WINTECH
TESTING & CERTIFICATION

Technical Report

Report No: DPP/R15527

UKAS TESTING
2223

Taylor Maxwell Birmingham
6080 Knights Court
Solihull Parkway
Birmingham Business Park
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<u>Project</u>

Corium Brick Cladding System

Project Ref: 15527

17th March 2016

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Testing Conducted by:	Wintech Engineering Ltd Halesfield 2 Telford Shropshire TF7 4QH
Test Conducted at:	Above Address
Test Conducted for:	Taylor Maxwell Birmingham
Standards Specified:	CWCT Test Methods for Building Envelopes – Dec 2005; Sections 5, 6, 7, 9, 11, 12 & TN 76

The Test Sequence was Witnessed Wholly or in Part by:	P Fasey	Taylor Maxwell Birmingham
	D French	Taylor Maxwell Birmingham
	D Adams	DAE Technical Services
	C Smith	IOBristol Ltd
	J Chisholm	IOBristol Ltd

Project No:	15527
Dates of Final Test Sequence:	8th, 11th and 12th February 2016
Product/System Tested:	Corium Brick Cladding System
Tests Performed:	As Listed in Section 5 – Test Procedures

Final Test Sequence Conducted by:	K Alden	Wintech Engineering Ltd
	D Reynolds	Wintech Engineering Ltd
	R Cadwallader	Wintech Engineering Ltd

Report Compiled by: D Price
Senior Test Engineer

Testing Supervised by: M Cox
Works Director

Technical Approval:
(Authorising Signatory) M Wass
Technical Director

Contents

1. INTRODUCTION

This report describes tests conducted at the test site of Wintech Engineering Ltd on a sample on behalf of Taylor Maxwell Birmingham.

The following test sequence was conducted on the 8th, 11th and 12th February 2016 in order to determine the weather tightness of the sample with respect to air leakage, water penetration, wind and impact resistance. The test methods were in accordance with the following standards, and testing was conducted at the request of Taylor Maxwell Birmingham.

<u>CWCT Standard Test Methods for Building Envelopes - December 2005</u>

Air Leakage (Infiltration & Exfiltration)	CWCT Section 5
Water Penetration – Static	CWCT Section 6
Water Penetration – Dynamic Aero Engine	CWCT Section 7
Water Penetration – Hose	CWCT Section 9
Wind Resistance – Serviceability	CWCT Section 11
Wind Resistance – Safety	CWCT Section 12
Impact Resistance – Serviceability & Safety	CWCT TN 76

Wintech Engineering Ltd is accredited by the United Kingdom Accreditation Service as UKAS Testing Laboratory No. 2223.

The test sample was supplied and erected on to the test chamber by Taylor Maxwell Birmingham.

2. SUMMARY OF TEST RESULTS

The following summarises the results of tests carried out. The sample was tested in the following sequence and the associated results are as follows;

Test Type	Peak Test Pressure	Result	Date of test	Classification
Test 1 – Air Leakage (Infiltration)	600 Pa	Pass	08.02.16	A4
Test 2 – Air Leakage (Exfiltration)	100 Pa	(See note[1])	08.02.16	N/A
Test 3 – Water Penetration (Static Pressure)	600 Pa	Pass	08.02.16	R7
Test 4 – Wind Resistance (Serviceability) – Internal	2400 Pa	Pass	11.02.16	N/A
Test 5 – Wind Resistance (Serviceability) - External	**2400 Pa	Pass	11.02.16	N/A
Test 6 – Repeat Air Leakage (Infiltration)	600 Pa	Pass	11.02.16	A4
Test 7 – Repeat Air Leakage (Exfiltration)	100 Pa	(See note[1])	11.02.16	N/A
Test 8 – Water Penetration (Static Pressure)	600 Pa	Pass	11.02.16	R7
Test 9 – Water Penetration (Dynamic Aero Engine)	600 Pa	Pass	11.02.16	N/A
Test 10 – Water Penetration (Hose)	-	Pass	11.02.16	N/A
Test 11 – Wind Resistance (Safety) – Internal	3600 Pa	Pass	12.02.16	N/A
Test 12 – Wind Resistance (Safety) - External	**3600 Pa	Pass	12.02.16	N/A
Test 13a – Impact Resistance (Retention of Performance)	-	Pass	12.02.16	Cat B*
Test 13b – Impact Resistance (Safety to Persons)	-	Pass	12.02.16	Cat B*

Note[1] : There is no classification or performance requirement for exfiltration testing in CWCT Standard for Systemised Building Envelopes – Section 5.

***The sample achieved a Class 2 during serviceability impacting and a 'Negligible Risk' class during the safety impacting in accordance with CWCT TN 76.**

****Note: A separate test was conducted on the outer wall as per Section 13 of Standard test methods for building envelopes to subject the rainscreen panels to loads that could not be applied during the first test.**

The test sample successfully passed all of the above CWCT test requirements and all tests are either equal to or in excess of the requirements for current BS EN Standards for Curtain Walling.

These results are valid only for the conditions under which the test was conducted.

3. DESCRIPTION OF TEST SAMPLE

Manufactured By: Wienerberger Limited

Sample Size: 6000 mm wide 6000 mm high

Rainscreen Type: Corium Brick Cladding System

Framing Material/Rail System: Refer To:
1) Telling DRG CT-01 Rev C, Tile Layout
2) Telling DRG CT-02 Rev B, Substructure Layout
3) Wintech DRG WEL/15/267 Rev B, Primary support Layout
4) EOS DRG G(1) Rev, CO2 Stud Layout
5) EOS DRG G(100) CO1, Stud Components
6) Plastestrip Profiles Items Fix/Ang/HD/60/40, Fastframes heavy duty aluminium angle rail, 3 or 6m lengths
7) Plastestrip Profile FIX/TEE/HD/100/60, Fastframes heavy duty aluminium tee rail, 3 or 6m lengths
8) Plastestrip Profile AL/TH/26/50/6, Tophat support rail - 26mm standoff - 6m lengths

Vapour Barrier: TYVEK House Wrap

Drainage and Ventilation: As specified by NHBC. 12mm holes underneath base flashing at 600mm centres. 2 No 12mm holes in soffit at 2000mm centres.

Fixing Bracket Details: Refer to:
1) Telling DRG CT-02, Rev B
2) EOS DRG G(1) Rev CO2
3) EOS DRG G (100) Rev CO1.
4) Plastestrip Profile Item FF FIX-BR-80 Single FastFrame helping hand bracket, inc isolator 80mm gives stand off of 88mm-120mm
5) Plastestrip Profile Item FF FIX/BR/100 Single Fast Frame helping hand bracket, inc isolator gives stand off 108mm-140mm
6) Plastestrip Profile Item FF FIX/BR/120 Single Fast Frame helping hand bracket, inc isolator 120mm gives stand off 128mm-160mm
7) Plastestrip Profile Item FF FIX/BR/140 Single Fast Frame helping hand bracket, inc isolator 140mm gives stand off 148mm-180mm
8) Plastestrip Profile Item FF FIX/BR/160 Single Fast Frame helping hand bracket, inc isolator 160mm gives stand off 168mm-200mm
9) Plastestrip Profile Item FF FIX/BR/200 Single Fast Frame helping hand bracket, inc isolator 200mm gives stand off 208mm-240mm
10) Plastestrip Profile Item FF FIX/BRD/80 Double Fast Frame helping hand bracket, inc isolator, 80mm gives stand off 88mm-120mm
11) Plastestrip Profile Item FF FIX/BRD/100 Double Fast Frame helping hand bracket, inc isolator, 100mm gives stand off 108mm-140mm
12) Plastestrip Profile Item FF FIX/BRD/120 Double Fast Frame helping hand bracket, inc isolator, 120mm gives stand off 128mm-160mm
13) Plastestrip Profile Item FF FIX/BRD/140 Double Fast Frame helping hand bracket, inc isolator, 140mm gives stand off 148mm-180mm
14) Plastestrip Profile Item FF FIX/BRD/160 Double Fast Frame helping hand bracket, inc isolator, 160mm gives stand off 168mm-200mm
15) Plastestrip Profile Item FF FIX/BRD/200 Double Fast Frame helping hand bracket, inc isolator, 200mm gives stand off 208mm-240mm
16) Plastestrip Profile ItemJT4-4-4.8x19, 19mm rail to bracket fixing
17) Plastestrip Profile Item JT3-3-5.5x25 S16, horizontal to vertical rail fixing, includes washer
18) Plastestrip Profile Item JT3-3-6.3x50, 50mm bracket to steel fixing

Further details of the test sample and façade system can be found in Appendix A – Sample Drawings.

Test Sample During Testing

Photograph No. 1

4. TEST ARRANGEMENT

4.1 TEST CHAMBER

A curtain walling specimen, supplied for testing in accordance with CWCT requirements, was mounted on to a rigid test chamber constructed from steel, timber and plywood sheeting.

The pressure within the chamber was controlled by means of a centrifugal fan and a system of ducting and valves. The static pressure difference between the outside and inside of the chamber was measured by means of a differential pressure transmitter.

4.2 INSTRUMENTATION

4.2.1 Static Pressure

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

4.2.2 Air Flow

A Laminar flow element, mounted in the air system ducting, was used along with differential pressure transducers to measure the airflow required to obtain pressures within the test chamber and has the capability of measuring airflow through the sample to an accuracy within 2%.

4.2.3 Water Flow

An in-line flowmeter, mounted in the spray frame water supply system, was used to measure water flow to the test sample to an accuracy of ± 5%.

4.2.4 Deflection

Digital linear measurement devices with an accuracy of +/- 0.1 mm were used to measure deflection of principle framing members.

4.2.5 Temperature & Humidity

A digital data logger capable of measuring temperature with an accuracy of ± 1°C and humidity with an accuracy of ± 5 %Rh was used.

4.2.6 Atmospheric Pressure

A digital barometer was used to take atmospheric pressure readings with an accuracy of ± 1Kpa.

4.2.7 General

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

4.3 PRESSURE GENERATION

Note: References are made to both positive and negative pressures in this document, it should be noted that in these instances, positive pressure is when pressure on the weather face of the sample is greater than that on the inside face and vice versa.

4.3.1 Static Air Pressure

The air supply system comprised of a centrifugal fan assembly and associated ducting and control valves which were used to create both positive and negative static pressure differentials. The fan provided a constant airflow at the required pressure and period required for the tests.

4.3.2 Dynamic Aero Engine

A wind generator was mounted adjacent to the external face of the test sample and used to create positive pressure differential during dynamic testing.

4.4 WATER SPRAY

4.4.1 Spray frame arrangement

A water spray system was used which comprised of nozzles spaced on a uniform grid, not more that 700 mm apart and mounted approximately 400 mm from the face of the sample. The nozzles provided a full cone pattern, as per the requirements outlined by CWCT. The system delivered water uniformly to the entire surface of the test sample at a rate of not less than 3.4 lt/m^2/min.

4.4.2 Hose arrangement

The water was applied using a brass nozzle which produced a solid cone of water droplets with a nominal spread of 30˚. The nozzle was provided with a control valve and a pressure gauge between the valve and the nozzle. The water flow to the nozzle was adjusted to produce 22 $\pm$ 2 litre/min when the water pressure at the nozzle inlet was 220 $\pm$ 20kPa.

4.5 IMPACTORS

4.5.1 Soft (S1) Body Impactor

A spherical/conical, glass bead filled impactor with a mass of 50 kg.

