

James & Taylor Ltd

Brick Slip Facade Cladding Systems

Model Performance Specification

Reference: 5.1

ISSUE REV 1 | 29 August 2025

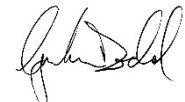
This document takes into account the particular instructions and requirements of our client James & Taylor. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party. This document is for general specification guidance only, describing a high quality brick slip system, and does not purport to be applicable to any individual project. Specifiers using this document for reference must in all cases adapt it to the specific requirements of their project and client using their professional knowledge and judgement.

Job number 306315-00

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Document Verification

Project title Brick Slip Facade Cladding Systems
Document title Model Performance Specification
Job number 306315-00
Document ref
File reference

Revision	Date	Filename	Model Performance Specification		
DRAFT 01	23 May 2025	Description			
			Prepared by	Checked by	Approved by
		Name	Matt Sangster Alexis Harrison	Alexis Harrison	
		Signature			
DRAFT 02	5 August 2025	Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name	Matt Sangster Alexis Harrison	Alexis Harrison	Graham Dodd
		Signature	 		
ISSUE	14 August 2025	Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name	Matt Sangster Alexis Harrison	Alexis Harrison	Graham Dodd
		Signature	 		
		Filename			

ISSUE REV1	29 August 2025	Description		
		Prepared by	Checked by	Approved by
Name		Matt Sangster Alexis Harrison	Alexis Harrison	Graham Dodd
Signature				

Issue Document Verification with Document

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Contents

1.	Using the Specification	1
1.1	Copyright ©	1
1.2	Purpose and nature of this document	1
1.3	Definition of common terms	1
2.	Performance: general requirements	2
2.1	Design & service life	2
2.2	Accommodation of movements	2
2.3	Applied loads	2
2.4	Impact	2
2.5	Fire	3
2.6	Corrosion	3
2.7	Visual quality	4
3.	Components, products & assemblies	5
3.1	Brick slip cladding systems	5
3.2	Metal components	7
3.3	Brackets, fixings and support rails	7
4.	Materials	8
4.1	Aluminium	8
4.2	Stainless Steel	8
4.3	Clay brick slip	8
4.4	Mortar for grouting brick slip cladding system	9
4.5	Sealant (non-structural)	10
5.	Accuracy of erection	11
5.1	Aluminium cladding support structure	11
5.2	Stainless steel cladding support structure	11
5.3	Fixings	11

5.4	Membranes	11
5.5	Brick slip cladding	11
6.	Minimum prescriptive requirements	11
6.1	Brick slip cladding system	11
6.2	Ancillary components (where applicable)	12

Tables

Table 1	Parties referred to in the specification	1
Table 2	Soft Body Impact Requirements	3
Table 3	Hard Body Impact Requirements	3
Table 4	Performance Requirements	6

1. Using the Specification

1.1 Copyright ©

This Specification is the property of Arup and is licensed to James & Taylor Ltd. Reproduction of this document shall only be undertaken in full. Reproduction for other purposes without the permission of Ove Arup & Partners Ltd is prohibited.

1.2 Purpose and nature of this document

This document is a model performance specification prepared for James & Taylor Ltd. which is not specific to a project or product. The Specification describes the technical performance criteria Arup considers suitable for the specification and evaluation of brick slip façade cladding systems.

The Specification is intended for use as a work in progress document to define technical performance parameters for the accompanying Evaluation Report, and for James & Taylor's customers and other specifiers to use as a guidance document when creating their own project-specific specifications.

The Specification is written in the imperative style. Statements that require actions shall be read as actions to be undertaken by the Contractor as part of the Works.

1.3 Definition of common terms

1.3.1 Parties

Table 1 Parties referred to in the specification

Term	Meaning
Employer's Agent	The Employer's Agent is the party responsible for coordinating the input of the Employer and the Employer's appointed consultants including Consultants involved in preparing the design intent information for the Works and others as necessary in relation to the Works. It includes any of these parties when directed and instructed by the Employer's Agent.
Contractor	Includes all sub-consultants, sub-contractors, and suppliers working under the Contractor either directly or indirectly with respect to the Works. References to 'they' and 'them' in this Specification refer to the Contractor unless the context of the clause indicates otherwise.

