

OBECO GLASS BLOCKS **TECHNICAL MANUAL**

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INSTALLATION OF GLASS BLOCKS

1 SCOPE

The Obeco Technical Manual covers the installation of glass blocks and fire-rated glass blocks in a non-structural panel, and technical data relating to the properties of glass blocks.

Material specifications and details covered in the Obeco Specification are repeated in this manual for ease of reference and completeness.

2 REFERENCED STANDARDS

AS

1231-2000, Aluminium and aluminium alloys – Anodic oxidation coatings
1530 Methods for fire tests on building components, materials and structures,
1530.4-1990, Part 4: Fire resistance tests of elements of building construction
2758 .1-1998, Aggregates and rock for engineering purposes, Part 1: Concrete aggregates,
3715-1989, Metal finishing – Thermoset powder coatings for architectural applications..
3700-2001, Masonry structures
3972-1977, Portland and blended cements.
4671-2001, Steel reinforcing materials

AS/NZS

1866:1977, Aluminium and aluminium alloys – Extruded rod, bar solid and hollow shapes.
4534:1998, Zinc and zinc-aluminium-alloy coatings on steel wire.

AS/NZS ISO

9001:2000, Quality management systems – Requirements
DIN (German Standard)
18175 Glass building bricks and blocks – Requirements, test methods

OBECO

Obeco Glass Block Coursing Charts
Obeco drawings

3 CONTRACT DRAWINGS AND SPECIFICATIONS

The Builder shall supply drawings, details and specifications of sufficient detail to define the extent and location of the work.

4 DETAILED DRAWINGS

When detailed drawings or schedules are required to execute the work, copies of these detailed drawings or schedules shall be submitted to the Builder for approval before the work commences.

5 DIMENSIONS AND SET-OUT

All work shall be installed in accordance with the contract drawings, which show the general layout. The main building dimensions shown on the architectural drawings take precedence over those shown on the engineering drawings, which have been included to assist the detailing.

Dimensions for straight glass block panels in all block sizes and frame options using standard 10mm joints, are as specified in the Obeco Glass Block Coursing Charts. Joint sizes can be varied up to a maximum width of 30mm. Curved and corner glass block panels should be set out on site. Minimum radii for curved panels are as specified in Obeco Drawing Number 08.

6 SUPERVISION

The contractor should ensure that the work is performed and directly supervised by appropriately experienced personnel.

NOTE: Glass Block Experts Pty Ltd, a wholly owned subsidiary of Obeco Glass Blocks Pty Ltd, is an installation contractor that is deemed to comply with these requirements.

7 QUALITY ASSURANCE

Suppliers and contractors shall provide assurance of the quality of all goods, materials and services to be provided. The following are deemed to meet this requirement:

- a quality assurance system complying with AS/NZS ISO 9001, or
- a quality control system approved by the Builder.

8 COMMENCEMENT

8.1 Builder

Work shall commence as soon as practical after, but not before, the Builder has issued:

- a written order;
- the relevant contract drawings, specifications and schedule of work; and
- written approval of any details provided by the Contractor.

8.2 Openings

Openings need to be prepared with correct flashing and lintels to suit glass block installation. This work is not the responsibility of the glass block installer. Sizing of openings shall allow enough clearance to accommodate the frame sizes as set out in the Obeco Coursing Charts.

8.3 Access

The Builder shall provide adequate and safe access to both sides of the panels.

9 INSPECTION AND COMPLETION

Glass block installation shall be inspected after the first course of the first panel is completed. The inspection shall verify that the following are correct and to the specification:

- fixing of the frame;
- fitting of expansion joints to the jambs and head; and
- installation of reinforcement in correct layout.

When work has reached inspection stage, the Contractor shall advise the Builder before covering, closing or completing the work.

On completion of all works, the Contractor shall formally advise the Builder of practical completion. Where the contract is staged, this advice shall be given on completion of each major stage.

10 MATERIALS

10.1 Glass blocks

10.1.1 General

- Obeco Glass Blocks shall be used for compliance with this specification,
- Obeco Glass Blocks are manufactured by SOLARIS®, WECK® Glass Blocks and MULIA® Glass Blocks.
- SOLARIS® and WECK® glass blocks comply with German standard DIN 18175
- Damaged or imperfect blocks shall not be used.
- Glass block panels are not load-bearing and adequate provision for support must be made around the panel.
- Glass blocks shall be stored in a dry place in their protective packing until required for installation. Care should be taken in handling to avoid damage to edges or chipping.