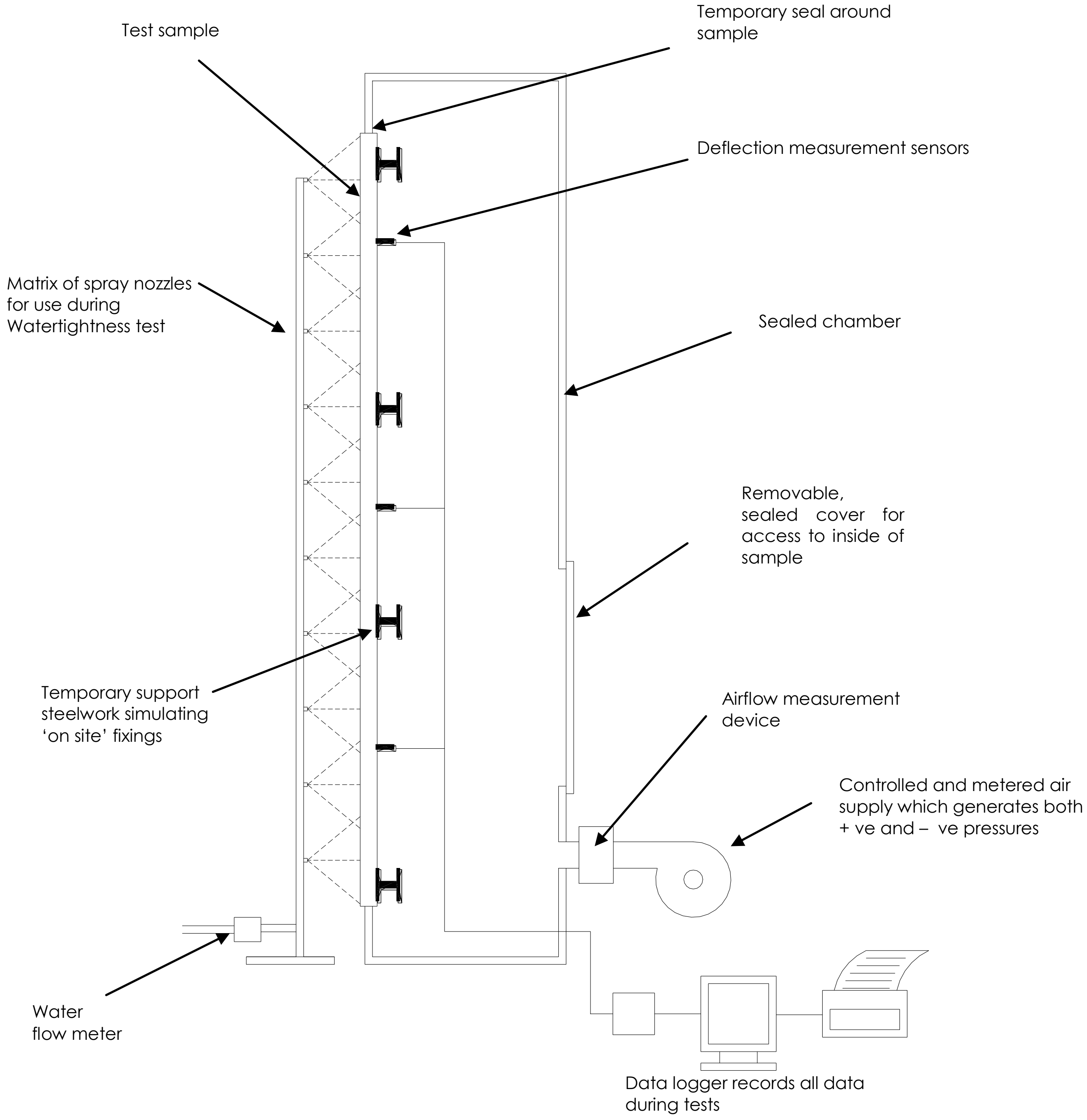
4.5.2 Hard (H2) Body Impactor

A steel ball with a diameter of 62.5 mm and a mass of 1.135 kg, was released from the height, calculated to result in the required impact energies and allowed to fall under gravity until it impacted the designated test zone of the sample.

All measurement devices, instruments and other relevant equipment were calibrated and are traceable to National Standards.

Figure 1

General Arrangement of a Typical Test Assembly



5. TEST PROCEDURES

5.1 SEQUENCE OF TESTING

1. Air Leakage – Infiltration
2. Air Leakage – Exfiltration
3. Water Penetration – Static Pressure
4. Wind Resistance – Serviceability - Internal
5. Wind Resistance – Serviceability - External
6. Repeat Air Leakage – Infiltration
7. Repeat Air Leakage – Exfiltration
8. Repeat Water Penetration – Static Pressure
9. Water Penetration – Dynamic Aero Engine
10. Water Penetration – Hose
11. Wind Resistance – Safety - Internal
12. Wind Resistance – Safety - External

13a. Impact Resistance (Retention of Performance)
13b. Impact Resistance (Safety to Persons)

5.2 AIR LEAKAGE

5.2.1 Infiltration

Three (3) preparatory pulses of **660 Pa (110% of peak test pressure)** positive pressure were applied to the test sample. An airtight seal comprising of plastic sheeting and adhesive tape was then attached to the face of the test sample.

Leakage through the test chamber and joints between the chamber and test sample was determined by measuring the air flow at the following positive pressures; **50, 100, 150, 200, 250, 300, 450 and 600 Pa** each step being held for at least 10 seconds.

Test results for the sample were determined by repeating the above sequence with the sample unsealed. The difference between the readings being the air leakage through the sample.

A check for concentrated air leakage was conducted following the above sequence.

5.2.2 Exfiltration

Three (3) preparatory pulses of **500 Pa** negative pressure were applied to the test sample. An airtight seal comprising of plastic sheeting and adhesive tape was then attached to the face of the test sample.

Leakage through the test chamber and joints between the chamber and test sample was determined by measuring the air flow at the following positive pressure; **50 and 100 Pa**, which was held for at least 10 seconds.

Test results for the sample were determined by repeating the above sequence with the sample unsealed. The difference between the readings being the air leakage through the sample.

5.3 WATER PENETRATION

5.3.1 Water Penetration – Static Pressure

Three (3) preparatory pulses of **660 Pa (110% of peak test pressure)** positive pressure were applied to the test sample.

Water was sprayed on to the sample as described in section 4.4.1 for 15 minutes at zero (0) Pa. The water spray continued and the pressure was increased in the following positive increments; **50, 100, 150, 200, 300, 450 and 600 Pa**, each stage being held for 5 minutes.

The interior face of the sample was continuously monitored for water ingress throughout the test.

5.3.2 Water Penetration – Dynamic Aero Engine

Water was sprayed on to the sample as described in section 4.4.1.

The sample was subjected to airflow from the wind generator, as described in 4.3.2, which achieved average deflections equal to those produced at a static pressure differential of **600 Pa** and these conditions were met for the specified 15 minutes.

The interior face of the sample was continuously monitored for water ingress throughout the test.

5.3.3 Water Penetration – Hose

Working from the exterior, selected areas of curtain wall were wetted from the bottom up, progressing from the lowest horizontal joint then the intersecting vertical joints.

Water was applied to the sample for 5 mins per 1.5 m length of joint, as described in section 4.4.2.

Throughout the water penetration testing, and for 30 minutes following the cessation of spraying, the internal face of the sample was examined for water penetration. The emergence of any water on the inside face would be recorded, and the location and extent of any leakage noted on a drawing of the test specimen.

5.4 WIND RESISTANCE

5.4.1 Wind Resistance – Serviceability

Three (3) preparatory pulses of **1200 Pa (50% of design wind load)** positive pressure were applied to the test sample. Upon returning to 0 Pa, any opening parts of the test specimen were opened and closed five (5) times, secured in the closed position and finally sealed with tape. All deflection sensors were then zeroed.

The sample was then subjected to positive pressure stages of **600, 1200, 1800 and 2400 Pa (25%, 50%, 75% and 100% of design wind load)** and held at each step for 15 seconds (± 5 secs).

The deformation status of the sample was recorded at each step at characteristic points as stated in the standard, following which the pressure was reduced to 0 Pa and any residual deformations recorded within 1 hour of the test.

The above test sequence was then repeated, including the preparation pulses, at a negative pressure differential. All sensors other than those used for recording the movement of framing members adjacent to their fixings to building structure were zeroed following preparation pulses.

Following each of the above tests, the sample was inspected for permanent deformation or damage.

5.4.2 Wind Resistance – Safety

Three preparatory positive air pressure pulses of **1200 Pa (50% of design wind load)** positive pressure were applied to the test sample, and the deflection sensors were zeroed.

The sample was subjected to a positive pressure pulse of **3600 Pa (2400 Pa x 150%)**. The pressure was applied as rapidly as possible but in not less than 1 second and was maintained for 15 seconds (± 5 secs).

Following this pressure pulse and upon returning to zero (0) pressure, residual deformations were recorded and any change in the condition of the specimen was noted.

After the above sequence, a visual inspection was conducted, any moving parts were operated and any damage or functional defects noted.

The above test sequence was then repeated, including the preparation pulses, with negative pressure. The deflection sensors were zeroed following the preparation pulses.

Following each of the above tests, the sample was inspected for any permanent deformation or damage.

5.5 IMPACT - SAFETY

5.5.1 Impact Test Procedure

The test sample was tested using a drop height which corresponded with the required performance level.

The Impactors, as described in section 4.5, were suspended on a wire/Nylon cord and allowed to swing freely, without initial velocity, in a pendulum motion until they hit the sample normal to its face. Only one impact was performed at any single position.

Tests were conducted at the required impact energies as shown in section 6.4.1 and 6.4.2 to the selected impact points and the impactors were not allowed to strike the sample more than once.

Drop heights were set to an accuracy of ± 10 mm.

6. TEST RESULTS

6.1 AIR LEAKAGE

6.1.1 Calculated Permissible Air Infiltration of Test Sample

Permissible air infiltration rate as CWCT standard test methods for building envelopes – section 5:
Fixed = 1.5 $m^3/hr/m^2$

The permissible air infiltration rate at intermediate test pressures was determined as specified by CWCT standard test methods for building envelopes – section 5.

Air permeability measured at maximum test pressure in the 2nd test should not increase by more than 0.3 $m^3/hr/m^2$ for fixed glazing above those recorded in the 1st test, as required in CWCT standard for systemised building envelopes: section 3 & BS EN 13116: 2001.

Measured area of test sample = 39.26 m^2

6.1.2 Air Leakage – Classification

Classification according to CWCT & BS EN 12152: 2002

Test 1 & 5 – Infiltration – Fixed glazing *A4*

Note: There is no classification requirement for exfiltration testing in CWCT standard for systemised building envelopes – section 5. However, Approved Document L2 requires a maximum air leakage rate of 10 $m^3/hr/m^2$ @ 50 Pa for a completed building envelope.

6.1.3 Fixed Glazing

Pressure Differential Pa	Maximum Air Permeability Rate –Infiltration $m^3/hr/m^2$				Maximum Air Permeability Rate – Exfiltration $m^3/hr/m^2$			
	Test No. 1		**Test No. 5**		**Test No. 2**		**Test No. 6**	
	Ambient ° C	**7.0**	**Ambient ° C**	**7.0**	**Ambient ° C**	**7.0**	**Ambient ° C**	**7.0**
50	**0.14**		**0.09**		**0.26**		**0.09**	
100	**0.20**		**0.09**		**0.39**		**0.21**	
150	**0.24**		**0.11**					
200	**0.29**		**0.16**					
250	**0.30**		**0.17**					
300	**0.40**		**0.21**					
450	**0.61**		**0.23**					
600	**0.78**		**0.40**					

Observations
No areas of concentrated leakage were found during testing.

Note: The standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%, for the above measurements is $\pm$ 5.33 % of the reading

Figure 2

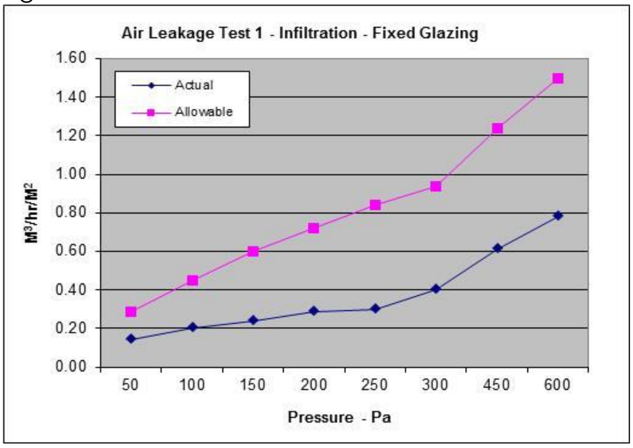


Figure 3

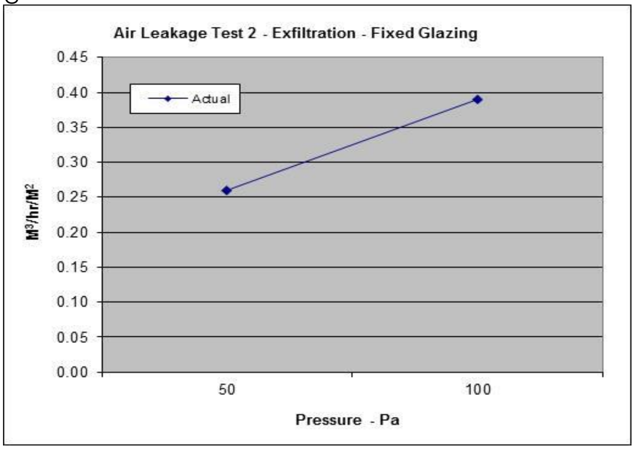


Figure 4

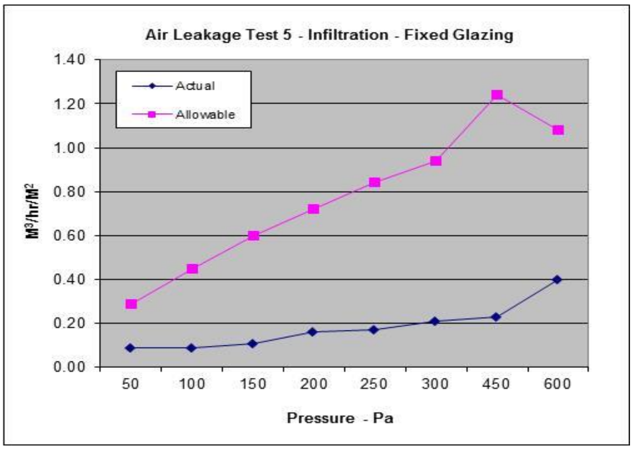
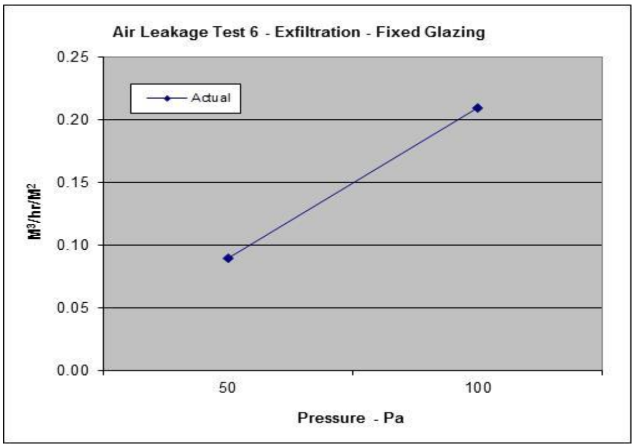


Figure 5



6.2 WATER PENETRATION

6.2.1 Water Penetration – Classification

Classification according to CWCT & BS EN 12154: 2000

Test 3 – Water Penetration – Static	R7

6.2.2 Test 3 – Water Penetration – Static

Temperatures (°C)

Water	9.0
Ambient	8.0

AIR PRESSURE Pa	COMMENTS
0 x 15 minutes	No Leakage
50 x 5 minutes	No Leakage
100 x 5 minutes	No Leakage
150 x 5 minutes	No Leakage
200 x 5 minutes	No Leakage
300 x 5 minutes	No Leakage
450 x 5 minutes	No Leakage
600 x 5 minutes	No Leakage

Observations

There was no water leakage observed during the water spray.