2. Performance: general requirements

2.1 Design & service life

The system shall have a minimum design life of 60 years, as defined in clause 3.3 of BS ISO 15686-1

The predicted service life of components shall be the service life predicted from recorded performance over time, as defined in clause 3.20 of BS ISO 15686-1.

All primary components as defined in section 7.2.4 of the CWCT Standard for systemised building envelopes shall have a predicted service life of not less than the design life of the Works, without the need for any cleaning or maintenance.

Secondary components shall be capable of replacement without compromising the long-term structural or weatherproof integrity of the cladding system. They shall be capable of replacement without progressive dismantling of the Works.

The predicted service life shall start from the date of Practical Completion of the project.

System manufacturers shall provide an assessment of the service life of the different components, to inform Contractor information at tender, and inclusion in their O&M manuals.

2.2 Accommodation of movements

The brick slip system shall accommodate the specified applied loads and movements without any reduction in the performance below the minimum levels required herein, this includes:

- Deflections due to design dead loads and live loads.
- Deflections under repeated cycles of the design wind load.
- Changes in dimension and shape arising from building and facade movements, including; shrinkage, deflections, and thermal and moisture movement.
- The contribution of locked-in stress to any component.

Consideration shall be given to the inclusion of keyed textures or features to assist the retention of pointing mortars over time, should particles detach due to movement and deflection.

2.3 Applied loads

2.3.1 Wind loads

A design wind pressure or suction of 2400 Pa shall be used, as stated in CWCT Standard for systemised building envelopes clause 2.2.4, as a maximum value if site specific wind calculations have not been performed.

The brick slip system shall be tested for serviceability and safety wind resistance to a peak pressure or suction of 2400 Pa and 3600 Pa, respectively, in accordance with CWCT Standard for systemised building envelopes clause 3.5.1 and 3.6.2.5.

2.4 Impact

2.4.1 External impact

2.4.1.1 Soft body impact

The brick slip system shall satisfy the following requirements in accordance with CWCT Technical Note 76:

Table 2 Soft Body Impact Requirements

Test	Exposure Categories (Table 3 of CWCT Technical Note TN 75)	Impact Energy (Joules / Nm)	Performance (Tables 1 & 2 of CWCT Technical Note TN 75)
Serviceability	B, C, E & F	120	Class 1
Safety	B & C	500	Negligible risk
Safety	E & F	350	Negligible risk

*when tested in the temporary, un-mortared state (see 3.1.2), Class 2 is acceptable for Serviceability and Low Risk is acceptable for Safety.

2.4.1.2 Hard body impact

The brick slip system shall satisfy the following requirements in accordance with CWCT Technical Note 76:

Table 3 Hard Body Impact Requirements

Test	Exposure Categories (Table 3 of CWCT Technical Note TN 75)	Impact Energy (Joules / Nm)	Performance (Tables 1 & 2 of CWCT Technical Note TN 75)
Serviceability	B	10	Class 1
Serviceability	C & E	6	Class 1
Serviceability	F	3	Class 1
Safety	B, C & E	10	Negligible risk
Safety	F	3	Negligible risk

*when tested in the temporary, un-mortared state (see 3.1.2), Class 2 is acceptable for Serviceability and Low Risk is acceptable for Safety.

2.5 Fire

2.5.1 General

The brick slip system shall comply with the requirements of Building Regulations Approved Document B.

2.5.2 Combustibility of cladding materials

The brick slip system shall be a minimum of A2-s1, d0 when classified to EN13501 Pt. 1.

Breather membranes shall be a minimum of Class B-s3, d0 when classified to 13501 PT. 1.

2.5.3 Compartmentation and fire stopping.

Proprietary fire stopping and sealing systems which have been shown by test to maintain the fire resistance of the cladding system shall be used.

2.6 Corrosion

2.6.1 Localised corrosion

Localised corrosion shall be prevented by avoiding designs that may trap water.

2.6.2 Cementitious surfaces

Visible anodised or mill finish aluminium components shall not be in direct contact with curing cementitious surfaces, such as mortars.

2.7 Visual quality

2.7.1 Generally

The materials and finishes shall provide a reasonably uniform appearance without visibly unacceptable blemishes or variations in colour or texture when viewed from inside and outside in all weather conditions during the day, and when fabricated, assembled and installed in accordance with the specified material and finishes requirements.

