



PROJECT - BOATMANS P2304

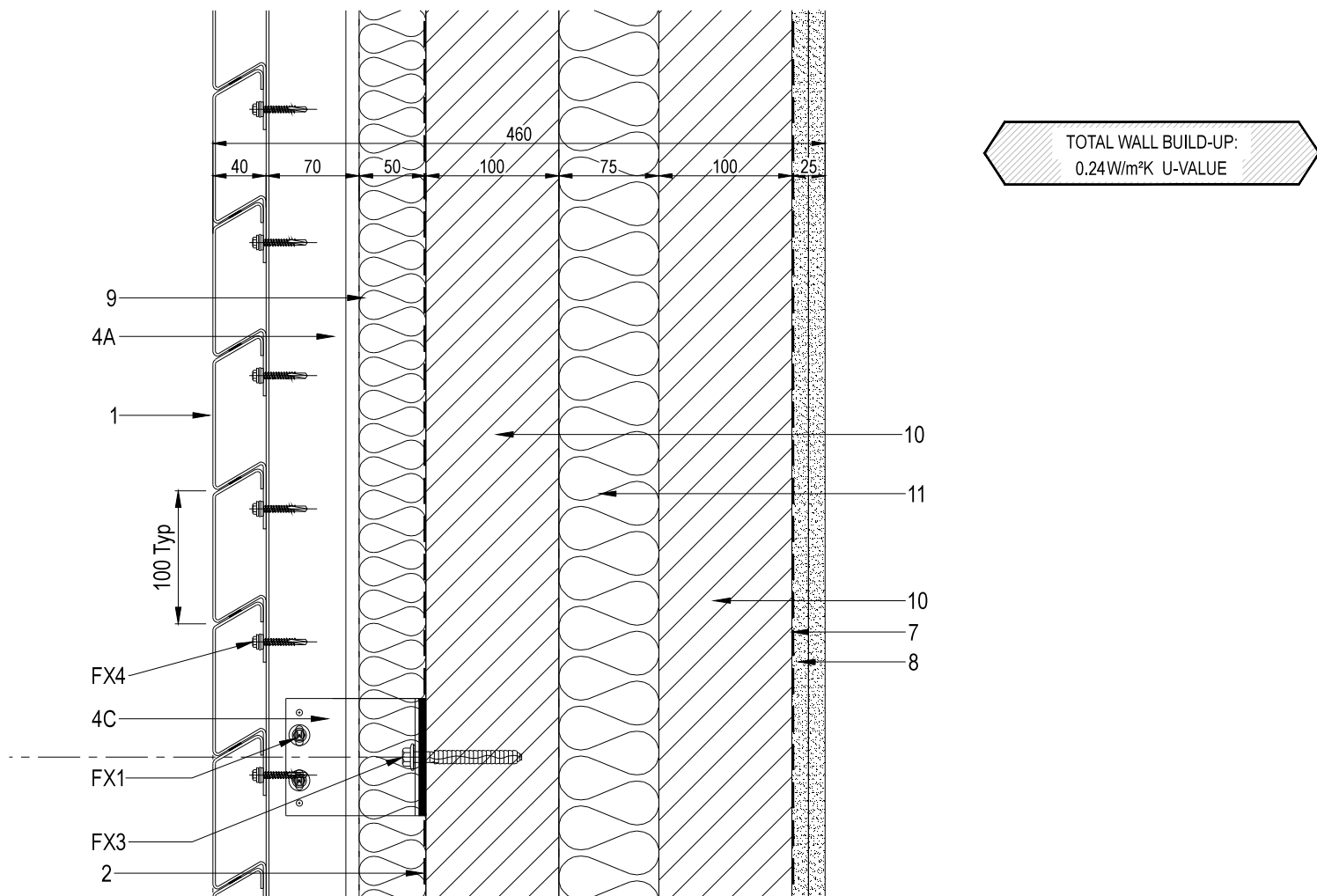
TECHNICAL SUBMISSION 001 Rev A



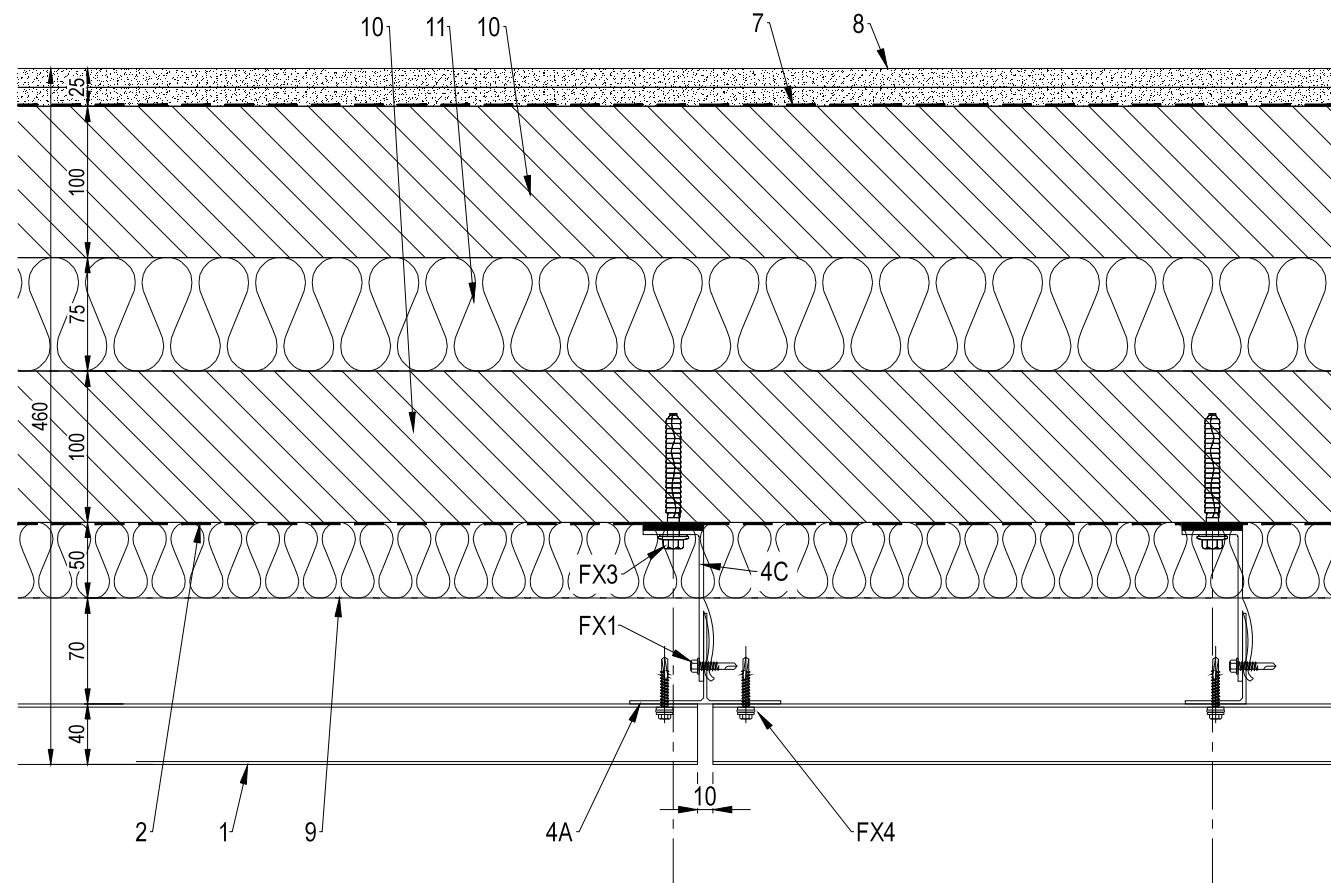
LINEAR CLADDING SYSTEM TECHNICAL SUBMISSION

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01 - BLOCKWORK VERTICAL SECTION
SCALE - 1:5



02 - BLOCKWORK PLAN VIEW
SCALE - 1:5

1. 2mm ALUMINIUM PANEL - GENIUS LINEAR SYSTEM.
COLOUR : ANODITE 545 BRONZE.
2. OBEX A1 BREATHER MEMBRANE
- 4A. 100X60 VERTICAL T RAIL OR 60x40 VERTICAL ALUMINIUM L RAIL.
60mm FACE FIXED TO HELPINGHAND BRACKET. RAILS NOT TO EXCEED 3120mm LONG
- 4C. 100mm DOWNER SINGLE HEIGHT HELPING HAND BRACKET USED AS RESTRAINT BRACKET. SINGLE BRACKETS AS DEAD LOAD BRACKETS.
7. VAPOUR CONTROL LAYER
8. 2x LAYERS 12.5mm PLASTERBOARD & SKIM
9. 50mm ROCKSILK RAINSCREEN SLAB INSULATION
10. 100mm MEDIUM DENSITY CONCRETE BLOCKWORK
11. 75mm MINERAL WOOL INSULATION

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS. ALL DIMENSIONS ARE IN MILLIMETRES
WINDOWS AND DOORS ARE TO BE READ IN CONJUNCTION WITH BS 4873:2009



GENERAL NOTES:

REVISIONS:

REV:	ISSUED FOR APPROVAL	DRN BY:	DATE:
P1	ISSUED FOR APPROVAL	DAL	14.04.23
P2	REVISED TO INTERNAL COMMENTS	DAL	02.06.23
P3	REVISED TO SHOW LINEAR CLADDING PANEL	DAL	24.07.23
P4	REVISED TO SHOW 100MM FACE LINEAR CLADDING PANEL AND COLOUR CONFIRMATION	DAL	14.08.23

CLIENT:

RIDGE AND PARTNERS LLP

PROJECT:

BOATMANS
MANCHESTER

TITLE:

CLADDING SPECIFICATION
SHEET, BLOCK SUBSTRATE
BIRD BEAKED JOINTS

SCALE @A3:
1.5

DATE:
Apr23

DRN BY:
DAL

PROJECT NO:

DRAWING NO:

REV NO:

P2304 SP02A

P4

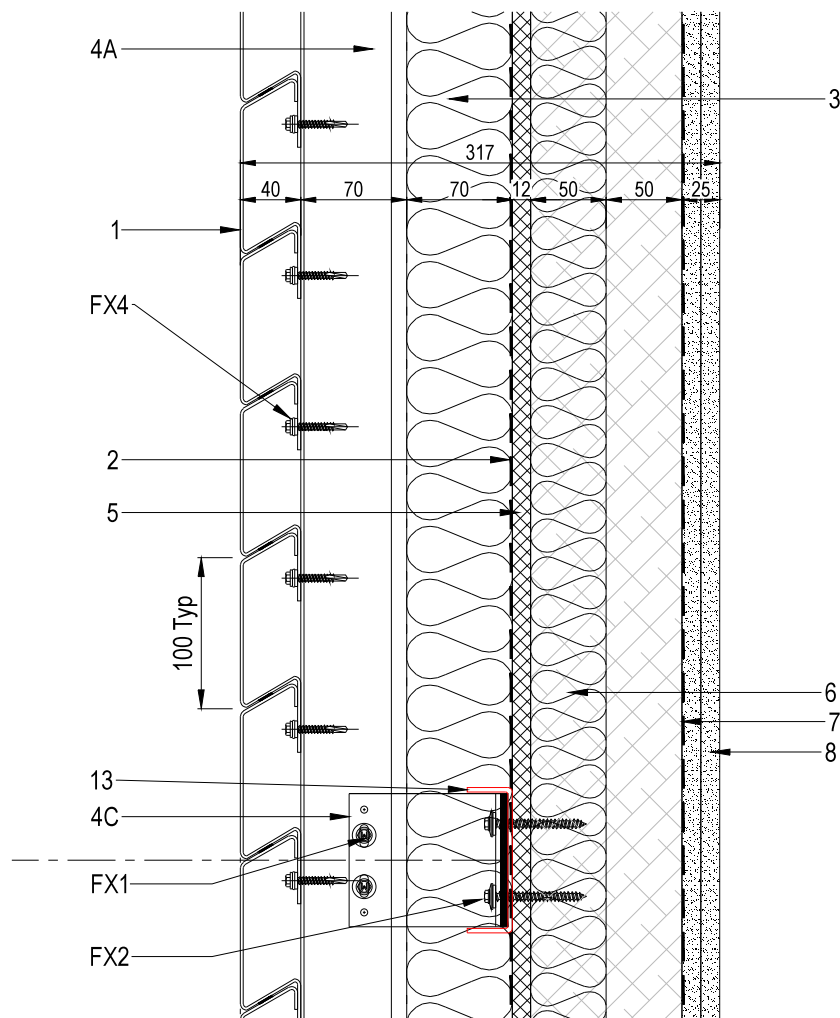
FOR APPROVAL

Quality Fast Facades
Camden House,
Camden Close,
Ainsworth,
Bolton, BL2 5RH

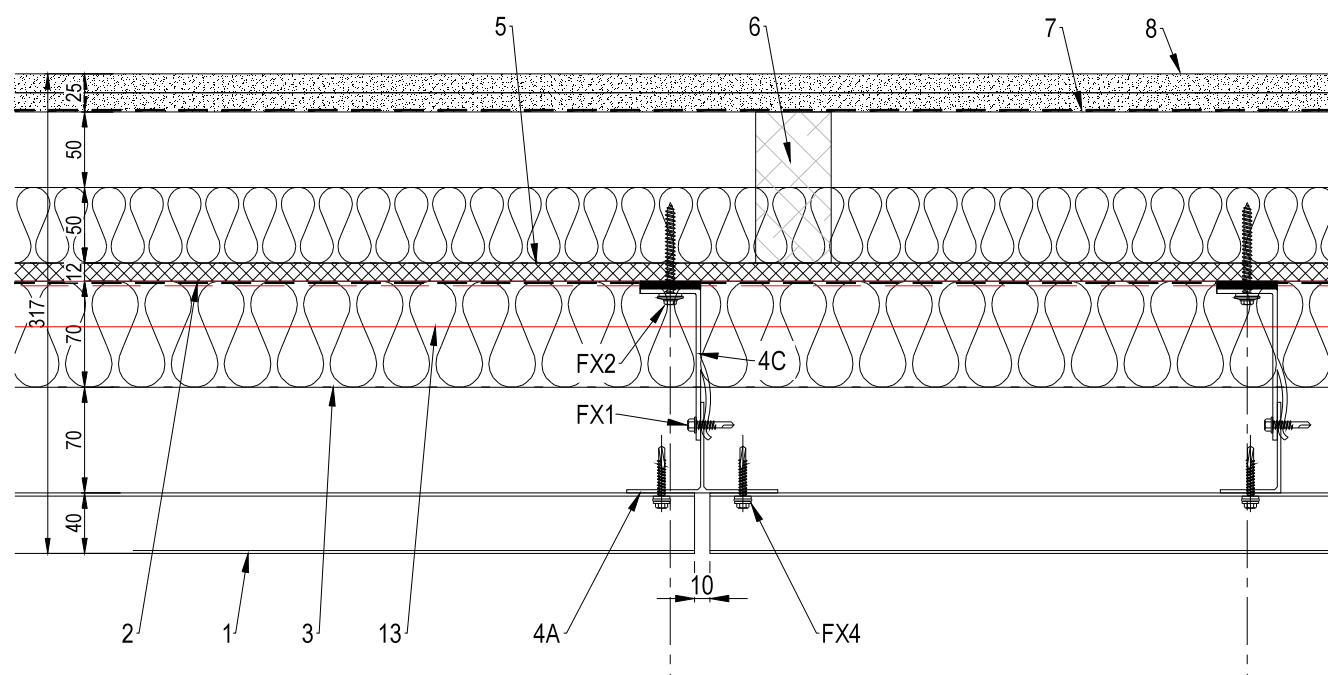
Tel: 0161 797 7662
www.qffacades.co.uk



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01 - TIMBER VERTICAL SECTION
SCALE - 1:5



02 - TIMBER PLAN VIEW
SCALE - 1:5

1. 2mm ALUMINIUM PANEL - GENIUS LINEAR SYSTEM. COLOUR : ANODITE 545 BRONZE.
2. OBEX A1 BREATHER MEMBRANE
3. 70mm ROCKSILK RAINSCREEN SLAB INSULATION
- 4A. 100X60 VERTICAL T RAIL OR 60x40 VERTICAL ALUMINIUM L RAIL. 60mm FACE FIXED TO HELPINGHAND BRACKET. RAILS NOT TO EXCEED 3120mm LONG
- 4C. 100mm DOWNER SINGLE HEIGHT HELPING HAND BRACKET USED AS RESTRAINT BRACKET. SINGLE BRACKETS AS DEAD LOAD BRACKETS.
5. STS 12mm A1 SHEATHING BOARD
6. 100x50 SOFTWOOD TIMBER STUDS, PARTIALLY FILLED WITH 50mm MINERAL WOOL INSULATION
7. VAPOUR CONTROL LAYER
8. 2x LAYERS 12.5mm PLASTERBOARD & SKIM
13. 3X30X106X30MM ALUMINIUM HORIZONTAL C CHANNEL TO BRIDGE STUDS WHERE NECESSARY. GRADE: 5080

- FX1. JT4 4 4.8x19
2 PER SINGLE SLIDING HELPING HAND BRACKET.
2 PER SINGLE DEAD LOAD HELPING HAND BRACKET.
- FX2. TAPFIX 6.3x50
2 PER SINGLE BRACKET
- FX4. JT3 3 5.5x35 S16

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P4	REVISED TO SHOW 100MM FACE LINEAR CLADDING PANEL AND COLOUR CONFIRMATION	DAL	14.08.23

CLIENT:

RIDGE AND PARTNERS LLP

PROJECT:

BOATMANS MANCHESTER

TITLE:

CLADDING SPECIFICATION SHEET, TIMBER SUBSTRATE BIRD BEAKED JOINTS

SCALE @A3:

1.5

DATE:

Apr23

DRN BY:

DAL

PROJECT NO:

P2304 SP02B

DRAWING NO:

REV NO:

P4

FOR APPROVAL

Quality Fast Facades
Camden House,
Camden Close,
Ainsworth,
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www.qffacades.co.uk



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H92 RAINSCREEN CLADDING

To be read with Preliminaries/General conditions.
(Help to complete individual sections is given in Guidance Notes to H92)

TYPE(S) OF RAINSCREEN CLADDING

Genius Facades Limited Cladding System comprising 2mm thick Aluminium Linear interlocking plank system carried by the adjustable aluminium support structure. The system is fixed to an inner leaf structural wall and other components such as insulant, membranes, breakers, etc are incorporated. The system is drained and back-ventilated.

Complete rainscreen wall design to take licence of all structural, thermal, acoustic, and air-tightness requirements to ensure compliance with current Building Regulations.

Approved, trained, and certified design/installation contractors to install the system and components.

System selected to have formal test certification from a UK accredited testing facility which complies with testing requirements laid out in the CWCT publication, "Testing for Ventilated Rainscreen Facades".

120 RAINSCREEN CLADDING

- Drawing reference(s): P2304 SP01A P3
- Primary support structure: Refer to drawing P2304 SP01A P3
- Rainscreen cladding system: Genius Facades Limited Linear cladding system
Manufacturer and reference: Genius Facades Limited, Lambert Works,
Colliery Road, Wolverhampton WV1 2RD
Telephone: 01922 716 245
E-mail: enquiries@geniusfacades.com
Type: Drained and back-ventilated
- Rainscreen panel: 2mm aluminium panels to meet performance criteria for deflection under wind load as clause 350.
Material: 2mm Aluminium 1050A
Thickness: 2mm
Colour & Finish: Anodite 545 Bronze
Joint type: As CWCT TESTING. No sealants or mastics to be used.
Joint width: Interlocking joint with 3M 1mm tape
- Air gap: 70mm and 50mm
- Support system: Adjustable support system comprising extruded vertical support rails with adjustable wall attachment brackets to zone range 20mm
Material: Extruded aluminium to BS1474 in 6063/T6 grade alloy.
Fasteners: Panels fixed with low profile 5.5 Tek Screws (Stainless Steel)
Number and location of fasteners: As detailed within the CWCT test and approved by the project engineer
- Backing wall: As clause 130
- Breather membrane: As section 785
- Thermal insulation: As clause 775.
- Accessories:
- Other requirements:

130 Internal wall: By others

130A

- Drawing references:
- Manufacturer:
- Material:
- Finish/colour:
- Fixing:
- Other requirements:

GENERAL REQUIREMENTS/PREPARATORY WORK

210 DESIGN

- Complete the detailed design of the rainscreen cladding and associated features shown on the preliminary design drawings to meet the requirements of this specification
- Co-ordinate detailed design with that for all related works.

215 DESIGN PROPOSALS: The preliminary design drawings indicate design intent but do not preclude submission with tender of reasonable alternative proposals for consideration.

220 SPECIFICATION:

- Comply with the latest edition of the Centre for Window and Cladding Technology (CWCT) 'Standard for walls with ventilated rainscreen' and 'Standard for testing of ventilated rainscreen' unless specified otherwise in this section.
- Keep a copy of the CWCT 'Standard for walls with ventilated rainscreen' and 'Standard for testing of ventilated rainscreens' together with other CWCT publications invoked by these documents, at the design office, workshop and on site, readily accessible for reference at all times during the course of the works.

225 INFORMATION TO BE PROVIDED WITH TENDER: N/A

230 INFORMATION TO BE PROVIDED AFTER ACCEPTANCE OF TENDER: N/A

235 INFORMATION TO BE PROVIDED BEFORE COMMENCEMENT OF RAINSCREEN CLADDING WORK: Submit to the CA before testing or fabrication the following rainscreen cladding particulars:

- Detailed drawings to fully describe fabrication and installation.
- Detailed calculations to prove compliance with all design/performance requirements.
- Project specific fabrication, handling and installation method statements.
- Certification for all incorporated components manufactured by others confirming their suitability for all locations in the rainscreen cladding.
- Recommendations for spare parts for future repairs or replacements.
- Recommendations for safe dismantling and recycling or disposal of all products.

- 240 PRODUCT SAMPLES: Before commencing detailed design provide the CA with identified samples of: 300mm long x 3 No samples for approval

Obtain approval of appearance before proceeding.

- 250 SAMPLES OF FIXINGS: At an agreed stage during detailed design work provide the CA with identified samples of each type of fixing, together with manufacturers' recommended torque figures

- 260 FABRICATION SAMPLES: At an agreed stage during detailed design work provide the CA with samples of:

Obtain approval of appearance before proceeding

- 270 MOCK-UP: N/A

DESIGN/PERFORMANCE REQUIREMENTS

- 310 GENERALLY:

- Comply with CWCT as 'Standard for walls with ventilated rainscreen', Section 2 - performance criteria unless specified or agreed otherwise.
- Project performance requirements specified in this sub-section are to be read in conjunction with CWCT performance criteria.

- 330 INTEGRITY OF VENTILATED RAINSCREEN CLAD WALLS: Determine size(s) and thickness of panels, the size(s), number and spacing of fixings, configuration and location of secondary support systems and incorporation of other accessories and fittings to ensure the cladding system, primary support structure and other elements forming the rainscreen wall will resist all factored dead, imposed and design live loads, and accommodate all deflections and movements without damage.

- Calculate wind loads on rainscreen walls appropriate to location, exposure, height, building shape, and size in accordance with BS 6399-2 standard method, taking full account of existing and known future adjacent structures.

Basic wind speed (V_b): _____ m/s.

Altitude factor (S_a): _____

Direction factor (S_d): _____

Seasonal factor (S_s): 1.

Probability factor (S_p): 1.

Terrain and building factor (S_b): _____

External and internal size effect factors (C_a): 1.

External pressure coefficients (C_{pe}): As determined from BS 6399-2, clauses 2.4 and 2.5.

Internal pressure coefficients (C_{pi}): As determined from BS 6399-2, clause 2.6.

Dominant opening: _____

- Impact load(s) in accordance with BS 8200:

Location and category _____

- Temporary imposed loads: _____

Raised by others with figures being utilised.

- 350 DEFLECTION UNDER WIND LOAD: At positive and negative applications of the design wind pressure the maximum normal deflection for the listed components must not exceed:
- Individual rainscreen panels – $L/90$ of the span measured between the points of attachment of the panel this being defined as the perimeter folded edges of the panel. The panel face (or pan) can deflect to a calculated safe dimension based upon the mechanical properties of the material.
- Framing members – $L/200$ of the span of the member measured between points of attachment to the building, or 20mm, whichever is the lesser.

- [illegible]

For viewing distances refer to <https://nhbc-standards.co.uk/9-finishes/9-1-a-consistent-approach-to-finishes/9-1-2-external-walls/>

- 380 GENERAL MOVEMENT: The rainscreen cladding must accommodate anticipated
building movements as follows: Zero movement as this is an existing building.
- 390 AIR PERMEABILITY GENERALLY: The average air leakage rate through the listed
wall(s) at a differential pressure of 50 pascals must not exceed the typical
10m³/hr/m²

430 THERMAL PROPERTIES:

- Method for calculating the thermal transmittance (U-value) of the rainscreen wall:
- Average U-value of rainscreen wall: 0.30 W/m²K.

440 CONDENSATION: The psychrometric conditions under which condensation must not form within or on the interior surface of the rainscreen wall or any surface of the wall that is on the warm side of any insulation are:

- Outdoor notional psychrometric conditions as BS 6229, table 6:

	Winter	Summer
Temperature	-5°C	18°C
Relative humidity	90%	65%
Vapour pressure	0.361 kPa	1.341 kPa
Duration	60 days	60 days

450 VAPOUR CONTROL LAYER: Determine the interstitial condensation risk of the rainscreen wall using the method described in BS 5250 appendix D. If necessary, provide a suitable vapour control layer to ensure that damage and nuisance from interstitial condensation does not occur.

460 SOUND TRANSMITTANCE BETWEEN INTERIOR AND EXTERIOR OF RAINSCREEN CLAD WALL: Minimum sound reduction indices (R) to BS EN ISO 140-3:

One third octave band centre frequency (Hz)	R(dB)
<u> </u>	<u> </u>

465 SOUND TRANSMITTANCE BETWEEN ADJOINING FLOORS ABUTTING RAINSCREEN CLAD WALL: Minimum sound reduction indices (R) to BS EN ISO 140-3:

One third octave band centre frequency (Hz)	R(dB)
<u> </u>	<u> </u>

470 SOUND TRANSMITTANCE BETWEEN ADJOINING ROOMS ABUTTING RAINSCREEN CLAD WALL: Minimum sound reduction indices (R) to BS EN ISO 140-3:

One third octave band centre frequency (Hz)	R(dB)
<u> </u>	<u> </u>

480 FIRE RESISTANCE OF BACKING WALL: To BS 476- 21

485 INTERNAL SURFACE SPREAD OF FLAME OF BACKING WALL: To BS 476-7

490 CAVITY FIRE BARRIERS: To BS 476-20 and must resist the passage of flame and smoke for not less than Confirmed by the Lead Designer

TESTING

The Centre for Window and Cladding Technology have developed “The Standard for Testing of Ventilated Rainscreen” and “Test Methods for Ventilated Rainscreen” Genius Facades Limited have commissioned and passed the following tests which are required by these standards for rainscreen systems –

- Weather-tightness and water penetration as test regime no 6 (barrier wall air permeability assumed as 5m³/hour/m²).
- Wind loading – Serviceability – as test regime no 8 (load applied 1.75kN/m²)
- Wind loading – Safety – as test regime no 9 (load applied as serviceability test x 1.5 for safety factor)
- Wind resistance – Cyclic loading as test regime defined in “Standard for Walls with Ventilated Rainscreen” section 2.8.2 and BRE digest 346 part 7 (load applied as wind loading, serviceability test level)

Other tests which may be required are -

595 AIR PERMEABILITY TESTS – N/A

620 WINDLOADING TEST – N/A

661 IMPACT TEST:

- To CWCT ‘Standard for testing of ventilated rainscreen’, clause 3.12.1 and BS 8200.

PRODUCTS

710 ALUMINIUM ALLOY FRAMING SECTIONS:

- To BS 1474, alloy 6063 and suitable for the specified finish.
- Structural members to comply with BS 8118.

712 ALUMINIUM ALLOY SHEET: To BS EN 485, BS EN 515 and BS EN 573 in an alloy, temper and thickness suitable for the application and specified finish.

~~715 MILD STEEL FRAMING SECTIONS/ REINFORCEMENT: To the relevant parts of BS 7668, BS EN 10029, BS EN 10113, BS EN 10137, BS EN 10155 and BS EN 10210, in a thickness suitable for the application, and for galvanizing or other protective coating.~~

~~717 MILD STEEL SHEET: To the relevant parts of BS 1449-1, BS EN 10048, BS EN 10051, BS EN 10111, BS EN 10131, BS EN 10139, BS EN 10140, BS EN 10149, BS EN 10209, and BS EN 10268 in a grade and thickness suitable for the application, and suitable for galvanizing or other protective coating.~~

~~720 STAINLESS STEEL SHEET: To the relevant parts of BS EN 10029, BS EN 10048, BS EN 10051, BS EN 10095, BS EN 10258, BS EN 10259 and BS EN 10088-2, austenitic, grade 1.4301 (304) generally, grade 1.4401 (316) when used externally or in severely corrosive environments, and in a thickness suitable for the application.~~

730 MECHANICAL FIXINGS:

- Stainless steel to BS EN ISO 3506 grade A2 generally, grade A4 when used in severely corrosive environments, or
- Mild steel to BS 4190 and suitable for galvanizing or other protective coating, or
- Aluminium complying with BS 1474 and BS EN 755.

732 ADHESIVES must not be degradable by moisture or water vapour.

735 FIXINGS AND FASTENERS must be:

- Of dimensions not less than recommended by their manufacturers.
- Capable of adequate three-dimensional adjustment to accommodate primary support structure and rainscreen cladding fabrication/installation tolerances.

776 THERMAL INSULATION:

- Material: Mineral Wool
Manufacturer and reference: Knauf Rocksil
Thickness: 50 & 70mm
Keep dry during installation.
- Installation method: Manual Handling

785 BREATHER MEMBRANE:

- Material: Obex Fire Rated Membrane
- Lay membrane over insulation as work proceeds ensuring continuity.
- Overlap joints not less than 150mm and seal with tape recommended by the membrane manufacturer, to prevent water reaching the insulation.
- Fully seal at penetrations using taping methods recommended by the membrane manufacturer.
- Before covering check for tears and punctures. Carefully repair using a patch of breather membrane with 150mm laps sealed with tape.
- Ensure that bottom edges overlap flashings, sills, etc. to allow free drainage to the exterior.

FINISHES

810 PROTECTIVE COATING OF MILD STEEL FRAMING

SECTIONS/REINFORCEMENT: All surfaces must be:

- Hot dip galvanized to BS EN ISO 1461, or
- Treated with an appropriate equivalent coating to BS 5493, BS EN ISO 12944 and BS EN ISO 14713.

820 PROTECTIVE COATING OF MILD STEEL MECHANICAL FIXINGS: All surfaces must be:

- Hot dip galvanized to BS EN ISO 1461, or
- Sherardized to BS 4921, class 1 coating thickness and passivated, or

FABRICATION AND INSTALLATION**910 GENERALLY:**

- Fabricate and install rainscreen cladding in accordance with this specification and the final detailed drawings.
- Fabricators and installers must employ competent rainscreen cladding operatives. Records of their experience are to be provided to the CA on request.
- Select and align all products to ensure uniformity of appearance.
- Joints must only occur at positions indicated on final detailed drawings.
- Isolate dissimilar metals to prevent electrolytic corrosion.
- Machine cut and drill all products in the workshop wherever possible.
- Mark or tag all products to facilitate identification during assembly, handling, storage and installation. Do not mark surfaces visible in the complete installation.
- Ensure that fabricated panels are stored prior to installation in a dry, ventilated area. Manufacturer's packaging must ensure that panels are separated from one another and in a moisture-free environment

912 METALWORK: As section Z11, unless specified otherwise in this section.

922 FIXINGS/ADHESIVES APPLICATION: As section Z20, unless specified otherwise in this section.

925 SEALANT APPLICATION: As section Z22, unless specified otherwise in this section.

930 ASSEMBLY:

- Carry out as much assembly as possible in the workshop.
- Joints, other than movement joints and designed open joints, must be rigidly secured, reinforced where necessary and fixed with hairline abutments.
- Take precautions to prevent displacement of components in assembled units. Obtain approval for any reassembly on site.

935 INSPECTION:

- All fabrications and assembled units must be carefully inspected for match with approved samples and for compliance with this specification and the final detailed drawings before dispatch to site.
- Give adequate notice of inspection arrangements to enable the CA and/or other affected parties to be present.

940 PROTECTION:

- All fabrications and assembled units must be protected against damage, corrosion and disfigurement during handling, installation and subsequent site operations.
- Protective coverings must be applied before dispatch to site and must not be detrimental to rainscreen cladding products, finishes or installation procedures.
- The patina on the panels is easily damaged by compression or scraping and care must be taken to avoid this damage

945 HANDLING AND STORAGE:

- Do not deliver to site any rainscreen cladding products and units which cannot be installed immediately or unloaded into a suitably well protected storage area.
- Store products and units on level bearers clear of the ground and separate with resilient spacers.
- Any protective should be removed from panels immediately after installation.

950 SUITABILITY OF STRUCTURE:

- Not less than 8 weeks before commencement of rainscreen cladding installation carry out a geometric survey of the supporting structure, checking line, level and fixing points. Report immediately to the CA if structure will not allow the required accuracy or security of erection.
- Coordinate geometric survey for rainscreen cladding with any other survey(s) for adjacent cladding.
- Set out erection datum points, lines and levels for a complete elevation at a time unless otherwise agreed with the CA.

960 PRELIMINARY RAINSCREEN CLADDING INSTALLATION: Complete a preliminary area of rainscreen cladding as set out below for inspection and approval of appearance by the CA.

970 RAINSCREEN CLADDING INSTALLATION:

- Set out straight, parallel and truly aligned.
- Tighten all mechanical fixings to manufacturer's recommended torque figures. Do not overtighten fixings intended to permit differential movement.
- Remove protective coverings only where necessary to facilitate installation and from surfaces which will be inaccessible on completion.

~~975 IN SITU WELDING is not permitted.~~

977 IN SITU WELDING is permitted, subject to completion of a 'hot work permit' form and compliance with its requirements.

980 INTERFACES: Ensure that flashings, closers, etc. (specified in another section) are located correctly and neatly overlap the rainscreen cladding to form a weather-tight junction.

985 DAMAGE:

- Do not repair rainscreen cladding without approval. Such approval will not be given where products and units are badly damaged or where the proposed repair will impair performance or appearance.
- Repairs may require additional site testing at the discretion of the CA.
- Schedule repairs or record on drawings for inclusion in the maintenance manual.

995 MAINTENANCE: Prepare a maintenance manual in accordance with CWCT 'Guide to good practice for facades', Section 10. Unless otherwise instructed or agreed the manual must be completed and handed over to the CA at practical completion.

