

POLYCASA PS

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POLYCASA PS

1. PRODUCT IDENTIFICATION

POLYCASA PS is the brand name for extruded Crystal Clear Polystyrene sheets from POLYCASA. The POLYCASA PS programme offers solutions for many indoor applications.

As a result of the extrusion process, POLYCASA can offer, apart from the clear, the anti-reflex and the standard opal white versions, a variety of colours and designs.

2. CHARACTERISTICS

POLYCASA PS sheets have good optical properties and a brilliant surface. The POLYCASA PS range contains sheets that are easy to fabricate, to vacuum form, and show a high light transmission (min 88% wavelength: 500 nm, thickness 3 mm).

Important benefits of POLYCASA PS sheets are their low price, low density (1.05), good chemical resistance and high rigidity. As a standard POLYCASA PS sheets are UV-stabilised and remain colour constant for many years when used indoors.

On special request POLYCASA PS sheets can be produced without UV-stabilisation. They then meet all current food contact legislation and can be used in contact with foodstuffs.

POLYCASA PS sheets also combine the following excellent properties:

- Excellent transparency
- Good surface hardness
- Good recyclability
- Low water absorption

3. APPLICATIONS

- Picture frames
- Shower cabin doors (flat and curved)
- Indoor glazing

4. FABRICATION AND FINISHING TECHNIQUES

POLYCASA PS sheets are easy to handle. POLYCASA offers a whole range of fabrication activities such as sawing, curving, drilling, etc. Contact your sales office for more information.

POLYCASA PS sheets can be machined using all the usual methods, such as sawing, milling, drilling, turning, grinding, polishing and thermoforming. More detailed information on these items can be found in the chapter "USER GUIDE", further in this brochure.

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5. STATEMENTS AND CERTIFICATES

5.1. Food approval statement

On request POLYCASA PS sheets can be produced without UV-stabilisation and they then can be used in contact with foodstuffs. Therefore, in applications where covers for foodstuffs or fittings for shops etc. are needed, POLYCASA PS Food Grade can offer a good solution.

POLYCASA PS food grade sheets are clear transparent extruded crystal Polystyrene sheets which are produced from raw materials which meet the compositional requirements of FDA (21 CFR 177.1640), BGA (recommendation V), European frame work 1935/2004/EC including European ordinance 10/2011 (former 2002/72/EEC).

It is the responsibility of the end user to verify whether the product is fit for purpose and meets the required migrational requirements for his application.

5.2 Fire classification according to European standards

- Europe13501-1 (formerly DIN 4102-1) Euroclass E (Fomerly B2)

5.3 Quality management

POLYCASA PS sheets are manufactured and audited for quality in compliance with the certified and regularly audited production and quality management system according to EN ISO 9001:2008.

5.4 Product safety statement

Product handling information documents for PS sheets are available on request.

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6. TECHNICAL INFORMATION

6.1. Technical data sheet

GENERAL			
Property	Method	Units	POLYCASA PS
Density	ISO 1183	g/cm ³	1,05
Rockwell Hardness	ISO 2039-1	M scale	150
OPTICAL			
Property	Method	Units	POLYCASA PS
Light Transmission	DIN 5036-3	%	89
Refractive Index	ISO 489	n ^D ₂₀	1.59
MECHANICAL			
Property	Method	Units	POLYCASA PS
Flexural Modulus	ISO 178	MPa	3450
Flexural Strength	ISO 178	MPa	85
Tensile Modulus	ISO 527-2	MPa	3400
Tensile Strength	ISO 527-2	MPa	45
Elongation	ISO 527-2	%	3
THERMAL			
Property	Method	Units	POLYCASA PS
Vicat Temp. (VST/B 50)	ISO 306	°C	101
Heat Deflection Temp. (A)	ISO 75-2	°C	86
Specific Heat Capacity	ASTM D-2766	J/gK	1.8
Coefficient of linear thermal expansion	DIN 53752	K ⁻¹ x10 ⁻⁵	8
Thermal conductivity	DIN 52612	W/mK	0.16
Degradation temperature		°C	> 280
Max service temperature		°C	80
Sheet forming temp. range		°C	130-170
IMPACT STRENGTHS			
Property	Method	Units	POLYCASA PS
Charpy (notched)	ISO 179-1	kJ/m ²	-
Charpy (unnotched)	ISO 179-1	kJ/m ²	6
ELECTRICAL			
Property	Method	Units	POLYCASA PS
Volume Resistivity	DIN 53482	Ω.cm	> 10 ¹⁴
Surface Resistivity	DIN 53482	Ω	> 10 ¹⁴

