4 GLAZED CURTAIN WALLING SYSTEMS

4.1 GENERAL

4.1.1 Scope

1 This Part specifies the requirements, components and workmanship for glazed curtain walling systems.

2 Related Sections are as follows:

This Section
Part 1..... General
Part 2..... Glass
Part 3..... Workmanship

Section 17 Metal Work
Section 26 Painting

4.1.2 References

1 The following standards are adopted and/or referred to in this Section:

AAMA 501.1 .....Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

ASTM C1048.....Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

ASTM E998.....Standard Test Method for Structural Performance of Architectural Glass Products Under the Influence of Uniform Static Loads.

ASTM F2813 .....Standard Specification for Glass Used as a Horizontal Surface in Desks and Tables.

ASTM F3006 .....Standard Specification for Ball Drop Impact Resistance of Laminated Architectural Flat Glazing.

BS 4315 .....Methods of test for resistance to air and water penetration; (BS 4315-1 Methods of test for resistance to air and water penetration - Windows and structural gasket glazing systems; BS 4315-2 Methods of test for resistance to air and water penetration - Permeable walling constructions (water penetration))

BS 4315-1 .....Methods of test for resistance to air and water penetration - Windows and structural gasket glazing systems

BS 5368 .....Methods of testing windows; (EN 1026 Windows and doors. Air permeability. Test method; EN 1027 Windows and doors. Water tightness. Test method; EN 12211 Windows and doors. Resistance to wind load. Test method)

BS 5368-1 .....Methods of testing windows - Air permeability test; (EN 1026 Windows and doors. Air permeability. Test method)

BS 5368-2 .....Methods of testing windows - Watertightness test under static pressure; (EN 1027 Windows and doors. Water tightness. Test method)

BS 5368-3 .....Methods of testing windows - Wind resistance tests; (EN 12211 Windows and doors. Resistance to wind load. Test method)

BS 6262 .....Glazing for buildings.

BS 6375 .....Performance of windows and doors; (BS 6375-1 Performance of windows and doors - Classification for weathertightness and guidance on selection and specification; BS 6375-2 Performance of windows and doors - Classification for operation and strength characteristics and guidance on selection and specification; BS 6375-3 Performance of windows and doors - Classification for additional performance characteristics and guidance on selection and specification)

BS 6375-1 .....Performance of windows and doors - Classification for weathertightness and guidance on selection and specification

BS 6496 .....Specification for powder organic coatings for application and stoving to aluminium alloy extrusions, sheet and preformed sections for external architectural purposes, and for the finish on aluminium alloy extrusions, sheet and preformed sections coated with powder organic coatings; (EN 12206-1 Paints and varnishes. Coating of aluminium and aluminium alloys for architectural purposes - Coatings prepared from thermosetting coating powder)

BS 6497 .....Specification for powder organic coatings for application and stoving to hot-dip galvanized hot-rolled steel sections and preformed steel sheet for windows and associated external architectural purposes, and for the finish on galvanized steel sections and preformed sheet coated with powder organic coatings; (EN 13438 Paints and varnishes. Powder organic coatings for hot dip galvanised or sherardised steel products for construction purposes)

EN 1096 .....Glass in building - Coated glass.

EN 1279 .....Glass in Building - Insulating glass units.

EN 12488 .....Glass in building - Glazing recommendations - Assembly principles for vertical and sloping glazing.

EN 12600 .....Glass in building - Pendulum test - Impact test method and classification for flat glass.

EN 13022 .....Glass in building - Structural sealant glazing

EN 15434 .....Glass in building. Product standard for structural and/or ultra-violet resistant sealant (for use with structural sealant glazing and/or insulating glass units with exposed seals); (EN 15434 Bonding sealants).

EN 15651 .....Sealants for non-structural use in joints in buildings and pedestrian walkways.

EN 16477 .....Glass in building - Painted glass for internal use.

ISO 10077 .....Thermal performance of windows, doors and shutters — Calculation of thermal transmittance.

ISO 12543 .....Glass in building — Laminated glass and laminated safety glass.

