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File Note

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1. Introduction

Arup is appointed by James & Taylor to undertake an independent technical review of the information provided by them on the Barracuda system, along with nine other mechanically fixed brick slip systems available on the UK market, based on their publicly available website information. James & Taylor requested that Arup produce a brick slip system 'model performance specification' with technical criteria against which the systems can be evaluated.

This document provides a summary of the key specification requirements from our *Model Performance Specification* and findings of the system review in our more detailed *Evaluation Report*.

2. Model performance specification

Arup's *Model Performance Specification* is a non-project/product specific document which outlines the technical performance criteria we consider suitable for the specification and evaluation of brick slip cladding systems.

The document recommends that a system shall satisfy the following key criteria. It shall:

- Feature mechanically fixed brick slips. No systems which rely on adhesives are accepted.
- Achieve adequate wind load resistance, in accordance with CWCT *Standard test methods for building envelopes*;
- Achieve adequate impact resistance, in accordance with CWCT *TN 75* and *TN 76*;
- Achieve adequate durability performance, comprising a test sequence of hygrothermal behaviour (*EAD 090062-01-0404:2021 – Annex M.1*), freeze/thaw resistance (*EAD 040914-00-0404 – Annex D.2,* or; *DD CEN/TS 772-22:2006*), cyclic wind resistance (*CWCT Standard for systemised building envelopes)*, followed by an impact test (*CWCT TN 75* and *TN 76*);
- The system shall safely retain brick slips in a temporary un-mortared state and final mortared state. Testing un-mortared is required to demonstrate the slips will not disengage from wind and impact loads during installation or the service life of the building, should the pointing mortars fail over time;

- The test panel size and backing wall construction shall exhibit mid span deflections representative of those that will occur in service;
- The system shall demonstrate adequate engagement of slips across the dimensional tolerance and range used with the system. Careful consideration shall be given to the manufacturer's declared and actual brick height tolerance (see footnote 1).
- Where a system incorporates slips cut from multiple brick types (e.g. handmade, frogged, perforated, etc), rather than a standard purpose made slip, the system shall be tested using a variety of brick types to represent this to demonstrate that performance can still be achieved where engagement of fixings may be discontinuous.
- 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.
- Consideration shall be given to the inclusion of keyed textures or features to assist the retention of pointing mortars over time, should mortar particles detach due to movement and deflection. Whilst there is no evidence of this widely occurring with brick slip systems generally (noting they have been in use for over two decades), it is theoretically possible for particles to break away over the longer term, especially where mortar joints are shallow and/or where adhesion on some surfaces may be against non-porous materials such as metals.

3. Brick slip system review

Arup's *Evaluation Report* reviews the major mechanically fixed brick slip systems currently on the market. A brief overview of each system is provided along with our understanding of the system's history and performance to date. The report includes a system comparison table which reviews each system against the clauses of the *Model Performance Specification*, to provide a comparative assessment of the systems based on key performance factors.

The report reviews the following systems (listed in alphabetical order):

1. Barracuda (James & Taylor);
2. BrickClad (Shackerley Facades);
3. Briklok (RJ Facades);
4. CERTUS (ACS Facades);
5. CMS40 (Cladmate);
6. Corium (Wienerberger);
7. MechSlip (Ibstock/Ash & Lacy);

[1] The method in BS EN 771-1 determines whether a brick slip satisfies the specified tolerance and range by a maximum deviation of mean from the declared work dimension of a sample of 10 bricks. This method obscurely makes it possible for slips within the sample to have dimensions which fall outside of the tolerance but will still satisfy the tolerance and range requirement when a mean average of the 10 bricks is applied. For example, a brick slip manufactured to a nominal height of 65 mm and declared as T1/R1 tolerance/range can have a possible height difference of 58-72 mm. 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 adjustment is provided, or careful grading of units is provided as part of the quality process, to ensure that the minimum required fixing embedment depth is achieved.

8. NaturAL-X (Ash & Lacy);
9. Occam (RJ Facades); and
10. SureBrick (Forterra).

A summary of the system comparison table is provided below.