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■ Chemical resistance at 20°C

Acetone	-	Glycols	+
Acids (weak solution)	+	Glycerine	+
Alcohols		Hexane	+
Ethyl	+	Methylene chloride	-
Isopropyl	+	Methyl ethyl ketone	-
Methyl	+	Mineral Oil	+
Ammonia (weak solution)	+	Paraffin	+
Benzene	-	Toluene	-
Carbon tetrachloride	-	Sodium Chloride (aq)	+
Chloroform	-	Sodium Hydroxide (aq)	+
Ethyl Acetate	-		

- Attacked

+ Not attacked

6.2. Product range POLYCASA PS

6.2.1. POLYCASA PS flat sheets

POLYCASA PS flat sheets are laminated on both sides with a PE-film.

■ Thickness Range

- From 0.85 mm up to 5.00 mm

■ Widths cut-on-line

- Min 500 mm
- Max 1250 mm for 0.85 mm up to 1,49 mm
- Max 2050 mm for 1.5 mm up to 5.00 mm

■ Lengths cut-on-line

- Min 1000 mm
- Max 2500 mm for 0,85 mm up to 1,49 mm
- Max 6000 mm for 1,50 mm up to 5,00 mm

■ Thickness tolerances (at 20°C)

- ≤ 2.5 mm ± 10 %
- > 2.5 mm ± 5 %

■ Cut-on-line tolerances (at 20°C)

- < 1000 mm ± 1.5 mm
- 1001 to 2000 mm -0/+6 mm
- >2000 mm -0/+9 mm

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■ Cut-to-size tolerances (at 20°C)

- for sizes ≤ 1000 mm ± 0.50 mm
- for sizes > 1000 mm ± 1.00 mm

■ Minimum production runs for

- Special thickness 2.000 kg
- Special pattern 3.000 kg
- Special colour 5.000 kg*
- Special dimensions 1.000 kg

*For more details, please contact our sales dept.

Other thicknesses, sizes and tolerances on request. For the standard stock programme see our product selector.

6.2.2. POLYCASA PS patterned sheets

POLYCASA PS patterned sheets are laminated only on the smooth side with a PE-film.

■ Thickness Range

- From 1.7 mm up to 5.00 mm

■ Widths cut-on-line

- Min 170 mm
- Max 1250 mm for $t < 2.0$ mm
- Max 1350 mm for $2.0 \leq t \leq 2.49$ mm
- Max 1500 mm for $t > 2.49$ mm

■ Lengths cut-on-line

- Min 1000 mm
- Max 2500 mm

■ Thickness tolerances (at 20°C)

- +/- 0.1mm

Thickness tolerances for patterns are to be measured on highest point of pattern.

■ Cut-on-line tolerances (at 20°C)

- ± 1.5 mm

■ Cut-to-size tolerances (at 20°C)

- for sizes ≤ 1000 mm ± 0.50 mm
- for sizes > 1000 mm ± 1.00 mm

■ Minimum production runs for

- Special thickness 1.000 kg
- Special pattern 3.000 kg
- Special colour 1.000 kg
- Special dimensions 250 kg

Other thicknesses, sizes and tolerances on request. For the standard stock programme see our product selector.

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7. USER GUIDE

7.1. Introduction

The manufacture of plastic articles from POLYCASA PS sheet normally involves secondary fabrication operations, including sawing, drilling, bending, decorating, and assembling. This guide covers the properties and characteristics of POLYCASA PS that need to be taken into account if secondary operations are to be performed successfully.

7.2. Fabricating

7.2.1. Machining guidelines

POLYCASA PS sheet can be worked with most tools used for machining wood or metal. Tool speeds should be such that the sheet does not melt from frictional heat. In general, the highest speed at which overheating of the tool or plastic does not occur will give the best results.

It is important to keep cutting tools sharp at all times. Hard, wear-resistant tools with greater cutting clearances than those used for cutting metal are suggested. High-speed or carbon-tipped tools are efficient for long runs and provide accuracy and uniformity of finish.