ISO 21005 .....Ships and marine technology — Thermally toughened safety glass panes for windows and side scuttles.

ISO 28278 .....Glass in building — Glass products for structural sealant glazing.

ISO 52022 .....Energy performance of buildings — Thermal, solar and daylight properties of building components and elements.

4.1.3 System Description

1 Glazed curtain walling systems shall include the following components:

(a) curtain wall, infill, and skylight glazing

(b) access doors and panels, including all hardware required for a complete and operable assembly

(c) all hardware and operating mechanisms for access door and all other operable assemblies

(d) all main and secondary runners and runner support systems, anchors, fixings, attachments, reinforcements and steel reinforcing for mullions and transoms required for a complete installation, except those indicated as being provided under other sections

(e) finishes, protective coatings, and treatments

(f) internal gutter and other water drainage systems

(g) all thermal insulation and safing associated with the work included in this Part, including supports, backing, and reinforcements

(h) all gaskets, sealants, elastomeric and metal flashing, including sealing at junctions with roofing waterproofing

(i) electrical bonding and earthing of all metal curtain wall components.

4.1.4 Qualifications

1 The Contractor's engineer or curtain wall subcontractor shall be experienced in providing engineering services of the kind indicated and as covered in this Part and are subject to approval by the Engineer.

2 Manufacturers and suppliers of all materials and components of the Work of this Part are subject to approval by the Engineer.

3 The installers of the Work of this Part are to have proven achievement and experience in similar work as applicable for at least 5 years and are subject to approval by the Engineer.

4.2 CURTAIN WALLS

4.2.1 General Requirements

1 Curtain wall systems are at a minimum to meet the requirements of this Section. Where special conditions or proprietary systems are to be used, the specifications herein are to be considered a performance specification guideline with specific additional specifications included elsewhere in the Project Documentation.

2 Where alternative curtain wall systems are to be developed and specified by implementation of the performance specification or as design of a proprietary system, the curtain wall works are to be carried out by an approved sub-contractor who fulfils the following requirements:

(a) regularly engaged in engineering, manufacturing, finishing, installing, glazing and sealing of the type of work specified in this section for minimum of five years

(b) able to demonstrate satisfactorily completed works of minimum size equal to that to be included in the Works

(c) able to demonstrate an understanding of the principles of rain screen, stack effect, air seals, dynamic forces, behaviour of cast-in-place concrete structures, water and weather controls as affecting building cladding systems

(d) able to provide documentation of calculations to verify design of the curtain walls

(e) provide documents to include details of all products, fixings and interfaces necessary to complete the fabrication and installation.

4.2.2 Performance Requirements

1 Glazing for curtain walls is to be double glazing and is to comply with the relevant provisions of BS 6262 or adopted standard.

2 The Contractor shall submit documentation and drawings for approval by the Engineer for internal framing members and external components as follows:

material:	type of metal alloy, size and details
finish:	powder coated, anodised, or other finish in accordance with the relevant provisions of BS 6496 and BS 6497
colour:	designated colour referred by British Standard Colour Chart Number

3 The minimum film thickness on curtain walls shall be 60-80 microns (refer to coating specification in Section 17).

4 Framing members, glass and glass fixings, frame fixings and ironmongery are to be designed to satisfy the following:

(a) Sustain wind loadings and sufficient to avoid damage or excessive deflection when subjected to these loads

(b) meet the weather tightness and other performance requirements in BS 4315, BS 6375 and BS 5368

(c) resistance to water and air penetration to the standards for the above exposure when tested in accordance with BS 4315 Part 1

(d) resistance to damage from thermal movement of the assembly or adjacent structure and assembles over the air temperature range 0 ºC to 50 ºC

(e) resistance to damage from the designed deflection of any adjacent structure shown on the arrangement drawings or as can be ascertained from the associated shop drawings

(f) thermal conductance of work, U-value shall be less than 2.8 W/m²K (0.009 Btu/ft²/h)

(g) opening vents (windows) will include the following:

(i) extruded aluminium framed opening vents, side hung outward opening with integral drainage.

