



# TOPGAL Guidebook

Polycarbonate Extruded Multi Wall  
Standing Seam System



## THE PLAZIT Plazit-Polygal GROUP

The Plazit-Polygal Group is a world leading manufacturer and supplier of plastic sheets, bringing together expert professionals committed to providing high quality, reliable products and solutions designed to meet customer needs. Both Plazit and Polygal started to manufacture extruded plastics sheets in 1973. Plazit began as a producer of extruded solid sheets, first from Poly Methyl Methacrylate (PMMA) and later from Polycarbonate (PC), while Polygal was the world pioneer in the manufacturing of PC multi wall sheets.

From modest beginnings, both companies expanded their operations worldwide and grew to become world leaders in the plastic sheeting market. In 2010 Plazit acquired in Spain a PMMA cast production facility (today Plazit Iberica) adding cast PMMA sheets to its range of products. In 2011 Plazit and Polygal merged to form the Plazit-Polygal Group. What started 40 years ago as small rural community workshops, has become a worldwide international group.

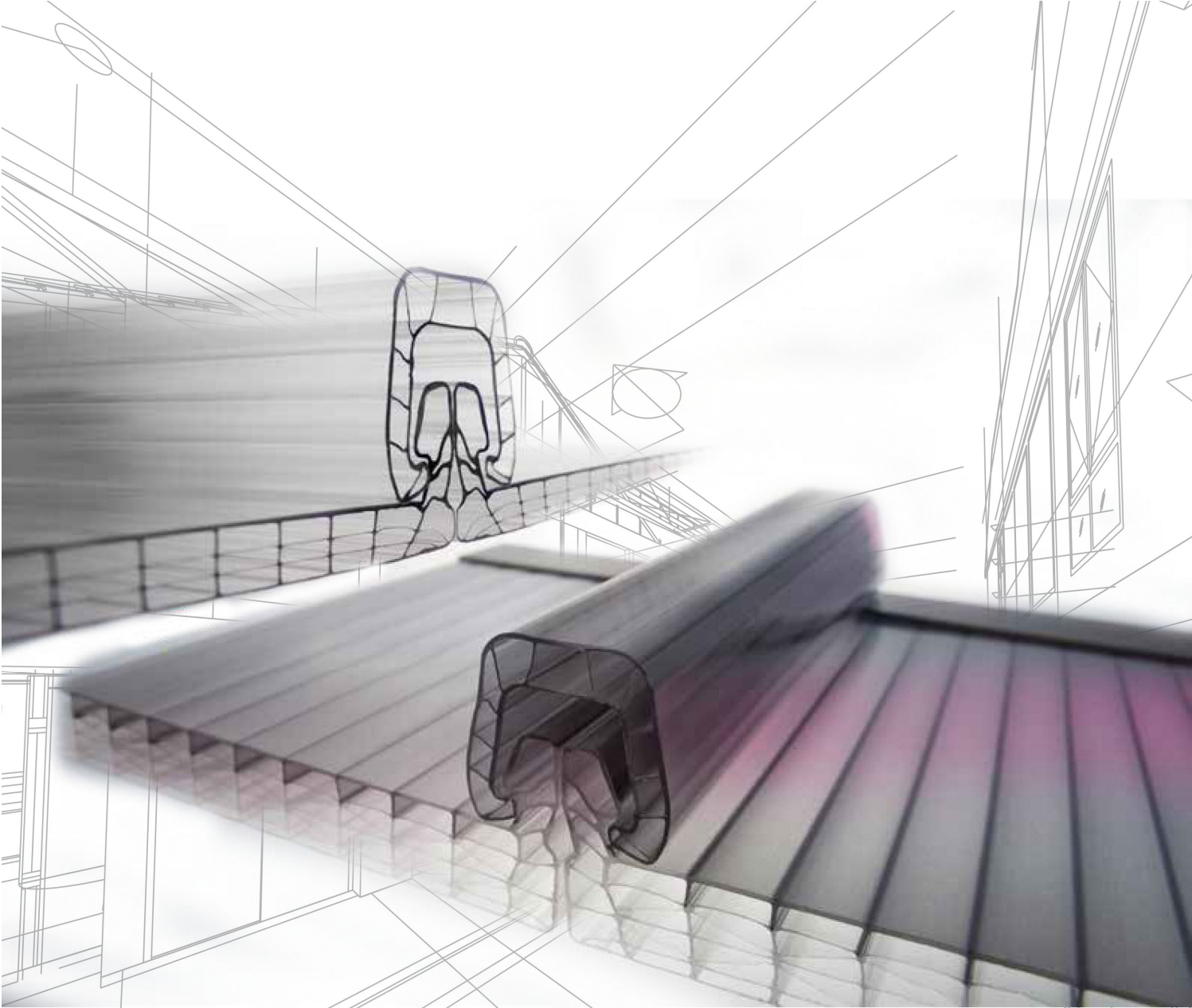
Today, The Plazit-Polygal Group's production facilities are spread around the globe (Israel, USA, Chile, Bulgaria, Russia and Spain) with more than 750 employees from different countries. A team of highly skilled professionals and modern laboratory facilities provide 24/7 customer technical support, engage in continuous product and process improvement, research and development of new products. Plazit-Polygal Group is a member of the CEFIC (European Chemical Industry Council), which groups the leading PMMA producers in the world, of EPSE (European Polycarbonate Sheet Extrusion) which groups the leading Polycarbonate extrusion producers in the world and of EPDA (European Plastics Distribution Association). Plazit-Polygal is certified ISO9001.

**YOUR LOCAL STRATEGIC PARTNER**

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# Introduction



## 1. Introduction

Polycarbonate is a unique engineering thermoplastic which combines a high level of mechanical, optical and thermal properties. It can be stabilized and protected to have an excellent resistance to sunlight and environmental exposure for a long period of time. It also has excellent electrical properties and it is fire self-extinguishing.

PC can be modified by different additives to perform specific applications: light reflection, light diffusion, IR blocking, etc.

The versatility of this material makes it suitable for many engineering applications.

When extruded in multi wall panel form, its optical and impact properties in particular render this material an ideal candidate for a wide range of roofing applications.

TOPGAL is the trade names of extruded multiwall (MW) polycarbonate (PC) standing seam system made by the Plazit-Polygal Group. With excellent transparency, safety and easy fabrication, TOPGAL are available in a broad range of thicknesses, colors and special effects.

## 2. Multi Wall Standing Seam System TOPGAL

### 2.1 Characteristics of the TOPGAL System

Topgal is a multi wall standing seam system suitable for the roofing and coverage of many types of building.

Topgal's unique multi wall structure, with its relatively low weight, enables the optimum transmission of light into buildings and provides excellent insulation against heat loss.

Topgal polycarbonate panels are available in thicknesses of 6, 8, 10, 16 and 20 mm, and in two standard panel widths – 600 mm and 1000 mm. The Topgal panel system includes all the necessary accessories for installation. The system is easy to assemble on-site and hundreds of square meters of coverage can be easily and quickly installed by a small team.

Topgal provides high structural strength and superior rigidity that exceeds the required standards, providing positive and negative wind-load resistance. Its standing-seam panel connections prevent water from collecting and penetrating, and strengthen the roof surface.

Topgal offers architects and builders a wealth wide range of options for building coverage with excellent quality, uniformity and optimum light transmission. It is available in a choice of colors and with reflective coatings for reflection of solar rays. The panel can have 2 sides UV protection layers and high thermal insulation. Because the panels are resistant to radiation deterioration, they will look good and stay strong for many times.

