TECHNOLOGY CENTRE

Technical Report

Title: Weathertightness product testing of a sample of Tiles International Rainscreen Cladding on a Eurobond backing wall

Report No: N950-11-16479a

ti dynamic facades

eurobond
delivering low risk building solutions

VINCI CONSTRUCTION UK

TECHNOLOGY CENTRE

Technical Report

Title: Weathertightness product testing of a sample of Tiles International Rainscreen Cladding on a Eurobond backing wall

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1 copy to Tiles International, 1 copy to Eurobond Laminates Ltd
1 copy to project file
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UKAS TESTING
0057

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CONTENTS

1 INTRODUCTION

This report describes tests carried out at the Technology Centre at the request of T I Tiles International Ltd and Eurobond Laminates Ltd.

The test sample consisted of a Tiles International Rainscreen System on a Eurobond Backing Wall.

The tests were carried out during November 2011 and were to determine the weathertightness of the test sample. The test methods were in accordance with the CWCT Standard Test Methods for building envelopes, 2005, for:

Wind resistance – serviceability & safety.

Watertightness –dynamic pressure.

Impact testing was also carried out to BS8200 Standards.

The testing was carried out in accordance with Technology Centre Method Statement C4091/MS rev 1.

This test report relates only to the actual sample as tested and described herein.

The results are valid only for sample(s) tested and the conditions under which the tests were conducted.

Technology Centre is accredited to ISO/IEC 17025:2008 by the United Kingdom Accreditation Service as UKAS Testing Laboratory No.0057.

Technology Centre is certified by BSI for:

- ISO 9001:2008 Quality Management System,
- ISO 14001:2004 Environmental Management System,
- BS OHSAS 18001:2007 Occupational Health and Safety Management System.

The tests were witnessed by Huw Thomas of Eurobond Laminated Ltd.

2 DESCRIPTION OF TEST SAMPLE

2.1 GENERAL ARRANGEMENT

The sample was as shown in the photo below and the drawings included in the appendix to this report.

The test sample comprised of 3 number 150 mm thick Rainspan support panels with 0.70 mm thick steel facings spanning 4000 mm horizontally between vertical steel supports by others. The panels were 1200 mm module and have a male/female joint along the top and bottom edges. The panels were stacked on top of each other to create the 3600 mm high sample. The panels were through fixed into the vertical supports at panel ands with 5.5 mm diameter self drilling self tapping fixings and into horizontal steel supports at the head and base of the sample with 5.5 mm diameter self drilling self tapping fixings at 450 mm centres. The panels were air sealed around the perimeter of the sample with a continuous 12 x 6 mm self adhesive foam tape.

An array of Aerolite Stonework panels was then fixed to the Rainspan composite backing wall supported by the Ti-tracking “Generic” horizontal carrier system fixed through the front skin of the composite panel by means of the SFS SL3 self drilling fixing.

The Aerolite Stonework panels were 17 mm thick comprising of a 12 mm natural granite backing and a 5 mm natural stone veneer c/w a reinforced fibreglass backing and have a system weight of 42 kg/m2.

The array of Aerolite Stonework panels as tested were (please see drawing in appendix);

1400mm x 600mm, 1000mm x 600mm, 1000mm x 1000mm, 1200mm x 600mm, 1200mm x 400mm, 1000mm x 400mm, 400mm x 400mm and 400mm x 200mm.

The panels had special grooved longitudinal edges called a Kerf that enabled them to engage into the horizontal Ti-tracking “Generic” carrier which was spaced at the panel module height centres.

The Ti-Tracking horizontal carriers were tek screw fixed through the front skin only of the Eurobond Rainspan composite panel by the SFS SL3 light section self drilling fixing.

These SL3 fixing centres ranged from panel to panel determined by its size; please see drawing in appendix for this information.

PHOTO 1000527

TEST SAMPLE ELEVATION

2.2 CONTROLLED DISMANTLING

During the dismantling of the sample no water penetration or discrepancies from the drawings were found.

PHOTO 1000470

TEST SAMPLE DURING INSTALLATION

PHOTO 1000471

SUPPORT RAIL ALONG TOP OF PANEL

PHOTO 1000528

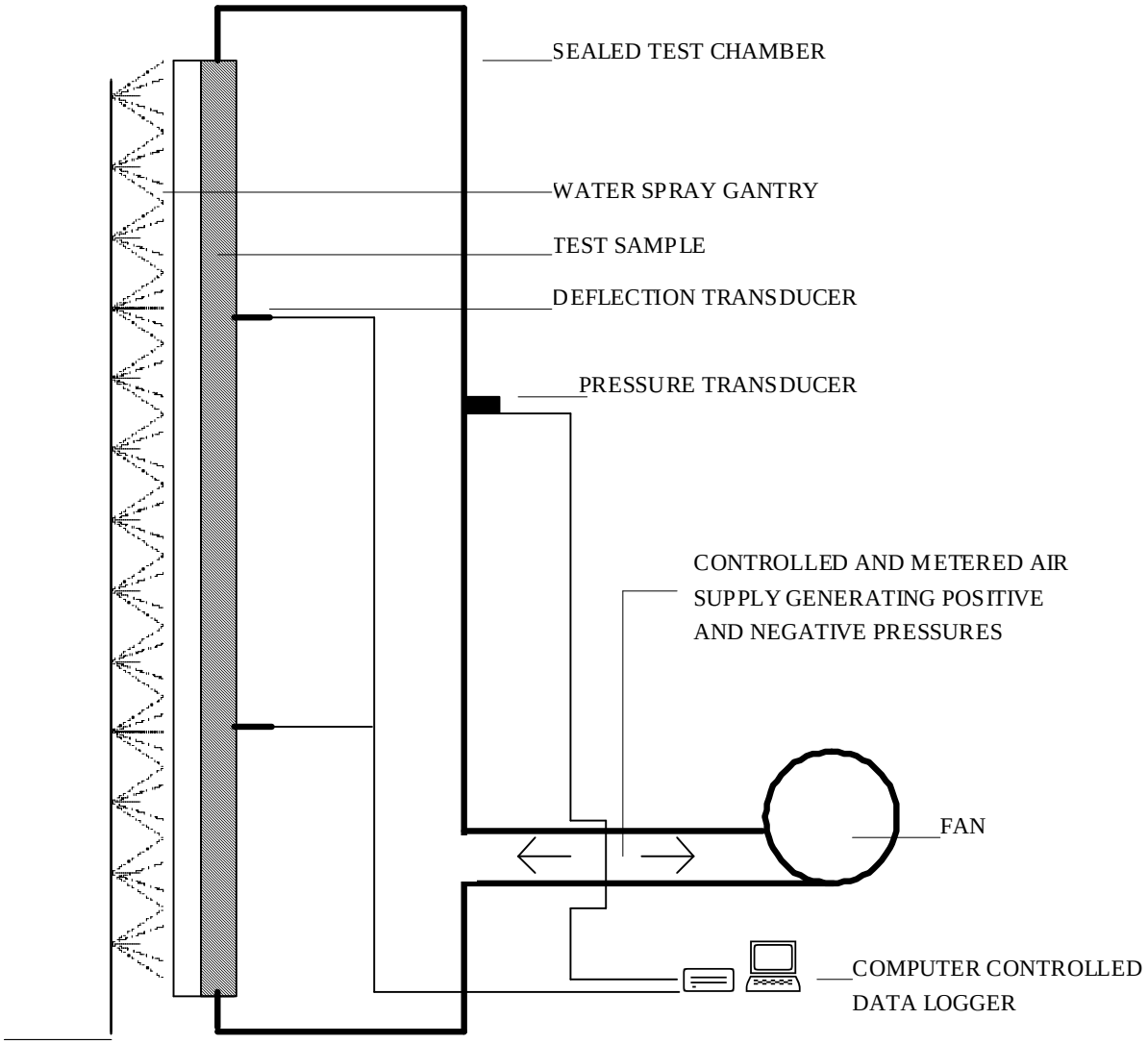
SIDE VIEW BETWEEN PANELS

3 TEST RIG GENERAL ARRANGEMENT

The test sample was mounted on a rigid test rig with support steelwork designed to simulate the on-site/project conditions. The test rig comprised a well sealed chamber, fabricated from steel and plywood. A door was provided to allow access to the chamber. Representatives of Tiles International installed the sample on the test rig. See Figure 1.

