TECHNOLOGY CENTRE

Technical Report

Title: Wind and impact resistance product testing of a sample of Petrarch Rainscreen Cladding and TEN66 Framing System for CEP Cladding Limited

Report No: N950-12-16605

VINCI CONSTRUCTION UK

Technical Report

Title: Wind and impact resistance product testing of a sample of Petrarch Rainscreen Cladding and TEN66 Framing System for CEP Cladding Limited

Client: CEP Cladding Limited, Wainwright Close, Churchfields, Hastings East Sussex TN38 9PP

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UKAS TESTING 0057

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BSI UKAS QUALITY MANAGEMENT 003 FS 95506

CONTENTS

1 INTRODUCTION

This report describes tests carried out at the Technology Centre at the request of CEP Cladding Limited.

The test sample consisted of a sample of Petrarch Rainscreen Cladding and TEN66 Framing System manufactured by CEP Cladding Limited.

The tests were carried out during October 2012 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, cyclic & safety.

Impact resistance.

The testing was carried out in accordance with Technology Centre Method Statement C4397/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 in part by:

Gary Tipping - CEP Cladding Limited

2 SUMMARY AND CLASSIFICATION OF TEST RESULTS

The following summarises the results of the tests carried out. For full details refer to Section 6.

2.1 SUMMARY OF TEST RESULTS

TABLE 1

Date	Test number	Test description	Result
9 October 2012	1	Wind resistance – serviceability	Pass
9 – 11 October 2012	2	Wind resistance – cyclic	Pass
12 October 2012	3	Wind resistance – safety	Pass
12 October 2012	4	Impact resistance	Pass

2.2 CLASSIFICATION

TABLE 2

Test	Standard	Classification / Declared value
Wind resistance	CWCT	±2400 pascals serviceability ±3600 pascals safety
Impact resistance	CWCT TN 76	Soft body – 500 J Hard body – 10 J Serviceability - Class 1 Safety - negligible risk

3 DESCRIPTION OF TEST SAMPLE

3.1 GENERAL ARRANGEMENT

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

The CEP installation procedure is also included in the appendix.

PHOTO 1020975

TEST SAMPLE ELEVATION

PHOTO 1020961

TEST SAMPLE SUPPORT FRAMEWORK

The TEN66 vertical aluminium support angles were secured to 100 x 100 vertical steel angles via four No.TEN66 fixing brackets per angle. Six No.TEN66 horizontal rails were fixed to the angles. The steel angles and steel channel surround were part of the test rig.

The two rainscreen panels measured 3042 mm wide by 1213 mm high each.

The lower panel was 10 mm thick Petrarch fitted with TEN66 mechanical secret fix brackets.

The upper panel was a 7 mm thick Petrarch panel fitted with TEN66 Maxx (factory bonded) secret fix brackets..

An aluminium flat strip was Sika fixed in the horizontal gap between the panels.

The joints between the panels were taped over with aluminium tape externally to form an airtight chamber for pressure testing. This was removed prior to impact testing.

3.2 CONTROLLED DISMANTLING

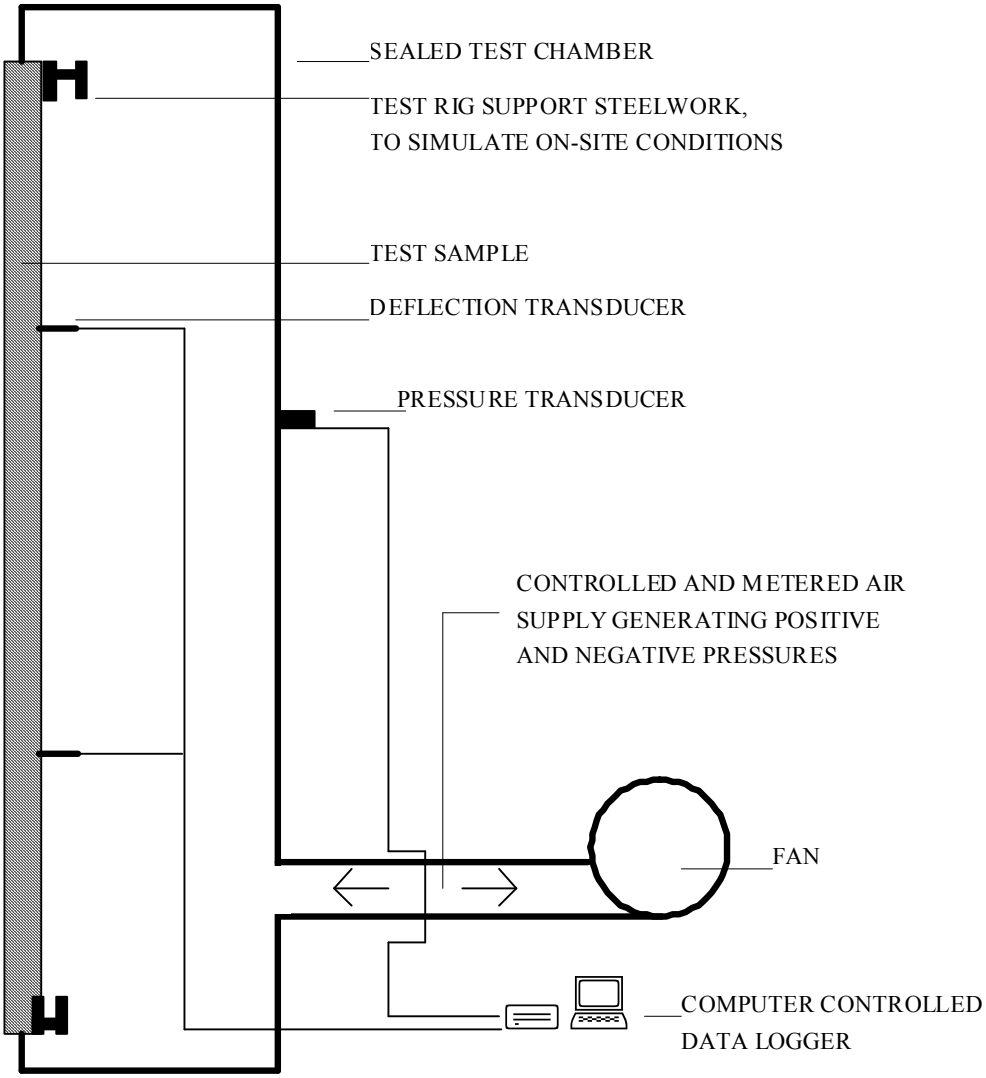
During the dismantling of the sample no damage or discrepancies from the drawings were found.

4 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 CEP Cladding Limited installed the sample on the test rig. See Figure 1.

FIGURE 1

TYPICAL TEST RIG SCHEMATIC ARRANGEMENT



SECTION THROUGH TEST RIG

5 TEST SEQUENCE

The test sequence was as follows:

(1) Wind resistance – serviceability

(2) Wind resistance – cyclic

(3) Wind resistance – safety

(4) Impact resistance

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.

