	2.150	1.595	1.320	1.145	1.020	810	640	560	478
2.000	3.685	1.820	1.445	1.195	1.025	900	715	600	520	450

Thickness 16 mm
(3W = 2,7 Kg/m² | 5W = 2,7 Kg/m² | 5X = 2,5 Kg/m² | 7W = 2,5 Kg/m²)

Load (N/m²)	Width (mm)									
	700	800	900	1.000	1.200	1.400	1.600	1.800	2.000	2.100
600	-	-	-	6.000	2.860	2.255	1.880	1.470	1.040	835
800	-	-	6.000	3.225	2.190	1.850	1.555	1.235	920	760
1.000	-	6.000	4.070	2.340	1.800	1.555	1.310	1.065	825	705
1.200	-	5.375	3.040	1.990	1.505	1.325	1.135	945	760	665
1.400	6.000	3.750	2.350	1.700	1.330	1.170	1.020	865	710	630
1.600	5.175	2.655	1.840	1.470	1.200	1.070	935	800	670	600
1.800	3.440	1.885	1.490	1.305	1.115	995	875	755	640	580
2.000	1.980	1.455	1.255	1.120	965	865	780	690	600	560

Thickness 16 mm
(10X = 2,8 Kg/m²)

Load (N/m²)	Width (mm)									
	700	800	900	1.000	1.200	1.400	1.600	1.800	2.000	2.100
600	-	-	-	6.000	3.025	2.305	1.915	1.505	1.070	830
800	-	-	-	5.090	2.235	1.905	1.595	1.270	935	755
1.000	-	-	6.000	2.590	1.850	1.595	1.335	1.090	835	710
1.200	-	6.000	3.470	2.120	1.555	1.360	1.165	960	760	660
1.400	-	5.160	2.660	1.750	1.380	1.210	1.045	885	715	625
1.600	-	3.600	2.045	1.570	1.240	1.110	970	825	675	600
1.800	6.000	2.310	1.610	1.380	1.165	1.030	905	770	640	575
2.000	4.170	1.790	1.340	1.175	1.015	910	805	705	605	555

Thickness 20 mm
(5W = 3,0 Kg/m2 | 7W = 3,1 Kg/m² | 10X = 3,2 Kg/m²)

Load (N/m²)	Width (mm)									
	700	800	900	1.000	1.200	1.400	1.600	1.800	2.000	2.100
600	-	-	-	-	5.160	2.480	2.060	1.645	1.230	1.015
800	-	-	-	-	2.910	2.185	1.825	1.465	1.100	925
1.000	-	-	-	6.000	2.295	1.935	1.635	1.320	1.010	855
1.200	-	-	-	3.900	2.035	1.760	1.485	1.215	945	805
1.400	-	-	6.000	2.660	1.810	1.585	1.345	1.115	880	765
1.600	-	-	3.480	2.120	1.630	1.435	1.235	1.035	835	735
1.800	-	6.000	2.570	1.800	1.535	1.370	1.175	990	800	704
2.000	6.000	3.700	1.960	1.560	1.400	1.240	1.080	925	765	680

Thickness 25 mm
(5W = 3,3 Kg/m² | 7W = 3,3 Kg/m²)

Load (N/m²)	Width (mm)									
	700	800	900	1.000	1.200	1.400	1.600	1.800	2.000	2.100
600	-	-	-	-	6.000	2.700	2.270	1.835	1.395	1.175
800	-	-	-	-	3.770	2.400	2.020	1.640	1.255	1.070
1.000	-	-	-	-	2.830	2.220	1.885	1.535	1.175	990
1.200	-	-	-	6.000	2.430	2.035	1.740	1.410	1.090	935
1.400	-	-	-	4.300	2.250	1.940	1.645	1.350	1.040	885
1.600	-	-	6.000	3.170	2.000	1.720	1.495	1.235	970	850
1.800	-	-	5.415	2.550	1.755	1.545	1.335	1.135	925	815
2.000	-	6.000	3.315	1.910	1.600	1.425	1.250	1.065	880	785

Thickness 25 mm
(10X = 3,4 Kg/m²)

Load (N/m²)	Width (mm)									
	700	800	900	1.000	1.200	1.400	1.600	1.800	2.000	2.100
600	-	-	-	-	6.000	3.110	2.430	1.920	1.435	1.198
800	-	-	-	-	5.080	2.590	2.110	1.700	1.290	1.090
1.000	-	-	-	-	3.390	2.400	1.940	1.565	1.200	1.010
1.200	-	-	-	-	2.760	2.155	1.780	1.415	1.100	950
1.400	-	-	-	6.000	2.490	2.000	1.685	1.370	1.060	905
1.600	-	-	-	3.800	2.270	1.815	1.515	1.260	1.000	865
1.800	-	-	6.000	2.890	1.945	1.650	1.414	1.180	950	830
2.000	-	6.000	4.050	2.180	1.660	1.455	1.270	1.080	895	800

Thickness 32 mm (10X = 3,7 Kg/m²)										
Load (N/m²)	**Width (mm)**									
	700	**800**	**900**	**1.000**	**1.200**	**1.400**	**1.600**	**1.800**	**2.000**	**2.100**
600	-	-	-	-	6.000	3.640	2.650	2.070	1.555	1.335
800	-	-	-	-	6.000	3.225	2.325	1.810	1.415	1.215
1.000	-	-	-	6.000	4.550	2.650	2.040	1.680	1.310	1.125
1.200	-	-	-	6.000	3.380	2.305	1.880	1.525	1.210	1.060
1.400	-	-	-	6.000	2.875	2.125	1.775	1.460	1.150	1.010
1.600	-	-	6.000	4.845	2.500	1.535	1.610	1.335	1.085	965
1.800	-	-	6.000	3.415	2.115	1.750	1.515	1.280	1.045	930
2.000	-	6.000	5.035	2.440	1.800	1.550	1.360	1.175	990	890

Thickness 35 mm (10X = 3,8 Kg/m²)										
Load (N/m²)	**Width (mm)**									
	700	**800**	**900**	**1.000**	**1.200**	**1.400**	**1.600**	**1.800**	**2.000**	**2.100**
600	-	-	-	-	6.000	4.357	2.925	2.215	1.690	1.265
800	-	-	-	-	6.000	3.687	2.575	1.955	1.540	1.330
1.000	-	-	-	6.000	5.930	2.980	2.135	1.770	1.415	1.235
1.200	-	-	-	6.000	4.100	2.510	1.970	1.610	1.315	1.165
1.400	-	-	-	6.000	3.260	2.245	1.855	1.545	1.240	1.105
1.600	-	-	-	6.000	2.740	2.085	1.740	1.440	1.180	1.055
1.800	-	-	6.000	3.805	2.285	1.890	1.595	1.355	1.120	1.015
2.000	-	-	6.000	2.625	1.920	1.655	1.440	1.262	1.075	985

Thickness 40 mm (10X = 4,3 Kg/m²)									
Load (N/m²)	**Width (mm)**								
	1.000	**1.050**	**1.200**	**1.250**	**1.400**	**1.600**	**1.800**	**2.000**	**2.100**
600	-	-	-	-	6.000	3.250	2.350	1.800	1.600
800	-	-	-	-	4.800	2.950	2.150	1.600	1.450
1.000	-	-	6.000	6.000	3.700	2.550	1.950	1.500	1.300
1.200	-	-	5.600	4.350	3.050	2.300	1.750	1.350	1.200
1.400	-	6.000	3.950	3.500	2.650	2.100	1.650	1.300	1.150
1.600	6.000	5.300	3.100	2.900	2.400	1.900	1.550	1.250	1.100
1.800	4.550	3.200	2.550	2.400	2.100	1.700	1.450	1.200	1.050
2.000	2.900	2.500	2.100	2.050	1.800	1.550	1.300	1.100	1.050

Load table **10W** structure (32,40,50,55,60mm thickness), fixed on 4 sides, width 1200mm:

Lenght (mm)	**(Sheet width= 1.200 mm)**				
	32 mm	**40 mm**	**50 mm**	**55 mm**	**60 mm**
	Load (N/m²)				
1.500	2.100	2.650	3.500	3.700	3.800
2.000	1.400	1.900	2.550	2.850	3.200
2.500	1.050	1.450	2.000	2.300	2.550
3.000	950	1.250	1.600	2.150	2.250
> 3.000	900	900	950	1.000	1.050

Thickness 10 mm (2W = 1,3 Kg/m² | 3Q = 1.3 Kg/m²)										
Load (N/m²)	**Width (mm)**									
	500	**600**	**700**	**800**	**900**	**1.000**	**1.200**	**1.400**	**1.600**	**1.800**
800	-	6.000	4.815	2.450	1.975	1.710	1.385	1.170	970	*780*
1.000	-	6.000	2.665	1.995	1.615	1.415	1.210	1.040	865	*695*
1.200	6.000	4.720	2.325	1.790	1.490	1.290	1.090	925	780	*630*
1.400	6.000	3.315	2.110	1.690	1.400	1.235	1.010	835	705	*580*
1.600	6.000	2.690	1.850	1.500	1.265	1.115	890	730	625	*525*
1.800	5.130	2.150	1.595	1.320	1.145	1.020	810	640	560	*478*
2.000	3.685	1.820	1.445	1.195	1.025	900	715	600	520	*450*

Example:
- Verify the admissible load (A) of a sheet knowing its section (2w) and its thickness 10 mm. The sheet dimension is 800x1500 mm.
By reading the width value in the 800 mm column, through the corresponding length value to be verified, it is possible to find the rupture load (1600 N/m²).
- Find the allowed length (B) for a sheet having a width of 1200 mm and which can withstand a load of 1000 N/m². Crossing the value 1200 mm with the load 1000 N/m² an allowed length of about 1210 mm is found.

4.14.2 Sheet fixed on two sides (suction load)

If a sheet is constrained on two sides, or if a sheet is very long, the planning parameter is given by the width of the sheet, which will have to be verified according to the expected load.