We offer professional and skilled staff to support designers and builders with any issues of architectural design, technical specification and installation.



## 2.2 Qualities

The Topgal system manufactured by the Plazit-Polygal group is ideal for installation in public buildings, sports facilities, transportation hubs and the interior spaces of industrial, commercial and leisure buildings and has following advantages:

- High light transmission
- Outstanding impact strength
- Lightweight
- UV protection on both sides or on tooth side, upon customer request
- Excellent weathering and ageing resistance
- Available in standard colors as well as special color layers that selectively reflect solar radiation
- Rigid structure provides strength under wind and snow loads
- Cold curving capability
- Waterproof
- Good chemical resistance to a wide range of substances
- Covered by 10 Year Warranty for light transmission and strength



## 2.3 Applications



Swimming pools



Car parking structures



Canopies



Interior Design - Lighting



Stadiums, industrial roofing, swimming pools, cladding and public areas



Architecture Cladding

## 2.4 Technical Specification of TOPGAL System

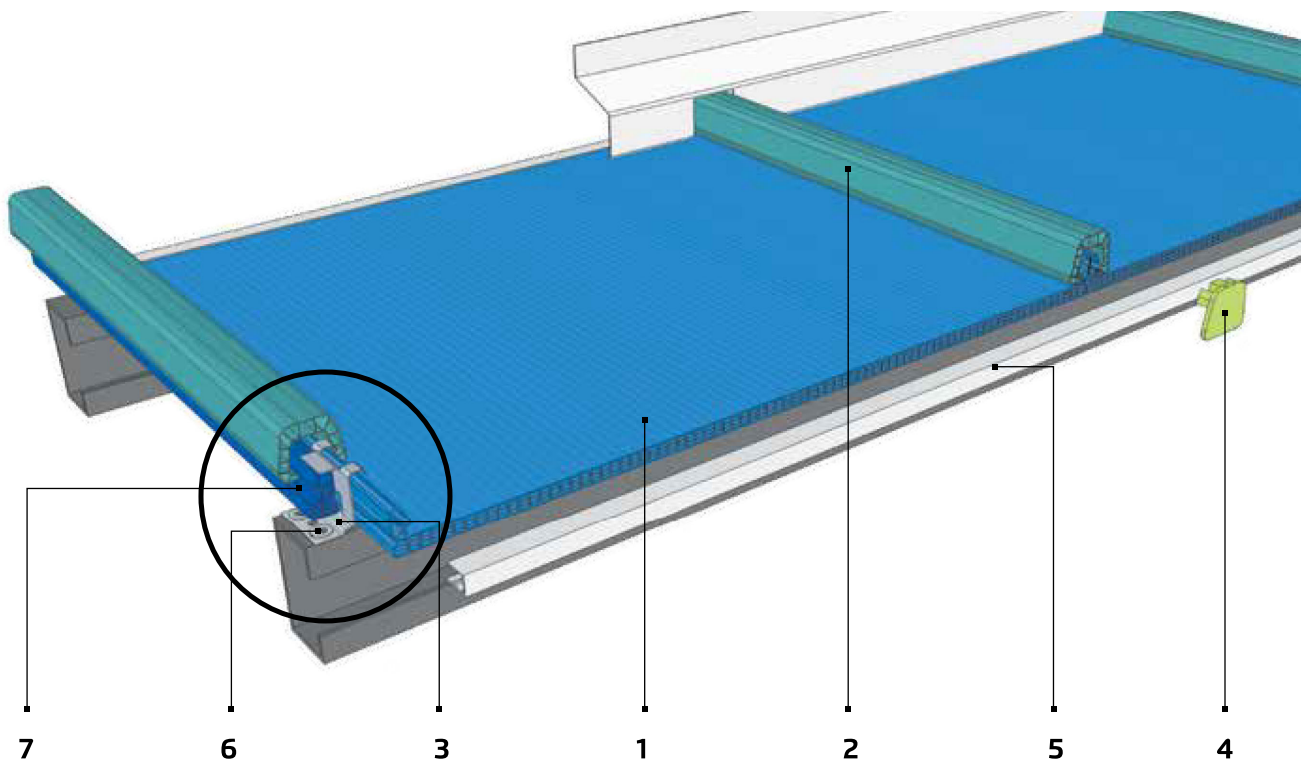
Structure	Thickness / Width, mm	Weight / Dead Load*, g/m <sup>2</sup>	K-Value, W/m <sup>2</sup> · °C	Impact Strength, joule	Min. Radius for Cold Bending*, m
	6/600	1600/2000	3.1	1.25	1.2
	8/600	1900/2200	2.4	1.53	1.8
	10/600	2200/2500	2.1	1.61	2.0
	16/600	3000/3300	1.9	2.00	3.2
	16/998	3000/3300	1.8	2.31	3.2
	20/998	3200/3500	1.5	3.00	4.0

Service Temperature Range: -40°C–+120°C for short time service, -25°C to +85°C for prolonged service

Coefficient of linear expansion:  $6.65 \cdot 10^{-5} \text{ m}/(\text{m} \cdot ^\circ\text{C})$

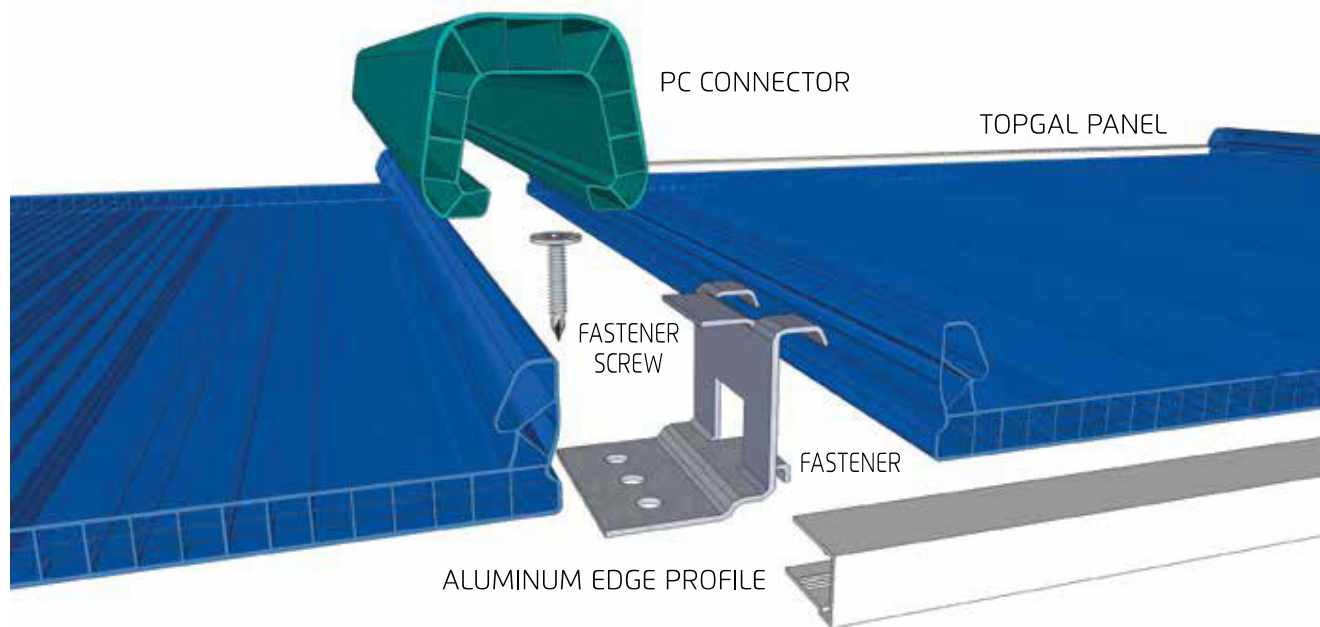
\* Dead Load is a weight of 1m<sup>2</sup> of TOPGAL system, includes installation accessories