6.2.3 Test 8 – Repeat Water Penetration – Static

Temperatures (°C)

Water	8.0
Ambient	7.0

AIR PRESSURE Pa	COMMENTS
0 X 15 minutes	No Leakage
50 x 5 minutes	No Leakage
100 x 5 minutes	No Leakage
150 x 5 minutes	No Leakage
200 x 5 minutes	No Leakage
300 x 5 minutes	No Leakage
450 x 5 minutes	No Leakage
600 x 5 minutes	No Leakage

<u>Observations</u>
There was no water leakage observed during the water spray.

6.2.4 Test 9 – Water Penetration – Dynamic Aero Engine

Temperatures (°C)

Water	8.0
Ambient	7.0

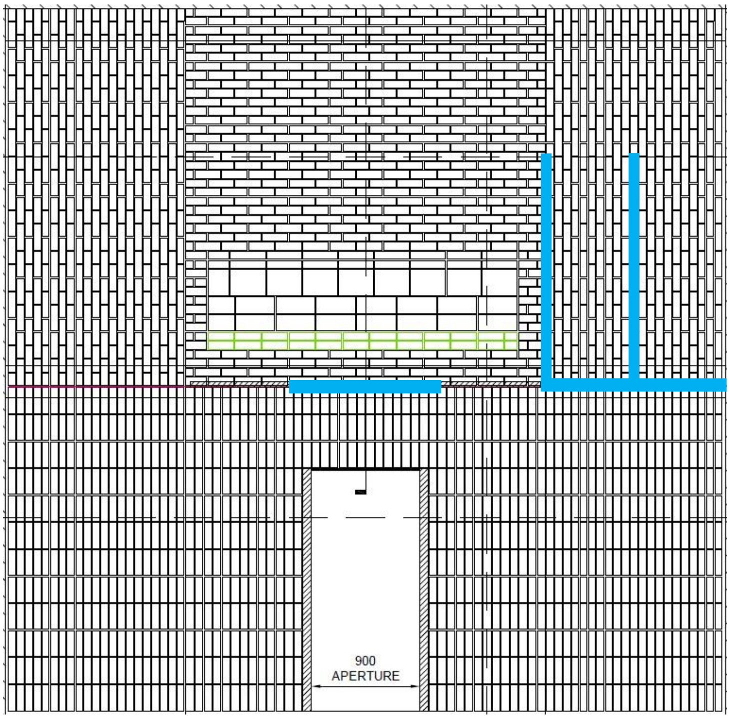
<u>Observations</u>
The sample was subjected to testing as described in section 5.3.2, for a period of not less than 15 minutes, during which no water leakage was observed through the sample.

6.2.5 Test 10 – Water Penetration – Hose

<u>Observations</u>
The sample was subjected to hose testing, as described in section 5.3.4. During the test, and for 30 minutes following the cessation of spraying, the sample was monitored for water ingress and none was found.

<u>Figure 6</u>

<u>Hose Test Areas</u>



- Hose test areas

View from Outside

Not to Scale

6.3 WIND RESISTANCE TESTING

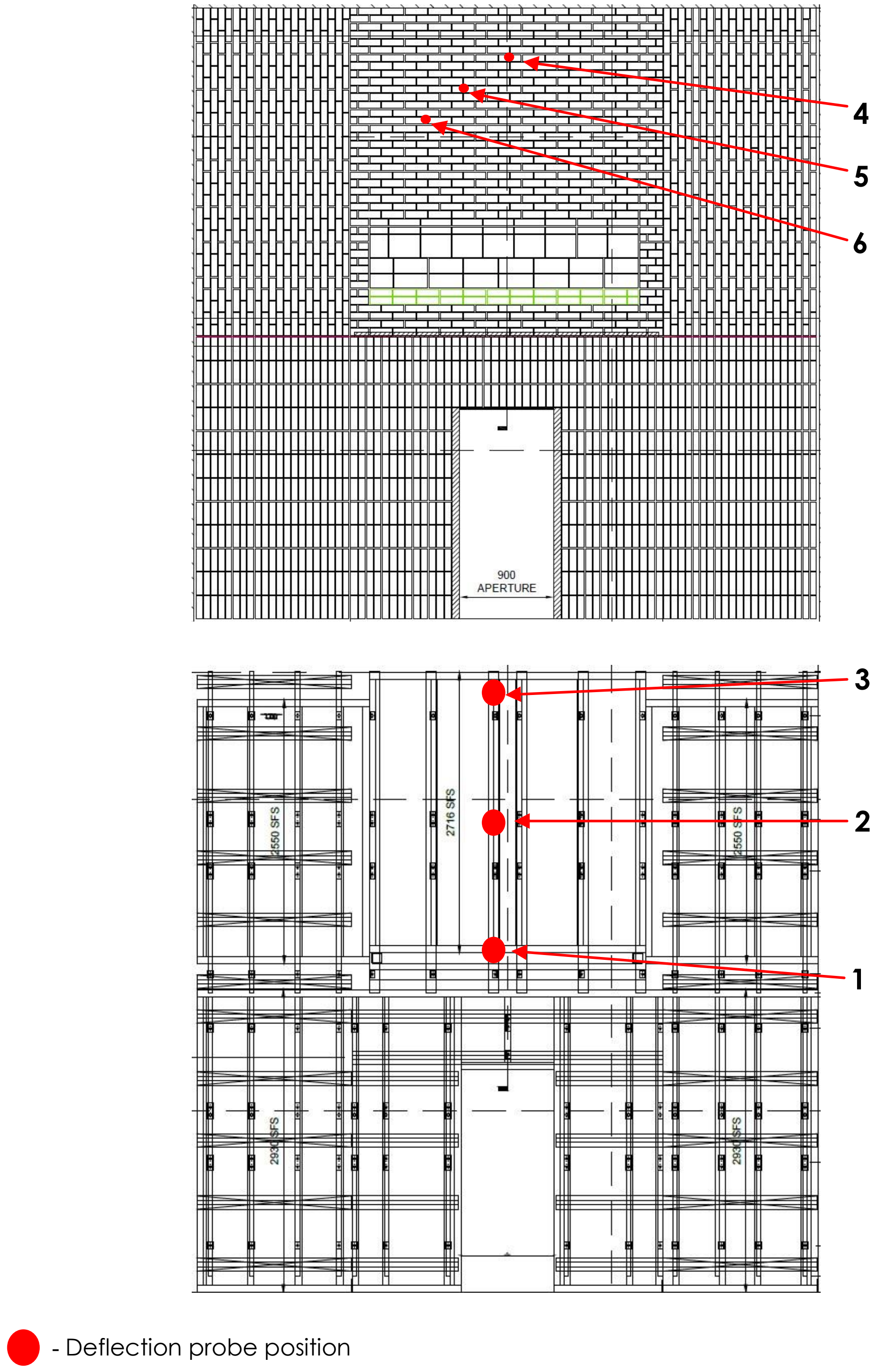
	Calculation of deflection
Group A comprised of probes 1, 2 & 3	= Probe 2 – ((Probe 1 + Probe 3)/2)
Group B comprised of probes 4, 5, & 6	= Probe 5 – ((Probe 4 + Probe 6)/2)

Note: A separate test was conducted on the outer wall as per Section 13 of Standard test methods for building envelopes to subject the rainscreen panels to loads that could not be applied during the first test.

An inspection carried out following tests 4, 5, 11 and 12, after both positive and negative pressure testing, showed no evidence of any permanent deformation or damage to the test sample.

Figure 7

Positions of Deflection Measurement Probes



View from Outside

Not to Scale

6.3.1 Test 4 & 5 - Wind Resistance, Serviceability

Temperatures (°C)	Ambient	-1.0

Measured Length of Framing Member (mm)		Allowable Deflection	
		Ratio	Calculated (mm)
Group A	2410	L/90	26.8
Group B	815	L/360	2.3

Frontal deflection shall recover by either 95%, or 1mm, whichever the greater.

6.3.1.1 Wind Resistance, Serviceability - Positive Pressure

Positive Pressure Pa	Results	
	Group A	Group B
0	0.0	0.0
600	0.4	0.0
1200	0.8	0.2
1800	1.2	0.1
2400	1.8	0.0
Residuals Immediately following test	0.1	-0.1

6.3.1.2 Wind Resistance, Serviceability - Negative Pressure

Negative Pressure Pa	Results	
	Group A	Group B
0	0.0	0.0
600	0.4	0.1
1200	0.9	0.1
1800	1.5	0.0
2400	2.1	0.0
Residuals Immediately following test	0.0	0.0

6.3.2 Test 11 & 12 - Wind Resistance, Safety

Temperatures (°C)	Ambient	2.0

Measured Length of Framing Member (mm)		Allowable Residual Deformation	
		Ratio	Calculated (mm)
Group A	2410	L/500	4.8
Group B	815	L/500	1.6

6.3.2.1 Wind Resistance, Safety - Positive Pressure

Positive Pressure Pa	Results	
	Group A	Group B
0	0.0	0.0
3600	2.8	0.2
Residuals Immediately following test	0.2	0.0

6.3.2.2 Wind Resistance, Safety - Negative Pressure

Negative Pressure Pa	Results	
	Group A	Group B
0	0.0	0.0
3600	3.5	0.0
Residuals Immediately following test	0.0	0.1

Note: The standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%, for the above measurements is ± 2.4 % of the reading

6.4 IMPACT TESTING

6.4.1 Test 13a – Impact – Retention of performance of exterior wall surfaces (Soft & Hard Body)

Temperatures (°C)	Ambient	4.0
Humidity (%RH)	93.0	

Impact Reference	Test Category	Impactor Type	Impact Energy (Nm)	Drop Height (mm)	Observations
E1	B	H2	10	898	Crack – safely retained
E2	B	H2	10	898	Crack – safely retained
E3	B	H2	10	898	No Damage
E4	B	H2	10	898	No Damage
E5	B	H2	10	898	Crack – safely retained
E6	B	H2	10	898	No Damage
E7	B	H2	10	898	No Damage
E8	B	H2	10	898	No Damage
E9	B	S1	120	245	No Damage
E10	B	S1	120	245	No Damage
E11	B	S1	120	245	No Damage
E12	B	S1	120	245	No Damage
E13	B	S1	120	245	No Damage
E14	B	S1	120	245	No Damage
E15	B	S1	120	245	No Damage
E16	B	S1	120	245	No Damage

NOTE: The system achieved a Class 2 during the serviceability impacting in accordance with CWCT TN 76.