The table shows the allowed width (a) of the sheet according to load values:

Thick. (mm)	Wall structure	Weight (kg/m²)	Load (N/m²)								
			500	**600**	**800**	**1.000**	**1.200**	**1.400**	**1.600**	**1.800**	**2.000**
6	2W | 3Q | 4W	1,3	580	550	510	480	445	410	-	-	-
8	2W | 3Q | 4W	1,5	680	655	610	570	535	510	480	455	425
10	2W | 3Q | 3W | 4W	1,7 | 1,75	750	725	670	620	580	550	515	485	465
16	5X | 7W	2,5	1.080	1.030	940	880	820	750	710	680	650
16	3W | 5W	2,7	1.050	1.000	915	850	780	725	680	640	595
16	10X	2,8	1.180	1.130	1.035	950	880	825	785	745	700
20	5W | 7W | 10X	3,0 | 3,2	1.230	1.190	1.110	1.035	965	905	850	810	770
25	5W | 7W | 10X	3,3 | 3,4	1.270	1.235	1.150	1.085	1.020	970	935	890	850
32	10X	3,7	1.355	1.315	1.240	1.170	1.110	1.040	980	935	895
35	10X	3,8	1.440	1.390	1.310	1.235	1.150	1.090	1.025	970	930
40	10X	4,3	1.490	1.420	1.350	1.265	1.172	1.100	1.050	1.000	950

4.14.3 Sheet fixed on three sides

Load table for sheets fixed on three sides, width 1.200 mm :

Lenght (mm)	Load (N/m²)				
	Width 10W sheet = 1200 mm				
	32 mm	*40 mm*	*50 mm*	*55 mm*	*60 mm*
1.500	800	950	1.150	1.050	1.200
2.000	850	950	1.000	1.100	1.150
2.500	900	950	1.000	1.100	1.150
3.000	900	950	1.050	1.100	1.150
> 3.000	800	900	900	1.000	1.100

4.14.4 Curved sheets load values

Width

Length

.
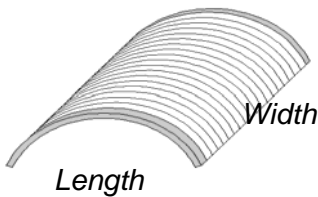
If a sheet is bent, it is absolutely essential to respect the minimum bending radius which is unique to the sheet being used (see chapter 4.9), The sheet's width depends both on the planned load and on the bending radius which has to be considered.

The chart details the allowed width of the sheet considering the load and the bending radius.

Thickness 6 mm												
$(2W = 1{,}3\ Kg/m^2 \mid 3Q = 1{,}3\ kg/m^2 \mid 4W = 1{,}3\ kg/m^2)$												
Load (N/m²)	minimum Radius = 900 mm											
	900	1.000	1.100	1.200	1.300	1.400	1.500	1.600	1.700	1.800	1.900	2.000
600	2.100	2.035	1.900	1.780	1.645	1.510	1.400	1.270	1.155	1.050	955	885
800	1.895	1.730	1.560	1.410	1.285	1.150	1.050	965	900	830	775	730
1.000	1.560	1.420	1.310	1.195	1.065	980	890	800	730	675	635	595
1.200	1.355	1.230	1.100	1.000	900	820	750	685	635	600	570	550
1.400	1.165	1.055	935	855	775	710	655	600	560	530	515	-
1.600	1.050	955	850	765	700	630	570	540	510	-	-	-
1.800	935	855	760	690	630	570	525	-	-	-	-	-
2.000	830	750	680	620	565	515	-	-	-	-	-	-

Thickness 8 mm																			
$(2W = 1{,}5\ Kg/m^2 \mid 3Q = 1{,}5\ kg/m^2 \mid 4W = 1{,}5\ kg/m^2)$																			
Load (N/m²)	minimum Radius = 1.200 mm																		
	1.200	1.300	1.400	1.500	1.600	1.700	1.800	1.900	2.000	2.200	2.400	2.600	2.800	3.000	3.200	3.400	3.600	3.800	4.000	4.200
600	-	2.100	2.075	1.950	1.855	1.755	1.645	1.530	1.430	1.270	1.110	985	905	835	780	735	700	675	660	655
800	2.100	1.970	1.815	1.700	1.580	1.455	1.335	1.230	1.150	990	860	775	720	680	650	630	620	610	610	610
1.000	1.895	1.710	1.555	1.405	1.245	1.120	1.025	945	880	765	695	645	610	590	580	570	570	570	570	570
1.200	1.665	1.490	1.300	1.160	1.060	965	890	825	765	695	635	600	570	555	545	535	535	535	535	535
1.400	1.390	1.225	1.100	1.000	910	840	780	730	680	605	565	535	515	510	510	510	510	510	510	510
1.600	1.160	1.040	950	855	780	735	690	645	600	550	515	-	-	-	-	-	-	-	-	-
1.800	1.055	950	870	785	720	670	625	580	550	500	-	-	-	-	-	-	-	-	-	-
2.000	950	850	760	700	640	590	550	520	500	-	-	-	-	-	-	-	-	-	-	-

Thickness 16 mm																		
$(10X = 2{,}8\ kg/m^2)$																		
Load (N/m²)	10X minimum Radius = 4.000 mm (2.900 mm opal)																	
	2.400	2.500	2.600	2.700	2.800	2.900	3.000	3.200	3.400	3.600	3.800	4.000	4.200	4.400	4.600	4.800	5.000	5.200	5.400
600	-	-	-	-	-	-	2.100	1.995	1.840	1.720	1.600	1.490	1.395	1.300	1.220	1.155	1.105	1.085	1.085
800	-	-	-	-	2.100	2.045	1.935	1.750	1.575	1.440	1.325	1.225	1.135	1.070	1.020	995	990	985	985
1.000	-	2.100	2.090	1.960	1.825	1.735	1.630	1.465	1.335	1.215	1.136	1.065	1.000	955	925	910	910	910	910
1.200	2.055	1.925	1.800	1.670	1.535	1.435	1.350	1.210	1.090	1.000	935	890	865	855	845	845	845	845	845
1.400	1.755	1.645	1.525	1.435	1.340	1.265	1.205	1.085	980	900	830	800	790	785	785	785	785	785	785
1.600	1.540	1.430	1.330	1.240	1.165	1.100	1.040	940	845	790	760	745	745	745	745	745	745	745	745
1.800	1.395	1.300	1.215	1.135	1.070	1.015	960	865	775	720	705	700	700	700	700	700	700	700	700
2.000	1.210	1.110	1.035	970	905	850	805	735	685	665	665	665	665	665	665	665	665	665	665

Macrolux Multiwall POLYCARBONATE SHEETS

Thickness 10 mm
(2W = 1,7 Kg/m² | 3Q = 1,7 kg/m² | 3W Macrofort = 1,7 kg/m² | 4W = 1,75 Kg/m²)

Load (N/m²)	2W, 3Q, 3W Macrofort minimum Radius = 1.500 mm	4W minimum Radius = 2.000 mm																	
	1.500	1.600	1.700	1.800	1.900	2.000	2.200	2.400	2.600	2.800	3.000	3.200	3.400	3.600	3.800	4.000	4.200	4.400	4.600	4.800
600	-	-	-	2.100	2.030	1.900	1.670	1.490	1.325	1.185	1.070	975	865	820	790	765	750	740	730	725
800	-	2.100	1.905	1.735	1.600	1.500	1.320	1.160	1.040	930	860	810	745	720	705	690	680	670	670	670
1.000	1.860	1.695	1.555	1.450	1.365	1.280	1.120	1.000	900	820	755	725	665	645	635	625	620	620	620	620
1.200	1.605	1.450	1.340	1.235	1.145	1.065	925	805	720	660	625	610	595	590	585	585	580	580	580	580
1.400	1.425	1.295	1.180	1.075	995	930	805	695	640	605	585	565	555	550	550	550	550	550	550	550
1.600	1.210	1.095	1.000	910	830	770	660	600	570	545	535	525	520	520	515	515	515	515	515	515
1.800	1.065	980	900	830	765	710	620	565	530	510	500	-	-	-	-	-	-	-	-	-
2.000	910	840	770	720	675	625	555	515	-	-	-	-	-	-	-	-	-	-	-	-

Thickness 16 mm
(3W = 2,7 Kg/m² | 5W = 2,7 Kg/m² | 5X = 2,5 Kg/m² | 7W = 2,5 Kg/m²)

Load (N/m²)	3W minimum Radius = 2.900 mm	5X, 5W, 7W minimum Radius = 2.400 mm																
	2400	2500	2600	2.800	2.900	3.000	3.200	3.400	3.600	3.800	4.000	4.200	4.400	4.600	4.800	5.000	5.200	5.400
600	-	-	-	2.100	2.050	1.975	1.845	1.720	1.610	1.495	1.385	1.295	1.215	1.150	1.100	1.050	1.015	1.005
800	2100	2100	2100	1.900	1.815	1.735	1.590	1.445	1.330	1.230	1.140	1.060	995	955	935	930	920	915
1.000	2070	1945	1810	1.585	1.500	1.410	1.285	1.175	1.080	995	940	905	880	865	860	855	850	850
1.200	1700	1565	1440	1.265	1.205	1.150	1.040	955	890	835	810	795	790	785	780	780	780	780
1.400	1485	1360	1260	1.120	1.060	1.005	920	845	790	750	735	730	730	725	725	725	725	725
1.600	1340	1235	1150	1.000	940	895	815	755	715	695	690	685	685	680	680	680	680	680
1.800	1220	1115	1025	910	865	815	740	685	655	645	645	640	640	640	640	640	640	640
2.000	1050	970	905	800	755	715	665	625	610	600	595	595	595	595	595	595	595	595

Thickness 20 mm
(5W = 3,0 Kg/m2 | 7W = 3,1 Kg/m² | 10X = 3,2 Kg/m²)

Load (N/m²)	5X, 5W minimum Radius = 3.000 mm	7W, 10X minimum Radius = 5.000 mm (3.600 mm opal)																
	3.000	3.100	3.200	3.300	3.400	3.500	3.600	3.700	3.811	3.900	4.000	4.200	4.400	4.600	4.800	5.000	5.200	5.400
600	-	-	-	-	-	-	2.100	2.025	1.945	1.885	1.820	1.690	1.570	1.430	1.330	1.245	1.200	1.190
800	-	-	-	-	2.100	2.020	1.945	1.870	1.800	1.730	1.665	1.535	1.405	1.300	1.210	1.145	1.115	1.110
1.000	-	2.100	2.085	1.995	1.920	1.845	1.775	1.695	1.620	1.550	1.480	1.345	1.230	1.140	1.075	1.045	1.035	1.035
1.200	2.090	2.005	1.930	1.845	1.770	1.695	1.615	1.540	1.455	1.400	1.325	1.200	1.085	1.010	980	965	965	965
1.400	1.985	1.900	1.820	1.720	1.640	1.560	1.480	1.405	1.315	1.245	1.170	1.045	965	920	910	905	905	905
1.600	1.825	1.720	1.640	1.545	1.475	1.395	1.315	1.245	1.165	1.100	1.035	935	880	855	850	855	850	850
1.800	1.680	1.590	1.490	1.390	1.295	1.215	1.110	1.045	990	945	905	850	815	810	810	810	810	810
2.000	1.595	1.480	1.375	1.270	1.160	1.060	980	915	865	830	800	780	770	770	770	770	770	770