6.3.2 Wind Resistance – cyclic wind load

The test sample was subjected to pressure pulses as shown in Table 1. The sequence was repeated five times followed by a single application of the design wind pressure (±2400 pascals). Each pressure cycle took approximately eight seconds.

Table 3

Load as fraction of design wind pressure	Number of cycles	Applied load
90%	1	±2160 Pa
40%	960	±960 Pa
60%	60	±1440 Pa
50%	240	±1200 Pa
80%	5	±1920 Pa
70%	14	±1680 Pa

6.3.3 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.

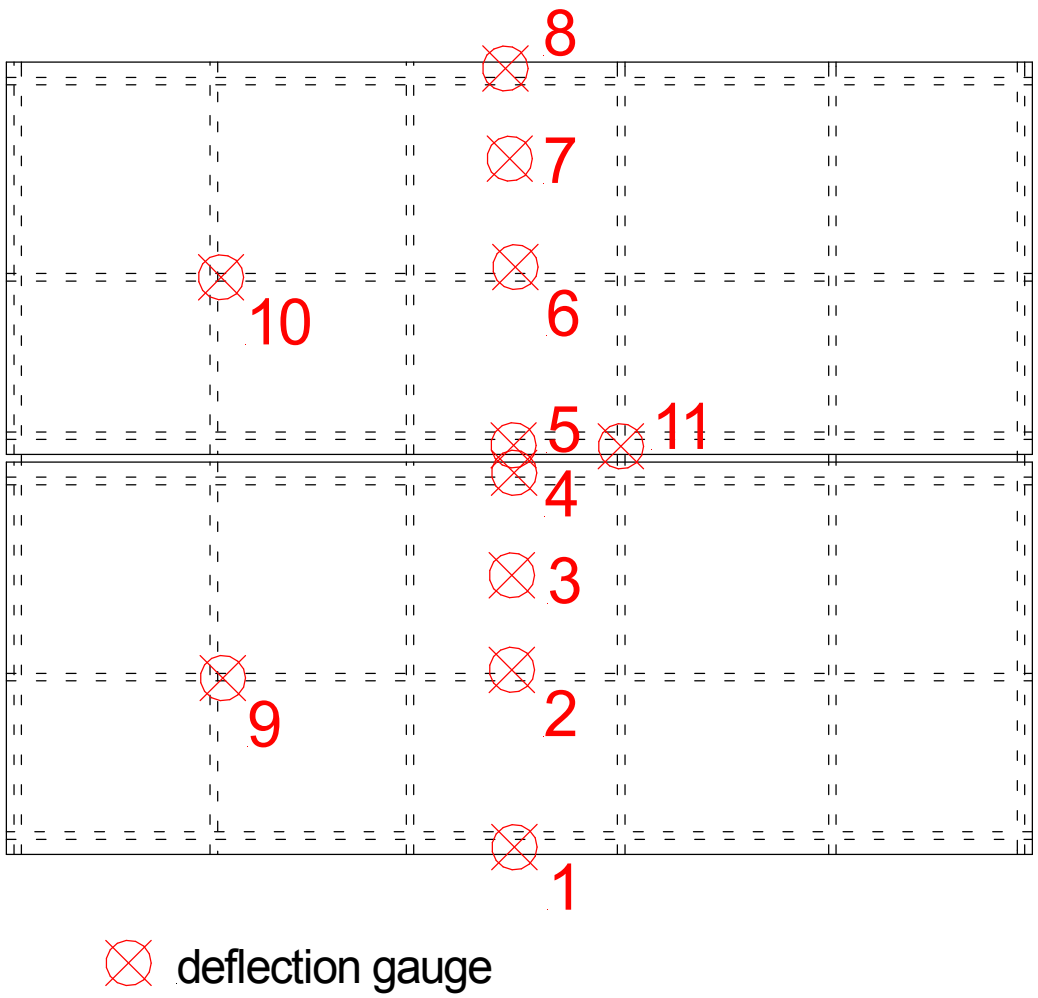
Any damage or functional defects were recorded.

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

FIGURE 2

DEFLECTION GAUGE LOCATIONS

Internal View



Deflection gauges 1 to 8 on back of panels.

Deflection gauges 9 to 10 on back of rail next to support.

Deflection gauge 11 on back of steel vertical support angle.

6.4 RESULTS

Test 1 (serviceability) Date: 9 October 2012

The deflections measured during the wind resistance test, at the positions shown in Figure 2, are shown in Tables 4 and 5.

No damage to the test sample was observed.

Ambient temperature = 8°C
Chamber temperature = 10°C

Test 2 (cyclic) Date: 9 – 11 October 2012

The deflections measured during the first and last set of pressure pulses, at the positions shown in Figure 2, are shown in Tables 6 and 7.

No damage to the test sample was observed.

Ambient temperature = 5 to10°C
Chamber temperature = 6 to12°C

Test 3 (safety) Date: 12 October 2012

The deflections measured during the structural safety test, at the positions shown in Figure 2, are shown in Table 8.

No damage to the sample was observed.

Ambient temperature = 10°C
Chamber temperature = 12°C

TABLE 4

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	607	**1208**	**1822**	**2436**	**Residual**
1	0.5	0.9	1.4	1.8	0.1
2	1.9	3.2	4.6	6.3	0.4
3	2.1	3.6	5.4	7.4	0.4
4	1.5	3.0	4.7	6.6	0.4
5	1.5	2.9	4.6	6.4	0.4
6	1.5	2.8	4.3	5.7	0.1
7	1.5	2.9	4.4	5.8	0.1
8	0.6	1.1	1.7	2.2	0.1
9	0.7	1.5	2.4	3.5	0.3
10	0.8	1.6	2.6	3.5	0.2
11	0.9	1.9	2.9	4.0	0.2

TABLE 5

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	-607	**-1229**	**-1803**	**-2400**	**Residual**
1	-0.8	-1.3	-1.9	-2.5	0.0
2	-1.5	-3.0	-4.7	-6.4	-0.2
3	-1.7	-3.5	-5.4	-7.4	-0.2
4	-1.5	-3.2	-4.9	-6.6	-0.1
5	-1.5	-3.2	-4.9	-6.6	-0.1
6	-1.8	-3.3	-4.9	-6.6	-0.1
7	-1.6	-3.2	-4.7	-6.4	-0.1
8	-0.6	-1.3	-2.0	-2.7	0.0
9	-0.8	-1.7	-2.7	-3.9	-0.3
10	-0.8	-1.7	-2.9	-4.1	-0.1
11	-0.9	-1.8	-2.9	-4.0	-0.1