### TOPGAL SYSTEM SCHEME






**DETAIL A**



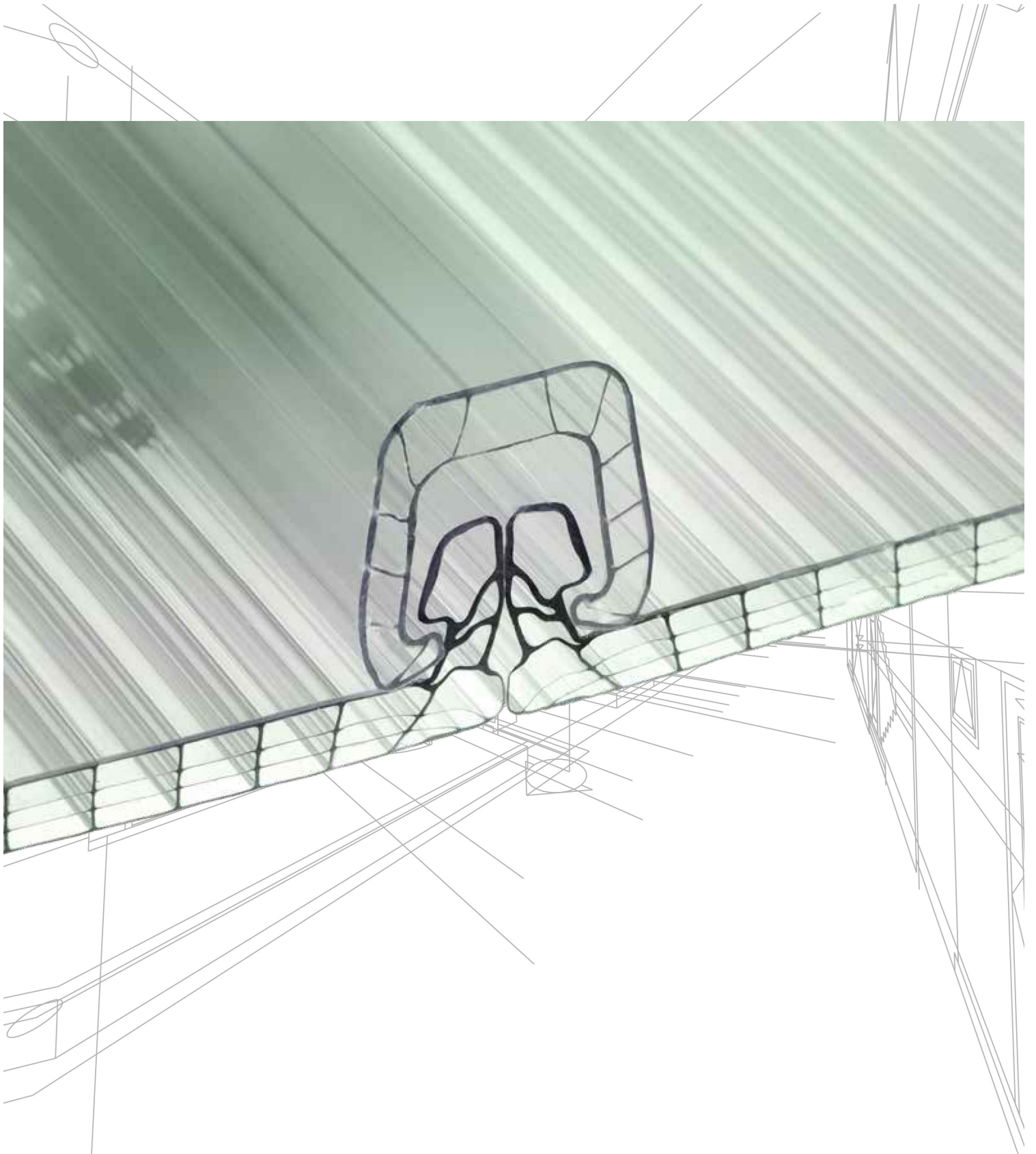
# Introduction

## TOPGAL SYSTEM ACCESSORIES

NN	Item	Function	Cat. No	Description
1		TOPGAL PANEL		Maximum panel length for export is 11.90m
2		PC CONNECTOR	#240	Color: panels matched
3		FASTENER	#534 – 6 mm #530 – 8 mm #531 – 10 mm #532 – 16 mm #533 – 20 mm	Stainless Steel
4		CONNECTOR END CAP	#525	Polycarbonate Color: clear
5		ALUMINUM EDGE PROFILE	#327 – 6 mm #311 – 8 mm #312 – 10 mm #313 – 16 mm #328 - 20 mm	Length 6 m
6		FASTENER SCREW	#431 -(for metal structures) #436 -(for wood structures)	Philips #10 / 5/8" Philips #10 / 1"
7		PC SIDE PROFILE	#245 – 6 mm #241 – 8 mm #242 – 10 mm #243 – 16 mm #244 - 20 mm	Color: panels matched
8		STOPPER	#554 – 6 mm #550 – 8 mm #551 – 10 mm #552 – 16 mm #553 – 20 mm	Stainless Steel
9		ALUMINUM CONNECTOR	#360	Length 6 m
10		ANTI DUST TAPE	#508 - 6-8 mm #509 – 10-16 mm #510 - 20 mm	Roll length 33m
11		ALUMINUM SIDE PROFILE	#361	Length 6 m
12		Gap Sealing Foam	#41525 - 6-10 mm #41526 - 16-20 mm	600 mm length (6-10 mm) 1000 mm length (16-20mm)



# Thermal Properties





## 3. Thermal properties

### 3.1 Service temperature and thermal expansion

#### Service Temperature

Plazit-Polygal TOPGAL Multi Wall PC panels and profiles can be installed in a diversity of applications, with varying temperatures. However, the material's mechanical performance is known to remain stable in prolonged service in temperatures ranging from -25°C to +85°C (according to EN 13650).

PC has a maximum service temperature of 120°C.

#### Thermal Expansion/Contraction

The coefficient of linear expansion of polycarbonate material is  $6.65 \cdot 10^{-5} \text{ m}/(\text{m} \cdot ^\circ\text{C})$ . This is high relative to that of most other materials in conjunction with which it is normally used. Consequently, careful allowance must be made for the thermal expansion of Plazit-Polygal polycarbonate products, both longitudinally and laterally.

In practical terms, it is necessary to allow 2.5mm/m length or width for thermal expansion in clear and whites and 4.5 mm/m in dark panels ( $\Delta T=80^\circ\text{C}$ ).

### 3.2 Thermal insulation and U-Value

Thermal Insulation definition is the resistance to heat transfer as a result of temperature differences between two material bodies.

In the case of Multi-Wall PC panels, the thermal insulation is important in application in which there is a difference between the outside to the inside air temperature.

Examples for the importance of thermal insulation can be seen in applications with close structures, such as sunrooms and swimming pools, whereas in roofing for open structures such as bus station and canopy the thermal insulation has no meaning.

