

PERSPEX®
FROM LUCITE®

Glazing Solutions
Verglasungen
Solutions pour
le vitrage



LUCITE®
The source of inspiration

Glazing Solutions

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1.0 INTRODUCTION

For many years Perspex® from Lucite® acrylic sheet has been used as a glazing material, firstly for aircraft canopies and then for a wide variety of architectural and industrial applications which take advantage of its outstanding properties:

- **Exceptional light transmission with no inherent edge colour**
Clear Perspex® transmits 92% of all visible light. No other product offers better light transmission – not even glass!
- **Excellent resistance to outdoor weathering**
We offer a ten year weathering guarantee on the outdoor performance of standard Perspex® sheet. No significant change in visual appearance nor physical performance will take place during ten years outdoors.
- **High gloss, hard surface**
Perspex® is one of the hardest thermoplastics and remains aesthetically attractive for much longer than many other plastic sheet products.
- **Good thermoformability**
Perspex® is easy to thermoform with low cost tooling leading to cost effective production.
- **Easy to clean**
The high gloss surface of Perspex® makes it easy to clean, keeping maintenance costs to a minimum.
- **High service temperature**
Perspex® has a maximum service temperature of 80-85°C minimising the risks of thermal distortion in service.
- **Safety**
Standard Perspex® is 5 times stronger than float glass and the Perspex® Impact Modified grades many times better again. It is internationally recognised as a safety glazing material meeting the requirements of ANSI Z.97 and BS 6262. Standard 3 mm Perspex® is rated Class C to BS 6206 impact test and Class A for 8 mm and above thicknesses.
- **Low density**
Perspex® is half the weight of an equivalent glass panel and is more easily transported, installed and supported.
- **Clear, tints and opal colours**
Perspex® is available in a wide range of transparent tints and opal colours giving maximum design freedom.
- **Cold Bending**
Perspex® can be readily cold bent to allow the installation of continuous rooflighting. A minimum cold bend radius of 200 times the thickness is possible with cast sheet and 300 times for the extruded grades.
- **Recyclability**
Perspex® is fully recyclable.

For further information please refer to the Perspex® guarantee available from your local Perspex® from Lucite® Sales office or via the Knowledge bank on www.lucitesolutions.com

2.0 PERSPEX® FROM LUCITE® STANDARD PRODUCTS

PERSPEX® CS Cast Acrylic Sheet

Cast Perspex® from Lucite is the original cell cast product first produced over 60 years ago. It offers better optical properties and craze resistance than extruded sheet and hence is often the choice for applications requiring critical visual performance. An impact modified grade of cast sheet is also available as is a variety of textured surface products for glazing applications. Please see **602 documentation** for full details of the product range.

Perspex® XT Extruded Sheet

The standard grade of extruded sheet is ideal for general glazing applications and is available in a range of clear, opal and tinted grades. Perspex® XT IM impact modified grades are also available – see later. Please refer to our **602, Product Range** for full details of the available product range.

3.0 PERSPEX FROM LUCITE SPECIAL PRODUCTS

Perspex® XT 0X02 - transmitting UV light for sunbed applications

Perspex® XT 0X02 has been specially formulated and tested to give very high UV light transmission above 300 nm together with excellent resistance to the long term ageing effects associated with UV radiation. It is used primarily in the glazing of sunbeds although it has also been used in scientific instruments. **Figure 1** gives details of the UV transmission of Perspex XT 0X02.

Since 0X02 is an extruded product, thermoformed components must be annealed to remove all moulding stresses before use. Full details of this and all other fabrication techniques can be found in **232, Workshop Handbook**.

Perspex® CS VE and VA - absorbing UV Light

Perspex® CS VE is available for applications where the **minimum transmission** of UV light is required, e.g. the glazing of museum exhibits to protect delicate artefacts. Perspex® CS VE absorbs 99.99% of all incident UV light below 400nm.

Perspex® CS VA has been developed for applications requiring **extreme resistance** to UV light. It is therefore the preferred grade for glazing applications in tropical regions. It is also suitable for high UV intensity street lighting applications.