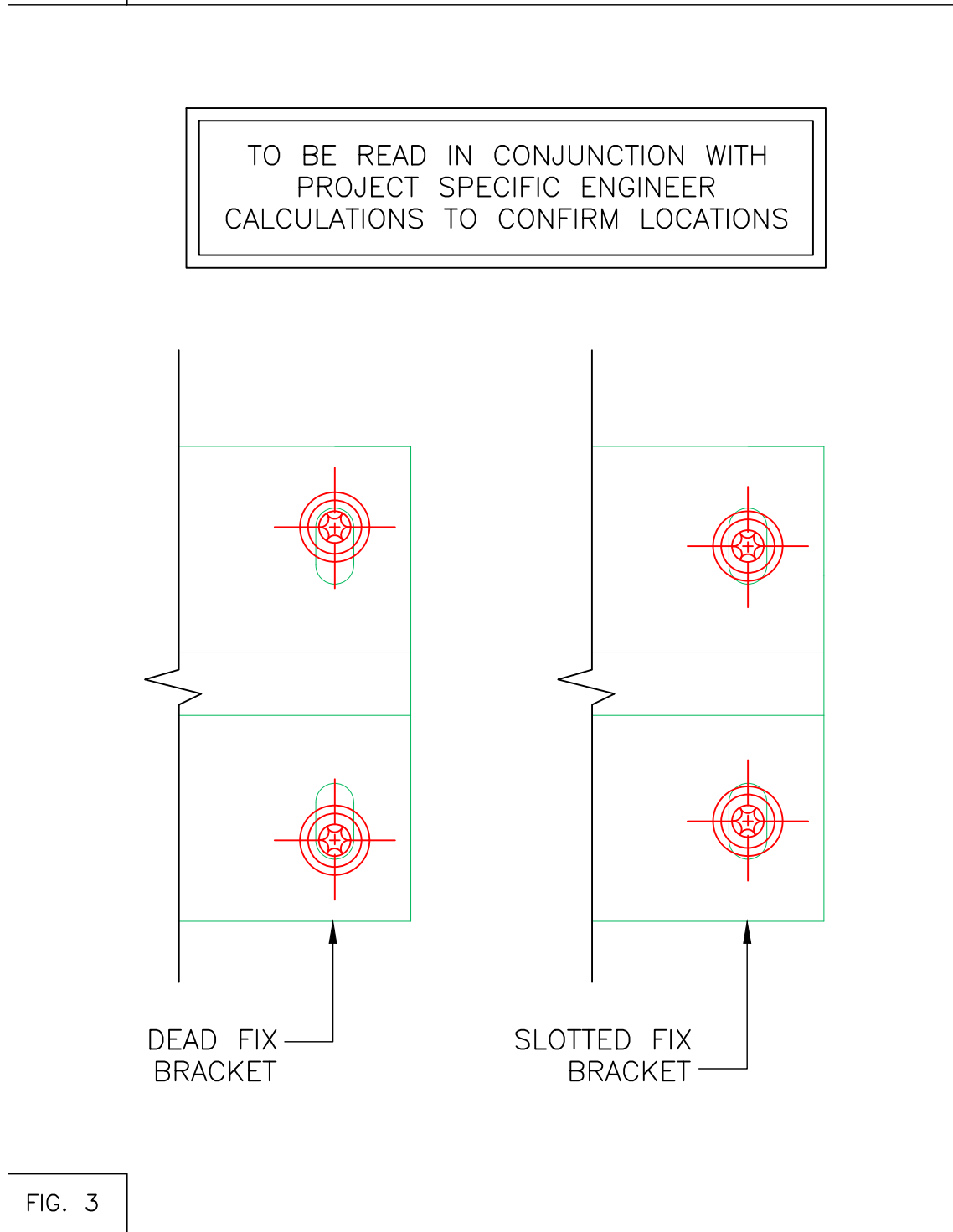
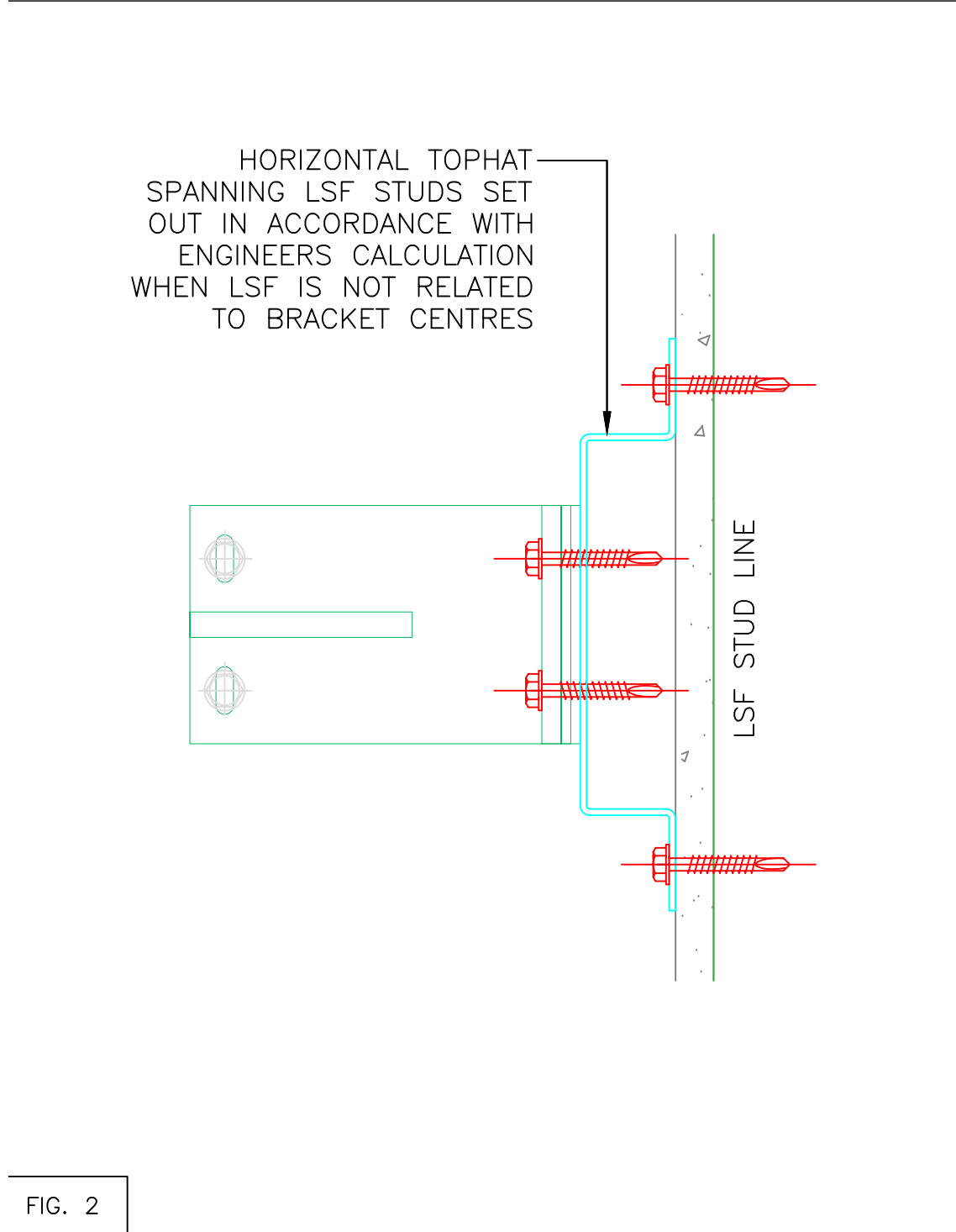
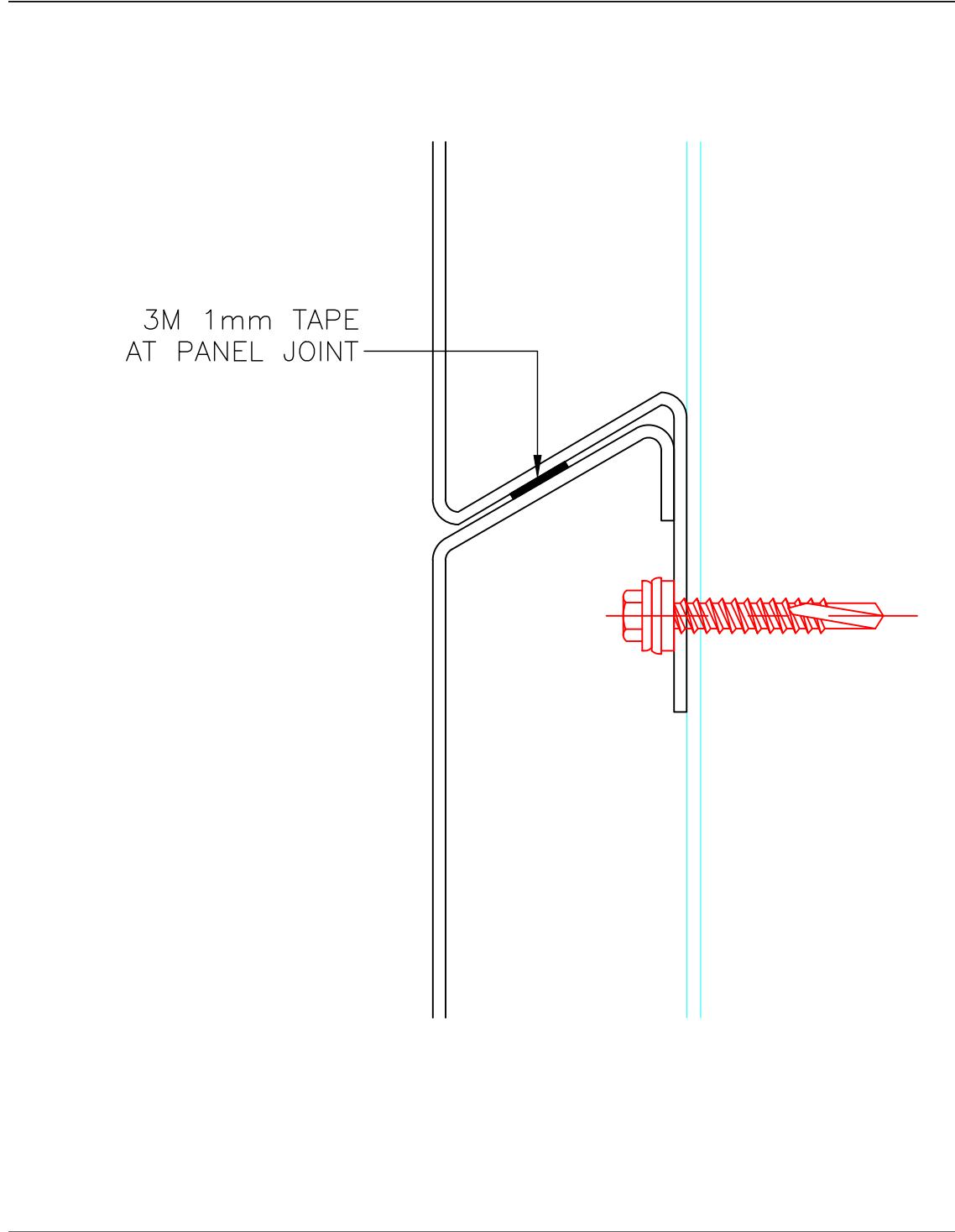
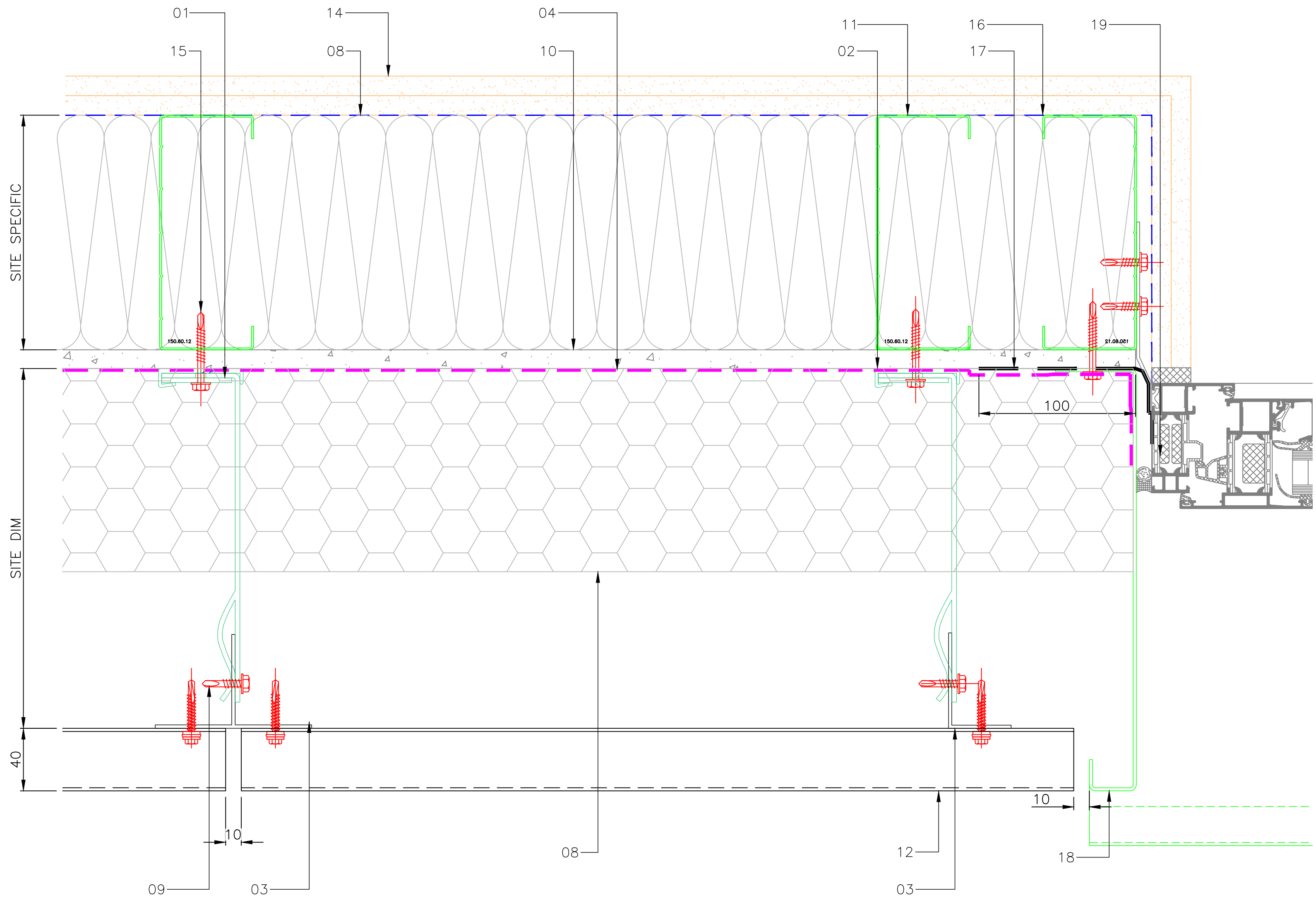


FIG. 3

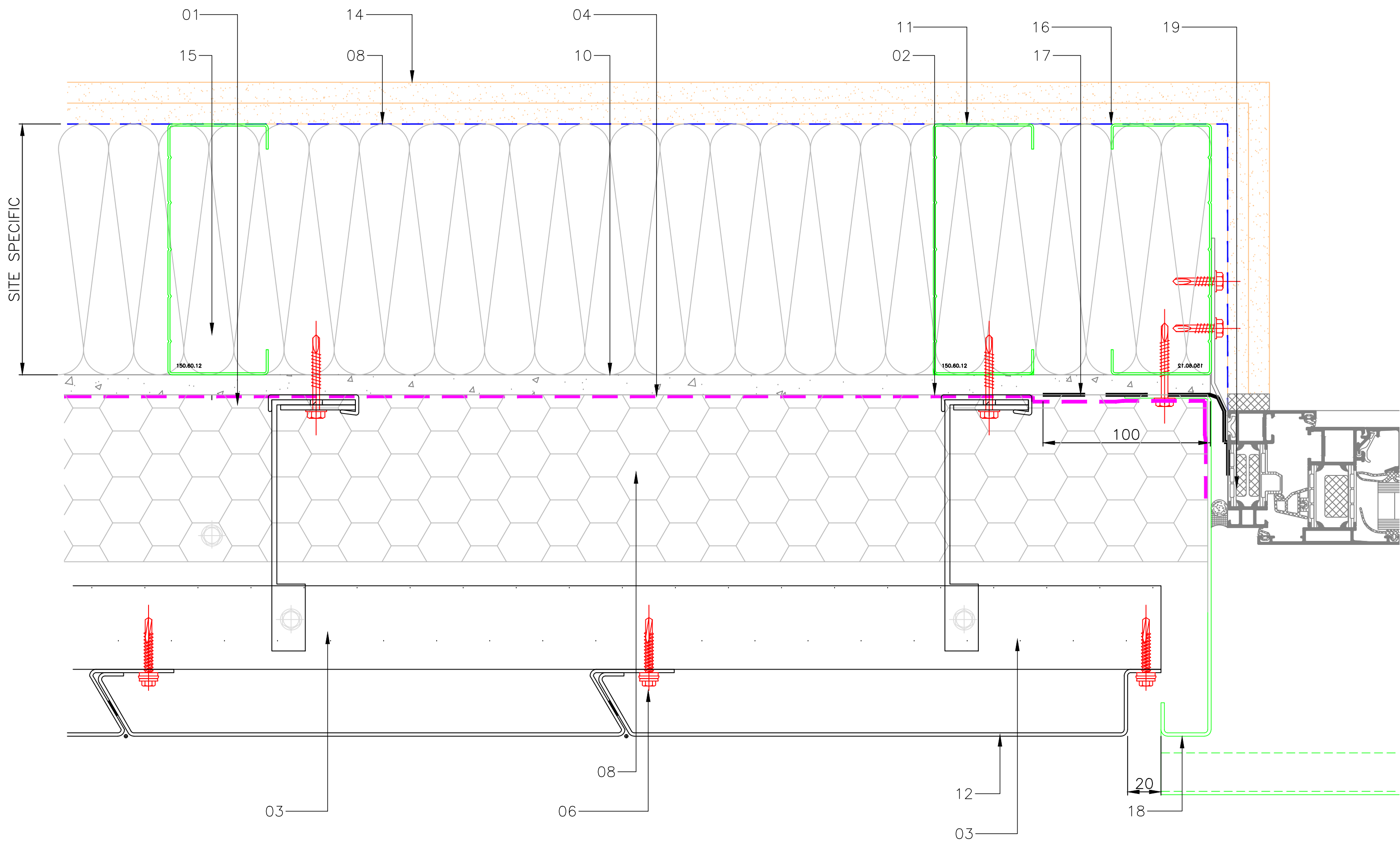
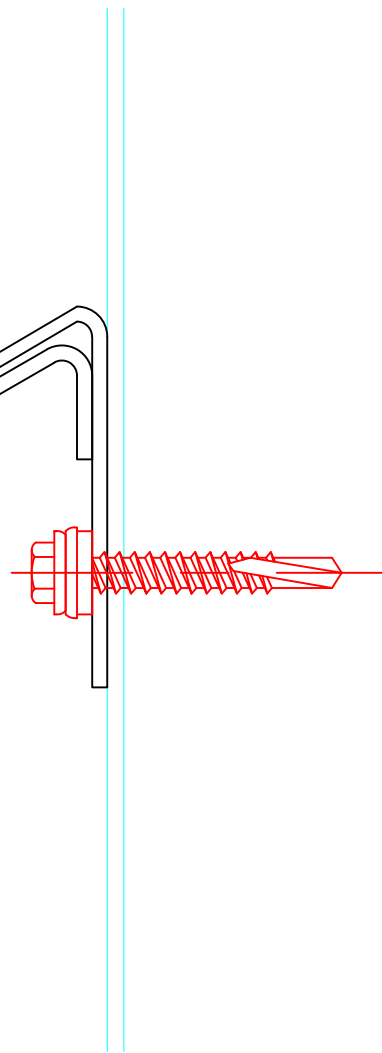


DETAIL LEGEND:	
01	3mm THICK ,75/150mm DEEP ALUMINIUM HELPING HAND BRACKET & BACKING PLATE FIXED TO STRUCTURE (SEE ALTERNATIVE FIXING DETAIL FIG 2), SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS DEAD FIXED OR SLIDING BRACKET (FIG.3) LOCATIONS TBA BY ENGINEER AS PROJECT SPECIFIC©
02	THERMAL ISOLATION PAD
03	2.2mm EXTRUDED 'L' OR 'T' RAIL MILL FINISHED AS STANDARD PPC IF REQUIRED <COLOUR / FINISH>
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
05	GENIUS CLIP
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)
07	LOW PROFILE TEK SCREW (S/S)
08	INSULATION AS PER PROJECT SPECIFICATION
09	5.5 TEK SCREW (STAINLESS STEEL)
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)
13	FLASHING
14	INTERNAL FINISHES
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
17	EPDM by OTHERS
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR
20	2mm CORNER SUPPORT ANGLE
21	1mm VERMIN MESH
22	COPING AND SUPPORT BRACKET
23	LOW PROFILE RIVET
24	PLYWOOD
25	FIRE BARRIER
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN
27	3M 1mm TAPE AT HORIZONTAL PANEL JOINT
28	GENIUS JOINT PROFILE

Site Location Plan:			
General Notes:			
1. All details to be read in conjunction with H92 Specification and engineers project specific calculations.			
2. Panel gaps over 10mm to have insect mesh installed behind.			
DRAWING DESIGN AND SPECIFICATION REMAINS THE PROPERTY OF GENIUS FACADES.			
© COPYRIGHT GENIUS FACADES 2013			
Rev	By:	Date:	Description
.	.	00.00.00	00.00.00
Client:			
Project Name and Address: GENIUS LINEAR STANDARD DETAILS ALUMINIUM			
Drawing Title: GENIUS LINEAR ALUMINIUM JAMB DETAIL			
Drawn by			
Drawing Date			
Checked by			
Checked Date			
Scale			
Sheet			
Drawing Status			
Drawing Reference		GF-LINEAR-D-01	



3M 1mm TAPE
AT PANEL JOINT



DETAIL LEGEND:		Site Location Plan:			
01	3mm THICK ALUMINIUM BRACKET @ 600 CENTRES SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS	General Notes: 1. All details to be read in conjunction with H92 Specification and engineers project specific calculations. 2. Panel gaps over 10mm to have insect mesh installed behind.			
02	THERMAL ISOLATION PAD				
03	3MM 1050 GRADE ALUMINIUM CONTINUOUS CHANNEL WITH HOLES PRE-DRILLED ON SITE				
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS				
05	GENIUS CLIP				
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)				
07	LOW PROFILE TEK SCREW (S/S)-ALUMINIUM TO BE PREDRILLED WITH 7mm HOLE SEE FIG.1				
08	INSULATION AS PER PROJECT SPECIFICATION				
09	5.5 TEK SCREW (STAINLESS STEEL)				
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS				
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION				
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)				
13	FLASHING				
14	INTERNAL FINISHES				
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER	DRAWING DESIGN AND SPECIFICATION REMAINS THE PROPERTY OF GENIUS FACADES.			
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS	© COPYRIGHT GENIUS FACADES 2013			
17	EPDM by OTHERS	Rev	By:	Date:	Description
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING	.	.	00.00.00	00.00.00
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR				
20	2mm CORNER SUPPORT ANGLE				
21	1mm VERMIN MESH				
22	COPING AND SUPPORT BRACKET				
23	LOW PROFILE RIVET				
24	PLYWOOD				
25	FIRE BARRIER				
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN				
27	SIKATAK ADHESIVE				
28	GENIUS JOINT PROFILE				
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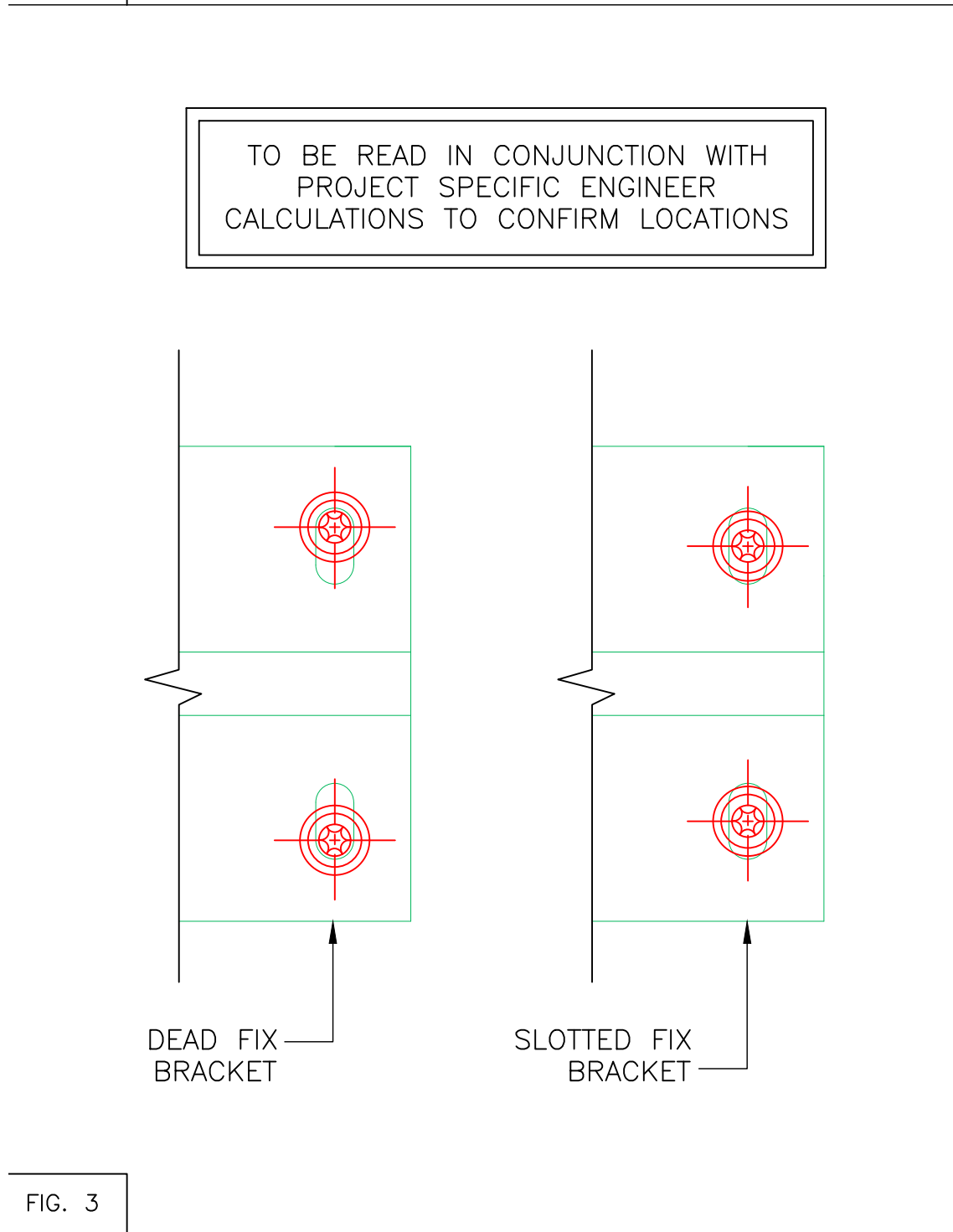
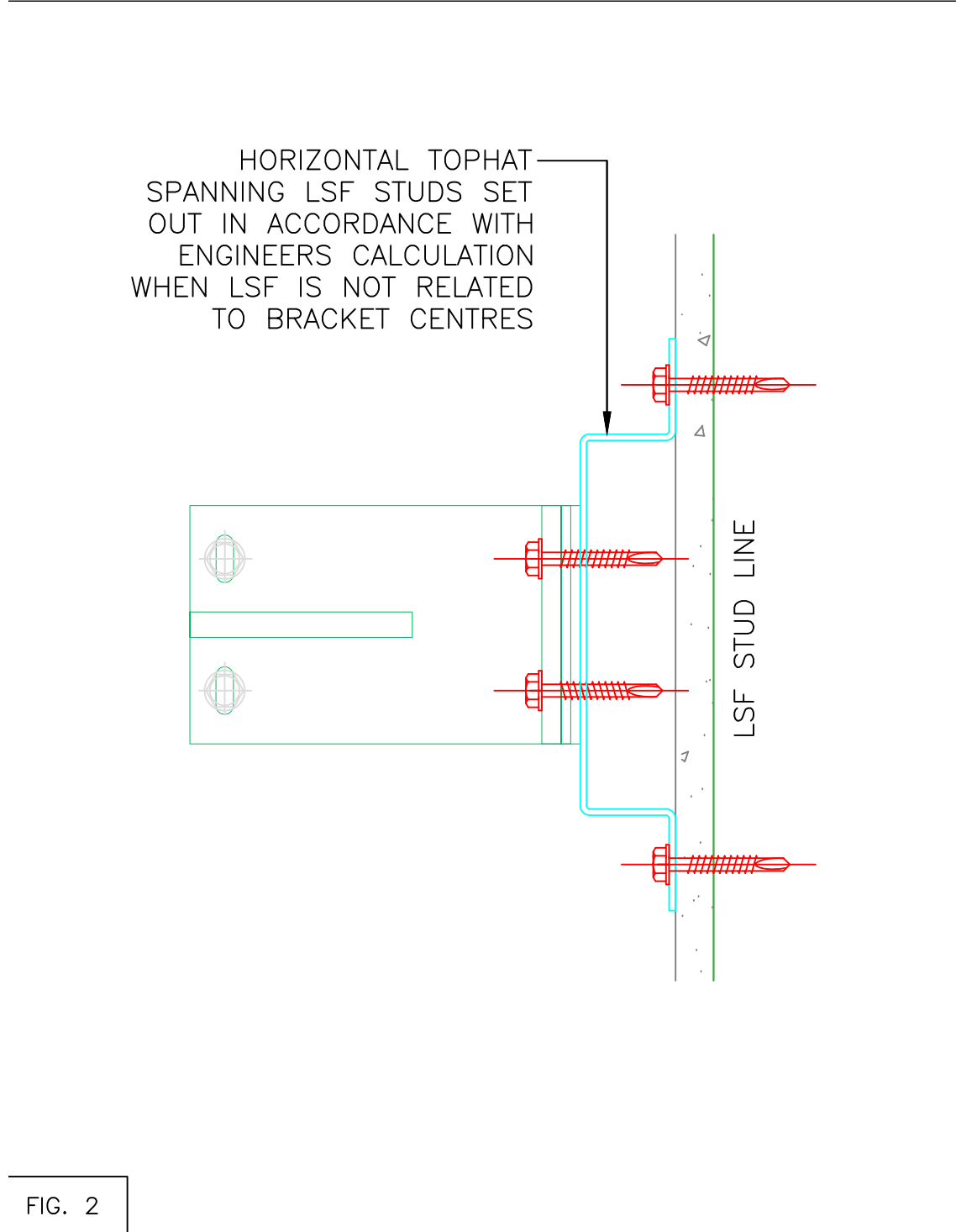
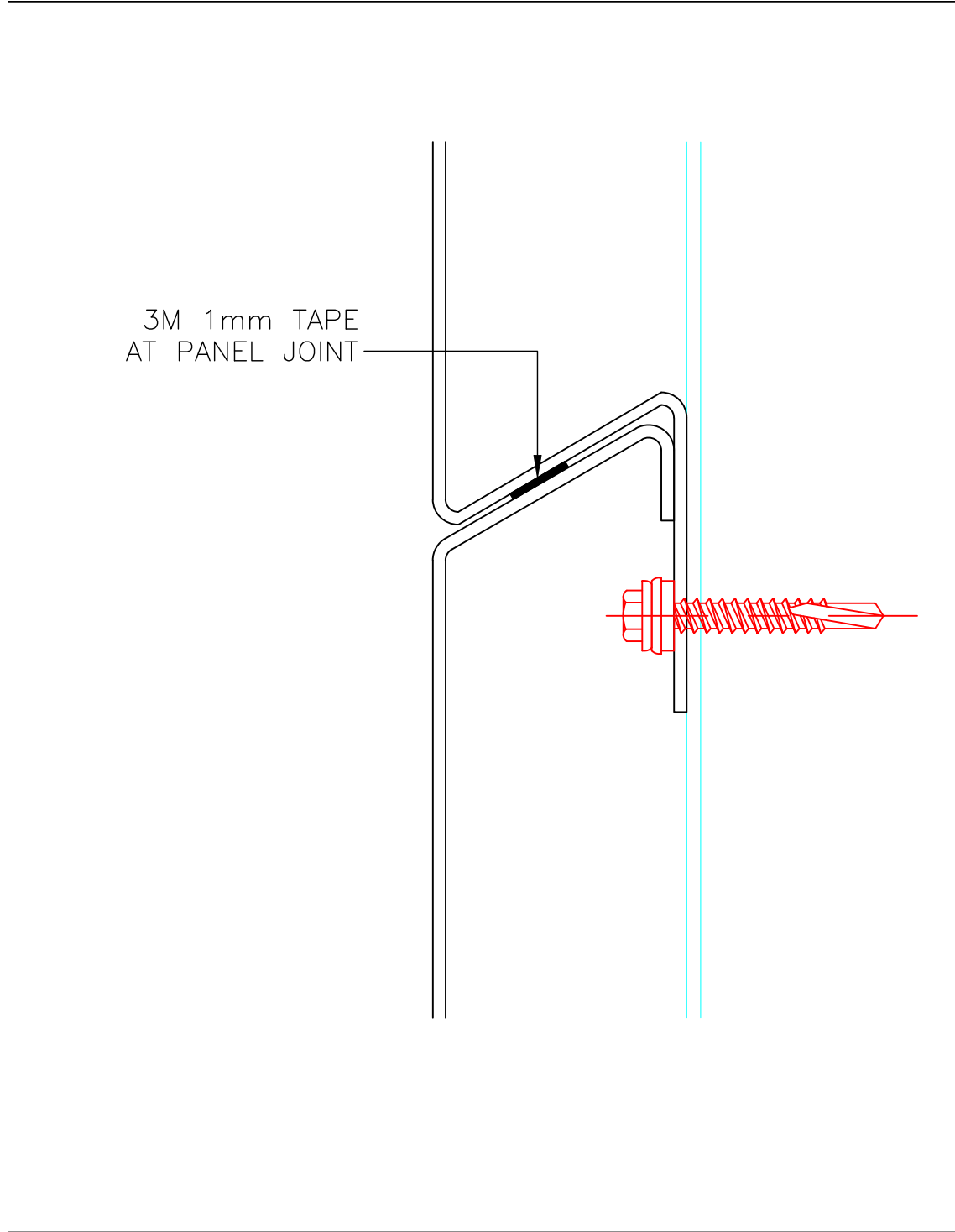
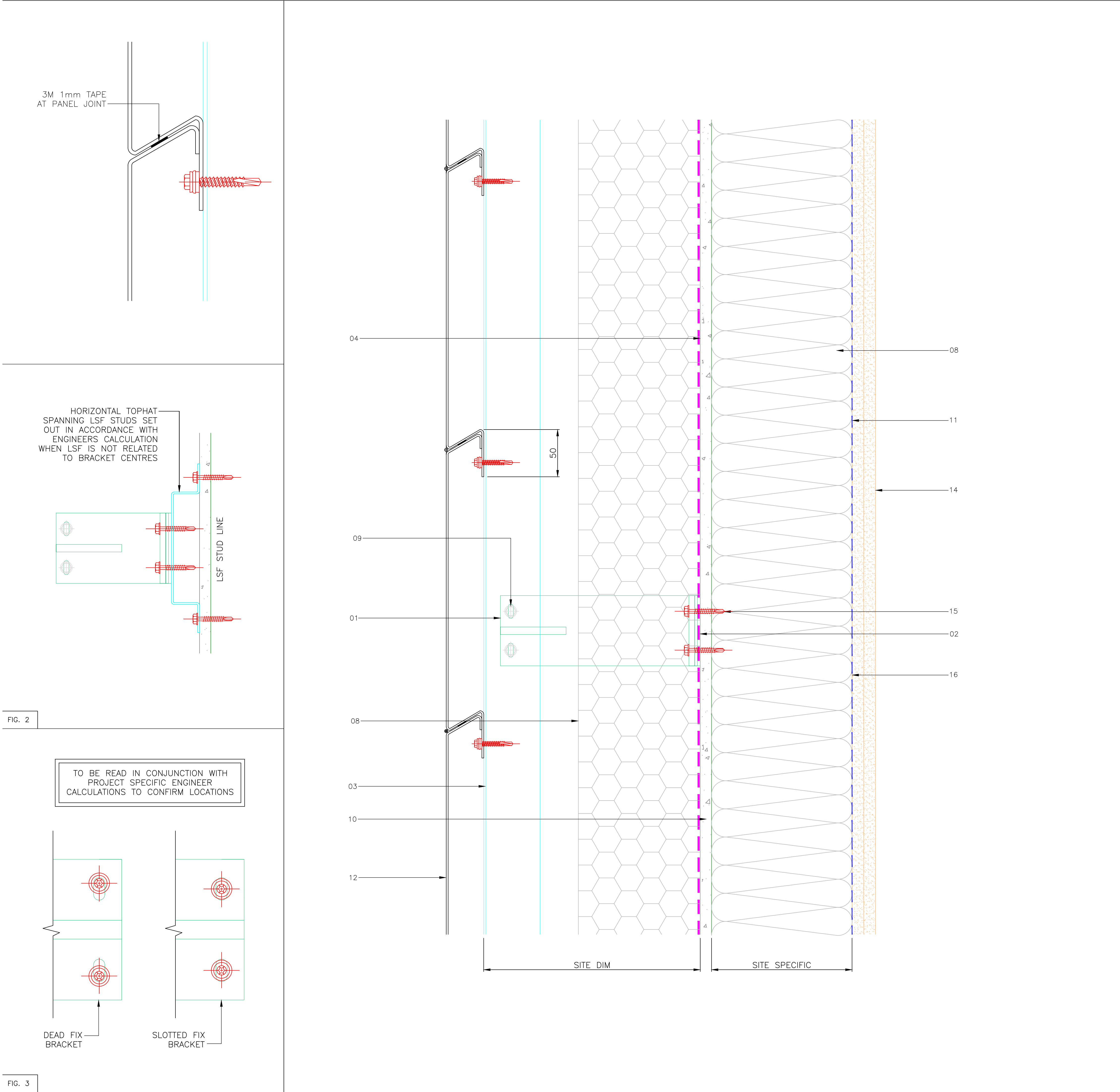
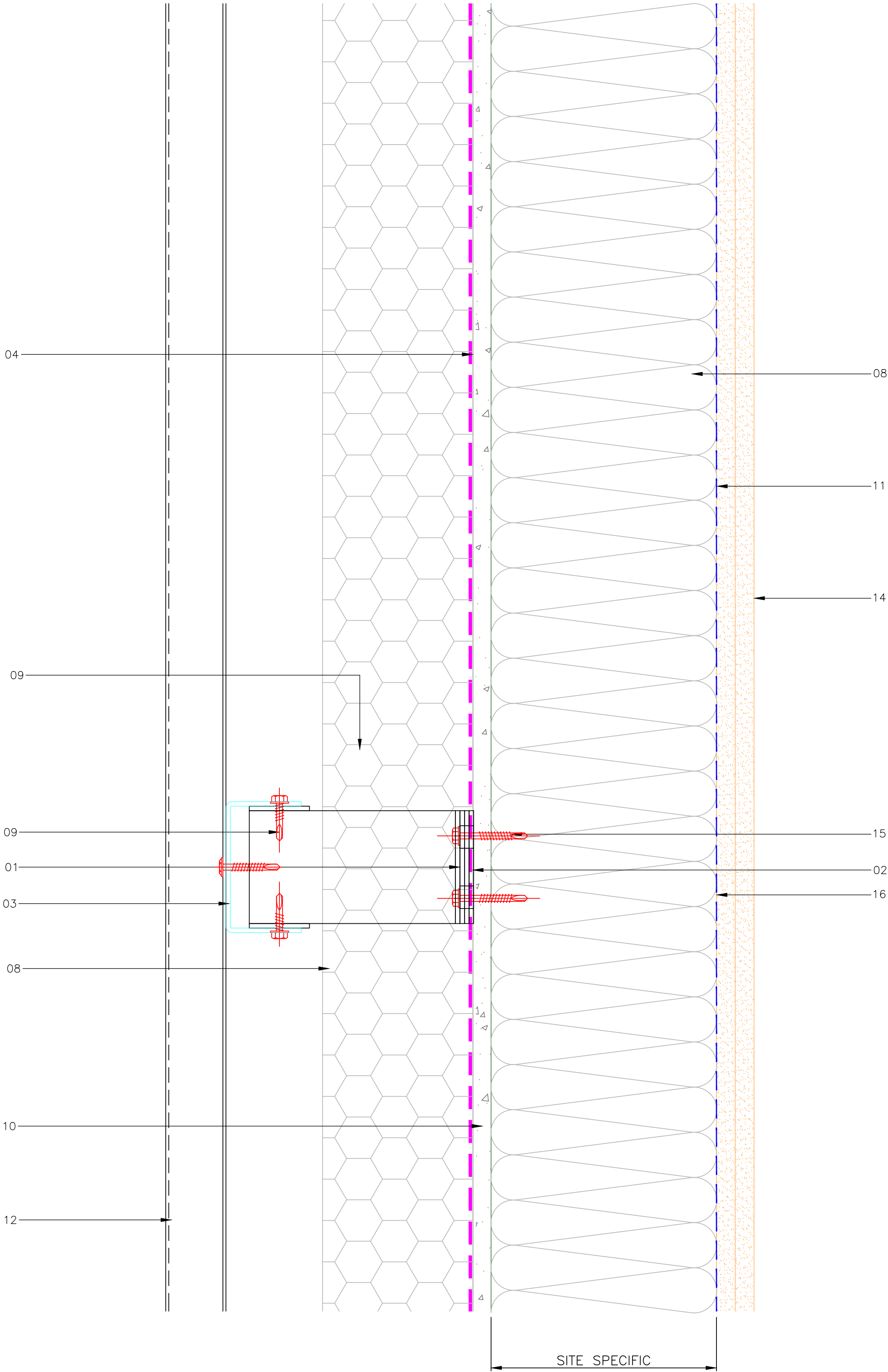
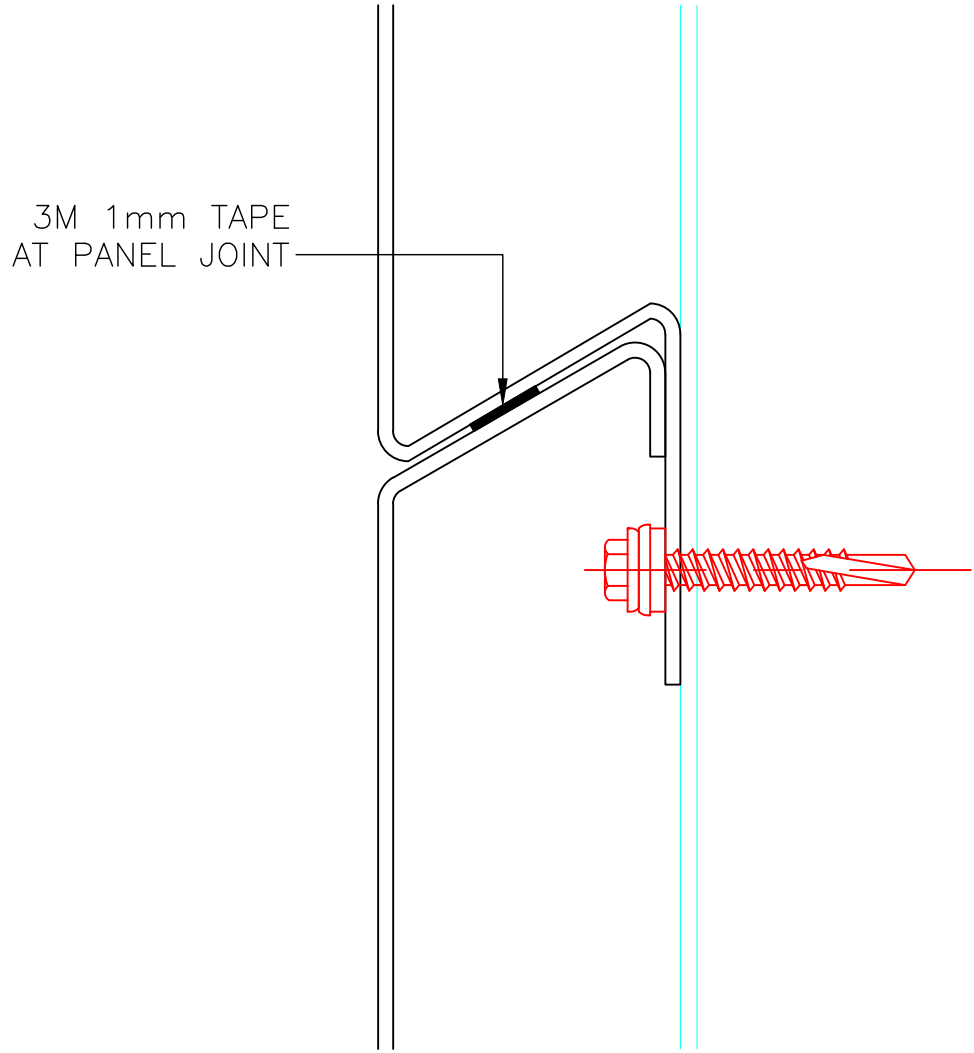