U or K-Value is the coefficient which determines heat loss in the glazing walls of a building. As the U-Value decrease the thermal insulation increase.

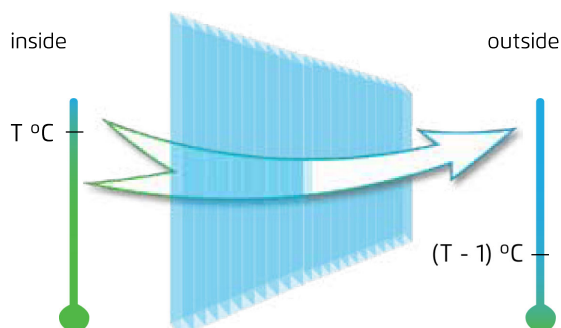
Definition: Heat flow rate through a wall of 1 square meter at a temperature difference of one degree Celsius between the two environments.

Unit:  $\text{W}/(\text{m}^2 \cdot ^\circ\text{C})$

$U = 1/R$

R - thermal resistance ( $\text{m}^2 \cdot ^\circ\text{C}/\text{W}$ )

Difference of temperature  $1^\circ\text{C}$



## 4. Optical Properties

### 4.1 Electro-Magnetic Waves

Electro-magnetic wave is a physical phenomenon in which energy advances in the space through alternating electric and magnetic fields.

The properties of the waves largely depend on its wavelength.

They are divided to various ranges by the wavelength, from the long to the short:

Radio waves, microwaves, Infra-Red (IR) heat radiation, visible light, Ultra-Violet (UV) light, X-Ray (Roentgen) radiation, Gama radiation, cosmic radiation.

Also, it is customary to divide it to Non-ionizing radiation (long to UV) and Ionizing radiation (wavelength shorter than UV).

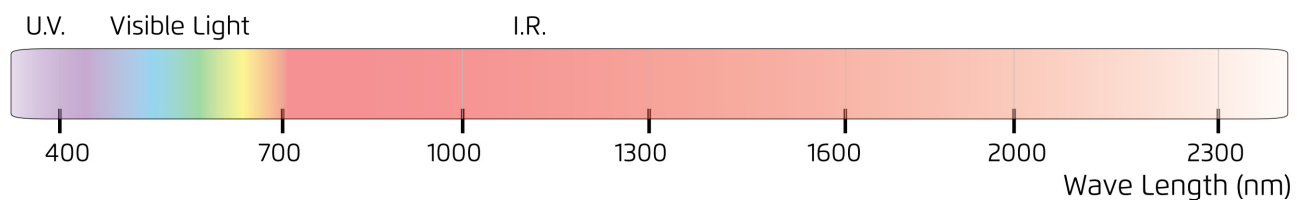
The Ionizing radiation causes chemical changes in molecules and biological damages. The Non-ionizing radiation causes heat in the material.

### 4.2 Solar Radiation

We are interested in the range of the electro-magnetic called Light which includes the IR, the visible light and the UV. The IR radiation is emitted from hot bodies; it is invisible, but we can feel it as heat.

The visible light is the waves at the range of 400-700 nanometer (nm). When we go through the wavelength from 400 nm and up, we gradually see all the rainbow colors, starting with violet and blue and finish with red. The light beyond the violet is called ultra-violet (UV) and it is invisible.

The solar radiation of the sun includes IR, visible light and UV. About half of its energy is in the visible range, 45% is in the IR range and 5% is in the UV range.



### 4.3 Light and material interaction

When a light ray impinges the surface of material, part of it is reflected from the material surface. The rest of it is penetrating into the material. If the material is opaque to light, the entire penetrating light is absorbed within the material and transforms to heat. However, if the material is transparent or partially transparent to light, the penetrating light advances inside the material, part of it is absorbed and turns to heat while the rest impinges the second surface. Part of the light that impinges the surface is reflected back into the material and continue to be absorbed while the other part escapes to the space out of the material.

Therefore, the light that impinge the material is partially reflected, partially absorbed and partially transmitted. The sum of energies of the reflected, absorbed and transmitted light is equal to the energy of the impinging light.

## 4.4 Light sources

Different light sources have different characteristics. The sun's light reaches the earth after passing through the atmosphere where certain parts of it are absorbed. This is the main light source we refer to, but it is not the only one.

There are artificial light sources such as electric lighting with different characteristics. According to the standard (EN 16153), we use two transmission properties:

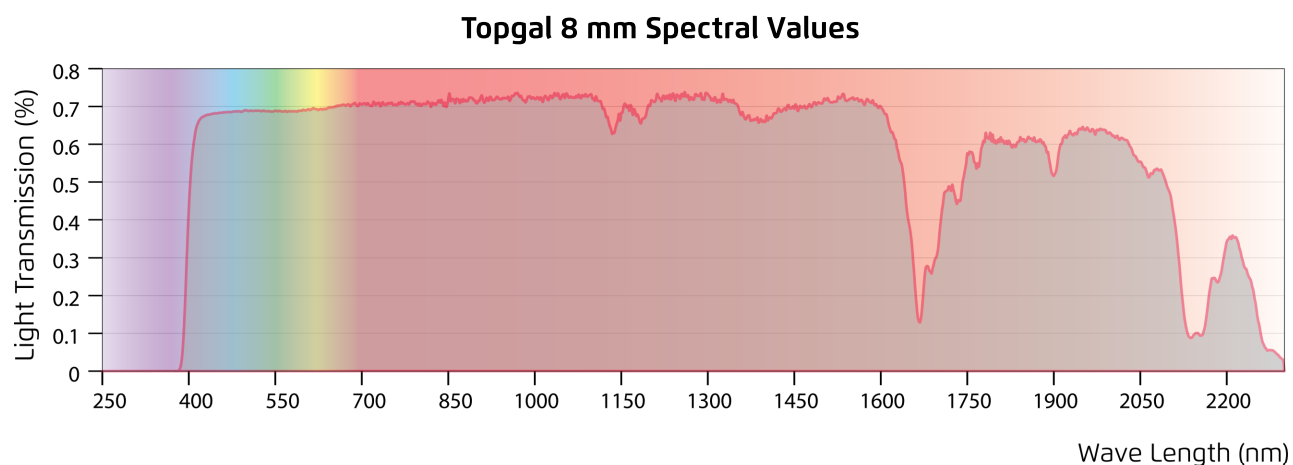
$\tau_e$  is the solar transmission of the product  $\tau_v$  is the visible transmission

The light sources for the two are different. The light source for  $\tau_e$  is similar to the sun's light in the range of 350-2400 nm, while the light for  $\tau_v$  is a standard source designated D65, in the range of 350-750 nm.

## 4.5 Properties of Transparent Polycarbonate (PC)

PC is a clear transparent plastic material with excellent mechanical properties. The material is transparent to visible light, partially absorbs IR light and totally absorbs (opaque) to UV light. The UV blocking property is a desirable one, since the UV radiation is harmful to the human body.

The spectral transmission graph of clear 8 mm PC TOPGAL panel is given here:



## 4.6 Geometry of Transmission and Reflection

Light that impinges the PC surface is reflected, partially in a specular reflection (as mirror) and partially in a diffused reflection at various directions.

Also, the light that pass the PC and transmitted through the far surface, is partially specular (continue the original ray direction) and partially diffused.

The ratio between the diffused light and the total (diffused + specular) light, in both transmission and reflection, is the Haze property of the sheet which describes the light diffusing property of it.