Figure 2 gives details of the Spectral Transmittance of Perspex® VE and VA.

Perspex® CS Black 962 - transmitting infra-red light

Perspex® CS Black 962 is a unique product which whilst appearing black to visible light gives excellent transmission in the near IR region (850nm). The product finds uses particularly in the surveillance field.

Figure 1 Spectral transmittance of 3 mm Perspex® from Lucite® XT extruded sheet grades

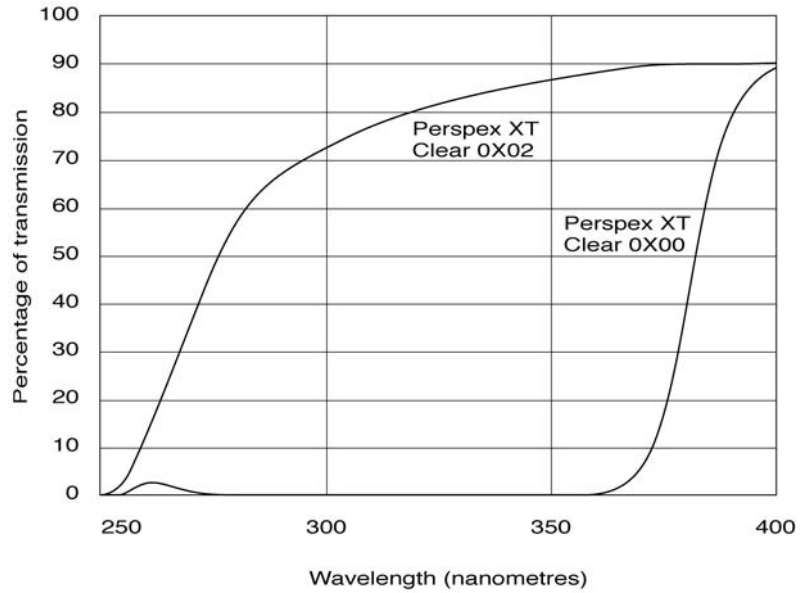
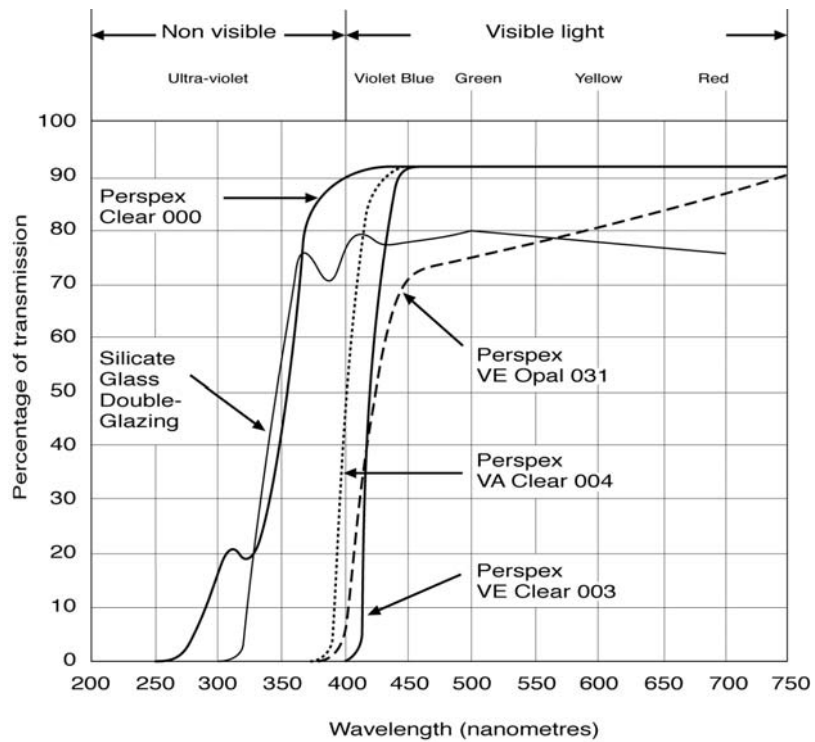


Figure 2 Spectral transmittance of 3 mm Perspex® from Lucite® GS cast sheet grades compared with silicate glass



4.0 APPLICATIONS

4.1 ARCHITECTURAL

NOTE: It is the installers responsibility to ensure that the design and construction of any Perspex® from Lucite® glazing structure complies with the statutory requirements of all local building codes or official building control standards.

