

TECHNICAL MANUAL



Macrolux[®]
Rooflite[®]

POLYCARBONATE SHEETS

IMPORTED INTO SOUTH AFRICA

SOLD AS **natralite[®]**

Head Office - Cape Town

Libra Close , Brackenfell
Tel 021 981 1440
Fax 021 981 1541

Gauteng

Cnr Northway Marlboro Drive
Kelvin , Sandton
Tel 011 804 2804
Fax 011 804 2808

George

Cnr Fabriek / Albert Rd
George Industria
Tel 044 873 0508/3
Fax 044 873 0503

Durban

22 Trotter Rd, Pinetown
Tel 031 701 9921
Fax 031 701 6807

www.duro.co.za • sales@duroc.co.za



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natrolite®

Description

MACROLUX® ROOFLITE® is a type of extruded sheets made of compact fretted or corrugated polycarbonate. The shape of the templates allows coupling with metal sections. MACROLUX® ROOFLITE® sheets guarantee high resistance against impact, they are extremely light and they have an ideal light transmission. MACROLUX® ROOFLITE® sheets are the ideal products for manufacturing industrial roofings, greenhouses, canopies, etc.

This manual outlines the main features and instructions for mounting MACROLUX® ROOFLITE® polycarbonate sheets.

For further information or comments please write to:

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WARNING: All other company or product names, herein mentioned are registered trademarks belonging to the owners in question.

WARNING: All information provided for in this manual was gathered to help customers during design and laying steps. Such information was processed according to our topmost know-how and it shall be subjected to modifications without prior notice. Data borne herein shall be deemed as non-binding information and hence shall not exempt the customer for performing his own check-ups with the aim of establishing suitability for the intended use. In case of doubt or difficulty, please seek Koscon Industrial S.A. advice before proceeding.

1. Polycarbonate general features

Polycarbonate is a thermoplastic polymer having excellent mechanical and physical properties. Due to its adaptability and durability, polycarbonates for example are used for manufacturing CDs and DVDs. In addition, its resistance against impacts makes of polycarbonates an ideal material for use in automotive, aeronautical and ballistic (airplane windows, automobile lights, anti-riot shields and helmets, etc) industry. All these characteristics, alongside high transparency, make polycarbonates suitable for application in the building industry.

1.1. Polycarbonate technical data.

	Value	Unit	Standard
Mechanical properties			
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 (1 mm/min)	2350	MPa	ISO 527
Impact properties			
Charpy V-notched impact strength	+23°C	75	kJ/m ²
	-30°C	15	kJ/m ²
Izod notched impact strength	+23°C	70	kJ/m ²
	-30°C	12	kJ/m ²
Physical properties			
Density	1,2	g/cm ³	ISO 1183
Water absorption (23° C; saturation)	0,35	%	ISO 62
Moisture absorption (23° C; 50% RH)	0,15	%	ISO 62
Water vapor permeability (23°C;85% RH;0,1mm)	15	g/(m ² 24h)	ISO 15106-1
Thermal properties			
Coefficient of linear thermal expansion (23°C±55°C)	0,65	10 ⁻⁴ /K	ISO 11359-2
Thermal conductivity	0,20	W/(m K)	ISO 8302
Vicat softening temperature (50N; 120°C/h)	145-149	°C	ISO 306
<i>TYPICAL VALUES REFERRED TO POLYCARBONATE AS RAW MATERIAL</i>			

1.2. Comparison with other products.

Compared to other plastic materials commonly used in the building industry and glass, polycarbonate is better due to various characteristics.

	U.M.	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	nd
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
Characteristics against fire	-	Very good	Flammable	Flammable	Flammable	Flammable	Fireproof
Resistance to aging	-	Good	Very good	Poor	Poor	Good	Excellent
Compatibility with chemicals	-	Good	Good	Poor	Good	Good	Very good

2. Sections

MACROLUX® ROOFLITE® array of sheets comes in various pieces, thicknesses and colours. Sections and their characteristics are described in detail in the annexes.

3. UV protection

MACROLUX® ROOFLITE® sheets are protected on the outer side with a layer of UV absorbers which protect the sheet against ageing, guaranteeing their durability over time. The protected side, which must be installed externally, is distinguished by the mark indicating “UV side” and by the lot number.

4. MACROLUX® ROOFLITE® XL protection on both sides

MACROLUX® ROOFLITE® XL (Extralife) sheets can be supplied with the UV protection on both faces. Such versions are subjected to limitations and minimum amounts. Please contact our offices for further information.