FIG. 3



DETAIL LEGEND:		Site Location Plan:	
01	3mm THICK ,75/150mm DEEP ALUMINIUM HELPING HAND BRACKET & BACKING PLATE FIXED TO STRUCTURE (SEE ALTERNATIVE FIXING DETAIL FIG 2), SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS DEAD FIXED OR SLIDING BRACKET (FIG.3) LOCATIONS TBA BY ENGINEER AS PROJECT SPECIFIC©		
02	THERMAL ISOLATION PAD	General Notes: 1. All details to be read in conjunction with H92 Specification and engineers project specific calculations. 2. Panel gaps over 10mm to have insect mesh installed behind.	
03	2.2mm EXTRUDED 'L' OR 'T' RAIL MILL FINISHED AS STANDARD PPC IF REQUIRED <COLOUR / FINISH>		
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS		
05	GENIUS CLIP		
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)		
07	LOW PROFILE TEK SCREW (S/S)		
08	INSULATION AS PER PROJECT SPECIFICATION		
09	5.5 TEK SCREW (STAINLESS STEEL)		
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS		
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION		
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)		
13	FLASHING		
14	INTERNAL FINISHES		
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER	DRAWING DESIGN AND SPECIFICATION REMAINS THE PROPERTY OF GENIUS FACADES.	
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS	© COPYRIGHT GENIUS FACADES 2013	
17	EPDM by OTHERS	Rev	By: Date: Description
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING	.	00.00.00 00.00.00
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR		
20	2mm CORNER SUPPORT ANGLE		
21	1mm VERMIN MESH		
22	COPING AND SUPPORT BRACKET		
23	LOW PROFILE RIVET		
24	PLYWOOD		
25	FIRE BARRIER		
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN		
27	3M 1mm TAPE AT HORIZONTAL PANEL JOINT		
28	GENIUS JOINT PROFILE		
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DETAIL LEGEND:		Site Location Plan:																	
01	3mm THICK ALUMINIUM BRACKET @ 600 CENTRES SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS	General Notes: 1. All details to be read in conjunction with H92 Specification and engineers project specific calculations. 2. Panel gaps over 10mm to have insect mesh installed behind.																	
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03	3MM 1050 GRADE ALUMINIUM CONTINUOUS CHANNEL WITH HOLES PRE-DRILLED ON SITE																		
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS																		
05	GENIUS CLIP																		
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)																		
07	LOW PROFILE TEK SCREW (S/S)-ALUMINIUM TO BE PREDRILLED WITH 7mm HOLE SEE FIG.1																		
08	INSULATION AS PER PROJECT SPECIFICATION																		
09	5.5 TEK SCREW (STAINLESS STEEL)																		
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS																		
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION	DRAWING DESIGN AND SPECIFICATION REMAINS THE PROPERTY OF GENIUS FACADES. © COPYRIGHT GENIUS FACADES 2013 <table><tr><td>Rev</td><td>By:</td><td>Date:</td><td>Description</td></tr><tr><td>.</td><td>.</td><td>00.00.00</td><td>00.00.00</td></tr></table>		Rev	By:	Date:	Description	.	.	00.00.00	00.00.00								
Rev	By:			Date:	Description														
.	.			00.00.00	00.00.00														
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)																		
13	FLASHING																		
14	INTERNAL FINISHES																		
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER																		
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS																		
17	EPDM by OTHERS																		
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING																		
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR																		
20	2mm CORNER SUPPORT ANGLE	Client: Project Name and Address: GENIUS LINEAR STANDARD DETAILS ALUMINIUM Drawing Title: GENIUS VERTICAL LINEAR ALUMINIUM HORIZONTAL JOINT DETAIL <table><tr><td>Drawn by</td><td></td></tr><tr><td>Drawing Date</td><td></td></tr><tr><td>Checked by</td><td></td></tr><tr><td>Checked Date</td><td></td></tr><tr><td>Scale</td><td></td></tr><tr><td>Sheet</td><td></td></tr><tr><td>Drawing Status</td><td></td></tr><tr><td>Drawing Reference</td><td>GF-LINEAR-D-02a</td></tr></table>		Drawn by		Drawing Date		Checked by		Checked Date		Scale		Sheet		Drawing Status		Drawing Reference	GF-LINEAR-D-02a
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Drawing Reference	GF-LINEAR-D-02a																		
21	1mm VERMIN MESH																		
22	COPING AND SUPPORT BRACKET																		
23	LOW PROFILE RIVET																		
24	PLYWOOD																		
25	FIRE BARRIER																		
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN																		
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28	GENIUS JOINT PROFILE																		
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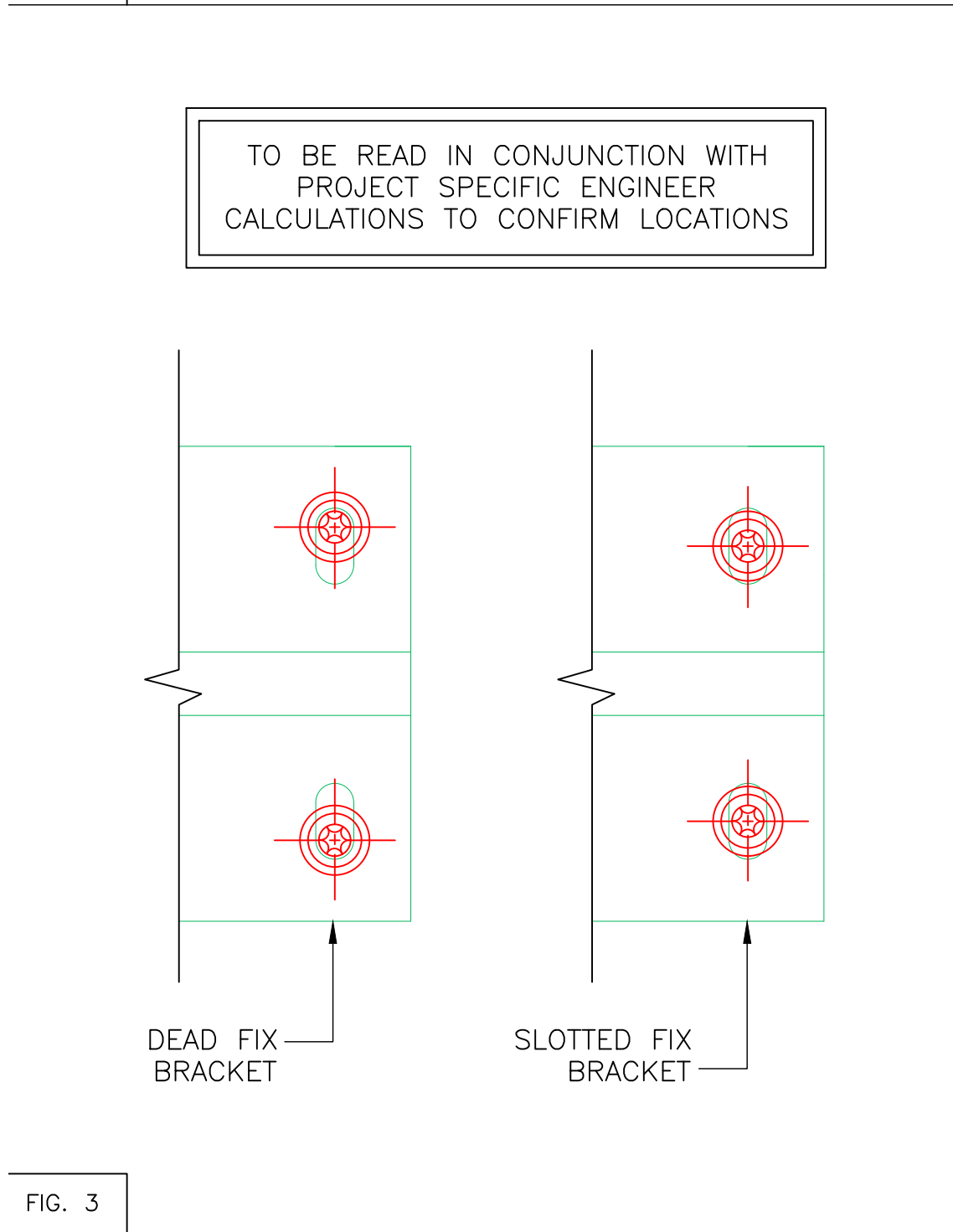
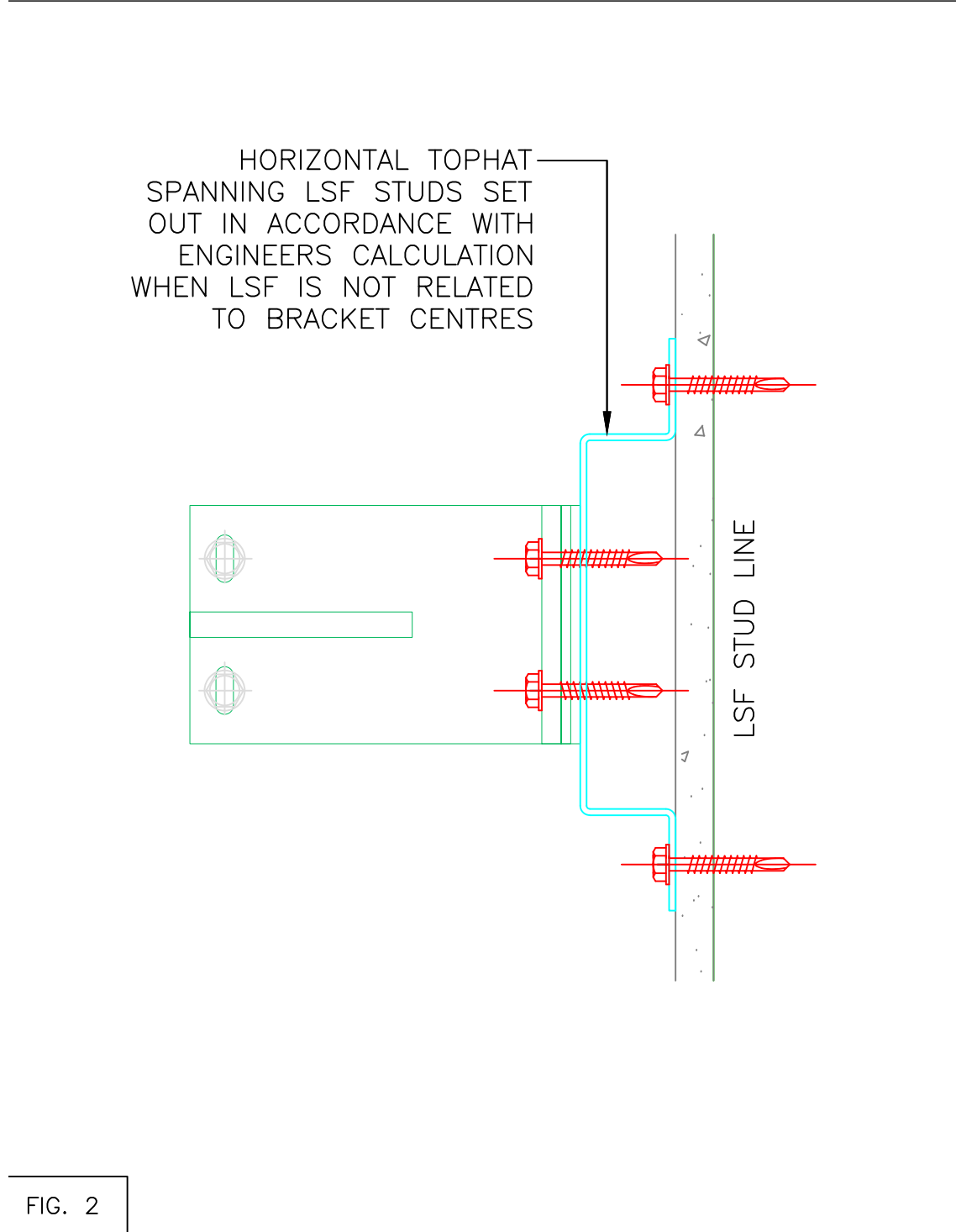
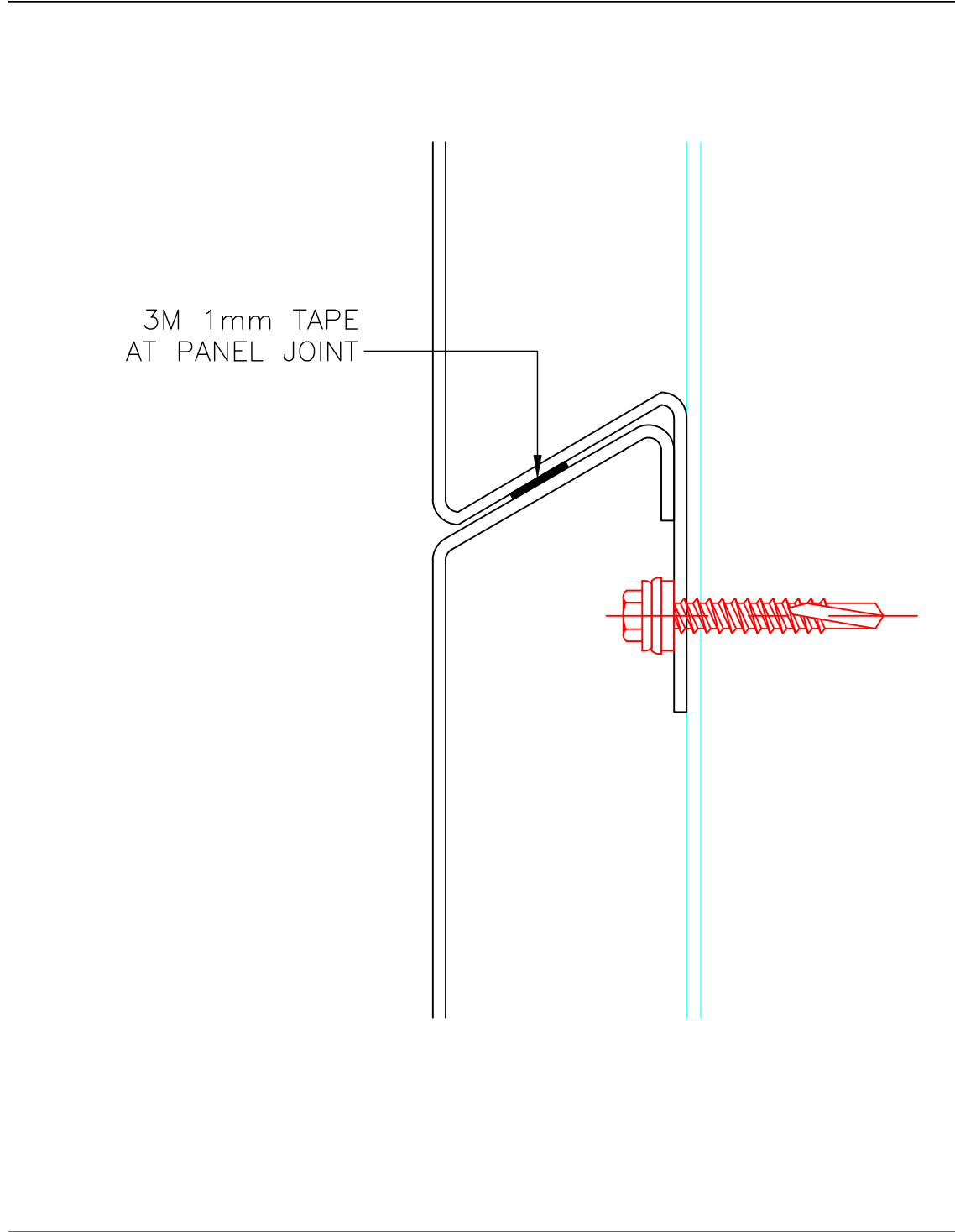
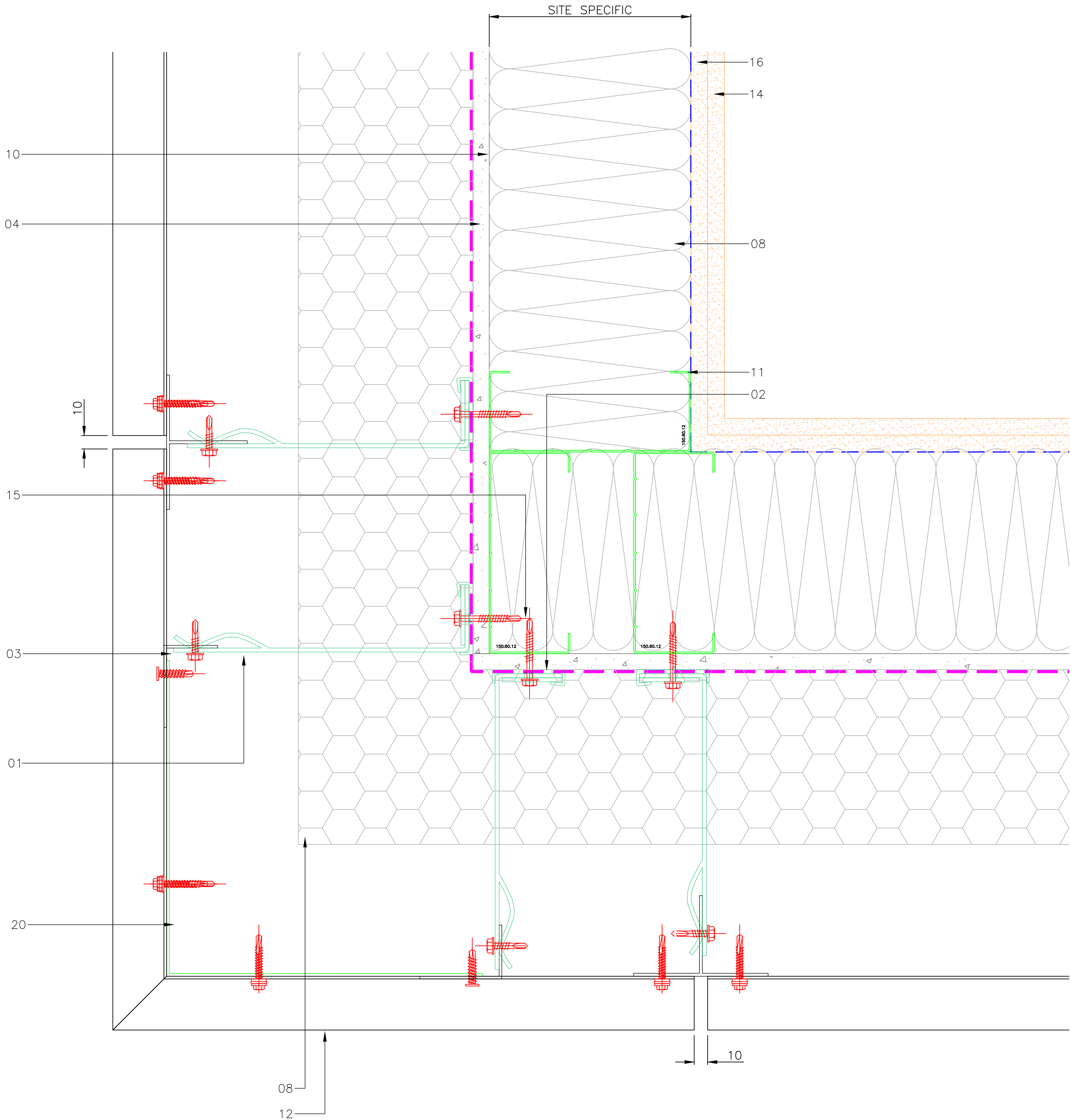


FIG. 3



DETAIL LEGEND:	
01	3mm THICK ,75/150mm DEEP ALUMINIUM HELPING HAND BRACKET & BACKING PLATE FIXED TO STRUCTURE (SEE ALTERNATIVE FIXING DETAIL FIG 2), SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS DEAD FIXED OR SLIDING BRACKET (FIG.3) LOCATIONS TBA BY ENGINEER AS PROJECT SPECIFIC©
02	THERMAL ISOLATION PAD
03	2.2mm EXTRUDED 'L' OR 'T' RAIL MILL FINISHED AS STANDARD PPC IF REQUIRED <COLOUR / FINISH>
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
05	GENIUS CLIP
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)
07	LOW PROFILE TEK SCREW (S/S)
08	INSULATION AS PER PROJECT SPECIFICATION
09	5.5 TEK SCREW (STAINLESS STEEL)
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)
13	FLASHING
14	INTERNAL FINISHES
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
17	EPDM by OTHERS
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR
20	2mm CORNER SUPPORT ANGLE
21	1mm VERMIN MESH
22	COPING AND SUPPORT BRACKET
23	LOW PROFILE RIVET
24	PLYWOOD
25	FIRE BARRIER
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN
27	3M 1mm TAPE AT HORIZONTAL PANEL JOINT
28	GENIUS JOINT PROFILE

Site Location Plan:			
General Notes:			
1. All details to be read in conjunction with H92 Specification and engineers project specific calculations.			
2. Panel gaps over 10mm to have insect mesh installed behind.			
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Drawing Reference		GF-LINEAR-D-03	





DETAIL LEGEND:

01	3mm THICK ALUMINIUM BRACKET @ 600 CENTRES SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS
----	---

THERMAL ISOLATION PAD

03	3MM 1050 GRADE ALUMINIUM CONTINUOUS CHANNEL WITH HOLES PRE-DRILLED ON SITE
----	--

04	BREATHING MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
----	--

GENIUS CLIP

06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)
----	--

07 LOW PROFILE TEK SCREW
(S/S)-ALUMNIUM TO BE PREDRILLED
WITH 7mm HOLE SEE FIG.1

08	INSULATION AS PER PROJECT SPECIFICATION
----	---

09	5.5 TEK SCREW (STAINLESS STEEL)
----	---------------------------------

10 CEMENT PARTICLE BOARD/ CALCIUM
SILICATE BOARD, FIXED IN
ACCORDANCE WITH MANUFACTURERS
RECOMMENDATIONS

11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION
----	--

12	2mm ALUMINIUM PANEL (GENI LINEAR SYSTEM)
----	---

13	CONTINUOUS PLANAR STARTER PACKER PPC BLACK
----	---

14 | INTERNAL FINISHES

15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER
----	--

16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
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17	EPDM by OTHERS
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18	ALUMINIUM WINDOW POD OR REVEA
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19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR
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20	2mm CORNER SUPPORT ANGL
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21	1mm VERMIN MES
----	----------------

22 | COPING AND SUPPORT BRACKETS

23 | LOW PROFILE RIVE

24	PLYWOOD
----	---------

25	FIRE BARRIER
----	--------------

26 | Z RAIL WITH STOP ENDS RIVETED TO
PANEL RETURN

27 | SIKATAK ADHESIVE

28	GENIUS JOINT PROFILE
----	----------------------

Site Location Plan:

General Notes:

1. All details to be read in conjunction with H92 Specification and engineers project specific calculations.

2. Panel gaps over 10mm to have insect mesh installed behind.

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Project Name and Address:

GENIUS LINEAR STANDARD DETAILS

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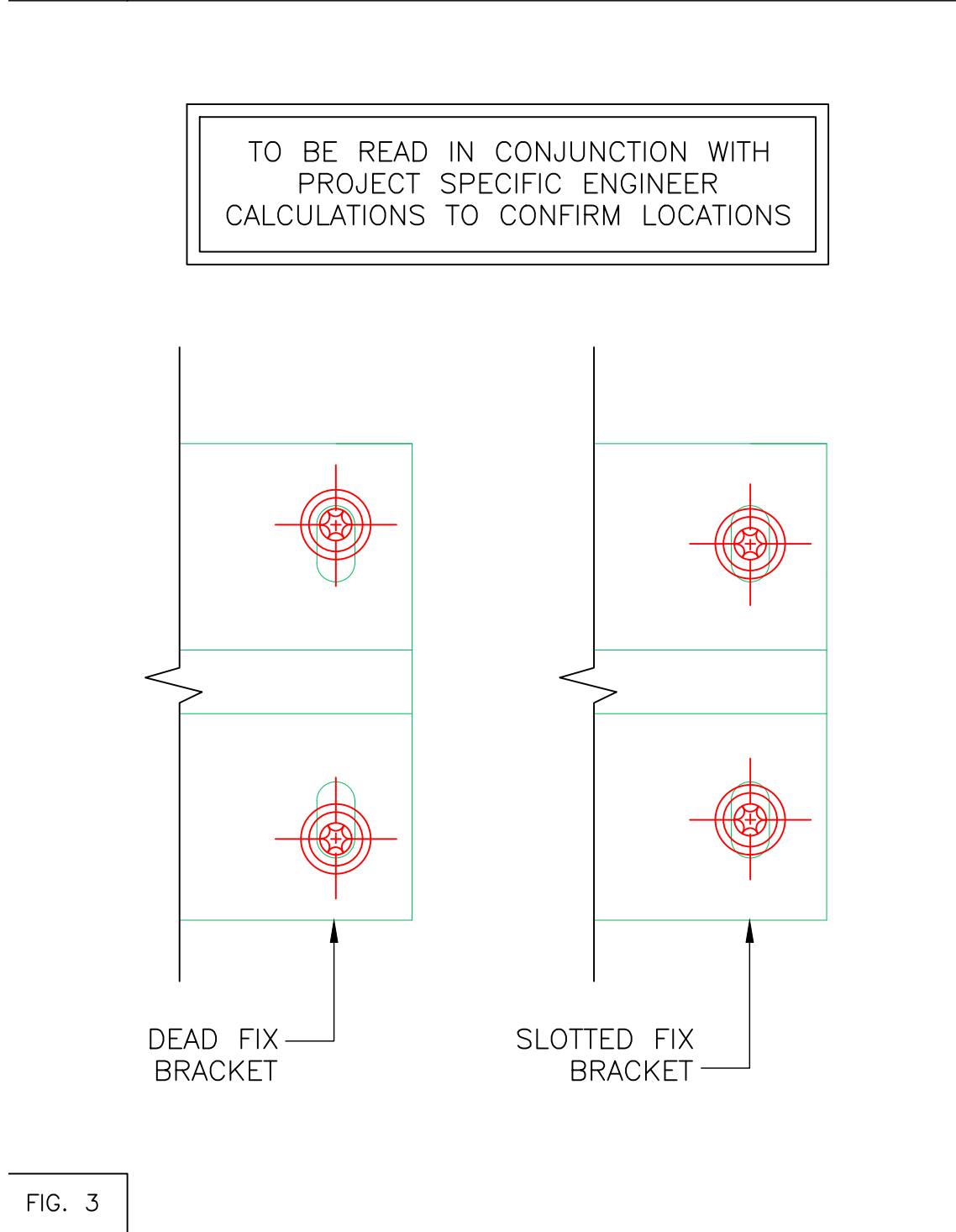
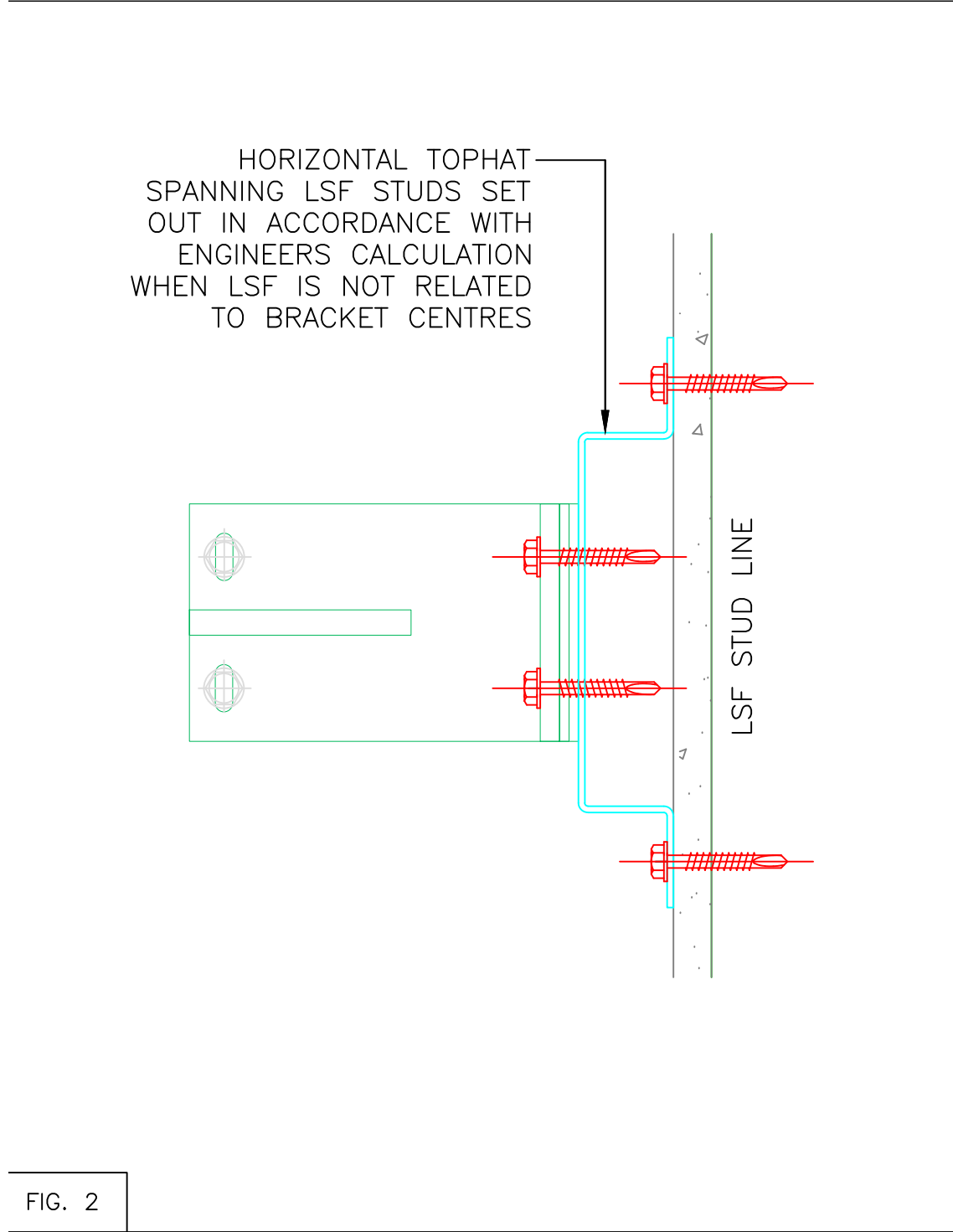
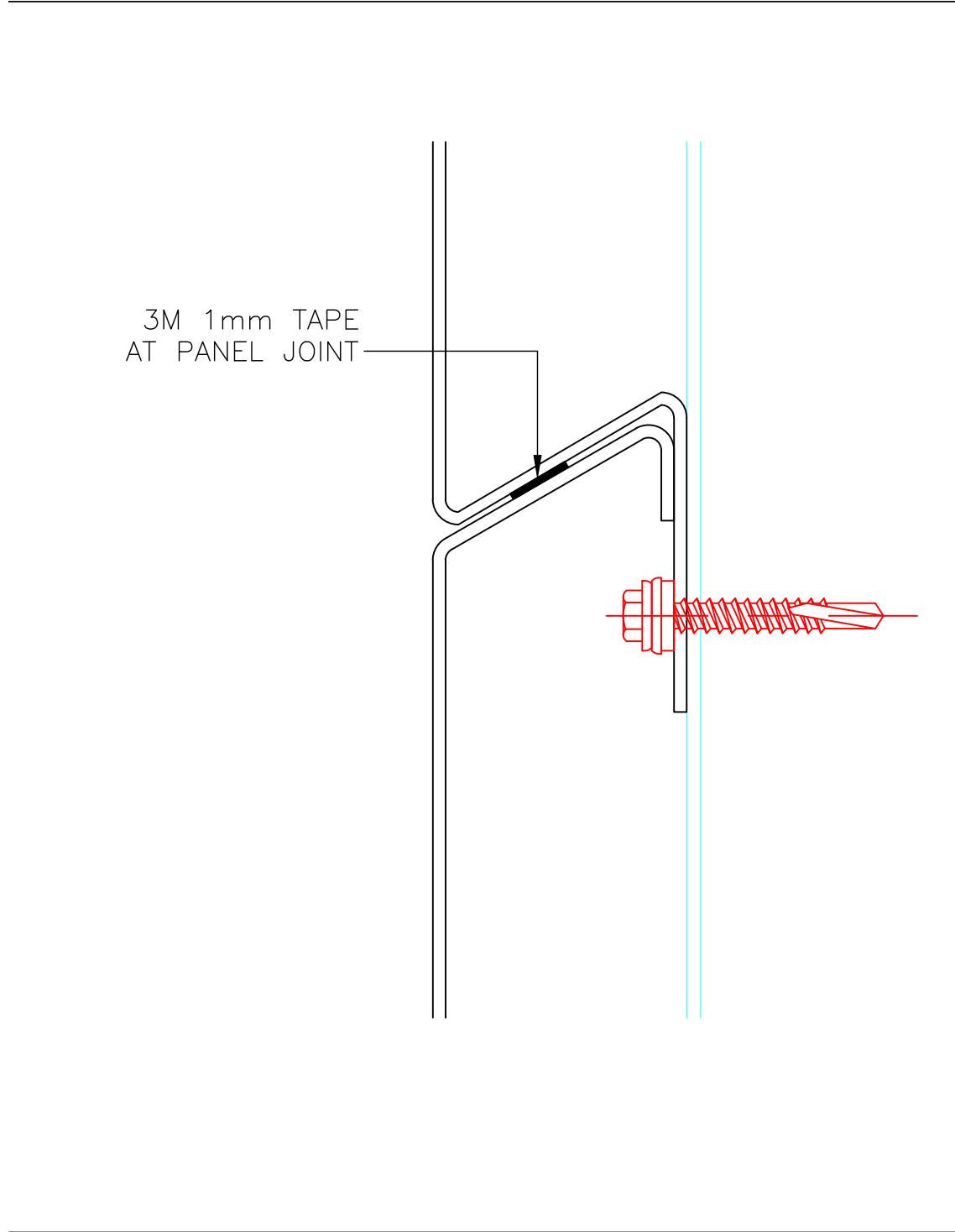
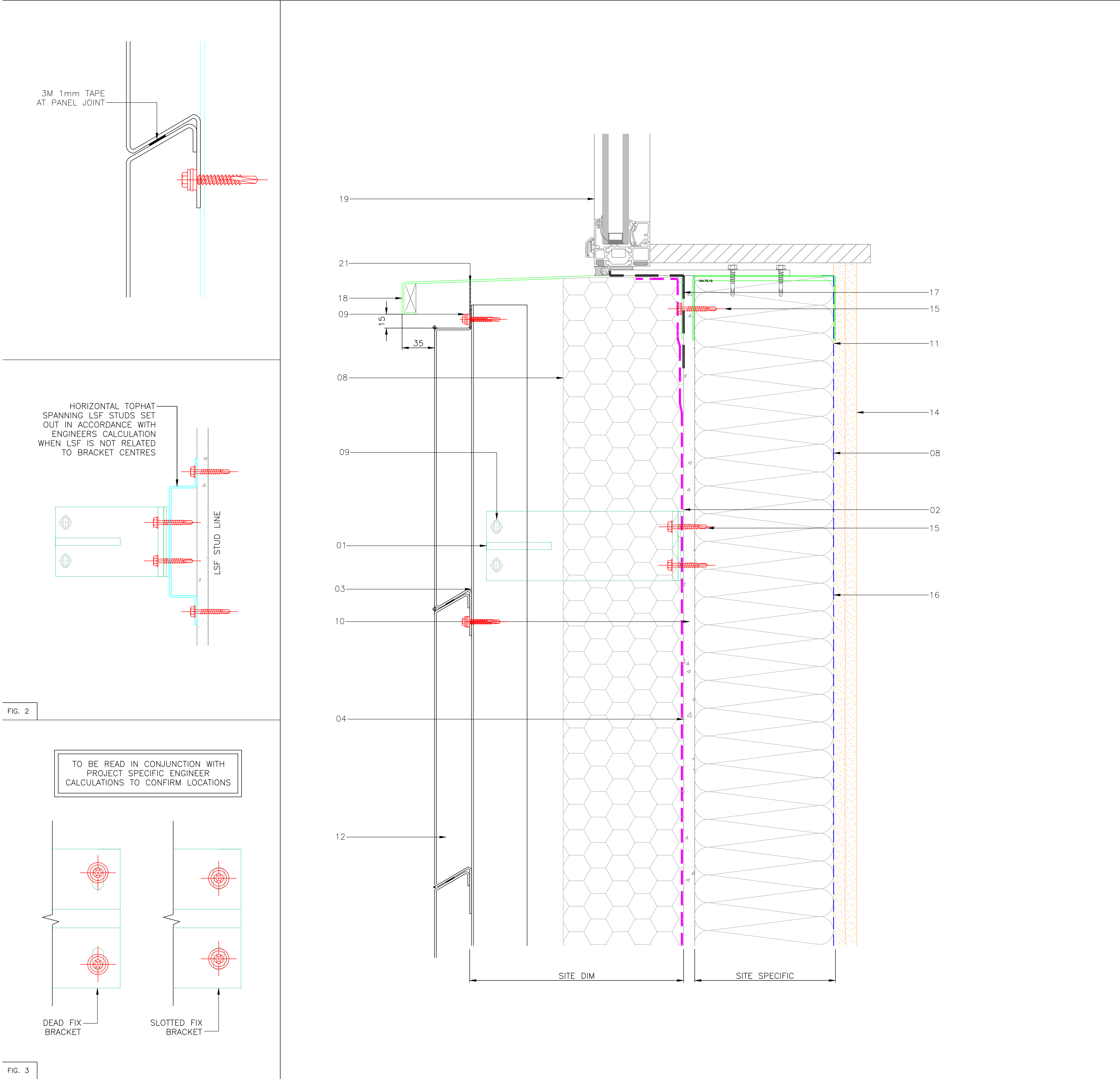
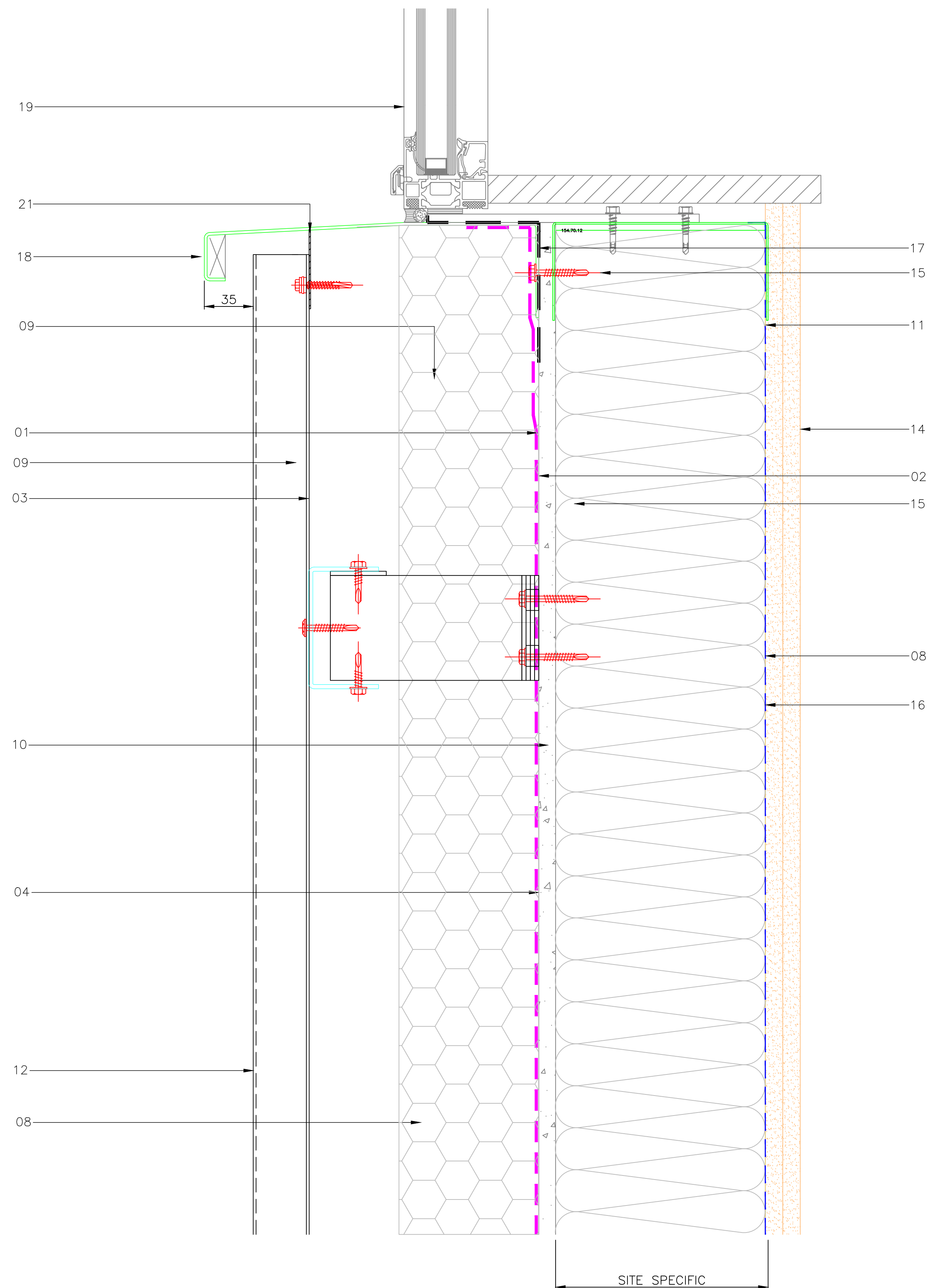


FIG. 3



DETAIL LEGEND:		Site Location Plan:	
01	3mm THICK ,75/150mm DEEP ALUMINIUM HELPING HAND BRACKET & BACKING PLATE FIXED TO STRUCTURE (SEE ALTERNATIVE FIXING DETAIL FIG 2), SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS DEAD FIXED OR SLIDING BRACKET (FIG.3) LOCATIONS TBA BY ENGINEER AS PROJECT SPECIFIC©	General Notes: 1. All details to be read in conjunction with H92 Specification and engineers project specific calculations. 2. Panel gaps over 10mm to have insect mesh installed behind.	
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11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION	DRAWING DESIGN AND SPECIFICATION REMAINS THE PROPERTY OF GENIUS FACADES.	
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)	© COPYRIGHT GENIUS FACADES 2013	
13	FLASHING	Rev	By: Date: Description
14	INTERNAL FINISHES	.	00.00.00 00.00.00
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER		
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS		
17	EPDM by OTHERS		
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING		
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR		
20	2mm CORNER SUPPORT ANGLE		
21	1mm VERMIN MESH		
22	COPING AND SUPPORT BRACKET		
23	LOW PROFILE RIVET		
24	PLYWOOD		
25	FIRE BARRIER	Client:	
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN		
27	3M 1mm TAPE AT HORIZONTAL PANEL JOINT		
28	GENIUS JOINT PROFILE		
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**GENIUS
FACADES**
QUALITY. TESTED. INNOVATION.