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Model performance specification clause	System									
	Barracuda	BrickClad	Briklok	CERTUS	CMS-40	Corium	MechSlip	NaturAl-X	Occam	SureBrick
2. Performance: general requirements										
2.1 Design and service life										
2.2 Accommodation of movements										
2.3.1 Wind loads										
2.4 Impact										
2.5 Fire										
2.6 Corrosion										
2.7 Visual quality										
3. Components, products & assemblies										
3.1 Brick slip cladding systems										
3.1.1 Testing authority										
3.1.2 Testing generally										
3.1.2 (a) Deflection limits	***TBC***									
3.1.2 (b) Wind resistance										
3.1.2 (c) Thermal transmittance										
3.1.2 (d) Fire	See clause 2.5									
3.1.2 (e) Impact resistance										
3.1.2 (f) Heat/rain resistance										
3.1.2 (g) Freeze/thaw resistance										
3.1.2 (h) Cyclic wind resistance										
3.1.3 Drainage and ventilation										
3.1.4 Cavity barriers										

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Model performance specification clause	System									
	Barracuda	BrickClad	Briklok	CERTUS	CMS-40	Corium	MechSlip	NaturAl-X	Occam	SureBrick
3.3 Brackets, fixings and support rails										
4. Materials										
4.1 Aluminium										
4.2 Stainless steel										
4.3 Clay brick slip										
4.4 Brick slip cladding system carrier frame	See clause 4.1 and 4.2									
4.5 Mortar for grouting brick slip cladding system										
4.7 Sealant (non-structural)										
5. Accuracy of erection										
5.1 Aluminium cladding support structure										
5.2 Stainless steel cladding support structure										
5.3 Fixings										
5.4 Membranes										
5.5 Brick slip cladding										
6. Minimum prescriptive requirements										
6.1 Generally										

The review concludes that Barracuda, BrickClad, CERTUS, CMS40, Corium, MechSlip, NaturAL-X, and SureBrick are tested to CWCT *Standard for Systemised Building Envelopes*, *European Assessment Document for Kits for External Wall Claddings – Mechanically Fixed*, and other relevant codes and standards.

All of the systems judged to be adequately tested achieved adequate wind load and impact resistance in a final mortared state. However, only Barracuda performed and passed testing in a temporary un-mortared state. This is not a requirement in the CWCT standards, so manufacturers do not ordinarily undertake this test. However, Arup recommends that manufacturers perform the testing in this state to demonstrate that brick slips are safely restrained when the façade is subjected to wind/impact loads during installation prior to mortar application.

Only Barracuda performed and passed the full durability test sequence. The other systems commonly undertook heat/rain and freeze/thaw testing but did not publish information for cyclic wind resistance or a subsequent impact test after the sequence in their online technical information, so whilst it is possible the systems may pass, this cannot currently be concluded. Arup recommends that manufacturers undertake this in due course to demonstrate their systems are fully satisfy the durability requirements, and will take steps to raise industry awareness of this.

Barracuda, Briklok, Corium, and SureBrick have published sufficient information to determine that the test panel size and backing wall construction adequately satisfy the requirements of the specification. Certus, MechSlip, and NaturAL-X published information to demonstrate the test panel size is appropriate but not the backing wall construction. It is important these requirements are satisfied to ensure the test panel performs and exhibits mid span deflections representative of its behaviour in service.

Only BrickClad and Occam did not provide details of the dimensions of brick slips tested. All the other systems performed testing with a stated nominal brick slip height of 65 mm, however, it is likely that the actual height of the slips varied from the nominal height, as such materials typically exhibit wide manufacturing tolerances. Only Barracuda performed the testing with a full range of slip heights which would potentially be included within the declared and actual height tolerances. As stated in Section 2, Arup recommends testing is performed with all brick slip heights that can legitimately occur in the declared tolerance and range to ensure the rail system adequately engages with and restrains the slips.

James & Taylor conducted independent studies to assess:

- the actual possible range in brick slip heights when manufactured to T1/R1, T2/R1, and T2/R2 tolerance/range;
- each system's ability to retain brick slips of the actual possible range in heights, factoring in the installation tolerance range of the horizontal support rails.

They concluded from their studies that it is possible for brick slips manufactured to a nominal height of 65 mm with a declared T1/R1 tolerance/range to have an actual height range of 58-72 mm. When assessing each system's ability to retain slips of this height range, they concluded the majority of systems assessed in this study to be incapable of engaging the full range of possible heights which might occur in typical brick batches. In our view, bricks for slip production would need to be selected for size according to the capability of each system.

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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.

DOCUMENT CHECKING

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