Technical Data		Standard Blocks		Special Blocks		
DESCRIPTION	UNIT	80mm	BSH 20	1930 F	1960 F	1990 F
Load-bearing properties	Own weight in kN/m ²	1.00	1.50	1.60	2.35	2.50
Thermal Protection DIN 4108-4 using mortar	Heat transmission coefficient U (Mean) in W/m ² K	2.80	2.80	2.20	1.80	1.50
	Heat transmission resistance (1/Λ Mean) in m ² K/W	0.17	0.17	0.28	0.40	0.51
Total Energy Transmission	g value	0.65	0.65	0.50	0.54	0.35
Sound Insulation DIN 4109	Sound insulation index Rw in dB	40/42	45	45	47	49
Fire Protection AS 1530.4	Fire Resistance Levels (FRLs) for vertical panels – walls	-/60/-	-/90/-	-/60/30	-/60/60	-/90/90
	FRLs for horizontal panels – floors BG blocks			60/60/30	60/60/60	120/120/90

10.1.2 Energy conservation

The energy transmission coefficient of glass block walls is comparable to standard double glazing.

The heat transmission resistance 1/Λ and the heat transmission coefficient U of glass block walls depend on the format of the glass blocks (see mean values for all sizes) and the material used for joints.

The following factors should be taken into account for determining the energy balance of buildings for a heating period:

- The equivalent energy transmission coefficient.
- Heat loss due to transmission.
- The useable heat gained due to transparent components.

Glass block walls can reduce the heating of rooms caused by direct sunlight in summer and warm rooms in winter by allowing heating from the sun while it is at a low angle.

10.1.3 Light transmission

Glass walls offer a high degree light transmission, up to 79% (depending on pattern) of vertically incident light. This is equivalent to normal double-glazed insulating panes. In the case of coloured glass blocks, light transmission varies with the intensity of colour.

The degree of transparency of glass block curtain walls can be controlled by design. Any degree of transparency can be achieved to obtain the right balance of comfort and privacy. For example:

- fully transparent blocks have plane and parallel sides and offer a full and undistorted view;
- patterned blocks prevent identification of objects, showing only contours; and
- other glass blocks create only diffuse light and hide all forms behind them.

A wide variety of blocks with different light properties are available to meet workplace regulations, such as unhindered view or screened environments e.g. in health care applications.

Special glass blocks with light guiding properties are also available. These blocks have prismatic structures within the block, arranged to guide and conduct incident light to the ceiling. For ideal results, the ceiling should be light and unstructured. These blocks are marked on the top side to facilitate correct installation.

10.1.4 Security

Glass block walls meet high security standards. Typical application areas are:

- sidelights to entrances;
- curtain walls in storage/production areas and workshops;
- secure areas in factories, airports etc;
- banks; and
- military establishments.

The German criminal investigation office (BKA), Wiesbaden, specially recommends glass blocks for secure environments.

Some examples of specific applications are as follows:

- a) Bullet resistance – Glass blocks offer high resistance to bullets. Ballistics tests were carried out using glass blocks on a standard configuration as per DIN 4242. In these tests, bullets were first directed at the blocks, then at the joints. The glass blocks did not splinter when impacted directly; splinters were detected only when joints were shot at. See Olin Australia Ltd Ballistic Laboratory Test Report Number 0W00303 for results on blocks that comply with AS2343 – Part 2 – 1984.
- b) Intrusion resistance – Curtain walls made of glass blocks offer a high degree of protection against intrusion. The degree of protection offered can be increased by selecting the right block size, joint thickness and by reinforcing the mortar. Note that high resistance classes require cross-reinforcing with special steel members.
- c) Ball impact – When a special block laying technique is utilised, glass block curtain walls of any size offer a high degree of protection against ball impact, vibrations and earthquakes. The structural robustness is derived from the static stability of the blocks as well as the reinforcement.

10.1.5 Noise insulation

When tested in accordance with DIN 4109, standard 80mm thick glass blocks provide a weighted sound insulation index of 40/42dB. Higher indices can be achieved using thicker blocks or different size blocks (see below).

10.2 Aluminium frames

Glass block panels shall be supported on all sides by fabricated aluminium frames of nominal dimensions 80 x 40 x 2.2mm.

Glass Block Size / Type	Noise Reduction (Sound Insulation Index) Rw
190 x 190 x 80	40dB
190 x 190 x 80 (BSH 20)	45dB
190 x 190 x 80 (1930 F)	45dB
190 x 190 x 160 (1960 F)	47dB
190 x 190 x 160 (1990 F)	49dB
240 x 240 x 80	42dB
240 x 115 x 80	45dB
300 x 300 x 100	41dB
Double layer wall of 240 x 240 x 80	50dB

Aluminium shall comply with AS/NZS 1866.