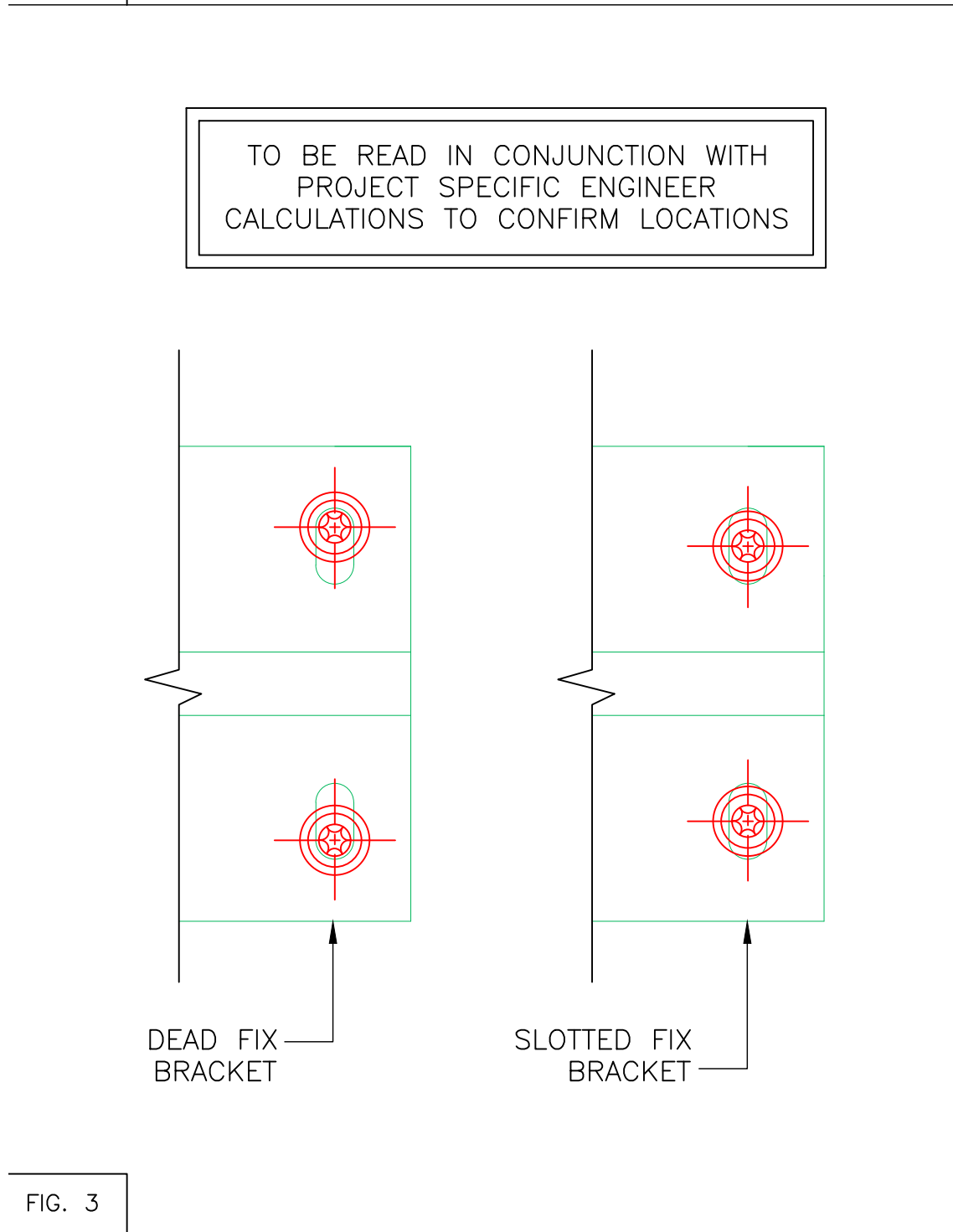
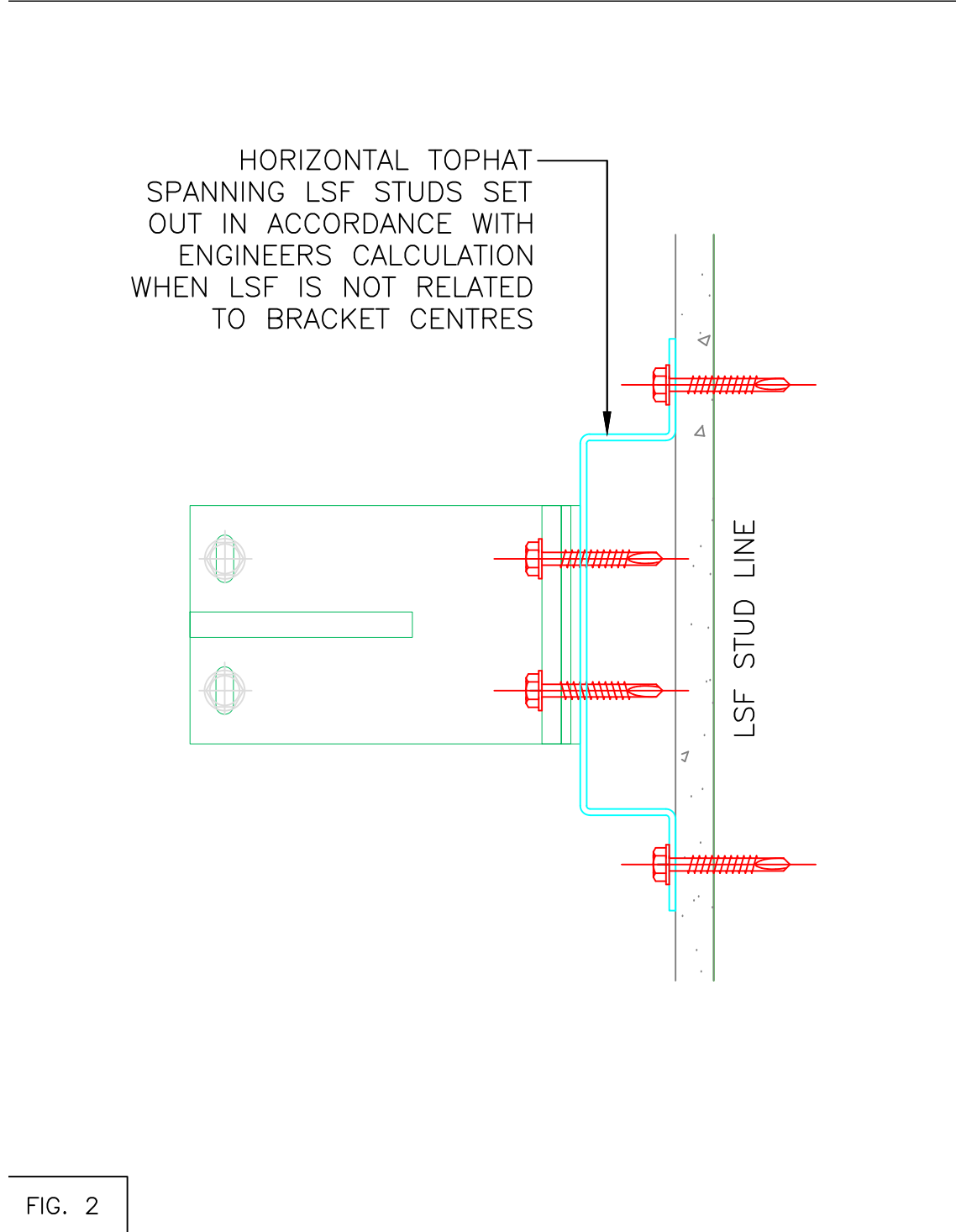
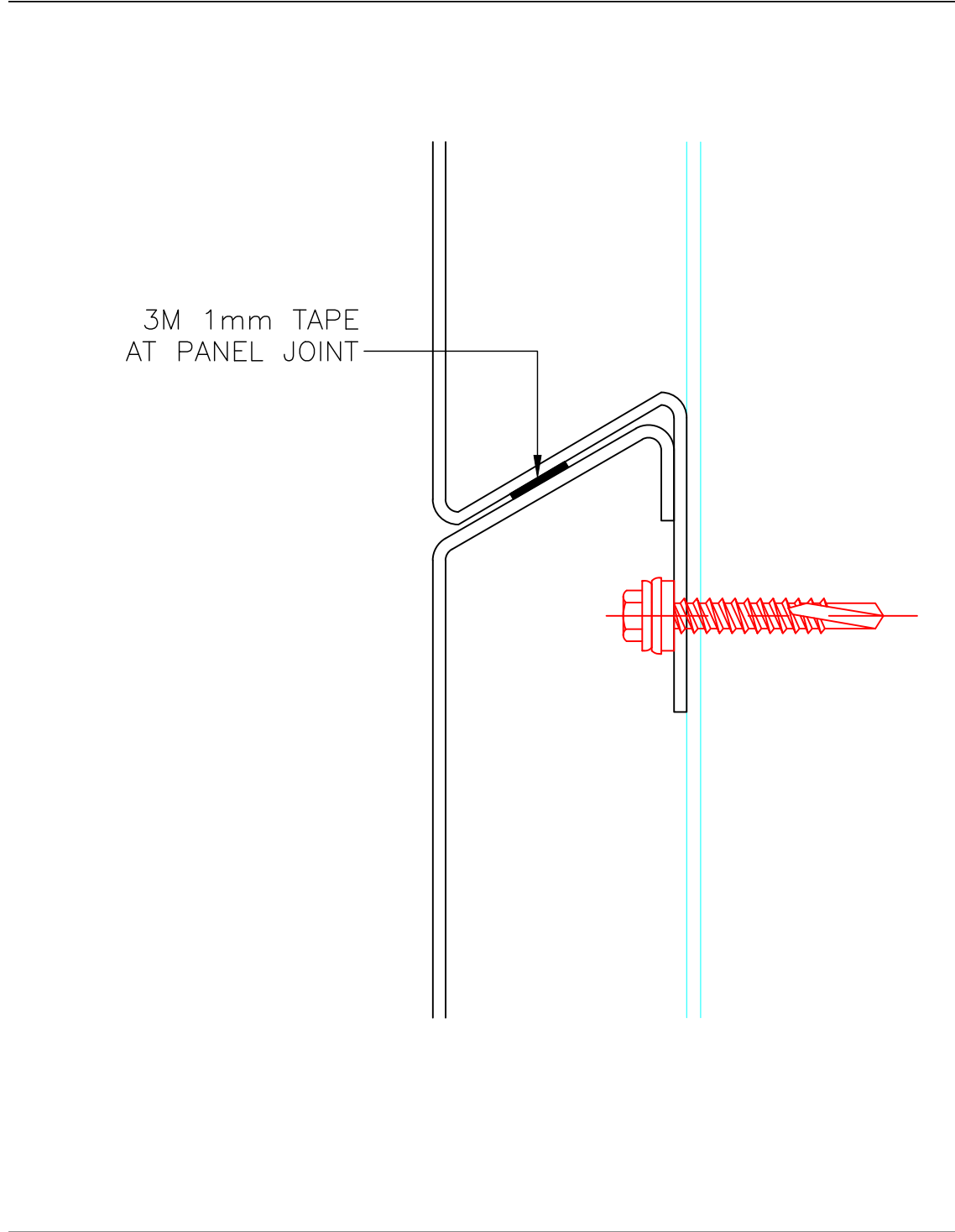
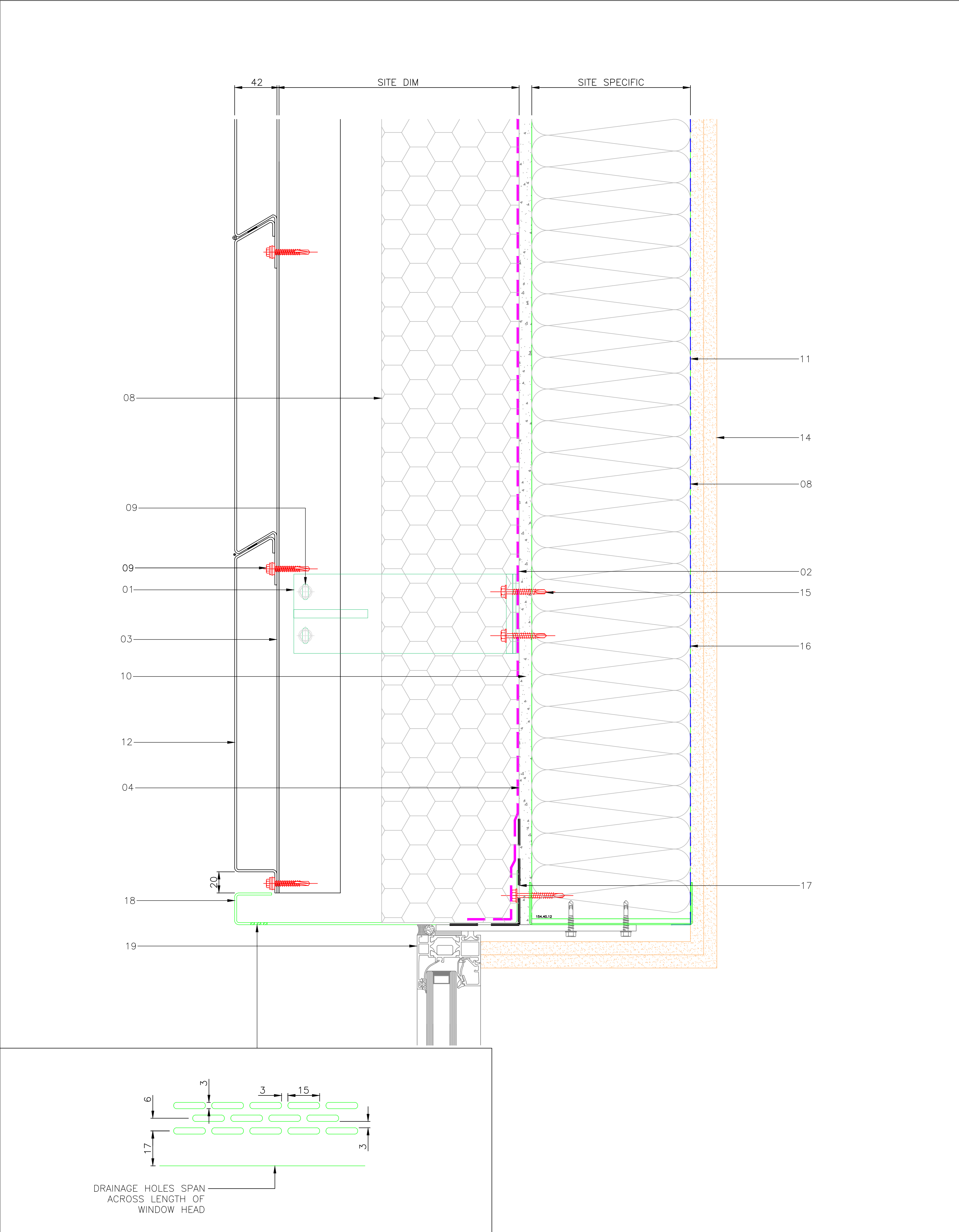
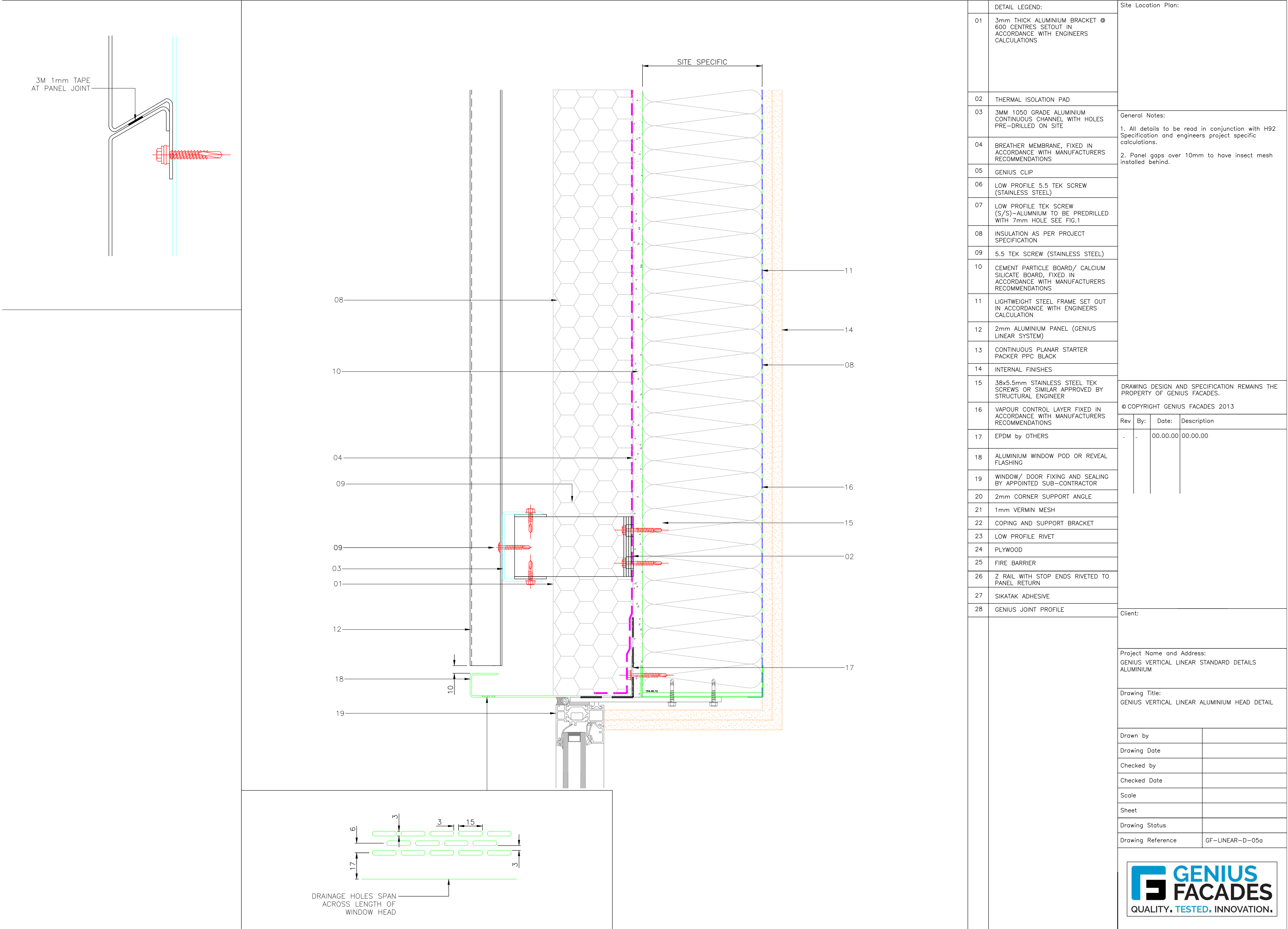


FIG. 3

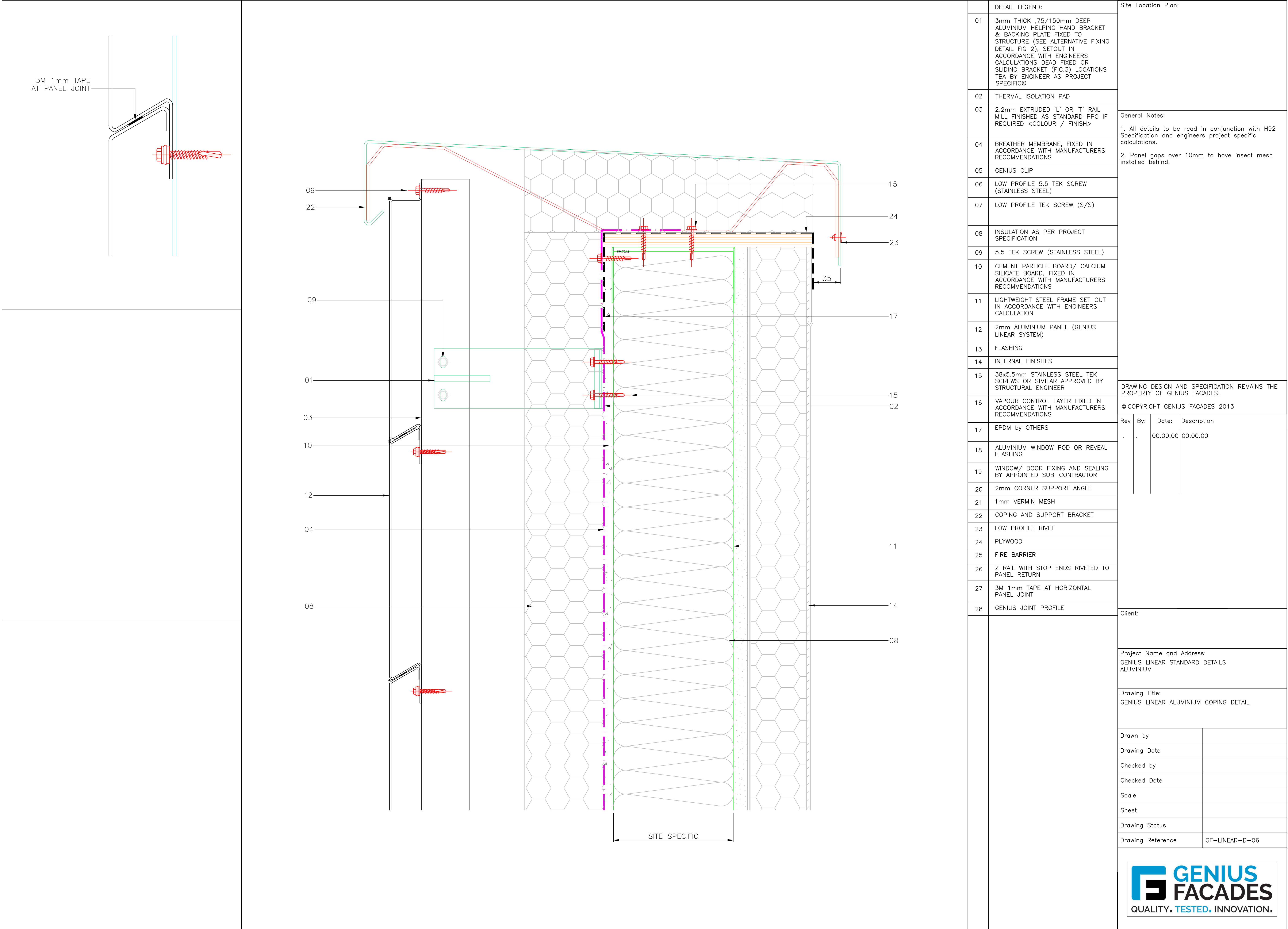


DETAIL LEGEND:		Site Location Plan:	
01	3mm THICK ,75/150mm DEEP ALUMINIUM HELPING HAND BRACKET & BACKING PLATE FIXED TO STRUCTURE (SEE ALTERNATIVE FIXING DETAIL FIG 2), SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS DEAD FIXED OR SLIDING BRACKET (FIG.3) LOCATIONS TBA BY ENGINEER AS PROJECT SPECIFIC©	General Notes: 1. All details to be read in conjunction with H92 Specification and engineers project specific calculations. 2. Panel gaps over 10mm to have insect mesh installed behind.	
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13	FLASHING	Rev	By: Date: Description
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15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER		
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27	3M 1mm TAPE AT HORIZONTAL PANEL JOINT		
28	GENIUS JOINT PROFILE		
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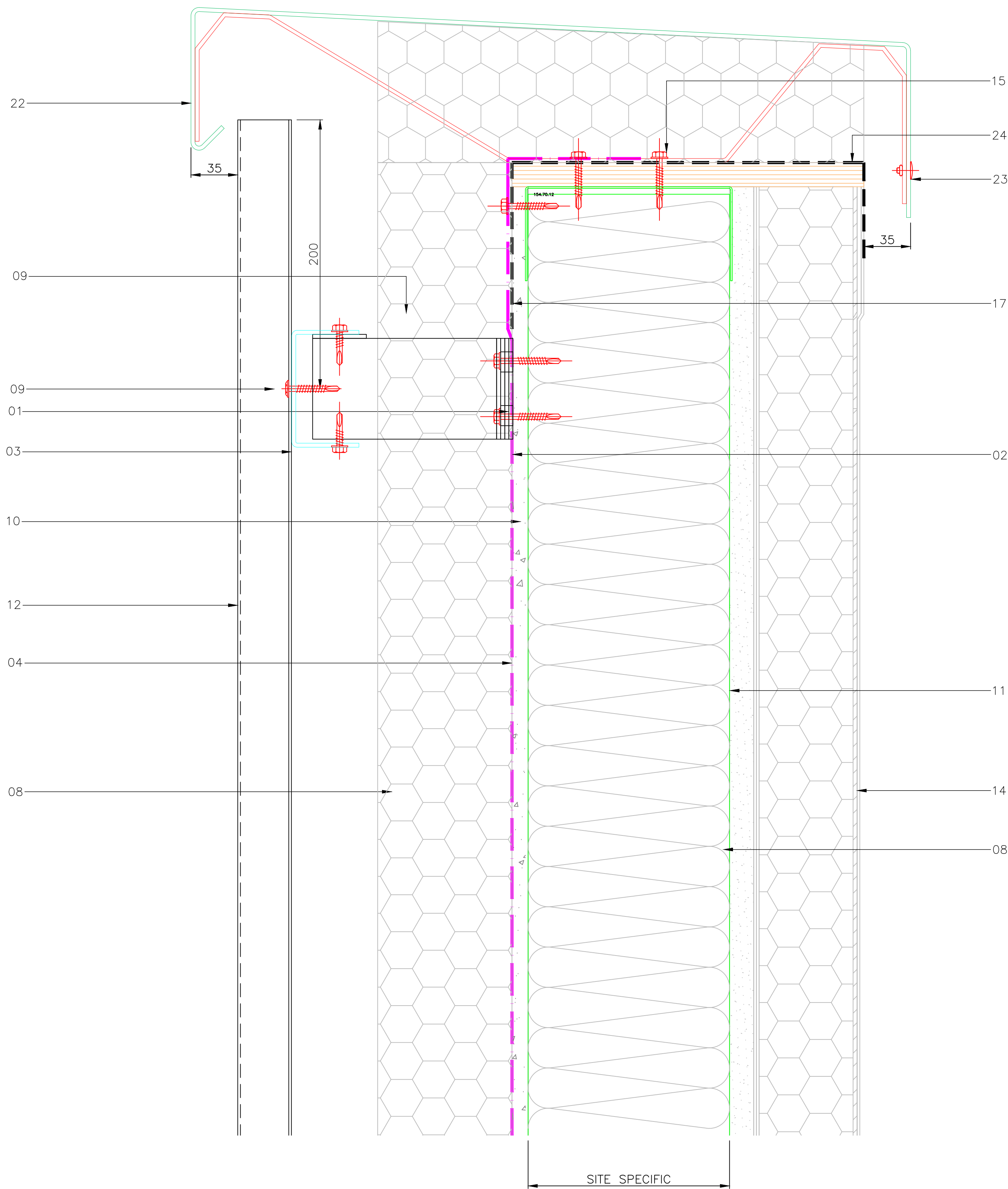
DETAIL LEGEND:	
01	3mm THICK ALUMINIUM BRACKET @ 600 CENTRES SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS
02	THERMAL ISOLATION PAD
03	3MM 1050 GRADE ALUMINIUM CONTINUOUS CHANNEL WITH HOLES PRE-DRILLED ON SITE
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
05	GENIUS CLIP
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)
07	LOW PROFILE TEK SCREW (S/S)-ALUMINIUM TO BE PREDRILLED WITH 7mm HOLE SEE FIG.1
08	INSULATION AS PER PROJECT SPECIFICATION
09	5,5 TEK SCREW (STAINLESS STEEL)
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)
13	CONTINUOUS PLANAR STARTER PACKER PPC BLACK
14	INTERNAL FINISHES
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
17	EPDM by OTHERS
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR
20	2mm CORNER SUPPORT ANGLE
21	1mm VERMIN MESH
22	COPING AND SUPPORT BRACKET
23	LOW PROFILE RIVET
24	PLYWOOD
25	FIRE BARRIER
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN
27	SIKATAK ADHESIVE
28	GENIUS JOINT PROFILE

Site Location Plan:			
General Notes: 1. All details to be read in conjunction with H92 Specification and engineers project specific calculations. 2. Panel gaps over 10mm to have insect mesh installed behind.			
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Drawing Reference		GF-LINEAR-D-05a	



DETAIL LEGEND:	
01	3mm THICK ,75/150mm DEEP ALUMINIUM HELPING HAND BRACKET & BACKING PLATE FIXED TO STRUCTURE (SEE ALTERNATIVE FIXING DETAIL FIG 2), SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS DEAD FIXED OR SLIDING BRACKET (FIG.3) LOCATIONS TBA BY ENGINEER AS PROJECT SPECIFIC©
02	THERMAL ISOLATION PAD
03	2.2mm EXTRUDED 'L' OR 'T' RAIL MILL FINISHED AS STANDARD PPC IF REQUIRED <COLOUR / FINISH>
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
05	GENIUS CLIP
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)
07	LOW PROFILE TEK SCREW (S/S)
08	INSULATION AS PER PROJECT SPECIFICATION
09	5.5 TEK SCREW (STAINLESS STEEL)
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)
13	FLASHING
14	INTERNAL FINISHES
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
17	EPDM by OTHERS
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR
20	2mm CORNER SUPPORT ANGLE
21	1mm VERMIN MESH
22	COPING AND SUPPORT BRACKET
23	LOW PROFILE RIVET
24	PLYWOOD
25	FIRE BARRIER
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN
27	3M 1mm TAPE AT HORIZONTAL PANEL JOINT
28	GENIUS JOINT PROFILE

Site Location Plan:			
General Notes:			
1. All details to be read in conjunction with H92 Specification and engineers project specific calculations.			
2. Panel gaps over 10mm to have insect mesh installed behind.			
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GENIUS LINEAR ALUMINIUM COPING DETAIL			
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Drawing Reference		GF-LINEAR-D-06	



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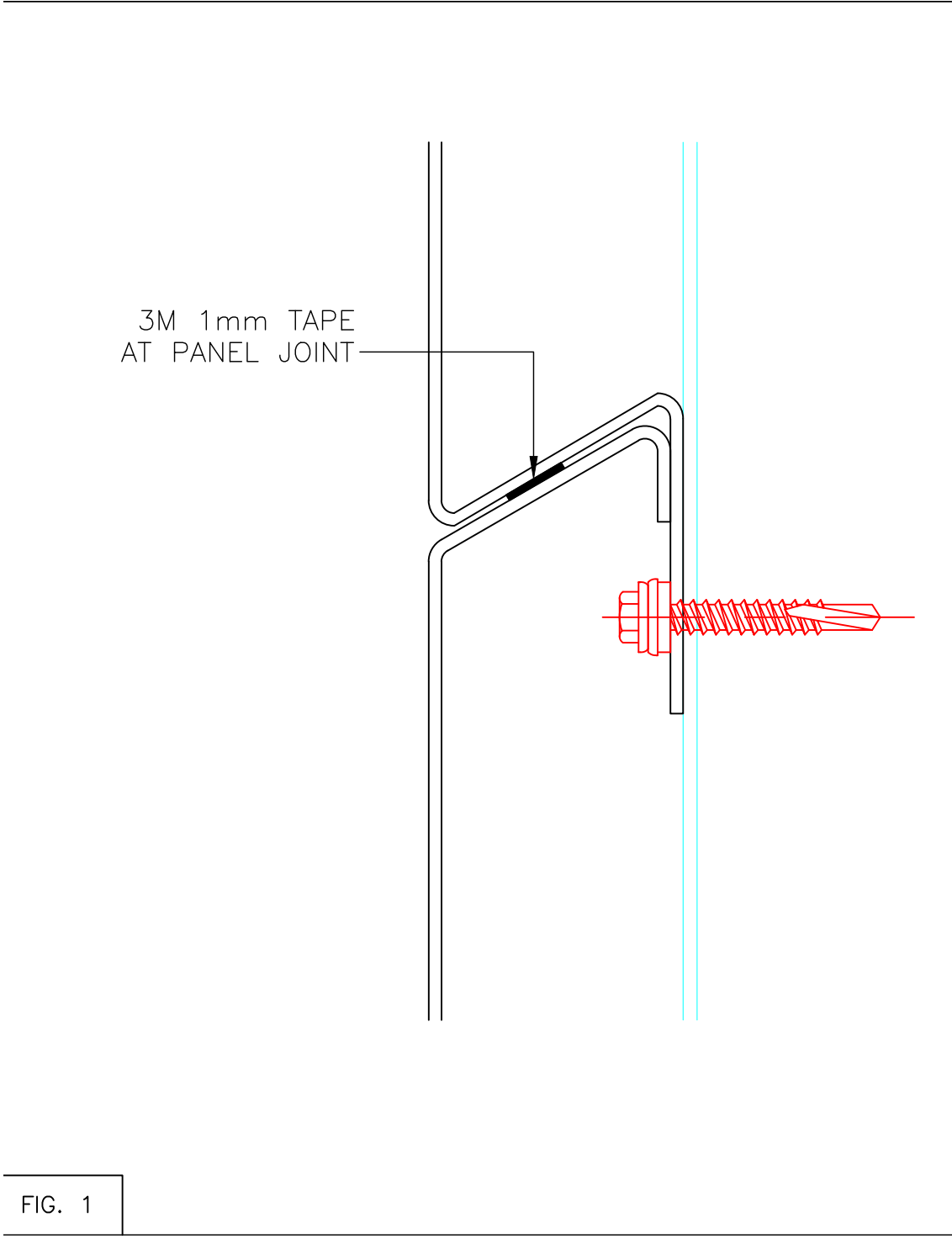


