

## TECHNICAL INFORMATION

### MONOGAL / PLAZCARB EXTRUDED POLYCARBONATE SHEET

**Sheets are produced according to ISO 11963:2012 standard.**

MONOGAL / PLAZCARB sheets are made from UV stabilized polycarbonate (PC) and are suitable for indoor applications, in areas where not in contact with UV radiation.

MONOGAL / PLAZCARB UV sheets are protected with an additional UV-blocking co-extrusion layer from one side and are suitable for applications where in contact with UV radiation from one side only.

MONOGAL / PLAZCARB 2UV sheets are protected with additional UV-blocking co-extrusion layers from both sides and are suitable for outdoor applications.

MONOGAL F / PLAZCARB F (Standard, UV or 2UV) are fire-retardant PC sheets.

## 1 – Dimensions

### Standard Sizes

Thickness	0.75 – 19.0	mm
Width	1000, 1220 and 2050	mm
Length	600 – 6000	mm

Sheets are also available cut to size, according to customer requirements

### Thicknesses Tolerances (25°C)

- Less than 1.5mm                    ±8%
- Between 1.5 - 1.9 mm           ±4%
- Between 2.0 - 14.9 mm         ±3%
- Between 15.0 - 19.0 mm       ±5%

### Width, Length and Diagonals Tolerances (25°C)

#### A - Sheets cut at production:

- Width & Length: -0.0 /+3.0 mm
- Diagonals:  
Up to 4000 mm - up to 2.0 mm  
Over 4000 mm - up to 4.0 mm

#### B - Sheets cut to size

- Width                                    ± 0.50 mm
- Length                                   ± 0.50 mm
- Diagonals:                            up to 0.5 mm

Flatness:

The maximum allowable bow for Monogal / Plazcarb extruded sheets, as manufactured, will be 0.5% of linear dimensions. Maximum bow allowed across the width of the sheet shall be  $\leq 5$  mm per meter of width. Maximum bow allowed along the length of the sheet shall be  $\leq 5$  mm per meter of length.

Flatness is measured on one single sheet placed on a flat and rigid surface.

2 - Optical Quality

Sheets are examined according to several parameters that determine their optical quality.

Maximum number of faults are as follows:

- Black specks of 0.5 mm in size, with a minimum distance between them of 1 meter.
- Air bubbles of 0.3 mm in size, with a minimum distance between them of 1 meter.
- Fish eyes of 1 mm in size, when there are no more than five (5) on an area of 0.5 m<sup>2</sup>.

3 - Shrinkage

During the extrusion process, PC sheets are formed and cooled while stretched. PC has a memory and when heated will shrink, especially in the extrusion direction, trying to get back to its relaxed form before extrusion.

This characteristic of Monogal / Palzcarb should be taken into account when planning the final sheet's dimensions.

<i>Sheet Thickness (mm)</i>	<i>Shrinkage M.D*</i>	<i>Shrinkage T.D*</i>
1.80 – 2.30	6% – 7%	0.5%
2.30 – 3.50	5% – 6%	0.5%
3.50 – 4.00	3% – 4%	0.5%
4.00 – 6.00	2% – 3%	0.5%
6.00 ++	2%	0.5%

\*M.D – Machine (extrusion) direction

\*T.D – Transverse (perpendicular to extrusion) direction

4 - Colors

Monogal /Plazcarb sheets are naturally colorless and exceptionally clear, however they can be pigmented to obtain a wide range of tints and colors. They are available transparent and in a wide range of translucent colors, opaque colors, opals and diffusers. Monogal / Palzcarb colored sheets maintain the same light transmission percentages regardless of thickness (except for opals, diffusers and LEDs). For a list of updated colors please contact your regional supplier.

## 5 – Typical Properties Values

Please note that the technical values given in the following tables are typical values for guidance and they are subjected to certain variability.