FIGURE 1

TEST RIG SCHEMATIC ARRANGEMENT



SECTION THROUGH TEST RIG

4 TEST SEQUENCE

The test sequence was as follows:

(1) Wind resistance – serviceability on Eurobond backing wall

(2) Wind resistance – safety on Eurobond backing wall

(3) Wind resistance – serviceability on rainscreen panels

(4) Wind resistance – safety on rainscreen panels

(5) Watertightness – dynamic

(6) Impact resistance

5 SUMMARY AND CLASSIFICATION OF TEST RESULTS

The following summarises the results of the tests carried out. For full details refer to Sections 6, 7 and 8.

5.1 SUMMARY OF TEST RESULTS

TABLE 1

Date	Test number	Test description	Result
30 November 2011	1	Wind resistance – serviceability	Pass
30 November 2011	2	Wind resistance – safety	Pass
30 November 2011	3	Wind resistance – serviceability	Pass
30 November 2011	4	Wind resistance – safety	Pass
30 November 2011	5	Watertightness – dynamic	Pass
30 November 2011	6	Impact resistance	Pass

TABLE 2

Test	Standard	Classification / Declared value
Wind resistance – Eurobond backing wall	CWCT	±2400 pascals serviceability ±3600 pascals safety
Wind resistance – Rainscreen panels	CWCT	±2400 pascals serviceability ±3600 pascals safety
Watertightness - dynamic	CWCT	600 pascals equivalent wind pressure
Impact resistance	BS8200	Category B*

*Please refer to results section. This category was achieved in all but one location.

6 WIND RESISTANCE TESTING

6.1 INSTRUMENTATION

6.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

6.1.2 Deflection

Displacement transducers were used to measure the deflection of principle framing members to an accuracy of 0.1 mm. The gauges were set normal to the sample framework at mid-span and as near to the supports of the members as possible and installed in such a way that the measurements were not influenced by the application of pressure or other loading to the sample. The gauges were located at the positions shown in Figure 2.

6.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air temperatures to within 1°C.

6.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

6.2 FAN

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

6.3 PROCEDURE

6.3.1 Wind Resistance – serviceability

Three positive pressure differential pulses of 1200 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 2400 pascals to 0. The pressure was increased in four equal increments each maintained for 15 ±5 seconds. Displacement readings were taken at each increment. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded

The test was then repeated using a negative pressure of -2400 pascals.

For the wind resistance test on the rainscreen panels the joints between the panels were sealed over and holes were opened at the sides of the sample to allow the pressure to enter the cavity between back wall and rainscreen. The above test procedure was then repeated.

6.3.2 Wind Resistance – safety

Three positive pressure differential pulses of 1200 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 3600 pascals to 0. The pressure was increased as rapidly as possible but not in less than 1 second and maintained for 15 ±5 seconds. Displacement readings were taken at peak pressure. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

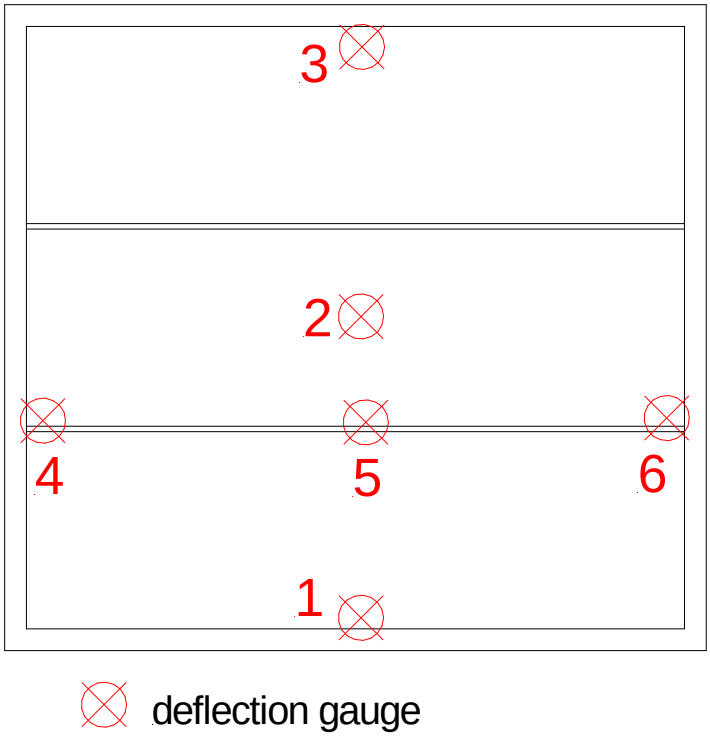
The test was then repeated using a negative pressure of –3600 pascals.

For the wind safety test on the rainscreen panels the joints between the panels were sealed over and holes were opened at the sides of the sample to allow the pressure to enter the cavity between back wall and rainscreen. The above test procedure was then repeated.

FIGURE 2

DEFLECTION GAUGE LOCATIONS

Internal View



6.4 PASS/FAIL CRITERIA

6.4.1 Calculation of permissible deflection

Gauge number	Member	Span (L) (mm)	Permissible deflection (mm)	Permissible residual deformation
2	Vertical backing wall	2800	L/200 = 14.0	1 mm
5	Horizontal backing wall	2800	L/200 = 14.0	1 mm

6.5 RESULTS

Test 1 (serviceability on backing wall) Date: 30 November 2011

The deflections measured during the wind resistance test, at the positions shown in Figure 2, are shown in Tables 3 and 4.

Summary Table:

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
2	Vertical backing wall	2403 -2416	5.2 -5.6	0.2 -0.4
5	Horizontal backing wall	2403 -2416	4.9 -5.0	0.1 -0.2

No damage to the test sample was observed.

Ambient temperature = 5°C
Chamber temperature = 6°C

Test 2 (safety on backing wall) Date: 30 November 2011

The deflections measured during the structural safety test, at the positions shown in Figure 2, are shown in Table 5.

No damage to the sample was observed.

Ambient temperature = 6°C
Chamber temperature = 7°C

Test 3 (serviceability on rainscreen panels) Date: 30 November 2011

No damage to the test sample was observed.

Ambient temperature = 6°C
Chamber temperature = 7°C

Test 4 (safety on rainscreen panels) Date: 30 November 2011

No damage to the sample was observed.

Ambient temperature = 6°C
Chamber temperature = 7°C

TABLE 3

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

ON BACKING WALL

Position	Pressure (pascals) / Deflection (mm)				
	599	1201	1806	2403	Residual
1	0.0	0.1	0.2	0.3	0.0
2	1.1	2.4	3.9	5.7	0.2
3	0.1	0.3	0.5	0.7	0.0
4	0.1	0.1	0.3	0.4	0.0
5	1.1	2.4	3.9	5.6	0.2
6	0.0	0.2	0.5	0.9	0.3
2 *	1.0	2.2	3.6	5.2	0.2
5 *	1.0	2.2	3.5	4.9	0.1

* Mid-span reading adjusted between end support readings

TABLE 4

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

ON BACKING WALL

Position	Pressure (pascals) / Deflection (mm)				
	-618	**-1196**	**-1815**	**-2416**	**Residual**
1	-0.1	-0.2	-0.3	-0.4	0.0
2	-1.2	-2.6	-4.4	-6.3	-0.4
3	-0.2	-0.4	-0.6	-0.9	0.0
4	-0.1	-0.3	-0.5	-0.7	-0.1
5	-1.2	-2.6	-4.2	-6.0	-0.4
6	-0.1	-0.3	-0.7	-1.2	-0.3
2 *	-1.1	-2.3	-3.9	-5.6	-0.4
5 *	-1.1	-2.3	-3.6	-5.0	-0.2

* Mid-span reading adjusted between end support readings

TABLE 5

WIND RESISTANCE - **SAFETY** TEST RESULTS

ON BACKING WALL

Position	Pressure (pascals) / Deflection (mm)			
	3620	**Residual**	**-3620**	**Residual**
1	0.4	0.0	-0.7	-0.1
2	8.3	0.6	-10.4	-0.5
3	1.1	0.0	-1.6	-0.1
4	0.0	-0.3	-1.1	-0.3
5	8.9	0.2	-9.7	-0.5
6	1.9	0.4	-2.5	-0.4
2 *	7.5	0.6	-9.2	-0.4
6 *	7.9	0.1	-7.8	-0.1

* Mid-span reading adjusted between end support readings

7 WATERTIGHTNESS TESTING

7.1 INSTRUMENTATION

7.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

7.1.2 Water Flow

An in-line water flow meter was used to measure water supplied to the spray gantry to within 5%.