6.4.2 Test 13b – Impact – Safety to persons (Soft Body)

Temperatures (°C)	Ambient	4.0
Humidity (%RH)	93.0	

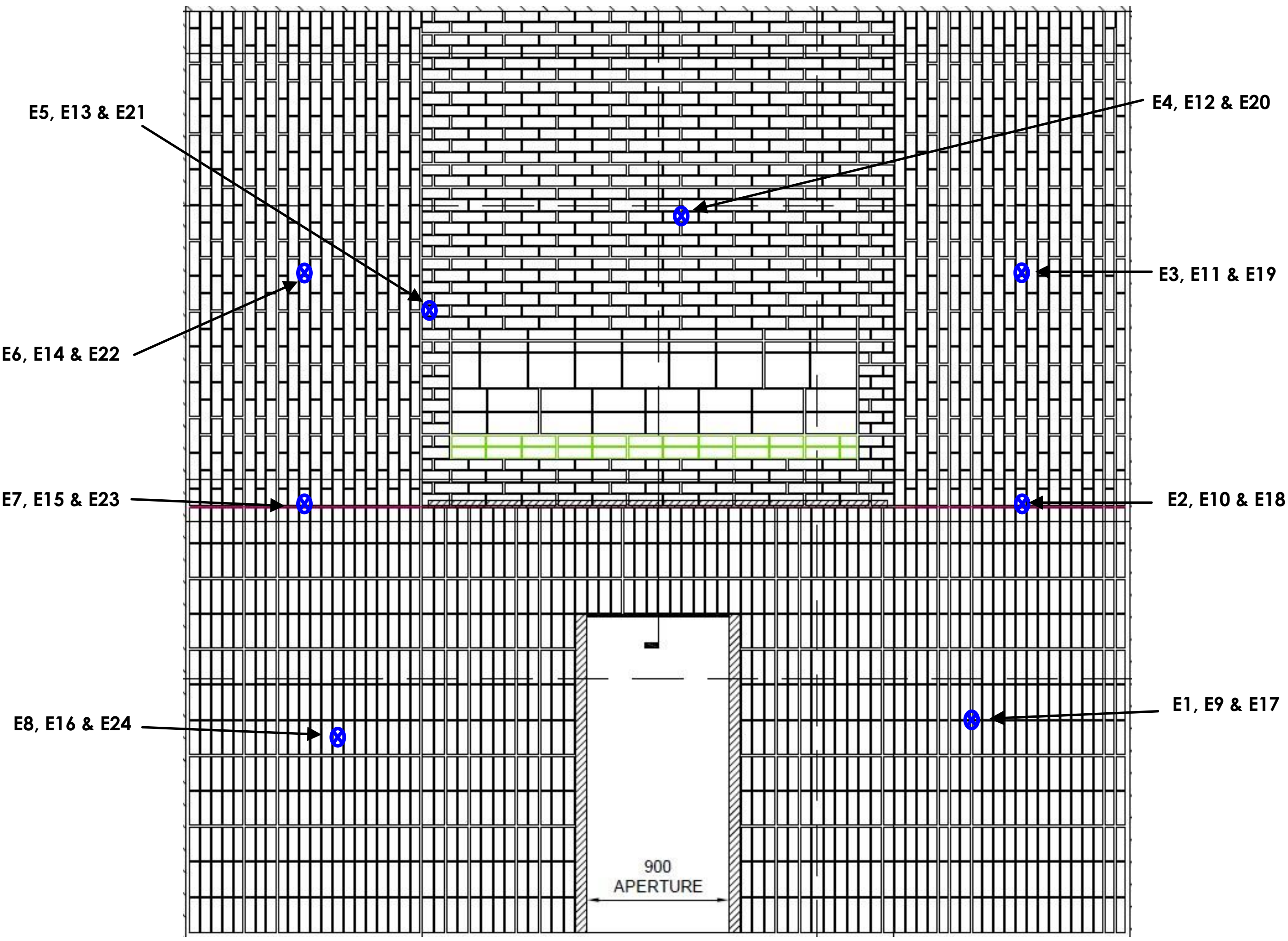
Impact Reference	Test Category	Impactor Type	Impact Energy (Nm)	Drop Height (mm)	Observations
E17	B	S1	500	1020	No Damage
E18	B	S1	500	1020	No Damage
E19	B	S1	500	1020	No Damage
E20	B	S1	500	1020	No Damage
E21	B	S1	500	1020	No Damage
E22	B	S1	500	1020	No Damage
E23	B	S1	500	1020	No Damage
E24	B	S1	500	1020	No Damage

NOTE: The system achieved a 'Negligible Risk' class during the safety impacting in accordance with CWCT TN 76.

NOTE: The hard body impacting for safety to persons was conducted during the retention of performance test due to the impact energy being the same.

6.4.1 Impact Positions

Figure 8



⊗ - External impact position

View from Outside

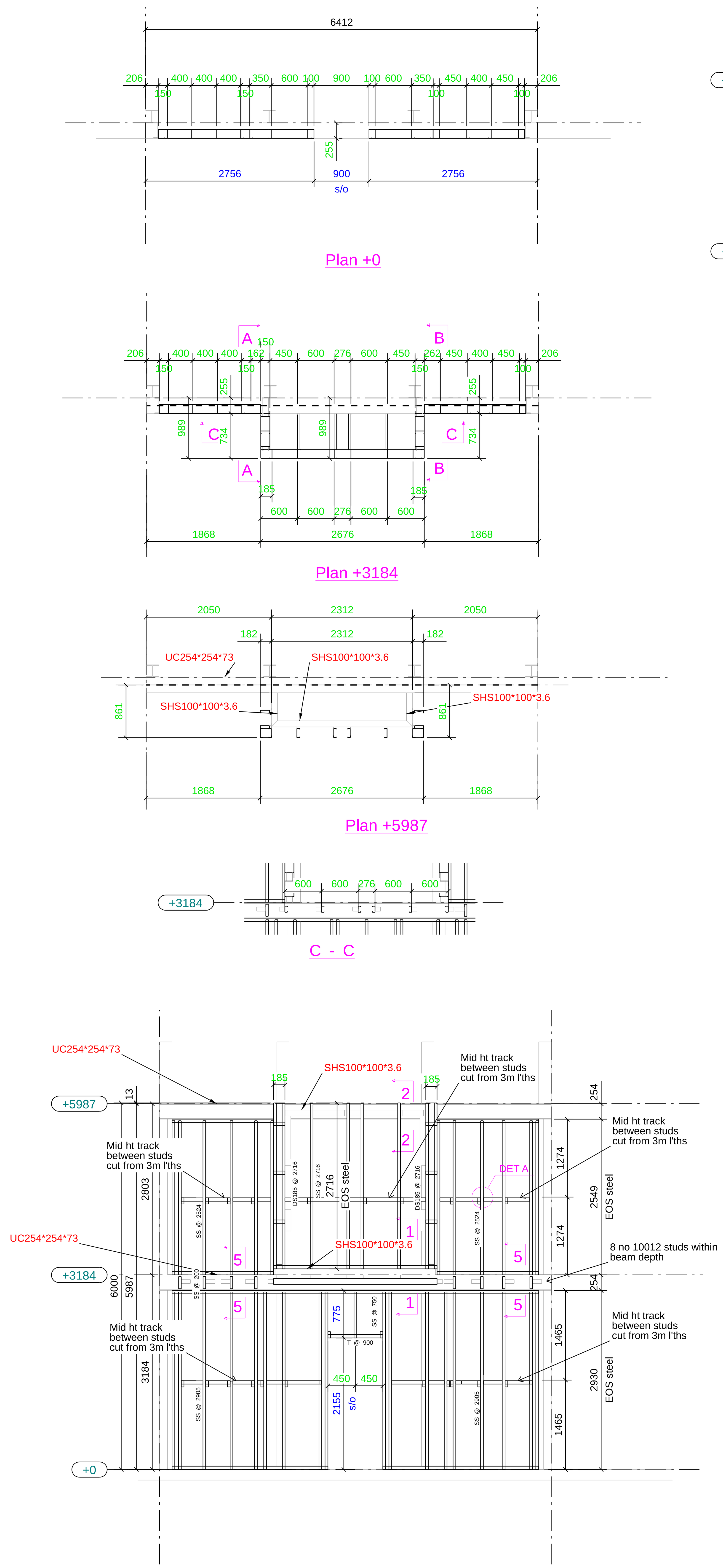
Not to Scale

APPENDIX A

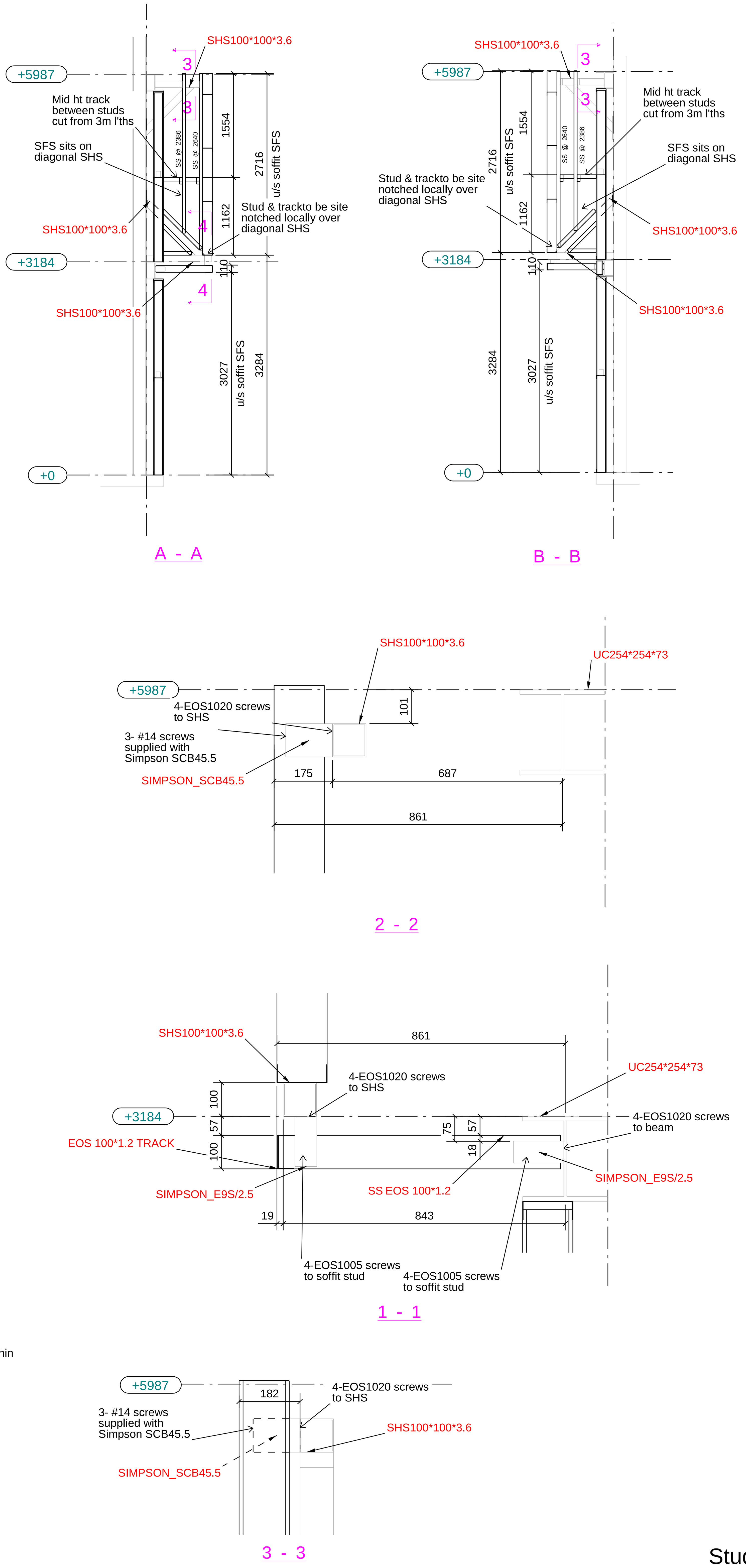
System Drawings

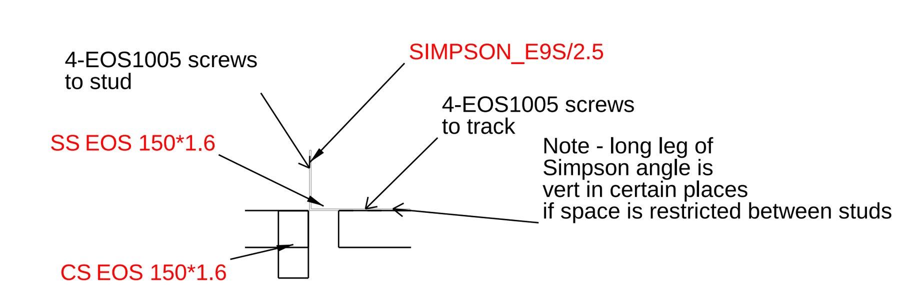
(4 drawings on 4 un-numbered pages)