Since plastics are poor heat conductors, the heat generated by machining operations must be absorbed by the tool or carried away by coolant. A jet of air directed on the cutting edge aids in cooling the tool and in removing chips.

Plain water or soapy water is sometimes used for cooling unless the trim scrap is to be reused.

7.2.2. Milling

Sheet manufactured from POLYCASA PS can be machined with standard high-speed milling cutters for metal, provided they have sharp edges and adequate clearance at the heel.

7.2.3. Drilling

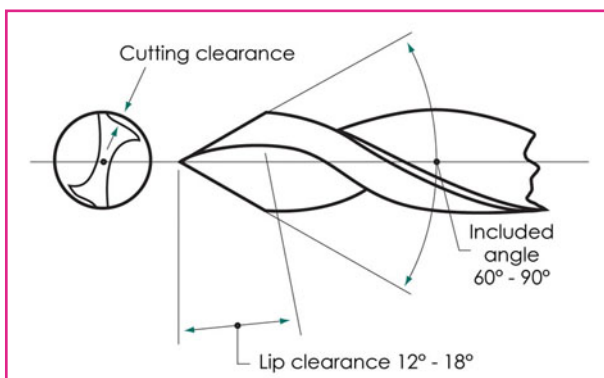


Figure 1
Suggested drill-point design for drilling plastic sheet

Drills designed especially for plastics are available, and their use is suggested. Standard twist drills for wood or metal can be used; however they require slower speeds and feed rates to produce a clean hole. Twist drills for plastics should have 2 flutes, a point with an included angle of 60° to 90°, and a lip clearance of 12° to 18°, as shown in figure 1.

Wide, highly polished flutes are desirable since they expel the chips with low friction and thus tend to avoid overheating and consequent gumming. Drills should be backed out often to free chips, especially when drilling deep holes. Peripheral speeds of twist drills for plastics ordinarily range from 30 to 61 m per minute. The rate of drill feed into the plastic sheet generally varies from 0.25 to 0.63 mm per revolution.

NOTE:

When drilling, be sure to hold or clamp the part securely to prevent it from cracking or slipping and presenting a safety hazard to the operator.

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7.2.4. Sawing

Following types of sawing operations can be used to saw thermoplastic materials: band saw, circular saw and jigsaw as well as hand operated saws.

It is recommended that new or well-sharpened tools are used. At very high cutting speeds, the saw blade should be cooled with water or an alternative appropriate cooling emulsion.

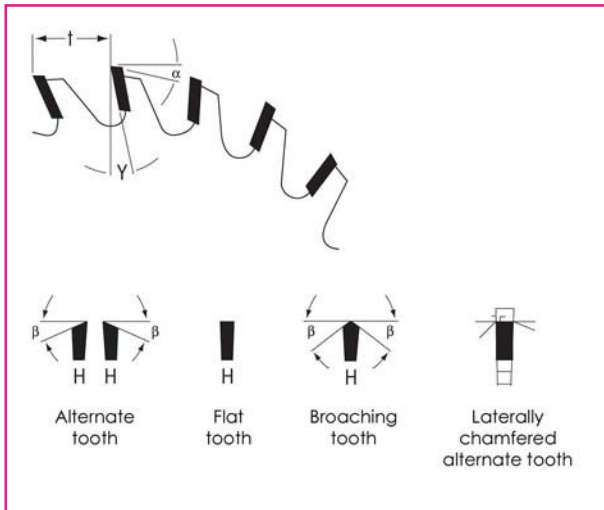


Figure 2
Example of Sawblades

Type of sawing	Band saw	Circular saw
Tooth distance	sheet thickness below 3 mm, 1 to 2 mm	8 to 12 mm
	sheet thickness 3 to 12 mm, 2 to 3 mm	8 to 12 mm
Clearance angle α	30 to 40°	15°
Rake angle ψ	15°	10°
Tooth angle β	-	15°
Cutting speed	1200 - 1700 m/min	2500 - 4000 m/min
Feed speed	-	30 m/min

Table 1

Sawing recommendations

7.2.5. Routing

Routers with sharp two-flute straight cutters produce very smooth edges. They are useful for trimming the edges of flat or formed parts, particularly when the part is too large or irregular in shape for a band saw. Portable, overarm, and under-the-table routers work equally well. The plastic sheet should be fed to the router slowly to avoid excessive frictional heating and shattering. The router or plastic sheet, whichever is moving, must be guided with a suitable jig. Compressed air can be used during the routing operation to cool the bit and aid in chip removal.