Thickness 25 mm
(5W = 3,3 Kg/m² | 7W = 3,3 Kg/m²)

Load (N/m²)	5W, 7W minimum Radius = 3.800 mm																	
	3.800	3.900	4.000	4.100	4.200	4.300	4.400	4.500	4.600	4.700	4.800	4.900	5.000	5.100	5.200	5.300	5.400	5.500
600		2.100	2.045	1.975	1.900	1.830	1.750	1.675	1.590	1.530	1.465	1.405	1.350	1.305	1.270	1.245	1.235	1.235
800	2.025	1.950	1.870	1.795	1.715	1.640	1.565	1.495	1.430	1.375	1.315	1.255	1.220	1.190	1.165	1.155	1.150	1.150
1.000	1.955	1.875	1.790	1.700	1.615	1.515	1.435	1.355	1.275	1.230	1.185	1.145	1.115	1.095	1.085	1.085	1.085	1.085
1.200	1.815	1.725	1.630	1.550	1.465	1.370	1.280	1.200	1.135	1.100	1.070	1.040	1.030	1.020	1.020	1.020	1.020	1.020
1.400	1.650	1.565	1.475	1.380	1.285	1.200	1.130	1.075	1.030	1.010	990	980	975	970	970	970	970	970
1.600	1.500	1.415	1.310	1.230	1.155	1.080	1.025	990	970	955	945	935	935	935	935	935	935	935
1.800	1.350	1.270	1.180	1.100	1.040	995	955	930	920	910	900	895	890	890	890	890	890	890
2.000	1.190	1.120	1.045	990	955	925	895	880	870	865	855	855	850	850	850	850	850	850

Thickness 25 mm (10X = 3,4 Kg/m²)										
Load (N/m²)	10X minimum Radius 6.250 mm (4.500 mm Opal)									
	4.500	4.600	4.700	4.800	4.900	5.000	5.100	5.200	5.300	5.400	5.600
600	1.760	1.670	1.605	1.540	1.480	1.420	1.370	1.330	1.295	1.280	1.265
800	1.570	1.505	1.445	1.340	1.320	1.280	1.245	1.215	1.200	1.185	1.185
1.000	1.425	1.355	1.290	1.245	1.200	1.165	1.140	1.130	1.120	1.120	1.120
1.200	1.260	1.195	1.155	1.120	1.095	1.074	1.065	1.060	1.060	1.060	1.060
1.400	1.130	1.085	1.055	1.030	1.015	1.005	1.005	1.005	1.005	1.005	1.005
1.600	1.040	1.015	990	970	965	955	955	955	955	955	955
1.800	970	945	935	925	915	910	910	910	910	910	910
2.000	910	890	880	875	875	875	875	875	875	875	875

IMPORTANT: *For thickness over 32 mm the bending radius is related to the thickness and the structure of the sheet. This value is very high so please refer to the values of flat solutions.*

Thickness 10 mm (2W = 1,7 Kg/m²)											
Load N/m²	Radius (mm)										
	1.500	1.600	1.700	1.800	1.900	2.000	2.200	2.400	2.600	2.800	3.000
600	-	-	-	2.100	2.030	1.900	1.670	1.490	1.325	1.185	1.070
800	-	2.100	1.905	1.735	1.600	1.500	1.320	1.160	1.040	930	860
1.000	1.860	1.695	1.555	1.450	1.365	1.280	1.120	1.000	900	820	755
1.200	1.605	1.450	1.340	1.235	1.145	1.065	925	805	720	660	625
1.400	1.425	1.295	1.180	1.075	995	930	805	695	640	605	585
1.600	1.210	1.095	1.000	910	830	770	660	600	570	545	535
1.800	1.065	980	900	830	765	710	620	565	530	510	500

Example:

(A) Verify the length of the sheet in a curved installation where the radius is 2.200 mm and the load is 1.000 N/m². By crossing the two values on the chart, the value of 1.120 mm is obtained.

(B) Verify the breaking load for a cold bended sheet having a minimum radius of 1.800 mm and a 1.075 mm width. In the radius = 1.800 mm column the closet value to 1.075 mm corresponds to a load of 1.400 N/m².

4.15 Compatibility to chemicals

Countless chemicals can come into contact with MACROLUX® MULTIWALL polycarbonate sheets, both for environmental reasons and due to manufacturing reasons. The compatibility on a chemical level depends both on the element and on its environmental concentration.

Here is a list of some substances and their compatibility with polycarbonate, just as an example:

CHEMICALS							
Acetaldehyde	∅	Alum	•	Cresol	∅	Naphtha	•
Acetylene	•	Aluminium alum	•	Decalin	•	Ammonium nitrate	•
Acetone	∅	Chrome alum	•	Diamlphthalate	▽	Calcium nitrate	•
Acetic acid 5%	•	Potassium alum	•	Dyburylphthalate	▽	Potassium nitrate	•
Acetic acid 30%	▽	Amilacetate	▽	Diethyl ether	▽	Acrylic nitrile	∅
Acetic acid	∅	Ammonia	∅	Dimethylformaldehyde	▽	Nitrobenzene	∅
Arsenic acid 20%	•	Sulphur dioxide	∅	Dinonilphthalate	∅	Nitrobenzole	▽
Arsenous acid 20%	•	Aniline	▽	Dioxane	∅	Aluminium oxalate	•
Benzyl acid	∅	Benzene	∅	Sulphur dioxide	▽	Phosphotic Oxychloride	•
Benzoic acid	∅	Industrial petrol	∅	Dioctyl adipate	∅	Carbon oxide	•
Boric acid	•	Benzole	∅	Dioctyl phtalate	∅	Zinc oxide	•
Butyric acid	∅	Sodium bicarbonate	∅	Diphyl	∅	Oxygen	•
Carbonic acid	•	Potassium dichromate	∅	Heptane	•	Ozone	•
Citric acid 10%	•	Sodium bisulphate	•	Hexane	•	Antimony pentachloride	•
Hydrochloric acid 10%	•	Sodium bisulphite	•	Methylic ester	▽	Pentane	•
Hydrochloric acid 35%	∅	Borax	•	Ether	▽	Potassium perchlorate 10%	•
Chromic acid 20%	•	Bromine	▽	Petroleum ether	∅	Perchlorethylene	▽
Phenic acid	∅	Bromobenzene	∅	Ethyl ether	∅	Potassium permanganate 10%	•
Hydrofluoric acid	▽	Bromobenzol	▽	Ethylamine	∅		
Fluosilicic acid 30%	•	Potassium bromide	•	Ethyl bromide	▽	Potassium persulphate	•
Formic Acid 30%	∅	Butane	•	Ethylamine	∅	Petroleum	∅
Phosphoric acid	•	Butanol	•	Etilencloridrina	▽	Pyridine	∅
Glycolic acid	•	Butyl acetate	∅	Ethilenchloride	▽	Caustic potash 5%	∅
Lactic acid 5%	•	Butylstearate	∅	Ethilenglycol	•	Propane	•
Nitric acid 10%	∅	Potassium carbonate	•	Phenol	∅	Synthetic saliva	•
Oleic acid	•	Sodium carbonate	•	Dimethil Fluorinamide	∅	Calcium soap	•
Oxalic acid	•	Concrete	•	Ammonium fluoride	∅	Soda	•
Perchloric acid	∅	Potassium cyanide	∅	Formalin	•	Caustic soda 5%	∅
Perchloric acid 10%	•	Cyclohexane	∅	Chlorine gas	∅	Aluminium sulphate	•
Propionic acid	∅	Cyclohexaol	∅	Nitrous gases	▽	Ammonium sulphate	•
Hydrogen sulphide	•	Cyclohexanon	∅	Glycerine	∅	Iron sulphate	•
Sulphuric acid at 50 %	•	Cyclohexene	∅	Glycol	•	Magnesium sulphate	•
Sulphuric acid 70 %	∅	Xylene	∅	Butylenic glycol	•	Manganese sulphate	•
Sulphurous acid 10%	▽	Sodium chlorate	•	Ethylenic glycol	•	Nickel sulphate	•
Tartaric acid	•	Ethyl chloridrine	∅	Ammonium hydrate	∅	Potassium sulphate	•
Thricloroacetic acid	∅	Chlorobenzol	▽	Calcium hydrate	•	Coppers sulphate	•
Thrimetilic acid	∅	Chloroform	∅	Sodium hydrate 1%	•	Sodium sulphate	•
Water	•	Aluminium chloride	•	Sodium hydrate 10%	▽	Zinc sulphate	•
Ammonia water	∅	Ammonium chloride	•	Iodine	▽	Iron sulphate	•
Acrylonitrile	∅	Chloride of lime	•	Calcium hypo chloride	•	Potassium sulphocyanide	∅
Allylic alcohol	∅	Calcium chloride	•	Sodium hypo chloride	•	Ammonium sulphide	∅
Benzyl alcohol	∅	Ethylene chloride	∅	Kerosene	•	Carbon sulphide	∅
Butilic alcohol	•	Iron chloride	•	Lime wash	∅	Sodium sulphide	∅
Ethyl alcohol 96%	•	Phosphorus chloride	∅	Ligroin	•	Styrol	∅
Pheniletylic alcohol	∅	Magnesium chloride	•	Mercury	•	Synthetic sweat	•
Isoamyl alcohol	∅	Mercury chloride	•	Potassium metabisulphite 4%	•	Tetrachlorethane	∅
Isopropyl alcohol	∅	Methylene chloride	▽	Methyl metacrylate	∅	Carbon tetrachloride	∅
Methyl alcohol	∅	Potassium chloride	•	Methanol	▽	Tetrahydrofuran	▽
n-butyl alcohol	•	Copper chloride	•	Methylamine	▽	Tetralin	∅
Propargylic alcohol	•	Sodium chloride 10%	•	Methylketone	▽	Tiophen	∅
Propyl alcohol	•	Sulphoral chloride	▽	Methylisobutylketone	•	Toluol	∅
Benzoic aldehyde	▽	Zinc chloride	•	Potassium Rhodanate	•	Turpentine	•
		Coppery chloride	•			Naphtha	•