(ii) weathertightness to BS 6375 Part 1

(iii) hermetically sealed double glazed units in accordance with BS 6262

(iv) opening panes shall be provided with friction stays capable of holding the pane open in any position against a pressure of 50 Pa.

4.2.3 Submittals

1 Shop drawings are to be prepared and approved by the Engineer before off-site fabrication of any item. The shop drawings shall clearly illustrate all aspects of the walling system and are to include, but not be limited to, the following information:

(a) the relationship of the Works to the structure, mechanical systems, roofs, and other related work

(b) the arrangement of components

(c) the sequence and details of fabrication assembly and erection

(d) dimensions of all components

(e) details of materials and finishes

(f) type, size, location and spacing of screws, bolts, welds anchoring devices and other accessories

(g) isometric drawings of sealing, flashing and jointing

(h) details of all connections to contiguous work

2 The Contractor shall submit samples of all components, materials and finishes as listed below. The size of the samples shall be as approved by the Engineer.

(a) samples matching the colour, texture, and other characteristics of each finish of each major component to be included in the glazed curtain wall

(b) finished samples of panels and major extrusions

(c) samples showing finishes over welds and over welded materials.

(d) fastening devices

(e) flashing

(f) gaskets

(g) sealants

(h) stud or plug welds to sheet and plate

(i) finish hardware

3 The Contractor shall submit manufacturer's performance data as well as application and removal procedures for all protection materials used during shipping, storage and installation.

4 Full scale mock-ups of the curtain wall system shall be provided for testing as detailed in the Clause 4.2.9 of this Part unless otherwise stated by the Engineer. The size, materials and construction of the mock-ups shall be to the standard and quality as required for the Works. The Contractor shall provide visual mock-ups and field mock-ups as indicated in the Project Documentation

5 The Contractor shall submit calculations, showing the following:

(a) design load assumptions

(b) pressure equalisation

(c) detailed engineering of mullions

(d) moment of inertia of mullions

(e) detailed engineering of anchorage hardware, clip angles, washers, anchor bolts, welds, torque pressures.

The calculations shall be prepared and signed by the Contractor’s engineer or curtain wall subcontractor (refer to Clause 4.1.4-1 of this Part). The calculations shall bear the Contractor’s stamp.

4.2.4 Alternative Design, Materials and Methods of Construction

1 Design, materials and methods of construction other than those indicated in the Project Documentation may be employed when such designs, materials and methods conform to all of the following:

(a) the design intent and specified design requirements

(b) the specified performance requirements

(c) all applicable codes and standards

(d) approval by the Engineer.

2 If option for alternative design or design by performance specification is required, the Contractor's engineer is to comply as follows:

(a) prepare and endorse complete engineering design and calculations and check and monitor the preparation of all shop drawings for conformance with the engineering design and calculations, and for compliance with the Project Documentation

(b) structural calculations are to be submitted for all components of the walling system (including for mock-ups) and are to indicate ultimate factors of safety

(c) the Contractor's engineer will be present at the Site during erection and installation of the walling system

(d) upon completion of the walling system, the Contractor's engineer is to prepare and endorse the necessary as-built drawings for submission to the Engineer.

3 Manufacturers and fabricators of curtain wall systems are to provide calculations as follows:

(a) submit glass fabricator/manufacturer's calculations for wind pressure analysis and thermal stress analysis

(b) submit written confirmation that the glass fabricator/manufacturer has reviewed the pertinent shop drawings and has confirmed the acceptability of the proposed use of the specified glass products

(c) submit written confirmation that the sealant manufacturer has reviewed the pertinent shop drawings and has confirmed the acceptability of the proposed use of the specified sealant products.

4.2.5 Quality Control

1 Prior to the start of fabrication, the Contractor is to submit a comprehensive Quality Control Program covering all phases of the walling system including, but not necessarily limited to, the following:

(a) procurement of materials including quality assurance programmes of major suppliers

(b) fabrication of components

(c) final assembly of components

(d) installation and Site quality control.