7.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air and water temperatures to within 1°C.

7.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

7.2 FAN

7.2.1 Static Pressure Testing

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

7.2.2 Dynamic Pressure Testing

A wind generator was mounted adjacent to the external face of the sample and used to create positive pressure differentials during dynamic testing. The wind generator comprised a piston type aero-engine fitted with 4 m diameter contra-rotating propellers.

7.3 WATER SPRAY

The water spray system comprised nozzles spaced on a uniform grid not more than 700 mm apart and mounted approximately 400 mm from the face of the sample. The nozzles provided a full-cone pattern with a spray angle between 90° and 120°. The spray system delivered water uniformly against the exterior surface of the sample.

7.4 PROCEDURE

Water was sprayed onto the sample using the method described above at a flow rate of at least 3.4 litres/m^2/minute.

The aero-engine was used to subject the sample to wind of sufficient velocity to produce average deflections in the principle framing members equal to those produced by a static pressure differential of 600 pascals. These conditions were maintained for 15 minutes. Throughout the test the inside of the sample was examined for water penetration.

7.5 PASS/FAIL CRITERIA

There shall be no water penetration to the internal face of the sample throughout testing. At the completion of the test there shall be no standing water in locations intended to remain dry.

7.6 RESULTS

Test 5 Date: 30 November 2011

No water penetration was observed throughout the test.

Chamber temperature= 6°C
Ambient temperature = 5°C
Water temperature = 5°C

8 IMPACT TESTING

8.1 IMPACTOR

8.1.1 Soft body

The soft body impactor comprised a canvas spherical/conical bag 400 mm in diameter filled with 3 mm diameter glass spheres with a total mass of approximately 50 kg suspended from a cord at least 3 m long.

8.1.2 Hard body

The hard body impactor was a solid steel ball of 62.5 mm diameter and approximate mass of 1.0 kg.

8.2 PROCEDURE (BS 8200)

8.2.1 Soft body

The impactor almost touched the face of the sample when at rest. It was swung in a pendular movement to hit the sample normal to its face. The test was performed at the locations shown in Figure 3. The impact energies were 120 Nm and 500 Nm.

PHOTO 1000614

SOFT BODY IMPACTOR

8.2.2 Hard body

The impactor almost touched the face of the sample when at rest. It was swung in a pendular movement to hit the sample normal to its face. The test was performed at the locations shown in Figure 4. The impact energy was 10 Nm.

PHOTO 1000617

HARD BODY IMPACTOR

8.3 PASS/FAIL CRITERIA

8.3.1 At impact energies for retention of performance

There shall be no failure, significant damage to surface finish or significant indentation.

8.3.2 At impact energies for safety

The structural safety of the building shall not be put at risk, no parts shall be made liable to fall or to cause serious injury to people inside or outside the building. The soft body impactor shall not pass through the wall. Damage to the finish and permanent deformation on the far side of the wall may occur.

8.4 RESULTS

Test 6 Date: 30 November 2011

No damage to the sample was observed during the soft body impact tests.

During the hard body impact test a small mark was visible on the panels, from close distance, at locations 1, 3 and 5.

No damage was observed at locations 2, 4, 6, 7, 8 and 9.

At location 10, a small 11 mm long corner piece came away from the front of the panel. The panel remained secure on the wall.

At location 11, minor edge damaged was observed, only visible from close range.

Ambient temperature = 7°C

FIGURE 3

SOFT BODY IMPACT TEST LOCATIONS

External View

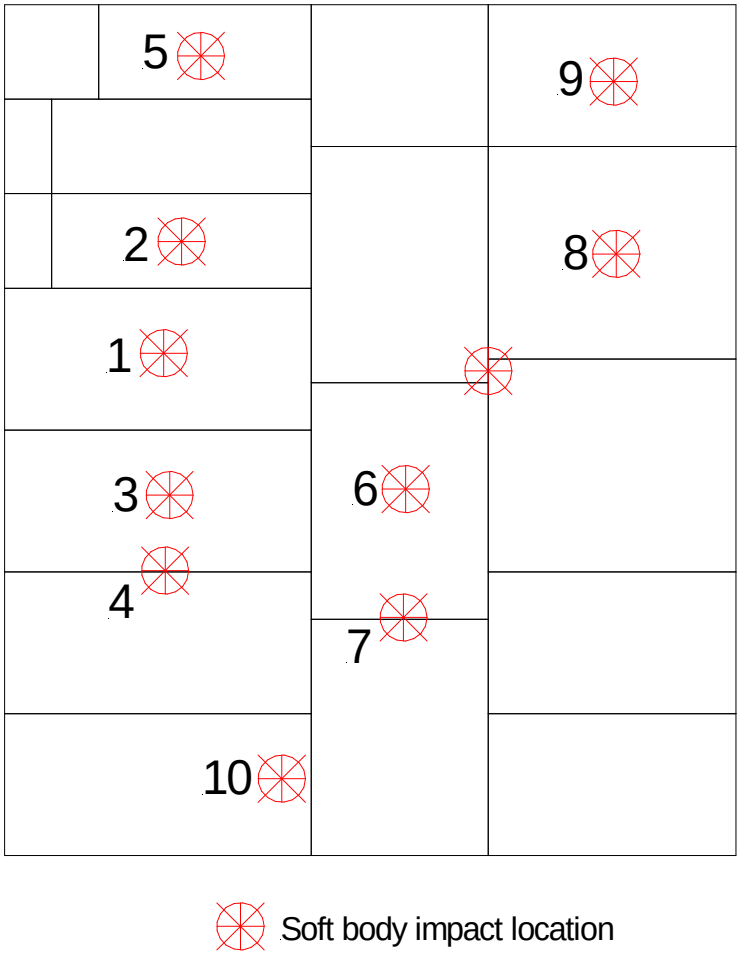
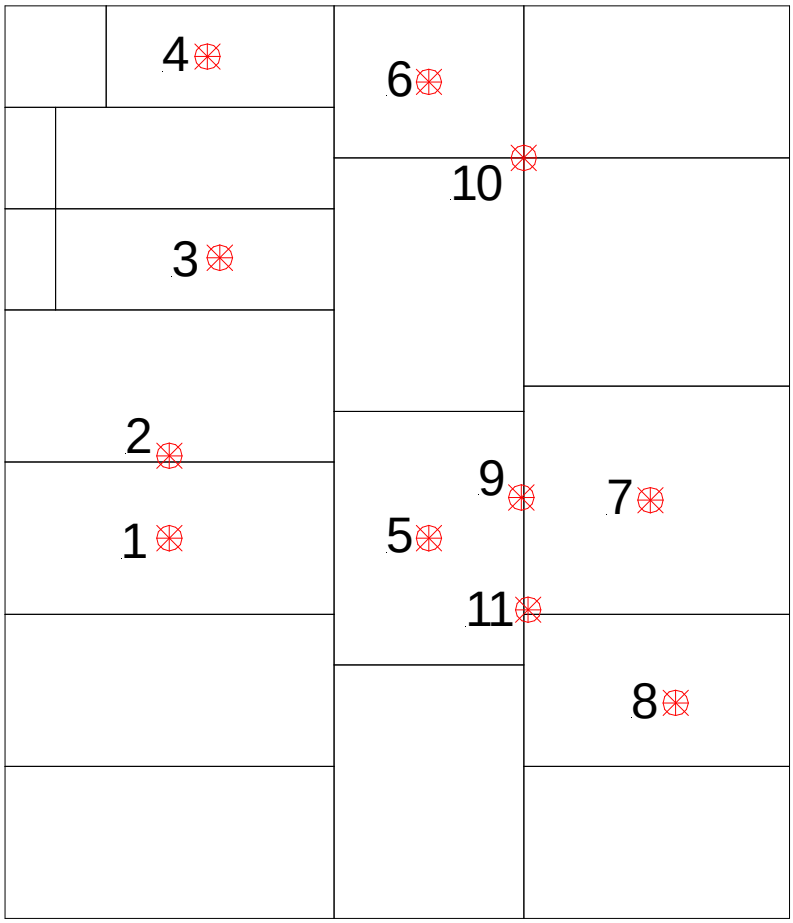