### Typical Properties – Monogal / Plazcarb – Extruded Polycarbonate Sheets

Properties	Method	Units	Monogal Plazcarb (R8000)
<b>General</b>			
Density	ISO 1183	g/cm <sup>3</sup>	1.2
Water Absorption	ISO 62 (1)	%	0.15
<b>Mechanical</b>			
Tensile Strength at Yield	ISO 527-2	MPa	60
Elongation at Yield	ISO 527-2	%	6
Elongation at Break	ISO 527-2	%	> 120
Tensile Modulus	ISO 527-2	MPa	2300
Flexural Strength	ISO 178	MPa	90
Flexural Modulus	ISO 178	MPa	2300
Impact Resistance (Charpy unnotched)	ISO 179/1fu	kJ/m <sup>2</sup>	No Break
Impact Resistance (Izod notched)	ISO 180/1A	kJ/m <sup>2</sup>	> 65
<b>Optical</b>			
Refractive Index	ISO 489		1.585
Light Transmission (thickness dependent)	ASTM D1003	%	81-90
Haze (3 mm transparent sheet)	ASTM D1003	%	< 1
<b>Thermal</b>			
Vicat Softening Temp.(50N)	ISO 306	°C	144
Heat Deflection Temp. (1.82 MPa)	ISO 75-1	°C	130
Coeff. of Linear Thermal Expansion (0-50°C)		µm/m°C	6.5
Thermal Conductivity	ASTM C177	W/mK	0.2
Maximum Continuous Service Temp.		°C	100
Maximum Short Time Service Temp.		°C	120
Minimum Temp.		°C	-50
<b>Electrical</b>			
Dielectric Constant (50Hz)	DIN 53483		3.0
Dissipation Factor tanδ (100Hz)	DIN 53483		0.0006
Dissipation Factor tanδ (1 MHz)	DIN 53483		0.009
Volume Resistivity	IEC 60093	Ohm.cm	>10 <sup>14</sup>
Surface Resistivity	IEC 60093	Ohm	>10 <sup>15</sup>

### Fire Properties

PC is a thermoplastic, therefore it will eventually melt and burn under the intense heat of fire. However, PC is considered a self-extinguish material meaning it will stop burning when the fire source is taken away. Monogal / Plazcarb sheets, unlike other materials do not produce toxic or corrosive gases when burning.

Monogal / Plazcarb extruded PC sheets classify:

- HB according to UL94 for thin gauge sheets
- V2 according to UL94 for higher gauge sheets
- V0 for fire retardant "F" grades
- B, s1, do according to UNE-EN ISO 13501 (specific thicknesses)

### Chemical Properties

Some chemical substances do not produce any effect on Plazcarb / Monogal, some cause staining, swelling, crazing, weakening or dissolve it completely. Plazcarb / Monogal sheets have good resistance mineral acids, many organic acids, neutral and acid salt solutions, oxidizing and reducing agents, aliphatic hydrocarbons, greases, waxes and oils and alcohols (except methanol). They have a good resistance to water up to 60°. A short contact with hot water will cause no effect, however, long exposition of PC to hot water or water vapor is not recommended.

### Important Note:

Any substance that comes with contact with Polycarbonate should be checked for compatibility. Even if the supplier confirms that the material is suitable for Polycarbonate, please apply it first to a hidden area to see if there are any effects. However this will cover you for short-time effects only. To assess long-term effects of substances on Polycarbonate, laboratory testing is required.

### ESC (Environmental Stress Cracking)

ESC (Environmental Stress Cracking) is a well-known phenomenon in plastics including PC, and a common reason of product failure. ESC is a result of the combination of stress and chemical exposure. Under harsh chemical environment, stressed sheets will fail by cracking and crazing. The level of stress needed for ESC is lower than the normal failure mechanical stress of PC in a chemical-free environment. Stresses can be induced during forming and fabrication. These can be eliminated by an annealing process (see Monogal / Plazcarb Guidebook for machining and forming instructions). Stresses can be induced also by improper installation (see Monogal / Plazcarb Guidebook for installation instructions). Cold bended sheets under permanent induced stress or sheets under periodic stress (fatigue) are also susceptible to ESC.