TABLE 6

WIND RESISTANCE – CYCLIC TEST RESULTS

First cycle

Position	Pressure (pascals) / Deflection (mm)							
	2160	**-2160**	**960**	**-960**	**1440**	**-1440**	**1200**	**-1200**
1	1.8	-2.3	1.1	-1.1	1.3	-1.4	1.2	-1.4
2	6.1	-5.8	3.1	-2.8	4.4	-3.8	4.1	-3.3
3	7.0	-6.7	4.1	-2.9	4.9	-4.2	4.6	-3.8
4	6.3	-6.0	2.7	-2.6	4.2	-3.9	3.9	-3.5
5	6.0	-6.0	3.5	-2.6	4.0	-3.9	3.6	-3.3
6	5.3	-6.0	2.3	-2.9	3.6	-4.0	3.2	-3.8
7	5.4	-5.8	2.9	-2.7	3.6	-3.9	3.2	-3.4
8	2.0	-2.4	0.9	-1.2	1.3	-1.7	1.2	-1.6
9	3.3	-3.5	1.5	-1.6	2.2	-2.2	2.0	-2.0
10	3.4	-3.7	1.7	-1.5	2.3	-2.2	2.0	-1.9

Last cycle

Position	Pressure (pascals) / Deflection (mm)							
	2160	**-2160**	**960**	**-960**	**1440**	**-1440**	**1200**	**-1200**
1	2.0	-2.2	0.9	-1.1	1.5	-1.6	1.2	-1.4
2	6.0	-5.6	3.7	-2.7	4.7	-4.1	3.9	-3.2
3	6.9	-6.5	3.6	-3.0	5.3	-4.6	4.5	-3.7
4	5.8	-6.0	2.9	-3.0	4.3	-4.5	3.3	-3.6
5	5.5	-6.0	2.5	-2.7	4.0	-4.2	3.3	-3.3
6	5.0	-5.9	2.5	-3.0	3.7	-4.5	2.7	-3.8
7	5.1	-5.6	2.5	-2.7	3.7	-4.1	3.0	-3.2
8	1.8	-2.5	0.9	-1.3	1.4	-1.9	1.1	-1.6
9	3.1	-3.2	1.6	-1.5	2.3	-2.3	2.0	-1.8
10	3.1	-3.4	1.5	-1.4	2.3	-2.3	1.8	-1.9

TABLE 7

WIND RESISTANCE – CYCLIC TEST RESULTS continued

First cycle

Position	Pressure (pascals) / Deflection (mm)				
	1920	-1920	1680	-1680	Residual
1	1.6	-1.9	1.5	-1.7	0.0
2	5.4	-5.0	4.9	-4.3	0.0.
3	6.2	-5.8	5.6	-5.0	0.0
4	5.3	-5.1	4.8	-4.4	0.0
5	5.0	-5.2	4.4	-4.5	-0.1
6	4.5	-5.3	4.0	-4.6	-0.1
7	4.5	-5.1	4.0	-4.4	-0.1
8	1.7	-2.3	1.5	-2.0	-0.2
9	2.7	-2.9	2.4	-2.5	0.0
10	2.8	-3.0	2.4	-2.5	0.0

Last cycle

Position	Pressure (pascals) / Deflection (mm)							
	1920	-1920	1680	-1680	Residual	2400	-2400	Residual
1	1.8	-2.0	1.6	-1.8	0.2	2.1	-2.5	-0.1
2	5.4	-5.0	4.9	-4.5	0.4	6.4	-6.3	-0.1
3	6.1	-5.9	5.5	-5.2	0.4	7.4	-7.4	-0.2
4	5.0	-5.4	4.4	-4.8	0.2	6.2	-6.7	-0.5
5	4.8	-5.4	4.1	-4.8	0.1	6.0	-6.7	-0.5
6	4.3	-5.4	3.8	-4.8	0.2	5.4	-6.7	-0.3
7	4.4	-5.2	3.8	-4.6	0.2	5.5	-6.4	-0.2
8	1.7	-2.2	1.5	-2.0	0.0	2.1	-2.8	-0.1
9	2.7	-2.9	2.4	-2.6	0.2	3.4	-3.7	-0.2
10	2.6	-3.0	2.3	-2.6	0.4	3.3	-3.9	-0.2

TABLE 8

WIND RESISTANCE - **SAFETY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)			
	3624	**Residual**	**-3602**	**Residual**
1	2.9	-0.1	-3.6	-0.2
2	9.2	0.1	-10.4	-0.7
3	10.9	0.2	-12.0	-0.8
4	9.9	0.3	-10.2	-0.8
5	9.7	0.2	-10.0	-0.5
6	8.6	0.2	-10.4	-0.6
7	8.7	0.2	-9.7	-0.5
8	3.3	0.1	-4.3	-0.2
9	5.4	0.3	-6.4	-0.7
10	5.4	0.4	-6.8	-0.7
11	6.4	0.2	-6.4	-0.4

* Mid-span reading adjusted between end support readings

7 IMPACT TESTING

7.1 IMPACTOR

7.1.1 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.

7.1.2 Hard body

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

7.2 PROCEDURE (TN76)

7.2.1 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 and 500 Nm at locations 1 to 4 and 500 Nm at all the other locations.

7.2.2 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.

7.3 PASS/FAIL CRITERIA

7.3.1 At impact energies for retention of performance

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

7.3.2 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.

7.4 RESULTS

Test 4 Date: 12 October 2012

No damage to the sample was observed throughout the testing.