5. MACROLUX® ROOFLITE® MINDEW

MACROLUX® ROOFLITE® sheets can be supplied, upon request, with an anti-condensation treatment performed on the inner surface. Application of the MINDEW treatment is ideal for applications in greenhouses and swimming pools in that it prevents condensation drops from dripping into the structure in question.

6. Warranty

MACROLUX® ROOFLITE® sheets are covered by a warranty against ageing for a period of 10 years. Warranty terms and conditions include loss of lighting and variation of the yellow index. Please contact our sales offices for accurate terms and conditions.

7. Light transmission

MACROLUX® ROOFLITE® sheets offer maximum light transmission allowing to exploit the light point to the maximum. MACROLUX® ROOFLITE® sheets offer a complete range of colours that allow proper dosage of light and offer advanced solutions to reduce the passage of solar energy, such as the “MACROLUX® ROOFLITE® ATERMICHE” sheets.

Colour	Light transmission			
	0.8 mm	1.0 mm	1.1 mm	1.2 mm
Crystal (0010)	89	89	89	89
Opal (0037)	80	75	75	75
Opal (9011)	2	2	2	2
Smoky grey (0024)	60	55	55	55

8. Fire behaviour

MACROLUX® ROOFLITE sheets maintain the optimal reaction to fire properties of the polycarbonate material. Various certificates valid in several countries are available. For further information, please contact our sales offices.

9. Thermal conductivity

Polycarbonate thermal conductivity confers the polycarbonate a good insulation property with respect to profiled sheets made of metal material.

Thermal conductivity	0.20 W/m K
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10. Thermal expansion

The polycarbonate thermal expansion value must always be borne in mind for proper designing.

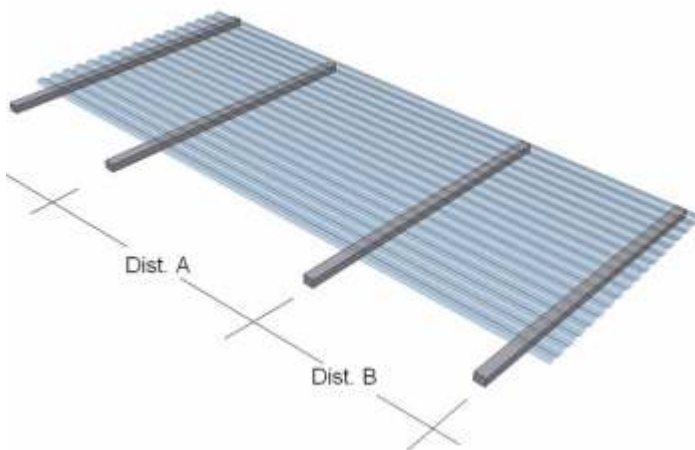
Thermal expansion	0.065 mm/m °C (6.5×10^{-5} 1/ K)
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Such value shall be deemed as an important parameter when selecting the suitable type of fixing.

11. Resistance to hail

MACROLUX[®] ROOFLITE[®] sheets obtained optimal hail resistance performances. Impact tests were performed at Istituto Giordano (Italy) with hail simulated by polyamide beads with a diameter of 40 mm and thrown at a growing speed. No breakages were observed even at high speed (60 m/sec).

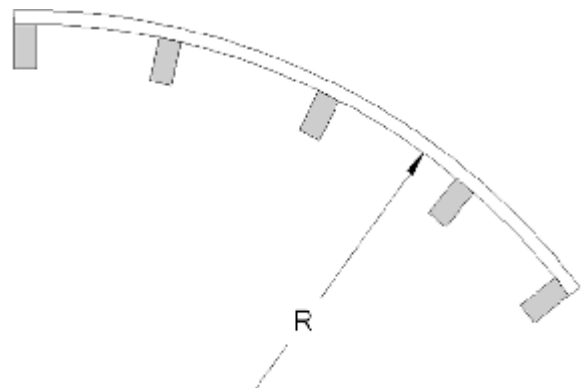
12. Flat solution – Minimum slope



In order to facilitate the flow of rain water we recommend laying the MACROLUX[®] ROOFLITE[®] sheets with a minimum slope of 5%.

13. Curved solution

MACROLUX[®] ROOFLITE[®] sheets may be mounted on curved structures but complying with the conditions that the radius outlined by the succession of the supports has a value greater than the minimum values indicated for each type of section.



