

TEST REPORT

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Project Title: Testing of HURST TRACKWALL Brick Slip System to EAD 090019-00-0404:2016 & EAD 090062-00-0404:2018

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EXECUTIVE SUMMARY

System One – HURST TRACKWALL Brick Slip Cladding System

Test	Method	Requirement	Summary of Results
Hygrothermal Behavior	EAD 090019-00-0404 – Annex D EAD 090062-00-0404 – Annex M	No cracking, blistering, peeling or delamination	No Defects
Freeze/Thaw	EAD 090019-00-0404 – Annex E EAD 090062-00-0404 – Annex M	No cracking, blistering, peeling or delamination	No Defects
Bond Strength – Wall	EAD 090019-00-0404 – Cl. 2.2.8	$\geq 0.08 \text{ N/mm}^2$ or cohesive failure of insulation*	0.47 N/mm^2
Impact Resistance – Wall	EAD 090019-00-0404 – Annex C EAD 090062-00-0404 – Annex G	Hard body Category I, II, III or IV	Category I
	EAD 090019-00-0404 – Annex C EAD 090062-00-0404 – Annex G	Soft body Category I, II, III or IV	Category I

* Requirements taken from EAD 090019-00-0404 – Cl. 2.2.8.



1 INTRODUCTION

Hurst Contracts Ltd has developed a cladding system using Trackwall and now wishes to subject the system to hygrothermal testing in accordance with the methods given in EAD 090019-00-0404:2016¹ and EAD 090062-00-0404:2018² to assess suitability of the system in situ applications.

2 TEST PROGRAMME

The Hurst Contracts Ltd system was subjected to the test program listed in Table 1.

Table 1 - Test Program

Test	Standard	Clause	No. of Tests per System
Hygrothermal Behavior	EAD 090019-00-0404 EAD 090062-00-0404	2.2.13 2.2.15	1
Freeze/Thaw	EAD 090019-00-0404 EAD 090062-00-0404	2.2.14 2.2.15	1
Soft Body Impact	EAD 090019-00-0404	2.2.7	3
Hard Body Impact	EAD 090062-00-0404	2.2.11	6
Bond Strength (after hygrothermal and freeze/thaw testing)	EAD 090019-00-0404	2.2.8	5

3 TEST SAMPLE

The wall was installed onto a 2.6 m high x 3.2 m wide light gauge steel test frame provided by Lucideon Limited.

Installation of the system was carried out by a technical team from Hurst Contracts Ltd.

The systems incorporated the following components:

3.1 HURST TRACKWALL Brick Slip Cladding System

- Ash & Lacy 2.7 mm 'C' Rail;
- Ash & Lacy 2.7 mm 'U' Rail;
- SFS-LP19-HEX TEK Screws;
- E-VS BOHR 3 FLT 4.8 mm x 38 mm For Light Steel Self Drill Countersunk Zinc Plated Screw;
- Ash & Lacy 2.4 mm 'Z' Rail;

¹ EAD 090019-00-0404:2016 Kits for Ventilated External Wall Claddings of Lightweight Boards on Subframe with Rendering Applied in Situ With or Without Thermal Insulation.

² EAD 090062-00-0404:2018 Kits for External Wall Claddings Mechanically Fixed.

- Trackwall Brick Slip Carry Board;
- Galvanized Steel Construction Board Washers 36 mm x 0.5 mm;
- Ultra TILEFIX ProFlex SP Tile Adhesive;
- La Paloma Cerámicas 230 x 28 x 50 mm Grey Escorial Brick Slips;
- Bostik Cementone Concentrated Mortar Plasticizer;
- Blue Circle Mastercrete Cement.

The system construction, together with the construction detail plates, are shown in Appendices 1-2.

4 TEST METHOD

4.1 Hygrothermal Test

The wall frame was centrally clamped to the face of a 2.4 m high x 3.0 m long test aperture.

Testing was carried out in accordance with EAD 090019-00-0404 Annex D and EAD 090062-00-0404 Annex M. The testing involved subjecting a panel to repeated heat/rain cycles followed by repeated heat/cold cycles at controlled humidity conditions designed to simulate naturally occurring conditions.

