APPENDIX

1.1 Sirim QAS International Test Report

Sample: Tempered Glass

Nominal Thickness: 12mm
Method of Test: AS / NZS 2208:1996

<table>
<tr><th>Clause</th><th>Requirements</th><th>Results</th><th>Remarks</th></tr>
<tr><td rowspan="3">2.2</td><td colspan="3">Thickness Requirements</td></tr>
<tr><td>Standard nominal thickness of safety glass</td><td>12mm</td><td>PASS</td></tr>
<tr><td>Glass Thickness Limits:
Minimum 11.8mm
Maximum 12.3mm</td><td>Sample 1 - 11.914mm
Sample 2 - 11.913mm
Sample 3 - 11.893mm
Sample 4 - 11.882mm</td><td></td></tr>
<tr><td rowspan="3">2.3</td><td colspan="3">Size Tolerance Requirement</td></tr>
<tr><td>
<table>
<tr><th rowspan="2">Standard Nominal Thickness</th><th colspan="4">Tolerance Limits</th></tr>
<tr><th colspan="2">Non-Patterned</th><th colspan="2">Patterned</th></tr>
<tr><td>>1200</td><td>≥ 1200</td><td><1200</td><td>≤1200</td></tr>
<tr><td>12</td><td>+2</td><td>+3</td><td>+4</td><td>+5</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>Declared Size: 1938mm x 876mm</td><td>1938mm x 876mm</td><td>PASS</td></tr>
<tr><td rowspan="2">2.4</td><td colspan="3">Squareness or Rectangular Panels</td></tr>
<tr><td>Does not exceed 5mm where the largest dimension is less than 1200mm and 10mm for all other panel</td><td>0mm</td><td>PASS</td></tr>
<tr><td rowspan="3">2.5</td><td colspan="3">Flatness Requirements</td></tr>
<tr><td>The flatness of panels shall be within the following limits</td><td>0mm</td><td>PASS</td></tr>
<tr><td>Localized ward 1.0mm over any 200mm span. Overall bow and warpage for 1501mm to 3000mm: 1mm in every 300mm.</td><td>0mm</td><td>PASS</td></tr>
<tr><td rowspan="6">3.2</td><td>Impact Test</td><td>Sample</td><td></td></tr>
<tr><td>All four test pieces shall not break, or shall break safely as defined for the specified material when tested, at any drop height appropriate to the class for which the material is intended.</td><td>* Remain unbroken until 1500mm drop height.
* Weight of 10 largest crack-free particles: 23.430 grams</td><td>PASS</td></tr>
<tr><td>For Grade A, the test shall be started from 300mm drop height. If the specimen does not brake and remains intact within the frame, the drop height shall be increased as follows; Grade A 300mm, 450mm, 600mm, 750mm, 900mm, 1200mm and 1500mm.</td><td>* Remain unbroken until 1500mm drop height.
* Weight of 10 largest crack-free particles: 29.010 grams</td><td>PASS</td></tr>
<tr><td colspan="3">Where breakage occurs it shall comply with the requirement as below:</td></tr>
<tr><td>1) The 10 largest crack-free fragments selected 3 minutes after impact, together weight no more than the mass equivalent to 6500mm² for the original test piece.

The maximum weight for area of 6500mm² for specimen with thickness of 5mm shall be 196.11 grams.</td><td>* Remain unbroken until 1500mm drop height.
* Weight of 10 largest crack-free particles: 20.725 grams</td><td>PASS</td></tr>
<tr><td>2) If the test piece does not break at the selected maximum drop height, use a centre-punch with sufficient force to deform or break the glazing material and examine the fracture pattern.</td><td>* Remain unbroken until 1500mm drop height.
* Weight of 10 largest crack-free particles: 32.725 grams</td><td>PASS</td></tr>
<tr><td rowspan="2">3.3</td><td colspan="3">Fragmentation Test</td></tr>
<tr><td>When tested, the sample shall comply with the minimum of 40 particles per square of 50mm side.</td><td>Sample 1: 41 pieces</td><td>PASS</td></tr>
<tr><td rowspan="2">1.6</td><td colspan="3">Classfication</td></tr>
<tr><td>All safety glazing materials shall be classified as either Grade A or Grade B</td><td>Grade A</td><td>PASS</td></tr>
</table>