14. Important advices

MACROLUX® ROOFLITE® sheets shall be mounted on continuous supports and orthogonal with respect to the length of the sheets.

The supports must be smooth and free of any objects capable of jeopardizing the integrity of the sheets, such as projecting nails, wires, strings, protection nets, etc.

15. Recommended maximum length

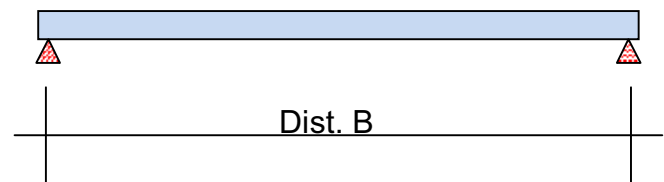
Alongside the high thermal expansion typical of polycarbonate and depending on the type of fixing used in the past for the MACROLUX® ROOFLITE®, we recommend using sheets with a maximum length of 4000 mm.

In case of extremely long flaps, we recommend overlapping several sheets length-wise; however, by means of a proper positioning of the slots suitably protected by sealing gaskets it is possible to use sheets even longer than 4 m.

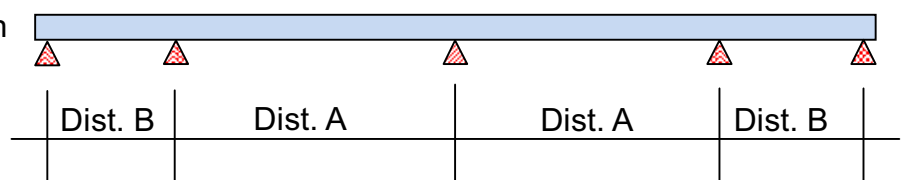
16. Allowable loads

Allowable values for the maximum distances between the supports are indicated in the tables regarding each single section. Such values can also be used for curved solutions. Alongside the type of sheet, the distance of the supports also depends on the type of application.

Sheet solution on two supports



Sheet solution on several supports



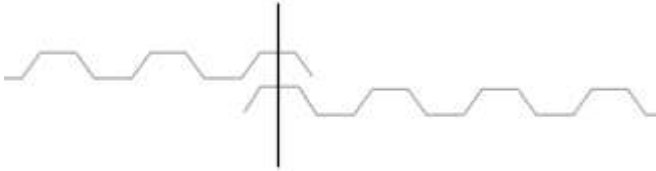
Fixing must be performed on all purlins according to the methods and indications provided for in this document. The values indicated in the tables are

- ✓ Ultimate strength safety coefficient equivalent to 1.5.

In case of very low slopes, deformation under load could create a counterslope causing leakage and water stagnation. In such cases, timely control of deformation under load is required.

17. Overlaps

Simple overlap



Double-pitch overlap

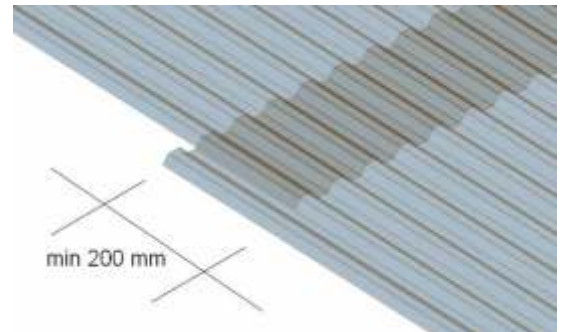


Overlapping MACROLUX® ROOFLITE® sheets require following simple rules.

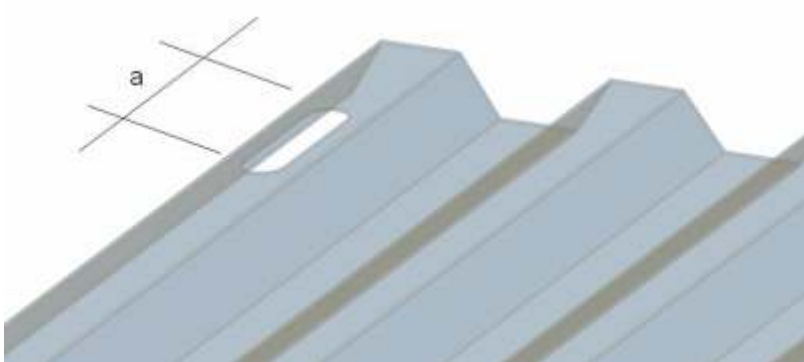
For side overlapping, at least one complete pitch is recommended, but in case of low slopes (5% to 10%) or in cases where the flap is considerably long (longer than 4 metres) at least a double pitch overlap is recommended.