FIGURE 4

HARD BODY IMPACT TEST LOCATIONS

External View



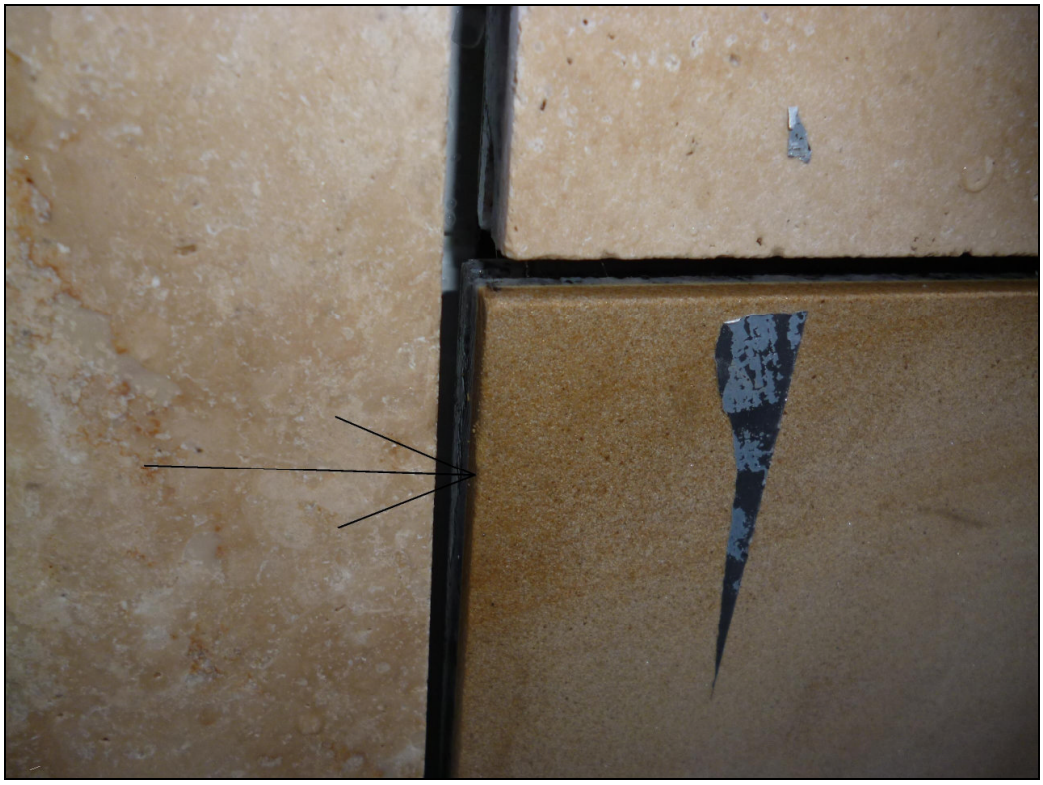
Hard body impact location

PHOTO 1000619

HARD BODY IMPACT AT LOCATION 10

PHOTO 1000621

HARD BODY IMPACT AT LOCATION 11



9 APPENDIX - DRAWINGS

The following 7 unnumbered pages are copies of Tiles international drawings numbered:

EB-001 rev 0,

EB-002 rev 0,

EB-003 rev 0,

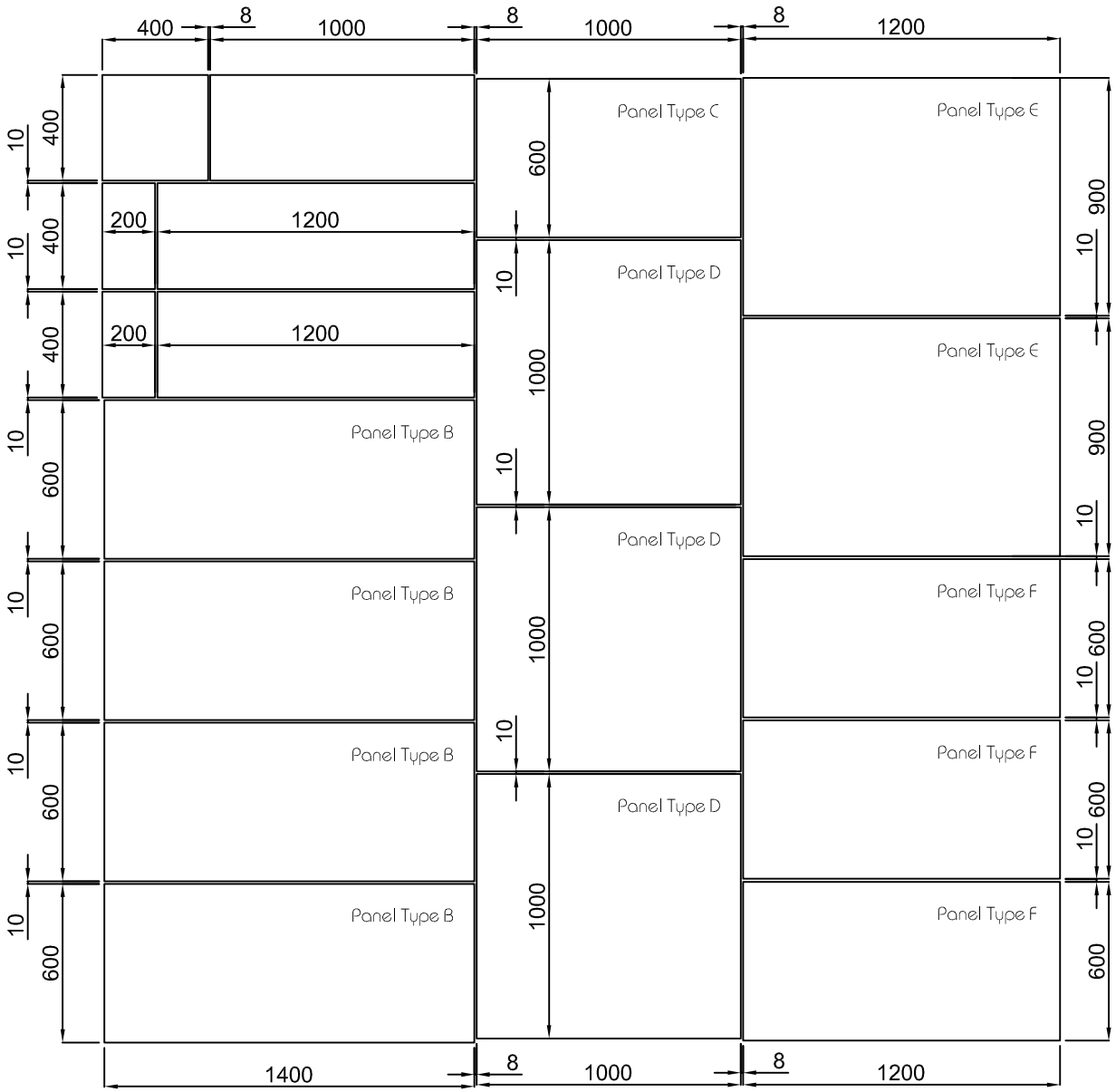
RSP-AEROLITE-002 rev A,

RSP-AEROLITE-010,

RSP-AEROLITE-011,

RSP-AEROLITE-012.