Trichlorethylamine	▽	Lanoline	•	Bovine tallow	•	Tiba	∅
Trichloro-ethylene	▽	Methanol 90%	∅	Mustard	•	Trisilin F	•
Trichlorethylphosphate	∅	Blood plasma	•	Lard	∅	WK 60	•
Ammonium trichloride	•	Periston	•	Vegetable juices	•	**OILS AND FATS**	
Phosphor trichloride	∅	Nailpolish solvent	▽	Orange juice	•	Aral BG	•
Tri cresyl phosphate	∅	Vaseline	•	Fruit juice	•	Baysolin	•
Triethanolamine	∅	Wick-Vaporuf	•	Apple juice	•	BP Energol	•
Urea	∅	**FOODS**		Grapefruit juice	•	Brunofix	•
Vinyl acetate	∅	Vinegar	•	Tobacco	•	Darina	•
Xylene	∅	Beet	•	Tea	•	Esso Estic	•
DISINFECTANT		Beer	•	Vanilla	•	Brake liquid	▽
Carboxylic Acid	▽	Butter	•	Wine	•	Mobil DTE	•
Hydrogen peroxide 10%	▽	Coffee	•	Vodka	•	Molikote	•
Baktol	▽	Cinnamon	•	Bovine tallow	•	Combustible oil	∅
Chloramine	•	Meat	•	**DETERGENTS**		Camphor oil	▽
DDT	▽	Cucumbers	•	Ajax	•	Machine oil	•
Delegol	•	Clove	▽	Calgonit	▽	Paraffin oil	•
Dimamin	∅	Chocolate	•	Bleach	•	Silicone oil	•
Lysoform 2%	•	Onions	•	Dor	•	Turpentine oil	∅
Maktol	•	Cognac	•	Fewa	•	Diesel oil	∅
Menfen	•	Gin	•	Horoliht M	•	Drill oil	▽
Oktozon 1%	•	Glucose	•	Impact	∅	Polyran	•
Perhydrol	•	Liquors	•	Into-Fensterklar	•	Rhenocalor N	•
Resorcina 1%	•	Maggi	•	Natril	•	Shell Spirax 90	•
Sagrotan 5%	∅	Margarine	•	Omo	∅	Shell Tellus 11-33	∅
Pure alcohol	•	Nutmeg	▽	P3 Asepto	▽	Skydrol	▽
Sublimate	•	Vegetable oils	•	Parifex 2%	•	Texano Regal	•
TB-Lysoform	▽	Liver oil	•	Persil	∅	Oily paint	∅
Tincture of iodine	∅	Linseed oil	•	Pril	•		
Trosilin G extra 1,5%	•	Olive oil	•	Rapdosept	∅		
Zephirol	∅	Castor oil	•	Rei	•		
FARMACEUTICALS		Fish	•	Riseptin	•		
Ambra solare	•	Pimento	▽	Laundry soap	•		
Conditioner	•	Tomato sauce	•	Sidolin	•		
Odol mouthwash	•	Rum	•	Somat	∅		
Hydroplex	•	Salt	•	Suwa	•		

•	Resistant
▽	Partially resistant
∅	NOT resistant

The compatibility tests are carried out by soaking a polycarbonate sample for 180 days in the substance to be tested at a constant temperature of 20°C. The esthetical aspect (dulling, fissures) is then evaluated and the mechanical characteristics are compared with the original values of the polycarbonate.
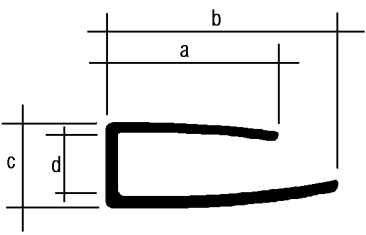
The above list cannot be considered exhaustive. In case of doubts, or for any unlisted substances, please contact our office.

> **IMPORTANT:** *As PVC-containing gaskets and acetic silicone are commonly used in the frame industry, we would like to stress that using them represents a danger for polycarbonate sheets.*

5 ACCESSORIES
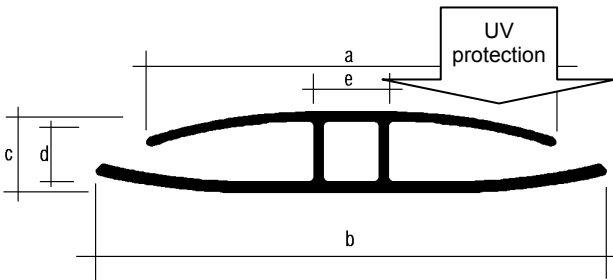
5.1 "U-shaped" polycarbonate closing profile

U-shaped profile are used to close the cut side of the MACROLUX® MULTIWALL polycarbonate sheets. They do not substitute the application of aluminium foil and they don't have the UV protection, but they protect the foil from water leaching.

"U-shaped" polycarbonate closing profile :					
Thickness:		6 mm	8-10 mm	16 mm	20 mm
	Cod.	*M633*	*M634*	*M635*	*M640*
	a)	19 mm	24 mm	30 mm	30 mm
	b)	25 mm	29 mm	34 mm	35 mm
	c)	8,5 mm	12,5 mm	18,5 mm	22,5 mm
	d)	6,5 mm	10,5 mm	16,5 mm	20,5 mm
Weight:		55 g/m	70 g/m	90 g/m	120 g/m
Standard packing nr°:		100	50	50	50
Length:		2.100 mm	2.100 mm	2.100 mm	2.100 mm

5.2 "H-shaped" polycarbonate join profile

H-shaped polycarbonate profiles have an UV protection on the external side and are used to join two MACROLUX® MULTIWALL sheets having the thickness detailed for each profile. They should not, however, be used as a weight-supporting structure, they are not guaranteed as watertight in a covering and they must be considered solely as a means for joining sheets.

"H-shaped" polycarbonate join profile :				
Thickness:		6 mm	8-10 mm	16 mm
	Cod.	*M430*	*M431*	*M432*
	a)	58 mm	62 mm	72 mm
	b)	72 mm	75,6 mm	84 mm
	c)	9,5 mm	13,5 mm	20 mm
	d)	7 mm	10,5 mm	17 mm
	e)	12 mm	11,5 mm	15,5 mm
Weight:		190 g/m	250 g/m	300 g/m
Standard packing nr.:		20	20	10
Length:		6.000 mm	6.000 mm	6.000 mm

5.3 "SNAP" union polycarbonate profile

The polycarbonate snap profile (which has an UV-protection on the external side) presents the advantage of facilitating the joining of MACROLUX® MULTIWALL sheets, which is carried out by simply applying pressure. The polycarbonate profile does not have any structural function and it is not guaranteed as watertight.

"SNAP" union polycarbonate profile :				
		Thickness:		10 mm
		Cod.		*M439*
	a)	a')	58 mm	57 mm
	b)	b')	18,5mm	17 mm
	c)	c')	21 mm	23 mm
	d)	d')	3,5 mm	2.5 mm
		Weight:		250 g/m
		Standard packing nr.:		10+10
		Length:		6.000 mm

5.4 Ridge polycarbonate profiles

The polycarbonate ridge profile have an UV protection on the external side and they are used to join two MACROLUX® MULTIWALL sheets at a ridge. The sheets must have the thickness detailed for each profile. However, they should not be used as weight-supporting structures and they must be considered solely for sheet joining. The special shape of the profiles permits the formation of 90° corners.

Ridge polycarbonate profile :			
	Thickness:	6 mm	10 mm
	Cod.	*M448*	*M449*
	a)	146 mm	148 mm
	b)	6 mm	10 mm
	Weight:	300 g/m	320 g/m
	Standard packing nr.:	10	10
	Lenght:	6.000 mm	6.000 mm

5.5 Aluminium profiles

5.5.1 Joining aluminium profile (cod.M9S7 + cod.M9S8 + cod.M9T1)

The profile is used to join two MACROLUX® MULTIWALL sheets on their lateral sides.

In case the profile is curved for use, the paired aluminium profiles need to be bent into arches. The kit is completed by gaskets and screws.
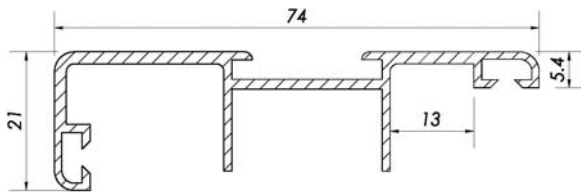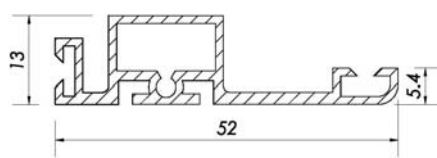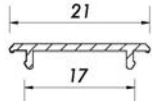
Aluminium joining profile			
Aluminium alloy: 6060 (UNI EN 573-3)		**Tolerances:** UNI 3879	
Anodizing: 15 µ			
Description	**Area**	**Weight**	**Length**
	Upper joining profile (*cod.M9S7*)		
	180 mm^2	0,486 kg/m	6.000 mm
	Lower joining profile (*cod.M9S8*)		
	199 mm^2	0,536 kg/m	6.000 mm
	Top profile (*cod.M9T1*)		
	27 mm^2	0,072 kg/m	6.000 mm

Gasket and accessories		
Tolerances: ISO 3302 CL E2	**Material:** Gomma EPDM	
Description	**Area**	**Weight**
Gasket thick. 1 mm (*cod.M9S3*)	15 mm^2	12 g/m
Gasket thick. 3 mm (*cod.M9S5*)	30 mm^2	37 g/m
Thermal cut (*cod.M9T5*)	73 mm^2	88 g/m
Screw 4,2 x 13 mm (*cod.M9T3*) Screw 4,2 x 19 mm (*cod.M9T4*)	---	---
Gasket for screws (cod.*M9Z9*)	---	0,9 g/cad

5.5.2 Side closing aluminium profile (cod.M9S9 + cod.M9T0 + cod.M9T1)
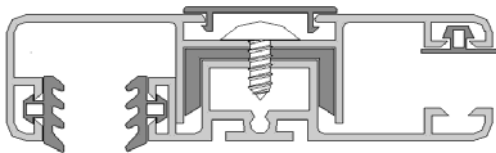
This profile is used to create the tympanum of a head or to connect the first MACROLUX® sheet (and the last) laterally. In case the profile is curved for use, the paired aluminium profiles need to be bent into arches. The kit is completed by gaskets and screws.