All judgements made with regard to the cosmetic appearance of the brick slip cladding shall be made at a minimum viewing distance of 3 metres.

3. Components, products & assemblies

3.1 Brick slip cladding systems

The brick slip system shall be a proprietary product tested and certified in accordance with CWCT's *Standard for Systemised Building Envelopes*, the *European Assessment Document for Kits for External Wall Claddings – Mechanically Fixed (EAD 090062-01-0404:2021)*, and other codes and standards specified within this document.

The tested assembly shall comprise all components used within the system, including but not limited to, the product tested, supporting framing including fixing methods and backing wall.

The test panel shall be a minimum height of 3 m and width of 3.5 m to adequately demonstrate its ability to accommodate thermal movements, service load and safety load deflections. (It is noted that this is larger than the minimum dimensions set out in the standards above, however; this is intentional to demonstrate that the system can accommodate the differential movement characteristics of the typical clay, cementitious, lime and metal based components featured in brick slip cladding.)

The test panel backing wall construction shall exhibit mid span deflections that are representative of those that will occur whilst in service. Deflections shall be measured at the front face of the brick slip.

Where the system is intended to accommodate multiple slip types, cut from standard bricks, a variety of brick types (i.e. manufacturing methods) shall be tested in all applicable tests. For example, deeply frogged bricks, misshapen handmade, or highly perforated products.

The system shall prevent ingress of vermin, but allow for sufficient ventilation to prevent a build-up of condensation.

3.1.1 Testing authority

Testing shall be conducted by an Independent Testing Authority. The appropriate National Authority shall have accredited the Independent Testing Authority.

Where the testing facilities of the Independent Testing Authority are not used, the calibration of the equipment, and the witnessing, reporting and certification of the results shall be by the Independent Testing Authority.

All measurement devices used in the tests shall be calibrated to National Standards and shall have current calibration certificates available for inspection during the test.

3.1.2 Testing generally

All testing of the brick slip system shall demonstrate that it can safely retain brick slips in its temporary unmortared state, and final mortared state, by independent test.

The testing shall also demonstrate this whilst incorporating samples exhibiting the full range of manufacturing tolerances applicable to the brick slips intended for use with the system, including:

- Maximum and minimum dimensional and shape tolerances of the brick.
- Maximum and minimum fabrication tolerances of the brick slip, e.g. cutting of grooves to accommodate cladding rails, etc.

Where brick slips are cut from clay masonry units (whole bricks), these shall be as measured and declared by the manufacturer in accordance with BS EN 771.1 and its UK National Annex.

The brick slip system shall demonstrate, by independent test, the performance requirements outlined in Table 4.

Tests f), g), and h) shall be performed in a sequence followed by additional impact testing to determine the long term durability of the brick slip system.

Table 4 Performance Requirements

Ref	Parameter	Test method	Performance requirement
a)	Deflection limits	Centre for Window and Cladding Technology (CWCT) Standard for systemised building envelopes (2006).	Under the action of the most onerous combination of loads, deflections of framing members shall not exceed the values given in the CWCT Standard for systemised building envelopes. The deflections shall be recovered fully when the loads are removed.
b)	Wind resistance (Serviceability + Safety)	CWCT Standard test methods for building envelopes – section 11 and 12.	Refer to section 3.5 and 3.6 of CWCT Standard for systemised building envelopes.
c)	Thermal transmittance	-	All brackets shall have thermal breaks.
d)	Fire	Classification in accordance with BS EN 13501-1.	Reaction Class A1 or A2-s1, d0
e)	Impact resistance	CWCT Standard Test Methods TN75 and TN76. Impact test shall be undertaken as a standalone test and an additional test following test sequence i), below.	Refer to section 2.4.
f)	Hygrothermal behaviour (heat-rain and heat-cold cycling)	EAD 090062-01-0404:2021 – Annex M.1	No detectable deterioration to the brick slips, such as spalling or cracking after each cyclic test. Fine mortar cracks of <0.5 mm mortar are acceptable, in accordance with category 1 of BRE Digest 251.
g)	Freeze/thaw resistance	An assembled sample of the system (including all components e.g. slips, mortar, cladding rails, etc.) shall be tested to either: - EAD 040914-00-0404 – Annex D.2 (30 freeze thaw cycles) - DD CEN/TS 772-22:2006 (100 freeze thaw cycles)	EAD test: No detectable deterioration to the brick slips, such as spalling or cracking after each cyclic test. DD CEN/TS 772-22 test: No damage of Type 4 or greater. Both tests: Fine mortar cracks of <0.5 mm are acceptable, in accordance with category 1 of BRE Digest 251.
h)	Cyclic wind resistance	CWCT Standard for systemised building envelopes (2006) – section 8.14.6.	No loss of integrity when subjected to the test sequence.
i)	Cladding element creep test (only applicable for systems designed for use on horizontal surfaces e.g. soffits, cornices, etc.)	EAD 090062-01-0404:2021	No loss of integrity when subjected to the test sequence.