4.1.1 Weathering Cycles

The wall was subjected to cyclic heat/rain conditions followed by heat/cold cycles according to the following program.

4.1.2 Heat/Rain – 80 Cycles

- Heating to 70°C.
- Rising over 1 hour and maintaining at 70°C (± 5) at 10-30% relative humidity (RH) for a further 2 hours.
- Followed by spraying with water (water temperature 15°C (± 5)) at 1 l/m²min for 1 hour.
- Draining for 2 hours.

On completion of the heat/rain cycles, the wall was conditioned for 48 hours at a temperature between 10 and 25°C with a minimum RH of 50%.

4.1.3 Heat/Cold – 5 Cycles

- Exposure to 50°C (± 5) with a rise of 1 hour and maximum 10% RH for 7 hours.
- Exposure to -20°C (± 5) with a fall over 2 hours and hold for 14 hours.

The wall was inspected every four heat/rain cycles and daily under the heat/cold cycles to observe changes in the visual characteristics of the panel.

4.2 Freeze/Thaw Test

After hygrothermal testing, the panel was subjected to freeze/thaw testing. The test involved subjecting a panel to repeated freeze/thaw cycles as follows:

4.2.1 Freeze/Thaw - 30 Cycles

Condition the test wall initially by wetting for 8 hours with an amount of 1.5 l/m²min (± 0.5) water with a temperature of 23°C (± 2), then start the cycles consisting of the following:

Freeze the surface of the test wall within two hours to -20°C (± 2) and maintain it for 4 hours (in total 6 hours).

Thaw the test wall for 1 hour at a temperature of 20°C (± 5).

Wet the test wall for 1 hour with an amount of 1.5 l/m²min (± 0.5) water with a temperature of 15°C (± 5).

After the 30 cycles, condition the test wall at ambient temperature 20 °C (± 10).

On completion of the cyclic testing, the wall was left to dry for 7 days.

4.3 Soft Body Impact Test

Testing was carried out in accordance with EAD 090019-00-0404 Annex C and EAD 090062-00-0404 Annex G. A rigid scaffold framework was constructed to hold the impactor such that the center of the soft body impactor was aligned with the brick slip wall.

The scaffold framework was then extended to provide a pulley point to retract the impactor.

The distance from the face of the wall that the front edge of the impactor for each impact energy was calculated can be seen in Table 2.

Table 2 - Impactor Drop Heights

Impact Energy (J)	Drop Height (mm)
10	340
60	2040
300	610
400	820

The impact test consisted of a bag (3 kg for 10 Joules and 60 Joules impacts and 50 kg for 300 Joules and 400 Joules impacts) suspended by a 3 m steel wire swung from differing drop heights, as stated in Table 2.



The impactor was pulled back to the desired distance from the face of the wall using a steel cable and then released.

Test positions were chosen considering various modes of behavior of the systems. The presence of any cracks at the impact point were noted.

4.4 Hard Body Impact Test

Testing was carried out in accordance with EAD 090019-00-0404 Annex C and EAD 090062-00-0404 Annex G.

The system was held in a steel frame and fixed back to a rigid scaffold framework.

To obtain an impact energy of 3 Joules, a 0.5 kg steel ball was released from a drop height of 613 mm and to obtain a 10 Joules impact energy, a 1 kg steel ball was released from a drop height of 1020 mm.

Test positions were chosen, considering, various modes of behavior of the systems. On completion of each impact, the area was inspected and the presence of any cracks at the impact point was noted.

4.5 Bond Strength Test

Testing was carried out in accordance with EAD 090019-00-0404 Clause 2.2.8.

The test was undertaken on the wall after being subjected to hygrothermal and freeze/thaw cycles.

For each system, specimens were cut as follows:

Table 3 – Specimen Sizes

System	Specimen Size	Number of Specimens
1	230 mm x 48 mm	5

The specimens were cut through the thickness of the finish, basecoat and mesh and into the insulation to a depth of 2 mm.