Side closing aluminium profile			
Aluminium alloy: 6060 (UNI EN 573-3)		**Tollerances:** UNI 3879	
Anodization: 15 μ		-	
Description	**Area**	**Weight**	**Length**
	Upper side profile (cod.M9S9)		
	217 mm^2	0,585 kg/m	6.000 mm
	Lower side profile (cod.M9T0)		
	176 mm^2	0,475 kg/m	6.000 mm
	Top profile (cod.M9T1)		
	27 mm^2	0,072 kg/m	6.000 mm

Gasket and accessories		
Tolerances: ISO 3302 CL E2	**Material:** EPDM rubber	
Description	**Area**	**Weight**
Gasket thick. 1 mm (cod.M9S3)	15 mm^2	12 g/m
Gasket thick. 3 mm (cod.M9S5)	30 mm^2	37 g/m
Thermal cut (cod.M9T5)	73 mm^2	88 g/m
Screw 4,2 x 13 mm (cod.M9T3) Screw 4,2 x 19 mm (cod.M9T4)	---	---
Gasket for screws (cod.M9Z9)	---	0,9 g/cad

5.5.3 Standard kit composition

The aluminium profiles can be used for MACROLUX® MULTIWALL sheets which range from 6 mm to 16 mm thickness, by applying different gasket combinations:

<table>
<tr><th colspan="4">Standard Kit (joining aluminium profile)</th></tr>
<tr><td rowspan="12">Composition :</td><td>Description</td><td>Cod.</td><td>Quantity</td></tr>
<tr><td>Upper joining profile</td><td>M9S7</td><td>n° 1 barra da 6 m</td></tr>
<tr><td>Lower joining profile</td><td>M9S8</td><td>n° 1 barra da 6 m</td></tr>
<tr><td>Top profile</td><td>M9T1</td><td>n° 1 barra da 6 m</td></tr>
<tr><td>Gasket thick. 1 mm</td><td>M9S3</td><td>24 m</td></tr>
<tr><td>Gasket thick. 3 mm</td><td>M9S5</td><td>24 m</td></tr>
<tr><td>Thermal cut</td><td>M9T5</td><td>6 m</td></tr>
<tr><td>Screw 4,2 x 13 mm</td><td>M9T3</td><td>n° 10</td></tr>
<tr><td>Screw 4,2 x 19 mm</td><td>M9T4</td><td>n° 10</td></tr>
<tr><td>Screw gasket</td><td>M9Z9</td><td>n° 10</td></tr>
<tr><td colspan="3">The aluminium profiles (upper, lower and top) and the thermal cut are used for sheets having a thickness of 6 mm, 10 mm, 16 mm</td></tr>
<tr><td rowspan="4">Accessories :</td><td>Description</td><td>6 mm</td><td>10 mm</td><td>16 mm</td></tr>
</table>

<table>
<tr><th colspan="5">Standard Kit (joining aluminium profile)</th></tr>
<tr><td rowspan="10">Composition :</td><td colspan="2">Description</td><td colspan="2">Cod.</td><td>Quantity</td></tr>
</table>

Standard Kit (joining aluminium profile)

Composition :	Description	Cod.	Quantity
	Upper joining profile	*M9S7*	n° 1 barra da 6 m
	Lower joining profile	*M9S8*	n° 1 barra da 6 m
	Top profile	*M9T1*	n° 1 barra da 6 m
	Gasket thick. 1 mm	*M9S3*	24 m
	Gasket thick. 3 mm	*M9S5*	24 m
	Thermal cut	*M9T5*	6 m
	Screw 4,2 x 13 mm	*M9T3*	n° 10
	Screw 4,2 x 19 mm	*M9T4*	n° 10
	Screw gasket	*M9Z9*	n° 10
	The aluminium profiles (upper, lower and top) and the thermal cut are used for sheets having a thickness of 6 mm, 10 mm, 16 mm		

Accessories :	Description	6 mm	10 mm	16 mm
	Upper slot	Gasket 3 mm	Gasket 1 mm	Gasket 1 mm
	Lower slot	Gasket 3 mm	Gasket 1* mm	Gasket 1* mm
	Screws	4,2 x 13 mm	4,2 x 13 mm	4,2 x 19 mm
	(if desired)*			

Standard Kit (side closing aluminium profile)

Composition :	Description	Cod.	Quantity
	Upper side profile	*M9S9*	n° 1 barra da 6 m
	Lower side profile	*M9T0*	n° 1 barra da 6 m
	Top profile	*M9T1*	n° 1 barra da 6 m
	Gasket thick. 1 mm	*M9S3*	12 m
	Gasket thick. 3 mm	*M9S5*	24 m
	Thermal cut	*M9T5*	6 m
	Screw 4,2 x 13 mm	*M9T3*	n° 10
	Screw 4,2 x 19 mm	*M9T4*	n° 10
	Screw gasket	*M9Z9*	n° 10
	The aluminium profiles (upper, lower and top) and the thermal cut are used for sheets having a thickness of 6 mm, 10 mm, 16 mm		
	If there is a perpendicular lateral sheet it must be planned for as a 10 mm thickness and it must be held by two 3 mm thick gaskets		

Accessories :	Description	6 mm	10 mm	16 mm
	Upper slot	Gasket 3 mm	Gasket 1 mm	Gasket 1 mm
	Lower slot	Gasket 3 mm	Gasket 1* mm	Gasket 1* mm
	Viti	4,2 x 13 mm	4,2 x 13 mm	Vite 4,2 x 19 mm
	(if desired)*			

5.5.4 Fixed aluminium sill profile (cod. M9R6)
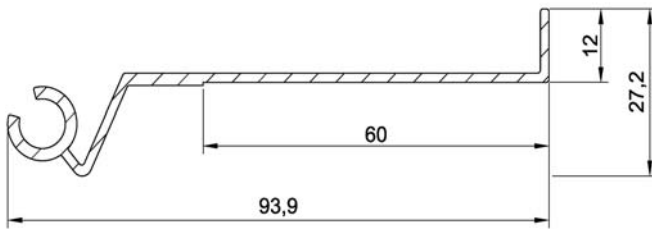
Length:	6500 mm
Aluminium alloy:	6060 (UNI EN 573-3)
Surface:	217 mm^2
Weight:	0,586 kg/m
Anodization:	15 µ
Tolerances:	UNI 3879

The fixed sill profile is used to connect the MACROLUX® MULTIWALL sheets to the existing structure (reinforced concrete edge beam or metal base). The sill has a round catch where the revolving sill *(M9R7)* is connected.
The position of the catch below the support line, together with the small vertical flap, prevents any water from flowing back, making the seal safe.

5.5.5 Revolving aluminium sill profile (thick. 10 mm and 16 mm sheet applications only) (cod. M9R7)
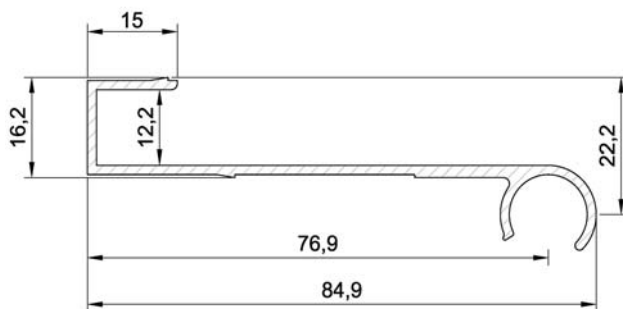
Length:	6500 mm
Aluminium alloy:	6060 (UNI EN 573-3)
Surface:	267 mm^2
Weight:	0,563 kg/m
Anodization:	15 µ
Tolerances:	UNI 3879

The revolving sill profile is used coupled with the fixed sill profile (*M9R6*) to achieve any angle sets. The rounded pawl allows to orientate into angles between 5° and 90°; if used in 90° position, it can be used to create the the base of the gable.

5.5.6 Aluminium panel-stop profile (thick. 10 mm sheet only) (cod. M9R4)
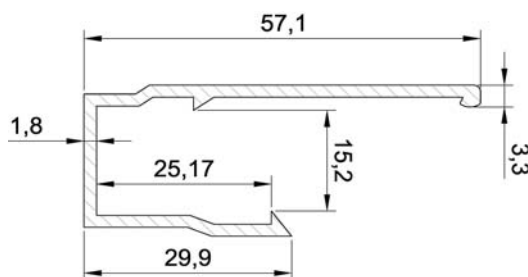
Length:	5700 mm
Aluminium alloy:	6060 (UNI EN 573-3)
Surface:	194 mm^2
Weight:	0,524 kg/m
Anodization:	15 µ
Tolerances:	UNI 3879

The panel-stop profile contains the sheet along the sill; the snap-on teeth allows an easy coupling with the revolving anodized aluminium sill (*M9R7*).

5.5.7 Aluminium panel-stop profile (thick. 16 mm sheet only) (cod. M9R5)
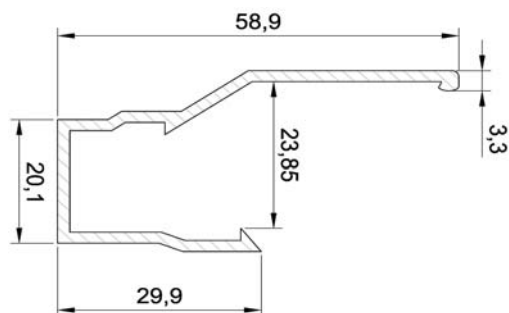
Length:	5700 mm
Aluminium alloy:	6060 (UNI EN 573-3)
Surface:	198 mm^2
Weight:	0,534 kg/m
Anodization:	15 µ
Tolerances:	UNI 3879

The panel-stop profile contains the sheet along the sill; the snap-on teeth allows an easy coupling with the revolving anodized aluminium sill (*M9R7*).

5.5.8 Reinfoircement aluminium profile (M9T2)
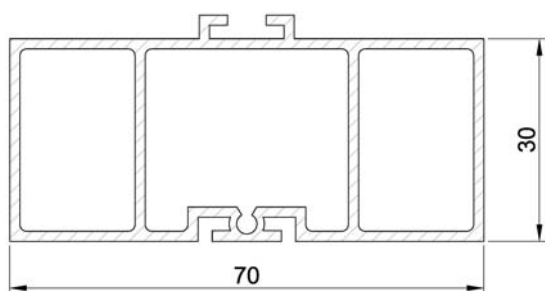
Length:	6000
Aluminium alloy:	6060 (UNI EN 573-3)
Surface:	421 mm^2
Weight:	1,137 kg/m
Anodization:	15 µ
Tolerances:	UNI EN 755-9

The reinforcement profile is used coupled with joining profile/side closing profile to increase the loads resistance.
The upper rails allows the scrolling along the cavities in the lower profile of joining/side aluminium profiles (*M9S8* and *M9T0).*

5.6 Aluminium foil adhesive tapes
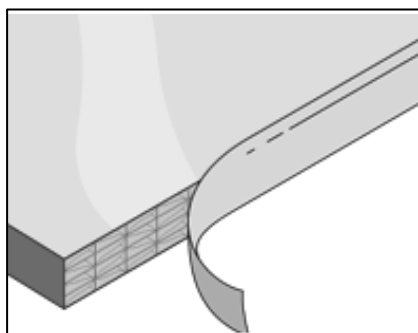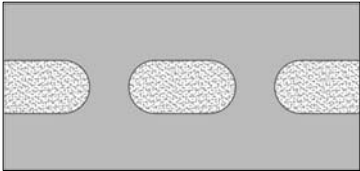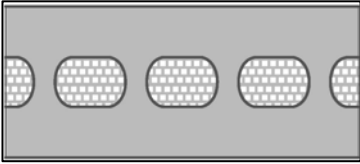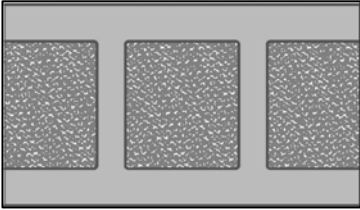
Aluminium foil adhesive tapes are used in order to seal the heads of MACROLUX® MULTIWALL sheets, so that dust will not get within the chambers. However, they should contribute to ventilation within the chambers, so that the water transmigrating due to hygroscopicity can evaporate easily.
To this purpose, we offer transpiring aluminium foil adhesive tapes that, thanks to a non-woven material filter, do not keep dust inside and permit light ventilation. The aluminium foil adhesive tape is rotproof, but it must be protected from leacking by means of a finishing coating (polycarbonate, aluminium, etc.).