END OF REPORT



LEGEND:

PANELS SIZES (Including m² and Panel Weight)

Panel Type B:
1400 x 600mm - 0.84m² / 35.28kg

Panel Type C:
1000 x 600mm - 0.60m² / 25.20kg

Panel Type D:
1000 x 1000mm - 1.00m² / 42.00kg

Panel Type E:
1200 x 900mm - 1.08m² / 45.36kg

Panel Type F:
1200 x 600mm - 0.72m² / 30.24kg

Panel Type G:
800 x 400mm - 0.32m² / 13.44kg

Panel Type H:
1000 x 400mm - 0..40m² / 16.80kg

Panel Type I:
1200 x 400mm - 0.48m² / 20.16kg

notes:

Drawing Title	Eurobond/Ti Tiles Test Rig Aerolite Stonework Panels Fixed to Rainspan Composite Panel		
Scale	1:25 at A4	Date Drawn	Sept. 2011
Drawing Number	EB-001	Revision	0

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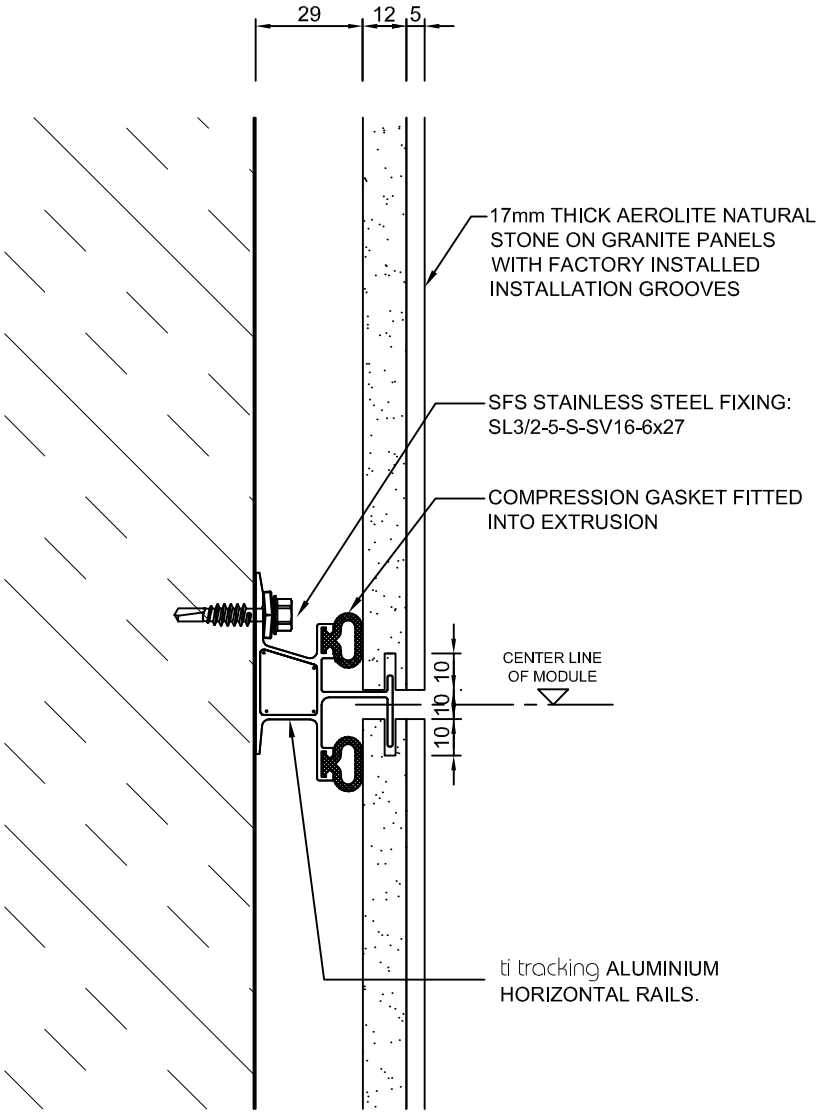

HORIZONTAL JOINT OPTION 1
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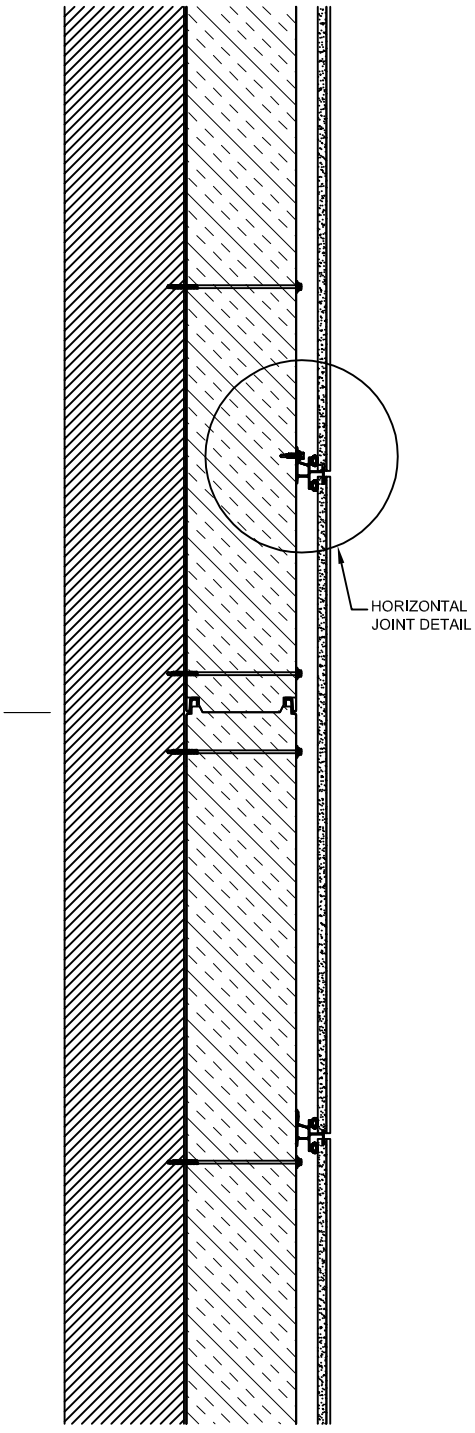

SECTION 1

NOTES:

Drawing Title	Eurobond/Ti Tiles Test Rig Aerolite Stonework Panels Fixed to Rainspan Composite Panel		
Scale	1:10 at A4	Date Drawn	Sept. 2011
Drawing Number	EB-002	Revision	0

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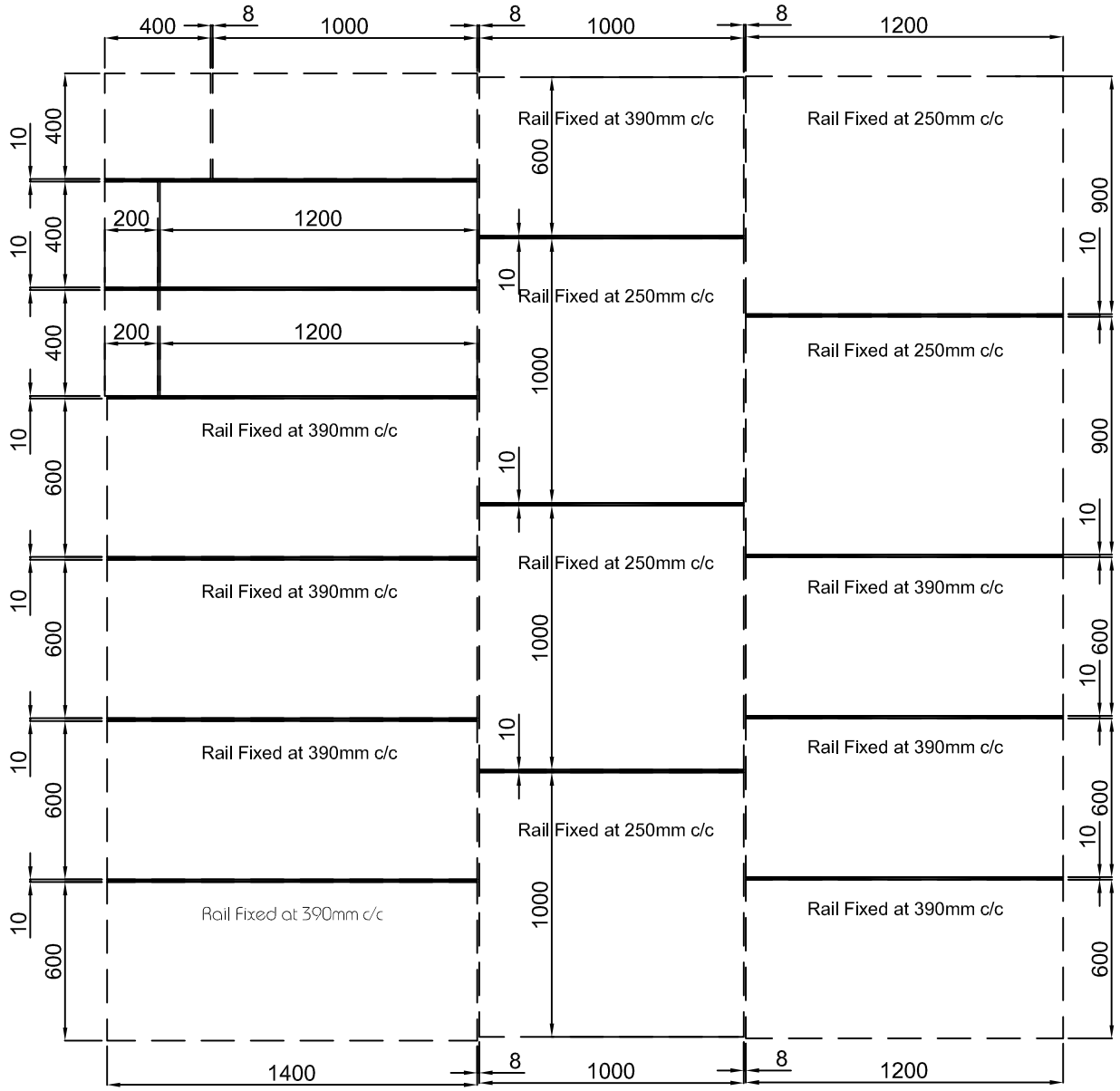