ROOFING

Perspex from Lucite has been extensively used as a roofing product in applications such as moulded domelights and continuous rooflights or barrel vaults. (Typical sheet thickness recommendations are given in **Appendix 8.2, Tables 7, 8, 9 and 11**).

4.2 BALCONY GUARDS

Perspex® from Lucite has been used for balcony guard in-fill panels across Europe for over 20 years. Typically, 6 mm and 8 mm sheets are used to ensure rigidity and impact strength. Following testing, approval has been gained to ANSI Z.97, BS 6206 and NFP 01-013.

The exceptional weathering performance of Perspex® ensures that no significant loss of mechanical properties takes place over a number of years.

Fixing Details

We recommend that infill panels made from Perspex® should be supported on all 4 edges to provide sufficient panel rigidity at a minimum sheet thickness. In order to reduce the possibility of the infill panel being sprung from its frame, the rebate depth should be at least 20 mm. If only 2 edge support is possible, then the thickness of the Perspex® sheet should be increased because of the lower flexural strength of the fixing system. Also minimum rebate depths should be increased to 35 mm to prevent “spring out” occurring.

Bolt fixing at the edge of a Perspex® sheet should NOT be used as the primary support method without the use of load spreading devices, because of problems associated with stress build-up and crazing in service.

Similarly the panel must be fitted on the inside of a support post to ensure that any impact loads bear against metal supports and not the fixing bolts. All bolt holes must be drilled oversize and contain Neoprene washers. Also a good quality Neoprene gasket should be used between Perspex® and any metal.

4.3 SECURITY GLAZING

Clear Perspex® from Lucite of the correct thickness can be used as security glazing for protection against projectiles from hand guns and other firearms.

The superb clarity of Perspex® makes it particularly attractive for the protection of prestigious offices, banks and other public buildings. Perspex® may also be used as self-supporting structures, free from metal framing, for added design appeal.

Perspex® can be laminated with other glazing materials, e.g. glass and polycarbonate, to produce high specification bullet resistant glazing.

4.4 FLOORING

Many entertainment buildings (e.g. dance halls and restaurants either interior or exterior) use the light transmitting property of Perspex® from Lucite® to provide design features.

Perspex® sheets and blocks are used because of their resistance to breakage, weathering and scratching.

The prime requirement of these floors is that they must feel rigid to walk across. Care should be taken to ensure the floor design meets all local building codes. The Table below gives recommendations for Perspex® sheet thickness against panel size assuming a loading requirement of 5000 N/m².

Guideline thicknesses of Perspex® required for different areas:

PANEL SIZE mm X mm	MINIMUM SHEET THICKNESS	TO RESTRICT DEFLECTION TO 1/4 SHEET THICKNESS
300 x 300	8mm	12mm
750 x 750	15mm	20mm
1000 x 1000	20mm	30mm
2000 x 1000	25mm	30mm
1500 x 1500	30mm	35mm

The surface hardness of Perspex® is usually acceptable for floors and if required the surface gloss can be refurbished by polishing.

The Perspex® floor should be protected against damage arising from contact with a metal or wooden support structure. This can be achieved by the use of acrylic compatible glazing rubbers.

4.5 ACOUSTIC SCREENING

In recent years, Perspex® from Lucite® has been used increasingly as glazed barriers to traffic noise and similar environmental noise pollution. Now available as **Perspex® Clearview** acoustic screening grades, the exceptional outdoor weathering performance of Perspex® is of prime importance in this application.

Figure 5 gives full details of the installation requirements of environmental noise barriers.