## 4.7 The Panel Standard Optical Properties

In the MW sheet standard (EN 16153), the solar and the visible transmission are designated  $\tau_{v, n-h}$  and  $\tau_e$ ,

n-h, where the n-h indicates a normal (perpendicular) light source and hemispherical (half sphere) total light collection.

The letter **e** indicates Solar (energy) properties while the letter **v** indicates Visible properties.

## 4.8 The Panel Color Influence

Colored panel changes the reflected and the transmitted light. The spectral curves of the transmitted and the reflected light are different from the source spectral curve.

Also, the total values  $\tau_v$  and  $\tau_e$  are changed by the color.

When the color exists in the volume of the panel, the absorption is taking place in the entire panel, results in temperature increase in the absorption sites.

The more color concentration and sheet weight, more energy is absorbed and less energy pass the remote surface.

## 4.9 Colors with Special Spectral Properties

Special selective layers of polycarbonate MW panels, developed by Plazit-Polygal, are one of the most advanced achievements in this field. Such layers make it possible to control the quality of light penetrating an enclosed space, by absorbing and reflecting some part of solar radiation.

There are colors of Multi Wall Plazit-Polygal PC panels with special spectral properties:

1. PolyShade (PSD) has a thin color layer at the outer surface with shiny metal appearance with improved solar properties. The PolyShade layer contains a special pigment that adds metallic luster to the surface and provides an optimal level of solar radiation reflection to prevent overheating of a room. The PolyShade layered panels are manufactured with different colors: silver, metallic blue and metallic green.
2. Silhouette (PNL) is a panel with pearl color layer and gentle silk appearance, sophisticated and lustrous exterior surface. The Silhouette panel radiates elegance and good taste, available in a variety of formats, features outstanding reflective qualities and selectivity making it an excellent choice and suitable for all daylight coverings.
3. Primalite (PRL) is a panel with unique color layer that selectively reflects a large portion of the Near Infra-Red solar radiation, while transmitting more of the visible light radiation. The color converts the transmitted light with greenish tint, while the reflected light has pink tint.

## 4.10 The Standard Thermal - Optical Properties

**U-Value** - The thermal transmittance of the sheet

**SHGC and g-Value** - The percentage of total solar energy that pass the sheet.

**SC** - Shading Coefficient - the ratio between the SHGC of the sheet and that of clear 3 mm glass.





# Technical Properties



## 5. Technical information

Typical Properties	Method	Units	Plazcryl (R7000)
<b>General</b>			
Density	ISO 1183	g/cm <sup>3</sup>	1.2
Light transmission (Depending on thickness)	ASTM D 1003	%	81 - 90
Water Absorption	ISO 489		1,585
<b>Mechanical</b>			
Tensile Strength at yield	ISO 527-2	MPa	60
Tensile Modulus	ISO 527-2	MPa	2300
Elongation at break	ISO 527-2	%	>100
Elongation at yield		%	6
Flexural Modulus	ISO 178	MPa	2330
Charpy Un-notched	ISO 179	kJ/m <sup>2</sup>	Not Break
Izod Impact notched	ISO 180a	kJ/m <sup>2</sup>	>65
<b>Thermal</b>			
Temp of deflection (HDT) Under load of 1.8MPa	ISO 75-1	°C	144
Vicat softening temp (50°C/h 50N)	ISO 306	°C	130
Thermal conductivity	DIN52612	W/m x °C	6.5
Coefficient of linear thermal expansion 0-50°C	ISO 11359	mm/(m x 1/°C)	0.2
GWFI (Glow-Wire Flammability index)	IEC60695-2	°C	120
<b>Electrical</b>			
Volume Resistivity	IES 60093	Ω x cm	3 x 10 <sup>14</sup>
Surface Resistivity, dry	IEC 60093	Ω	6 x 10 <sup>15</sup>
Dissipation Factor 1Mhz	IEC 60250		0.009
Dissipation Factor 100Hz	IEC 60250		0.0006

### 5.1 Acoustic

Accordance with DIN 52210-75, the maximum obtainable sound transmission class for a particular thickness is listed below.

Panel Thickness (mm)	Sound reduction Values (dB)
6 - 8	18
10	19
16	21
20	22

## 5.2 Chemical resistance

Plazit-Polygal PC panels have been successfully used in combination with building materials and glazing components. The chemical stability depends on many factors such as concentration of the chemical agents and on expose temperature. Considering the complexity of chemical computability, all chemicals which come into contact with polycarbonate should always be tested.

Polycarbonate is sensitive to the impact of several chemical substances, such as mineral acids of various concentrations, organic acids, salt solutions, fats, liquid and gaseous ammonia, amino acids, solvents, adhesives and dyes. The degree of sensitivity to chemical substances depends on such factors as concentration, temperature, duration of contact with the sheet surface, load impact, as well as on the presence in the sheet of internal strains including those caused at the sheet's fitting to the supporting structure. When a necessity arises of using a substance absent from the polycarbonate's Table of Chemical Compatibility, the plant laboratory of Plazit-Polygal Group is able to conduct appropriate tests and to issue conclusions on the possibility of its use. In particular, special caution should be exercised with respect to using adhesives, silicones and other sealants due to the possibility of the material's fast destruction. In any event, a high-quality mechanical coupling would be preferable.

The impact on polycarbonate of such substances, widely used in the construction industry, has the following mechanism: at a direct contact, the substance penetrates the material and destroys the links between polymer chains, making them shorter. As a result, micro cracks appear in the polycarbonate, the strains are concentrating at such locations and the cracks are further developing. Under this mechanism's action, combined with the impact of external loads (cold bending, snow, wind and other loads), the micro cracks are widening and the polycarbonate becomes fragile quite soon (under load - in a matter of several days).

The polycarbonate's destruction under impact of untested and probably non-compatible chemical substances displays a characteristic pattern and can therefore be identified at a laboratory check. The "self-healing" practice, whereas the cracks are sealed using improvised means, is only capable of exacerbating the problem. That is why on the detection of cracks and of increased material's fragility, particularly in the areas where silicones, thermo washers and sealing tapes of the coupling profiles are used, it is essential to apply to the company's laboratory for examining the materials contacting with the polycarbonate.

Whenever it is necessary to glue the polycarbonate sheets and seal them, the Plazit-Polygal experts may recommend the double-sided adhesive tapes and the company tested silicones, the list of which is available on demand. Plazit-Polygal Group offers lab service for testing chemical stability of gaskets and sealants which have been approved.