A 230 mm x 48 mm steel plate was bonded to the face of the sample with an epoxy resin and allowed to cure for 24 hours. A centralized tensile load was provided to the plate at a rate of 1-10 mm/min through a tensile load machine until failure was recorded.

Bond strength (σ_B) was determined using the tensile load at failure (f) and the area of the plate (A) according to the equation below:

$$\sigma_B = f/A$$



5 RESULTS

5.1 Hygrothermal Test

According to EAD 090019-00-0404 Annex D and EAD 090062-00-0404 Annex M, the performance requirements of the large scale hygrothermal test rig is that neither the base coat or finish should show evidence of any of the following defects:

- Deterioration such as blisters, flaking, cracking or delamination of the cladding element that allows water penetration to the insulation.
- Detachment of the cladding element.
- Irreversible deformation.

At the end of the test program, no water penetration shall be evident up to the interface kit/substrate.

5.1.1 Results

Table 4 – Hygrothermal Test Results

System	System Description	Defects
One	HURST TRACKWALL Brick Slip Cladding System	No defects

5.2 Freeze/Thaw Test

According to EAD 090019-00-0404 Annex D and EAD 090062-00-0404 Annex M, the sample is deemed to have satisfactorily completed the wet freeze/thaw testing if the following defects do not occur during or at the end of the test program:

- Cracking or delamination of the skin that allows water penetration to the cladding element.
- Blistering flaking or other visible change to the surface.
- Deterioration associated with joints between the cladding element.
- Detachment of brick slip.
- Irreversible deformation.

5.2.1 Results

Table 5 – Freeze/Thaw Test Results

System	System Description	Defects
One	HURST TRACKWALL Brick Slip Cladding System	No defects

5.3 Soft Body Impact Test

The results of the soft body impact testing carried out are given in Tables 8 and can be categorized in accordance with EAD 090019-00-0404 Annex C and EAD 090062-00-0404 Annex G as follows:

Table 6 – Summary Results of Soft Body Impact Testing

System	System Description	Maximum Impact Achieved without Damage	Category
One	HURST TRACKWALL Brick Slip Cladding System	400 Joules	I

5.4 Hard Body Impact Test

The results of the hard body impact testing carried out at both 3 Joules and 10 Joules energy, given in Table 9, and can be categorized in accordance with EAD 090019-00-0404 Annex C.

Table 7 – Summary Results of Hard Body Impact Testing

System	System Description	Maximum Impact Achieved without Damage	Category
One	HURST TRACKWALL Brick Slip Cladding System	10 Joules	I

Categorization of Hurst Contracts Ltd tested system is determined by the lowest category achieved during both soft and hard body testing.

*Category I can be used in the following areas:

A zone readily accessible at ground level to the public and vulnerable to hard body impacts but not subjected to abnormally rough use (e.g.: Façade bases in buildings sited in public locations, such as squares, schoolyards, or parks. Cleaning gondolas can be used on the façade).

5.5 Bond Strength - Full Wall

The results of the bond strength testing carried out on Hurst Contracts Ltd.'s system is given in the Results Table 10 along with their modes of rupture.

6 CONCLUSIONS

The Hurst Contracts Ltd systems' performance is detailed in the Executive Summary.

TABLES

Table 8 - Results of the Soft Body Impact Tests Carried Out on HURST TRACKWALL Brick Slip Cladding System

Impact Energy (Joules)	Observations
10	No Damage
60	No Damage
300	No Damage
400	No Damage

Table 9 - Results of Hard Body Impact Tests Carried Out on HURST TRACKWALL Brick Slip Cladding System

Location	Diameter Under 3 Joules Impact Energy	Cracking	Diameter Under 10 Joules Impact Energy	Cracking
1	No Damage	No	No Damage	No
2	No Damage	No	No Damage	No
3	No Damage	No	No Damage	No

Table 10 - Results of Bond Strength Tests Carried Out on HURST TRACKWALL Brick Slip Cladding System

Sample Size (mm)	Test Number	Ultimate Load (kN)	Ultimate Strength (N/mm ²)	Mode of Failure
230 x 48	a	5.20	0.47	At substrate and back of brick slip interface
	b	5.90	0.53	At substrate and back of brick slip interface
	c	3.50	0.32	At substrate and back of brick slip interface
	d	5.50	0.50	At substrate and back of brick slip interface
	e	5.80	0.53	At substrate and back of brick slip interface
Mean		5.18	0.47	-

NOTE: The results given in this report apply only to the samples that have been tested.