In case of shapes with low TRAPEZ or wave, it is necessary to install sheets with a double-pitch side overlap (as for example with wave 76/18).

In case of overlapping several sheets length-wise, it is necessary that such operation be performed at a transverse support and that there be at least a 200 mm overlap.



18. Fixing



Fixings must be provided with gaskets suitable to guarantee watertight sealing bearing in mind that the hole must be suitably slotted to guarantee the thermal expansion of the polycarbonate sheet.

The slotting pitch depends on the length of the sheet and it is equivalent to:

Screw diameter 6 mm	
Sheet length (mm)	Slotting (mm)
Up to 2.000 mm	10 mm
Up to 4.000 mm	12 mm
Up to 6.000 mm	15 mm
Up to 8.000 mm	20 mm
Up to 10.000 mm	25 mm

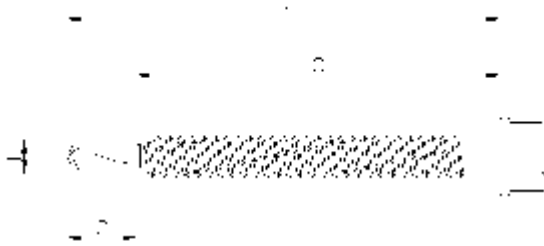
19. Fixing at the purlin

MACROLUX® ROOFLITE® sheets must be anchored in an integral manner with respect to the support structure through an adequate number of fixings and suitable for support (wood, metal purlin, etc.).

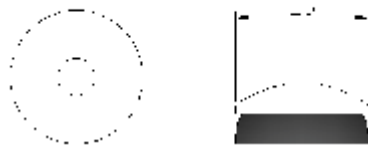
The distance required for proper fixing depends on the pitch and shape of the fret.

The fastening force must be such not to deform the sheet but, at the same time, guarantee a good operation of the gasket.

- ✓ Self-drilling fixings on a metal structure with gasket and metal washer



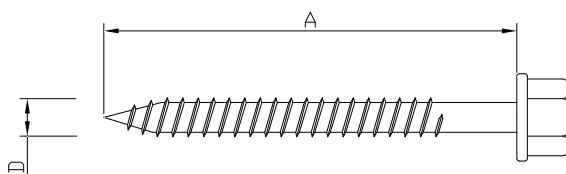
Self-drilling screw



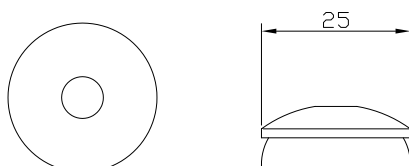
EPDM sealing washer with aluminium metal washer 25 mm.

Size	Spanner (mm)	Diameter D (mm)	Total length A (mm)	Useable length B (mm)	Drilling capacity C (mm)
6.3 x 45 mm	8	6.3	45	30	6
6.3 x 60 mm	8	6.3	60	45	6
6.3 x 80 mm	8	6.3	80	65	6
6.3 x 100 mm	8	6.3	100	85	6

- ✓ Recommended fixings on wooden structures (**not available**) with gasket and metal washer.



Screw for wood



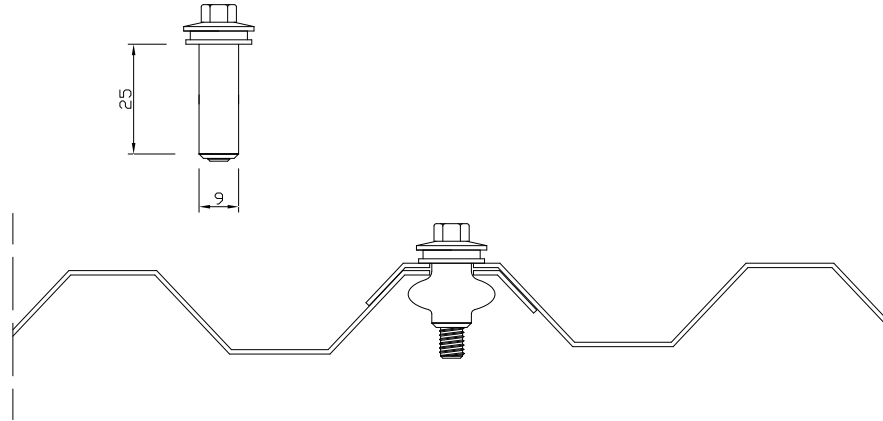
EPDM sealing washer with aluminium metal washer 25 mm.