FIG. 1

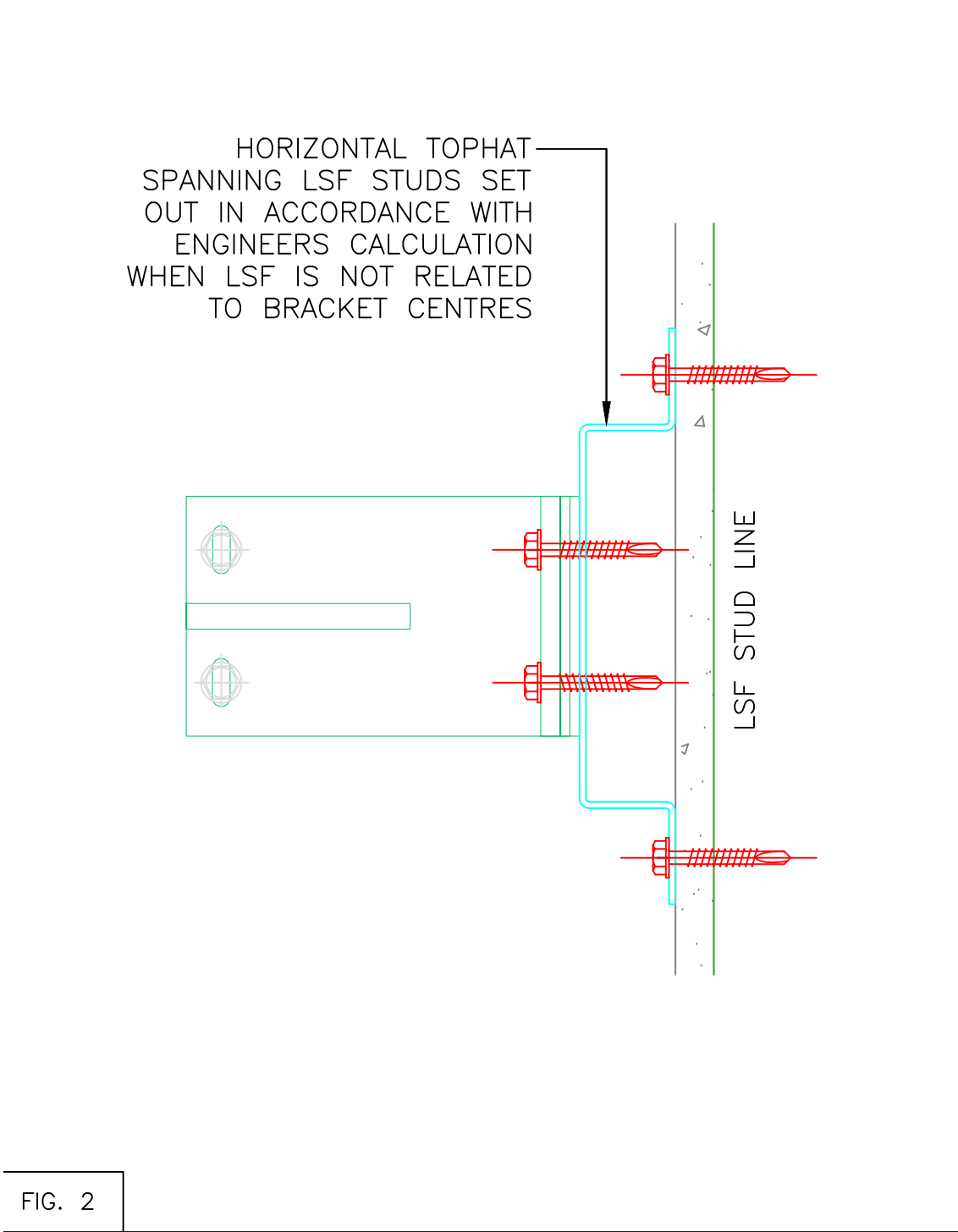


FIG. 2

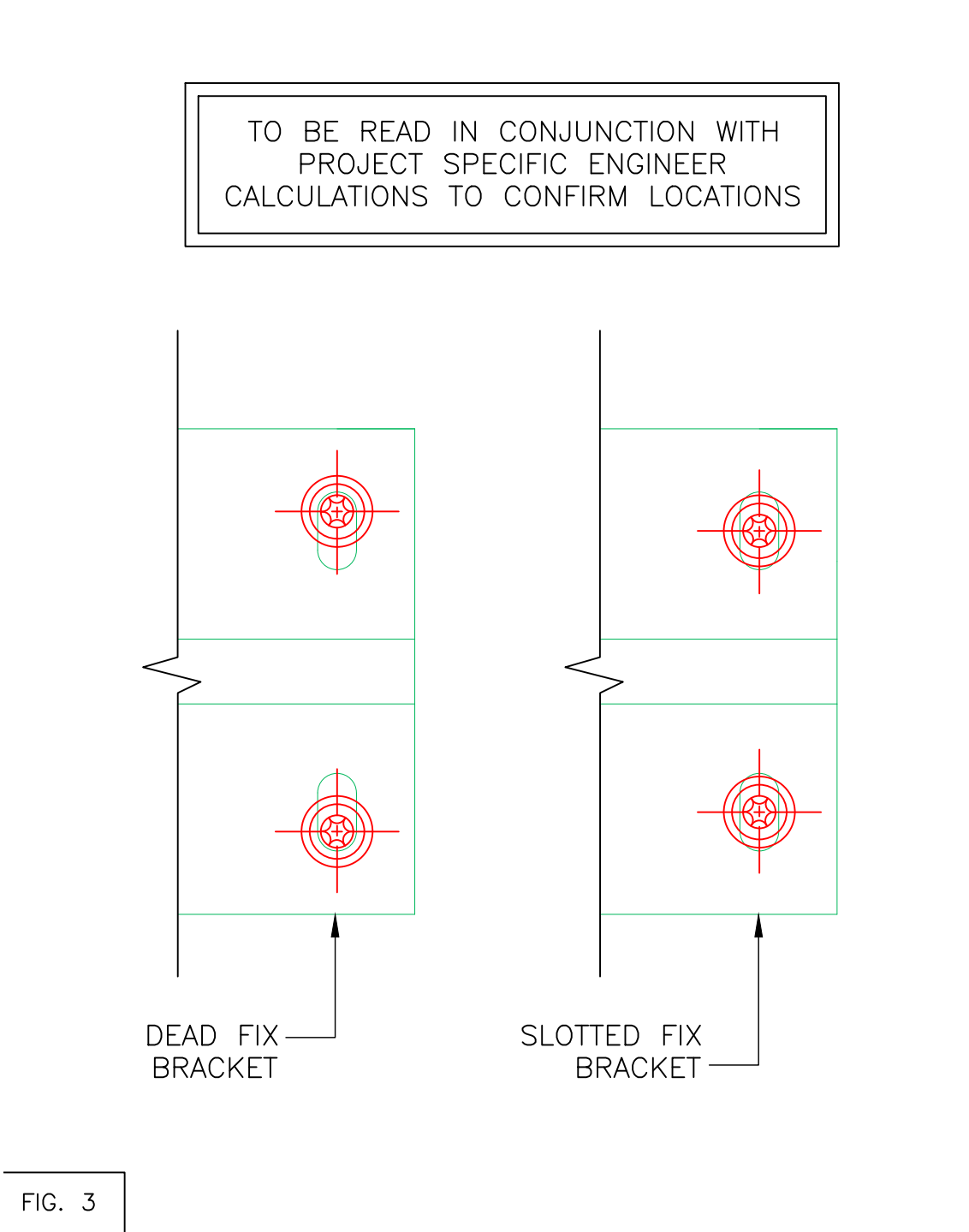
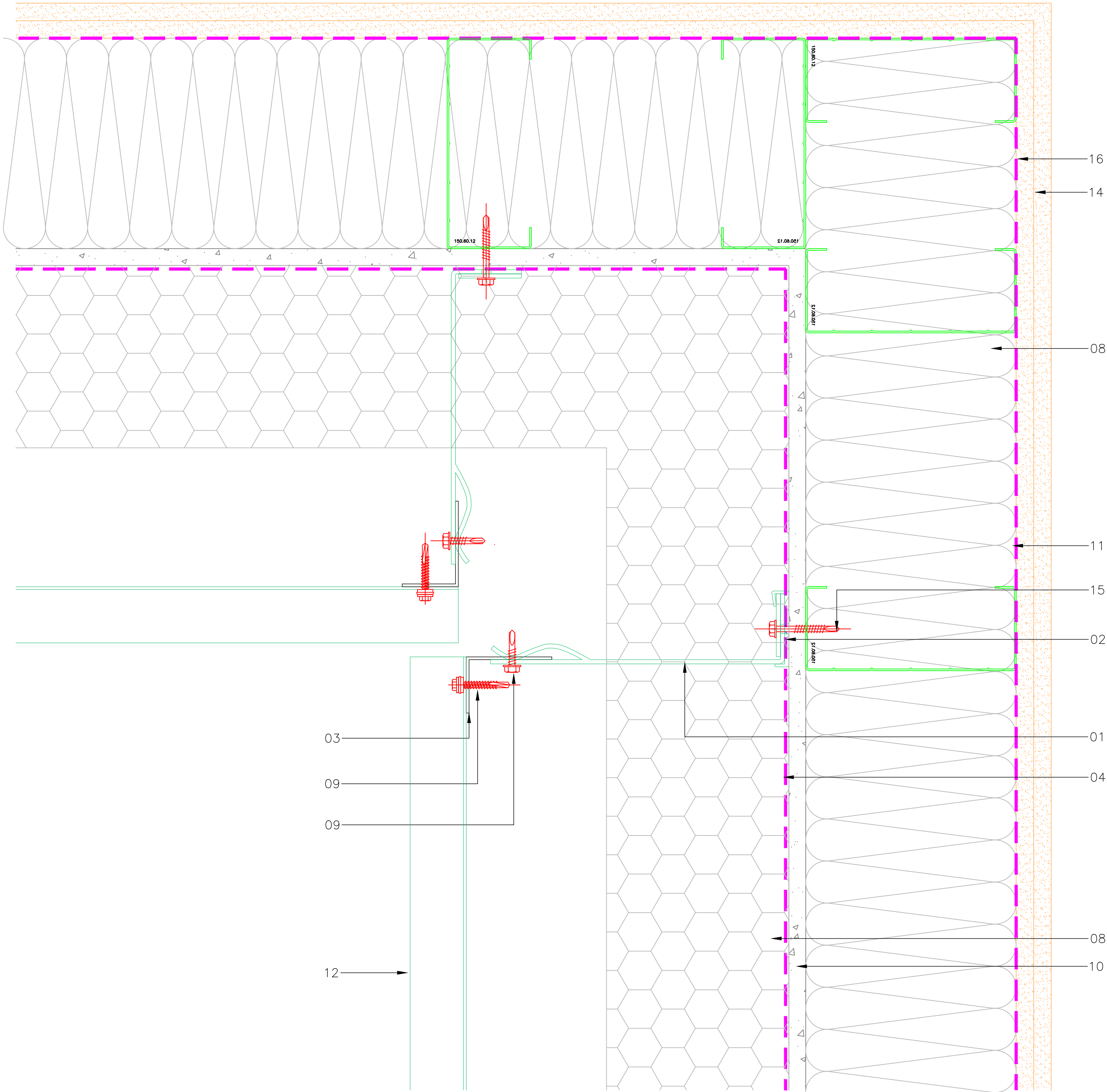
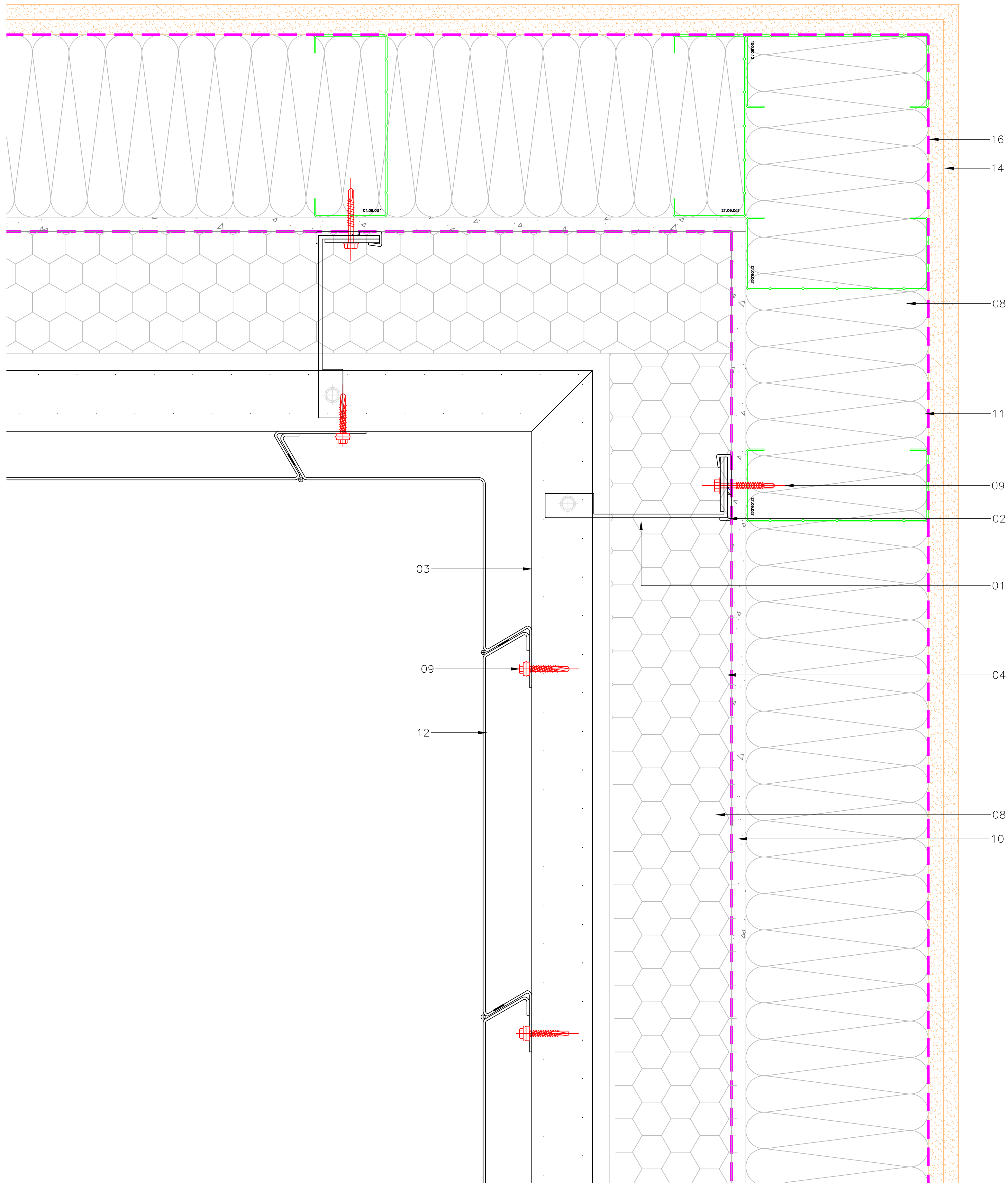
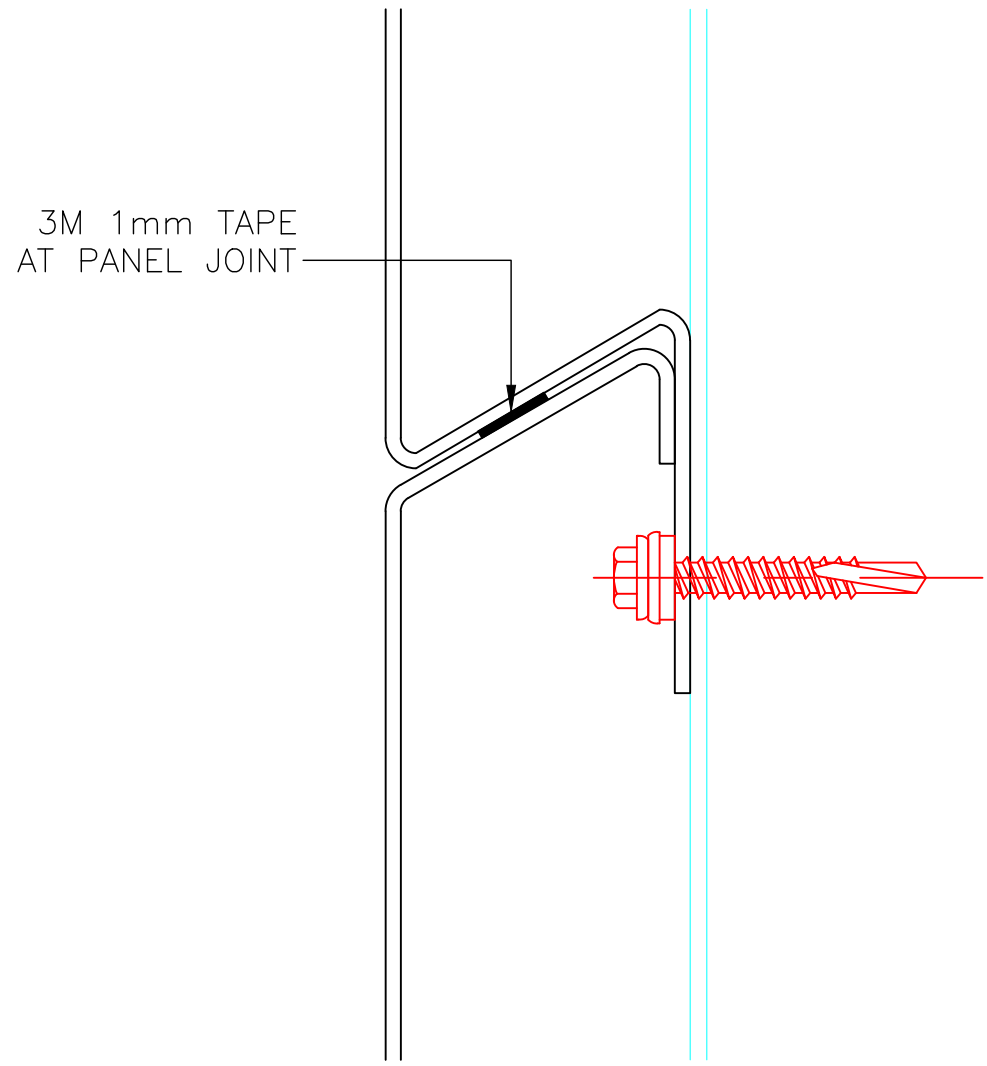


FIG. 3



DETAIL LEGEND:		Site Location Plan:	
01	3mm THICK ,75/150mm DEEP ALUMINIUM HELPING HAND BRACKET & BACKING PLATE FIXED TO STRUCTURE (SEE ALTERNATIVE FIXING DETAIL FIG 2), SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS DEAD FIXED OR SLIDING BRACKET (FIG.3) LOCATIONS TBA BY ENGINEER AS PROJECT SPECIFIC©	General Notes: 1. All details to be read in conjunction with H92 Specification and engineers project specific calculations. 2. Panel gaps over 10mm to have insect mesh installed behind.	
02	THERMAL ISOLATION PAD		
03	2.2mm EXTRUDED 'L' OR 'T' RAIL MILL FINISHED AS STANDARD PPC IF REQUIRED <COLOUR / FINISH>		
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS		
05	GENIUS CLIP		
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)		
07	LOW PROFILE TEK SCREW (S/S)		
08	INSULATION AS PER PROJECT SPECIFICATION		
09	5.5 TEK SCREW (STAINLESS STEEL)		
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS		
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION	DRAWING DESIGN AND SPECIFICATION REMAINS THE PROPERTY OF GENIUS FACADES.	
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)	© COPYRIGHT GENIUS FACADES 2013	
13	FLASHING	Rev	By: Date: Description
14	INTERNAL FINISHES	.	00.00.00 00.00.00
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER		
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS		
17	EPDM by OTHERS		
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING		
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR		
20	2mm CORNER SUPPORT ANGLE		
21	1mm VERMIN MESH		
22	COPING AND SUPPORT BRACKET		
23	LOW PROFILE RIVET		
24	PLYWOOD		
25	FIRE BARRIER	Client:	
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN		
27	3M 1mm TAPE AT HORIZONTAL PANEL JOINT		
28	GENIUS JOINT PROFILE		
		Project Name and Address: GENIUS LINEAR STANDARD DETAILS ALUMINIUM	
		Drawing Title: GENIUS LINEAR ALUMINIUM INTERNAL CORNER DETAIL	
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		GENIUS FACADES QUALITY. TESTED. INNOVATION.	



DETAIL LEGEND:	
01	3mm THICK ALUMINIUM BRACKET @ 600 CENTRES SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS
02	THERMAL ISOLATION PAD
03	3MM 1050 GRADE ALUMINIUM CONTINUOUS CHANNEL WITH HOLES PRE-DRILLED ON SITE
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
05	GENIUS CLIP
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)
07	LOW PROFILE TEK SCREW (S/S)-ALUMINIUM TO BE PREDRILLED WITH 7mm HOLE SEE FIG.1
08	INSULATION AS PER PROJECT SPECIFICATION
09	5.5 TEK SCREW (STAINLESS STEEL)
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)
13	CONTINUOUS PLANAR STARTER PACKER PPC BLACK
14	INTERNAL FINISHES
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
17	EPDM by OTHERS
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR
20	2mm CORNER SUPPORT ANGLE
21	1mm VERMIN MESH
22	COPING AND SUPPORT BRACKET
23	LOW PROFILE RIVET
24	PLYWOOD
25	FIRE BARRIER
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN
27	SIKATAK ADHESIVE
28	GENIUS JOINT PROFILE

Site Location Plan:			
General Notes:			
1. All details to be read in conjunction with H92 Specification and engineers project specific calculations.			
2. Panel gaps over 10mm to have insect mesh installed behind.			
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Client:			
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Drawing Title: GENIUS VERTICAL LINEAR ALUMINIUM INTERNAL CORNER DETAIL			
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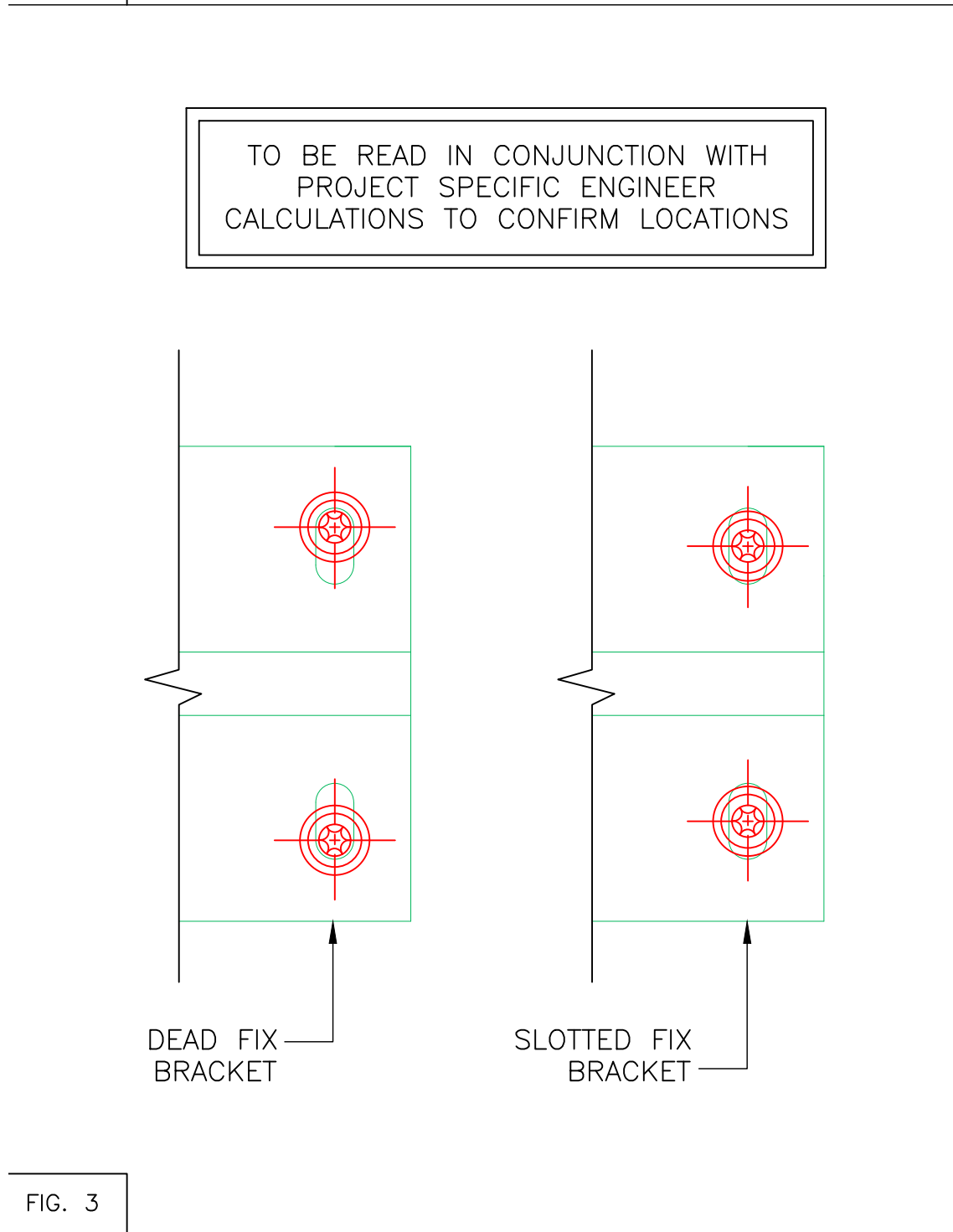
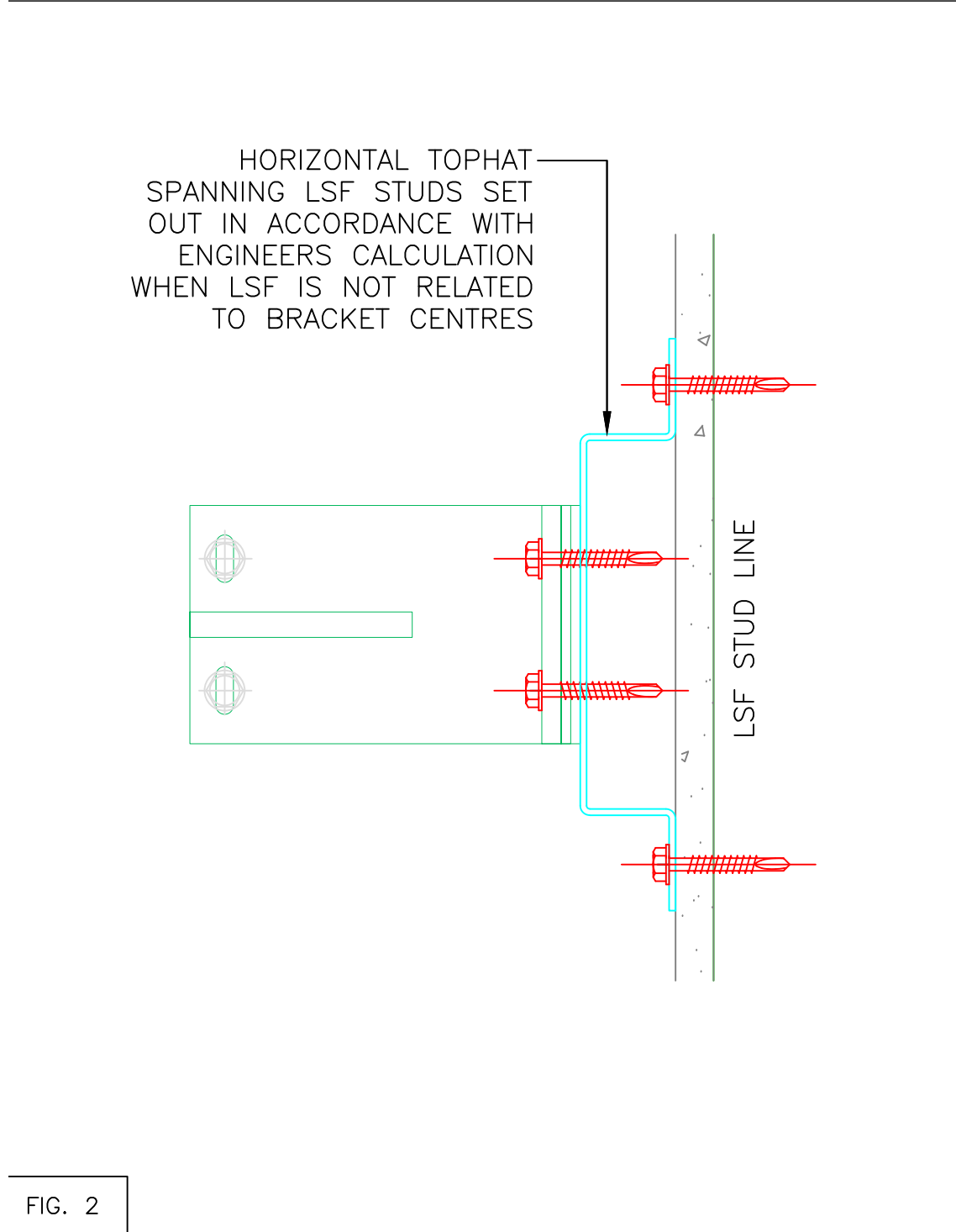
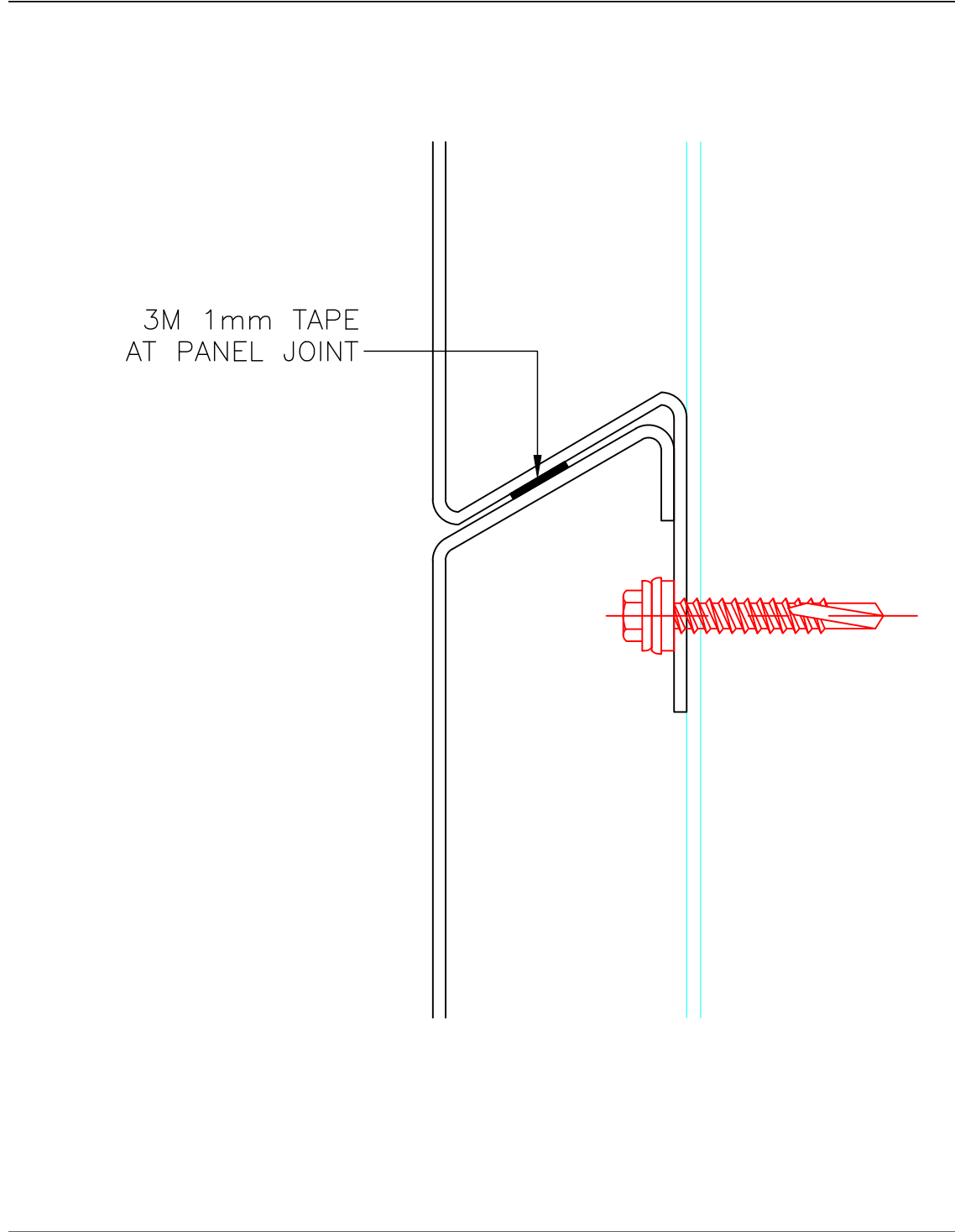
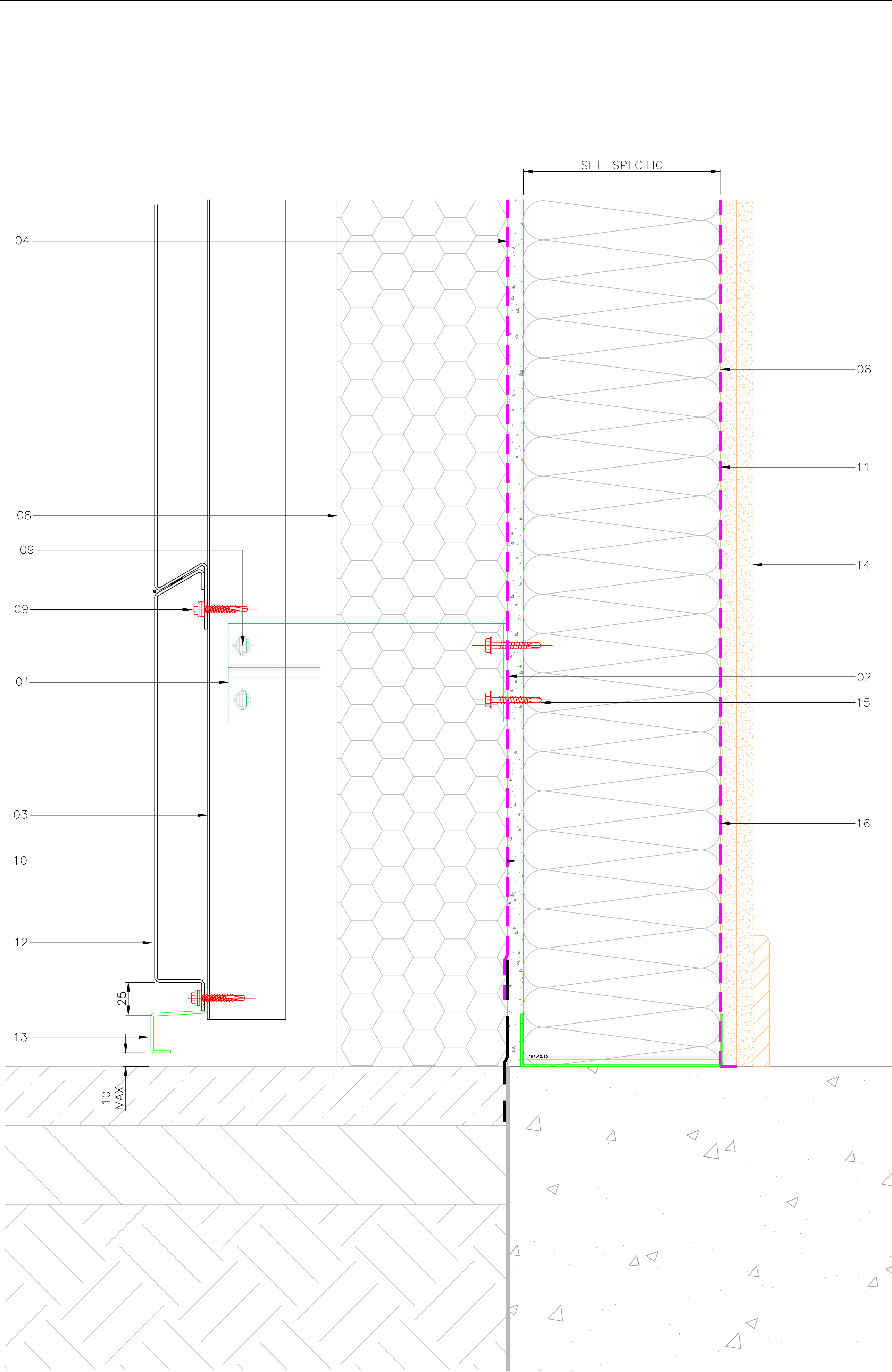
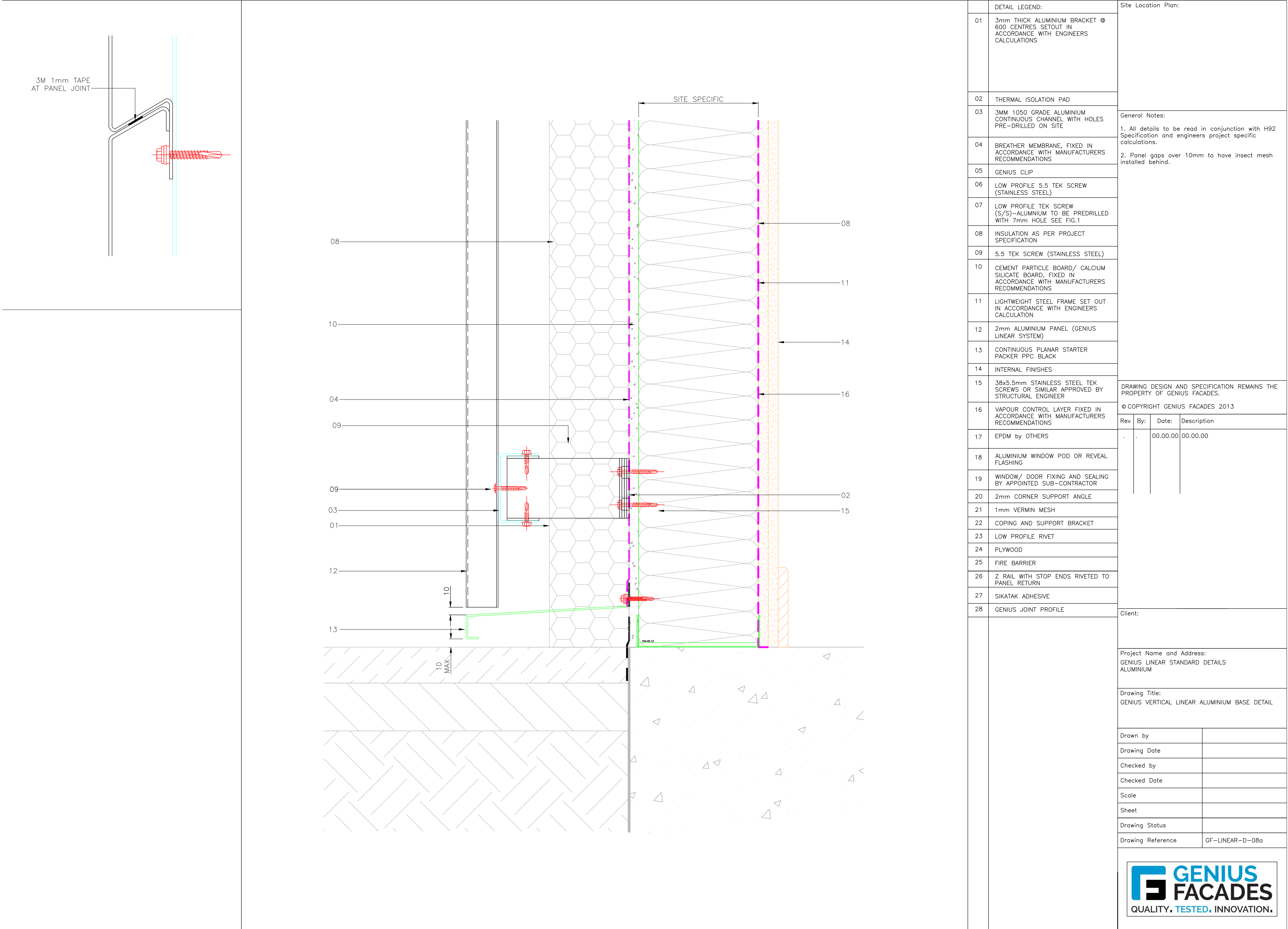