Ambient temperature = 11°C

FIGURE 3

SOFT BODY IMPACT TEST LOCATIONS

External View

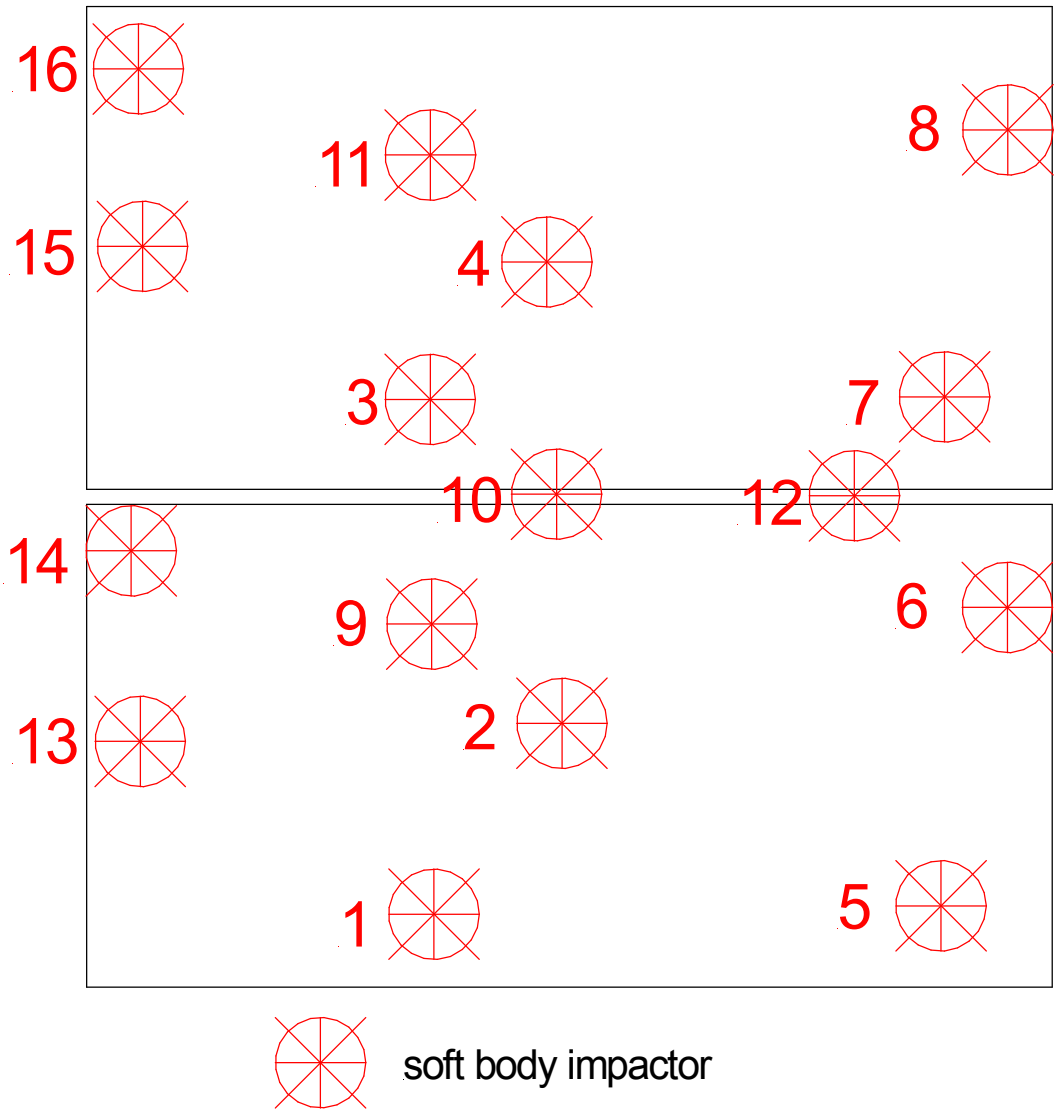
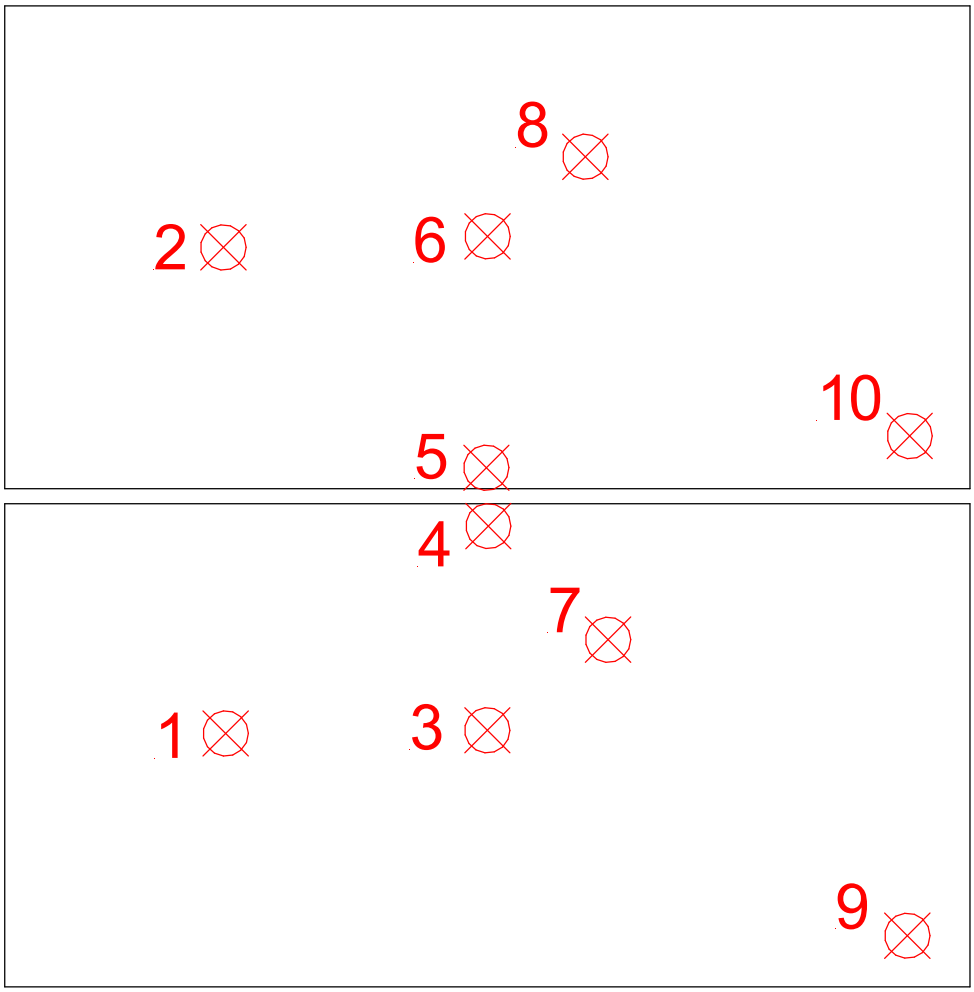


FIGURE 4

HARD BODY IMPACT TEST LOCATIONS

External View



⊗ hard body impactor

PHOTO 1030028

SOFT BODY IMPACTOR READY FOR RELEASE

PHOTO 1030035

SOFT BODY IMPACTOR ON PANEL JOINT

PHOTO 1030035

HARD BODY IMPACTOR ON LOWER PANEL

PHOTO 1030039

HARD BODY IMPACTOR ON UPPER PANEL

8 APPENDIX - INSTALLATION PROCEDURE & DRAWINGS

The following 8 unnumbered pages are copies of the CEP Cladding Limited installation procedure and 7 drawings of the system.