Size	Spanner (mm)	Diameter D (mm)	Length A (mm)
6.5 x 60 mm	8	6.5	60
6.5 x 75 mm	8	6.5	75
6.5 x 100 mm	8	6.5	100

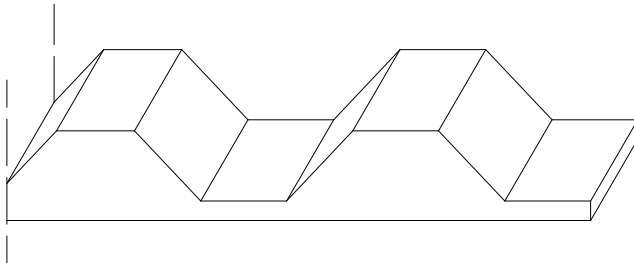
For supports made of wood consider screwing at least 30 mm deep.

20. Side overlap seam

At the side rebate of two MACROLUX® ROOFLITE® sheets it is recommended to seam the two overlapped strips with a special dowel.



21. Spacer



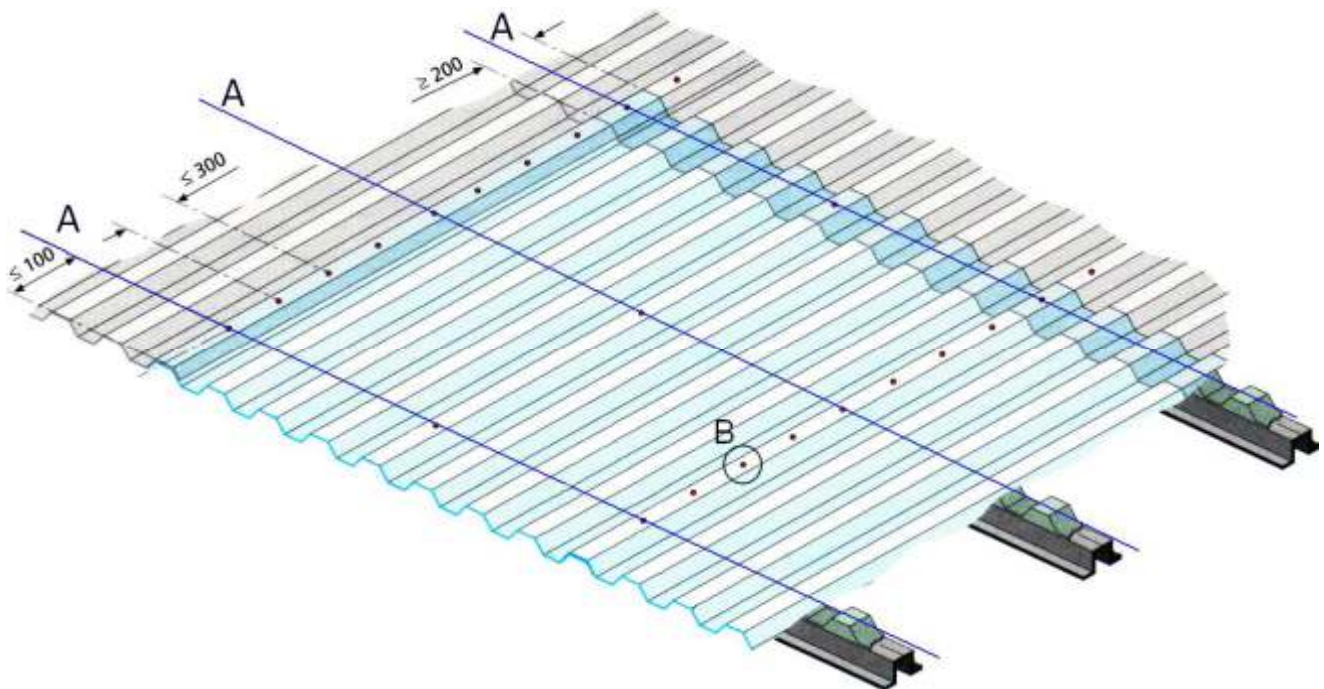
For better thermal insulation and in order to prevent the pressure-fastening of the screws from damaging the polycarbonate fret by pressing it, use of an “under-fret” made of PE interposed between the purlin and the fret is recommended.