3.1.3 Drainage and ventilation

Water shall not accumulate anywhere within the system. Openings or weep vents in the brick slip cladding shall be sufficient to ventilate and drain any water within the system to the outside.

The system shall maintain an unobstructed, ventilated and drained cavity of not less than 38 mm wide immediately inboard of the brick slip cladding system, to ensure effective ventilation and drainage. Gaps shall be incorporated to allow for tolerances of the construction.

3.1.4 Cavity barriers

System drawings shall clearly demonstrate how continuity of cavity barriers, including continuity of intumescent strips at horizontal locations are to be coordinated with the brick slip cladding framing.

3.2 Metal components

3.2.1 Metal components and framework

Grinding, cutting and shaping of metals shall be carried out using tools which will not contaminate them with particles which could stain or corrode them.

3.2.1.1 Pressing and folding

The folding and forming of aluminium and stainless steel sheet shall be carried out over dies or mandrels.

The minimum radii for the respective metals are recommended by the Aluminium Federation in such publications as *The Properties of Aluminium and Its Alloys* and *The Designer's Guide to rolled Aluminium, Part 2*, and the Steel Construction Institute in *Design manual structural stainless steel*.

Trial bends shall be made on scrap material of the alloy, temper and thickness being used to ensure that it is not cracked, torn, unevenly stretched or separated at grain boundaries.

3.3 Brackets, fixings and support rails

All brackets, cladding rails and support structure for the system used outside the control line shall be Grade 1.43xx stainless steel, or aluminium.

Brackets used within the cladding zone shall be thermally broken. All fixings shall be stainless steel.

Bolts, screws and nuts used for fixing the cladding to the structure shall be of adequate strength for their purpose.

The design and detailing of fixings shall not introduce locked-in stresses that may be detrimental to the performance of the brick slip system during the service life. This includes any stresses which may develop within a panel or component as a result of fixings which restrict panel movement.

4. Materials

4.1 Aluminium

4.1.1 Extrusions

All extruded aluminium shall have the chemical composition and temper appropriate for its function, exposure and applied finish. They shall comply with BS EN 755, BS 1161 and BS EN 515.

4.1.2 Sheet, strip and plate

Sheets for hidden flashings shall have the chemical composition and temper appropriate for its function. They shall comply with BS EN 485 and BS EN 573.

4.2 Stainless Steel

4.2.1.1 Plate, sheet and strip

Stainless steel in plate, sheet and strip shall comply with BS EN 10029, BS EN 10048, BS EN ISO 9445 and BS EN 10088 as appropriate.

Unless noted otherwise, grade 1.44xx (formerly 316) shall be used for visible components, in all other circumstances grade 1.43xx (formerly 304) shall be used.

4.2.1.2 Fixings and fasteners

Fixings and fasteners shall comply with BS EN ISO 3506-1 and BS EN ISO 3506-2.

Unless noted otherwise, grade A4 shall be used for visible fasteners, in all other circumstances grade A2 shall be used.

Set screws shall comply with BS EN ISO 3506-3.

Self-tapping screws shall conform to BS EN ISO 3506-4.

4.2.1.3 Sections

Stainless steel sections shall comply with BS EN 10088-3.

4.3 Clay brick slip

Bricks slips shall be made from vitrified clay materials (ceramic) and shall be suitable for use as external cladding. Brick slips may be manufactured as slips or cut from conventional bricks (clay masonry units).