Test reports showing compliance of Clearview products to European and DIN standards are available at request.

4.6 AQUARIA

Clear Perspex® from Lucite® cast sheet can be used for the glazing of water tanks and aquaria. Perspex® blocks up to 60 mm thickness are available in a number of different sizes for large area glazed panels. The ease with which Perspex® can be thermoformed enhances the design potential for tanks and aquaria.

4.7 BOAT GLAZING

Outstanding weathering performance and its resistance to marine environments are the reasons why Perspex® from Lucite® is used throughout the world as a high specification boat glazing product.

A wide range of attractive tints are available in various thicknesses to provide style, safety and comfort.

4.8 VEHICLE GLAZING

Since its introduction as a tough and durable product for aircraft glazing, Perspex® from Lucite® has found many new uses within vehicle glazing not only because of the many attributes listed previously but also because of its good chemical resistance to motor oils and fuels.

Its ease of fabrication permits Perspex® to be manufactured into articles not possible with glass. Perspex may easily be refurbished by polishing.

Typical automotive glazing products made from Perspex® include:

- Motor cycle windshields
- Number plates
- Side and rear windows for tractor cabs
- Truck visors
- Caravan windows
- Aerodynamic spoilers
- Wind deflectors

Thermoformed acrylic sheet is now almost exclusively used as the glazing for touring caravan windows where all the requirements for light weight, safety, good weathering properties and ease of fabrication to produce double glazed units are met. In addition, certain Perspex® grades and thicknesses are accredited to the German Transport Regulations (ABG) as approved materials for rooflights, side and rear windows for vehicles and caravans.

5.0 COMPATIBLE GLAZING PRODUCTS IN CONTACT WITH PERSPEX® FROM LUCITE®

When installing Perspex® glazing panels it is essential to ensure that all ancillary products and materials used in contact with the sheet are fully compatible with acrylic. Failure to observe this may result in permanent damage to the Perspex® glazing. For example, rubber sealing strips and profiles should be made from butyl rubber or polysulphide rubber. Certain EPDM rubbers can be used as alternatives, as can compatible silicone sealants, **but in all cases it is important to seek the advice of the product supplier before use. Plasticised PVC sealing strips should not be used under any circumstances as these are known to cause stress crazing of acrylic sheets.**

6.0 CLEANING AND MAINTENANCE

Perspex® from Lucite® is very easy to clean using water with a small amount of detergent. Chamois leather is suitable for cleaning, but cloths must never be used dry. It is also very important that neither solvent nor proprietary window cleaners of any description are used to clean Perspex® glazing. Proprietary acrylic polishes are available to restore the surface finish of Perspex glazing in the event of accidental scratches and these products are available from your local Perspex® from Lucite® supplier.

7.0 FABRICATION OF PERSPEX® FROM LUCITE®

The fabrication of Perspex® sheets for glazing applications can generally be carried out using typical workshop tools, but for full details of this and the appropriate health and safety precautions please refer to **232, Workshop Handbook** which is available from your local Perspex® supplier.

8.0 APPENDIX

8.1 – PROPERTIES

Table 1 Compares the typical physical and mechanical properties of Perspex® from Lucite® cast and extruded sheet.

PROPERTIES	TEST METHOD	UNITS	PERSPEX® CS CAST SHEET	PERSPEX® XT EXTRUDED SHEET
Tensile Strength	ISO 527 (1)	MPa	75	70
Elongation at Break	ISO 527 (1)	%	4	4
Flexural Strength	ISO 178 (2)	MPa	116	107
Flexural Modulus	ISO 178 (2)	MPa	3210	3030
Charpy Impact Strength	ISO 179 (3)	kJ.m ⁻²	12	10
Vicat Softening Point	ISO 306 Methode A	°C	>100	>105
Rockwell Hardness	ISO 2039-2	M-Skala	102	101
Light Transmission	ASTM D1003	% (4)	>92	>92
Refractive Index	ISO 489/A	-	1,49	1,49
Water Absorption	ISO 62	%	0,2	0,2
Relative Density	ISO 1183	-	1,19	1,19