FIG. 3

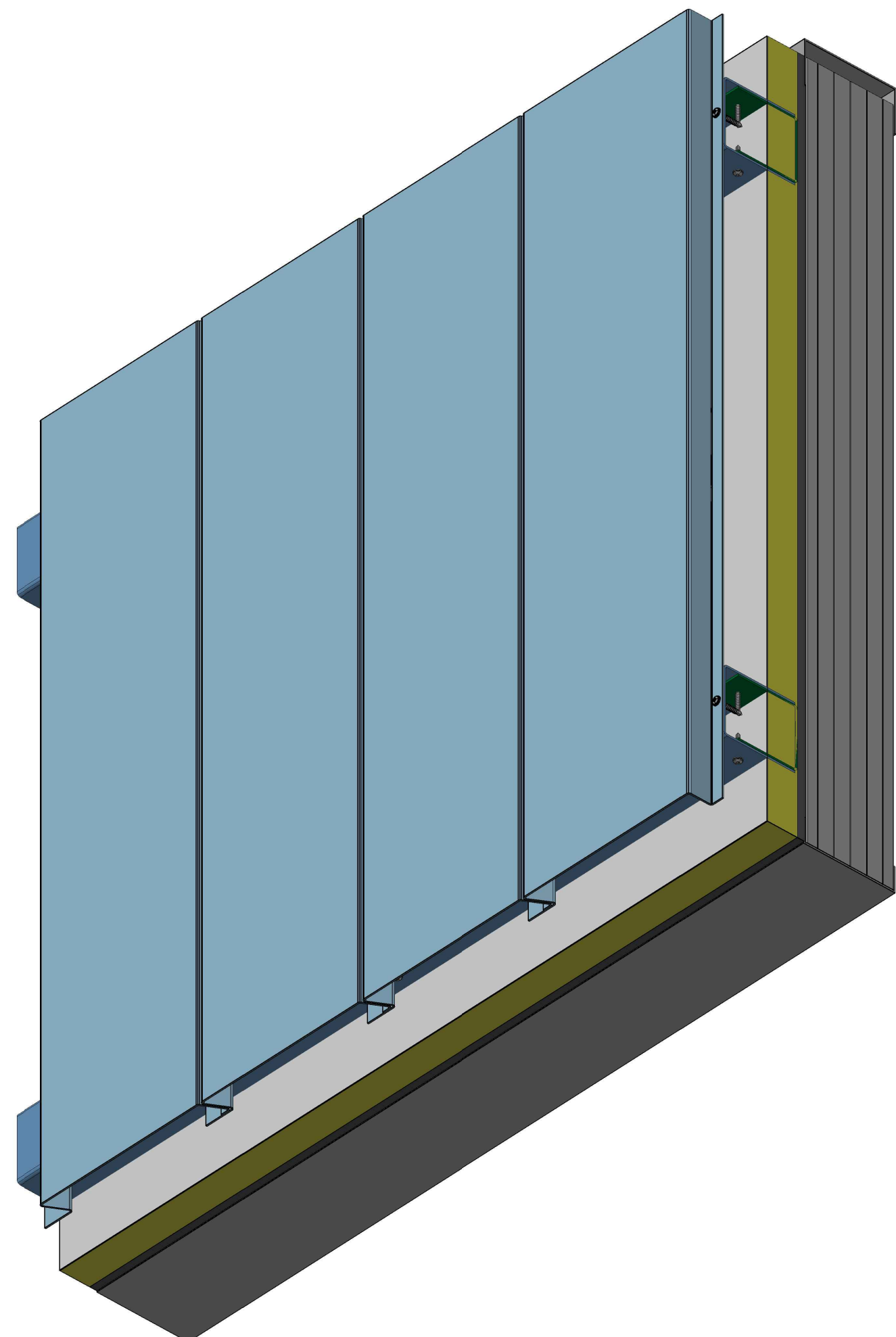
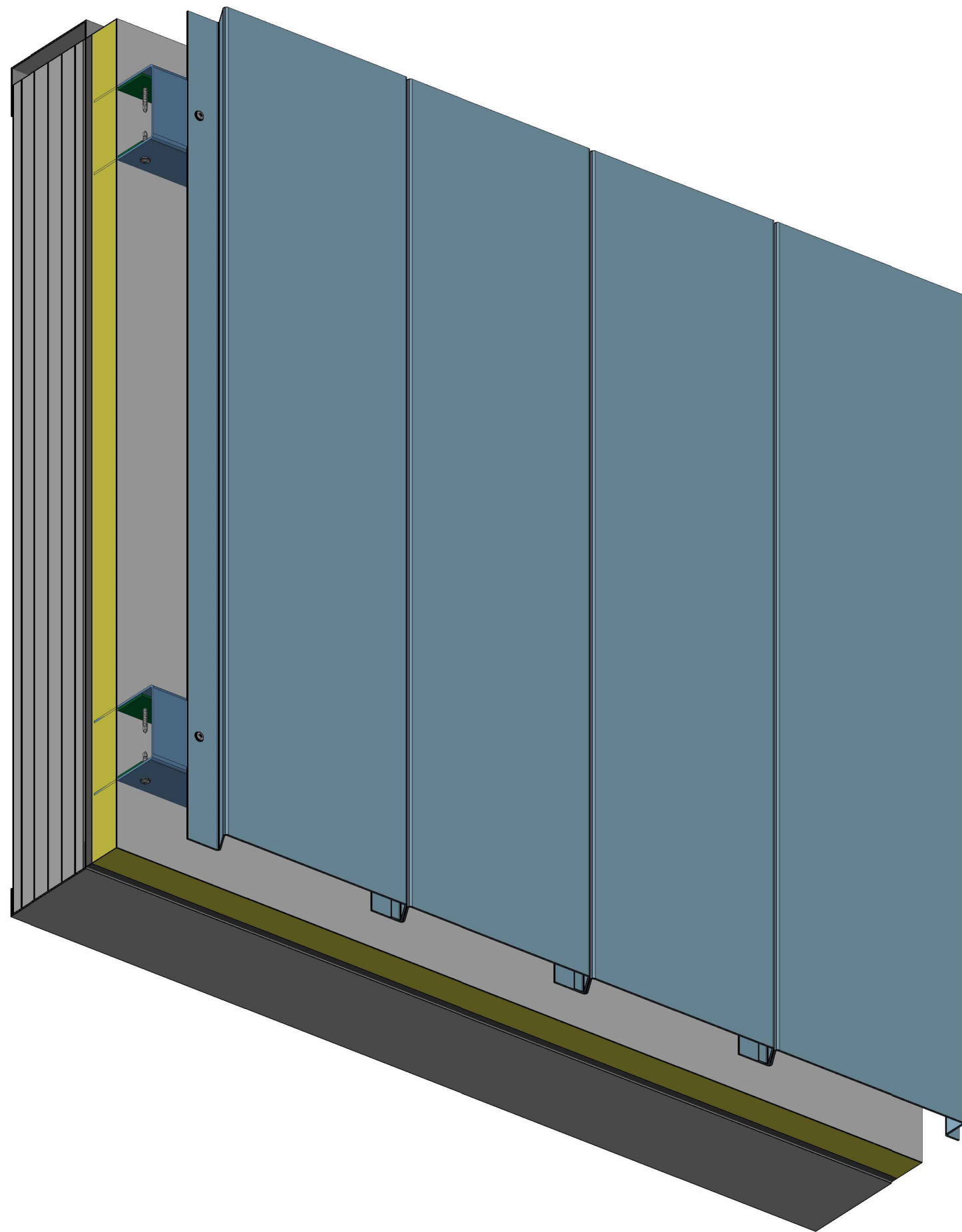
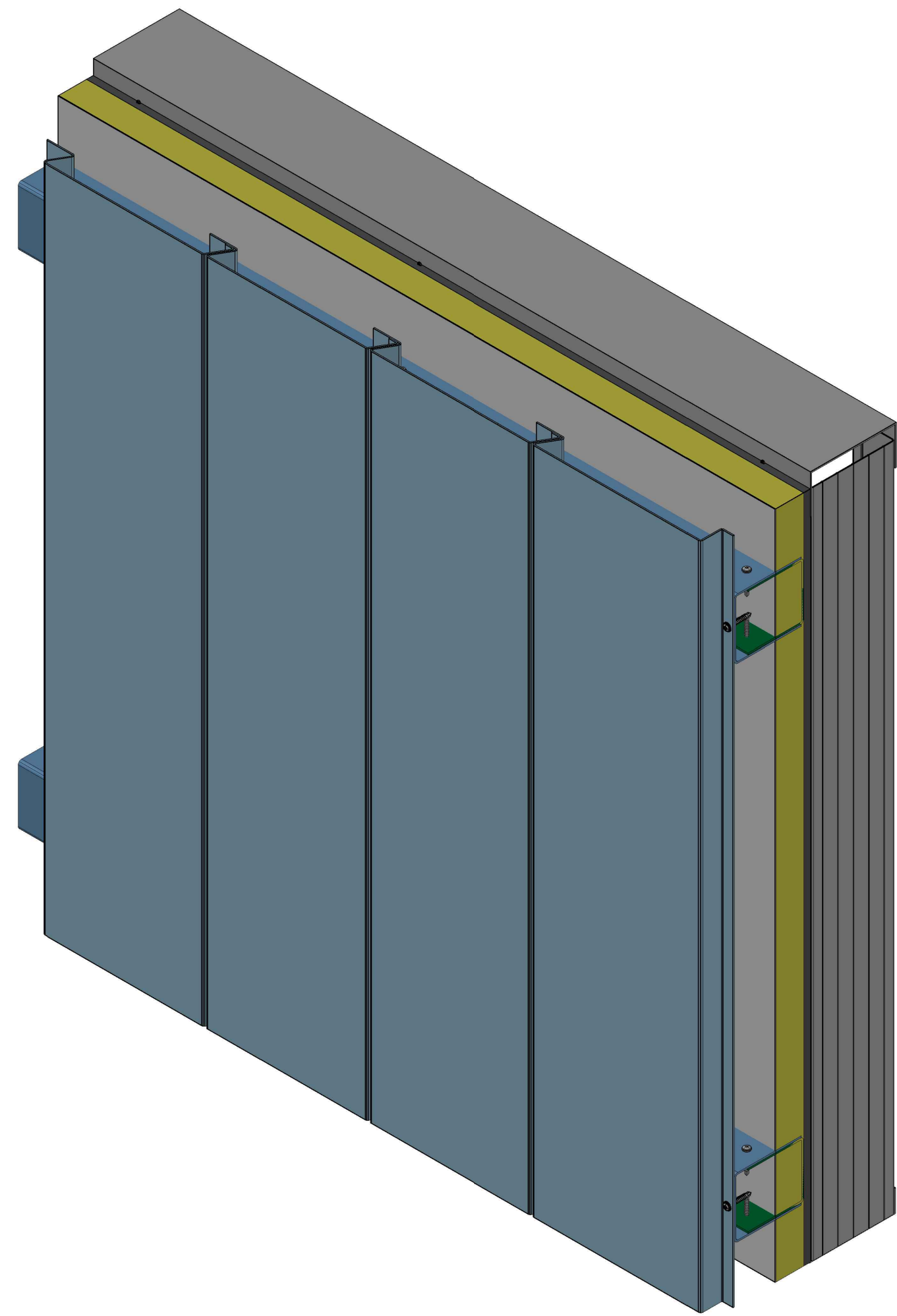
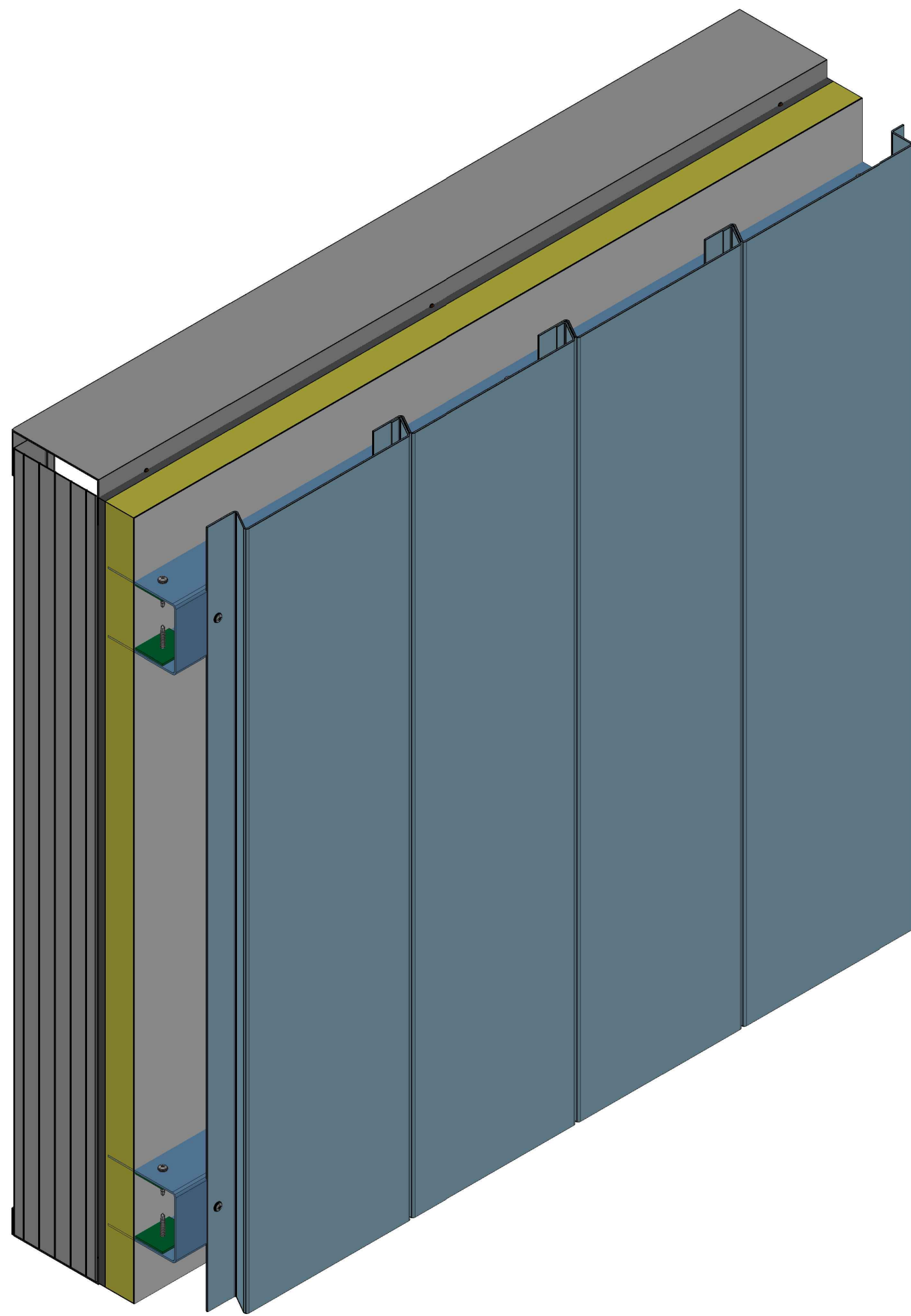


	DETAIL LEGEND:	Site Location Plan:	
01	3mm THICK ,75/150mm DEEP ALUMINIUM HELPING HAND BRACKET & BACKING PLATE FIXED TO STRUCTURE (SEE ALTERNATIVE FIXING DETAIL FIG.2), SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS DEAD-FIXED OR SLIDING BRACKET (FIG.3) LOCATIONS TBA BY ENGINEER AS PROJECT SPECIFIC©	General Notes: 1. All details to be read in conjunction with H92 Specification and engineers project specific calculations. 2. Panel gaps over 10mm to have insect mesh installed behind.	
02	THERMAL ISOLATION PAD		
03	2.2mm EXTRUDED 'L' OR 'T' RAIL MILL FINISHED AS STANDARD PPC IF REQUIRED <COLOUR / FINISH>		
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS		
05	GENIUS CLIP		
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)		
07	LOW PROFILE TEK SCREW (S/S)-ALUMNIUM TO BE PREDRILLED WITH 7mm HOLE SEE FIG.1		
08	INSULATION AS PER PROJECT SPECIFICATION		
09	5.5 TEK SCREW (STAINLESS STEEL)		
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS		
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION	DRAWING DESIGN AND SPECIFICATION REMAINS THE PROPERTY OF GENIUS FACADES.	
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)	© COPYRIGHT GENIUS FACADES 2013	
13	FLASHING	Rev	By: Date: Description
14	INTERNAL FINISHES	.	00.00.00 00.00.00
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER		
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS		
17	EPDM by OTHERS		
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING		
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR		
20	2mm CORNER SUPPORT ANGLE		
21	1mm VERMIN MESH		
22	COPING AND SUPPORT BRACKET		
23	LOW PROFILE RIVET		
24	PLYWOOD		
25	FIRE BARRIER		
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN		
27	SIKATAK ADHESIVE		
28	GENIUS JOINT PROFILE		
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		GENIUS FACADES QUALITY. TESTED. INNOVATION.	



DETAIL LEGEND:	
01	3mm THICK ALUMINIUM BRACKET @ 600 CENTRES SETOUT IN ACCORDANCE WITH ENGINEERS CALCULATIONS
02	THERMAL ISOLATION PAD
03	3MM 1050 GRADE ALUMINIUM CONTINUOUS CHANNEL WITH HOLES PRE-DRILLED ON SITE
04	BREATHER MEMBRANE, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
05	GENIUS CLIP
06	LOW PROFILE 5.5 TEK SCREW (STAINLESS STEEL)
07	LOW PROFILE TEK SCREW (S/S)-ALUMNIUM TO BE PREDRILLED WITH 7mm HOLE SEE FIG.1
08	INSULATION AS PER PROJECT SPECIFICATION
09	5,5 TEK SCREW (STAINLESS STEEL)
10	CEMENT PARTICLE BOARD/ CALCIUM SILICATE BOARD, FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
11	LIGHTWEIGHT STEEL FRAME SET OUT IN ACCORDANCE WITH ENGINEERS CALCULATION
12	2mm ALUMINIUM PANEL (GENIUS LINEAR SYSTEM)
13	CONTINUOUS PLANAR STARTER PACKER PPC BLACK
14	INTERNAL FINISHES
15	38x5.5mm STAINLESS STEEL TEK SCREWS OR SIMILAR APPROVED BY STRUCTURAL ENGINEER
16	VAPOUR CONTROL LAYER FIXED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS
17	EPDM by OTHERS
18	ALUMINIUM WINDOW POD OR REVEAL FLASHING
19	WINDOW/ DOOR FIXING AND SEALING BY APPOINTED SUB-CONTRACTOR
20	2mm CORNER SUPPORT ANGLE
21	1mm VERMIN MESH
22	COPING AND SUPPORT BRACKET
23	LOW PROFILE RIVET
24	PLYWOOD
25	FIRE BARRIER
26	Z RAIL WITH STOP ENDS RIVETED TO PANEL RETURN
27	SIKATAK ADHESIVE
28	GENIUS JOINT PROFILE

Site Location Plan:			
General Notes: 1. All details to be read in conjunction with H92 Specification and engineers project specific calculations. 2. Panel gaps over 10mm to have insect mesh installed behind.			
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Drawing Status			
Drawing Reference		GF-LINEAR-D-08a	



Site Location Plan:

- General Notes:
1. All details to be read in conjunction with H92 Specification and engineers project specific calculations.
 2. Panel gaps over 10mm to have insect mesh installed behind.

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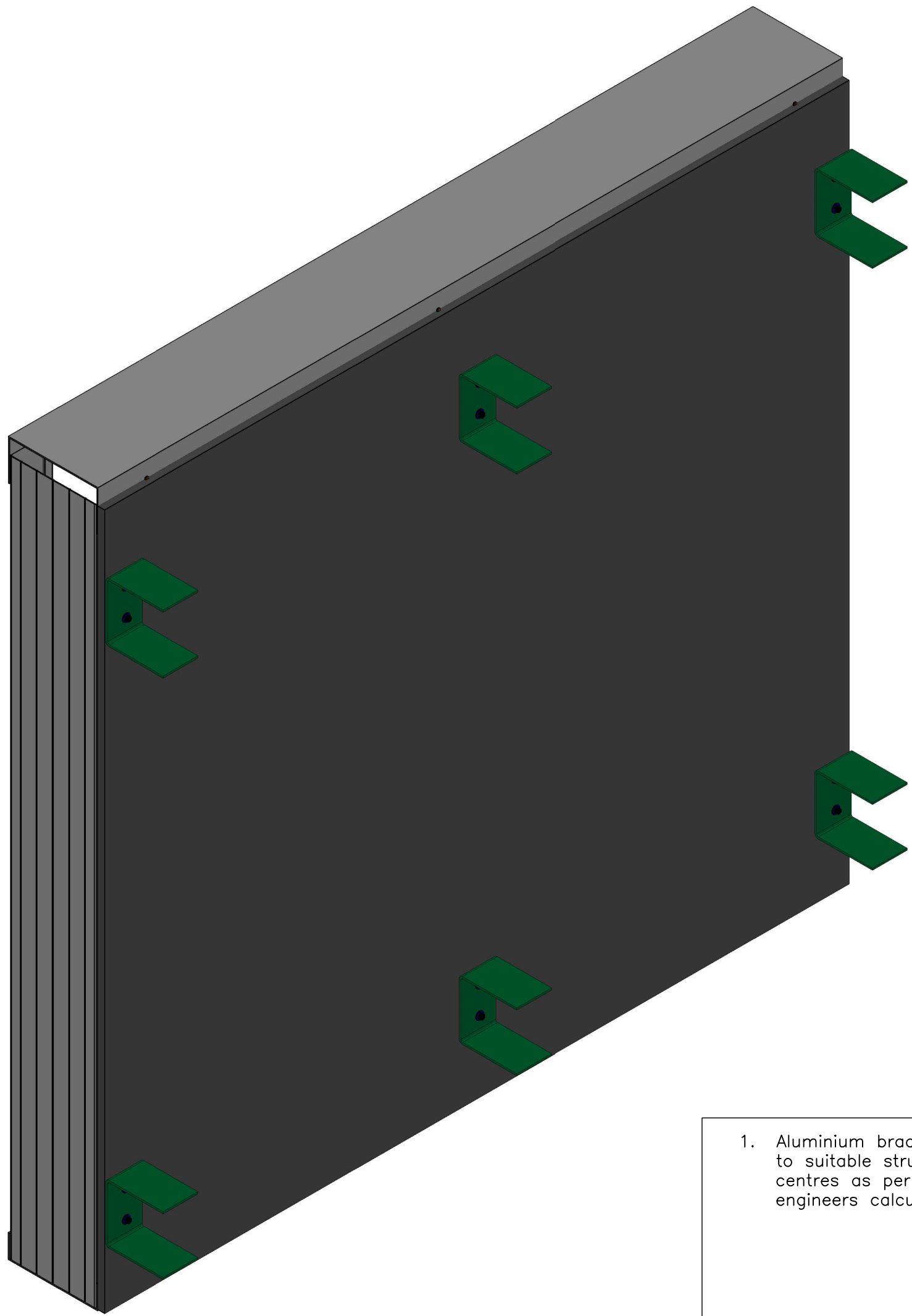
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ALUMINIUM

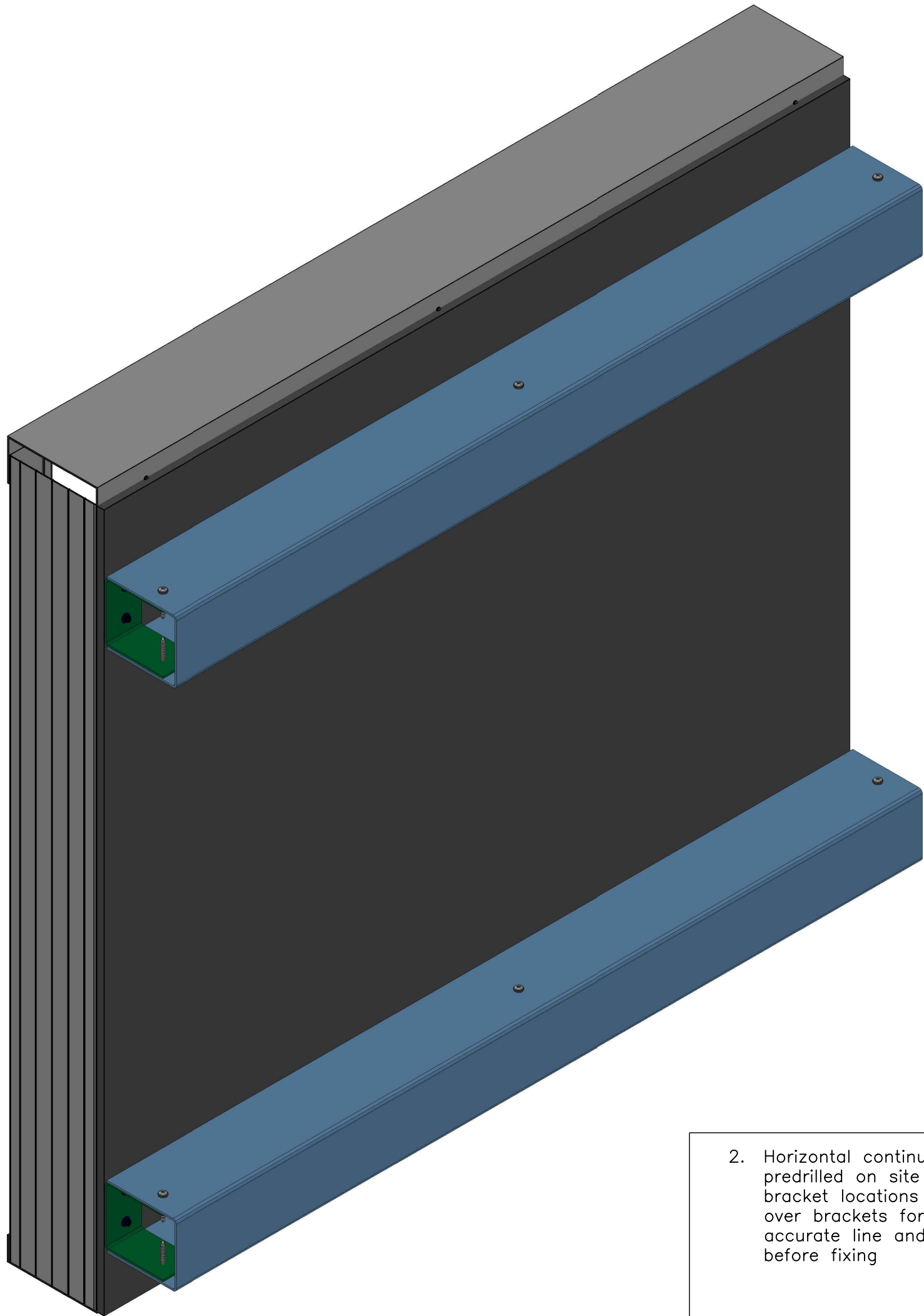
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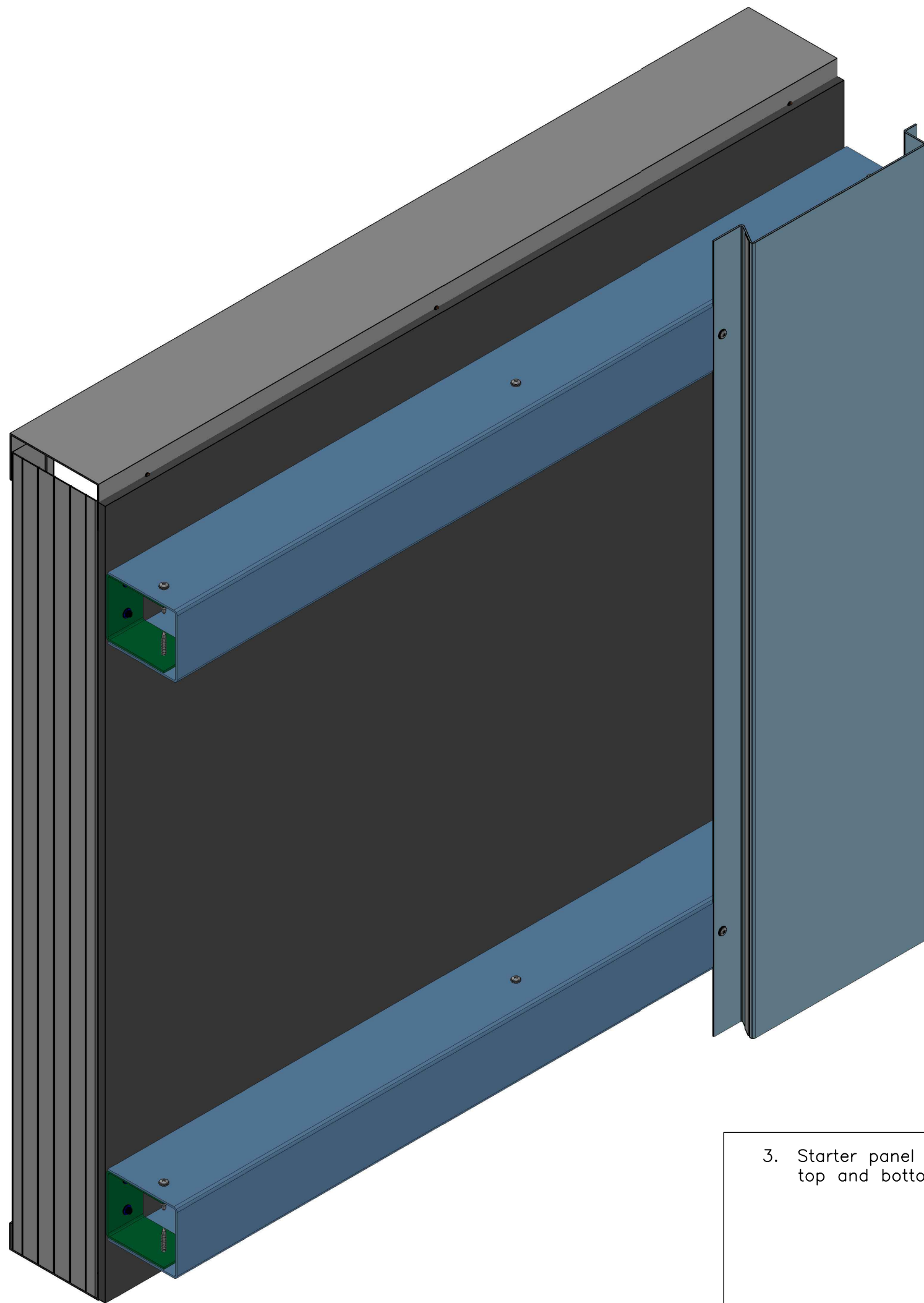




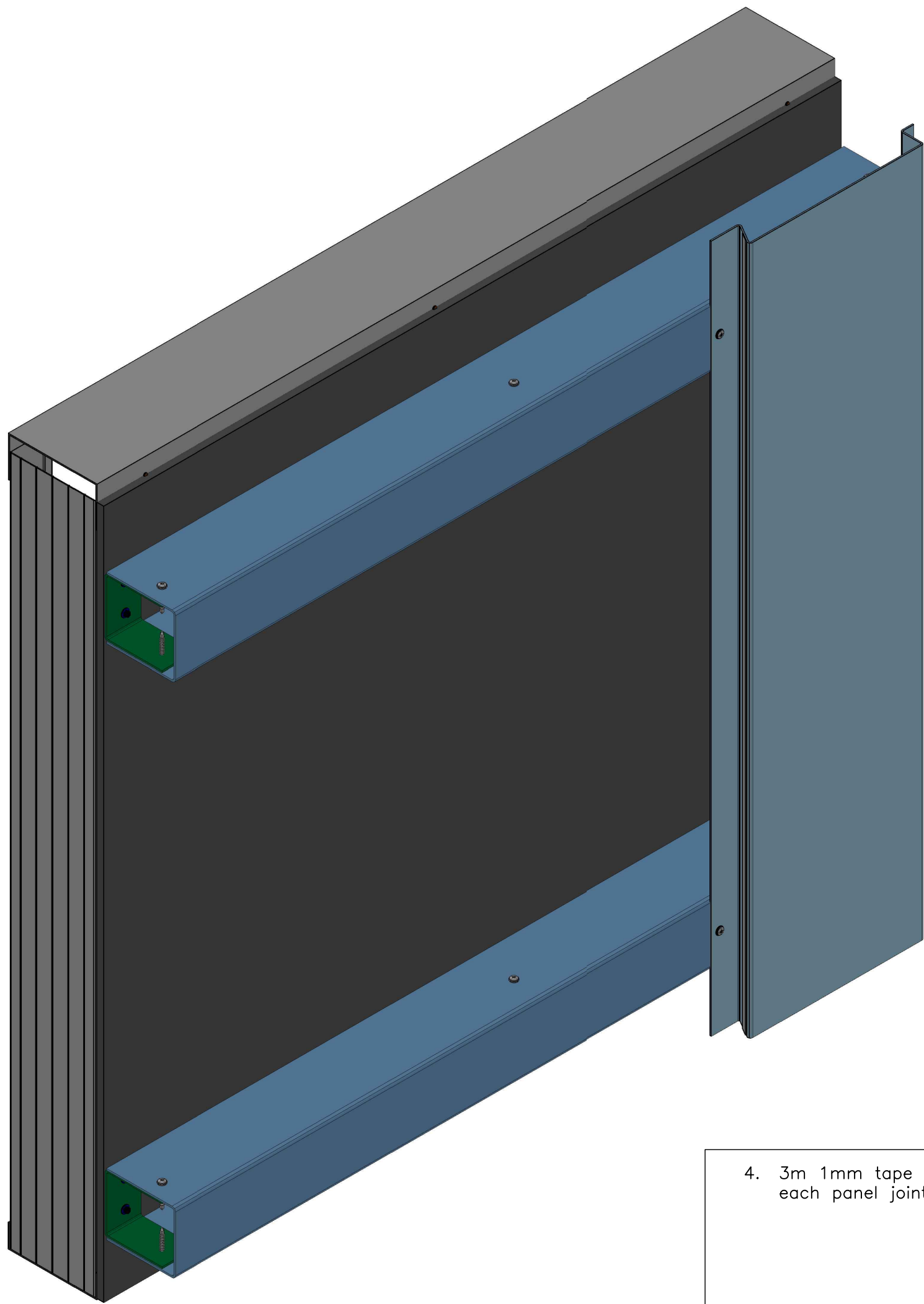
1. Aluminium brackets fixed to suitable structure at centres as per structural engineers calculations



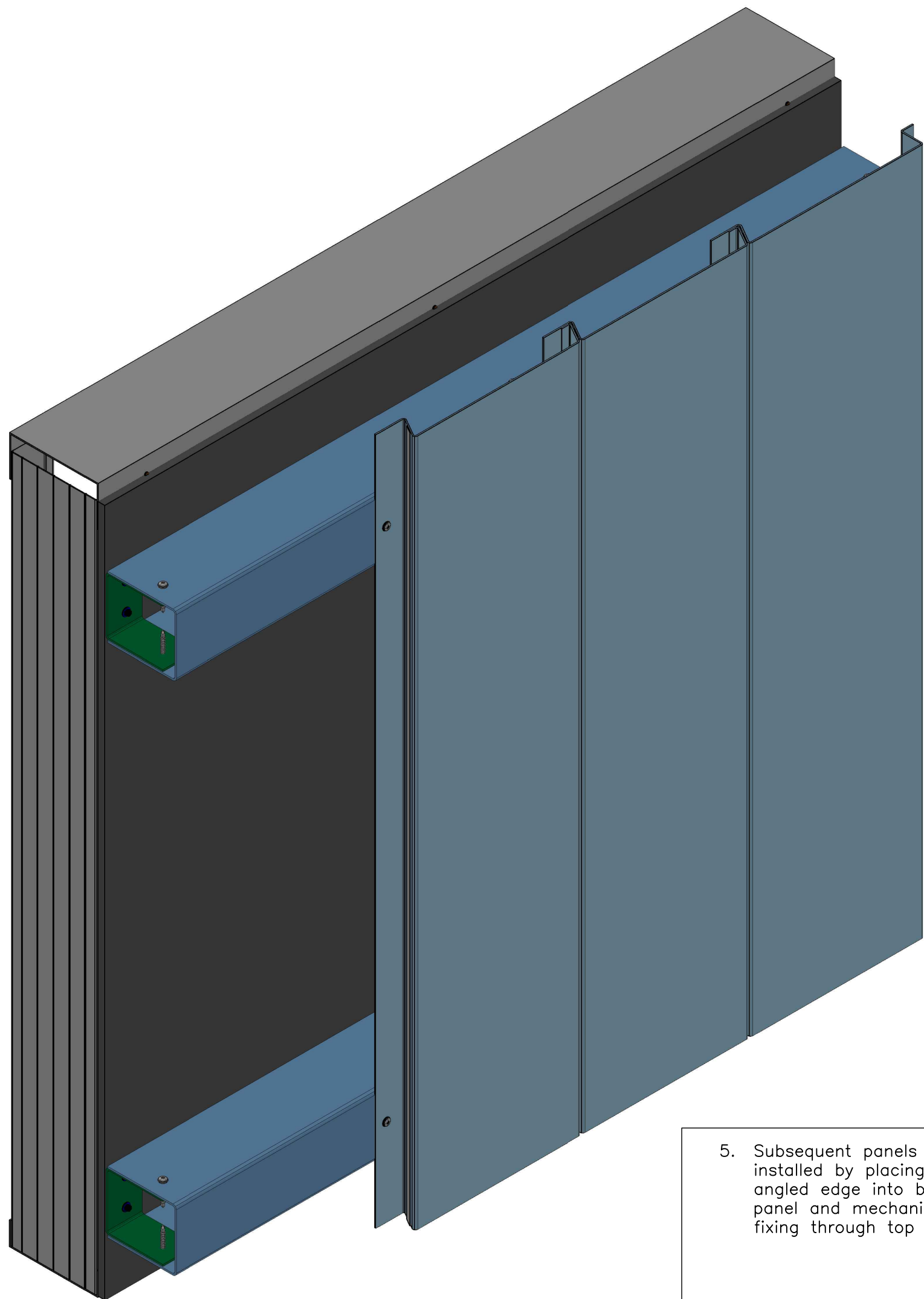
2. Horizontal continuous rail predrilled on site at bracket locations slotted over brackets for accurate line and level before fixing



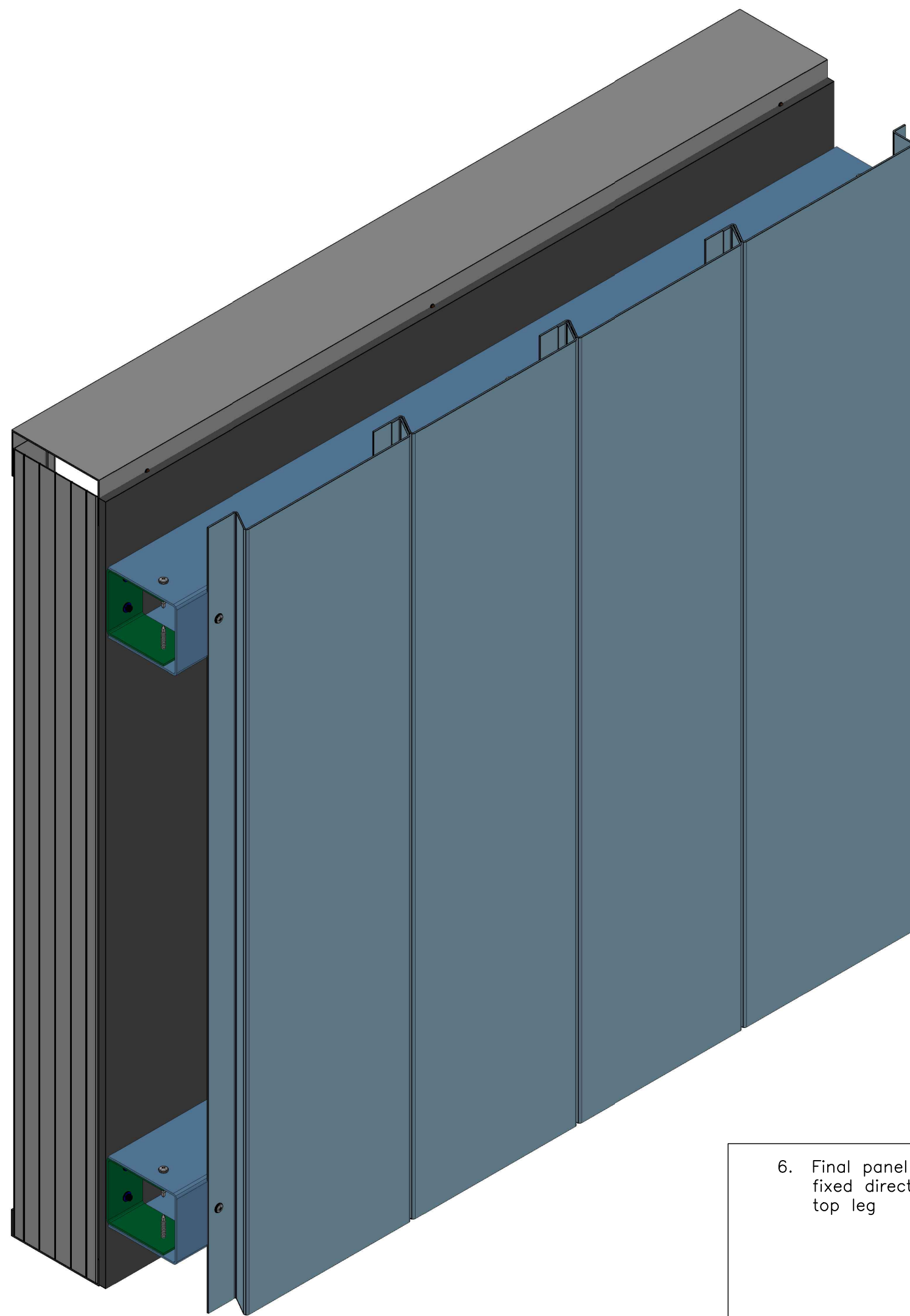
3. Starter panel fixed at top and bottom



4. 3m 1mm tape added on each panel joint



5. Subsequent panels installed by placing angled edge into below panel and mechanical fixing through top leg.



6. Final panel can be fixed direct through top leg

Site Location Plan:

General Notes:

1. All details to be read in conjunction with H92 Specification and engineers project specific calculations.
2. Panel gaps over 10mm to have insect mesh installed behind.
3. Panels to be predrilled before fixing as per standard details
4. Flashings maybe required at either end of system due to module setting out.