Sample: Laminated Glass

Nominal Thickness: 6.38mm
Method of Test: AS / NZS 2208:1996
(Safety Glazing in Building)

Sample Description:

	First Layer	Second Layer	Third Layer
Materials	FL3	0.38 CLR	FL3
Thickness	3mm	0.38mm	3mm

Clause	Requirements	Results	Remarks
2.2	**Thickness Requirements**		
	Standard nominal thickness of safety glass	12mm	**PASS**
	Glass Thickness Limits: Minimum 5.6mm Maximum no limit	Sample 1 - 6.07mm Sample 2 - 6.07mm Sample 3 - 6.06mm Sample 4 - 6.06mm	
2.3	**Size Tolerance Requirement**		
	Standard Nominal Thickness / **Tolerance Limits** — Non-Patterned: >1200, ≥ 1200; Patterned: <1200, ≤1200 6: +2, +3, +4, +5		
	Declared Size: 1938mm x 876mm	1938mm x 876mm	**PASS**
2.4	**Squareness or Rectangular Panels**		
	Does not exceed 5mm where the largest dimension is less than 1200mm and 10mm for all other panel	0mm	**PASS**
2.5	**Flatness Requirements**		
	The flatness of panels shall be within the following limits	0mm	**PASS**
	Localized ward 1.0mm over any 200mm span. Overall bow and warpage for 1501mm to 3000mm: 1mm in every 200mm.	0mm	**PASS**
3.2	**Impact Test**		
	All four test pieces shall not break, or shall break safely as defined for the specified material when tested, at any drop height appropriate to the class for which the material is intended.	Sample 01: * Break safely at 450mm drop height	**PASS**
	When breakage occurs it shall comply with requirements for breakage as given.	Sample 02: * Break safely at 600mm drop height.	
	1) It has broken and numerous cracks or fissures appear but no shear or opening develop within the body of the glazing material through which a 76mm diameter sphere can be passed freely, additionally if fragments are detached after 3 min impact, they shall in total weight no more than the mass equivalent to 10 000mm^2 of the original test piece and the largest single fragment shall weigh less than the mass equivalent to 4400mm^2 of the single piece.	Sample 03: * Break safely at 450mm drop height.	**PASS**
	2) If the test piece cracks or deforms but is held together in a safe manner, it passes.	Sample 04: * Break safely at 450mm drop height	**PASS**
3.3	**Boil Test for Laminated Glass**		
	When tested, the test sample might crack, but no bubbles or other defects shall develop more than 12mm from the edge of the test sample or from any crack that have developed.	No physical defect observed	**PASS**
1.6	**Classfication**		
	All safety glazing materials shall be classified as either Grade A or Grade B	Grade A	**PASS**

Sample: Tempered Laminated Glass

Nominal Thickness: 9.52mm
Method of Test: AS / NZS 2208:1996
(Safety Glazing in Building)

Sample Description:

	First Layer	Second Layer	Third Layer
Materials	TPFL4	1.52 CLR	TPFL4
Thickness	4mm	1.52mm	4mm

Clause	Requirements	Results	Remarks
2.2	**Thickness Requirements**		
	Standard nominal thickness of safety glass	12mm	**PASS**
	Glass Thickness Limits: Minimum: - Maximum: -	Sample 1 - 9.64mm Sample 2 - 9.65mm Sample 3 - 9.21mm Sample 4 - 9.23mm	
2.3	**Size Tolerance Requirement**		
	Standard Nominal Thickness / **Tolerance Limits** — Non-Patterned: >1200, ≥ 1200; Patterned: <1200, ≤1200 10: +2, +3, -, -		
	Declared Size: 1938mm x 876mm	1938mm x 876mm	**PASS**
2.4	**Squareness or Rectangular Panels**		
	Does not exceed 5mm where the largest dimension is less than 1200mm and 10mm for all other panel	0mm	**PASS**
2.5	**Flatness Requirements**		
	The flatness of panels shall be within the following limits	0mm	**PASS**
	Localized ward 1.0mm over any 200mm span. Overall bow and warpage for 1501mm to 3000mm: 1mm in every 300mm.	0mm	**PASS**
3.2	**Impact Test**		
	All four test pieces shall not break, or shall break safely as defined for the specified material when tested, at any drop height appropriate to the class for which the material is intended.	* Break safely at 1500mm drop height	**PASS**
	When breakage occurs it shall comply with the requirement as given:	* Break safely at 1500mm drop height.	
	1) It has broken and numerous cracks or fissures appear but no shear or opening develop within the body of the glazing material through which a 76mm diameter sphere can be passed freely, additionally if fragments are detached after 3 min impact, they shall, in total, weight no more than the mass equivalent to 10 000mm^2 of the original test piece and the largest single fragment shall weigh less than the mass equivalent to 4400mm^2 of the single piece.	* Break safely at 1500mm drop height.	**PASS**
	2) If the test piece cracks or deforms but is held together in a safe manner, it passes.	* Break safely at 1500mm drop height	**PASS**
3.3	**Boil Test for Laminated Glass**		
	When tested, the sample might crack, but no bubbles or other defects shall develop more than 12mm from the edge of the test sample or from any cracks that have developed	No physical defect observed	**PASS**
1.6	**Classfication**		
	All safety glazing materials shall be classified as either Grade A or Grade B	Grade A	**PASS**