NB: (1) 5 mm/min, (2) 2 mm/min, (3) un-notched, (4) in 3mm

Table 2 Fire test performance of Perspex® from Lucite® to the more important international fire tests

COUNTRY	PRODUCT TYPE	TEST	RESULT/CLASS
France	Cast	NFP 92-307	M4
	Extruded	NFP 92-307	M4
Germany	Cast	DIN 4102	B2
	Extruded	DIN 4102	B2
Holland	Cast	NEN 6005	Class 3 surface spread of flame
	Extruded	NEN 6006	Class 4 contribution to flashover
United Kingdom	Cast	BS 476:Pt 7	Class 4 under 3 mm
	Cast	BS 476:Pt 7	Class 3 for 3 mm and above
United States	Extruded	BS 476:Pt7	Class 4 all thicknesses
	Cast	UL 94	HB
	Extruded	UL 94	HB

Perspex® cast acrylic sheet burns at a rate similar to hard woods but with low smoke evolution. Encapsulating the edges of all Perspex® sheets into metal glazing profiles greatly reduces the ease of ignition.

Table 3 The Sound Reduction Index of Perspex® from Lucite® in decibels (db)

GLAZING OPTION	SOUND REDUCTION INDEX (db)
1 x 3 mm Perspex®	26
1 x 6 mm Perspex®	32
1 x 8 mm Perspex®	34
1 x 12 mm Perspex®	35

To maximise the efficiency of double glazing it is important to minimise sound leakage within the glazing profile.

Table 4 The heat transfer coefficient (U value) of Perspex® from Lucite® and glass windows measured in W/m². °C

GLAZING OPTION	AIR GAP BETWEEN PANELS	HEAT LOSS (U VALUE)	
		GLASS	PERSPEX®
3 mm single pane	-	5,6	5,2
5 mm single pane	-	5,5	4,9
3 mm double pane	3 mm	4,0	3,6
3 mm double pane	12 mm	3,1	2,9
3 mm double pane	20 mm	2,9	2,7

Table 5 The thermal conductivity coefficient (K value) of Perspex® from Lucite® and glass

Unit	GLASS	PERSPEX®
Wm/m ² . °C	1,15	0,189

8.2 – DESIGN DATA

Table 6 The minimum cold-bend radius for Perspex® from Lucite® barrel vaults in temperate climates

SHEET THICKNESS (mm)	3	4	5	6
Perspex® Cast	600	800	1000	1200
Perspex® Extruded	900	1200	1500	1800

The above figures were originally derived from stress/strain studies. From experience gained over 20 years it is known that if the minimum cold-bend radius is reduced further there is a greater risk of sheet crazing in service.

Table 7 The recommended thickness of cast and extruded Perspex® from Lucite® for barrel vaults where the barrel height is 1/2 span dimension

BARREL SPAN (mm)	SHEET WIDTH	
	1000 mm	2000 mm
800	3 mm	4 mm
1100	4 mm	5 mm
1400	5 mm	5 mm
1700	6 mm	6 mm
2000	6 mm	8 mm

Table 8 The recommended thickness of cast and extruded Perspex® from Lucite® for barrel vaults where the barrel height is 1/4 span dimension

BARREL SPAN (mm)	SHEET WIDTH	
	1000 mm	2000 mm
800	4 mm	5 mm
1100	4 mm	5 mm
1400	5 mm	6 mm
1700	6 mm	8 mm
2000	6 mm	8 mm

Table 9 The recommended thickness of cast and extruded Perspex® from Lucite® for barrel vaults where the barrel height is 1/8 span dimension

BARREL SPAN (mm)	SHEET WIDTH	
	1000 mm	2000 mm
800	4 mm	6 mm
1100	5 mm	6 mm
1400	6 mm	8 mm
1700	6 mm	8 mm
2000	8 mm	10 mm

- NB:**
1. All the above calculations have been based on an assumed wind load of 1000 N/m².
 2. When using impact modified grades the above thicknesses should be increased to the next size.