G (1)
C (100)
CT-01 Rev C
CT-02 Rev B

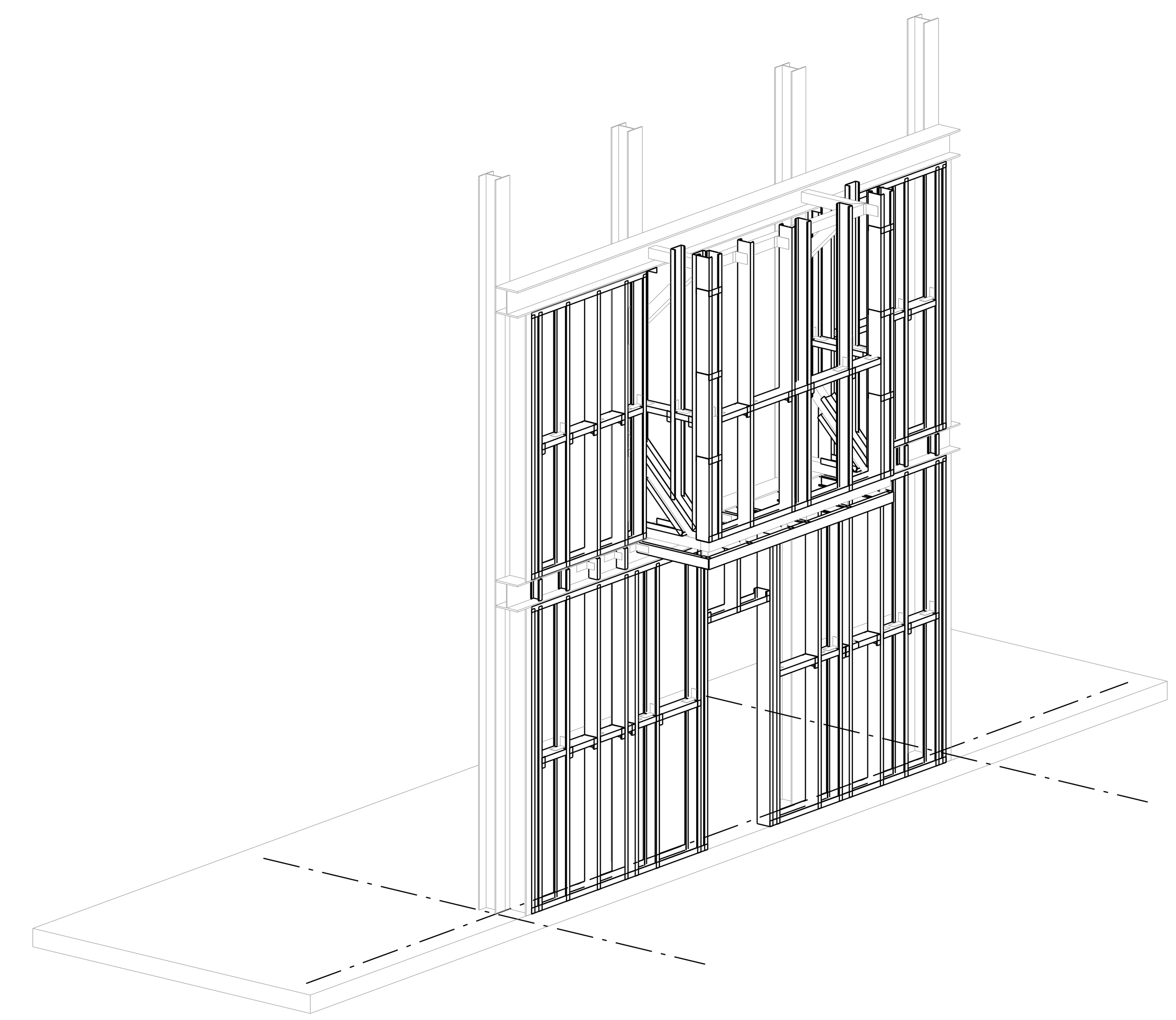


Elevation

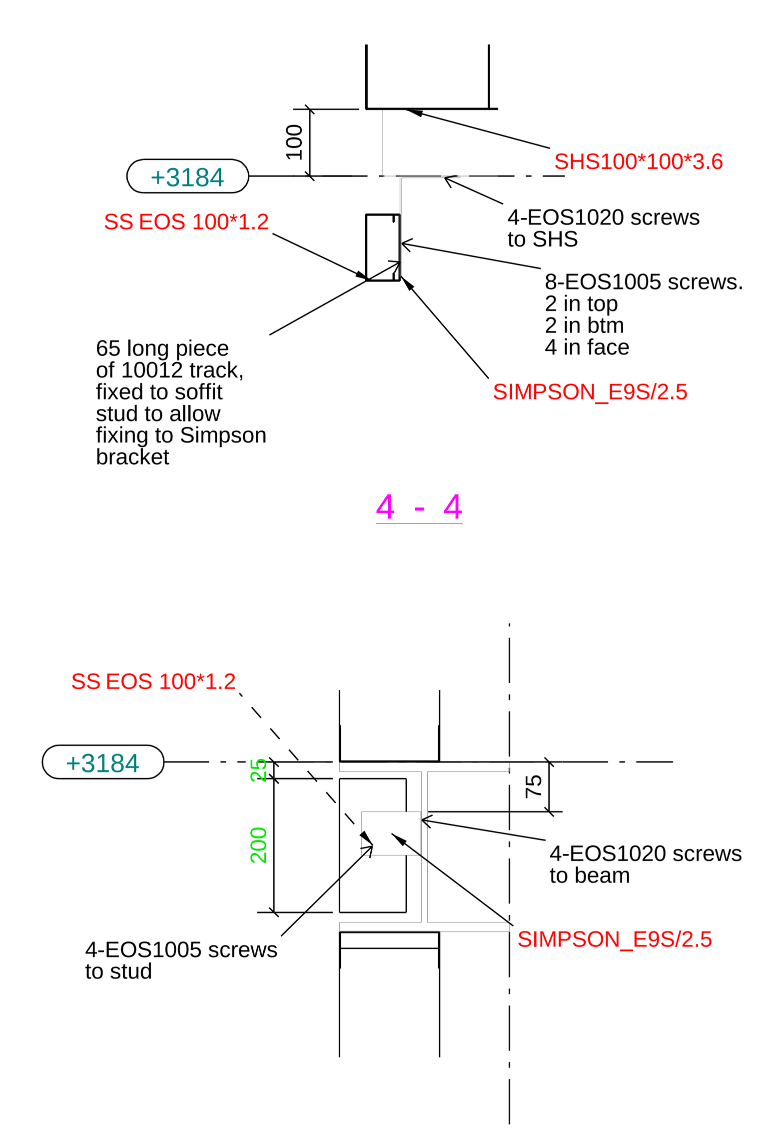




DETAIL A TYP CONN FOR MID HT TRACK TO STUD



3d view



Studs are 15016 at crs shown
Studs within beam depth are 10012-8 no.
Head, base & mid ht track are 15012
Soffit studs are 10012 at crs shown
Soffit front face rail is 10012 track
Top track is deflection head track
Track to conc slab use EOS1021 HUS 6x45 screw anchors @ 600 c/c's
Track to steel use EOS1020 Hex Head Self Drill 5.5x40 screws @ 600 c/c's
SFS to SFS & Simpson Brackets use EOS1005 5.5x25 Screws

WINTECH
Drawing as supplied to WEL
BUILDING ENVELOPE TESTING

Corium Test Rig

NOTES

General Notes

Every stud connecting to top track requires a deflection head bracket (UNO) refer to EOS Standard Details drawing F451 .G100 details 203, 204, 205 & 265

Please refer to following GA's
During installation of EOS system
F451.G100 - Standard Details
F451.G101 - Non Standard Details

'EOS Steel' height dimension inclusive of 25mm deflection

S/O = Structural Opening

Design Constraints:
Below information to be followed UNLESS NOTED OTHERWISE on specific GA's

Studs to be SS15016
Head & Base Track T15012 to be fixed @ 600c/c

Jambs:Single Stud SS15016
Lintels:Single Track T15012
Sills:Single Track 0

Indicates brick tie - Min 150mm, Max 225mm from inside of jamb stud

Glazing spanning slab to slab no load applied to EOS system

MJ Indicates movement joint see F451G101 for detail

NT - Indicates hard fixed track detail at head Deflection to be allowed by others

KEY PLAN:

Notes + revisions:

C02	25/11/15	STUDS ADDED WITHIN BEAM DEPTH. NOTES ADDED
C01	23/11/15	CONSTRUCTION ISSUE
P01	20/11/15	APPROVAL ISSUE

Project Number: F451
Project: Corium Test Rig
Title: Plans, Elevs & Isometric

Drawing No. G [1]	Status: Construction
Revision: C02	Scale: 1:10 1:100 1:50 1:150
Drawn By: AM	Checked By: PP

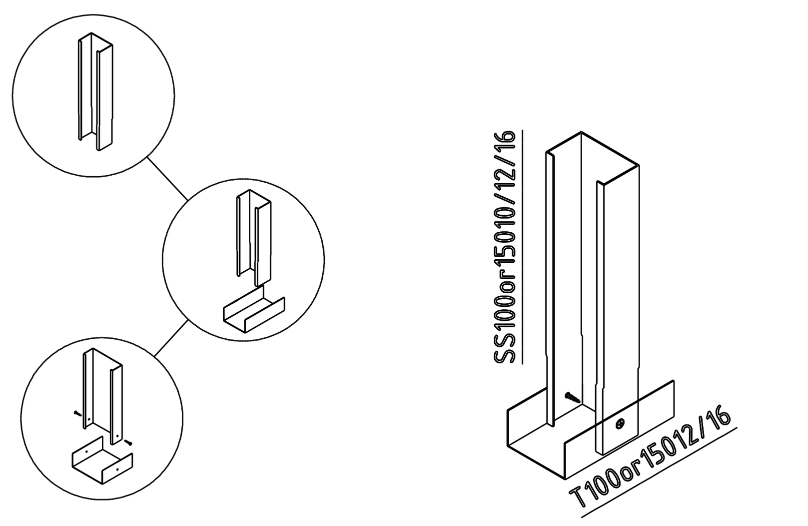
Preliminary: ☐ Approval: ☐ Construction: ☒

EOS

Heighington Lane | Aycliffe Industrial Park | Newton Aycliffe | Co. Durham | DL5 6QG
Tel: 01325 303030 | Fax: 01325 301724 | www.eosuk.org

Tekla Structures

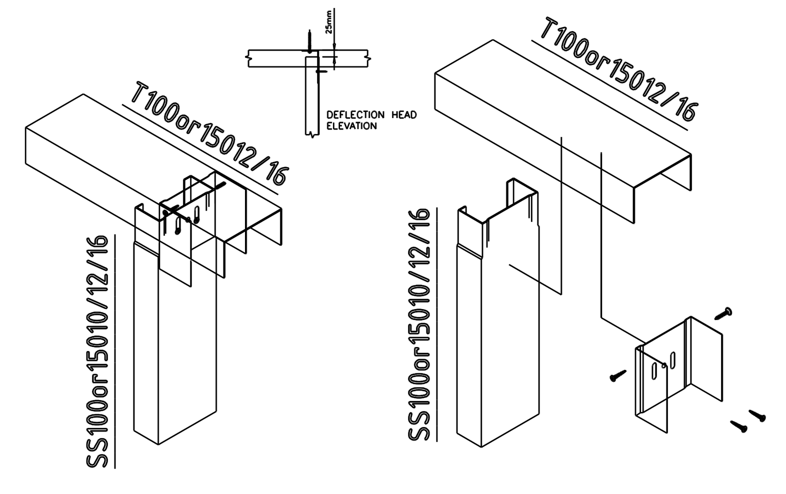
TYPICAL CONNECTION DETAILS



VERTICAL STUD (TYPICALLY WITH 50mm SWAGE TO BOTTOM OF STUD) FIXED TO HORIZONTAL TRACK USING 25mm TEK SCREWS FIXING INTO BOTH FLANGES OF THE BASE TRACK ON THE CENTRE LINE OF BOTH THE TRACK AND THE STUD.

TYPICAL STUD TO TRACK FIXING DETAIL FOR SINGLE STUDS

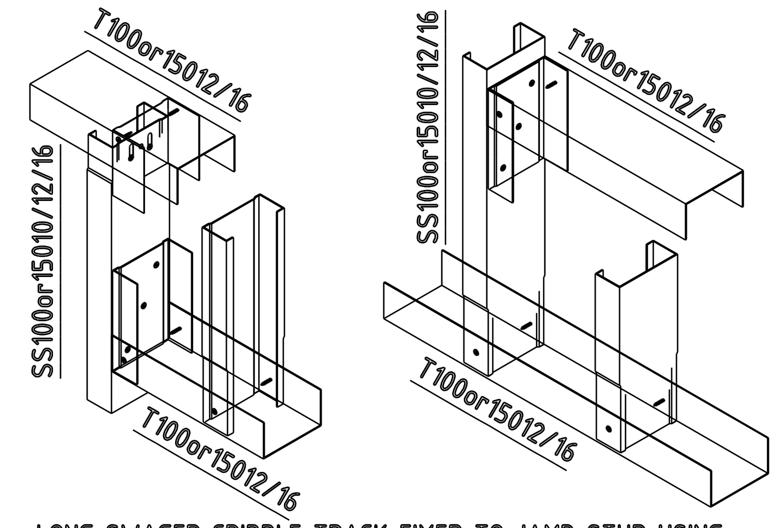
TYPICAL CONNECTION DETAILS



EDB BRACKET FIXES TO THE WEB OF THE VERTICAL STUD WITH 2 NO. 25mm TEK SCREWS (LARGE WASHER). THE BRACKET IS THEN FIXED IN POSITION THROUGH THE TRACK USING 25mm TEK SCREWS FIXINGS INTO BOTH FLANGES OF THE TRACK. MINIMUM EDGE DISTANCE OF 15mm MUST BE OBSERVED

TYPICAL DEFLECTION HEAD BRACKET DETAIL FOR SINGLE STUDS

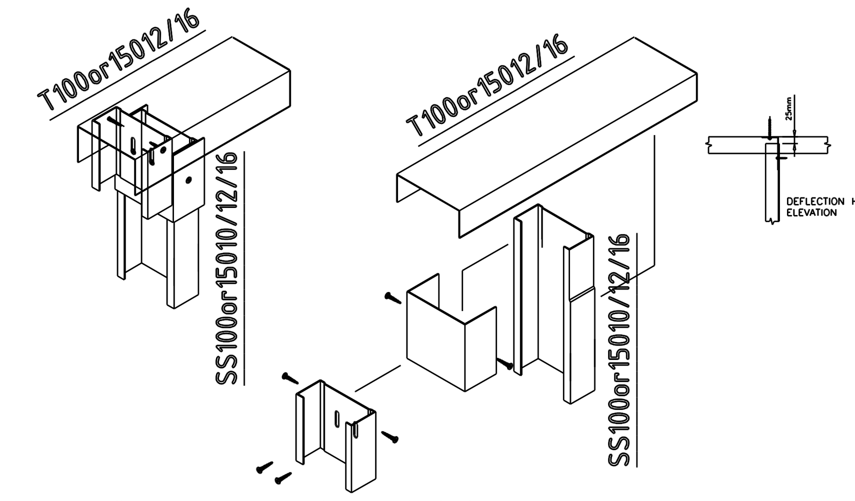
TYPICAL CONNECTION DETAILS



100mm LONG SWAGED CRIPPLE TRACK FIXED TO JAMB STUD USING TYPICALLY 3 No 25mm TEK SCREW FIXINGS. HEAD/CILL TRACK FIXED INTO STUD USING 25mm TEK SCREW FIXINGS INTO BOTH FLANGES OF THE HEAD/CILL TRACK ON THE CENTRE LINE OF BOTH THE TRACK AND THE STUD.