## Chemical Compatibility Chart of polycarbonate products at room temperature:

### Chemicals

- Acetaldehyde	+ Calcium hypochloride
+ Acetic acid, up to 10%	+ Carbon dioxide, moist
- Acetone	+ Carbon monoxide
+ Acetylene	+ Chloride of lime magma
- Acrylonitrile	+ Chloride of lime solution, 2% in water
+ Alumen	+ Chromic alum, saturated solution in water
+ Aluminum chloride anhydrous, saturated solution in water	+ Chromic acid, 20% in water
+ Aluminum alumen potash, saturated solution in water	+ Citric acid 10%
+ Aluminium oxalate	+ Copper chloride, saturated solution in water
+ Aluminium sulfate, saturated solution in water	+ Cupric sulphate, saturated solution in water
± Allyl alcohol	- Carbon bisulphide
- Ammonia	- Chloric gas, dry
- Ammonia water	- Chloroform
- Ammonium sulphide, saturated solution in water	- Caustic potash
- Amyl acetate	- Caustic potash solution
+ Ammonium chloride, saturated solution in water	- Caustic soda
+ Ammonium fluoride, saturated solution in water	- Cresol
+ Ammonium nitrate, saturated solution in water	± Chlorobenzene
+ Ammonium sulphate, saturated solution in water	- Cyclohexanone
- Aniline	± Dinonyl phtalate (softener)
+ Antimony chloride, saturated solution in water	± Dioctyl phtalate (softener)
+ Arsenic acid, 20%	± Diphyl 5.3
+ Benzine (Petroleum Benzin) (non-aromatic)	+ Decalin
- Benzaldehyde	+ Diethylene glycol
- Benzoic acid	+ Diglycol acid, saturated solution in water
- Benzene	- Diamyl phtalate
- Benzyl alcohol	- Diethyl ether
+ Borax, saturated solution in water	- Dibutyl phtalate (softener)
+ Boric acid	± Dimethyl formamide
- Bromine	± Dioxan
- Brombenzene	+ Ethyl alcohol, 96% pure
- Butyric acid	+ Ethylene glycol
- Butyl acid	- Ethyl amine
- Butyl acetate	- Ethyl bromide
+ Butane (liquid and gaseous)	- Ethylene chlorohydrine
+ Butyl alcohol	- Ethyl dichloride
+ Butylene glycol	± Ether
+ Cyclohexanal	- Hydrochloride acid, concentrated
+ Cyclohexane	- Hydrofluoric acid, concentrated
+ Calcium chloride, saturated solution in water	+ Heptane
+ Chloric gas, moist	+ Hexane
+ Calcium nitrate, saturated solution in water	+ Hydrochloride acid, 20%
Trichloro - acetic acid, 10%	+ Hydrosilicofluoric acid, 30%
+ Calcium soap fat, pure	+ Hydrofluoric acid, 5%
	+ Hydrogen superoxide, 30%
	- Formic acid

**+ - compatible      +/- - limited use      - - not compatible**

# Technical Properties

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- Glycerin
- Iodine
- Isopropyl alcohol
- + Ferric chloride, saturated solution in water
- + Ferrous sulphate
- + Glycol
- + Illuminating gas
- Lead tetraethyl, 10% in benzine
- + Lactic acid, 10% solution in water
- + Ligroine (carbon-hydrogen mixture)
- + Magnesium chloride, saturated solution in water
- + Magnesium sulphate, saturated solution in water
- + Manganese sulphate, saturated solution in water
- + Mercury
- + Mercury chloride, saturated
- + Methane
- Milk of lime, 30% slurry in water
- + Nitric acid, 10%
- Nitric acid, 10-20%
- + Oxalic acid, 10% in water
- + Oxide of zine
- + Oxygen
- + Ozone
- Perchloric acid, concentrated
- ± Petroleum ether (carbon hydrogen mixture)
- ± Petroleum
- ± Potato-spirit oil
- + Pentane
- + Perchloric acid, 10% in water
- + Perhydrol 30%
- + Potassium bichromate, saturated solution in water
- + Potassium bromate, saturated solution in water
- + Potassium carbonate, saturated solution in water
- + Potassium chloride, saturated solution in water
- + Potassium nitrate, saturated solution in water
- + Potassium metabisulphite, 4% in water
- Methyl methacrylate
- Methanol
- Methyl amine
- Methyl ethyl ketone
- Methylene chloride
- Narton solution
- Nitric acid, 20%
- Nitro benzene
- Nitrous fumes, dry
- Perchloroethylene
- Phenol
- Pyridine
- ± Phenyl ethyl alcohol
- ± Phosphorus oxychloride
- ± Potassium cyanide
- + Potassium rhodanide, saturated in water
- + Potassium perchlorate, 10% in water
- + Potassium permanganate, 10% in water
- + Potassium persulphate, 10% in water
- + Potassium sulphate, saturated solution in water
- + Propane gas
- + Propanyl alcohol
- + Propionic acid, concentrated
- + Propyl alcohol
- + Resorcin solution, 1%
- Styrene
- Sulphuric acid, concentrated
- Sulphurous acid, 10%
- Sulphury chloride
- + Soda
- + Sodium bicarbonate, saturated solution in water
- + Sodium bisulphate, saturated solution in water
- + Sodium bisulphite, saturated solution in water
- + Sodium carbonate, saturated solution in water
- + Sodium chlorate, saturated solution in water
- + Sodium chloride, saturated solution in water
- + Sodium hypochloride, 0.5% solution in water
- + Sodium sulphate, saturated solution in water
- + Spirit, pure
- + Sublimate, saturated solution in water
- + Sulphur
- + Sulphuric acid, 50%
- + Sulphuretted hydrogen
- ± Sodium sulphite, saturated solution in water
- ± Sulphur dioxide
- ± Sulphuric acid, 70%
- + Tartaric acid, 10%
- Tetrachloroethane
- Tetrahydrofurane
- Tetraline
- Thiophene
- Toluol
- Trichloroethylamine
- ± Trichloroethylene
- ± Tricresylol phosphate (softener)
- + Trichloroethyl phosphate (softener)
- + Urea, saturated solution in water
- + Water
- ± Xylol
- + Zinc chloride, saturated solution in water
- + Zinc sulphate, saturated solution in water

**+ - compatible**    **+/- - limited use**    **- - not compatible**

### Germicides

- + Baktol, 5%
- Carbolic acid
- + Chloramine
- DDT
- + Delegol, 5%
- ± Dimamine T, 5%
- + Hydrogen superoxide
- + Lysoform, 2%
- + Maktol
- + Merfen, 2%
- + Oktozon, 1%
- + Perhydrol
- + Resorcin solution 1%
- + Spirit, pure
- + Sublimate
- TB-Lysoform
- + Trosilon G extra, 1.5%
- ± Sagrotan, 5%
- ± Tincture of iodine
- ± Zephirol

### Detergents

- + Ajax
- + Javel water
- + Laundry soap
- + Silicone fluid-emulsion
- + Soft soap

### Technical Oils & Lubricants

- + Aral BG®58
- + Automatic switch grease
- + Baysilon®-silicone oils
- + BP Energol HL 100®
- + BP Energol EM 100®
- + BP H LR 65®
- + Brake fluid (ATE)
- + Burnishing oil Brunofix®
- Camphor oil
- + Cable insulating oil IG 1402
- + Cable insulating oil KH 190
- + Calcium soap fat
- + Castor oil
- + Contact oil 611
- ± Diesel oil
- Drilling oil
- + Esso Estic 42-45®
- + Fish oil
- + Grease R Z Darina®
- ± Heating fuel oil
- + Hydraulic oil Vac HLP 16
- ± Jet propulsion fuel JP4 (kp 97-209°C) Skydrol 500 A®
- + Mobil DTE oil light®
- + Mobil special oil 10 w 30®
- + Molikote®-paste
- + Molikote®-powder
- + Nato-turbine oil 0-250
- + Naphtenic lubricating oil
- + Paraffin oil
- + Polyran® MM25 (lubricating oil)
- + Rape seed oil
- + Renocalor N®
- + Sewing machine oil
- + Shell Spriax 90 EP®
- + Shell Tellus 33®
- + Silicone fluid
- + Sodium soap fat
- + Texaco Regal oil BRUO®
- + Texaco Regal oil CRUO®
- + Train oil
- + Turbo oil 29
- ± Shell Tellus 11-33®
- ± Turpentine oil
- ± Valvoline WA 4-7
- ± Varnish