END OF REPORT

APPENDIX 1 - Sample Construction

Full Scale Wall

Lucideon Limited provided 2.6 m high x 3.2 m wide steel frame.

The brick slip cladding system was installed by Hurst Contracts Ltd employees.

3000 x 2.7 mm base rail fixed to top and bottom of provided steel frame using E-VS BOHR 3 FLT 4.8 mm x 38 mm fixings at 400 mm centers. Extra rail was cut to size to make up 3.2 m system width.

3000 x 2.7 mm support rails knocked into place with a mallet in-between the base rails flush against the sides of the steel frame and fixed to the steel frame using E-VS BOHR 3 FLT 4.8 mm x 38 mm fixings at 400 mm centers. Rail was cut to size to be able to fit into the 2.6 m high frame.

Additional support rails were knocked into place based on 600 mm centers. Each support rail was fixed using Hexagon set screw fixings at the top and bottom base-support rail intersect.

2400 x 1200 x 12 mm Y-wall boards were fixed to the rails using E-VS BOHR 3 FLT 4.8 mm x 38 mm fixings at 600 mm horizontal centers and 400 mm vertical centers. This is repeated until the Y-wall had filled the 2.6 x 3.2 m frame. The Y-wall was cut to size where needed.

A 2.4 mm Z-rail was fixed through the Y-wall at the base of the steel frame into the base and support rails using E-VS BOHR 3 FLT 4.8 mm x 38 mm fixings. Additional Z-rails were fixed horizontally across the Y-wall surface separated by 400 mm centers.

1200 x 1200 mm brick slip carry board was mechanically fixed to the Z-rails using E-VS BOHR 3 FLT 4.8 mm x 38 mm fixings and washers at 300 mm horizontal and 400 mm vertical centers.

A 20 kg bag of ULTRA TILEFIX ProFlex SP Tile Adhesive was prepared as per the package instructions and mixed with 4.2–4.5 L of water until an even consistency was achieved. The tile adhesive was applied to the carry board and levelled flush with the board's peaks.

While the tile adhesive is still wet the Grey Escorial Brick Slips were applied to the carry board in between the peaks of the carry board. Each row of brick slips was staggered by half a brick slip in relation to the rows above and below. The cladding system was left for 24 hours while the tile adhesive set.

A mixture of Bostik Concentrated Mortar Plasticizer and Blue Circle Mastercrete Cement was prepared and mixed into an even consistency and applied in between the joints and over the surface of the cladding system ensuring all gaps were filled. Excess was removed and a motor pointer was used at each brick slip joining for a stylized finish.

The cladding system was left to cure for 7 days.

APPENDIX 2 - Construction Details (Plates)



Plate 1 – Installation of Base and Support Rails



Plate 2 – Application of Y-Wall Boards to Base and Support Rails



Plate 3 – Application of 'Z' Rails Upon Y-Wall



Plate 4 – Fixing of Brick Slip Carry Board Upon 'Z' Rails



Plate 5 – Application of Tile Adhesive and Brick Slips



Plate 6 – Application of Plasticizer and Cement Mixture



Plate 7 – Finished Wall

APPENDIX 3 - Soft Body Impact Testing (Plates)