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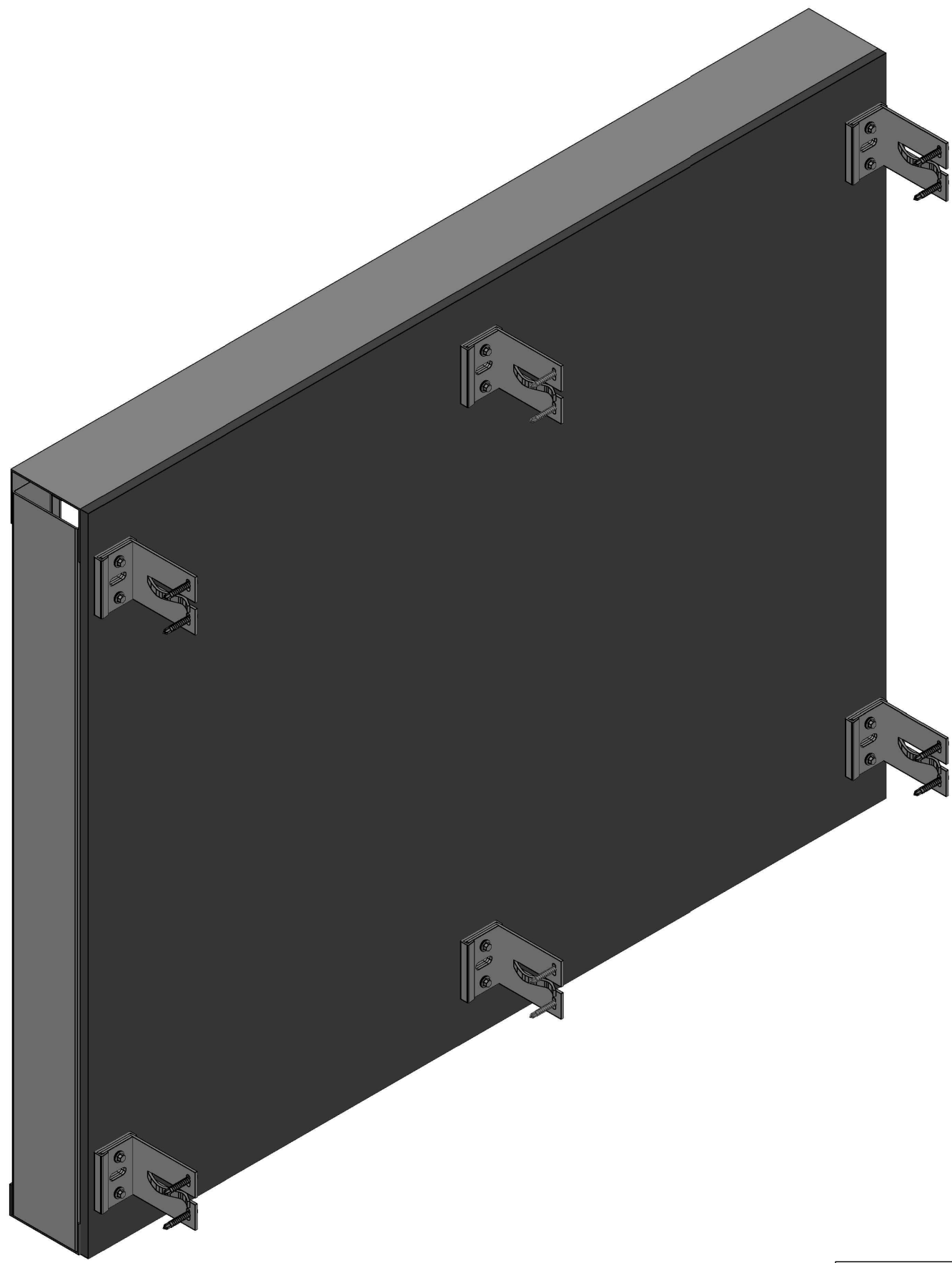
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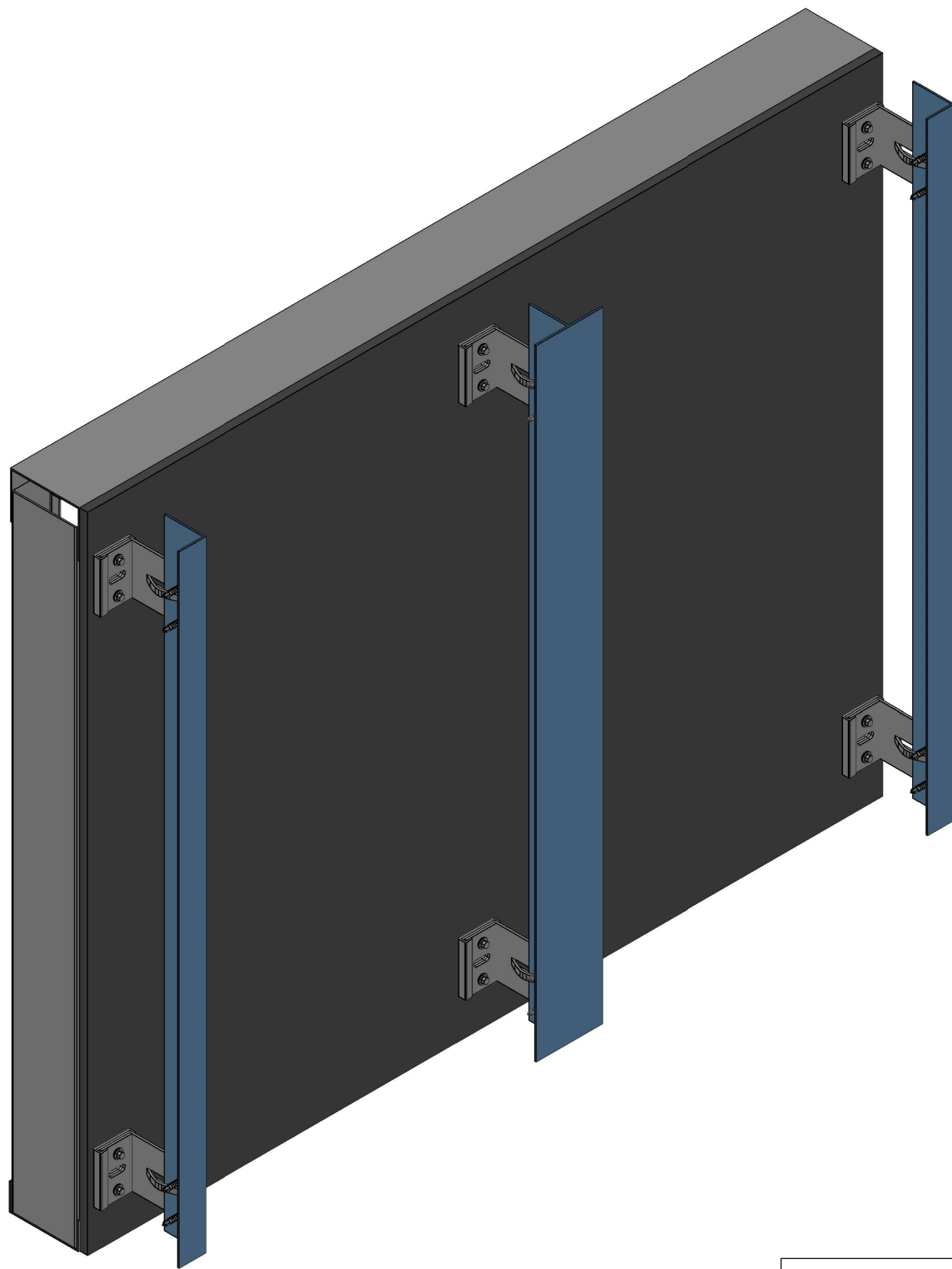
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GENIUS LINEAR STANDARD DETAILS
ALUMINIUM

Drawing Title:
GENIUS VERTICAL LINEAR INSTALLATION

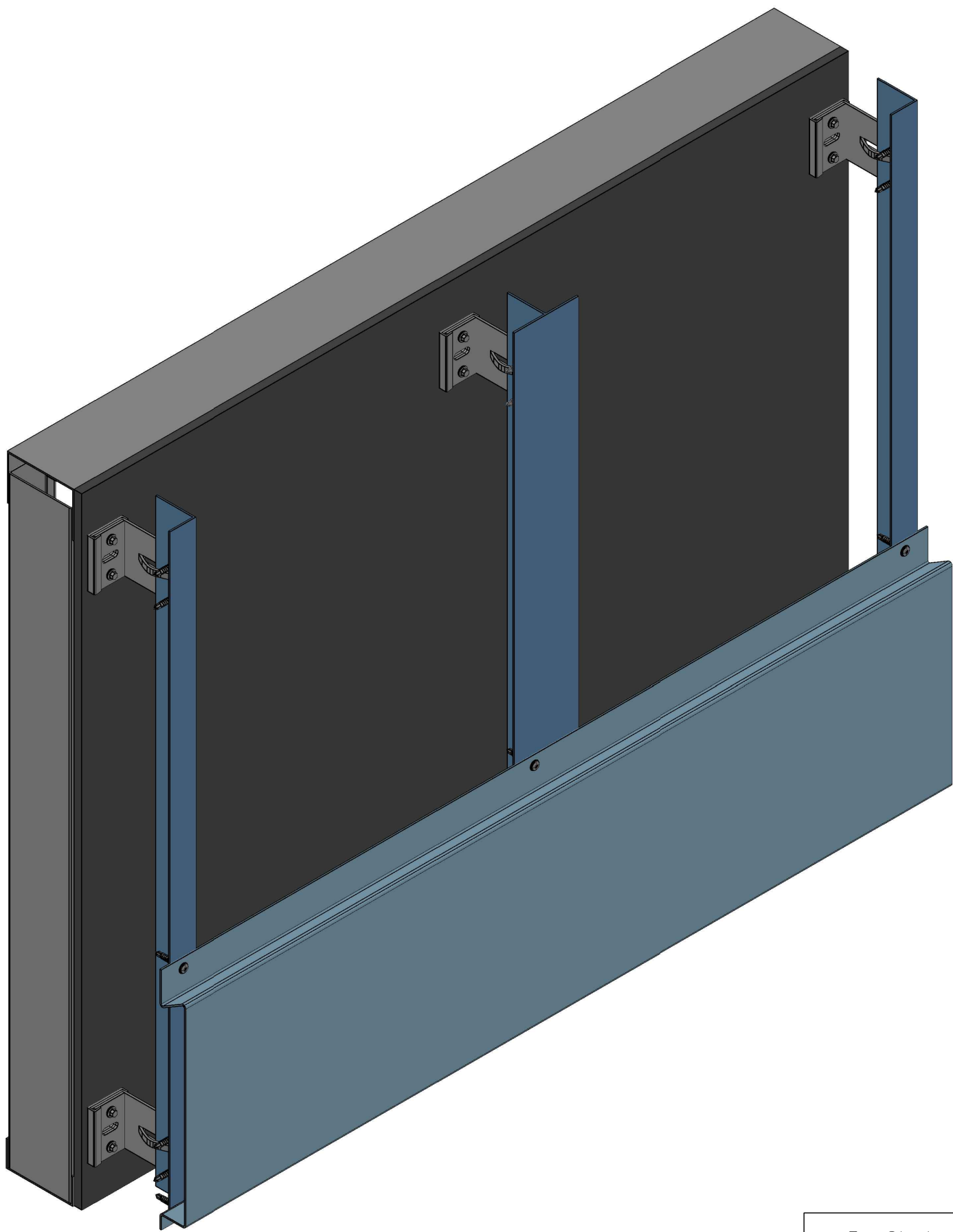
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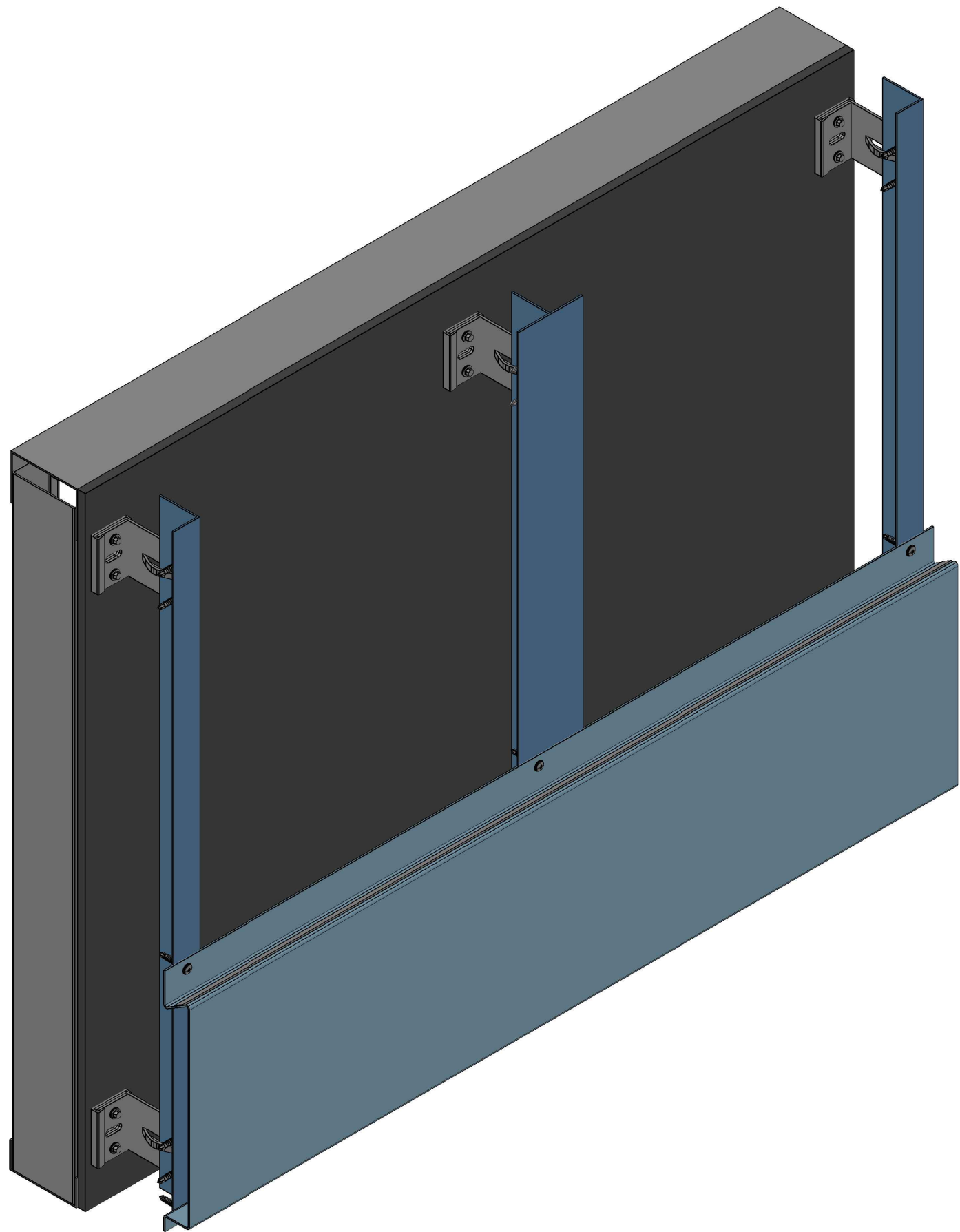
1. Aluminium helping hand brackets fixed to suitable structure at centres as per structural engineers calculations



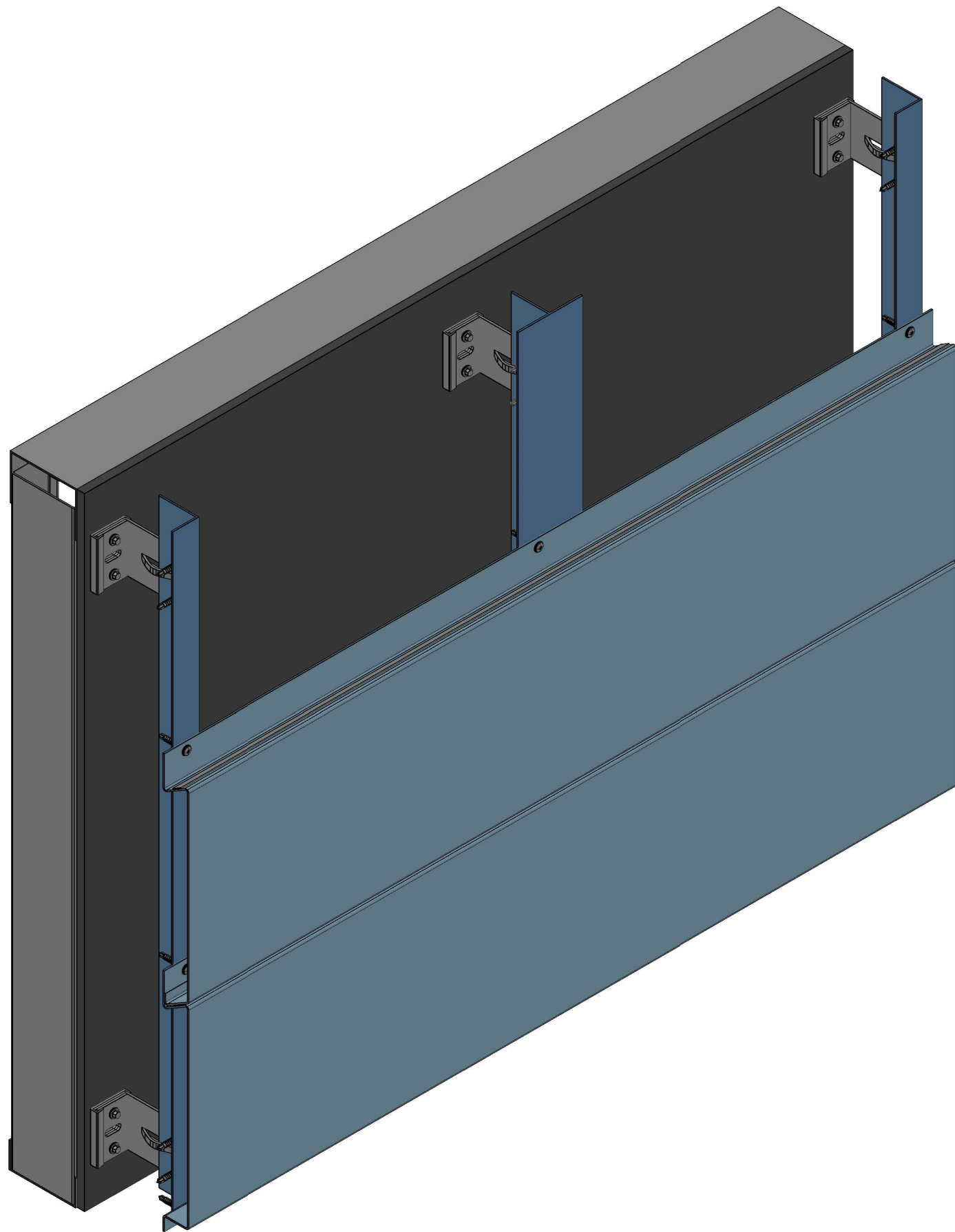
2. Vertical continuous rail at bracket locations slotted into helping hand brackets for accurate line and level before fixing



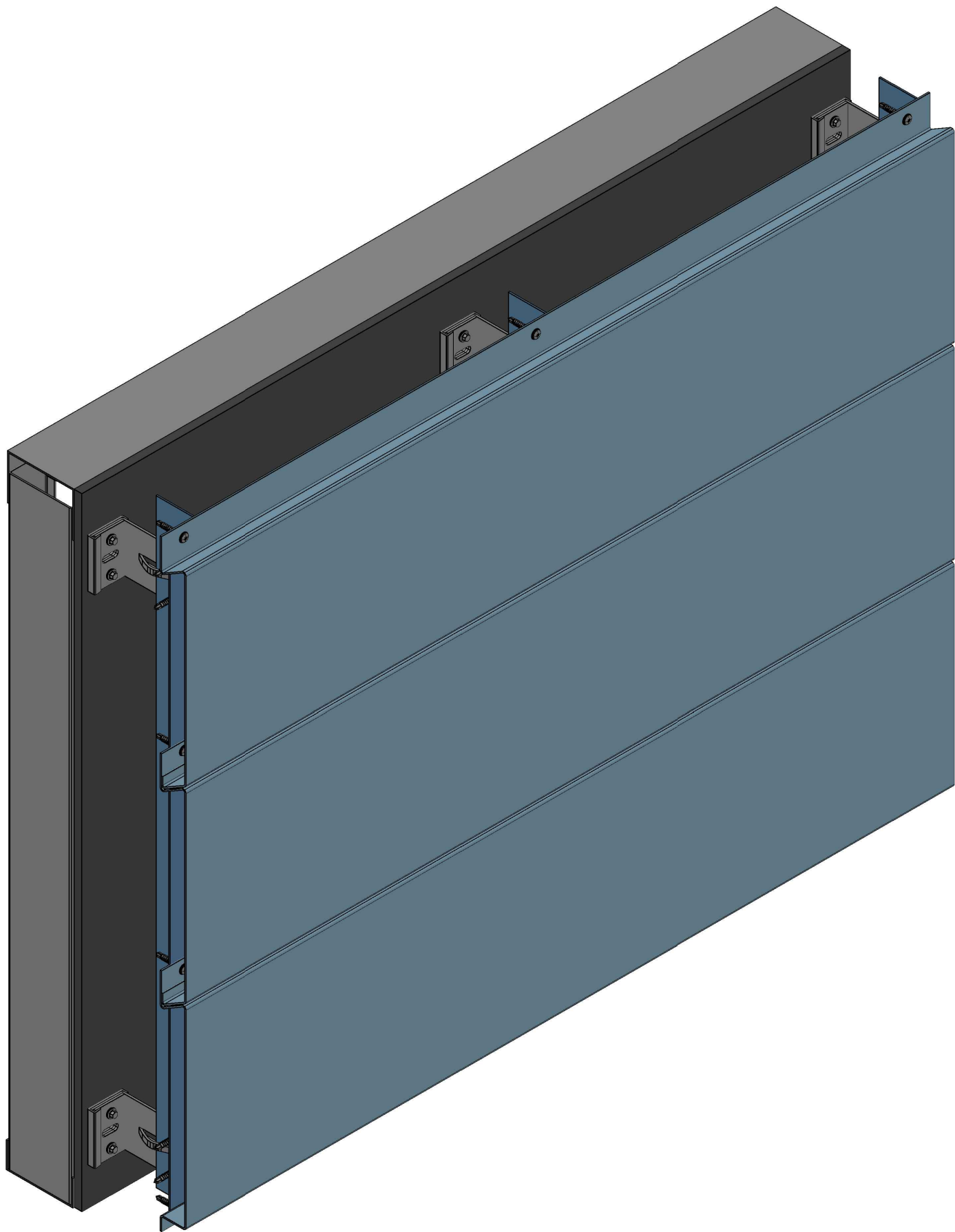
3. Starter panel fixed at top and bottom



4. 3m 1mm tape added on each panel joint



5. Subsequent panels installed by placing angled edge into below panel and mechanical fixing through top leg.



6. Final panel can be fixed direct through top leg

Site Location Plan:

General Notes:

1. All details to be read in conjunction with H92 Specification and engineers project specific calculations.
2. Panel gaps over 10mm to have insect mesh installed behind.
3. Panels to be predrilled before fixing as per standard details
4. Flashings maybe required at either end of system due to module setting out.

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Client:

Project Name and Address:
GENIUS LINEAR STANDARD DETAILS
ALUMINIUM

Drawing Title:
GENIUS LINEAR INSTALLATION

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Technical Report

Report No: R13110 Rev 2



Genius Facades Limited
Unit 5
WS2 Industrial Estate
Bloxwich Road
Walsall
WS2 7BD

Project

Genius Rear Ventilated Planar/Curvation & Linear Rainscreen
Facade – Systems Test
CWCT Test Sequence
Project Ref: 13110

9th June 2014

Rev 1 – this report has been amended by changing part of section B1 and it replaces previous report No. R13110 dated 15th April 2013.

Rev 2 – this report has been amended by changing the company address, system name and system drawings and it replaces previous report No. R13110 Rev 1 dated 24th May 2013.

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Testing Conducted by: Wintech Engineering Ltd
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Test Conducted at: Above Address

Test Conducted for: Genius Facades Limited

Standards Specified: CWCT Test Methods for Building Envelopes – Dec 2005;
Sections 7, 11, 12, CWCT TN 76 & BS 8200 as per method
statement DPP/MW/M13110 Rev 1 dated 3rd April 2013

Project No: 13110

Dates of Final
Test Sequence: 4th & 5th April 2013

Product/System Tested: Genius Rear Ventilated Rainscreen Facade

Tests Performed: As Listed in Section 5 – Test Procedures

Final Test Sequence
Conducted by: D Reynolds Wintech Engineering Ltd
D Price Wintech Engineering Ltd

Report Compiled by:

J Hollins
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Testing Supervised by:

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Works Director



Technical Approval:
(Authorising Signatory)

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Technical Director



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1. INTRODUCTION

This report describes tests conducted at the test site of Wintech Engineering Ltd on a sample of rainscreen, on behalf of Genius Facades Limited.

The following test sequence was conducted on the 4th and 5th April 2013 in order to determine the weather tightness of the sample with respect to water penetration, wind and impact resistance. The test methods were in accordance with the following standards, and testing was conducted at the request of Genius Facades Limited.

CWCT Standard Test Methods for Building Envelopes - December 2005

Water Penetration – Dynamic Aero Engine	CWCT Section 7
Wind Resistance – Serviceability	CWCT Section 11
Wind Resistance – Safety	CWCT Section 12
Impact – Safety (Hard & Soft body)	CWCT TN 76 & BS 8200

Testing was conducted in accordance with the following Method Statement; DPP/MW/M13110 Revision 1, dated 3rd April 2013 by Wintech Engineering Ltd.

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 Genius Facades Limited.

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;

	Peak Test Pressure	Result	Date of test	Category
Test 1 – Water Penetration (Dynamic Aero Engine)	600 Pa	Pass	04.04.13	-
Test 2 – Wind Resistance (Serviceability)	2400 Pa	Pass	04.04.13	-
Test 3 – Wind Resistance (Safety)	3600 Pa	Pass	04.04.13	-
Test 4a – Impact Resistance (Retention of performance of exterior wall surfaces) - External	-	Pass	05.04.13	B
Test 4b – Impact Resistance (Safety to persons) - External	-	Pass	05.04.13	B

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: Genius Facades Ltd

Sample Size: 3620mm wide x 4800mm high

Rainscreen Type: Genius Rear Ventilated Rainscreen Facade

Framing Material: See drawings in Appendix A

Finish: Powder coated & anodised

Panel Types: Planar: 3620mm wide x 190mm high/1200mm wide x 190mm high
Curvation: 3620mm wide x 190mm high
Linear: 3620mm wide x 200mm high/3620mm wide x 400mm high

Fixing Bracket Details: See drawings in Appendix A

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 rainscreen 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 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 $\pm 5\%$.

4.2.3 Deflection

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

4.2.4 Temperature & Humidity

A digital data logger capable of measuring temperature with an accuracy of $\pm 1^\circ\text{C}$ and humidity with an accuracy of $\pm 5\%$ Rh was used.

4.2.5 Atmospheric Pressure

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

4.2.6 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 than 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/m²/min.

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

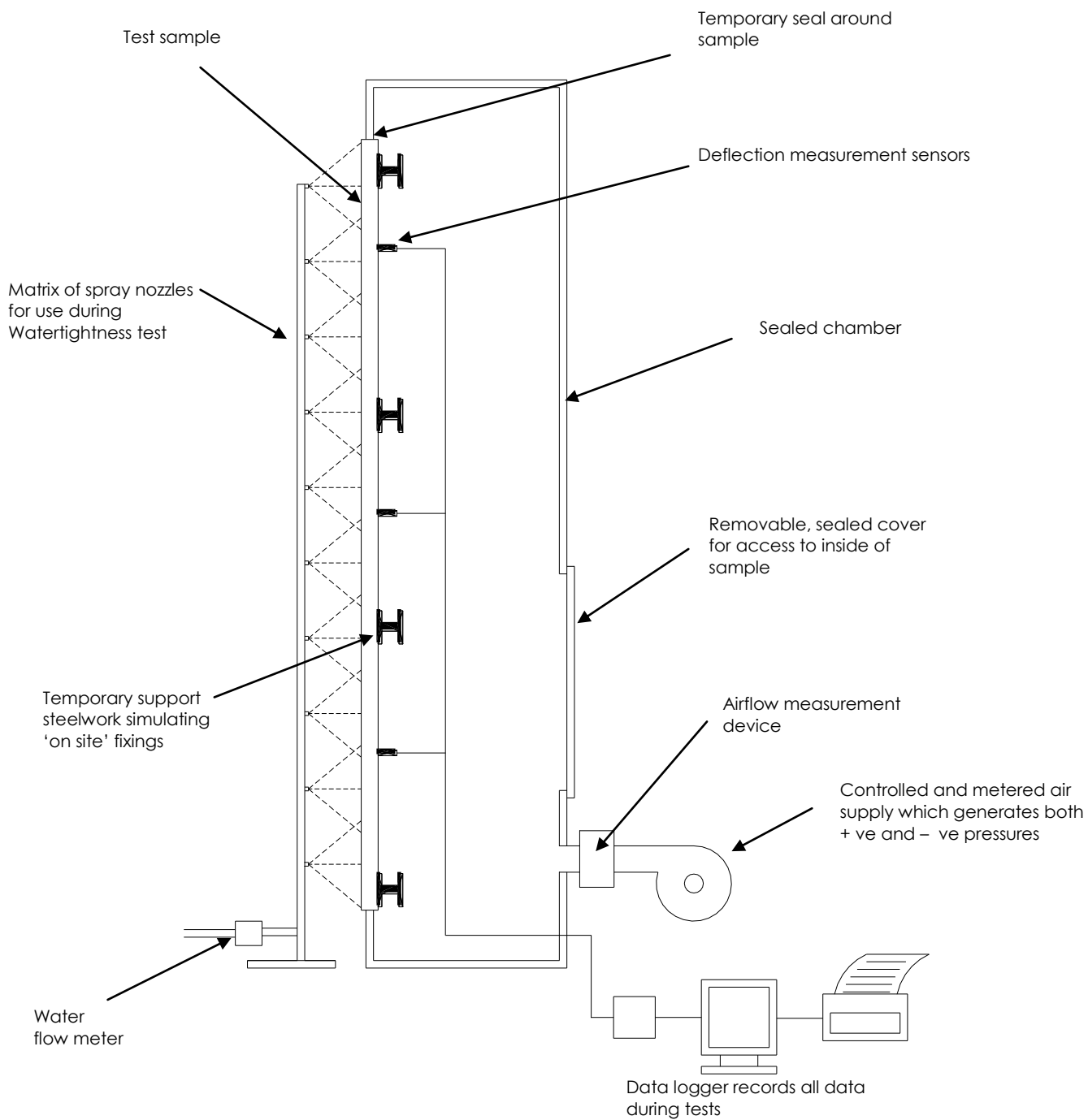
A steel ball with a diameter of 62.5 mm and a mass of 1.135 Kg, modified to allow it to swing from a nylon cord, rather than being dropped onto the sample as required in BS8200, was released from the height, calculated to result in the required impact energies and allowed to fall under gravity until it impacted the designated test zone of the sample.

Note: The test standard requires that the hard body impactor is to be dropped vertically on to the sample however as the test sample is mounted in a vertical arrangement, the above method has been adopted and as such is a deviation from the test standard.

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. Water Penetration – Dynamic Aero Engine
2. Wind Resistance – Serviceability
3. Wind Resistance – Safety
4. Impact Resistance – Retention of performance of exterior wall surfaces
5. Impact Resistance – Safety to persons

5.2 Water Penetration

5.2.1 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 **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 WIND RESISTANCE

5.3.1 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.

5.3.2 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.

5.4 IMPACT - SAFETY

5.4.1 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 6.3.1 and 6.3.2 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 WATER PENETRATION

6.1.1 Test 1 – Water Penetration – Dynamic Aero Engine

Temperatures (°C)

Water	6.8
Ambient	7.2

Test Time	Water collected (Litres)
15 minutes	12.61 ltrs

Observations

The sample was subjected to testing as described in section 5.3.2, for a period of not less than 15 minutes, during which water leakage was observed through the sample, by the means of observation holes cut in the support backing wall. The water was also collected by means of a drainage system at the bottom of the sample, which was then weighed at the end of the test.

6.2 WIND RESISTANCE TESTING

Calculation of deflection

Group A comprised of probes 1, 2 & 3

$$= \text{Probe 2} - ((\text{Probe 1} + \text{Probe 3})/2)$$

Group B comprised of probes 4, 5, & 6

$$= \text{Probe 5} - ((\text{Probe 4} + \text{Probe 6})/2)$$

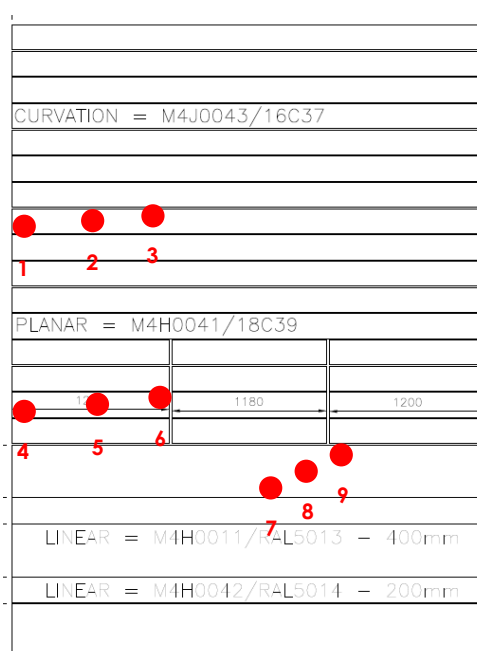
Group C comprised of probes 7, 8, & 9

$$= \text{Probe 8} - ((\text{Probe 7} + \text{Probe 9})/2)$$

An inspection carried out following tests 2 and 3, after both positive and negative pressure testing, showed no evidence of any permanent deformation or damage to the test sample.

Positions of Deflection Measurement Probes

Figure 2



View from
Outside

Not to Scale

● - Deflection Measurement Probe Locations

6.2.1 Test 2 - Wind Resistance, Serviceability

Temperatures (°C)	Ambient	7.2
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Measured Length of Framing Member (mm)		Allowable Deflection	
		Ratio	Calculated (mm)
Group A	1160	L/90	12.9
Group B	1140	L/90	12.7
Group C	680	L/90	7.6

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

6.2.1.1 Wind Resistance, Serviceability - Positive Pressure

Positive Pressure Pa	Results		
	Group A	Group B	Group C
0	0.0	0.0	-0.1
600	-0.4	-0.4	-0.4
1200	-0.9	-0.7	-0.8
1800	-1.3	-1.0	-1.1
2400	-1.7	-1.3	-1.5
Residuals immediately following test	0.0	0.0	-0.1

6.2.1.2 Wind Resistance, Serviceability - Negative Pressure

Negative Pressure Pa	Results		
	Group A	Group B	Group C
0	0.0	-0.1	0.0
600	0.3	0.3	0.2
1200	0.8	0.7	0.4
1800	1.4	1.2	0.8
2400	1.9	1.5	1.0
Residuals immediately following test	0.0	-0.1	0.0

6.2.2 Test 3 - Wind Resistance, Safety

Temperatures (°C)	Ambient	5.0
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Measured Length of Framing Member (mm)		Allowable Residual Deformation	
		Ratio	Calculated (mm)
Group A	1160	L/500	2.3
Group B	1140	L/500	2.3
Group C	680	L/500	1.4

6.2.2.1 Wind Resistance, Safety - Positive Pressure

Positive Pressure Pa	Results		
	Group A	Group B	Group C
0	0.0	-0.1	0.0
3600	-2.6	-2.2	-2.6
Residuals immediately following test	-0.1	-0.1	-0.1

6.2.2.2 Wind Resistance, Safety - Negative Pressure

Negative Pressure Pa	Results		
	Group A	Group B	Group C
0	0.0	0.0	0.0
3600	2.9	2.4	0.4
Residuals immediately following test	0.0	-0.1	0.0

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

6.3 IMPACT TESTING

6.3.1 Test 4a – Impact – Retention of performance of exterior wall surfaces (Soft & Hard Body)

Temperatures (°C)	Ambient	2.0
Humidity (%RH)		64

Impact Reference	Test Category	Impactor Type	Impact Energy (Nm)	Drop Height (mm)	Observations	Result
E1	B	H2	10	898	Bounce – No Damage	Pass
E2	B	H2	10	898	Bounce – No Damage	Pass
E3	B	H2	10	898	Bounce – No Damage	Pass
E4	B	H2	10	898	Bounce – No Damage	Pass
E5	B	H2	10	898	Bounce – No Damage	Pass
E6	B	H2	10	898	Bounce – No Damage	Pass
E7	B	H2	10	898	Bounce – No Damage	Pass
E8	B	H2	10	898	Bounce – No Damage	Pass
E9	B	H2	10	898	Bounce – No Damage	Pass
E10	B	H2	10	898	Bounce – No Damage	Pass
E11	B	H2	10	898	Bounce – No Damage	Pass
E12	B	H2	10	898	Bounce – No Damage	Pass
E13	B	H2	10	898	Bounce – No Damage	Pass
E14	B	S1	120	245	Bounce – No Damage	Pass
E15	B	S1	120	245	Bounce – No Damage	Pass
E16	B	S1	120	245	Bounce – No Damage	Pass
E17	B	S1	120	245	Bounce – No Damage	Pass
E18	B	S1	120	245	Bounce – No Damage	Pass
E19	B	S1	120	245	Bounce – No Damage	Pass
E20	B	S1	120	245	Bounce – No Damage	Pass
E21	B	S1	120	245	Bounce – No Damage	Pass
E22	B	S1	120	245	Bounce – No Damage	Pass
E23	B	S1	120	245	Bounce – No Damage	Pass
E24	B	S1	120	245	Bounce – No Damage	Pass
E25	B	S1	120	245	Bounce – No Damage	Pass
E26	B	S1	120	245	Bounce – No Damage	Pass

Please note that Impact References E14-E26 were subject to 3 impacts at each location in accordance with CWCT TN 76.