Powder coated aluminium frames shall comply with AS 3715. The finished paint thickness shall be not less than 65µm.

Anodised aluminium frames shall comply with AS 1231. The anodised coating shall be 10µm unless otherwise specified.

10.3 Reinforcement

Steel reinforcement shall be nominal 6mm mild steel in accordance with AS 4671.

In all areas except for a “severe marine environment” as defined by AS 3700 (see below), all steel reinforcement shall be treated with a protective coating in accordance with AS/NZS 4534. Coating mass (min) 290 g/m².

In a “severe marine environment” stainless steel grade 316 or 316L to AS 1449 shall be used.

AS 3700 bases the “exposure environment” on proximity to features such as surf coasts, non-surf coasts and industry producing chemical pollutants.

AS 3700 defines a surf coast as an area of salt water where breaking waves are a normal occurrence. Only a severe marine environment requires stainless steel reinforcement. The difference between “marine environment” and “severe marine environment” is as follows.

- Marine environment – The extent of the area varies depending on factors such as winds, topography and vegetation. For sheltered areas such as around Botany Bay, it extends from about 100 m from the beach to 1 km inland.
- Severe marine environment – The extent to which such conditions extend inland from a surf coast depends on prevailing winds, extent of wave action and marine surf and land topography, but is generally from the beachfront to about 1 km inland. Around sheltered bays, the region extends inland about 100m.

10.4 Mortar

Mortar shall be a 3:1 mix of sand to cement. Cement should be slow setting Portland cement with low shrinkage, complying with AS 3972 unless specified otherwise.

Sand should be clean, sharp and free from salts, vegetable matter and impurities. It should conform to AS 2758.1, with a grain size of 0-4mm. (The following grading is specified in AS 2758.1)

Sieve	Percent Passing
4.76mm	100
2.36mm	95 – 100
1.18mm	60 – 100
600µm	30 – 100
300µm	10 – 50
150µm	0 – 15
75µm	0 – 10
Fineness modulus	1.5 – 2.8

Water should be clean and potable.

The minimum compressive strength of the mortar should be 12MPa at 28 days.

11 INSTALLATION

11.1 Load transfer

Glass block walls are non load-bearing and must not be subjected to any loads other than their own weight.

Glass block walls must be fixed on two opposite sides, so that the horizontal forces from the wall are safely distributed.

Suitable expansion and sliding joints must be provided to ensure that wall movements, as well as compressive forces, are absorbed. Sliding joints must be provided at the perimeter, while expansion joints must be filled with a durable and weatherproof elastic material. The latter must be a minimum of 10mm thick.

11.2 Aluminium frames

Aluminium frames should not be load-bearing and should be fixed to the jambs of the surrounding structure at maximum 450mm centres. Fixing materials and methods should be compatible with the surrounding material.

The frames should be installed such that they are plumb and level.

11.3 Expansion joints

Expansion and sliding joints allow glass surfaces to adjust to temperature changes. The expansion joints also secure the structure against undue loads. Expansion and sliding joints must be sealed against moisture. Expansion material shall be closed cell waterproof type, nominal 10mm thick and shall be installed into the jamb and head of the perimeter framing. Separating membrane shall be placed in the sill and on the inside flanges of the framing on all sides.

Vertical expansion joints shall be located at a minimum 6m intervals horizontally.

Horizontal slip joints shall be located at a minimum 6m intervals vertically. Details provided in Obeco Drawing Number 09.

11.4 Mortar

Mortar should be a stiff, homogenous mix of 1 part cement to 3 parts sand, mixed as dry as practicable.

Mixed mortar should be of a consistency that will allow it to stick to the edge of the glass block when it is turned 90°. Glass blocks are non-absorbent and accordingly the mortar must be much less moist than standard bricklaying. The consistency should be spreadable, but not dry to the point of separating or crumbling.

Anti-freeze and accelerators shall not be used.

For external applications, a stearate waterproofing agent (Waterblock 300 or equivalent) shall be added at a ratio of 550 ml to 20 kg of cement. The waterproofing agent is to be added to the mixing water for even dispersion.

Glass blocks should be laid in stack bond. Joints should be equal thickness. Standard joint thickness is 10mm. Joints must be packed solid. Blocks should be placed by hand and adjusted by tapping with a rubber mallet.