Koscon Industrial S.A. offers both a tape applying service and standard aluminium rolls.

Following are the most used tapes:

Description	*Cod.*	*Available dimensions*
Red tape:	MX46	50 mm x 150 m
	M947	75 mm x 150 m
	M949	90 mm x 150 m
Transparent tape:	M9Q3	50 mm x 100 m
	M9Q4	50 mm x 132 m
	M9L3	75 mm x 100 m
Stokvis PP coated aluminium tape:	M967	25 mm x 50 m
	M964	30 mm x 50 m
	M965	38 mm x 50 m
	M957	50 mm x 50 m
	M966	70 mm x 50 m
Sellotape aluminium breather tape:	M968	38 mm x 50 m
	M969	50 mm x 50 m
	M970	70 mm x 50 m
Sellotape PE coated aluminium breather tape:	M9Q9	43 mm x 33 m
ALU PET aluminium breather tape (only 10X):	MXA7	60 mm x 50 m

6 PRIOR TO SETTING UP

6.1 Packing and shipping

MACROLUX® MULTIWALL sheets are by our standards packed on wooden pallets and protected by a heavy polyethylene film, which is welded thermally and appropriately sealed with strips. The sheets number ranges so to weight from 1000 to 1200 kg.

Custom-made sheets shall be packed at Koscon Industrial S.A.'s discretion. Should you have special requests (moving the sheets at a construction site, problems concerning unloading, etc.) please make any agreement you may need with our commercial offices when you place your order. Our staff will be happy to help you solve any problem.

6.2 Transport

MACROLUX® MULTIWALL sheets should be transported by appropriate means, so that both sheets and pallets lie flat on the platform. Any belts or blocks which may be needed to secure the pallets during the transport should be positioned as not to damage the sheets. Any damage due to transport have to be communicated within eight days from the moment the goods are received. In order to analyse the problem correctly, the limitation should be noted on the transportation document - CMR.

6.3 Handling and storage

The handling and storage phases represent delicate situations for MACROLUX® MULTIWALL sheets, as they may be damaged. The following instructions should be applied in each detail.

- When a forklift is used, the outmost attention should be paid. In no instance should the forks touch the sheets directly.
- If belts or equalizers are used for lifting, the minimum width of the belts shall be of at least 200 mm, to distribute the applied force correctly, wooden planks with a length greater than that of the sheet width need to be interposed between the package or the pallet and the belt itself.
- The width of the forks should be such as to avoid that the pallet should flex, and the length shall be adequate, at least 2,1 linear meters.
- If more pallets are stored, no more than three pallets must be piled on each other. (Do not pile pallets directly on each other, supports that protect the surfaces from direct contact should be used (Styrofoam, insulating materials).
- If a pallet which was previously lying on the ground is piled on top of another, verify that there is nothing on the lower surface which could ruin the surfaces which they shall lie upon.
- Store the pallets with their unopened packaging, with a slight slant, so that any possible condensate and water stagnation can flow away.
- Deposit unopened packaged goods indoors, or, should this be impossible, cover them with material which can repair them from bad weather and which ensures a correct air circulation.
- If a packaging has been opened, sheets must be stored inside, safe from heat sources and direct sun light. They must be stocked on plane surfaces, in a horizontal position in order to avoid any bending or curving of the surfaces.
- Once a packaging has been opened, its packages must necessarily be stored indoors.
- At construction sites sheets need to be used immediately after opening the packing.
- If a single sheet is transported by hand, the sheet should be moved holding it on its side.

IMPORTANT: The protective film which is present on both sides of the sheets tends to stick to the sheet itself if it is exposed to high temperatures (PALLETS LYING UNDER THE HOT SUN) and make the subsequent removal difficult. The client is responsible for the unloading of the material. The goods are usually consigned at the warehouse or at the construction site of the client, on a motor vehicle.
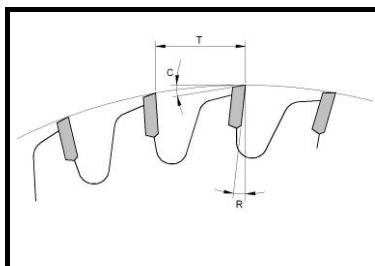
6.4 Tooling

Multiwall MACROLUX® MULTIWALL sheets can be easily processed using standard tools workshop everyday ; however a few simple precautions should be observed:

- ✓ The tools used must be suitable for polycarbonate;
- ✓ The tools must be well sharpened.
- ✓ In case it is needed to cool the tool during the process is necessary to use air or water that doesn't contains any oil emulsion which could attack the polycarbonate.
- ✓ The PE protective film should be left of the sheet until the installation to avoid error on the identification of the UV protected side and to prevent scratches from handling.
- ✓ It's possible for the tools to reach high temperature making difficult the removal of the protective film.
- ✓ The sheet must be stuck to avoid vibrations.
- ✓ Finish off the borders if necessary
- ✓ Remove any processing waste with compressed air.

6.4.1 Cutting

Multiwall polycarbonate MACROLUX® sheets can be cut by means of commonly used cutting instruments, such as vertical, horizontal or circular cutters, as well as hack sawing machines.
Just a few simple precautions are necessary, such as the fact that the sheet must be held down in such a way that vibrations will not compromise the exact cutting operation. In case no specific blades for plastic materials are available, blades for iron or blades with small teeth can be used.
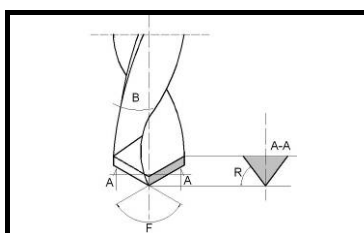
	Cutting angle:	C	20° - 30°
	Rake angle:	R	5° - 15°
	Teeth pitch:	T	9 -15 mm
	Blade speed:	-	1.800-2.400 m/min
	Cutting speed:	-	max 22 m/min(*)
	(*) depends in base of thickness		

The transparent tape which is present on standard sheets stocked in our warehouse has the sole purpose of keeping the chambers clean from the dust which is usually present in warehouses and workshops. It should be removed when the sheet is being cut and substituted adequately for the material which is going to be re-stocked.

IMPORTANT: *During the cutting use all the necessary tools to protect the safety of personnel working (googles, shields, safety devices ecc..)*

6.4.2 Drilling

Any hole on MACROLUX® sheets must be drilled with adequate drill bits:

	Rake angle:	R	0° - 15°
	Sharp angle:	F	120° - 160°
	Sharp angle:	B	20°- 40°
	Progress:	-	0.1 - 0.3 mm/rev

Due to thermal expansion, penetrating fastenings are advised against unless they are adequately reinforced.
Check with special care that chips deriving from drilling are removed from the chambers.

6.4.3 Applying the adhesive tape
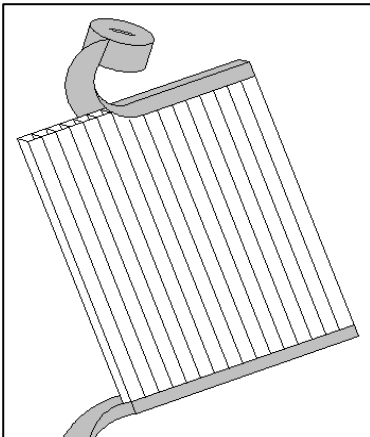
Prior to setting up, the heads of MACROLUX® MULTIWALL sheets should be closed with adhesive aluminium tape in order to preserve the cleanliness of chambers over time.
The suggested kind of tape is a solid aluminium tape for the lower edge of the sheet and an aluminium tape with micro holes for the upper edge, in order to boost ventilation and to avoid condensate stagnating.
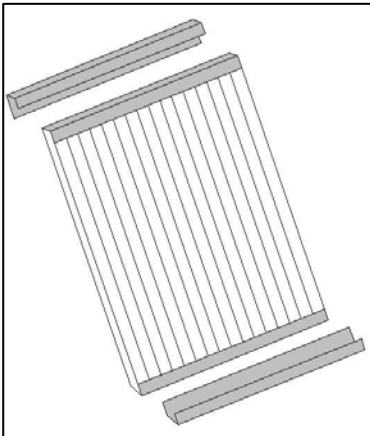
Subsequently, the tape should be protected by direct weather contact, in order to prevent leaching.
Inserting the taped edge in polycarbonate or aluminium profile can do this. These profiles should have holes to allow water to flow out.
The transparent tape which is usually present on standard sheets does not protect the sheet over time, but only during the lapse of time during which the sheet is stocked in a warehouse.

IMPORTANT: *Applying the tape is an indispensable step for a correct setting up, regardless of which solution is being implemented*

6.4.4 Thermowelding
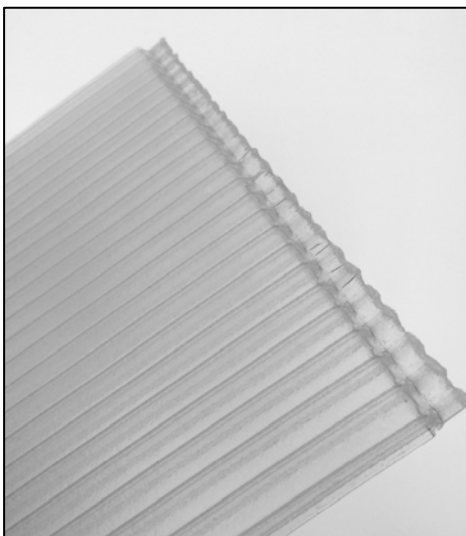
The MACROLUX® MULTIWALL sheets can be supplied welded at the ends.
The termowelded of the heads reduce the infiltration of dust anddirty into the chambers. This finishing doesn't guarantee the perfect water tightness and doesn't prevent the formation of condensation into the chambers. The presence of small holes on the edge can't be considered a defect that can be closed with a thin layer of silicone compatible with the polycarbonate. The possible formation of condensation spots inside the cells is a phenomenon linked to the hygroscopic properties of the material and the specific climatic conditions (inside temperature, outdoor temperature, relative humidity) that can't be avoided in advance. The possible formation of condensation is a phenomenon that will disappear with the establishment of conditions and doesn't affect the chemical, physical and mechanical properties of sheets.