Wind Load Resistance Chart (BS 6262 Part 3)

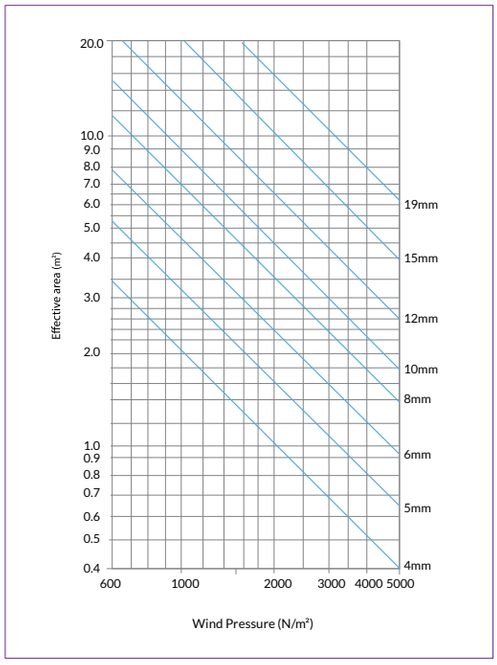

Figure 4 – Float glass wind load resistance

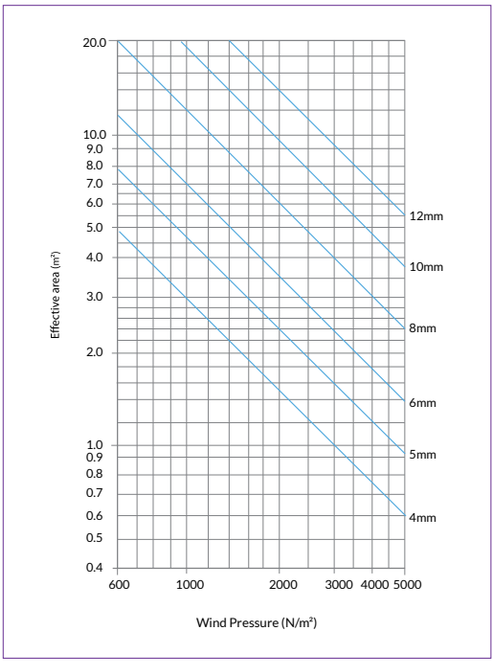

Figure 5 – Toughened glass wind load resistance

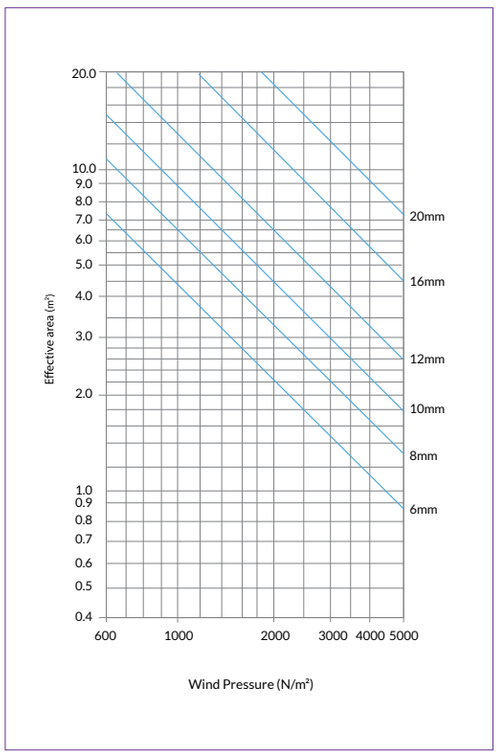

Figure 6 – Laminated glass wind load resistance

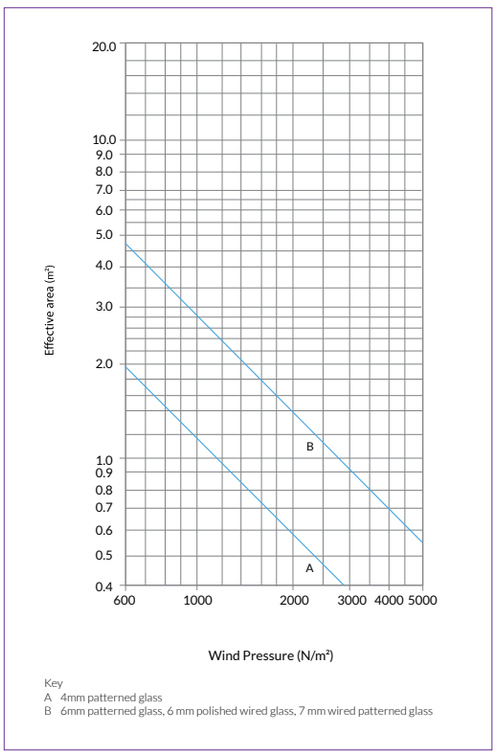

Figure 7 – Patterned glass and wired glass load resistance

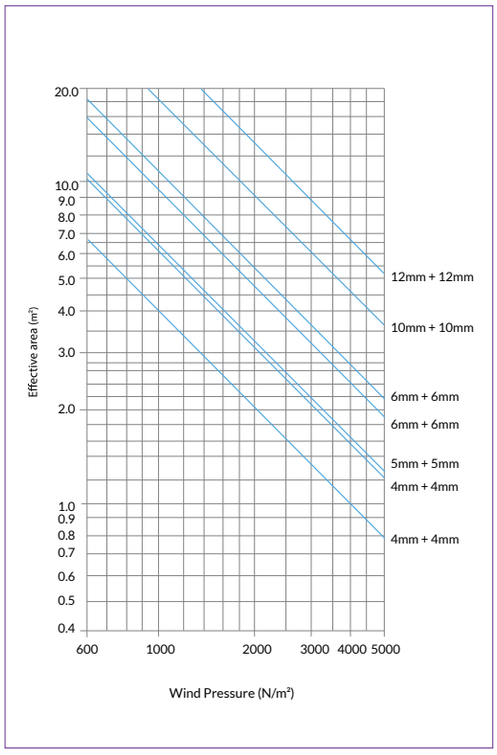

Figure 8 – Float glass insulating units wind load resistance

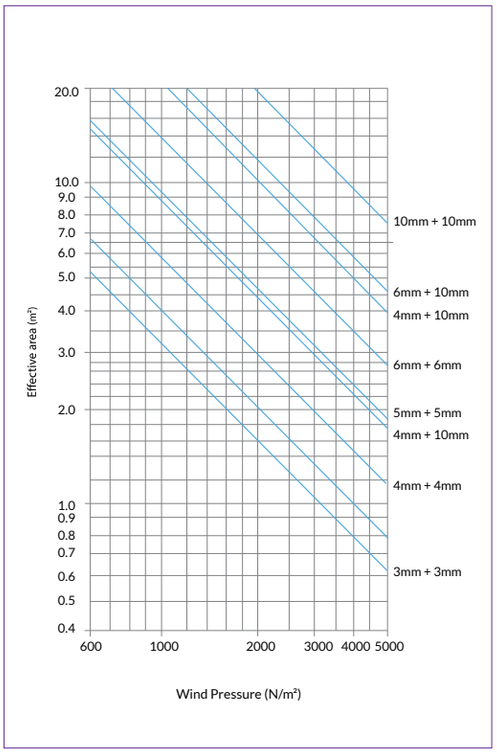

Figure 9 – Toughened glass insulating units wind load resistance

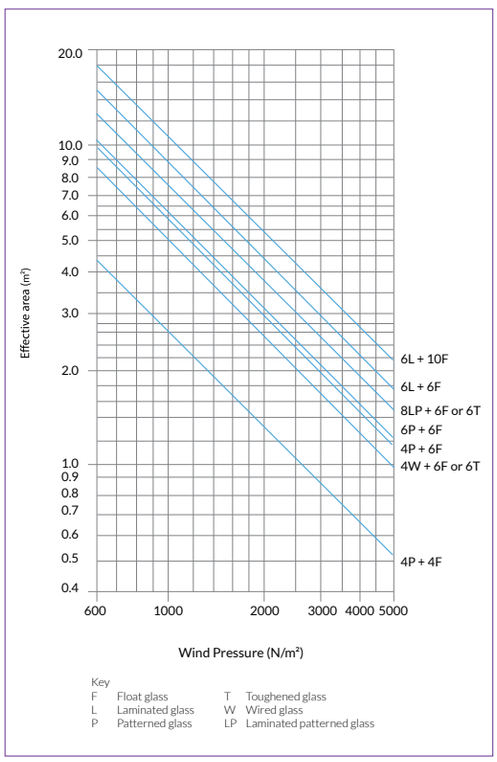

Figure 10 – Various insulating units wind load resistance

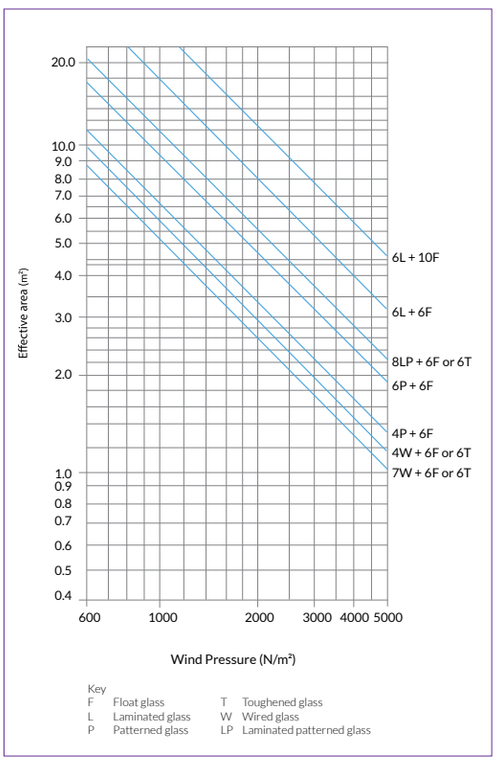

Figure 11 – Various insulating units wind load resistance

Standards and Regulations relevant to Glass and Glazing