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7.3. Forming

7.3.1. Thermoforming

There are a number of different thermoforming techniques that can, under well-controlled conditions, be used to form POLYCASA PS sheet, once heated, into the shape of a mould by mechanical, air pressure, or vacuum forces. Both male (plug) and female (cavity) moulds are used. Tooling can range from low cost plaster moulds to expensive water cooled steel moulds but cast aluminium is more commonly used. Other materials including wood, gypsum, and epoxy can also be used. Forming processes to be discussed include straight vacuum, drape, matched mould, pressure-bubble plug-assist, plug-assist pressure, vacuum snap-back, pressure-bubble vacuum snap-back, trapped-sheet contact-pressure, free, and mechanical. In the event that during the heating up of POLYCASA PS small bubbles appear, this is due to the fact that the sheets have absorbed moisture during storage. In this case, the sheets must be pre dried before they are worked on.

7.3.2. Straight vacuum forming

Vacuum forming is the most versatile and widely used forming process. The equipment costs less and is simpler to operate than most pressure or mechanical techniques. In straight vacuum forming, POLYCASA PS is clamped in a frame and heated. When the hot sheet is in an elastic state, it is placed over the female mould cavity. The air is then removed from the cavity by vacuum and atmospheric pressure then forces the hot sheet against the contours of the mould. When the POLYCASA PS sheet has cooled sufficiently, the formed part can be removed. Thinning at the upper edges of the part usually occurs with relatively deep moulds. The hot sheet being drawn to the centre of the mould first causes thinning. Sheeting at the edges of the mould must stretch the most and thus becomes the thinnest portion of the formed item. Straight vacuum forming is normally limited to simple, shallow designs. See figure 3 + 4

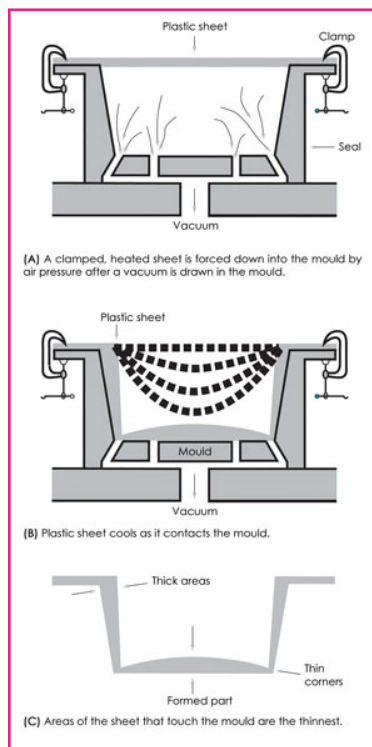


Figure 3
Straight vacuum forming

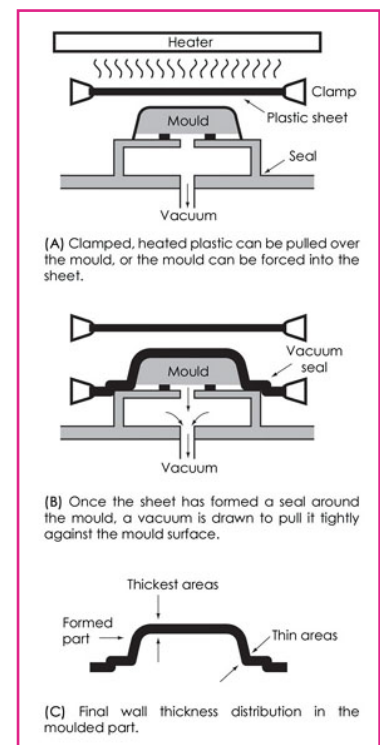


Figure 4
Drape forming

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7.3.3. Drape forming

Drape forming is similar to straight vacuum forming except that after the POLYCASA PS sheet is framed and heated, it is mechanically stretched, and a pressure differential is then applied to form the sheet over a male mould. In this case, however, the sheet touching the mould is close to its original thickness. It is possible to drape-form items with a depth-to-diameter ratio of approx. 4 to 1; however, the technique is more complex than straight vacuum forming. Male moulds are easier to build and generally cost less than female moulds; however, male moulds are more easily damaged. Drape forming can also be used with gravitational force alone. For multi-cavity forming, female moulds are preferred because they do not require as much spacing as male moulds.