END OF REPORT

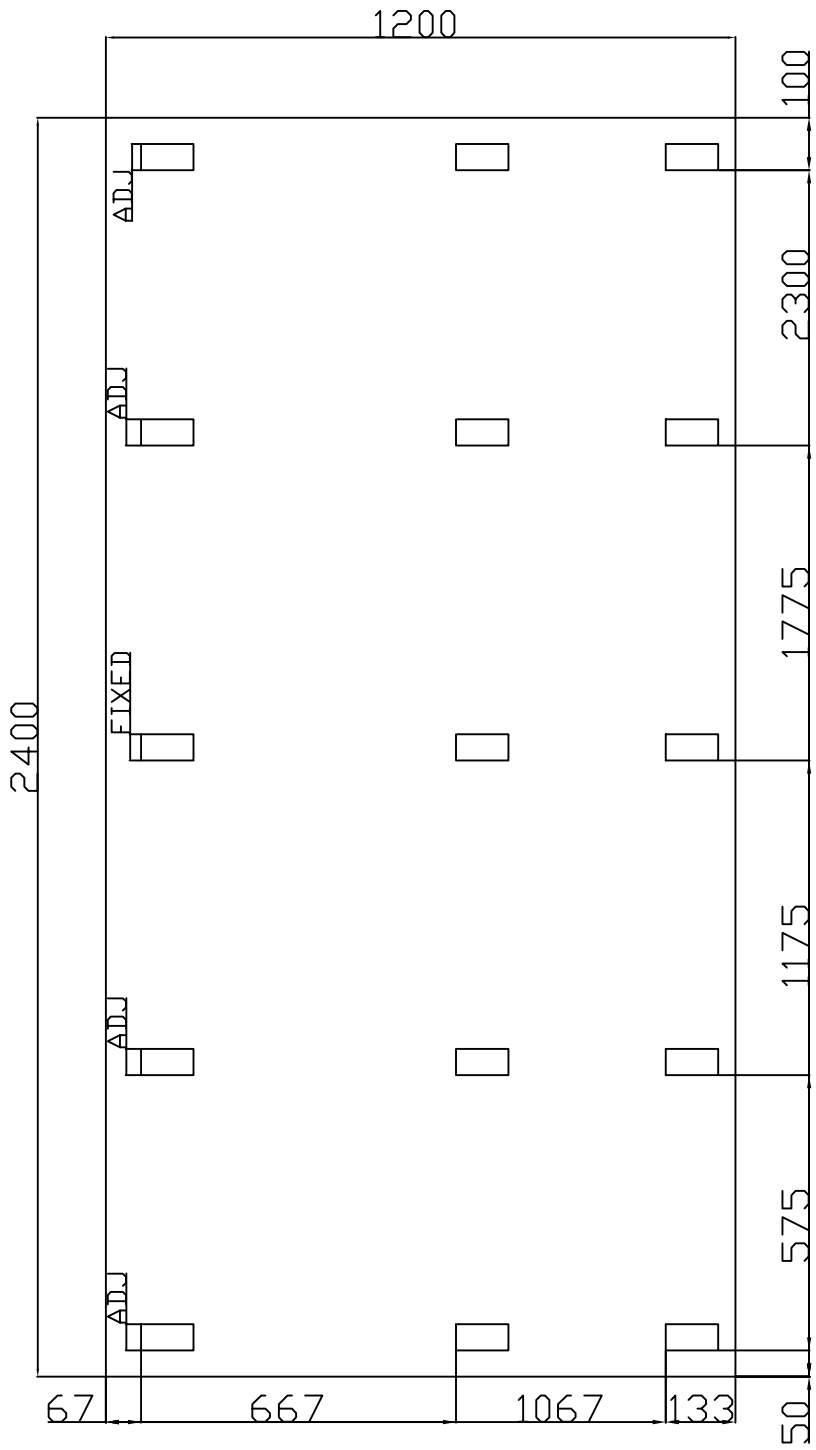
CWCT Installation Procedure

1) Marked up helping hand bracket spacing.
2) Drilled helping hand bracket fixing holes.
3) Placed isolator onto the back of each helping hand bracket.
4) Inserted bolt with washer into front of each helping hand bracket.
5) Bolted helping hand brackets through 8mm steel frame work to nuts placed behind.
6) 4 brackets in each column (6 total, 4 rows). 3 singles, 1 double. (double bracket second row from the TOP)
7) Carrier rail pressed into brackets vertically. Cavity of 172mm
8) Tested to make rails perfectly vertical
9) Rivet fixed rails to brackets. 2 rivets per single, 4 per double. Singles sliding points riveted. Double fixed point riveted
10) Carrier rail pinned to frame work in correct position.
11) Drilled two holes per vertical horizontal meeting.
12) Riveted horizontal rail to vertical.
13) Offer panel up to horizontal carrier rail.
14) Used top of adjustable panel brackets to level panel
15) Self tapping through fix point bracket.
16) Sika fixed aluminium flat strip between both panels.

Note:

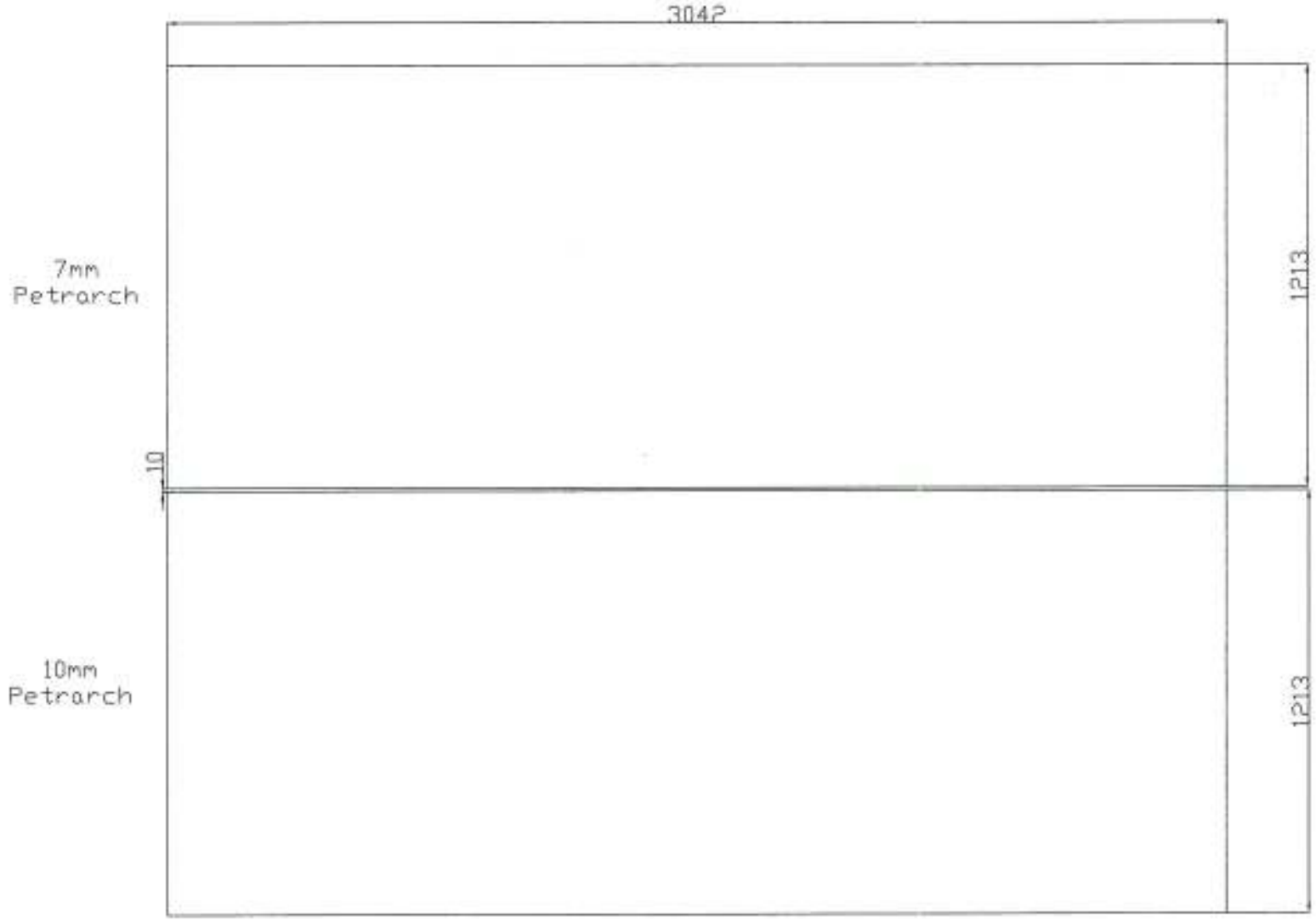
- Eighteen single helping hand brackets used.
- Eighteen single isolators (100mm x 88mm) used.
- Six double helping hand brackets used.
- Six double isolators (150mm x 100mm) used.
- Forty-eight 25mm x 6mm bolts used.