**+ - compatible    +/- - limited use    - - not compatible**

## Technical Oils & Lubricants

- + Aral BG®58
- Automatic switch grease Baysilon®-silicone oils
- + BP Energol HL 100®
- + BP Energol EM 100®
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- + Brake fluid (ATE)
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- + Train oil
- + Turbo oil 29
- ± Shell Tellus 11-33®
- ± Turpentine oil
- ± Valvoline WA 4-7
- ± Varnish

## Adhesives & Sealing Materials

- ± All-purpose glue
- + Cellux® - adhesive film
- + Gypsum
- + Insulating tape
- + Perbunan C®
- + Putty
- + Rubber (softener-free)
- + Terostat®
- + Tesafilm
- + Tesamoll®
- + Sea 210
- + Silpruf
- + Serbaseal MP
- + Dow Corning 917
- + Dow Corning 3793 (w.)
- + Dow Corning 7098
- + Dow Corning 791
- + Parasilico PL (cl.)
- + Proglaze
- + 3M 431 -aluminum tape
- + Gerlinger 712 -aluminum tape

## Polishing Agents & Antistatics

- ± Antistaticum 58
- Antistatic C, 5%
- ± Arquad 18®, 50%
- + Delu-Antistatic solution®
- + Persoftal®, 2%

+ - compatible      +/- - limited use      - - not compatible

### 5.3 Fire performances

Plazit-Polygal TOPGAL panels have received high ratings in several major European, American and other fire performance tests. More detailed information and official test reports are available from your local Service Centre or authorized dealer.

#### Flammability

**\*Classifications depend on thickness.**

Method	Classification*
ASTM D-635	CC-1
ASTM-E-84	Class A
EN 13501	B, s1, d0

### 5.4 UV protection

Polycarbonate panels are a perfect material for construction. They are lightweight, durable, aesthetic and easy to install. However, polycarbonate disadvantage is its sensitivity to ultraviolet radiation from sunlight.

One of the properties of the polymer is its ability to absorb ultraviolet radiation. However, under its influence, polycarbonate degrades and is rapidly destroyed; it leads to yellowing, blushing and reduction in the strength of the material.

During the material production and study, technology of polycarbonate sheet protection against UV was changed. In the early years, to protect the polycarbonate from solar radiation a lacquer was applied. The disadvantages of this coating were cracking, blushing and uneven distribution over the surface of the sheet. Later, application of special protective coating by coextrusion was developed.

Protective coextrusion layer, which is an integral part of the sheet, is a polycarbonate, enriched with a special active additive. The greater is the concentration of the additive, the more effective and thinner can be coextrusion layer.

The warranty provided by the Plazit-Polygal Company is an indication that the produced material will not lose its physical, mechanical and optical properties (i.e. preserves its impact resistance, do not become turbid, do not turn yellow) during the guaranteed period.

It is important to remember:

Tooth side of the panel with Ultraviolet radiation protection only is referred as "external." Care should be taken on the compliance of the manufacturer's recommendations for panels installation. Otherwise, the complaint will not be accepted by manufacturer.



## 5.5 Impact strength - hail resistance

### Small Hard Body Impact Test:

A free-falling dart (tup) according to ASTM D5628 (equivalent to ISO 6603-1) is allowed to strike a supported specimen directly. Either a dart having a fixed mass may be dropped from various heights, or a dart having an adjustable mass may be dropped from a fixed height.

The procedure determines the energy (mass x height) that will cause 50 % of the specimens tested to fail (mean failure energy). Results are expressed in Joules.

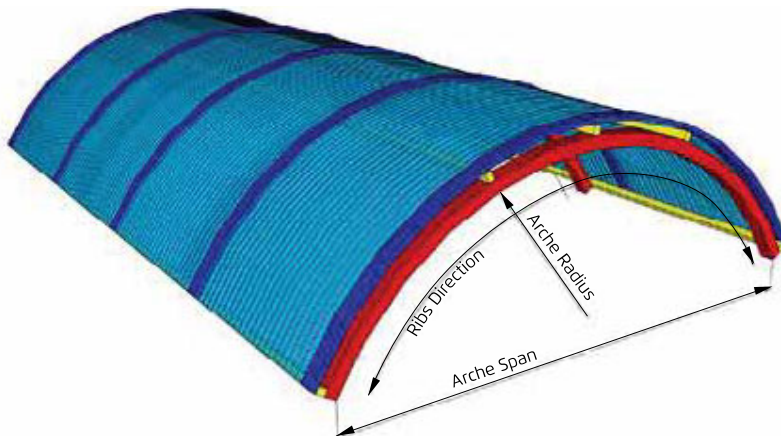
Loss of „Impact strength in the event of hail“ shall be determined by an impact test according to ASTM-D-5628-95 geometry FE (tup diameter 20mm). In this test, failure is determined when the upper wall of the panel is penetrated by the tup. The panel does not reach the required standard if the Mean Failure Energy obtained in the test is less than 0.831 Joule. This energy is equal to the energy generated by a 20 mm diameter ice ball at a speed of 21 m/s.

## 5.6 Bending the sheet

Plazit-Polygal TOPGAL panels can be successfully cold curved over curved support glazing profiles, to suit many glazing applications, e.g. domes, roof lights, etc. Providing the radius is not below the minimum recommended value, then the introduced stress by cold curving will not have any adverse effect upon the mechanical performance of the panel. Panels must always be bent longitudinally, never across the width of the panel.

Panel Thickness (mm)	Minimum cold bending radius* (mm)
6	1200
8	1800
10	2000
16	3200
20	4000

\* Valid for panels with standard weight only



## 5.7 Durability

The durability of the panel is demonstrated, according to EN 16153, by testing the panel properties before, during and after artificial ageing.

The properties to test are the Yellowness Index (YI) and the Light Transmission (LT).

There are two levels of radiant exposure in the total daylight range (300 nm to 2500 nm) to consider:

- 18 GJ/m<sup>2</sup> (5000 kWh/m<sup>2</sup>) which is 30% more than the highest Direct Normal Irradiation occurrence on the globe.
- 10 GJ/m<sup>2</sup> (2778 kWh/m<sup>2</sup>) which is reached in Australia, South Africa, South-West USA, North Chile and Argentina.