TYPICAL SINGLE TRACK CILL & SINGLE TRACK LINTEL DETAIL

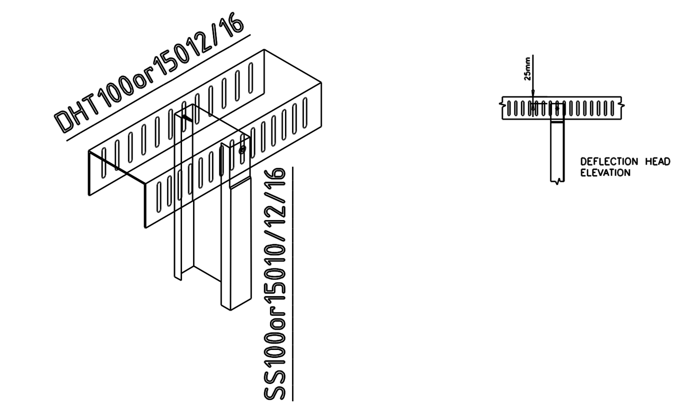
TYPICAL CONNECTION DETAILS



VERTICAL STUD FIXED TO TRACK USING 25mm TEK SCREWS FIXING INTO BOTH FLANGES OF THE TRACK. TRACK TO OVERLAP STUD AND FIXED INTO POSITION WITH 25mm TEK SCREWS EITHERSIDE TO ALLOW DEFLECTION BRACKET TO BE FIXED TO FORM DEFLECTION DETAIL TO THE JAMB STUD. EDB BRACKET FIXES TO THE WEB OF THE VERTICAL CLOAKING TRACK WITH 2 NO. 25mm TEK SCREWS (LARGE WASHER)

TYPICAL DETAIL USING CLOAKING TRACK FOR DEFLECTION HEAD FIXING FACE

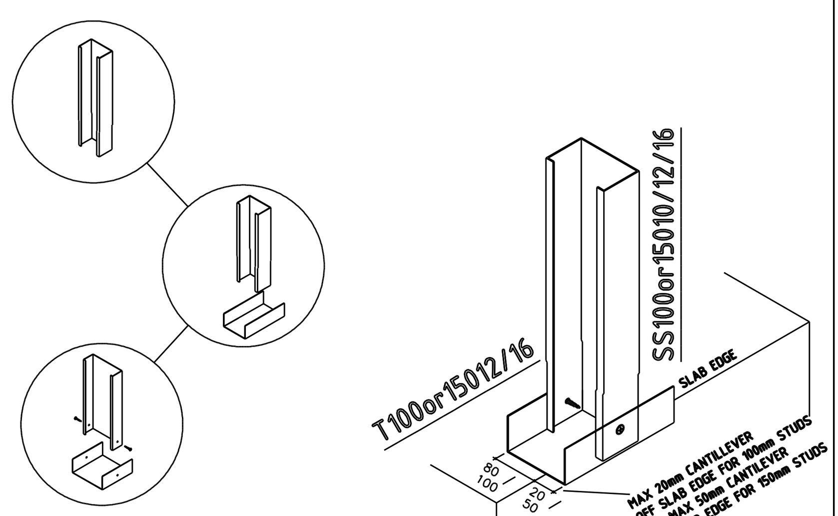
TYPICAL CONNECTION DETAILS



VERTICAL SWAGED STUD FIXED TO DEFLECTION HEAD TRACK WITH 2 NO. 25mm TEK SCREWS (LARGE WASHER) (ONE EITHER SIDE). SCREWS TO BE FIXED CENTRAL IN SLOT TO ALLOW +/- 12.5mm MOVEMENT

TYPICAL DEFLECTION HEAD TRACK DETAIL FOR SINGLE STUDS

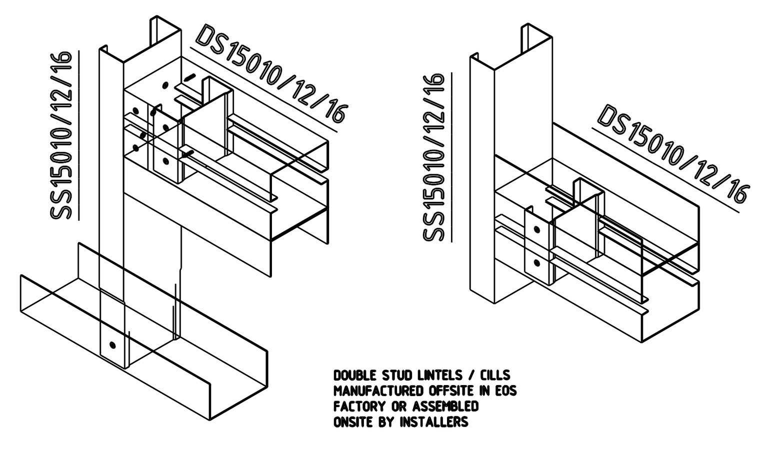
TYPICAL CONNECTION DETAILS



VERTICAL STUD (TYPICALLY WITH 50mm SWAGE TO BOTTOM OF STUD) FIXED TO HORIZONTAL TRACK USING 25mm TEK SCREWS FIXING INTO BOTH FLANGES OF THE BASE TRACK ON THE CENTRE LINE OF BOTH THE TRACK AND THE STUD.

TYPICAL OVERHANG LIMITS FOR TRACK SECTIONS

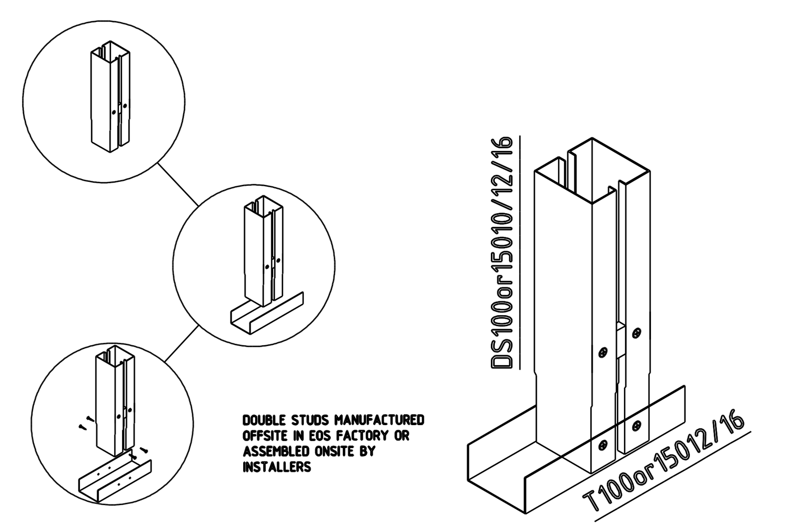
TYPICAL CONNECTION DETAILS



LINTELS FIXED TO JAMB STUD USING A MINIMUM 3 No. 25mm TEK SCREW FIXINGS. DOUBLE STUD LINTEL FORMED FROM 2 No. STUDS AND 1 No. TRACK FIXED USING 25mm TEK SCREW FIXINGS INTO BOTH FLANGES OF THE STUD. TRACK FIXED TYPICALLY AT 600mm STAGGERED CENTRES ALONG THE CENTRE LINE OF THE STUD FLANGE.

TYPICAL DOUBLE STUD LINTEL & DOUBLE STUD CILL DETAIL (SINGLE JAMB)

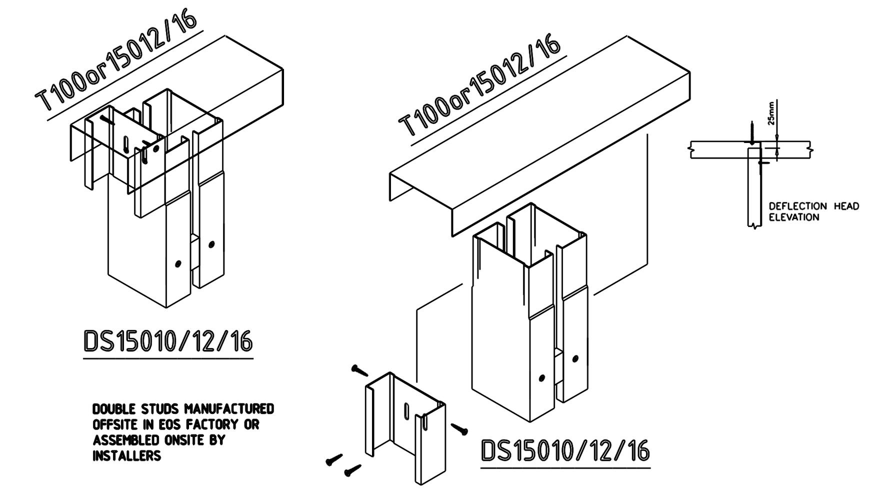
TYPICAL CONNECTION DETAILS



DOUBLE STUD (TYPICALLY WITH 50mm SWAGE TO BOTTOM OF STUDS) FIXED TO HORIZONTAL TRACK USING 25mm TEK SCREWS FIXING INTO BOTH FLANGES OF THE BASE TRACK ON THE CENTRE LINE OF BOTH THE TRACK AND THE STUD.

TYPICAL STUD TO TRACK FIXING DETAIL FOR DOUBLE STUDS

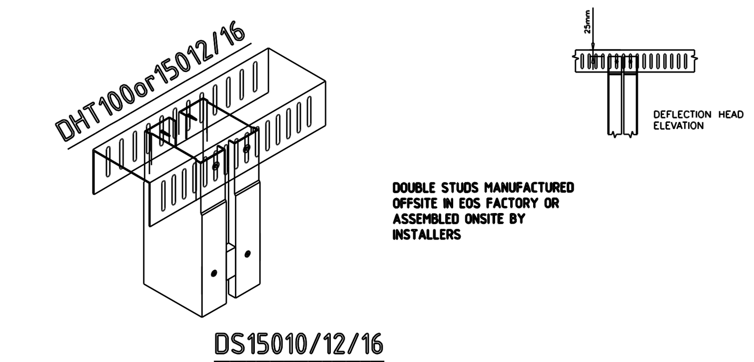
TYPICAL CONNECTION DETAILS



VERTICAL DOUBLE STUD FIXED TO EDB USING 2 No. 25mm TEK SCREWS. THE BRACKET IS THEN FIXED IN POSITION THROUGH THE TRACK USING 25mm TEK SCREWS FIXING INTO BOTH FLANGES OF THE TRACK.