RevNo	Revision note	Date	Signature	Checked



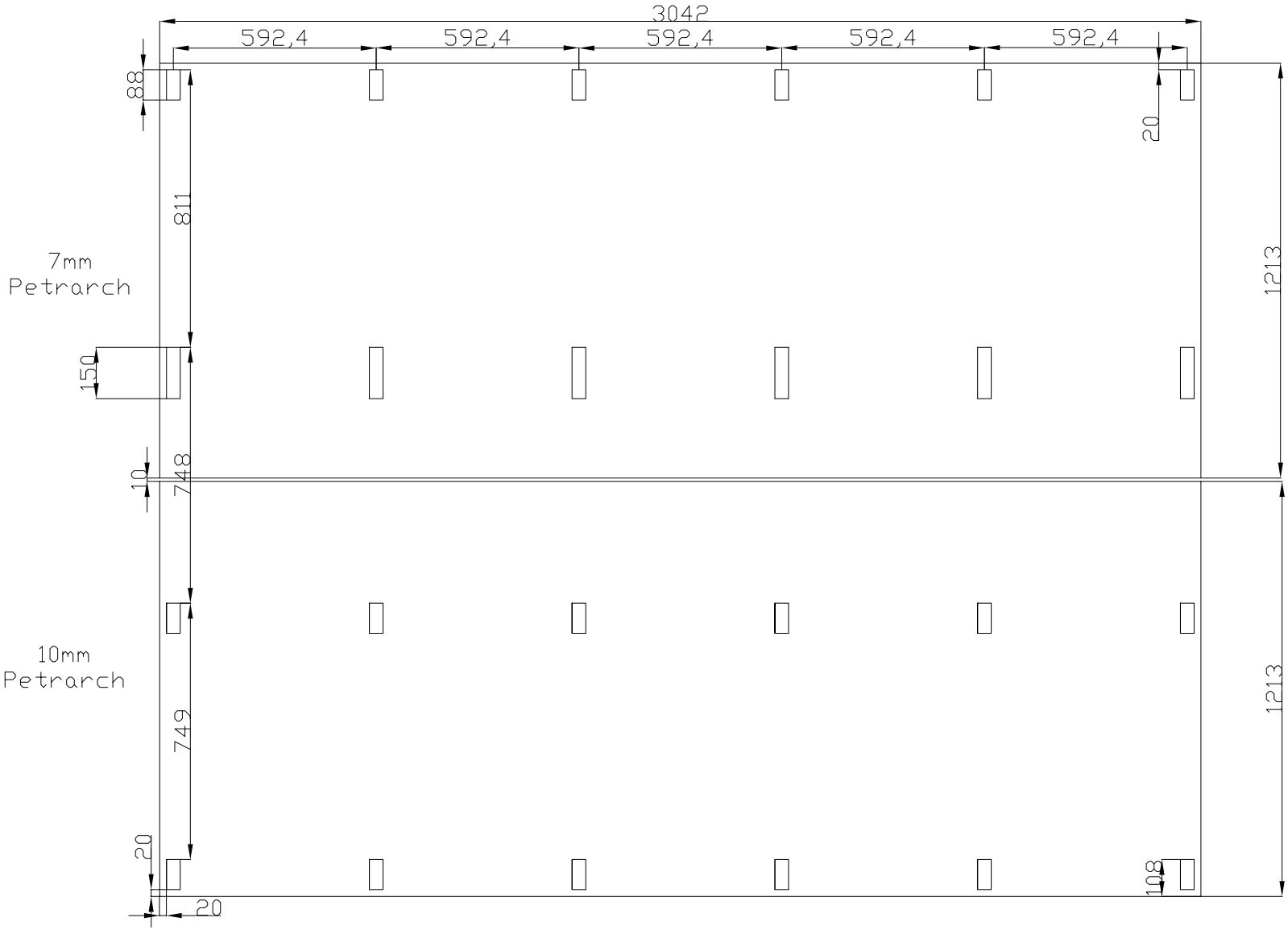
Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference	
Designed by Michael Nutt		Checked by Neil Trimby	Approved by - date 17/09/2012	File name Petrarch	Date 17/09/2012	Scale 1:1
CEP Claddings Ltd		7mm & 10mm Petrarch				
		CEP-MN-001			Edition B	Sheet 1/1

Mark	Revision note	Date	Signature	Checked



Item ref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference	
Designed by Michael Nutt		Checked by Neil Trimby	Approved by – date 18.09.2012	Filename 7mm + 10mm	Date 18.09.2012	Scale 1:1
CCP Cladding Ltd				7mm + 10mm Petrarch		
					Edition A	Sheet 1/1

RevNo	Revision note	Date	Signature	Checked



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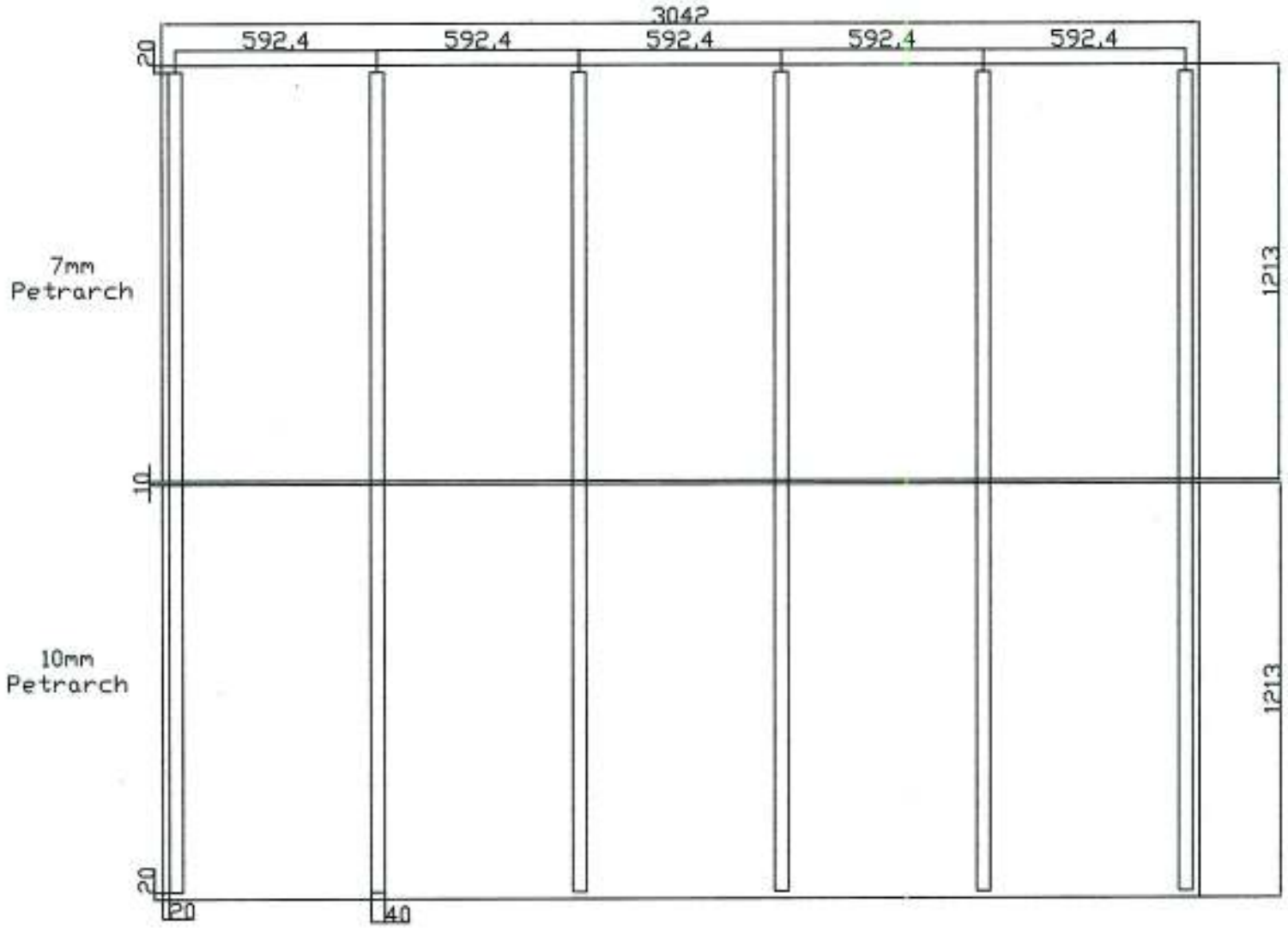
CEP Cladding Ltd		Helping Hand Bracket Layout			
		CEP-MN-003		Edition B	Sheet 1/1