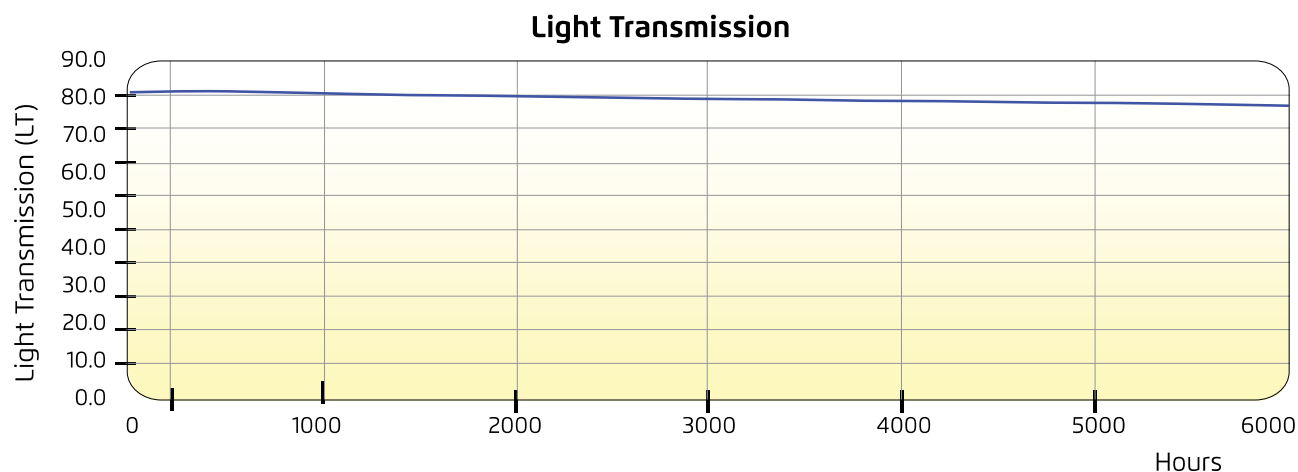
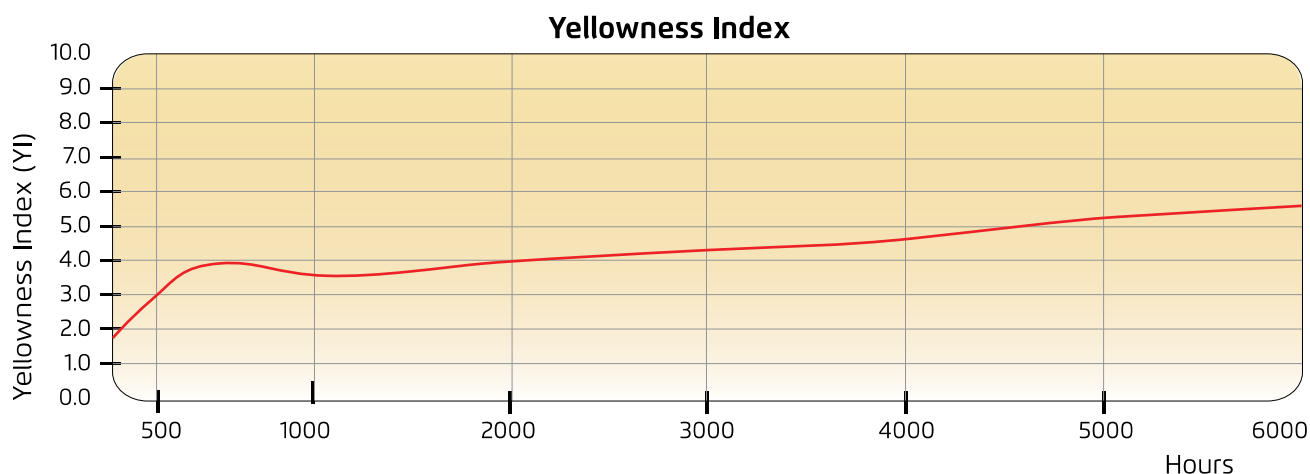
For safety reasons, all Plazit-Polygal PC products data relate to the 18 GJ/m<sup>2</sup> radiant exposure level.

For the purpose of durability assessment, sheet samples are measured for YI and LT and placed in a Xenon ageing tester. Both properties are measured in intervals, until the 18 GJ/m<sup>2</sup> level is reached. A clear product is classified ΔA when the variation in YI is less than 10 units and the variation in LT is less than 5% of the unexposed sample.

A colored product which has the same PC material as the clear product and the same UV protection, is classified ΔD without further testing.

Regarding the mechanical properties (E-Modulus and tensile strength), a sample which has been classified according to the above, is assumed to lose less than 10% of its original value.

See below a typical graph of YI and LT vs exposure time:



# User Guide



## 6. User guide information

### 6.1 Packaging

Plazit-Polygal TOPGAL panels and profiles are generally delivered in 20' and 40' box containers, protected on both sides by polyethylene sheets against scratching, and secured to prevent damage from movement within the container. The panel ends are sealed with masking tape to prevent dust and insects from entering into the fluting of the panels.

The maximum panel length is 5.8 meters for a 20' container and 11.8 meters for a 40' container. Shipping of panels of different lengths should be coordinated in advance with the regional sales manager. It is recommended to unload the containers by hand using a slanted roller conveyor with adjustable height.

PC products must be stored away from exposure to sunlight and according to the company's storage guidelines.

### 6.2 Storage

Store in dry, dark & well-ventilated area, with NO EXPOSURE to sunlight, wind, dirt or hard objects to prevent damage.

Store on a flat clean raised surface and placed on a soft material (cardboard) to prevent damage. Supported, sloped stacking is recommended. If stacked flat, stack to a maximum height of 1 meter (3 feet).

Outdoors, PC products should be covered with an opaque material (cardboard, wood, EPDM sheet etc.) that provides protection from the sun.

Outdoors, storage of PC products exposed to sun light will cause the protective polyethylene film to bake onto the sheet, and it WILL NOT BE ABLE TO BE REMOVED.

Outdoors, DO NOT store PC products under flexible PVC coverings.

### 6.3 Cleaning

Plazit-Polygal PC products - will give longer and better service life with simple cleaning:

- Rinse sheet with water
- Use warm soapy (mild liquid dish soap) water to clean sheets. If any dirt remains, gently wipe off with a soft cloth.
- Apply final rinse and dry with soft cloth, if possible, to prevent water spotting.

DO NOT use sponges, squeegees, brushes or sharp instruments as they may damage the UV protective coating and surface.

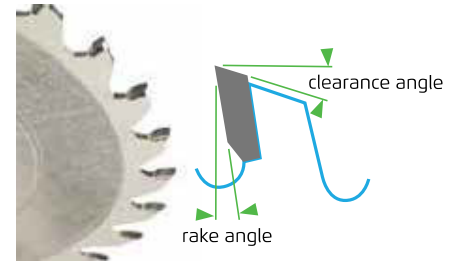
## 6.4 Additional Operations

**Cutting** - Plazit-Polygal Multi wall panel can be cut easily and accurately with standard workshop equipment. This includes standard circular, jig, or table saw with a blade having 8-12 teeth per inch. Saw dust should be blown out of the channels using clean compressed air. Circular saws should have fine-toothed panel blades. Thinner gauges can be cut with a box knife. It is important that the knife is sharp.

**Trimming** - standard box cutting knife.

Sawing recommendations:

	Circular saw	Bandsaw
Clearavce angle	20° - 30°	327
Rake angle	15°	0.5°
Cutting speed	180 - 250 m/min	200 - 250 m/min
Blade or hand speed	1800 - 2400 m/min	-
Tooth spacing	2-5 mm	1.5 - 2.5 mm



**Drilling** - Holes can be drilled by a power drill using standard high-speed steel twist drills or drills with an angular wedged bid. When drilling, support should be given immediately beneath the drill to avoid vibration.

Very clean holes are easily obtained. All holes should be drilled at least 40 mm from the edge of the sheet. The clearance angle should be 15° whereas the rake angle should be 0° - 5°. The use of liquid cooling media is not recommended.

Drilling recommendations:

	Hole diameter (mm)	Speed (rev/min)
Clearavce angle	20° - 30°	327
Rake angle	15°	0.5°
Cutting speed	180 - 250 m/min	200 - 250 m/min
Blade or hand speed	1800 - 2400 m/min	-
Tooth spacing	2 - 5 mm	1.5 - 2.5 mm

**Bonding** - Adhesive bonding can be accomplished by using chemically and physically compatible elastomeric adhesives. Plazit-Polygal Multi Wall panels can be bonded to various plastics, glass, metals and other materials. Choice of the bonding agent depends on flexibility, heat resistance, appearance, etc.

**Cold forming** - Plazit-Polygal Multi Wall panels can be easily sprung into arches. The arch must be parallel to the ribs (see Section 4.6, minimum radius)