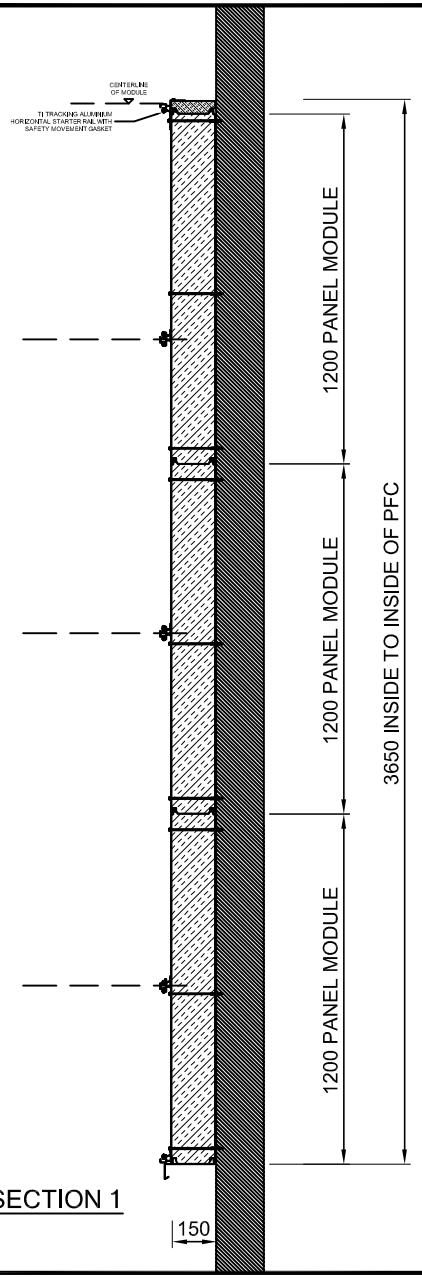

SECTION 1

Drawing Title	Eurobond/Ti Tiles Test Rig Aerolite Stonework Panels Fixed to Rainspan Composite Panel		
Scale	1:25 at A4	Date Drawn	Sept. 2011
Drawing Number	EB-003	Revision	0

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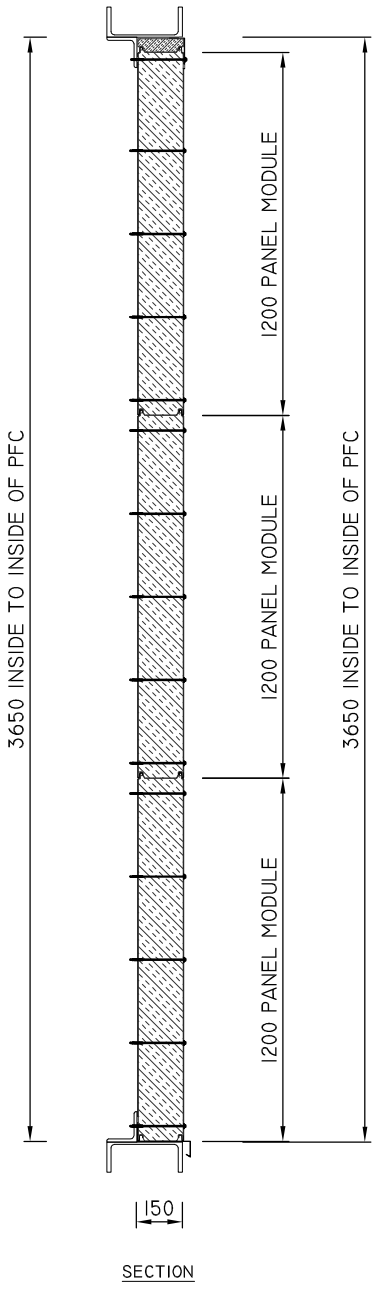