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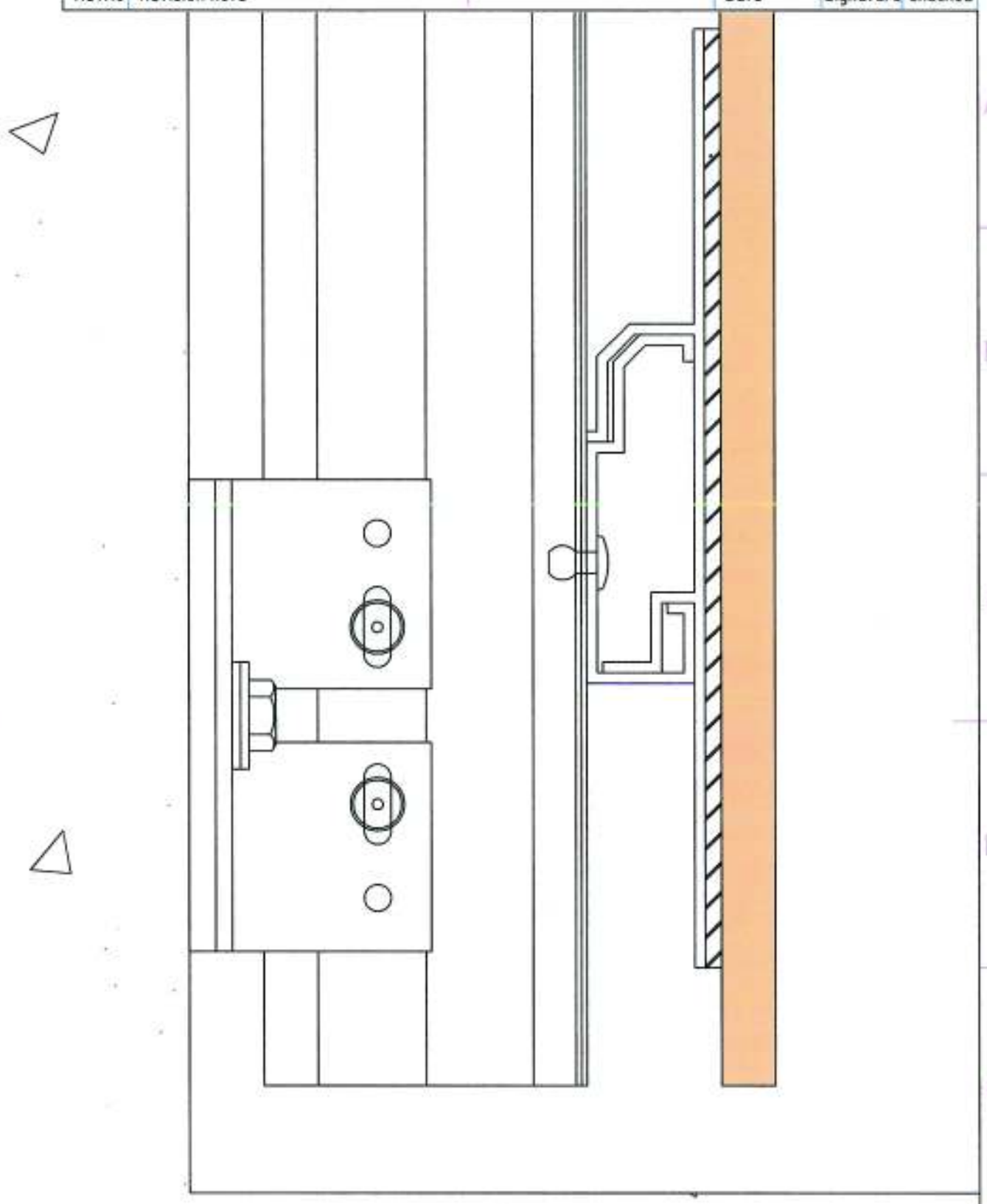
CEP Cladding Ltd			7mm + 10mm Petrarch			
					Edition A	Sheet 1/1

RevNo	Revision note	Date	Signature	Checked



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Designed by	Checked by	Approved by - date	File name	Date	Scale
Michael Nutt	XXX	XXX - 00/00/00	Sika Hanger Rail	05/10/2012	1:1

