

Design Considerations

We would suggest that before any patent glazing is designed for a new building that the following practical information is considered at the earliest stage.

Public Safety

Patent glazing has demonstrated an excellent record of public safety over many years. The following table can serve as a guide for selection of a suitable safety glass in any of our overhead patent glazing systems.

Glazing height Above floor level	Suitable Double Glazing types	Suitable Single Glazing Types
0-5 Metres	The lower pane should be toughened or laminated. If the lower pane is toughened glass then the upper pane should also be toughened *	Toughened, Laminated or Wired glass
5-13 Metres	The lower pane should be toughened or laminated. If the lower pane is toughened glass then the upper pane should also be toughened *	Toughened glass not more than 6mm thick and 3m ² in area, Laminated or Wired glass
Over 13 Metres	The lower pane should be laminated *	Laminated or Wired glass

* It is possible to use wired glass as an inner pane in double glazed units. However this is not considered good practice in patent glazing due to a higher risk of thermal breakage occurring with this glass type.

Structural Requirements

Patent Glazing is not intended to withstand loads imposed by the structure to which it is attached. Our patent glazing systems are designed to resist the most adverse combination of loads likely to occur, such as dead load (self weight), wind, snow and where necessary, maintenance. Consideration should be given to how readily the patent glazing will be accommodated by the structure, therefore, consultation with us at design stage is recommended for most contracts.

Structural Tolerances

The dimensional and positional accuracy of the supporting structure is of prime importance. Patent glazing systems can overcome slight discrepancies in the structure of approximately 1.5mm per pane width, but tolerances above these can have an effect on the integrity of the system.

Weather Resistance

Experience has shown that patent glazing used in pitches above 15° will produce excellent weather resistance. Pitches below 15° or where large volumes of water are likely, can be achieved successfully by means of a larger bottom overhang and additional sealing to the outer glazing bar cappings. Our Skyline, Skyline Box and Rafterline glazing systems all include external pressure caps and are the most suitable for low pitches. Discharges from down pipes or other concentrations of water should not be allowed to flow over sloping patent glazing. Separate drainage gutters should always be provided.

Glazing Bar Spans

We offer a wide range of glazing systems which can achieve large spans to suit most designers requirements. The glazing system must always be fixed to OTHERS structural supports which require pitching to the roof slope to achieve weathertightness. Our chart below shows indicative spans for all our glazing bar ranges based on the glazing bars being spaced at 600mm centres and should be used for guidance only.

Glazing System	Bar Section	Depth mm	Maximum Roof Span		Vertical Span		Ix-xcm4	Zx-x cm3
			Double Glazing	Single Glazing	Double Glazing	Single Glazing		
Skyline Box	SPG5	70	2400	4000	3000	3800	408,448	11,422
Skyline Box	SPG7	95	3750	5000	3800	4800	1,018,214	21,747
Skyline Box	SPG10	120	4500	5750	4400	5500	1,837,643	29,225
Skyline Box	SPG15	170	5750	7500	5500	7000	4,698,570	51,317
Skyline	SPG2	70	1600	2000	2400	3000	17,366	3,893
Skyline	SPG3	90	3000	3500	3000	3800	41,123	7,299
Skyline	SPG4	115	4000	5000	3850	4900	111,709	17,848
Traditional	BL2	52	-	1750	-	2050	7,532	2,245
Traditional	BL4	64	2000	2250	2400	3050	16,681	4,427
Traditional	BL6	76	2700	3400	2800	3550	30,630	7,473
Traditional	BL7	89	3200	4200	3300	4100	56,324	11,649
Traditional	BL8	102	3650	4700	3600	4500	83,947	15,981
Heritage	LC5	45	-	2700	-	2900	6,650	2,376
Heritage	LC7	53	2700	3250	3050	3350	13,070	4,031

Glazing Bar Spacings

At the dawn of the Patent Glazing era, a consistent production of glass had evolved at a dependable width and glazing bar centres have historically remained at this width since (approximately 600mm centres / 2 feet)

Conveniently, a 600mm wide pane of glass or double glazed unit can usually be carried safely and practically by two site personnel under each man's arm, and this rule of thumb for the optimum width remains today.

Wider centres than 600mm can be used on Patent Glazing, but consideration must be given to the logistics of access, provision of lifting equipment and future repairs/replacement.

Under CDM the Designer has a responsibility to specify suitable products to enable a project to be executed safely. It is therefore important that the Patent Glazing Contractor is approached early on in the design stage to discuss the practicalities of using glazing panels with large widths.

We do not recommend the use of the popular 6.4mm laminated glass in sloping patent glazing at centres over 650mm, due to the risk of mechanical breakage occurring (self weight). At wider centres, we recommend using toughened glass or a special toughened laminated composition.

Finishes for Aluminium

(a) Mill

This description applies to untreated aluminium surfaces. The rate at which the original bright metallic appearance will become dull as the surface oxidizes and develops a roughened texture depends upon environmental conditions. Mill finish is not usually suitable where appearance of the glazing system is of importance. This finish would be more suitable for a factory roof rather than a feature canopy.

(b) Powder Coating

This process begins with the mill finish material being pre-treated in tanks of acid to clean the outside faces thoroughly. The aluminium is then spray coated with a polyester based powder, which is stoved on to produce a protective film. An extensive range of colours are available as standard and many non-standard or metallic finishes are available at a surcharge. All Powder coating supplied by the Standard Patent Glazing Company conforms to BS 6496.

(c) Anodized

Suitably prepared aluminium is treated electrochemically during which process the surface of the metal is converted to a hard, translucent film of aluminium oxide forming a protective coating. A small range of colours are available as standard.