TYPICAL DEFLECTION HEAD BRACKET DETAIL FOR DOUBLE STUDS

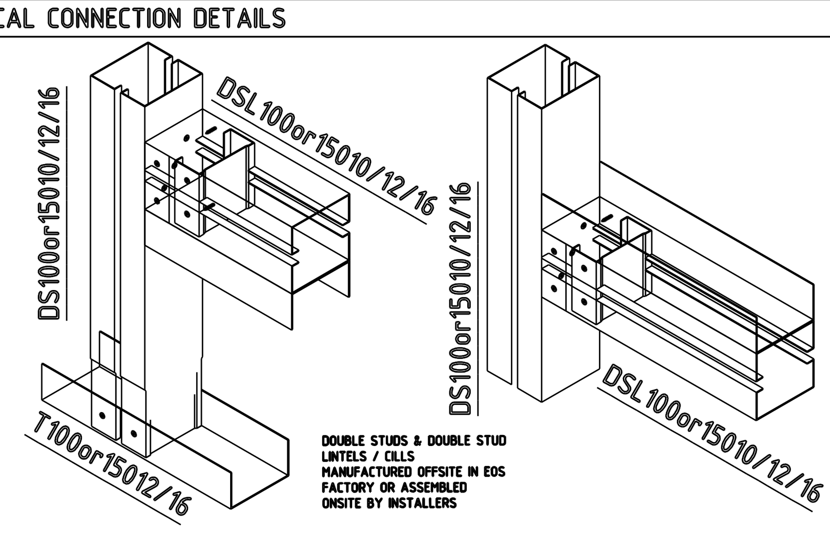
TYPICAL CONNECTION DETAILS



VERTICAL DOUBLE STUD FIXED TO DEFLECTION HEAD TRACK USING 2 No. 25mm TEK SCREWS (LARGE WASHER) (ONE EITHER SIDE). SCREWS TO BE FIXED CENTRAL IN SLOT TO ALLOW +/- 12.5mm MOVEMENT

TYPICAL DEFLECTION HEAD TRACK DETAIL FOR DOUBLE STUDS

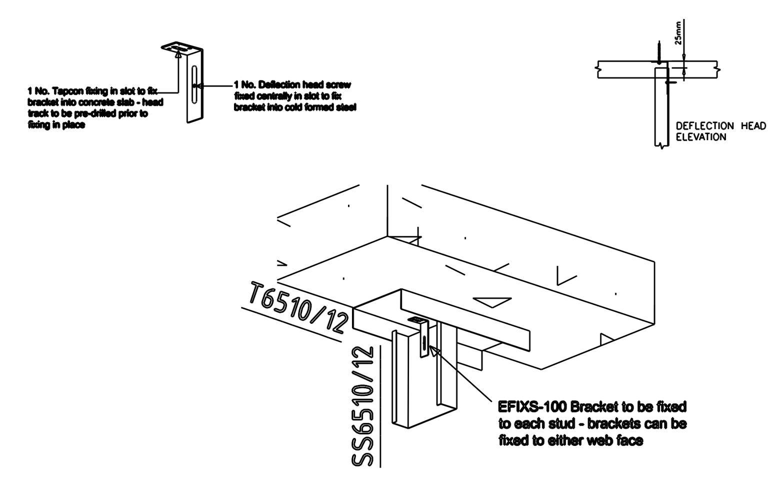
TYPICAL CONNECTION DETAILS



LINTELS FIXED TO JAMB STUD USING A MINIMUM 3 No. 25mm TEK SCREW FIXINGS. DOUBLE STUD LINTEL FORMED FROM 2 No. STUDS AND 1 No. TRACK FIXED USING 25mm TEK SCREW FIXINGS INTO BOTH FLANGES OF THE STUD. TRACK FIXED TYPICALLY AT 600mm STAGGERED CENTRES ALONG THE CENTRE LINE OF THE STUD FLANGE.

TYPICAL DOUBLE STUD LINTEL & DOUBLE STUD CILL DETAIL (DOUBLE JAMB)

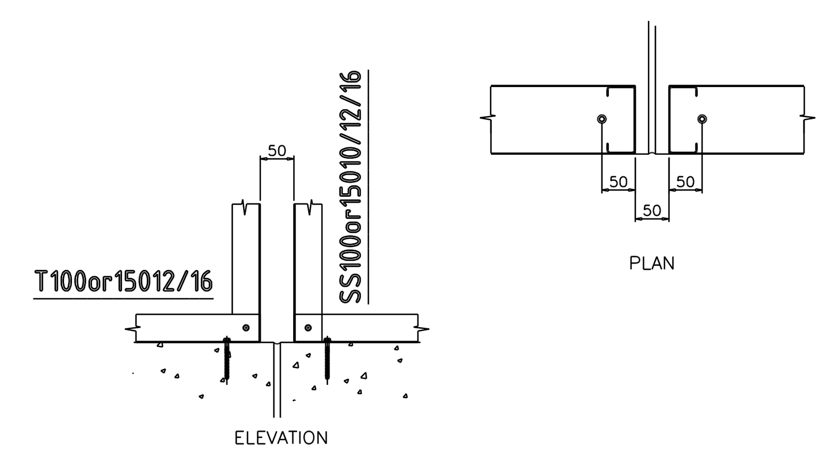
TYPICAL CONNECTION DETAILS



EFIXS100 BRACKET FIXES TO THE WEB OF THE VERTICAL STUD WITH 1 NO. 25mm TEK SCREW (LARGE WASHER). THE BRACKET IS THEN FIXED IN POSITION THROUGH THE TRACK USING 1 No. TAPCON FIXING. ENSURE THE CORRECT DEFLECTION IS ALLOWED FOR BETWEEN END OF STUD & UNDERSIDE OF TRACK.

TYPICAL DEFLECTION HEAD BRACKET DETAIL FOR SINGLE 65mm STUDS

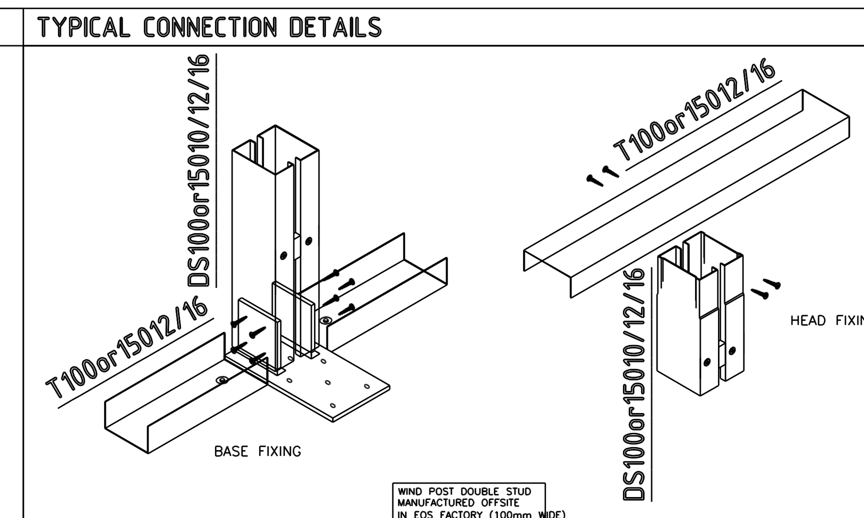
TYPICAL CONNECTION DETAILS



HEAD & BASE TRACKS ARE TO BE SPLIT EITHER SIDE OF THE MOVEMENT JOINT - EACH TRACK SECTION IS TO BE FIXED 50mm (MAX) FROM THE END OF THE TRACK.

TYPICAL MOVEMENT JOINT DETAIL

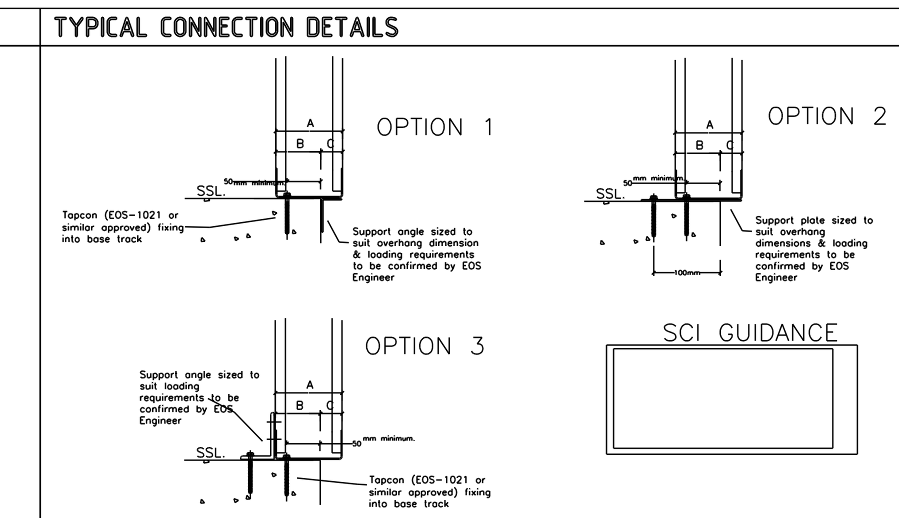
TYPICAL CONNECTION DETAILS



WINDPOST BASE PLATE FIXED TO STRUCTURE TO EOS ENGINEERS REQUIREMENTS. WINDPOST DOUBLE STUD FIXED TO WINDPOST BASE PLATE USING 4 No. 25mm TEK SCREWS & FIXED TO HEAD TRACK USING 25mm TEK SCREWS TO EACH SIDE.

TYPICAL WINDPOST DETAIL

TYPICAL CONNECTION DETAILS



SCI GUIDANCE STATES THAT THE SFS CAN ONLY OVERHANG BY THE AMOUNTS INDICATED IN THE TABLE ABOVE WITHOUT ADDITIONAL SUPPORT. 3 POSSIBLE OPTIONS ARE ABOVE & ARE TO BE SPECIFIED BY EOS ENGINEERS.

TYPICAL OVERHANG DETAIL

EOS Standard Details

NOTES

CONTRACTORS MUST CHECK ALL DIMENSIONS ON SITE
ONLY FIGURED DIMENSIONS TO BE WORKED FROM.
ALL ERRORS AND DISCREPANCIES MUST BE IMMEDIATLEY REPORTED TO THE DESIGN OFFICE OF ENGINEERED OFF-SITE SYSTEMS LIMITED.
DETAIL TO BE READ IN CONJUNCTION WITH ARCHITECTS & ENGINEERS DETAILS

General Notes

Every stud connecting to top track requires a deflection head bracket (UNO) refer to EOS Standard Details drawing F451 .G100 details 203, 204, 205 & 265

Please refer to following GA's
During installation of EOS system
F451.G100 - Standard Details
F451.G101 - Non Standard Details

'EOS Steel' height dimension inclusive of 25mm deflection

S/O = Structural Opening

Design Constraints:
Below information to be followed UNLESS NOTED OTHERWISE on specific GA's

Studs to be SS15016
Head & Base Track T15012 to be fixed @ 600c/c

Jambs:Single Stud SS15016
Lintels:Single Track T15012
Sills:Single Track 0

Indicates brick tie - Min 150mm, Max 225mm from inside of jamb stud

Glazing spanning slab to slab no load applied to EOS system

MJ Indicates movement joint see F451.G101 for detail

NT - Indicates hard fixed track detail at head Deflection to be allowed by others

KEY PLAN:

Notes + revisions:

C01	23/11/15	CONSTRUCTION ISSUE

Project Number: F451	
Project: Corium Test Rig	
Title: EOS Standard Details	
Drawing No. G [100]	Status: Construction
Revision: C01	Scale: 1:9.5 1:10
Drawn By: AM	Checked By: PP

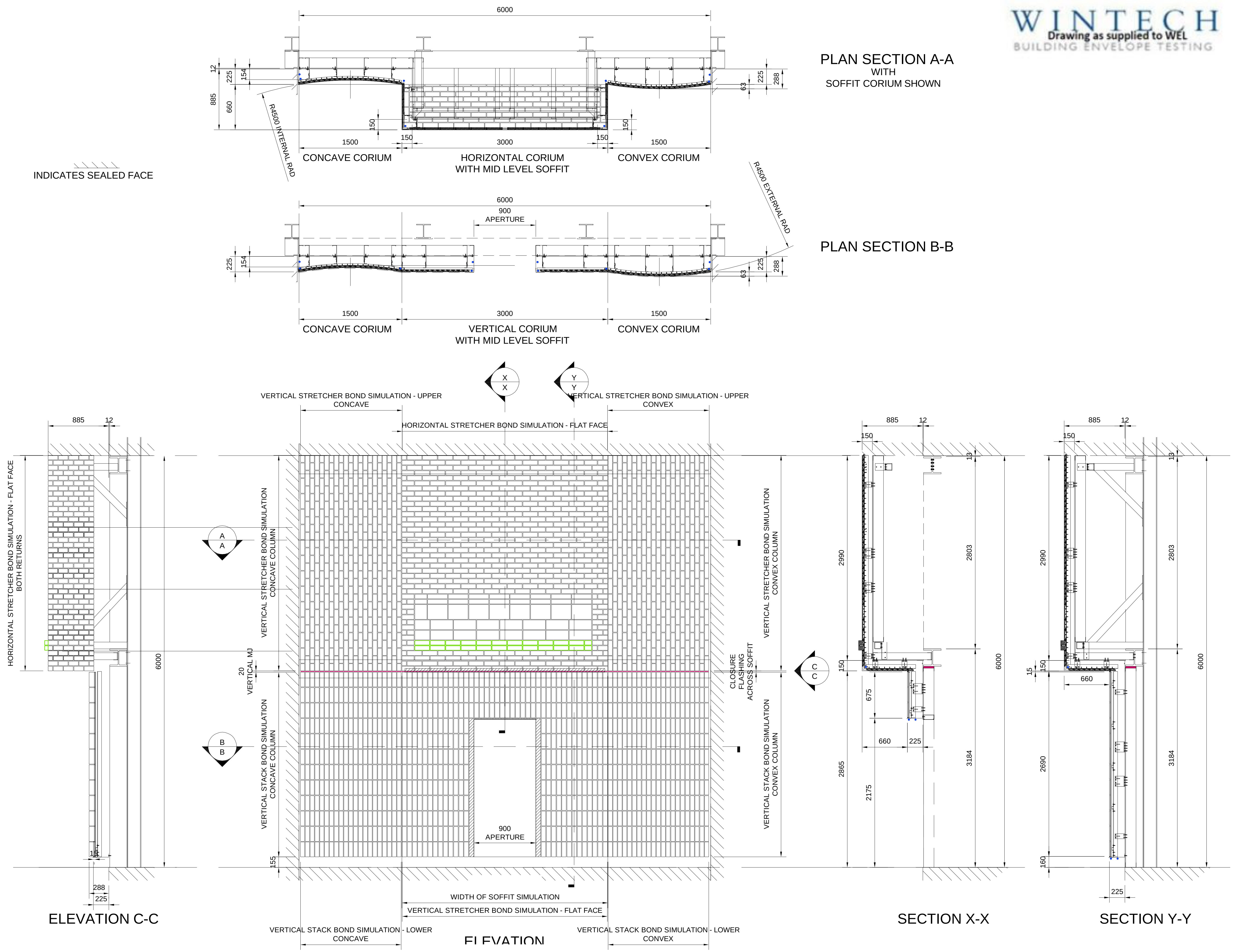
Preliminary: ☐ Approval: ☐ Construction: ☒