## 6 - Handling Monogal / Plazcarb Sheets

### Burning Behavior

Under intense heat or fire Monogal / Plazcarb sheets will melt and burn. When storing or working with Monogal / Plazcarb the necessary fire precautions must be considered.

### Sheets Storage

Monogal / Plazcarb sheets must be stored with their original protective masking in a cool, dry and well-ventilated room, at a reasonable constant temperature, away from direct sunlight, excessive humidity, rain or solvent's vapors. Never leave the sheets on uncovered pellets. Failing to store Monogal / Plazcarb in adequate conditions can compromise the performance of the product. Long term exposure to the sun or other heat sources can cause fusing of the protective polyethylene film to the sheet surface, impeding its removal.

Monogal / Plazcarb sheets are best stored horizontally on their delivery pallets. Pay attention to avoid pressure on the unsupported areas.

### Protective Film

Both surfaces of Monogal / Plazcarb sheets are protected by a fully recyclable polyethylene (PE) film. Keep this film in position as long as possible and remove only and immediately after installation. Sharp objects, sharp particles or even small chips can penetrate the protective PE masking, and damage the surface, therefore always lay Monogal / Plazcarb on a clean smooth surface.

Monogal / Plazcarb protective film is suitable for thermoforming.

### Machining and Forming with PE Film

It is preferable to leave the protective film in position throughout machining to keep the sheet surface in perfect condition. Normal thermoforming temperatures do not affect the adhesive used for the film on Monogal / Plazcarb sheets and can therefore be left in place during most heating and forming operations. However, care should be taken to ensure there are no defects in the film (holes, scratches, bubbles), which could mark the part during the forming process. High-heat deep-draw thermoforming applications can cause the PE film to adhere more strongly. Printed film must be removed before thermoforming, to avoid transfer of the printing ink to the sheet's surface.

### Cleaning Monogal / Plazcarb Sheets

Monogal / Plazcarb sheets are produced in clean room environment and do not need to be cleaned before use. However, cleaning may be needed after fabrication, before sensitive processes like vacuum metallization or printing or for maintenance during use. In the case that Monogal / Plazcarb sheets needs to be cleaned, wash the sheet surface with clean fresh water with a mild soap. Be sure that the soap you are using is compatible with PC. Test a hidden area before cleaning. Use a clean, soft cloth or sponge and rinse well. Do not scrub or use brushes. Dry with a soft cloth. Do not rub dry. The use of window cleaning fluids or solvents such as alcohols, turpentine, acetone, etc., can cause damage to the sheet.

### Monogal / Plazcarb Environmental Advantages

Monogal / Plazcarb sheets are environmental friendly. The long-time resistance to aging and weathering of Monogal / Plazcarb sheets often ensures a service time of decades. They do not need to be removed or replaced for many years reducing the environmental burden of plastics waste. The sheets and their polyethylene protective layers are fully recyclable. They do not contain any toxic materials or heavy metals, which may cause environmental damage or health risks. Ozone Depleting Substances (ODP) are not used in the manufacture of Monogal / Plazcarb sheets. Monogal / Plazcarb do not release pollutant substances to the environment during manufacture. They do not produce toxic or corrosive gases upon burning. Fires can be extinguished with water.

Monogal / Plazcarb sheets can be used for energy recovery and chemical or mechanical recycling. Monogal / Plazcarb scrap is not classified as hazardous waste. Small amounts can be disposed as household refuse. Large quantities should be disposed for recycling.

### Working with Monogal / Plazcarb Sheets

For general guidelines about how to work with Monogal / Plazcarb sheets please refer the Monogal / Plazcarb Guidebook.

All information, recommendations or technical advice given in this technical sheet, is given in good faith, to the best of our knowledge and based on our present experience and procedures. However, no liability or other legal responsibility is assumed for the full adequacy, accuracy or completeness of this information. We reserve the right to make any changes, according to technological progress and further developments. The customer is not released from the obligation to conduct careful inspection and testing of incoming goods.

Product design using Monogal/Plazcarb sheets must be carried out only by qualified experts in the sole responsibility of the customer. Performance should be verified by testing, carried out only by qualified experts in the sole responsibility of the customer.