The appearance of the anodic film depends upon material composition, form, temper or condition and surface texture and care should be taken in the selection of materials for components that are required to be closely matched. Different extruded sections and sheet materials can give different shading results, and for this reason, powder coating will give a more consistent finish. All anodic oxide coating supplied by the Standard Patent Glazing Company conforms to BS 3987.

Solar Heat Gain

The local climate, the configuration, structure and surroundings of a building, the position and orientation of the glazing and the glazed infill material govern the build up of solar heat in a building.

Intelligent positioning of the patent glazing may enable the designer to maximise the beneficial winter solar heat whilst controlling the sometimes overpowering summer solar heat. Heat gain can be reduced further by the use of a solar control or reflective glass or by internal/external shading devices.

Due to an uneven build up of heat and the risk of thermal stresses, laminated glass should not generally be considered for a patent glazing design where internal shading devices are in close proximity to the patent glazing.

Heat Conservation

Following the introduction of the first L Regulations in 2003 and the updated 2006 paper, concern for the environment is now very firmly everybody's business.

A careful choice of glazing system and infill material can cut down heat loss to a minimum, thus reducing the amount of fuel required to keep the building at a comfortable temperature.

Panes of single glass or plastic sheet materials offer little resistance to the loss of heat by conduction and carry a high thermal transmittance.

Our Thermally broken glazing systems and Double glazed units with low emissivity coatings significantly increase the thermal resistance of any glazing system and also help reduce the risk of condensation. We offer three proprietary Thermally broken glazing systems which are suitable for complying with Building Regulation L 2006.

1. Skyline Glazing Box System (see page 14 for details)
2. Skyline Glazing System (see page 16 for details)
3. Rafterline Glazing System (see page 18 for details)

Thermal Safety With Glass

When glass is directly exposed to solar radiation it will absorb heat, thus increasing the temperature and expanding the glass. Areas of glass not in contact with solar heat will therefore remain cooler. This will result in thermal stresses from the differential expansion of the glass. Toughened glass is not affected by thermal stresses and remains our preferred choice for an infill in our patent glazing systems.

Maintenance and Access

Safe and efficient means of access for the maintenance of patent glazing both inside and outside should be considered at design stage. Permanent access systems, which are independent of the glazing system are the preferred option especially for high level glazing.

Periodic cleaning of the glazing to remove dirt and the build up of debris will be required to keep the glazing system in a good condition and to avoid the loss of light transmission from the glass. Certain glass products can be subjected to thermal stresses if the panes are unclean for prolonged periods of time.

Aluminium sections with powder coated or anodised finishes must be cleaned regularly to conform to the terms of guarantee. It is advisable to check all components annually for damage or deterioration and replacement materials should be fixed as soon as possible.

Condensation

Condensation will occur on any surface with a temperature less than the dew point of the atmosphere near the surface. Therefore, when the surface temperature of any part of the patent glazing and the relative humidity of the atmosphere reach a critical combination, condensation will occur.

Ground frost, cold rain and low temperature with high wind will exacerbate the formation of condensation. Adequate ventilation will serve to reduce condensation. Inside buildings, the humidity will be increased by the release of moisture from cooking of food, the presence of people or a large body of water, such as a swimming pool. This moisture can reach high levels where ventilation is inadequate. The possibility of condensation forming on glass may be minimised

by using double glazed units with a low U Value, combined with a thermally broken glazing bar such as the Skyline, Skyline Box and Rafterline ranges.

For a more in-depth explanation of Condensation, the GGF (Glass & Glazing Federation) have published an interesting document, which can be viewed from our web site at <http://www.patent-glazing.com/condensation.htm>

Fire

All of our sloping patent glazing systems have a designation AA as defined in BS 476: Part 3 when they are installed with an infill such as 6mm wired cast glass or other glasses of at least 4mm thick.

If elements of the structure have need for a level of fire resistance when tested in accordance with BS 476: Parts 20 and 22, certain types of patent glazing will be suitable.

These may either be tested or approved as 'deemed to satisfy' by fire authorities or local authority building inspectors.

A joint venture by the Patent Glazing Contractors Association and Pilkington Glass Ltd was organised to test the heat resistance of patent glazing when subjected to smoke temperatures. This test was carried out at Warrington Fire Research Centre and produced the following results.

The test sequence attempted the following furnace temperatures:

1. 300°C for 30 minutes
2. 400°C for 15 minutes
3. 500°C for 15 minutes
4. 600°C for 30 minutes

The results demonstrated that all aluminium and lead covered steel (Heritage) glazing bars should perform adequately at smoke temperatures up to 600°C. Laminated glass of nominal 6.4mm thickness remained intact up to 400°C and toughened glass of nominal 6mm thickness remained intact at 600°C. The full report may be viewed from our web site at www.patent-glazing.com/fire-report.htm

Fragility/Human Impact

Patent Glazing conforms to its own British Standard, that of BS 5516:2004 - Design and installation of sloping and vertical patent glazing. All of our glazing systems are designed to withstand maintenance, wind and snow loads likely to be imposed on them. All infill materials which we use comply with BS 6206 - Impact performance requirements for flat safety glass and safety plastics for use in buildings.

In connection with Human Impact, the loading considered is that which relates to a person having accidental contact with the glass. As soon as the word 'accidental' is used, the loads cannot be quantified.

The variables that relate to this occurrence are as follows:

- *Size and weight of person*
- *Part of the body that impacts the glass; hand, leg, head, trunk and their relative hardnesses*
- *Velocity (speed) of the body when impacting the glass*
- *Angle of impact; e.g. 90° (normal to) or 5° (glancing).*

Because the possible loadings cannot be quantified It is therefore advisable for the Building Designer to protect people from falling onto the patent glazing by means of adjacent guard rails, footwalks, gantry systems, etc rather than attempting to make the patent glazing system impact resistant.