22. Arrangement of the accessories

For proper laying of the MACROLUX® ROOFLITE® sheet, buffers made of foamed PE are required to be arranged beneath the fret so as to enhance resistance against the fastening force of the screw; furthermore, the foamed bumper increases the air sealing between the support and polycarbonate sheet. The distance of the support purlins shall be assessed depending on the expected load, the thickness and type of template (check the suitable sheet tables).

Fixings passing through the purlins (fixing lines A) shall be performed on the ridge of the fret and sufficient (in number) to guarantee stability against wind. The seaming on the overlap, at positions not provided with the purlin (B), being required for all side overlaps.

Minimum arrangement of fixings per template can be observed from the annexed product specifications sheet.



Overlapping with already existing frets must be at least 200 mm both upstream and downstream. Such value shall be increased in case of low slope.

Any projections, with respect to the last purlin, of the polycarbonate sheet shall not exceed 100 mm.

23. Packaging and forwarding

In standard packaging, MACROLUX[®] ROOFLITE[®] sheets are supplied on wooded pallets, protected by a thermowelded and fastened heavy polyethylene film.

Customised sheets shall be packaged according to the discretion of Koscon Industrial S.A. In case of special requests (transfer at worksites, unloading problems, etc.), please make arrangements when placing orders with our sales offices and the latter will see to meeting your requirements.

24. Transport

MACROLUX[®] ROOFLITE[®] sheets shall be transported on suitable means in such a manner that sheets and pallets completely lie against the platform. Ropes and blocks, required to hold the pallets firm during transport, shall be positioned in such a manner not to damage the sheets. Any damage occurring during transport shall be reported within eight hours upon reception of the goods. For proper analysis of the problem, reference to the CMR transport document is required.

25. Transfer and storage

Transfer and storage of MACROLUX[®] ROOFLITE[®] sheets are delicate operations that could damage the sheets. Therefore, strict compliance with the following instructions is of paramount importance:

Maximum care when using forklift trucks is recommended. Forks shall not come into direct contact with the sheets under no circumstances whatsoever.

In case belts or balances are used for lifting, use belts at least 200 mm wide for proper distribution of weights, interpose a wooden board – with a greater length than the width – of the sheet between the package or pallets and the ropes.

The distance of the forks must be such to avoid flexions of the pallet.

In case of storage of several pallets stack a maximum of three pallets (do not stack the pallets directly but use supports capable of preserving the contact surface (polystyrene, insulations etc.).

In case of stacking a pallet previously laid against the ground, ensure that there are no objects on lower part of the pallet capable of ruining the surface on which they are meant to lie.

Stack the pallets with an integral packaging with a slight slope to allow flow of possible condensations and water stagnation.

Keep the integral packages in sheltered place or in a place where they can be covered with canvas to protect the packages against harsh conditions and ensure proper aeration.

If the packaging has been open, the sheets must be stored inside, safe from heat sources and direct sunbeams. They must be stocked on plane surface, in horizontal position in order to avoid bending and curving of the surfaces.

If performed by hand, transfer of single sheets shall occur with the sheet on its side.

26. Cleaning

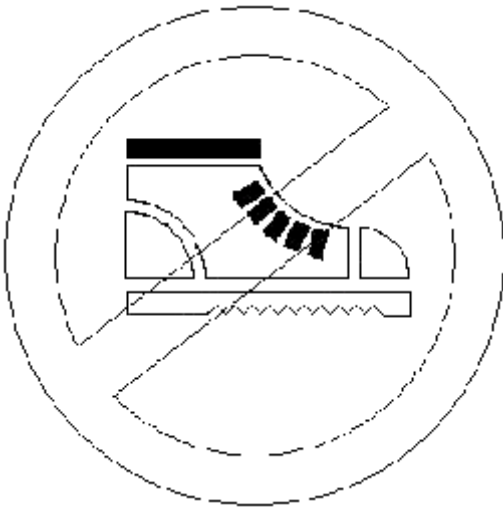
When cleaning MACROLUX[®] ROOFLITE[®] sheets, strictly use only products certified for cleaning polycarbonates (see the manufacturer specifications sheet).