WINTECH Drawing as supplied to WEL BUILDING ENVELOPE TESTING

EOS

Heighington Lane | Aycliffe Industrial Park | Newton Aycliffe | Co. Durham | DL5 6QG
Tel: 01325 303030 | Fax: 01325 301724 | www.eosuk.org

WINTECH
Drawing as supplied to WEL
BUILDING ENVELOPE TESTING



ALL ELEVATIONS ARE VIEWED FROM OUTSIDE UNLESS OTHERWISE STATED

CONTRACT NUMBER : CT

Rev.	Date	By	Comments
C	12.2.16	PK	CORIUM PROFILES AS BUILT
B	6.11.15	PK	TRIMS ADDED
A	23.10.15	PK	CONSTRUCTION UPDATE

Drawing Status :

CONSTRUCTION

Contract :

TAYLOR MAXWELL

Telling Architectural

Telling Architectural Ltd
7 The Dell
Enterprise Drive
Four Ashes
Wolverhampton
WV10 7DF
Tel : 01902 797 700
Fax : 01902 797 720

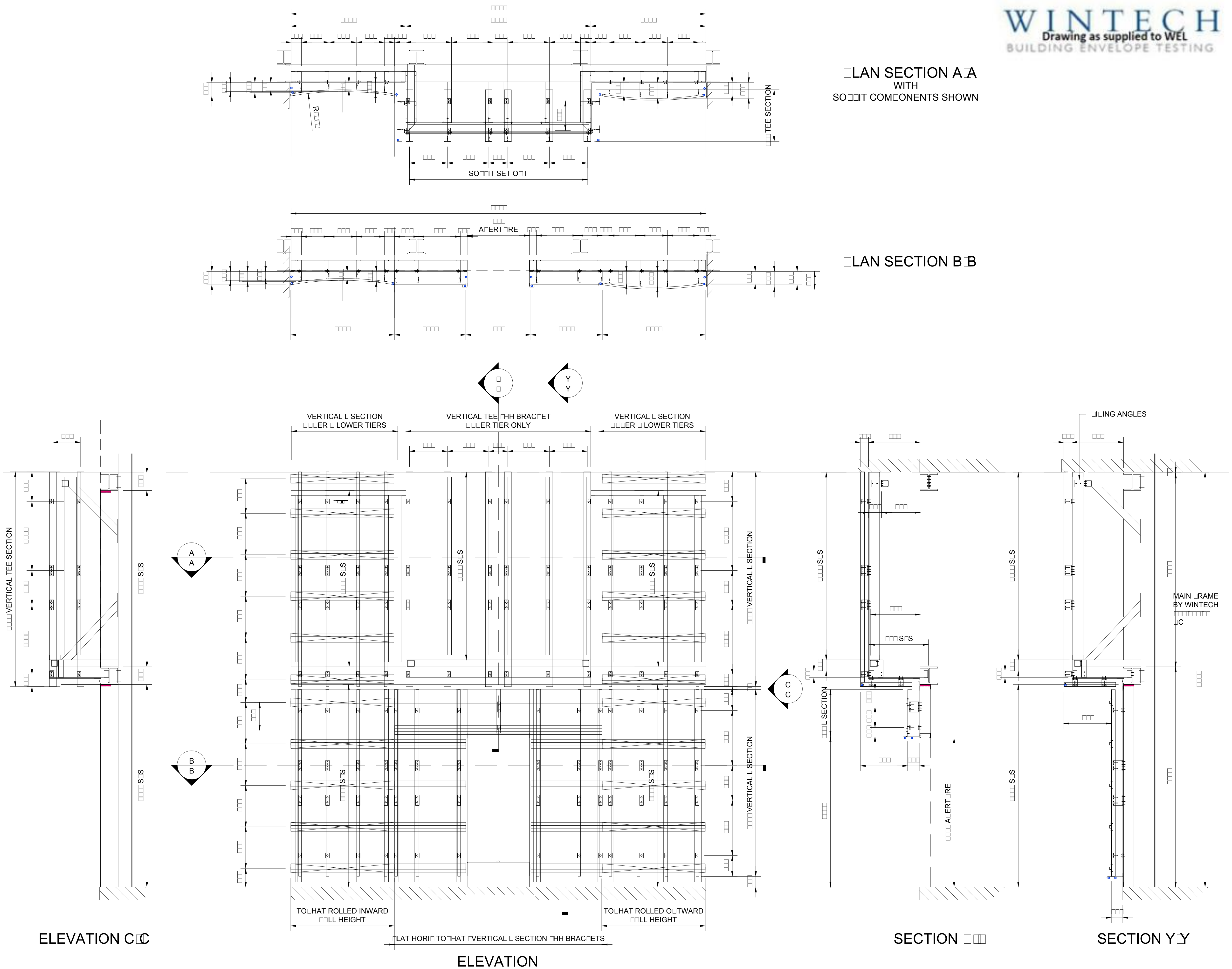
Drawing Title :

VERTICAL CORIUM
TEST WALL PROPOSALS
BRICK LAYOUT

Scale :	Checked : rc	Drawn : psk
1 : 50	Date : 22.10.15	Date : 22.05.14

Size	Drawing No.	Rev.
A3	CT-01	C

WINTECH
BUILDING ENVELOPE TESTING
Drawing as supplied to WEL



ALL ELEVATIONS ARE VIEWED □ROM O□TSIDE □NLESS OTHERWISE STATED

CONTRACT N□MBER □ CT

B			TRIMS ADDED
A			CONSTR□CTION □□DATE

CONSTRUCTION

TAYLOR MA□WELL

Telling Architectural

VERTICAL CORI□M
TEST WALL □RO□OSALS
S□BSTR□CT□RE LAYO□T

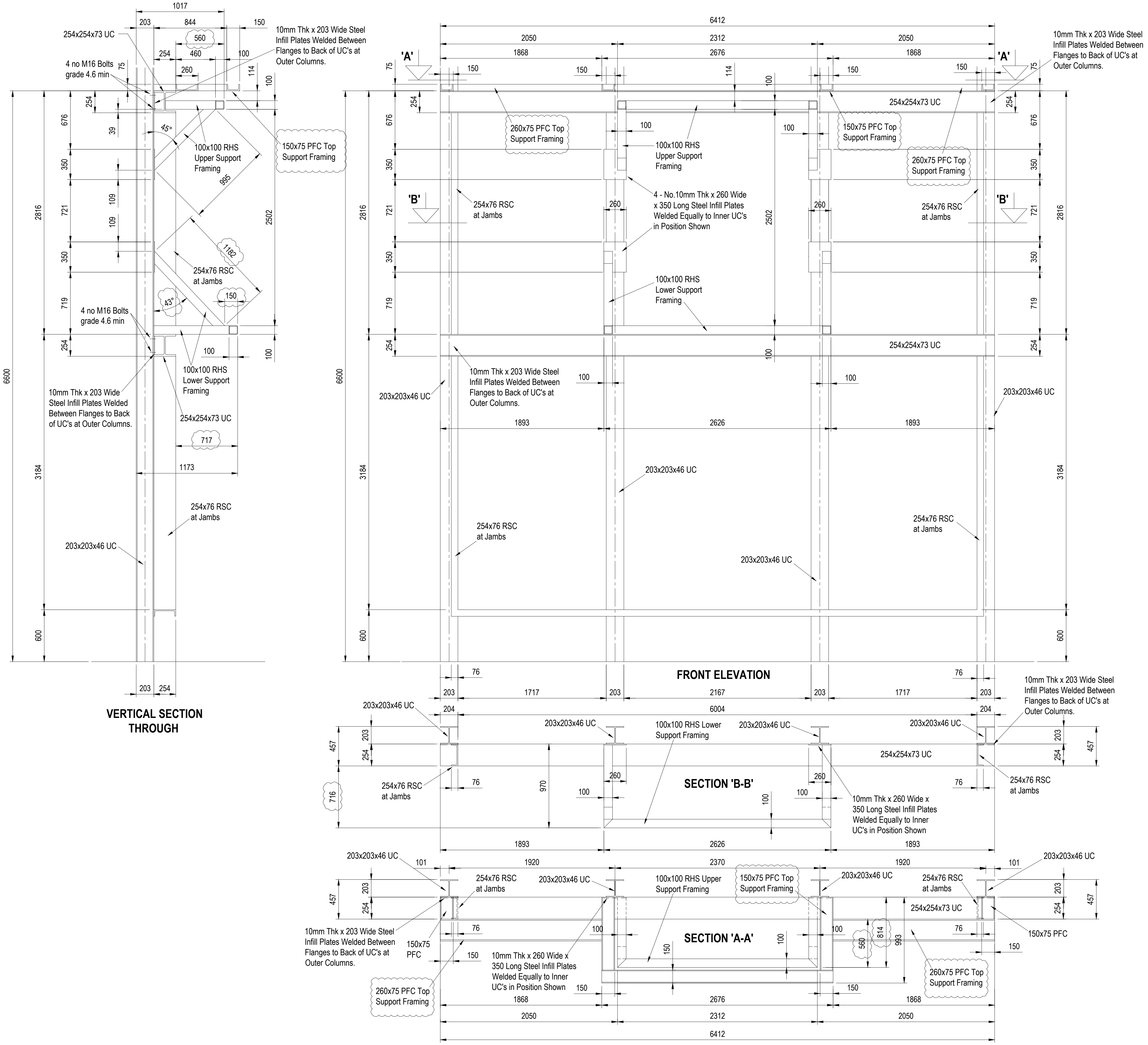
A□ CT□□□ B

APPENDIX B

Support Steelwork Drawing

(1 drawing on 1 un-numbered page)

WEL/15/267 Rev B



NOTES

1. NO DIMENSIONS ARE TO BE SCALED FROM THIS DRAWING – IF IN DOUBT ASK
2. THIS DRAWING MUST NOT BE ALTERED BY HAND
3. DISCREPANCIES IN SITE DIMENSIONS TO BE REPORTED TO WINTECH.
4. ALL DIMENSIONS IN MILLIMETRES
5. ALL LEVELS IN METRES

NOTE: STEELWORK FABRICATION & BOWING TOLERANCE = ± 10mm

Rev	Date	Description	By
B	22.10.15	OUTER CHANNELS ADDED AT TOP OF FRAME	HGD
A	21.10.15	TOP & BOTTOM CHANNELS ADDED TO FRAME	HGD

WINTECH
WINDOW AND CLADDING TESTING AND LABORATORY SERVICES
WINTECH ENGINEERING LTD, HALESFIELD 2, TELFORD, SHROPSHIRE, TF7 4QH.
TEL: 01952 586580 FAX: 01952 586585
E-MAIL ADDRESS: testing@wintech-group.co.uk

Project :	CORIUM TEST WALL - TELLING ARCHITECTURAL
Main Contractor :	N/A
Architect :	N/A
Drawing Title :	TEST RIG STEEL SUPPORT FRAME ASSEMBLY
Scale :	1:40
Contract No :	15527
Date :	15.10.15
Drawing No :	WEL/15/267
Drawn By :	HGD
Latest Revision No :	B
Checked By :	-

APPENDIX C

Dismantling

C1. DISMANTLING

The dismantling was conducted on 15th, 16th and 17th February 2016 by representatives of Taylor Maxwell Birmingham and was witnessed by representatives of Wintech Engineering Ltd.

There was no water evident in the system in parts designed not to be wetted, and it was found that the system fully complied with the system drawings in Appendix A provided by Taylor Maxwell Birmingham at the time of the dismantle.

~~~~~~~~~~~~~~~~~~~~ END OF REPORT ~~~~~~~~~~~~~~~~~~~~