Joints should be struck smooth while the mortar is still plastic and before the final set.

Joints shall be raked to 10mm for grout. Joints at top, bottom and vertical edge of each panel (between glass block and framing) shall be recessed to 10mm for a silicone perimeter joint.

Freshly mixed mortar can cause skin irritation. Direct contact should be avoided where possible and exposed skin areas washed promptly with water. If any gets in the eyes, they should be rinsed immediately with water and prompt medical attention sought.

11.5 Reinforcement

Vertical and horizontal reinforcement shall be spaced at a maximum of 600mm centres.

Where possible, reinforcement shall be continuous in the shortest span. Where it is necessary to join reinforcement, the lap shall be a minimum length of 500mm.

Reinforcing should be laid into the perimeter mortar bed (inside the frame) on all sides. All vertical and horizontal reinforcing shall overlap the perimeter reinforcing.

Reinforcing is installed as follows:

- Place lower half of mortar in bed joint. Do not furrow.
- Press reinforcing into place.
- Cover reinforcing with upper half of mortar and trowel smooth

Horizontal reinforcing that bridges an expansion joint should overlap the joint 500mm to either side and shall be encased in a plastic sleeve to allow free movement.

In both the vertical and horizontal application, two single bars shall be laid parallel.

Mortar cover to reinforcement should be 15mm minimum external and 10mm minimum internal. Reinforcement shall not be in contact with glass blocks at any location.

11.6 Grout

Grout should comply with the appropriate standards for mortar listed in clause 11.2 and shall comprise:

- 3 parts 30 micron mineral sand, soda ash or silica type
- 1 part cement
- 1 part pure silica
- 550ml Stearate per 20 kg cement – mixed in the same way as for mortar – see above.

Iron joints smooth and clean off excess grout. When grout has dried, use a dry cloth to remove the light film remaining. Keep cloth clean of sand particles to avoid scratching.

11.7 Silicone perimeter joint

The perimeter joint (between glass block and frame) must be silicone sealed to allow for free movement into the expansion joint and maintain water tightness. Remove excess sealants, caulking material and the like with commercial solvents such as mineral spirits and rinse off, taking care not to damage sealants with excess solvent.

11.8 Integrated elements

Integrated elements in the glass block wall such as doors, windows, ventilation slits etc. must follow the grid pattern of the glass block wall. The edge strips can be used to accommodate the frames of integrated elements.

11.9 Maintenance and Cleaning

Glass block panels need little maintenance. They should be washed occasionally with soapy water and rinsed off, then dried with a soft cloth, taking care to avoid sand particles which can scratch the glass.

Powder coated and anodised aluminium should be cleaned regularly with a pH-neutral detergent solution (see AS 3715 and AS 1231) and thoroughly rinsed. Solvents or abrasive solutions should not be used.

12 FIRE RATED PANELS

12.1 General

Fire-resistant glass structures are usually made of one or more transparent space-enclosing elements in conjunction with seals and fastening elements. When they function as a space enclosing elements, they need to prevent the spread of fire and smoke for the nominated period of time.

Glass blocks used in fire-resistant glass structures are not load-bearing, however they offer great versatility where fire protection is required, but where natural light and/or transparency are desirable.

Fire-resistant glass blocks can be used in the following situations:

- To provide fire protection in emergency escape routes.
- To provide fire protection on boundary walls.
- To provide fire separation between floors.

Fire Resistance Levels (FRLs) are expressed in terms of:

- Structural adequacy – the capacity of the element to resist failure, collapse or major damage;
- Integrity – the capacity to resist the formation of cracks, fissures and the like; and
- Insulation – the capacity to keep the temperature on the external face within specified limits

These properties are measured in minutes and expressed as xx/yy/zz. See Technical Data Figure 1 for FRLs of different glass blocks