7 ASSEMBLING INSTRUCTIONS

7.1 Preliminary checks

- Check that storing was carried out according to the indications given.
- Check that the tolerances values of the sheets and of any accessories are in keeping with those detailed.
- Check and verify that the product is free from evident defects, by informing Koscon Industrial S.A. before the assembling is begun.
- Prepare all the necessary devices regarding safety on the workplace and respect the regulations in force.
- To achieve a correct set-up, the planes of the bases and of the girder on which the sheets and the profiles shall be set up. Their surface and the relevant distances should be checked and levels and surfaces will have to be reconstructed as needed.
- Avoid moving the sheets by sliding them on a surface, especially if the protection film has been removed.

IMPORTANT: MACROLUX® MULTIWALL sheets should be set up so that the chambers' walls are vertical or lying in the same direction as the slope. A setting up with the chambers' wall in a horizontal direction is not allowed, since this would favour the stagnating of the condensation within the chambers.

IMPORTANT: While positioning MACROLUX® MULTIWALL sheets MAKE SURE THAT THE UV-PROTECTED SIDE (recognizable thank to the coloured film and to the branding made with a hot instrument) IS ON THE OUTSIDE.

IMPORTANT: Sheets with an asymmetric structure could have a different optical aspect. According to face orientation there could be a different light refraction. In case of a double side protected sheets always verify before installation.

7.2 Assembling

MACROLUX® MULTIWALL sheets should be assembled with adequate supports which satisfy the prerequisites detailed in the previous point. In particular, they should:

- Provide an adequate holding.
- Have a sufficient expansion space.
- The mechanical resistance of the profile should be higher than or equal to the load transmitted by the sheet.

7.2.1 Minimum slope

5%
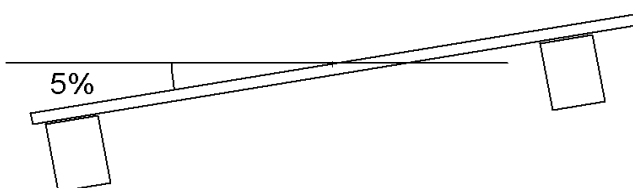
If a covering is being made, the minimum slope indication of 5% should be respected so that rain can flow away.

7.2.2 Mechanical resistance of the aluminium profiles

The standard aluminium profile need to be supported, in turn, and held by the underlying load-bearing structure. The yield point load of the aluminium profile is related to the load transmitted by the MACROLUX® MULTIWALL sheet, which, in turn, shall be related to the centre of the profile and to the distance of the bearings of the profiles.

Load N/m^2	Distance between aluminium profiles (mm)		
	700 mm	1.050 mm	1.200 mm
600	2.300 mm	1.900 mm	1.800 mm
900	1.900 mm	1.550 mm	1.450 mm
1.200	1.650 mm	1.350 mm	1.250 mm
1.500	1.500 mm	1.200 mm	1.100 mm
2.000	1.300 mm	1.050 mm	950 mm

IMPORTANT: *The figures mentioned in this paragraph are not to be used to calculate the sheet's dimension, but solely for calculating the dimensions of the aluminium profiles' supports.*

7.3 Assembling the sheets with profiles

The positioning centre to centre of the aluminium profile is related to the width of the MACROLUX® MULTIWALL sheet, the expansion space and the space occupied by the profile's inner part.
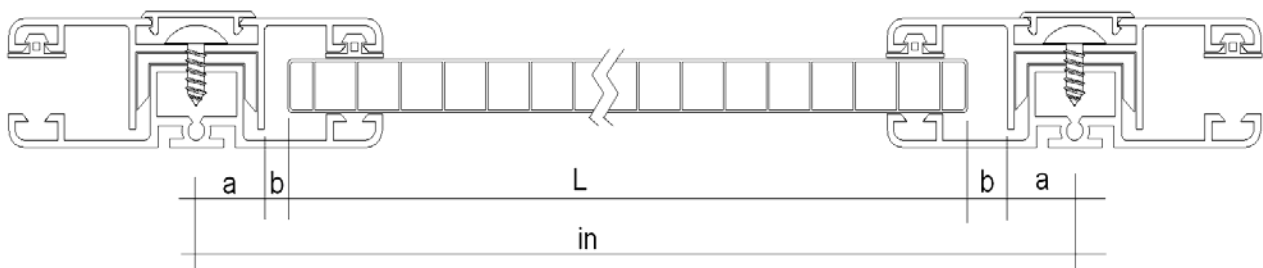
$$in = L + 2 \times (a + b)$$

Dove:

in   = *distance between aluminium profiles*
a   = *space occupied by the aluminium profile*
b   = *dilatation space*
L   = *Macrolux® Multiwall sheet width*

A first-approximation figure, which needs to be verified (minimum beating depth, thermal expansion, etc.), can be assumed to be of 30 mm.

7.3.1 Flat solution installation
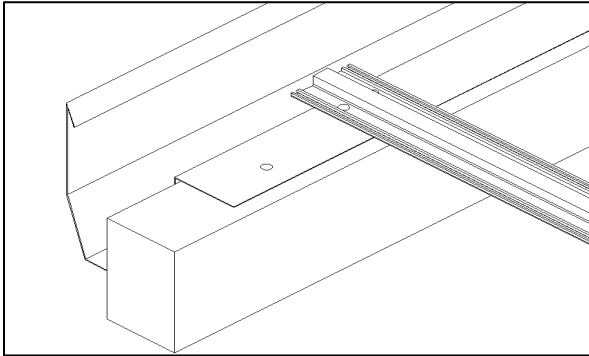
A. Insert the adequate gaskets for the thickness which is being used in the grooves of the upper and lower profiles.

B. Position the lower profile at the desired centre to centre and fix it on the lower side at the existing supports.

C. Insert the thermal cut in its seat.
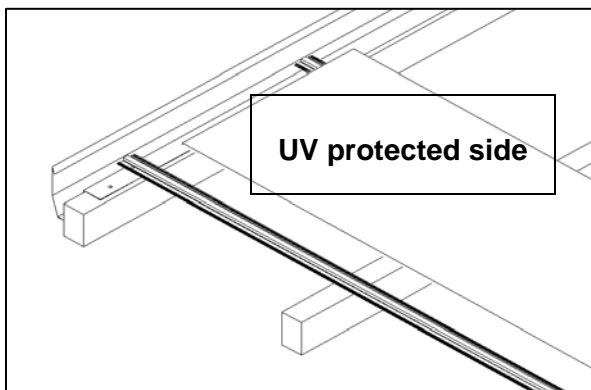
UV protected side

D. Position the sheets, to which the aluminium tape has been applied, MAKING SURE THAT THE UV-PROTECTED SIDE (recognizable through the coloured film and the branding made with a hot instrument) IS FACING OUTSIDE.
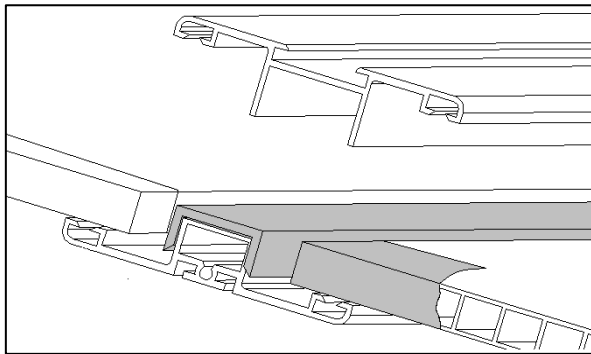
E. Fix the sheet with the upper profile, taking care to check that the gaskets are pressed correctly.   The joining screw between the lower and the upper profile should be positioned at a distance not exceeding 500 mm..
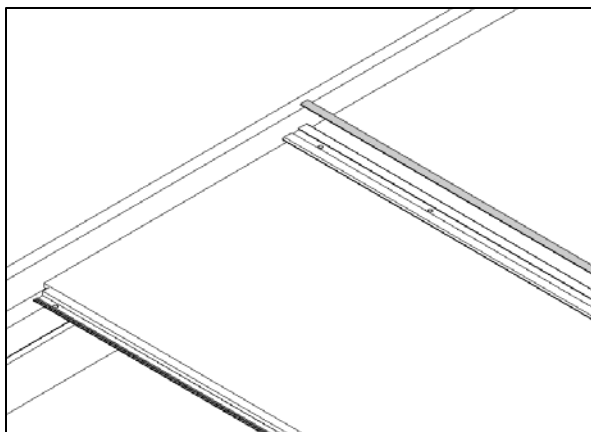
F. Insert the snap top in the upper part of the profile.

G. Protect the sides of the sheet which are closed with aluminium tape by means of an adequate protection (U-shaped aluminium or polycarbonate profiles), these profiles must favour the flowing out of any condensate water.