4.3.1 Technical requirements

Brick slips shall comply with the requirements of BS EN 771-1, its National Annexe, and to the following criteria:

Durability designation	F2 (see clause 4.3.1.1)
Soluble salt content	S2
Tolerances	T1 or T2, in accordance with brick or slip manufacturer's declaration (see clause 4.3.1.2).
Range	R1 or R2, in accordance with brick or slip manufacturer's declaration (see clause 4.3.1.2).

4.3.1.1 *Freeze thaw*

Note that compliance with the durability designation of F2 (freeze-thaw resistance) for brick slips does not automatically mean durability of the entire cladding system. System freeze-thaw testing is also required in accordance with the testing described in Table 4 of this document.

4.3.1.2 *Size and range tolerances of brick slips*

Careful consideration shall be given to the manufacturer's stated size tolerances for either the bricks (prior to cutting) or manufactured slips, to ensure the mechanical fixings can enable adequate engagement of slips. For example, a batch of nominally 65 mm height units in compliance with the T2 R1 category (the most commonly available category of bricks in the UK) might include units with a minimum face height of 59 mm, and maximum face height of 71 mm. For the T1 R1 category this may be broader still, from 58 to 72 mm respectively.

It is safety-critical that for systems where the engagement depth of mechanical fixings into the slips (via horizontal rails or similar), is relied upon to provide adequate restraint against wind and impact resistance, that either a form of engagement depth adjustment is provided in the fixings, or careful size measurement grading of units is provided as part of the manufacturing quality process, to ensure that the minimum required fixing embedment depth is achieved.

Brick slips designated Tm tolerance or Rm range, (whereby the manufacturer declares their own values), shall only be acceptable where the tolerances exceed those of T2 and/or R2. Declared tolerances broader than T1 and R1 shall not be acceptable, except where specific testing in accordance with this specification has been undertaken to demonstrate adequate engagement of the slips.

Units outside of the actual size and range used during testing of the system shall never be used, except where mechanical fixings can be adjusted to ensure the same embedment depth used during testing.

4.3.1.3 *Variety of brick types*

Where a system features slips cut from a variety of brick types (i.e. different manufacturing methods), all typical types shall be tested. This is because many products will have discontinuous engagement of mechanical fixings due to features such as irregular shapes in hand made bricks, frogs, perforations, etc.

4.4 **Mortar for grouting brick slip cladding system**

4.4.1 *Mortars generally*

Mortars shall be selected and graded to provide adequate strength, durability and ductility for use on the brick slip cladding system. It shall be noted that mortars which are too weak (such as those containing insufficiently strong binders or insufficient proportion of binders) will have reduced durability against frost and erosion. However, excessively strong mortars will have insufficient capacity to accommodate movement in the cladding system and may be excessively brittle or transfer excessive loads into the brick slips themselves or other parts of the cladding system.

The following clauses (4.4.2 and 4.4.3) give general guidance, however; mortar type and grade needs to be developed specifically for the brick slip cladding system, and adequacy shall be proven via the testing programme defined in section 3.1.

4.4.2 *Cementitious Mortars*

Mortars shall be factory-made masonry mortars in accordance with BS EN 998-2.

Mortars for brick slip cladding shall be minimum Class (iii) / M4 compressive strength class except for external exposed features, including parapets, projecting gable walls, etc., where mortars shall be Class (ii)/ M6 compressive strength class.

Mortar mix shall be as defined in PD 6697 and NA to BS EN 1996-1-1, and Mortar Mixes table below.

Mortar joints used on individual projects shall not deviate from those tested.

Mix proportions are by volume. Once work has commenced the mix proportions shall not change unless advised.

Mortar mixes:

Mortar designation group	(i)	(ii)	(iii)
Compressive Strength Class	M12	M6	M4
Portland Cement: lime: sand	1:¼:3	1:½:4½	1:1:5-6
Portland Cement: premixed lime & sand – (proportion of lime to sand given in brackets)	1:3 (1:12)	1:4-4½ (1:9)	1:5-6 (1:6)
Portland Cement: sand & entrainer	1:3	1:4	1:5-6
Masonry Cement: sand & entrainer		1:2½-3½	1:4-5

4.4.3 Proprietary pointing Mortars

Mortars shall be minimum Class (iii) / M4 compressive strength class.