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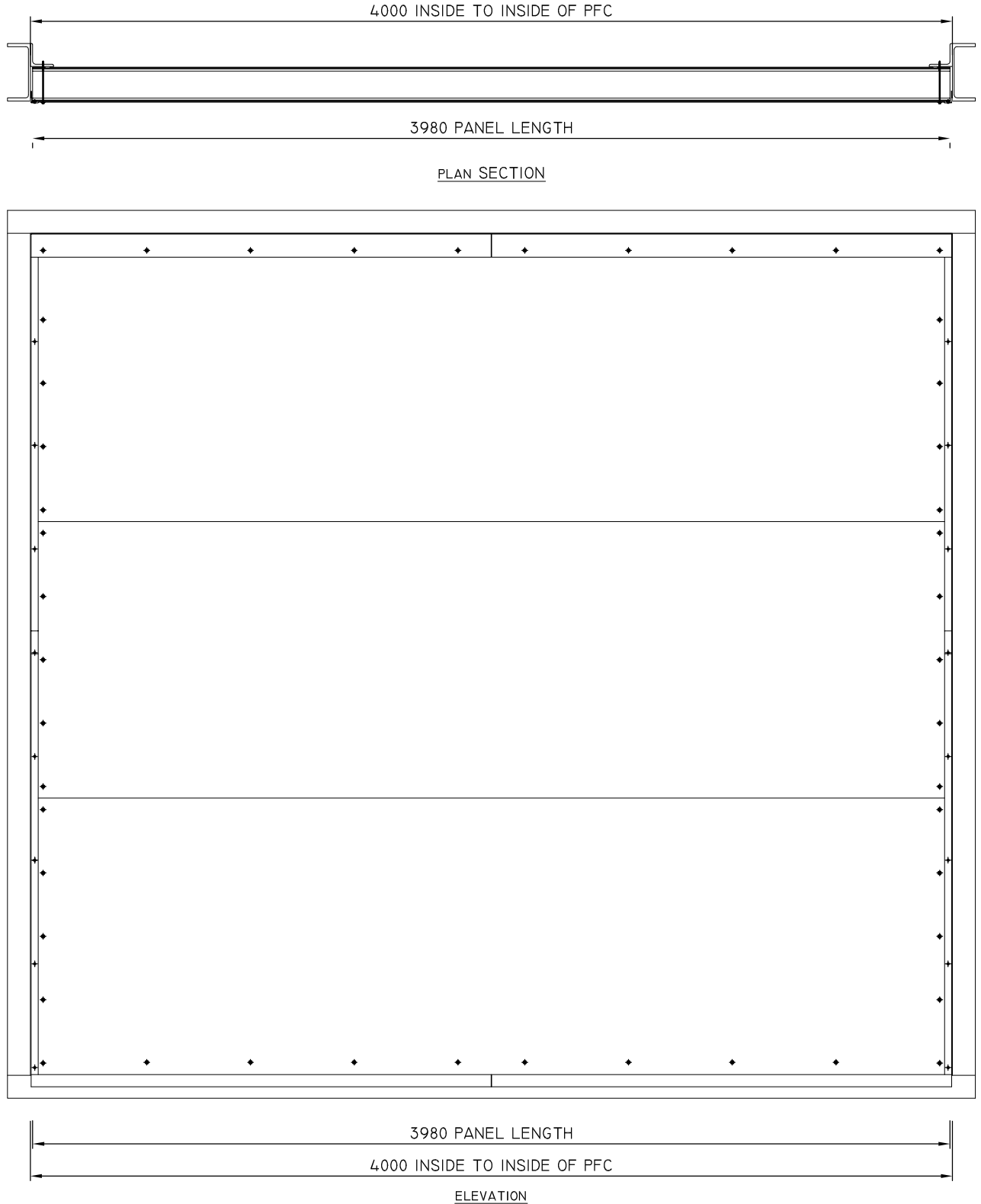
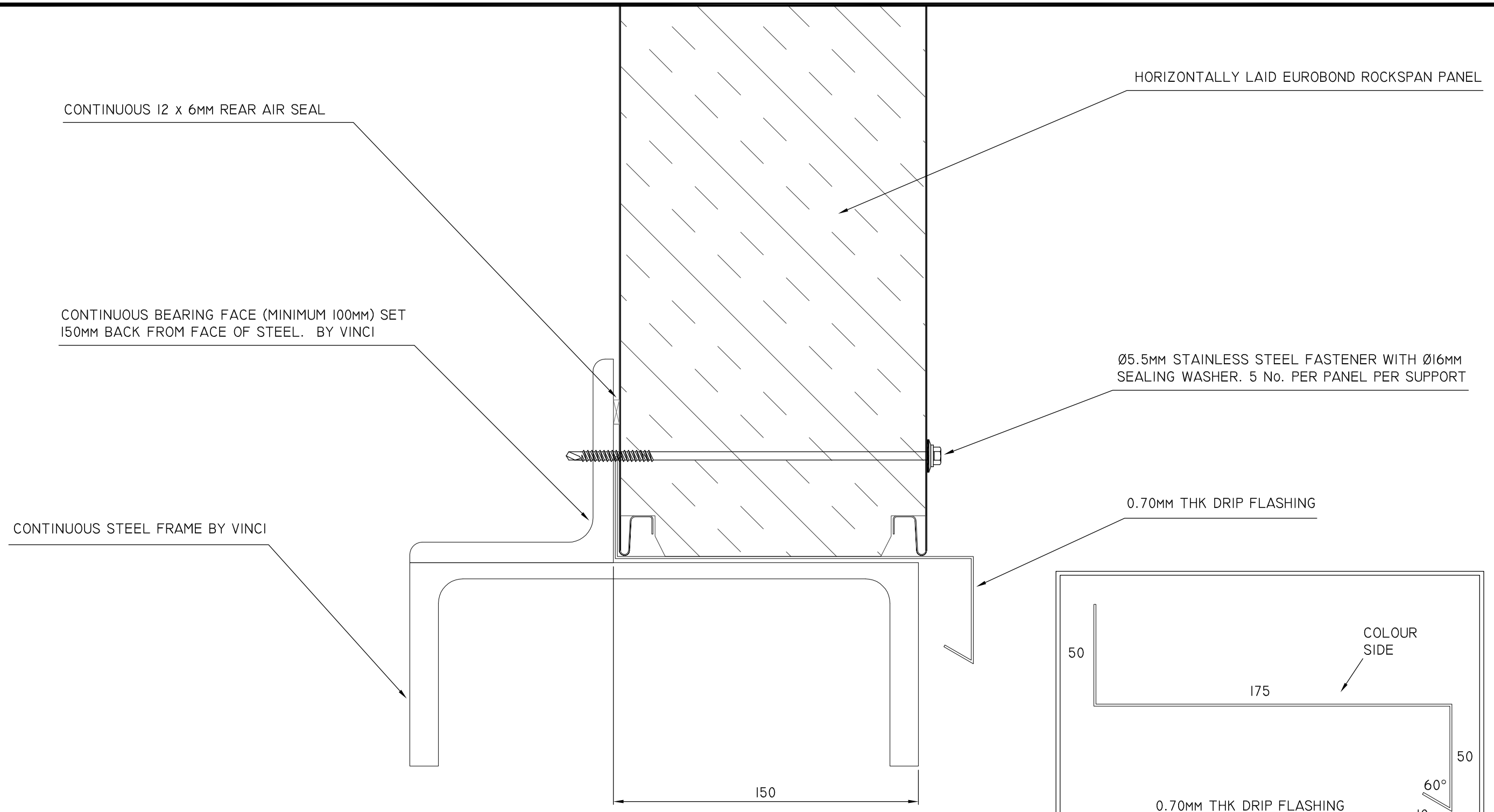