The above are in addition to the requirements of Section 1, General.

4.2.6 Delivery, Storage and Handling

1 The requirements of this Clause are in addition to the requirements for delivery, storage and handling of materials as detailed elsewhere in the Project Documentation.

2 The Contractor is to verify with the Engineer the location and adequacy of temporary storage and lay-down areas of curtain wall materials prior to delivery.

3 Curtain wall components are to be delivered to the Site in labelled protective packages individually identified for each intended location.

4.2.7 General Warranty

1 The Contractor is to provide agreement to indemnify the Owner against any defects in the design, workmanship, quality of materials, water tightness or performance of the Works included in this Part and to repair or replace defective design, workmanship or materials of the walling system during the warranty period. Defective materials and workmanship include:

(a) abnormal deterioration, ageing and weathering of the walling system

(b) leakage of water or air exceeding specified limits

(c) structural failure of components resulting from exposure to pressures and forces within specified limits

(d) failure of operating parts to function normally

(e) glass breakage due to defective design, manufacture or installation or exposure to pressures and forces within specified limits

(f) deterioration or discoloration of finishes in excess of normal weathering and ageing

(g) failure of the walling system to meet any other specified performance requirements

2 The warranty shall not include damage caused by vandalism, or natural conditions exceeding the performance requirements.

3 The warranty period shall be as stated elsewhere in the Project Documentation.

4.2.8 Special Finish Warranty

1 Where special finishes (a finish required by the design, but not a manufacturer's standard finish) are specified, the Contractor shall obtain a warranty from the manufacturer covering failure of the applied finish, and agreeing to repair or replace items that show evidence of finish deterioration. Deterioration of finish includes but is not limited to, colour fade, chalking, cracking, peeling, and loss of film integrity.

2 The special finish warranty period shall be as stated elsewhere in the Project Documentation.

4.2.9 Testing and Mock-Ups

1 Propriety curtain walling and roof light systems are to have been subject to testing of specimens under laboratory conditions for resistance to:

(a) air leakage

(b) water leakage

(c) wind leakage

2 The Contractor is to ensure that the proper testing authority requirements are complied with; such requirements include the following:

(a) testing shall be conducted by an independent testing laboratory, identified by the Contractor and approved by the Engineer.

(b) all measurement devices used in the tests are to have been calibrated and documented to meet applicable British Standards.

(c) the independent testing laboratory undertaking the tests shall be accredited for the required tests to an appropriate national body.

3 The specimens shall be subject to a performance test. The specimens used for performance testing will have been designed and constructed using the same methods, materials and sequences as for the system to be installed on the building. The techniques, skills and quality control used for the installation in the test will be those that are to be used for installation on the building.

4 Laboratory tests required to be undertaken are as follows:

(a) air permeability tests method in accordance with the provisions of BS 5368 Part 1

(b) watertightness static test method in accordance with the provisions of BS 5368 Part 2

(c) watertightness dynamic test method in accordance with the provisions of Architectural

Aluminium Manufacturers Association Standard AAMA 501.1.

(d) wind resistance serviceability test in accordance with the provisions of BS 5368 Part 3, as modified by BS 6375 Part 1.

(e) wind resistance safety test in accordance with the provisions of BS 5368 Part 3

4.3 STRUCTURAL GLAZING

4.3.1 General

1 All structural glazing work must be done under factory controlled conditions, the exception being for field replacement of broken glass and for two sided structural work.

2 All structural glazing work must be quality controlled and monitored on a full-time basis by experienced quality control supervisory personnel, suitably qualified, and approved by the Engineer.

3 No glazing is to proceed until all aspects of testing, certification, compatibility, etc. as outlined herein have been performed and satisfactorily met all requirements.

4.3.2 Structural Sealant

1 All structural glazing must be installed with an approved structural silicone sealant meeting the requirements of BS 2571 or adopted standard.