See figure 4

7.3.4. Matched-mould forming

Matched-mould forming is similar to compression moulding in that heated POLYCASA PS sheet is trapped between male and female dies made of wood, plaster, epoxy or some other material.

Although they cost more, water-cooled matched moulds produce more accurate parts with close tolerances.

7.3.5. Pressure-bubble plug-assist vacuum forming

The pressure-bubble plug-assist vacuum forming technique can be used when POLYCASA PS sheet is to be formed into deep articles that must have good thickness uniformity. The sheet is placed in a frame and heated, and controlled air pressure is used to create a bubble. When the bubble has been stretched to a predetermined height, the male plug-assist (normally heated) is lowered to force the stretched sheet into the cavity. Plug speed and shape can be varied for improved material distribution; however, the plug is made as large as possible so that the plastic material is stretched close to the shape of the finished product. The plug should penetrate 75 to 85% of the mould cavity depth. Air pressure is then applied from the plug side while a vacuum assist is being drawn on the cavity. The female mould must be vented to allow the escape of trapped air.

7.3.6. Plug-assist pressure forming

Plug-assist pressure forming is similar to plug-assist vacuum forming in that a plug forces the hot POLYCASA PS sheet into a female cavity. Air pressure applied from the plug then forces the plastic sheet against the walls of the mould. Plug design and plug speed can be varied to optimize material distribution.

7.3.7. Plug-assist vacuum forming

Corner or periphery thinning of cup- or box-shaped articles can be prevented by use of a plug-assist to mechanically stretch and pull additional plastic material into the female cavity. The plug should be 10 to 20% smaller than the mould and should be heated to just under the forming temperature of the sheet. Once the plug has forced the hot sheet into the mould cavity, air is drawn from the mould to form the part.

Plug-assist vacuum forming and plug-assist pressure forming (see previous section) allow deep drawing and permit shorter cooling cycles and good wall thickness control. Both processes require close temperature control and are more complex than straight vacuum forming.

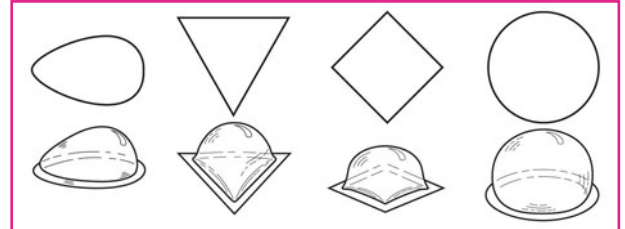
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7.3.8. Free forming

In free forming, air pressures of about 2.76 MPa can be used to blow a hot POLYCASA PS sheet through the silhouette of a female mould. Air pressure causes the sheet to form a smooth bubble-shaped article such as used in skylight panels or window well covers. Since only air touches each side of the pad, there will be no mark-off unless a stop is used to form a special contour in the bubble.

Figure 5

Examples of free-form shapes that can be obtained with openings



7.4. Assembly

POLYCASA PS sheet can be fabricated into a variety of shapes and articles with solvent, cement (a polymer dissolved in a solvent), or adhesive bonds. In general, when the surfaces to be joined are irregular, cement is preferred over a solvent.

Solvents and cements are not the best choice when bonding POLYCASA PS sheet to other thermoplastics. Adhesives, including cyanoacrylates, two-part acrylics and hot melts, are more effective when bonding POLYCASA PS to dissimilar plastics and can be used to bond POLYCASA PS to itself.

7.4.1. Assembly guidelines

The following guidelines should be observed when bonding POLYCASA PS sheeting:

- The sheet edges must be clean and free from contamination.
- The surfaces must be smooth and accurately aligned.
- A solvent or cement must be sufficiently active to soften the mating surfaces for some flow to occur when pressure is applied.
- When using solvents in POLYCASA PS sheet assembly, it is advisable that the work area be climate controlled with low humidity to minimise joint 'whitening'. If this is not possible, the addition of 10% glacial acetic acid to the solvent or use of a slower curing cement-type bond is suggested.
- Fixture pressure must be maintained to prevent movement of the joint until it is solid.
- Good ventilation is required when working with solvents. Exposure levels must be controlled according to OSHA guidelines.