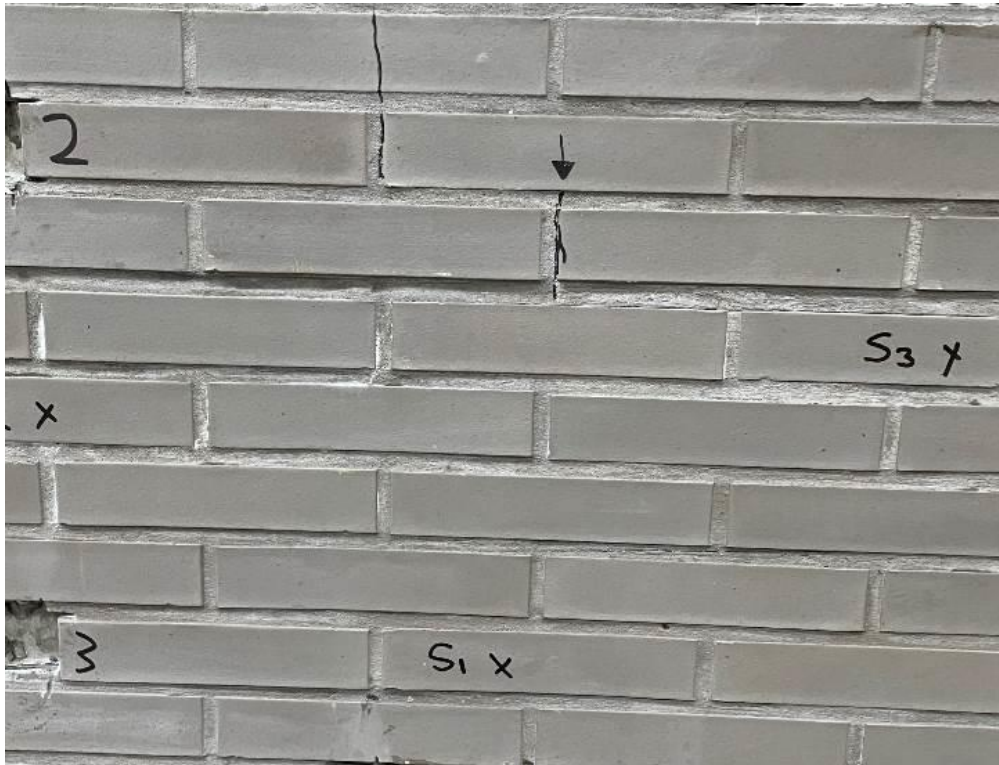


Plate 8 – Soft Body Impact of HURST TRACKWALL Brick Slip Cladding System

APPENDIX 4 - Hard Body Impact Testing (Plates)

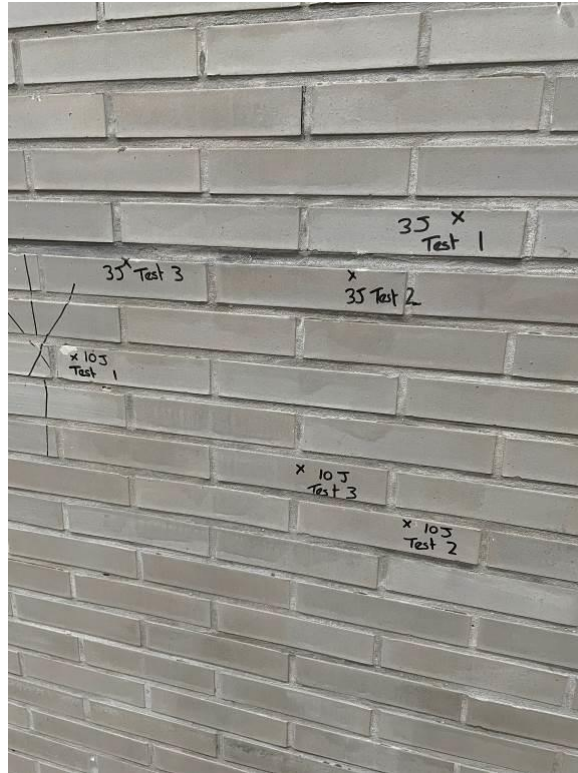


Plate 9 – Hard Body Impact of HURST TRACKWALL Brick Slip Cladding System

APPENDIX 5 - Bond Strength Test (Plates)