2 Surface preparation, priming and application will include the following:

(a) a primer shall be used only if required by sealant manufacturer to obtain specified adhesion and performance

(b) sealant shall not be applied when substrates are wet or when the temperature is below 4.4 ºC units shall not be moved until the silicone sealant is fully cured and in no cases before the times given below unless otherwise confirmed in writing by the manufacturer:

(i) from the plane in which the unit is sealed (minimum 24 hours).

(ii) shipment to site (minimum 3 days from sealing).

(iii) erection to site (minimum 7 days from sealing).

3 The Contractor is to provide certification from the sealant manufacturer that he has reviewed the Contractor's shop drawings and sealant details and has tested all components of the glazing work to be included in the Works that will come into contact with sealant, and finds the same compatible and suitable for the purpose intended for.

4 The sealant manufacturer is to make periodic inspections of the glazed curtain walling work during the course of the Project. An initial inspection shall be undertaken at the start of glazing to verify that sealant work is proceeding in accordance with their recommendations, including de-glazing of randomly selected units to inspect and verify quality of sealant and workmanship. The sealant manufacturer is to submit inspection reports covering his observations and any recommendations.

4.3.3 Use of Sealants

1 Sealants specified in this Section are to be used in strict in accordance with the manufacturer's printed instructions and should be applied only by craftsmen specially trained or experienced for their use. Before applying sealing materials, all mortar, dirt, dust, moisture and other foreign matter is to be completely removed from surfaces it will contact.

2 When adjoining surfaces are required to be masked (to maintain a clean and neat appearance), sealant shall be to be tooled to fill the joint and provide a smooth finished surface.

3 Sealant shall be black in colour unless otherwise approved by the Engineer.

4.4 INSTALLATION

4.4.1 Anchors and Connections

1 Anchors and connections for the curtain walling system are to be provided as designated and as applicable Section 17, Part 6, or if part of a proprietary system or manufacturer's design, as submitted and approved by the Engineer.

4.4.2 Corrosion Protection

1 Corrosion protection for components of the curtain walling system shall comply with Section 17, Part 6.

4.4.3 Lightning Protection

1 Lightning protection measures are to comply with Section 17, Part 6.

4.4.4 Insulation and Safing

1 Installation of insulation and safing (fire protection) are to comply with Section 17, Part 6.

4.4.5 Flashing

1 Flashing requirements are to comply with Section 17, Part 6.

4.4.6 Field Quality Control

1 Field quality control of site tests, air filtration and water penetration tests are to comply with Section 17, Part 6.

4.4.7 Cleaning

1 Cleaning of the entire walling system is required in compliance with Section 17, Part 6 and as specified herein.

2 The Contractor shall provide instruction and training for the proper cleaning and routine maintenance of the façade. The instruction and training shall be such that personnel working to an agreed procedure, based upon the supplier's recommendations can undertake the cleaning of the installation.

4.4.8 Maintenance Manual

1 For projects of major size which include within the Project Documentation a requirement for the preparation of a maintenance manual, the manual shall be developed in parallel with the design and shall include, but not be limited to the following information:

(a) the name, address and telephone number of each company, manufacturer, supplier and subcontractor involved in the supply of materials, components, assemblies and finishes

(b) clear and concise description of the construction used to form the various areas of the installation

(c) recommendations for routine maintenance, cleaning, suitable cleaning agents and details of any lubrication and adjustments required for working parts

(d) a full set of as-built drawing time of completion

(e) copies of all guarantees, including details of their term and conditions

4.4.9 Inspection

1 The completed curtain wall system is to be inspected at regular intervals. The purpose of this inspection includes, but is not necessarily limited to the following:

(a) to review the effectiveness of the cleaning methods employed

(b) to monitor the performance of the material and components of the curtain walling system against their anticipated life

(c) inspecting for damage or failure of any part of the system

(d) checking on the effectiveness of maintenance or remedial work.

2 A detailed inspection plan shall be developed for use by the Owner. The inspection plan shall be to the approval of the Engineer. The inspection plan shall developed in consultation between the manufacturer and Contractor. It shall include procedures and recording methods to enable a systematic monitoring of the condition of the installation and assist in the prediction of the need for preventive maintenance or replacement of component parts.

END OF PART