The following standards and regulations are relevant to glass and glazing:

General

BS EN 572	Glass in building. Basic soda lime silicate glass products
Part 1:2004	Definitions and general physical and mechanical properties
Part 2:2004	Float glass
Part 3:2004	Polished wire glass
Part 4:2004	Drawn sheet glass
Part 5:2004	Patterned glass
Part 6:2004	Wired patterned glass
Part 7:2004	Wired or unwired channel shaped glass
Part 8:2004	Supplied and final cut sizes
Part 9:2004	Evaluation of conformity / Product standard
BS 952	Glass for glazing
Part 1:1995	Classification
Part 2:1980	Terminology for work on glass
BS EN 1036	Glass in building.
Part 1:2007	Mirrors from silver-coated float glass for internal use. Definitions, requirements and test Methods
Part 2:2008	Glass in building. Mirrors from silvercoated float glass for internal use. Evaluation of conformity; product standard

Fire Resistance

BS 476	Fire tests on building materials and structures (These are test and performance specifications and are not specific to glass) Various parts of the Builing Regulations affect design in terms of conservation of fuel and power, fire safety and means of escape
BS EN 13501	Fire classification of construction products and Building Elements
BS EN 1363	Fire resistance tests
Part 1:1999	Fire resistance tests. General requirements
Part 2:1999	Fire resistance tests. Alternative and additional procedures
BS EN 14600:2005	Doorsets and openable windows with fire resisting and /or smoke control characteristics, requirements and classification
BS 5588	Fire precautions in the design, construction and use of Buildings
BS EN 357:2004	Glass in building - Fire resistant glazed elements with transparent or translucent glass products Classification of fire resistance