Table 10 The recommended thickness of cast and extruded Perspex® from Lucite® for flat roofs

ROOF SPAN (mm)	GLAZING PROFILES SPACING (mm)		
	800	1000	1200
800	5 mm	6 mm	6 mm
1400	6 mm	8 mm	8 mm
2000	6 mm	8 mm	10 mm

The values for **Table 10** assume a snow load of 750 N/m².

RECOMMENDED THICKNESS OF PERSPEX® FROM LUCITE® FOR WINDOWS

The required thickness is dictated by two considerations. The first is the desired impact strength and the second is the wind loading which an external window must sustain. In most countries statutory requirements or codes of practice exist which specify wind loads for building structures and these must be followed. For example, in the United Kingdom, BS CP3 Chapter V Part 2 is the Code of Practice to be followed when designing windows or glazed structures.

Figures 3 and 4 give the recommended thicknesses of Perspex® from Lucite® for various wind loads.

Figure 3 The recommended thicknesses of Perspex® for various wind loads when designing for square windows, with all edges fully supported

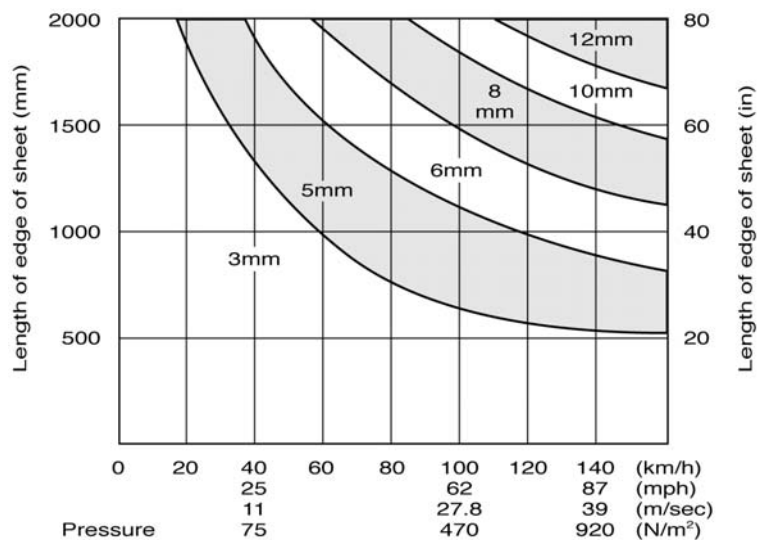
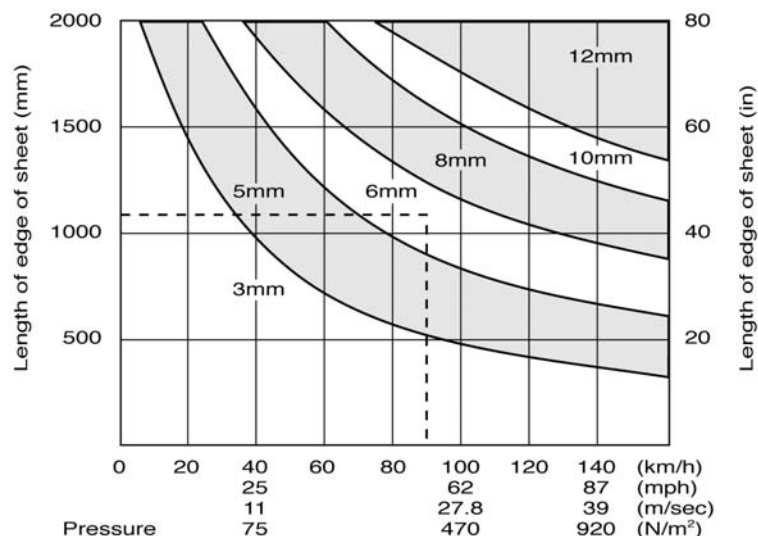


Figure 4 The recommended thicknesses of Perspex® for various wind loads when designing for rectangular windows, with all edges fully supported



NB: The figures for sheet thickness apply to areas bounded by the curves

Example of the use of Figure 4

To determine the thickness of Perspex® from Lucite® that must be used for a window 1100 x 1520 mm with a wind load of 90km/h (380 N/m²), determine the point of intersection between wind load line and **shorter** panel size (see the dotted line). The recommended thickness is 6 mm.