H. Carry on until the covering is completed.

7.3.2 Curved solution installation (closing gable)

In all set-ups (with polycarbonate snap-on outside or steel/aluminium snap-on inside) for a dome, with the external width of the edge beam equal to L, the end gable can be created as follows:
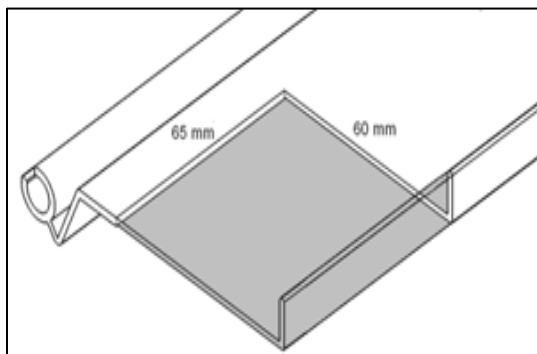

A. On the gable side, the sides of fixed sill (cod. M9R6), whose length is equal to the external measurement of the edge beam (L), must be trimmed, cutting away a 65x60 mm section.
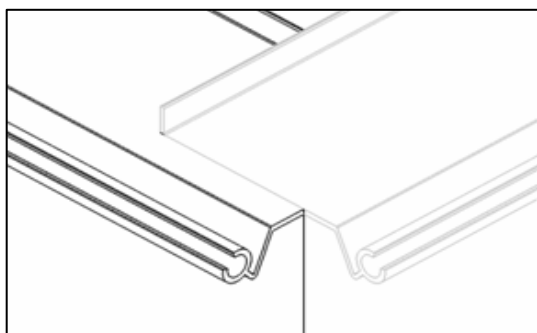

B. Seal the two sills with silicone.
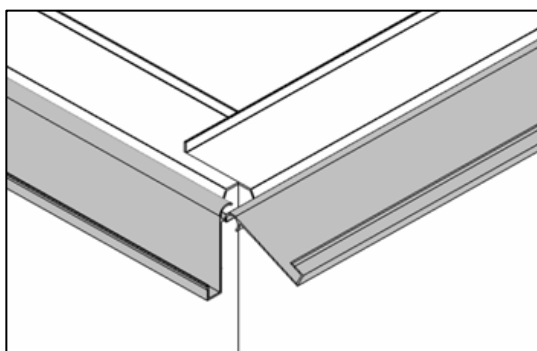
C. Cut the revolving sill (cod. M9R7) required for the gable, 30 mm longer than the external width of the edge beam. Insert the revolving sill (cod. M9R7) both into the gable and laterally, making sure that the latter protrudes by 35 mm in relation to the edge of the fixed sill.
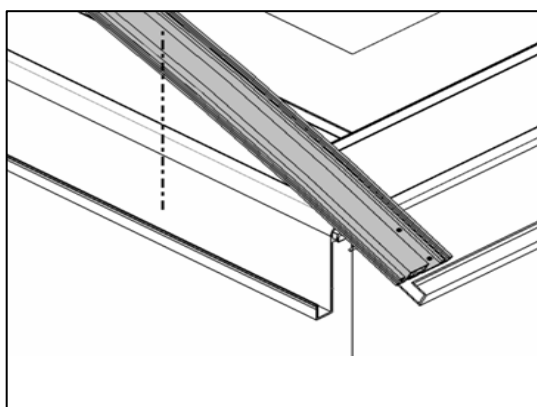
D. Fasten the lower profile of the gable (cod. M9T0) onto the side revolving sill so that the edge of the profile itself is aligned with the gable's vertical sill (cod. M9R7).
The profile must be provided with a gasket (cod. M9S3 or M9S5). The lower profile must be calendered to the radius planned in the design. The extension of the profile must be 30 mm less than the extension of the polycarbonate panel.
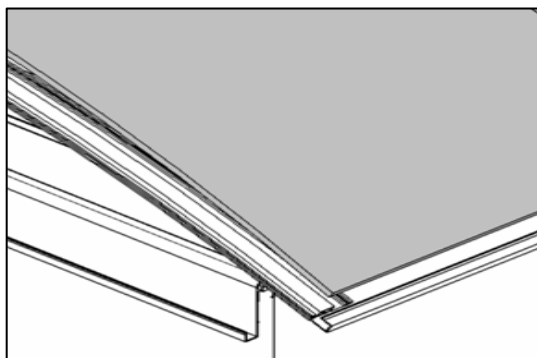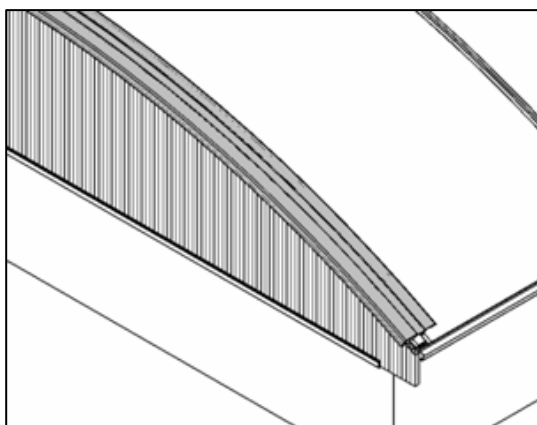
**E.** Insert the Macrolux ® Multiwall sheet .
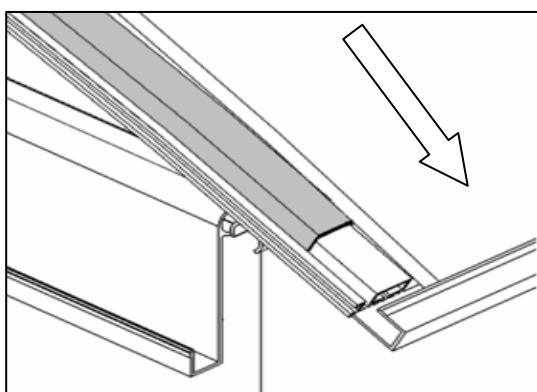
**F.** Insert the thermal cut (*cod. M9T5*) into the lower profile slot.
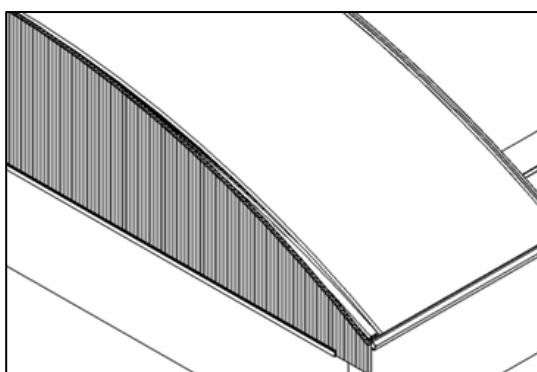
G. Cut a 10 mm-thick Multiwall sheet to fill the gable, following the shape given by the upper edge of the gable profile (the ends of the gable sheet must also be closed with the aluminium tape).

H. Position the upper profile for the gable (cod. M9S9), with the sealing joints in contact with the MACROLUX® MULTIWALL sheet.
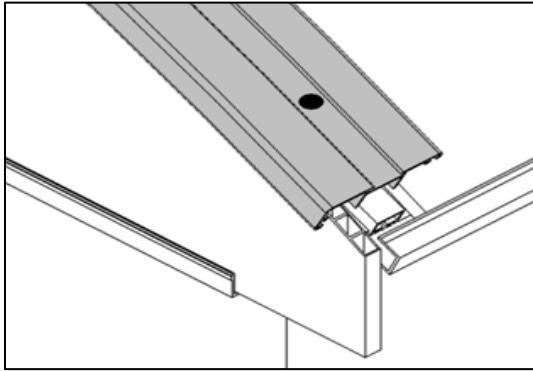
I. Fasten the two profiles, making sure you start near one edge and proceed at regular intervals to the opposite side.
The length of the profile will be equal to the length of the lower profile .
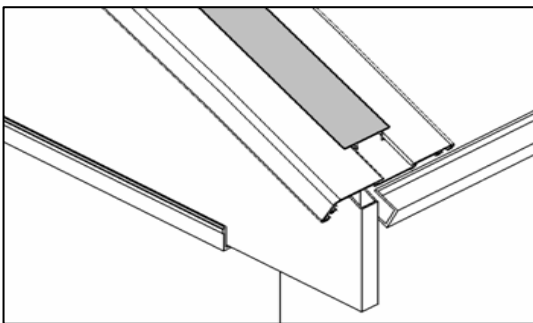
J. Insert the cap (cod. M9T1) required for correct finishing and to hide the fastening screws.
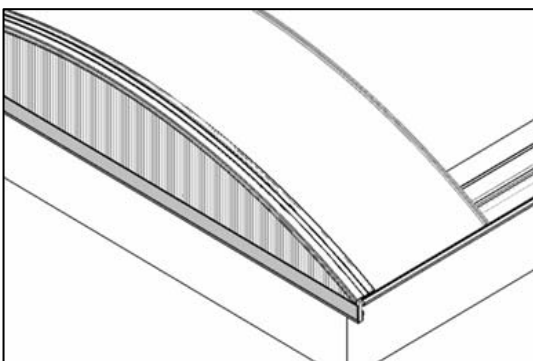

K. Insert the clip for 10mm thickness (cod. M9R4), cut to a length equal to the external width of the edge beams (L) + 200 mm.

7.4 Fixing buttons

In order to fix MACROLUX® MULTIWALL sheets in place and in order to guarantee a minimal expansion, plastic buttons are available, as well as their gaskets:

		Thickness:	6 mm	10 mm	16 mm
		Cod:	*M960*	*M961*	*M962*
	Button's external diameter:		49 mm	49 mm	49 mm
	Screw hole:		Φ 6 mm	Φ 6 mm	Φ 6 mm
	Steam height:		6 mm	10 mm	16 mm
	Steam external diameter:		14 mm	14 mm	14 mm
	Gasket external diameter:		45 mm	45 mm	45 mm
	Gasket external diameter:		30 mm	30 mm	30 mm
	Material:		PMMA		
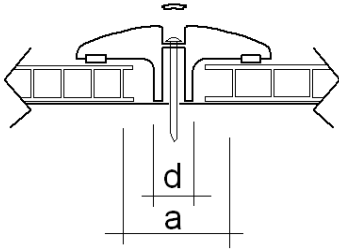
In order to fix MACROLUX® MULTIWALL sheets with passing screw, buttons which allow the user to achieve the necessary mechanical reinforcing
Use the specific button for each thickness, this will also ensure that the sheet will not be crushed even if the screw is excessively tightened Drill the hole on the sheet allowing for the established thermal expansion figure:

$$a = d + \lambda$$

Dove:

d   = *space occupied by the fixing button*

λ = *expansion space*

a   = *hole space*

Clean the sheet thoroughly from any tooling residue. Verify that the hole is contained within the holding gasket, if it is not the case the button cannot be used. The buttons should be positioned corresponding to the structures, at a distance not exceeding 500 mm.

7.5 Complements

On the basis of each specific situation, adequate finishing metal pieces (ridge, eave, wall connection, etc.) need to be provided. Each additional sealing, if one is required, should be carried out with neutral, non-acetic silicone, which has been explicitly indicated and which is compatible with polycarbonate.

8   MANUTENTION

8.1 Cleaning

During the set-up phase, MACROLUX® MULTIWALL sheets can get dirty. To clean them, use solely products which are certified for cleaning polycarbonate (check the specific manufacturing data).Koscon Industrial S.A. can supply a detergent for cleaning the sheet, upon request.The sheets need to be cleaned regularly with water and non-alkaline soap or with adequate detergents, and then they need to be rinsed with much water. This shall keep the light-transmission intact.
Dirt must be removed with the outmost care, using soft pads which do not scrape off the protection layer.

8.2 Access to the roofing

Both in the set-up phase and during maintenance, do not walk directly on the polycarbonate MACROLUX® sheets.
The sheets CANNOT be walked upon directly and could be crushed.
If access to the roofing is needed, position planks which need to rest on several supports, so that the weight is correctly distributed.

IMPORTANT: *In case access to the covering is required, use every necessary device to ensure safety on the workplace and respect the regulations in force in each country, so as to prevent falling and crushing.*