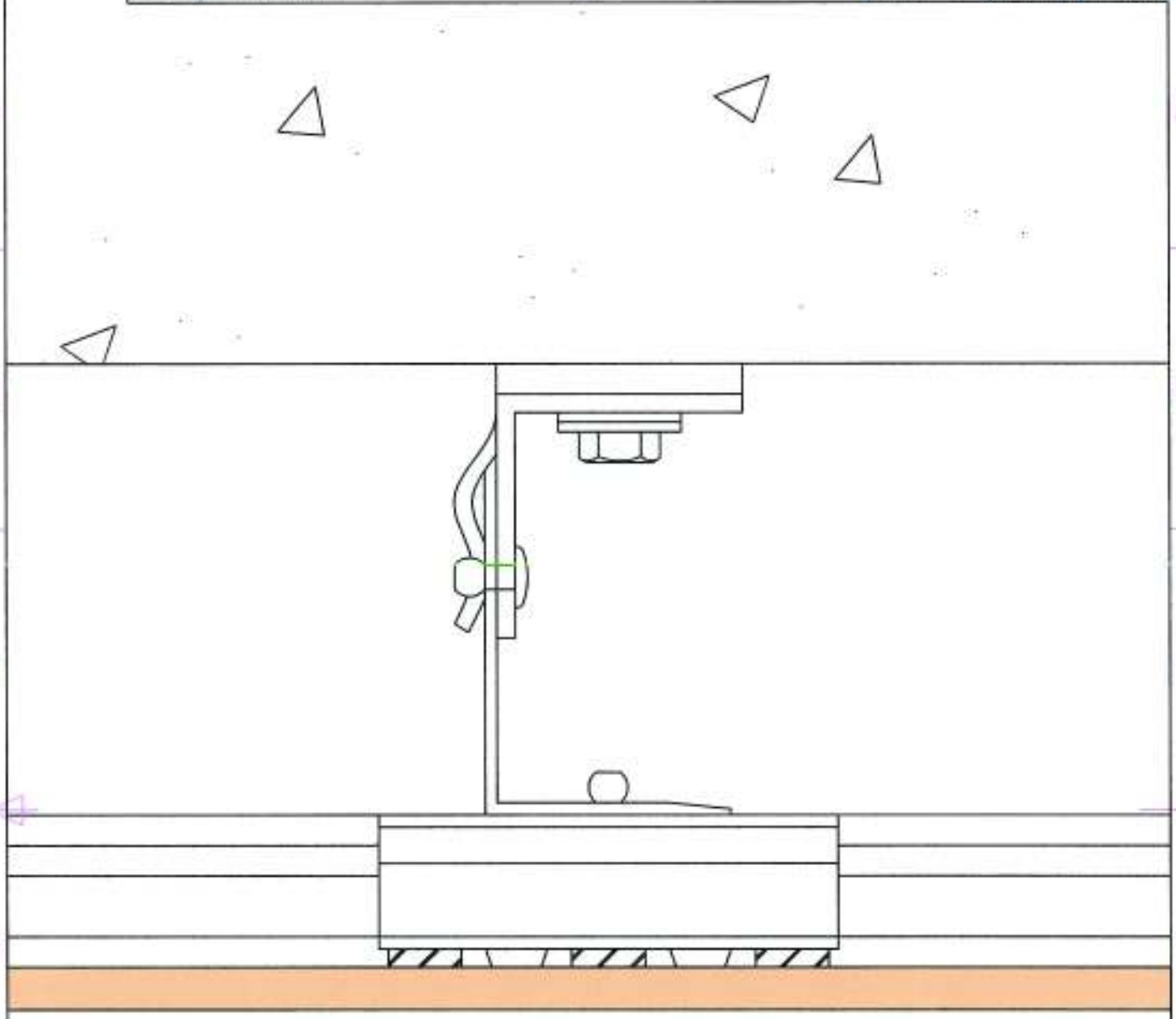
CEP Claddings Ltd

Base Detail

Sika Hanger Rail

Edition	Sheet
B	1/1

RevNo	Revision note	Date	Signature	Checked



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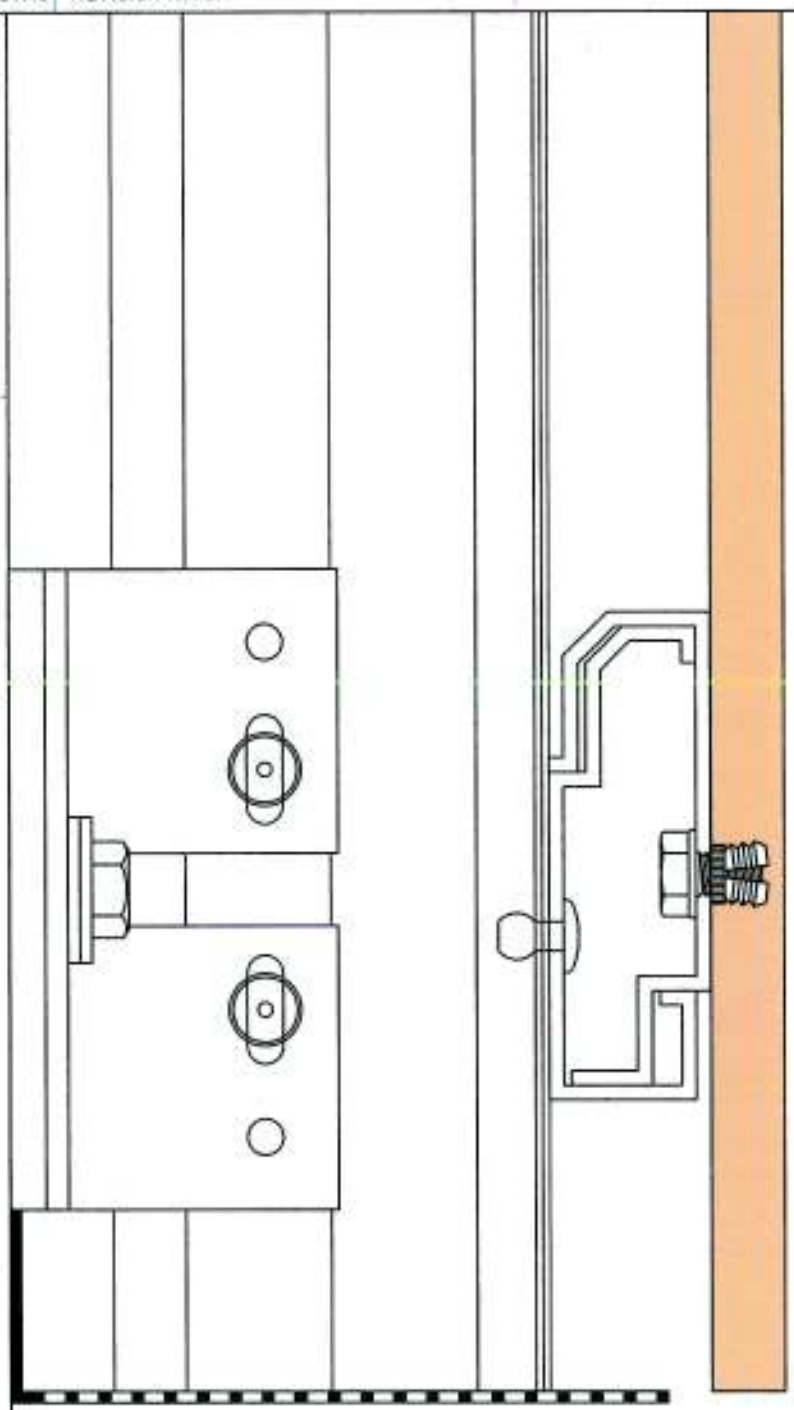
CEP Claddings Ltd

Intermediate Support

Sika Hanger Rail

Edition	Sheet
B	1/1

RevNo	Revision note	Date	Signature	Checked



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CEP Claddings Ltd

Base Detail

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