In order to maintain the light passages, the latter must be cleaned periodically with water and non-alkaline soap or with suitable detergents, subsequently thoroughly rinsing with water. Dirt must be removed with maximum care, using soft rags to avoid altering the protection layer.

WARNING:

Do not use alkaline detergents, solvents in general, abrasive detergents, brushes, steel wool, blades or sharp devices that might damage the UV protection layer.

27. Safety – Access to roofing



During both laying and maintenance operations do not walk directly on the MACROLUX[®] ROOFLITE[®] polycarbonate sheets.

As a matter of fact, the polycarbonate sheets are NOT made to be walked on and they are subject to breaking.

In case you need access to the roofing, use the suitable gangways which guarantee safety for all the operators.

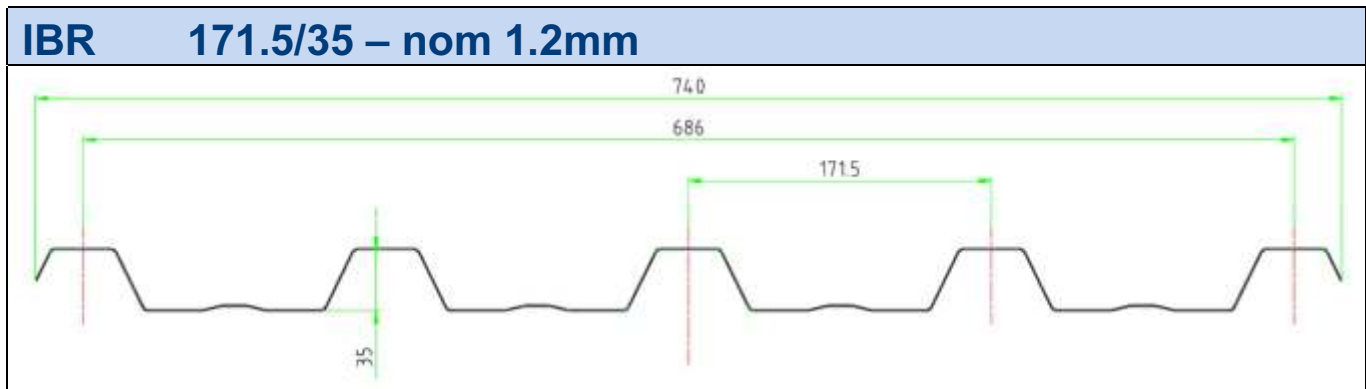
Protect the sheets against possible scratches with suitable covers.

WARNING:

In case of access to the roofing, should there be risks of falling or breaking, assemble all the required elements in compliance with all the work safety regulations in force in the country in question.

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	Units - Unità	Value - Valore	Notes - Note
Thickness - Spessore	mm	1.2	± 10% (Average, medio)
Pitch - Passo	mm	171.5	-
Height- Altezza	mm	35	± 2 mm
Nominal width Larghezza nominale	mm	740	-0 mm; +10 mm
Cover Larghezza utile	mm	686	± 5 mm
Length - Lunghezza	mm	On request A richiesta	Maximum suggested length 6,0 m Massima lunghezza consigliata 6,0 m
Minimum bending radius Raggio minimo di curvatura	mm	8500	-
Light transmission⁽¹⁾ Trasmissione luminosa⁽¹⁾	%	90	Clear - Cristallo (0010)
Fire certification - Certificato fuoco	-	B s1 d0	According to EN 13501-1 ^(**) In base a EN 13501-1 ^(**)
Coefficient of thermal expansion Coefficiente di dilatazione termica	mm/m °C	0,065	-
Service temp. (continuous use) Temp. di esercizio (uso continuo)	°C	-40° +120°	
UV protection - Protezione UV	-	Yes - Si	Coextruded on external side Coestrusa sul lato esterno

⁽¹⁾ Internal test according to ASTM D1003. The light transmission can vary according to production tolerance

^(**) Fire certification could be subject to limitations

✓ **BREAKING STRENGTH VALUES (*) FOR EVENLY DISTRIBUTED LOADS**

Thickness Spessore (mm)	Distance A			Distance B		
	600 N/m ²	900 N/m ²	1.200 N/m ²	600 N/m ²	900 N/m ²	1.200 N/m ²
1.2	1.550	1.400	1.300	1.250	1.100	1.050

(*) Breaking strength values (safety coefficient 1.5)

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For further laying conditions see the MACROLUX® ROOFLITE® technical manual

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