Plate 10 – Typical Bond Strength Test Arrangement

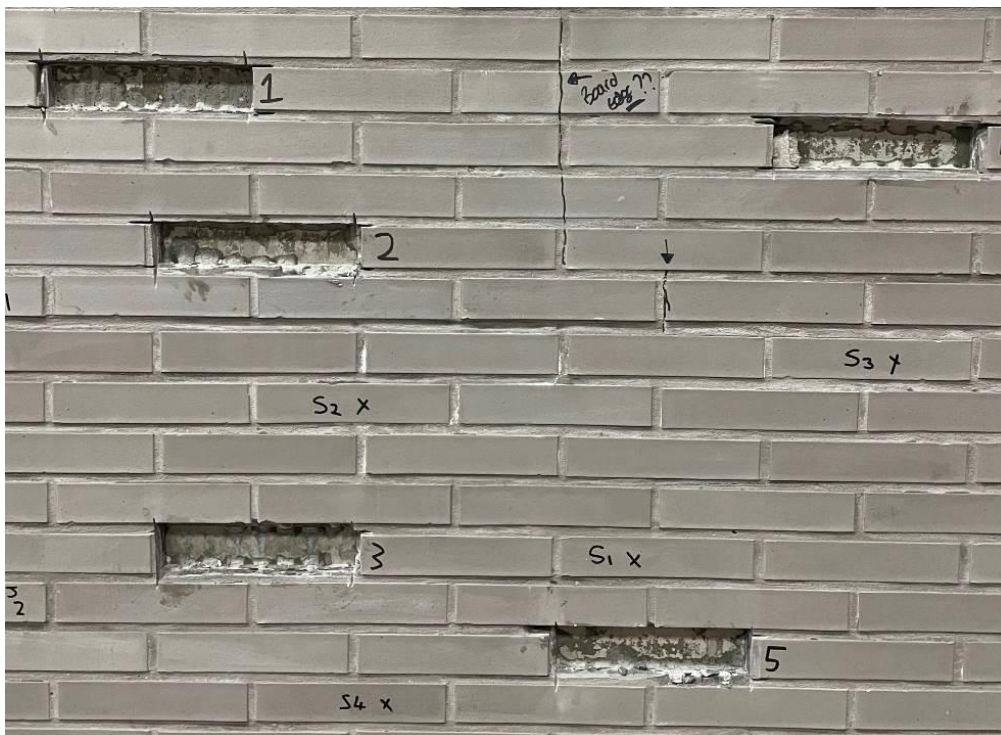





Plate 11 - Bond Strength Failures on HURST TRACKWALL Brick Slip Cladding System



Plate 12 - Bond Strength Failed Brick from HURST TRACKWALL Brick Slip Cladding System

APPENDIX 6 - Batch Details

Product	Description	Image of Label
Base 'C' Rail	3000 x 100 x 70 mm - 2.7 mm Thickness - Steel Base Rail	
Support 'U' Rail	3000 x 104 x 70 mm - 2.7 mm Thickness - Steel Support Rail	
Y-Wall	2400 x 1200 x 12 mm Sheathing Board	
Fixing	E-VS BOHR 3 FLT 4.8 mm x 38 mm For Light Steel Self Drill Countersunk Zinc Screws	
Fixing	Tech Screw Self-Drilling Self- Tapping Screws	
Rail	2.4 mm Steel 'Z' Rail	
Carry Board	Brick Slip Carry Board 1200 x 1200 x 12 mm	
Washer	Galvanized Steel Construction Board Washers 36 mm x 0.5 mm	

Product	Description	Image of Label
Tile Adhesive	<p>ULTRA TILEFIX ProFlex SP Tile Adhesive</p>	
Brick Slip	<p>La Paloma Cerámicas 230 x 28 x 50 mm Grey Escorial</p>	
Mortar Plasticizer	<p>Bostik Cementone Concentrated Mortar Plasticizer</p>	
Cement	<p>Blue Circle Mastercrete Cement</p>	