7.4.2. Bonding techniques: solvents, cements and adhesives

Small articles with flat surfaces can be joined by placing the pieces together and applying the appropriate bonding agent (solvent, cement, or adhesive). Care should be taken to ensure that the joints are uniformly coated; a solvent can be effectively applied with a needle applicator. The assembly should be clamped into position until the bond is set. When larger articles are to be solvent bonded, it is best to immerse the joining surfaces in a solvent bath until the material is softened and then clamp them into position until the bond has set. A constant level of solvent immersion should be maintained in a shallow pan with a support pad, screens, and other means to ensure part-to-part uniformity.

Several solvents, cements, and adhesives provide strong bonds with good clarity when used in POLYCASA PS sheeting fabrication operations:

Material	Bond Type
Methyl Ethyl Ketone (MEK)	Solvent
Methylene Chloride	Solvent
Mixture of PS in a 50/50 mixture toluene/MEK (300 g PS/1000 g mixture)	Solvent
Super Glue Cyanoacrylate	Adhesive

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7.4.3. Mechanical fastening

POLYCASA PS sheet can be fabricated with mechanical fasteners into attractive joints.

The diameter of the holes should be oversized to allow movement of the assembly caused by thermal expansion. Screws and rivets provide permanent assembly. Standard nuts, bolts, and machine screws are used in many instances, in addition, special screws and rivets specially designed for use with plastics are available. Springs, clips, and nuts are low cost, rapid, mechanical fasteners. Hinges, knobs, catches and dowels are some other devices used in mechanical assemblies.

7.5. Finishing

7.5.1. Sanding

POLYCASA PS sheet is best sanded wet to avoid the frictional heat build-up that is characteristic of dry sanding techniques. If water coolants are used, the abrasive lasts longer and the cutting action increased. Progressively finer abrasives are used: for example, rough sanding with 80-grit silicon-carbide would be followed by finer sanding with 280-grit silicon-carbide, wet or dry. The final sanding may be with 400 or 600-grit sandpaper. After the sanding is finished and the abrasives removed, additional finishing operations may be required.

7.5.2. Joining

A standard woodworking jointer-planer will produce an accurately aligned and good quality finished edge on POLYCASA PS sheeting. Carbide or high speed blades, which have a longer life, will provide a uniform finish as well.

7.5.3. Filing

When many thermoplastics, including POLYCASA PS, are filed, a light powder that tends to clog some files is produced. Therefore, aluminium Type A, shear-tooth, or other files that have coarse, single-cut teeth with an angle of 45° are preferred.

7.5.4. Solvent polishing

The appearance of saw-cut edges can be improved by first sanding and then solvent polishing with MEK or methylene dichloride. It may be necessary to add a slow drying component such as diacetone alcohol to prevent humidity blush after drying.

NOTE:

When using solvents, proper ventilation of the area is essential. Follow all precautions listed on the Material Safety Data sheet supplied with the solvent being used.

7.5.5. Printing

POLYCASA PS sheeting can be printed with conventional equipment; however, the ink does not penetrate a plastic as it does with paper and cloth and is therefore subject to damage by abrasion. This can be minimised by applying a light coat of clear lacquer over the printing.

There are a number of different methods used when printing on plastics including letterpress, letter flex, dry offset, offset lithography, rotogravure, stencilling, and a commonly used silk screen process. In silk screening, the ink is spread on a fine metallic or fabric screen onto the product, and a squeegee is used to force the ink through the screen on the sheet.

Since each application may require a different type of ink, it is suggested that an ink manufacturer be consulted for recommendations.

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7.6. Vertical glazing

In order to determine the required dimensions for POLYCASA PS sheets, fixed on all sides, the following factors are to be taken into consideration:

- Coefficient of thermal expansion
80 x 10⁻⁶ corresponding to 0.08 mm per m length and a 1°C change of temperature.
- Inside width of the frame
The frames can be made of plastic, wood or metal. It is highly recommended that the frame rebate consist of relatively dense material. For a defined edge length, the frame must be larger and this according to the amounts indicated below:

Edge length	Addition
500 mm	3.0 mm
1000 mm	5.0 mm
1500 mm	7.0 mm
2000 mm	10.0 mm
3000 mm	15.0 mm

- Depth of rebate
The rebate should be approx. 25 mm deep.
- Length/width ratio
The figures take a length/width ratio of 1:1.5 up to 1: 3 into account.

