

TUFFAK / MONOGAL / PLAZCARB "MRT" QUALITY POLYCARBONATE SHEET



Monogal / Plazcarb "MRT" are polycarbonate (PC) sheets specially designed for optical applications. They are produced using special materials in dedicated production lines with rigorous clean room environment and computerized state-of-the-art video technology in order to detect very small imperfections.

1. DIMENSIONS

Standard Sizes

Thickness 0.5 - 2.0 mm

Width ≤ 1250 mm

Length 600 - 4000 mm

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

Thicknesses Tolerances (25°C)

0.5 - 0.65 mm ±2%

0.8 - 2.0 mm ±5%

Width, Length and Diagonals Tolerances (25°C)

A - Sheets cut at production:

- Length: -0.0 /+3.0 mm
- Width: -0.0 /+2.0 mm
- Diagonals: ±2.0 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 "MRT" sheets, as manufactured, will be 0.5 % of linear dimensions. 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.

| Defect | Inspection Method | Quality Standard |
|-------------|---|---|
| Scratch | Eye test from 350 mm at angle of 25°- 45° | Slight, moderate scratches seen in an angle of less than 25° are allowed. Obvious scratches are not allowed. |
| Dirt | | Not allowed |
| Ripple | | Moderate ripple is allowed. Obvious ripple is not allowed |
| Grain (Dot) | Eye test from 350 mm under daylight lamp of 1000 Lux | - Dots < 0.3 mm ² allowed - 50 dots, 0.3 - 0.5 mm ² , per m ² allowed - 8 dots, 0.5 - 0.8 mm ² , per m ² allowed - Dots > 0.8 mm ² not allowed |
| Bubble | | Bubbles > 0.3 mm ² not allowed |
| Black specs | | Black specs < 0.3 mm ² , with a minimum distance between them of 0.5 meters, allowed |
| Edges | | Tidy and clear edges, no cracks allowed. |

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3. PROTECTIVE PE FILM

Both surfaces of Monogal / Plazcarb "MRT" 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 "MRT" sheets on a clean smooth surface.

The PE cover is examined according to several parameters that determine its quality.

| Defect | Inspection Method | Quality Standard |
|--------------|-------------------------|--|
| Uniformity | | Area with ripples < 1% |
| Dust | Eye test over light box | Slight dust below the edge of the sheet, up to 2mm from the edge, is allowed |
| Scratch | | Not allowed if it cuts through until the sheet surface |
| Glue Residue | | Not allowed |

4. 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.

| Properties | Method | Units | Monogal / Plazcarb MRT |
|---|-------------|-------------------|------------------------|
| General | | | |
| Density | ISO 1183 | g/cm ³ | 1.2 |
| Water Absorption (23°C) | ISO 62 (1) | % | 0.15 |
| Mechanical | | | |
| 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 ² | No Break |
| Impact Resistance (Izod notched) | ISO 180/1A | kJ/m ² | > 65 |
| Optical | | | |
| Refractive Index | ISO 489 | | 1.585 |
| Light Transmission (thickness dependent) | ASTM D1003 | % | 81-90 |
| Haze (3 mm transparent sheet) | ASTM D1003 | % | < 1 |
| Thermal | | | |
| Vicat Softening Temp.(50N) | ISO 306 | °C | 144 |
| Heat Deflection Temp. (1.82 MPa) | ISO 75-1 | °C | 130 |
| Coeff. of Linear Thermal Expansion (0-500C) | | 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 |
| Electrical | | | |
| 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 ¹⁴ |
| Surface Resistivity | IEC 60093 | Ohm | >10 ¹⁵ |

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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 MRT sheets, unlike other materials do not produce toxic or corrosive gases when burning.

Monogal / Plazcarb MRT extruded PC sheets classify HB according to UL94.

Chemical Properties

Some chemical substances do not produce any effect on Monogal / Plazcarb MRT, some cause staining, swelling, crazing, weakening or dissolve it completely. Monogal / Plazcarb MRT sheets have good resistance to mineral acids, many organic acids, neutral and acid salt solutions, oxidizing and reducing agents, aliphatic hydrocarbons, greases, waxes, 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.

5 - Handling Monogal / Plazcarb MRT Sheets

Burning Behavior

Under intense heat or fire Monogal / Plazcarb MRT sheets will melt and burn.

When storing or working with Monogal / Plazcarb MRT the necessary fire precautions must be considered.

Sheets Storage

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

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Protective Film

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Monogal / Plazcarb MRT 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 MRT 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 MRT Sheets

Monogal / Plazcarb MRT 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 MRT sheets need 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 MRT Environmental Advantages

Monogal / Plazcarb MRT sheets are environmental friendly. The long-time resistance to aging and weathering of Monogal / Plazcarb MRT 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 MRT sheets. Monogal / Plazcarb MRT do not release pollutant substances to the environment during manufacture. They do not produce toxic or corrosive gases upon burning. Fire can be extinguished with water. Monogal / Plazcarb MRT sheets can be used for energy recovery and chemical or mechanical recycling. Monogal/ Plazcarb MRT 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 MRT Sheets

For general guidelines about how to work with Monogal / Plazcarb MRT 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 MRT 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.

These suggestions and data are based on information we believe to be reliable. They are offered in good faith, but without guarantee, as conditions and methods of use are beyond our control. We recommend that the prospective user determines the suitability of our materials and suggestions before adopting them on a commercial scale.

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