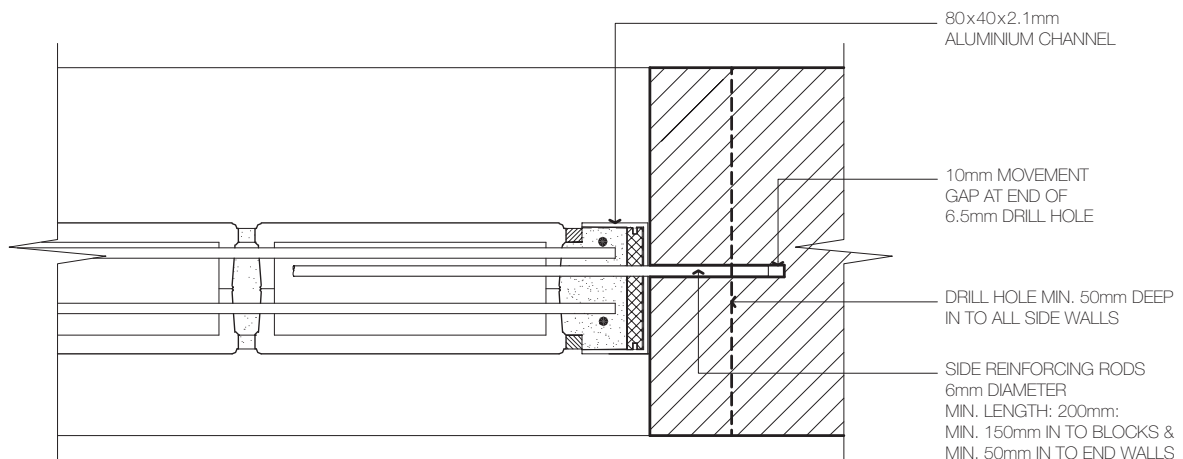
12.2 Fixing for Integrity Rated Panels

This work instruction covers glass block installation to achieve FRLs of -/60/- (see clause 12.3) and -/90/- (see clause 12.4). The standard details set out in clauses 1 to 11 above apply, except where modified below.

In both instances, the maximum overall panel size is 9m², with a maximum height of 3.5m and a maximum width of 6m.

Modifications to standard fixing details are as follows:

- a) Frames – to be in accordance with clause 11.2, except for the addition of steel anchor pins at 600mm centres from the glass block joint (150mm depth) into the jambs of the surrounding structure (50mm depth), as per drawing below.



- b) Reinforcing – to comprise two 6mm nominal diameter rods in each horizontal joint and one in every second vertical joint, its position changing between inside and outside.
Reinforcing of the mortar in the perimeter framing to be two 8mm nominal diameter rods on all sides, as per drawing below.
- c) Cross spacers – are not to be used in fire rated glass block construction.
- d) Expansion material – to be compressible fire-approved type.

12.3 FRL -/60/-

When installed in accordance with this specification, including clause 12, all SOLARIS® 190 x 190 x 80mm (Solaris 198) glass blocks with a nominal face thickness of 8mm would be capable of achieving a FRL of -/60/- when tested in accordance with the requirements of AS 1530.4. (see CSIRO Opinion Number FCO-2115).

12.4 FRL -/90/-

When installed in accordance with this specification, including clause 12, all SOLARIS® 190 x 190 x 80mm (Solaris 198 BSH20) glass blocks with a face thickness of 20mm would be capable of achieving a FRL of -/90/- when tested in accordance with the requirements of AS 1530.4. (see CSIRO Opinion Number FCO-1833).

12.5 Fixing for Integrity and Insulation Rated Panels

This work instruction covers glass block installation to achieve FRLs of -/60/60 (see clause 12.6) and -/90/90 (see clause 12.7). The standard details set out in clauses 1 to 12 above apply, except where modified below.

In both instances, the maximum overall panel size is 9m², with a maximum height of 3.5m and a maximum width of 6m.

Modifications to standard fixing details are as follows:

- e) Frames – to be in accordance with clause 11.2, except that the framing shall be 160 x 40 x 2.2mm, and the addition of steel anchor pins at 600mm centres from the glass block joint (150mm depth) into the jambs of the surrounding structure (50mm depth).
- f) Reinforcing – to comprise three 6mm nominal diameter rods in each horizontal joint and two in every second vertical joint, their position changing between inside and outside.
Reinforcing of the mortar in the perimeter framing to be three 8mm nominal diameter rods on all sides.
- g) Cross spacers – are not to be used in fire rated glass block construction.
- h) Expansion material – to be compressible fire-approved type.

12.6 FRL -/60/60

When installed in accordance with this specification, including clause 12, all SOLARIS® 190 x 190 x 160mm (Solaris 1960 F) glass blocks would be capable of achieving a FRL of -/60/60 when tested in accordance with the requirements of AS 1530.4. (see CSIRO Opinion Number FCO-1835).

12.7 FRL -/90/90

When installed in accordance with this specification, including clause 12, all SOLARIS® 190 x 190 x 160mm (Solaris 1990 F) glass blocks would be capable of achieving a FRL of -/90/90 when tested in accordance with the requirements of AS 1530.4. (see CSIRO Opinion Number FCO-1836).