Important when glazing with POLYCASA PS sheets:

- Care is to be taken when installing for adequate free space due to thermal expansion.
- The edging tape must not stick to the POLYCASA PS sheets. Rubber and plastic profiles without plasticizers can be used for the edging tape.
- The sealing medium must have permanent elasticity, suitable materials being polysulphides and silicon rubbers in a neutral position.

7.7. Curving capabilities

- All curves with radius between 450 mm and 570 mm
- Maximum sheet height: 1950 mm
- Maximum sheet width: 1000 mm
- Maximum sheet thickness: 5 mm
- Minimum sheet thickness: 2 mm
- Tolerances on Radius: ± 15 mm
 Length + width: ± 1 mm/m

Other materials, shapes, radius, thickness and dimensions must be tested prior to ordering.

NOTE: Two control tools for the radius (i.e. a curved profile where the sheet will be mounted in) must be sent to POLYCASA prior to the first order.

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7.8 Thermal insulation

POLYCASA PS sheets used in indoor glazing applications results in considerable energy cost savings by preventing excessive heat loss in winter and blocking heat entry in the summer. The heat loss factor, normally referred to as the K-value, of POLYCASA PS is significantly lower than for glass at the same thickness. Some examples of the heat insulation performance of POLYCASA PS in single and double glazing systems are given below and compared with glass.

Advantages of POLYCASA PS to glass

- **At the same thickness:**
 - Improvement of the K-value = U-value
 - Weight saving

Single glazing:

- Improvement K-value:

Glass 5 mm:	K-value = 5.74 W/m ² C
POLYCASA PS 5 mm:	K-value = 5.01 W/m ² C
$\Delta = 0.73 \text{ W/m}^2\text{C} = 12.7\%$	
- Weight saving:

Glass 5 mm:	12.5 kg/m ²
POLYCASA PS 5 mm:	5.25 kg/m ²
$\Delta = 7.25 \text{ kg} = 58\%$	

Double glazing:

- Improvement K-value:

2 x glass 4 mm with air gap 5 mm:	K-value = 3.57 W/m ² C
2 x POLYCASA PS 4 mm with air gap 5 mm:	K-value = 3.15 W/m ² C
$\Delta = 0.42 \text{ W/m}^2\text{C} = 11.8\%$	
- Weight saving:

2 x glass 4 mm:	20 kg/m ²
2 x POLYCASA PS 4 mm:	8.4 kg/m ²
$\Delta = 11.6 \text{ kg/m}^2 = 58\%$	

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- **At the same K-value:**
 - Weight saving
 - Volume saving

Single glazing:

Glass 10 mm: K-value = 5.60 W/m²°C

POLYCASA PS 2 mm: K-value = 5.50 W/m²°C

- Weight saving:

Glass 10 mm: 25.00 kg/m²

POLYCASA PS 2 mm: 2.10 kg/m²

$\Delta = 22.9 \text{ kg/m}^2 = 91.6\%$

- Volume saving:

$\Delta = 8 \text{ mm}$

Double glazing:

2 x glass 5 mm with 15 mm air gap: K-value = 3.05 W/m²°C

2 x POLYCASA PS 3 mm with 10 mm air gap: K-value = 2.99 W/m²°C

- Weight saving:

Glass 2 x 5 mm: 25.0 kg/m²

POLYCASA PS 2 x 3 mm: 6.3 kg/m²

$\Delta = 18.7 \text{ kg/m}^2 = 74.8\%$

- Volume saving:

Glass 2 x 5 + 15: 25 mm

POLYCASA PS 2 x 3 + 10: 16 mm

$\Delta = 9 \text{ mm}$

K-values / U-values for customer specific glazing systems can be provided upon request.

For more information contact one of the sales offices of POLYCASA.

8. CONCLUDING REMARKS

For more details on further processing methods, please contact our technical customer service.

NOTE:

Our technical recommendations are without legal obligation.

The information given in this brochure is based on our knowledge and experience to date. It does not release the user from the obligation of carrying out their own tests and trials, in view of the many factors that may affect processing and application; neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose.

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