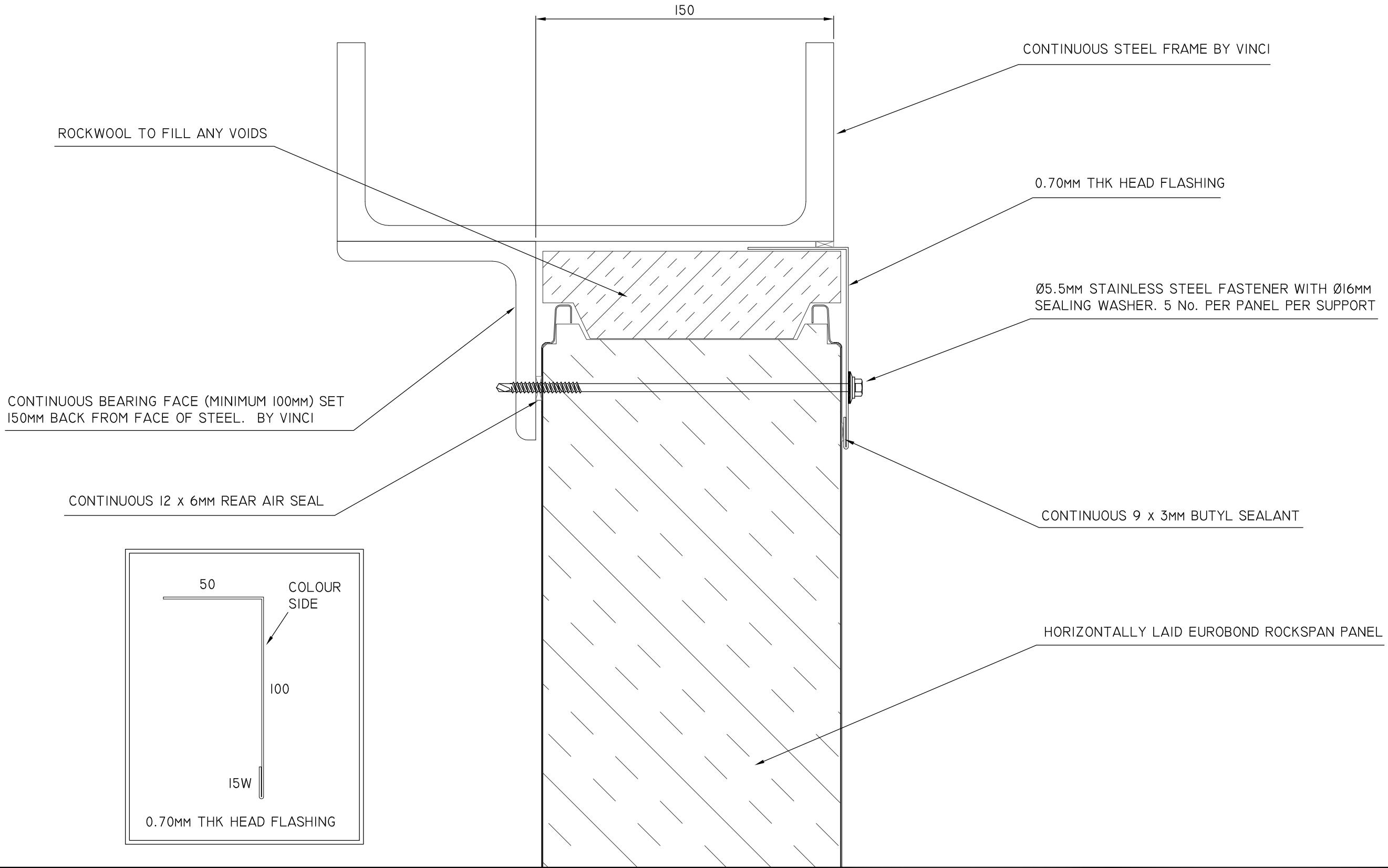
PLAN SECTION

ELEVATION

REV	DESCRIPTION :	DATE	DRN BY : H.T.		ISSUE 1
A	PANEL FIXING ARRANGEMENT AMMENDED	25/8/11	CHECKED :		EUROBOND LAMINATES / T I TILES JOINT TESTING RAINSPAN AEROLITE TESTING PANEL ELEVATION, SECTION & PLAN SECTION
			DATE :17/8/2011	X:\DRAWINGS\TEMPLATES\EUROBOND_TEMPL_SQ_GR.JPG	
			SCALE : 1:25		DRAWING NO : RSP-AEROLITE-002 Rev A



REV	DESCRIPTION :	DATE	DRN BY : H.T.		ISSUE 1
			CHECKED :	X:\DRAWINGS\TEMPLATES\EUROBOND_TEMPL_SQ_GR.JPG	EUROBOND LAMINATES / T 1 TILES JOINT TESTING RAINSPAN AEROLITE TESTING DRIP DETAIL
			DATE :27/10/2011		
			SCALE : 1:2		DRAWING NO : RSP-AEROLITE-010



REV	DESCRIPTION :	DATE	DRN BY : H.T.		ISSUE 1
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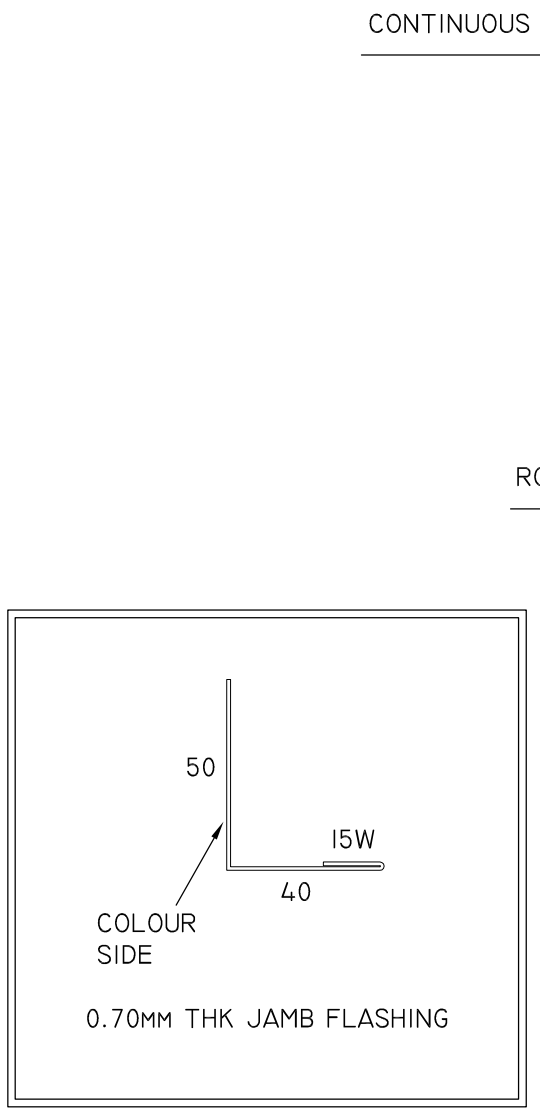
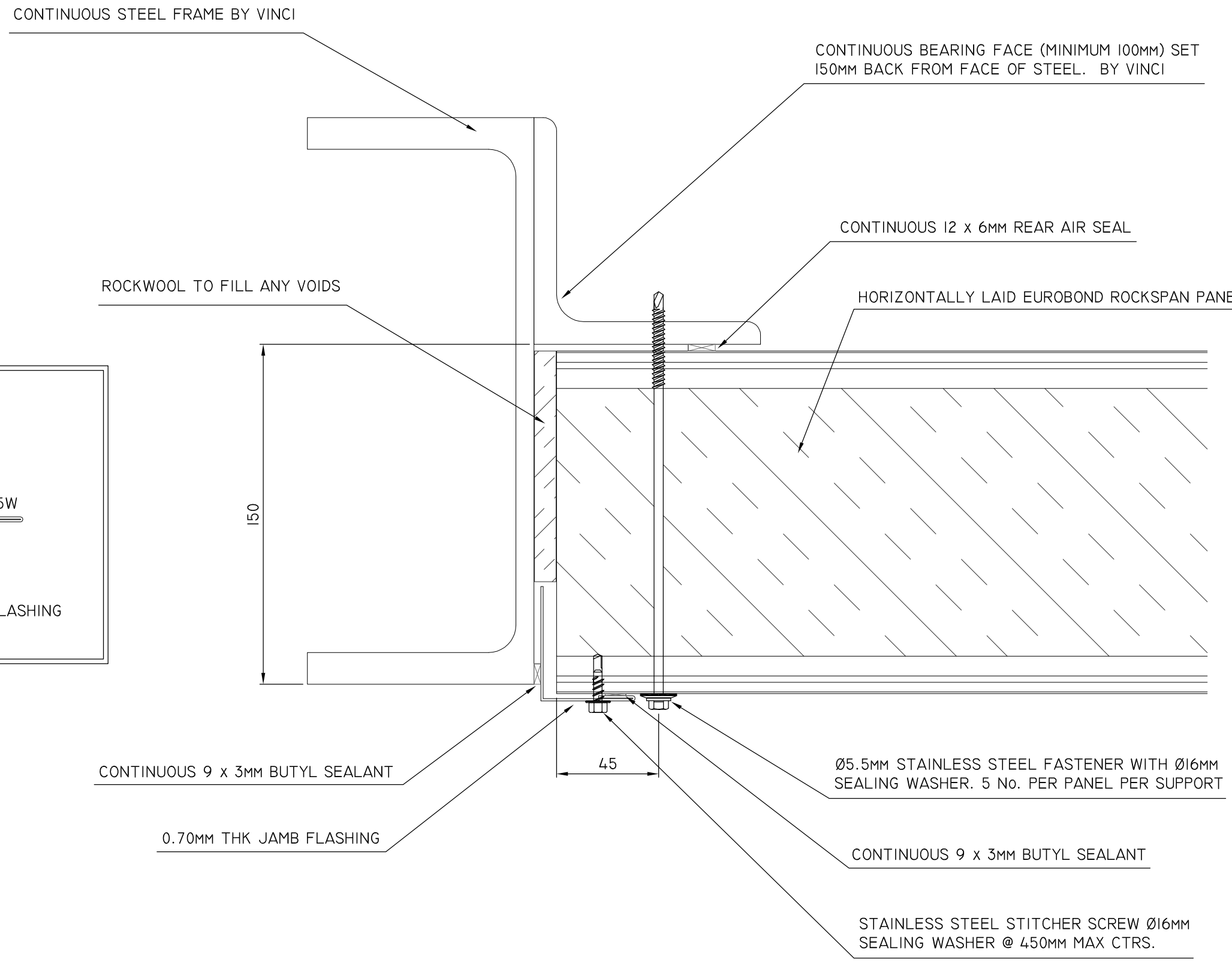
			DATE :27/10/2011		
			SCALE : 1:2		DRAWING NO : RSP-AEROLITE-011





REV	DESCRIPTION :	DATE	DRN BY : H.T.		ISSUE 1
			CHECKED :	X:\DRAWINGS\TEMPLATES\EUROBOND_TEMPL_SQ_GR.JPG	EUROBOND LAMINATES / T 1 TILES JOINT TESTING RAINSPAN AEROLITE TESTING JAMB DETAIL
			DATE :27/10/2011		
			SCALE : 1:2		DRAWING NO : RSP-AEROLITE-012

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