NB: At the recommended thickness, the sheet can deflect under full wind load and it is therefore important to use the appropriate depth of rebate, as recommended in **Table 12**, to ensure the sheet remains firmly fixed in the frame.

8.3 – INSTALLATION

Mounting Details

The preferred method of mounting Perspex® from Lucite® glazing is between metal frames. Aluminium profiles or glazing bars are generally acceptable and these can be obtained from your local Perspex® distributor, who will be able to give full advice on products available and the manufacturers recommended fixing methods.

As a general rule, Perspex® should be fixed in the frames with rubber profile sections as is the normal glazing practice. If preferred, flexible mastics may be used and polysulphide sealants have been found to be suitable for this purpose. Silicone sealants can be used but, as stated earlier, it is very important to use rubber profiles or sealants which are known to be compatible with acrylic sheet.

In the event of any doubt the manufacturers advice should be sought first. When installing glazing in any frame system, two critical observations need to be taken into account:

1. Thermal expansion clearance
2. Rebate depth

- Thermal expansion clearance**
 Perspex® from Lucite® has a high thermal expansion coefficient compared to traditional glazing materials and allowance within the frames must be made in both directions for thermal expansion and contraction. Failure to observe this rule can lead to stresses in the sheet which can cause distortions in the panel and crazing at the edges of the sheet in time.

An allowance of 5 mm per metre run length should be allowed in both dimensions during installation. This figure has been found from long experience to be sufficient for all locations and climates.

- Rebate depth**
 It follows from the above that the rebate depth must be sufficient to allow for the expansion clearance **and also the thermal contraction** that can take place in winter. Rebate depth must also be sufficient to prevent the sheet from being deflected out of the frame in gale force winds.

Figure 5 shows a typical profile assembly and Table 11 the recommended rebate depth for various panel sizes, based on installation at 20° C.

Figure 5 Mounting details for Perspex® from Lucite® glazing

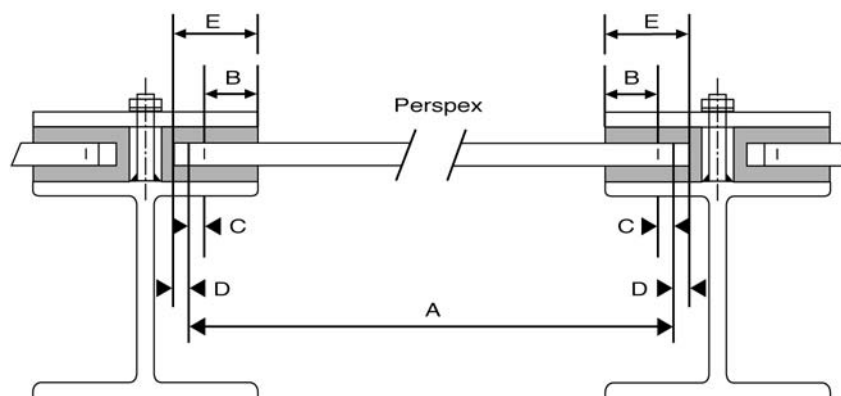


Table 11 The recommended rebate depth for glazed Perspex® from Lucite® panels in frames

NOMINAL PANEL SIZE (A)	MINIMUM REBATE DEPTH (B)	CONTRACTION ALLOWANCE (C)	EXPANSION ALLOWANCE (D)	TOTAL REBATE (E)
1000 mm	30 mm	5 mm	5 mm	40 mm
2000 mm	35 mm	10 mm	10 mm	55 mm
3000 mm	40 mm	15 mm	15 mm	70 mm

9.0 TALK TO US

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