Mortars shall be a proprietary gun-applied mortar system specifically developed for the selected brick slip cladding system and as recommended by the system manufacturer.

Mortars shall be proprietary lime mortars or similar approved, graded to provide sufficient flexibility to accommodate the movements and joint size tolerances expected of the façade, whilst providing a sufficient level of frost resistance and durability for the building location

Mortar ingredients shall conform to the following standards:

- Natural Hydraulic Lime (NHL) to BS EN 459: Part 1
- Calcium Lime (CL90) to BS EN 459: Part 1
- Sand to BS EN 13139
- Pigments to BS EN 12874
- GGBS to BS EN 15167

4.5 Sealant (non-structural)

In general, sealant shall be selected and applied in accordance with the guidelines contained in BS 6213, BS EN ISO 11600 and CIRIA Guide 178. The sealant shall be silicone.

Backing rods shall be closed cell polyethylene foam. When closed cell sections are used non-gassed products shall be selected.

Sealant shall be compatible (non-staining) with brick.

5.

5. Accuracy of erection

5.1 Aluminium cladding support structure

Structural aluminium shall be erected in accordance with the tolerances given in BS 8118-2.

5.2 Stainless steel cladding support structure

Structural steelwork shall be erected in accordance with the tolerances given in the Structural Engineer's Movement and Tolerance Report.

5.3 Fixings

Fixings including primary fixings to the building structure shall be installed in accordance with the fixing manufacturer's recommendations and required procedures.

5.4 Membranes

Membranes used for flashing, waterproofing and vapour control shall be continuous and shall be fixed mechanically and with adhesive to the backing components and completely sealed. They shall be formed into shapes compatible with the building interfaces. They shall be sealed at all joints, and fixing penetrations.

5.5 Brick slip cladding

5.5.1 Accuracy

The brick slip system shall be installed to the following permitted deviations:

Table 5 Permitted installation tolerances

Line (straightness on plan)	± 3.0 mm in any one 6 m wide bay of brick slip cladding
Level (horizontality on elevation), when measured across the top surface of the bricks slips	± 3.0 mm in any one 6 m wide bay of brick slip cladding length of wall
Plumb (verticality in vertical section)	± 3.0 mm across a single storey
Plane (flatness in all directions planar to face)	± 3.0 mm in any one 6 m width module or across a single storey

Courses shall be kept level and true to line. All brick slips shall be accurately plumb.

6. Minimum prescriptive requirements

6.1 Brick slip cladding system

The brick slip system shall include the following minimum prescriptive requirements:

- All fixings outside or through the vapour control line shall be stainless steel.
- All brackets outside the vapour control line shall be stainless steel or aluminium.
- All brick slip units shall be individually mechanically fixed. Adhesive fixing of brick slips shall not be accepted under any circumstances.

- Where brick slips return around corners, both legs of the slip shall be mechanically supported. Connection of header and stretcher slips should not be purely reliant on adhesion of the mitred parts.
- Openings in the brick slip cladding shall be sufficient to ventilate the cavity and allow water which may accumulate in the cavity to drain to the outside.
- The system shall be detailed so it allows for a minimum air gap of 38 mm as per CWCT guidance between the internal face of the brick slips and the cavity face of the insulation.

6.2 Ancillary components (where applicable)

The ancillary components of the system shall include the following minimum prescriptive requirements:

- Where an inner vapour control line and outer weathering membrane are present in the same wall construction, the vapour control line shall have lower water vapour permeability than the outer weathering membrane.
- Where flexible or sheet vapour control membranes are connected together or to other systems, they shall be continuously sealed and positively clamped.
- Smoke and fire stops shall be incorporated as required by the Building Regulations.
- Cavity Barriers shall be provided as required by the Building Regulations, extending across the cavity so that the cavity is closed. Mechanical restraint to cavity barriers shall be incorporated.
- Continuous cavity trays, sealed to the supporting structure/ vapour control layer above fire stops, shall be provided so that any water is drained to the outside.
- The air/vapour control line shall be designed to resist the maximum design wind load. Flexible membranes shall not be permitted to span further than 100 mm without support.
- Aluminium sheet used in concealed locations shall not be less than 1.6 mm thick.
- Aluminium trims and flashings to have a minimum 2.0 mm thickness.