Noise Control

BS EN ISO 140	Acoustics Measurement of sound insulation in buildings and of building elements.
BS EN 12758:2011	Glass in building. Glazing and airborne sound insulation. Product descriptions and determination of properties
BS EN ISO 717	Acoustics
Part 1:1997.	Rating of sound insulation in buildings and of building elements. Airborne sound insulation
Part 2:1997.	Rating of sound insulation in buildings and of building elements. Impact sound insulation
BS 5821, ISO 717	Part 3:1982 Methods for rating the sound insulation in buildings and of building elements. Method for rating the airborne sound insulation of façade elements and façades
BS 8233:1999	Sound insulation and noise reduction for buildings. Code of practice

Solar Control and Thermal Insulation:

BS EN 1096	Glass in building. Coated glass.
Part 1:1999	Definitions and classification
Part 2:2001	Requirements and tests methods for class A, B and S coatings
Part 3:2001	Requirements and test methods for class C and D coatings
Part 4:2004	Evaluation of conformity/ Product standard
BS EN 12898:2001	Glass in building. Determination of the emissivity
BS EN 1279	Glass in building. Insulating Glass Units
Part 1:2004	Generalities, dimensional tolerances and rules for the system description
Part 2:2002	Long term test method and requirements for moisture penetration
Part 3:2002	Long term test method and requirements for gas leakage rate and for gas concentration tolerances
Part 4:2002	Methods of test for the physical attributes of edge seals
Part 5:2005	Evaluation of conformity
Part 6:2002	Factory production control and periodic tests
BS EN 410:2011	Glass in building. Determination of luminous and solar characteristics of glazing
BS EN 673:2011	Glass in building. Determination of thermal transmittance (U value). Calculation method
BS EN ISO 12567	Thermal performance of windows and doors
Part 1:2010	Determination of thermal transmittance by the hot-box method. Complete windows and doors
Part 2:2005	Determination of thermal transmittance by hot box method. Roof windows and other projecting windows
BS EN ISO 14438:2002	Glass in building. Determination of energy balance value. Calculation method

Safety, Security, Design and Installation:

BS 6262:1982	Glazing for buildings
Part 1:2005	General methodology for the selection of glazing
Part 2:2005	CodAe of practice for energy, light and Sound
Part 3:2005	Code of practice for fire, security and wind loading
Part 4:2005	Safety relating to human impact
Part 6:2005	Code of practice for special applications
Part 7:2005	Code of practice for the provision of information
BS 6180:2011	Barriers in and about buildings. Code of practice
BS 5516:2004	Patent glazing and sloping glazing for buildings.
Part 1:2004	Code of practice for design and installation of sloping and vertical patent glazing
Part 2:2004	Code of practice for sloping glazing
BS EN 1063:2000	Glass in building. Security glazing. Testing and classification of resistance against bullet attack
BS 5357:2007	Code of practice for installation and application of security glazing
BS EN 356:2000	Glass in building. Security glazing. Testing and classification of resistance against manual attack
BS EN 13541:2001	Glass in building. Security glazing. Testing and classification of resistance against explosion pressure
BS 8213:2004	Windows, doors and rooflights
CPart 1:2004	Design for safety in use and during cleaning of windows, including door-height windows and roof windows. Code of practice
Part 4:2007	Code of practice for the survey and installation of windows and external doorsets
BS EN 12150	Glass in building. Thermally toughened soda lime silicate safety glass
Part 1:2000	Definition and description
Part 2:2004	Evaluation of conformity / Product standard
BS EN 12600:2002	Glass in building. Pendulum test. Impact test method and classification for flat glass
BS EN ISO 12543	Glass in building. Laminated glass and laminated safety glass
Part 1:2011	Definitions and description of component parts
Part 2:2011	Laminated safety glass
Part 3:2011	Laminated glass
Part 4:2011	Test methods for durability
Part 5:2011	Dimensions and edge finishing
Part 6:2011	Appearance
BS EN 1863	Glass in buildings. Heat strengthened soda lime silicate glass
Part 1:2011	Definition and description
Part 2:2004	Evaluation of conformity. Product standard
BS EN 14179	Glass in building. Heat-soaked thermally-toughened soda lime silicate safety glass
Part 1:2005	Definition and description
Part 2:2005	Evaluation of conformity / product standard
BS EN 14449:2005	Glass in building. Laminated glass and laminated Safety glass Evaluation of conformity / product standard
BS 8000	Workmanship on building sites
Part 7:1990	Code of Practice for glazing
BS EN 14072:2003	Glass in furniture. Test methods