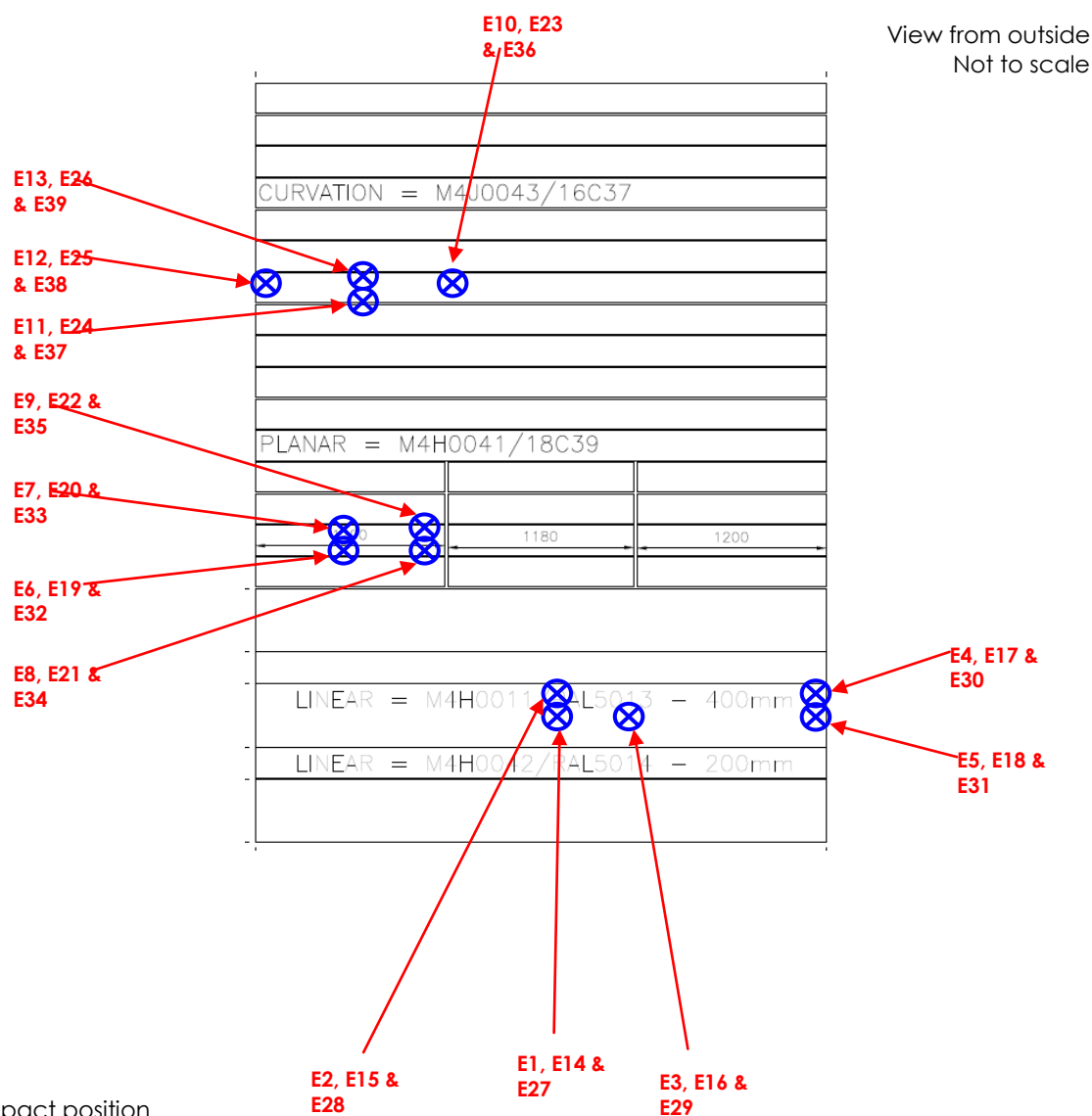
6.3.2 Test 4b – Impact – Safety to persons (Soft Body)

Temperatures (°C)	Ambient	2.0
Humidity (%RH)		64

Impact Reference	Test Category	Impactor Type	Impact Energy (Nm)	Drop Height (mm)	Observations	Result
E27	B	S1	500	1020	Bounce – No Damage	Pass
E28	B	S1	500	1020	Bounce – No Damage	Pass
E29	B	S1	500	1020	Bounce – No Damage	Pass
E30	B	S1	500	1020	Bounce – No Damage	Pass
E31	B	S1	500	1020	Bounce – No Damage	Pass
E32	B	S1	500	1020	Bounce – No Damage	Pass
E33	B	S1	500	1020	Bounce – No Damage	Pass
E34	B	S1	500	1020	Bounce – No Damage	Pass
E35	B	S1	500	1020	Bounce – No Damage	Pass
E36	B	S1	500	1020	Bounce – No Damage	Pass
E37	B	S1	500	1020	Bounce – No Damage	Pass
E38	B	S1	500	1020	Bounce – No Damage	Pass
E39	B	S1	500	1020	Bounce – No Damage	Pass

6.3.3 Impact Positions

Figure 3



APPENDIX A

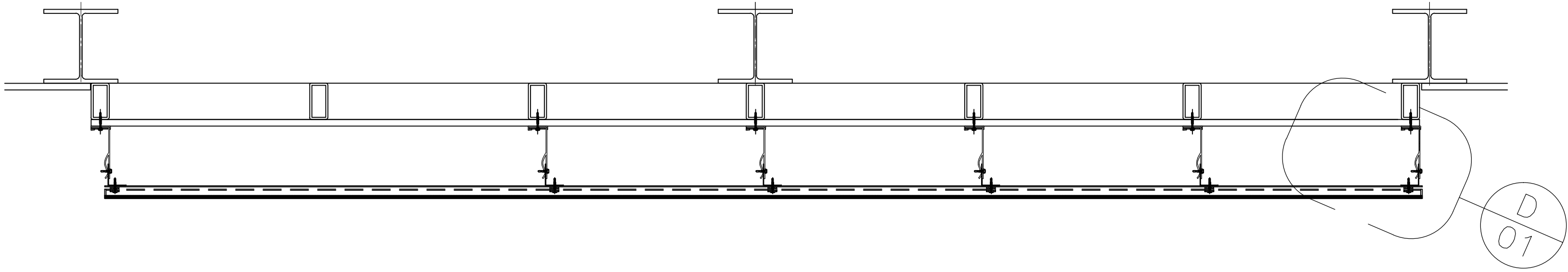
System Drawings

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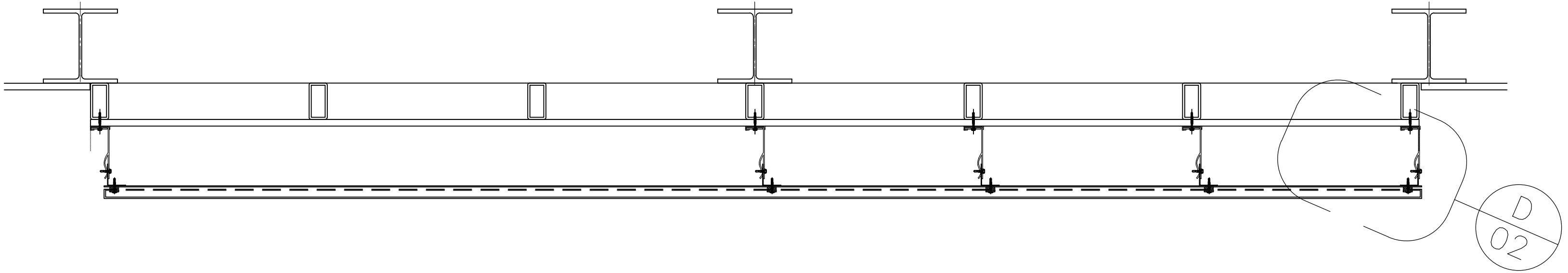
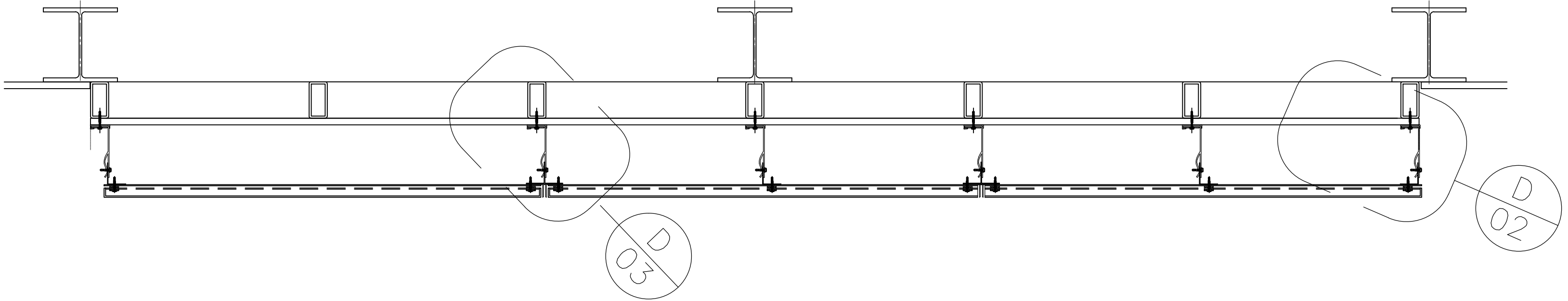
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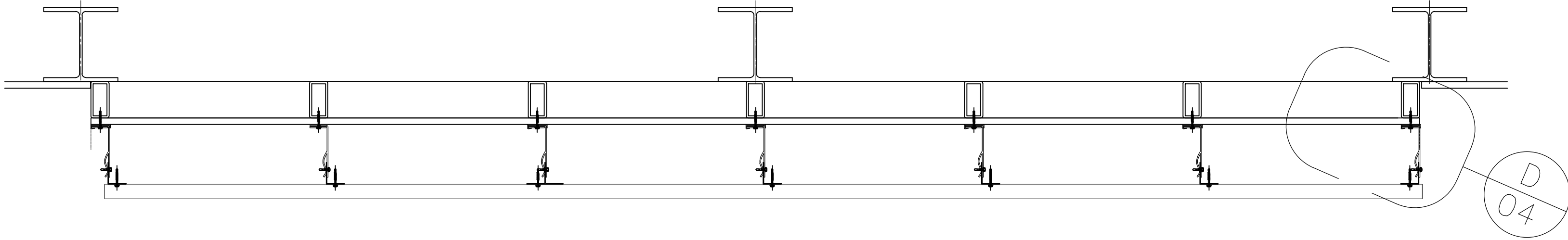
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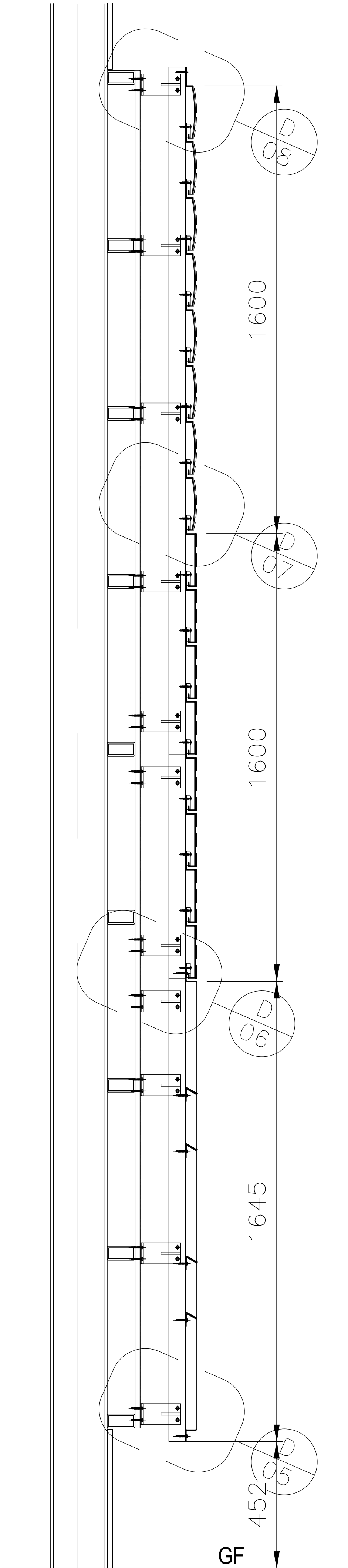
PLAN SECTION THROUGH PLANAR



PLAN SECTION THROUGH LINEAR



VERTICAL SECTION



Site Location Plan:



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ISSUE FOR COMMENT

A	LJC	26/03/2013
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ISSUE FOR COMMENT – UPDATED TO SUIT INTERNAL COMMENTS

B	LJC	24/04/2013
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FINAL ISSUE

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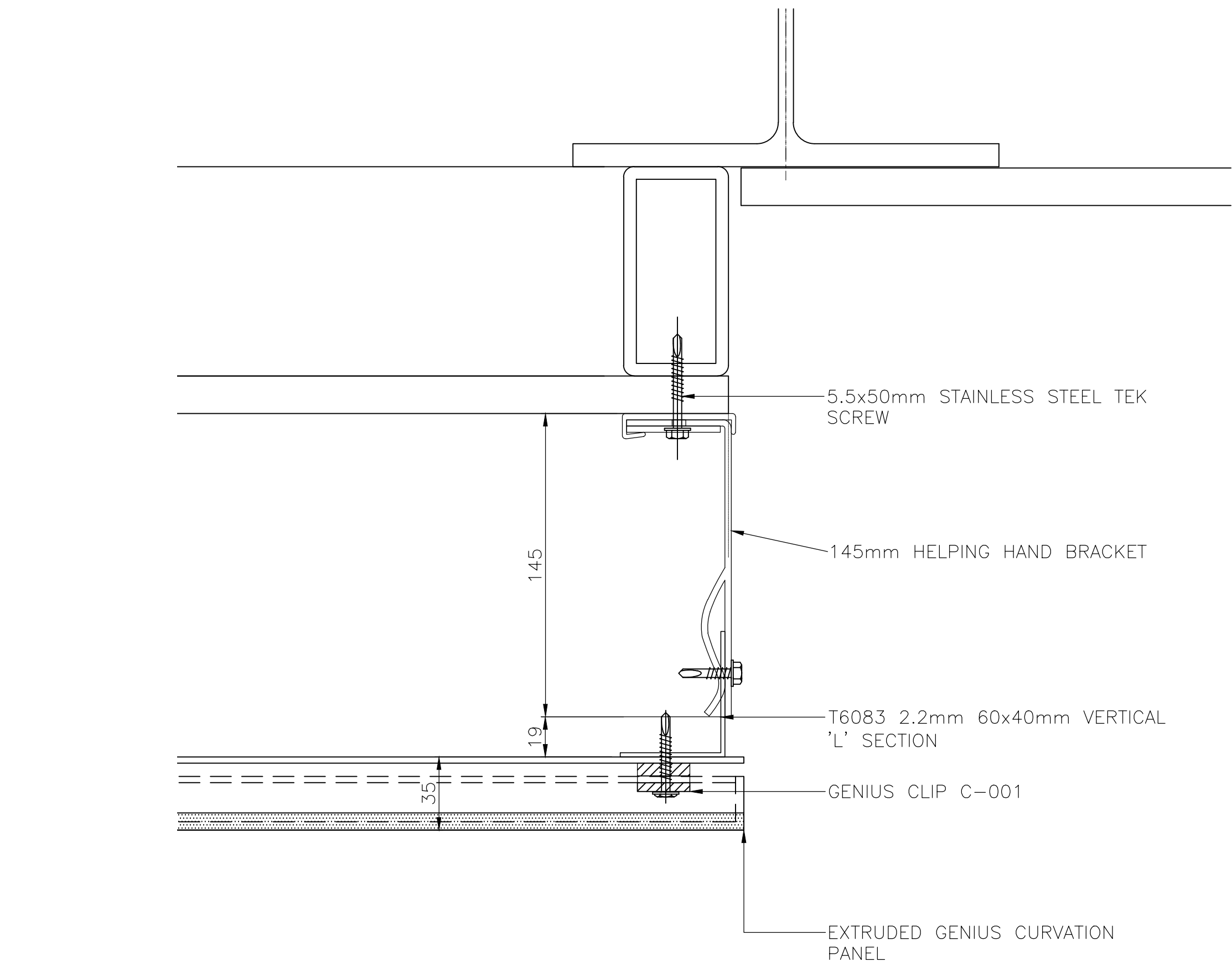
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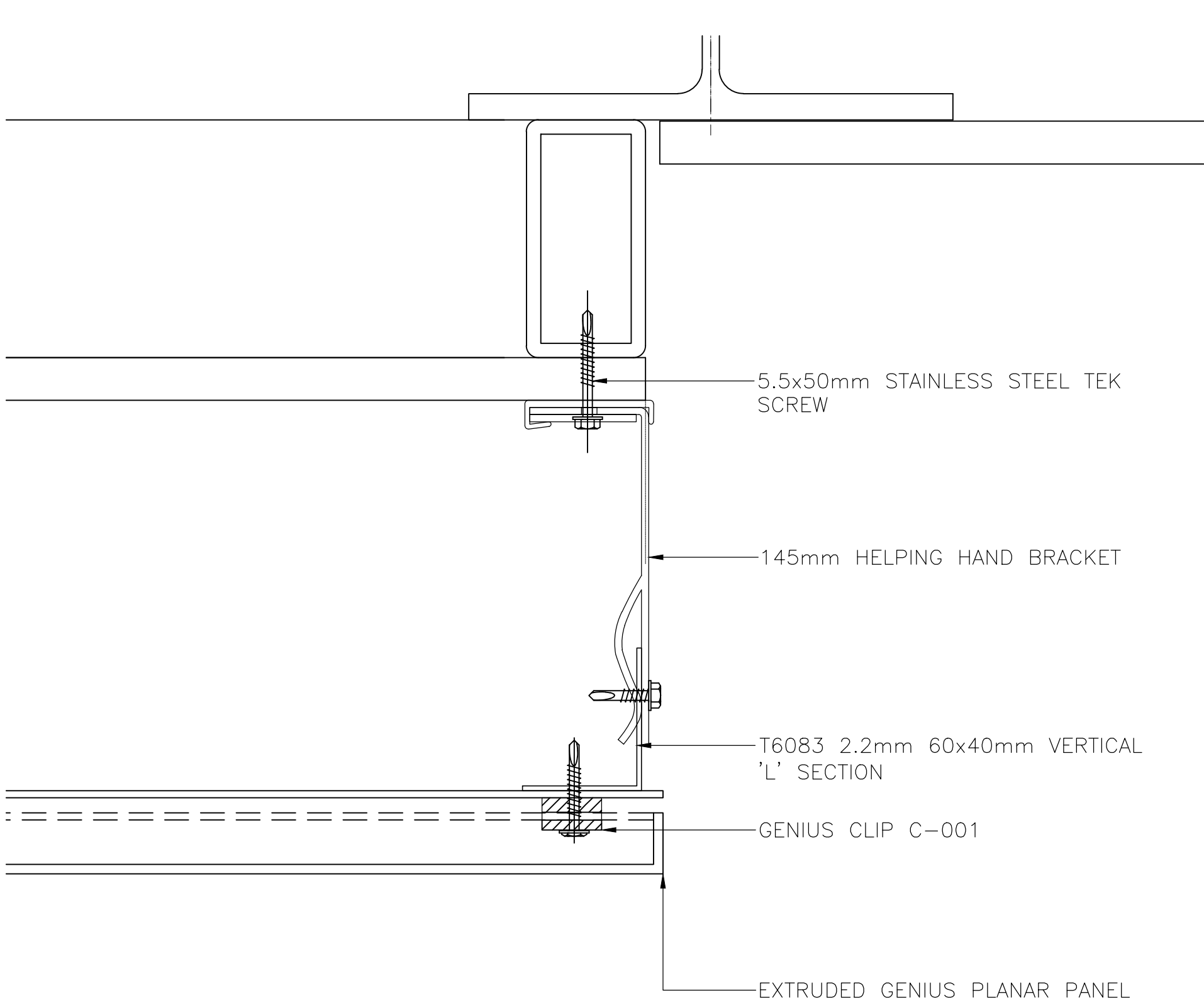
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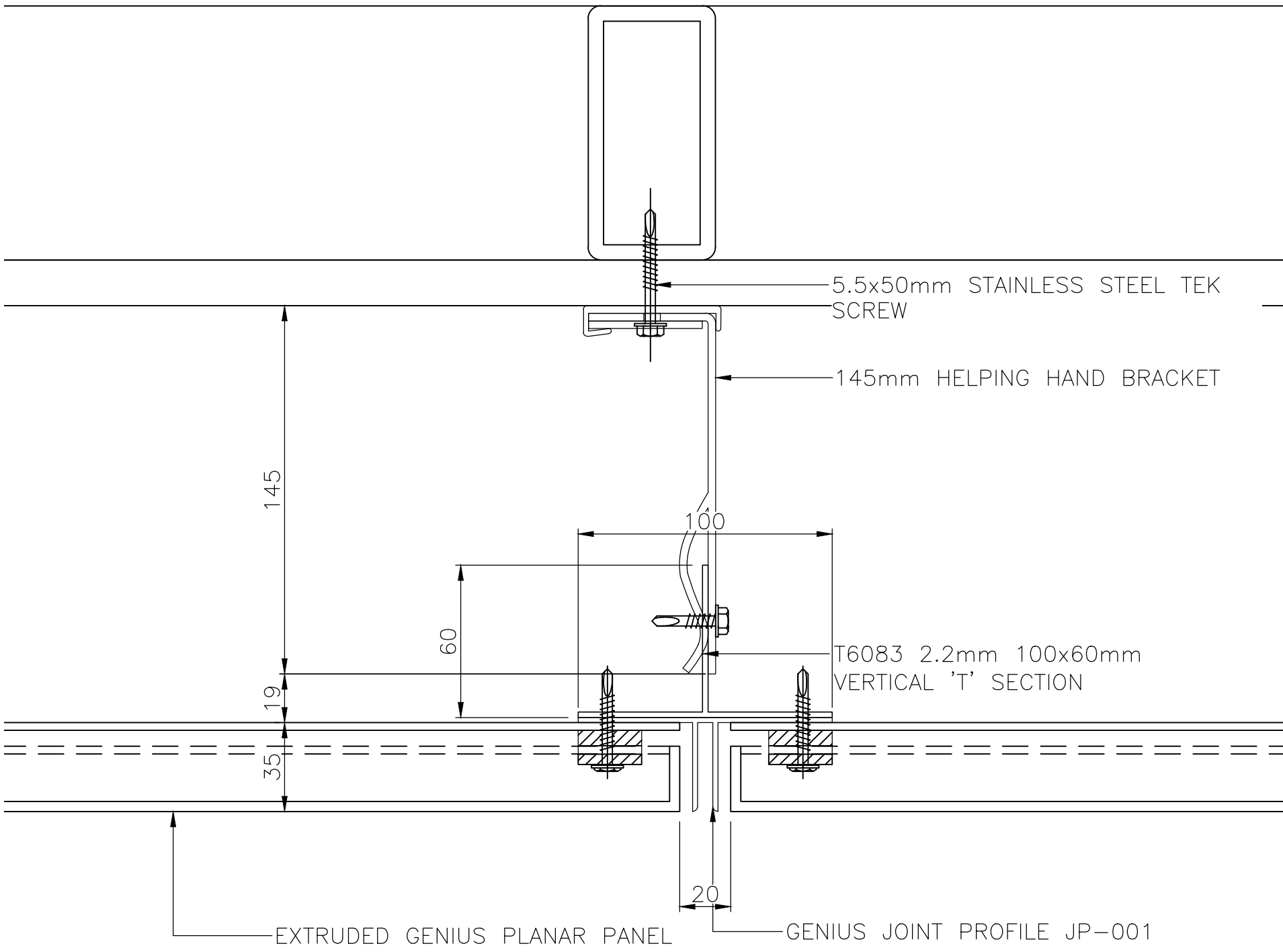
genius facades
genius



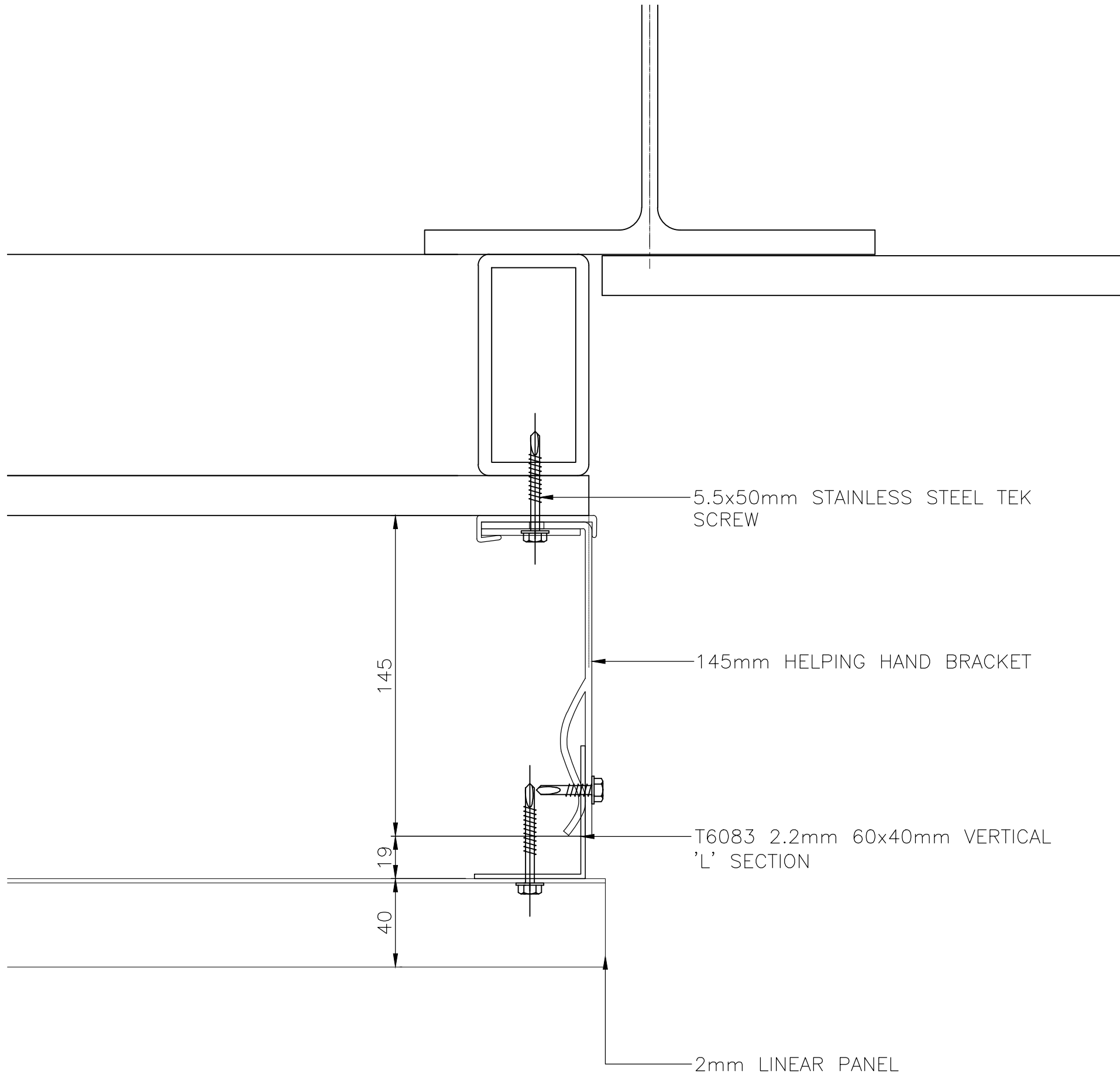
CURVATION VERTICAL END DETAIL 01



PLANAR VERTICAL END DETAIL 02



PLANAR VERTICAL JOINT DETAIL 03



LINEAR VERTICAL END DETAIL 04

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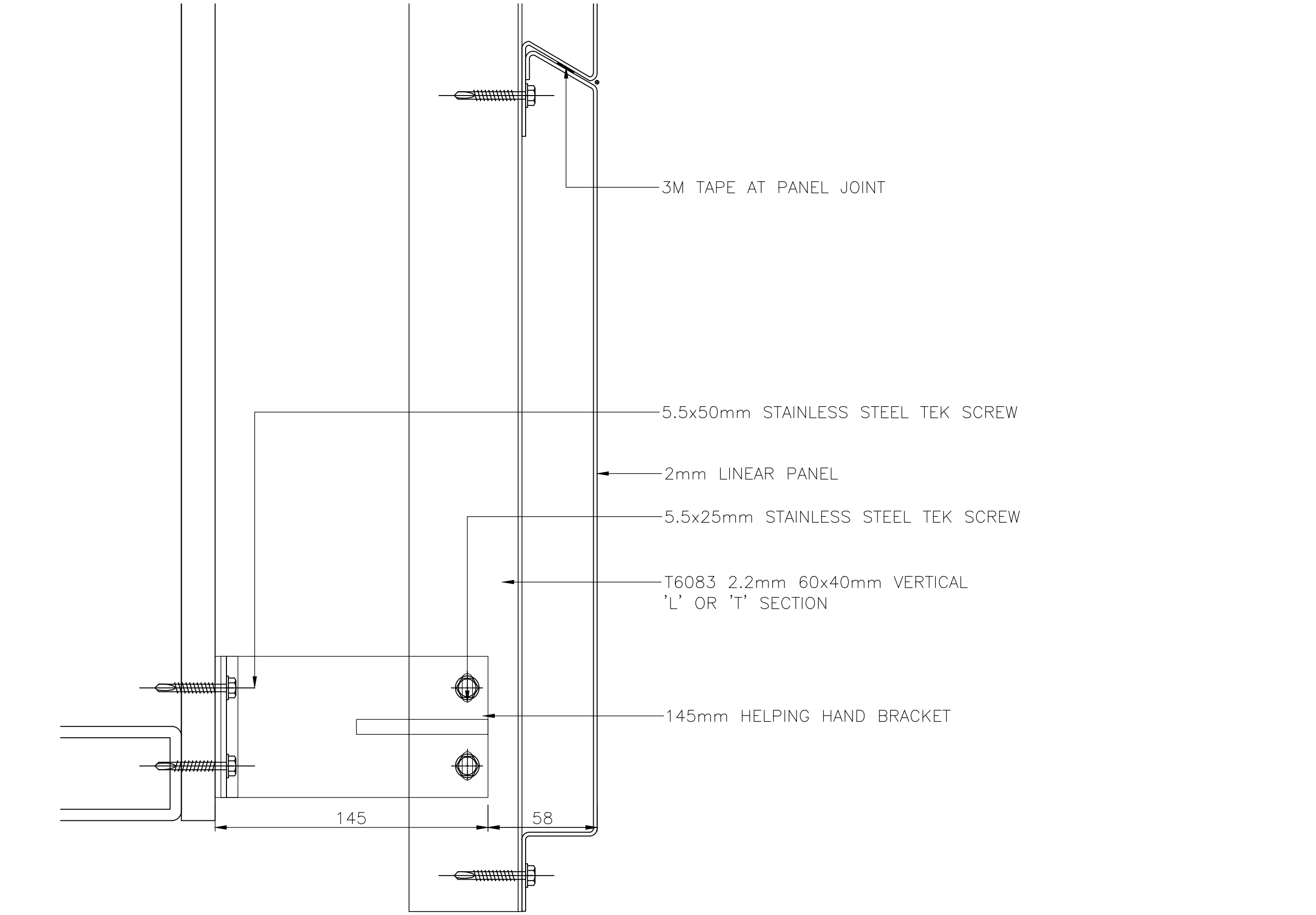
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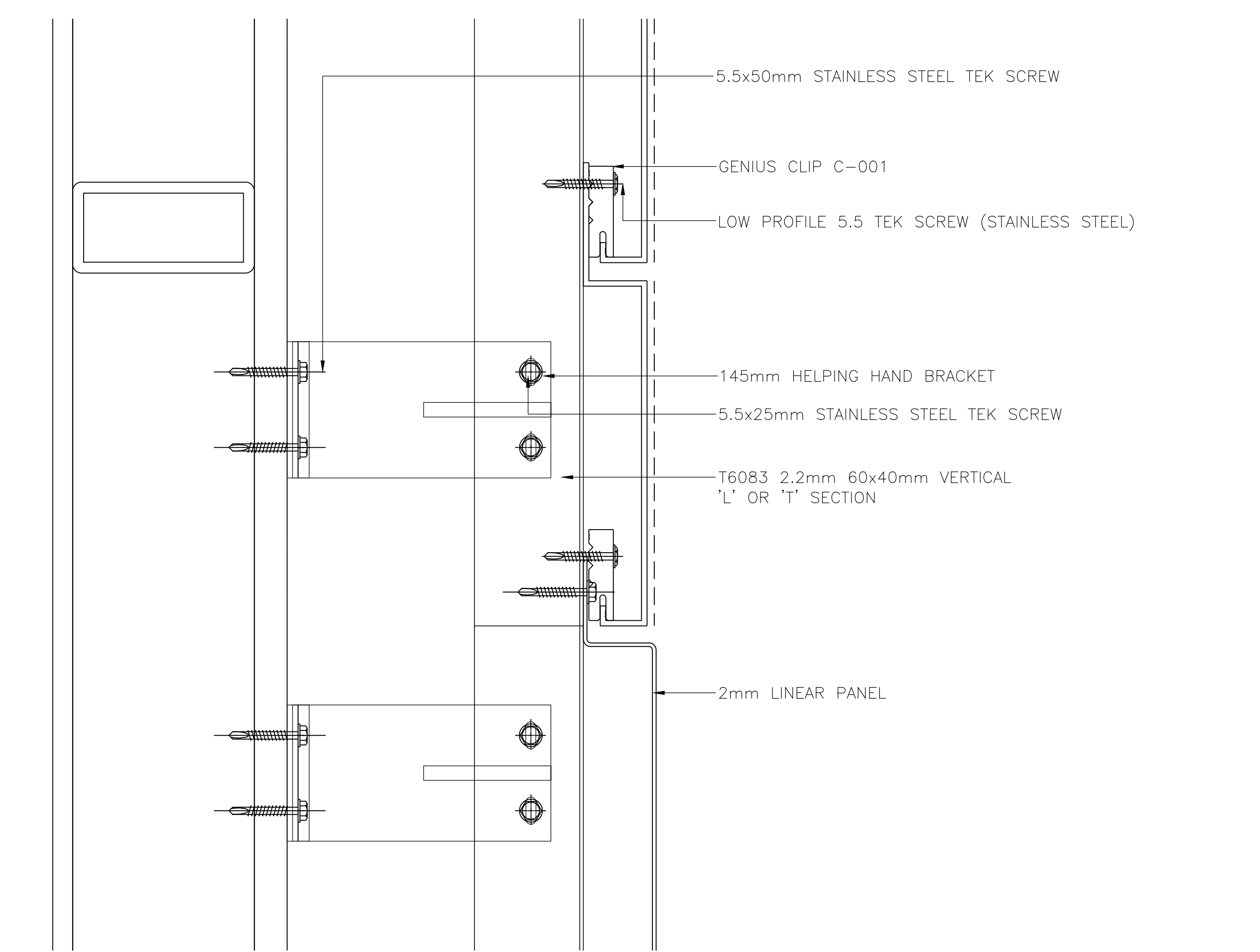
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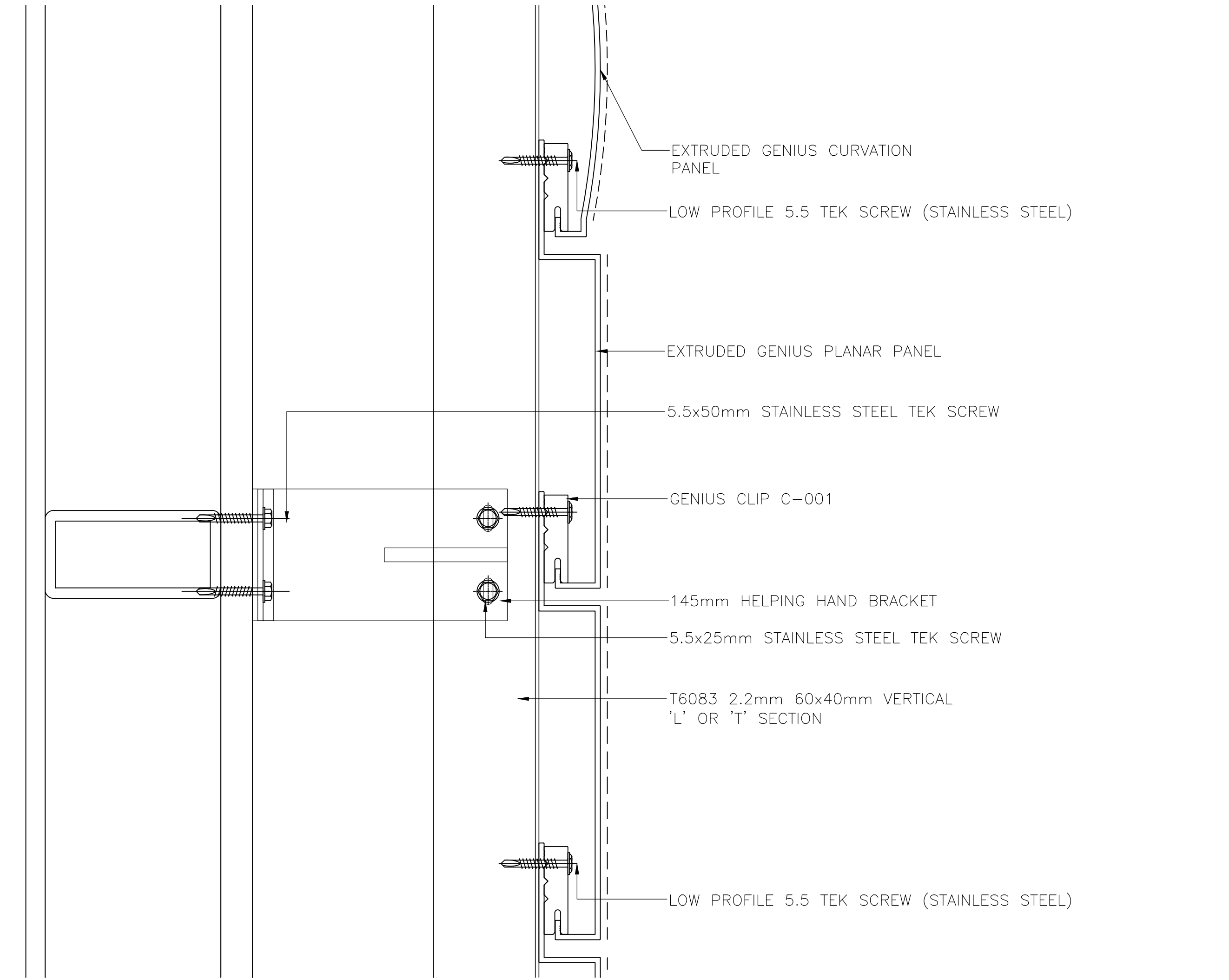
genius facades
genius



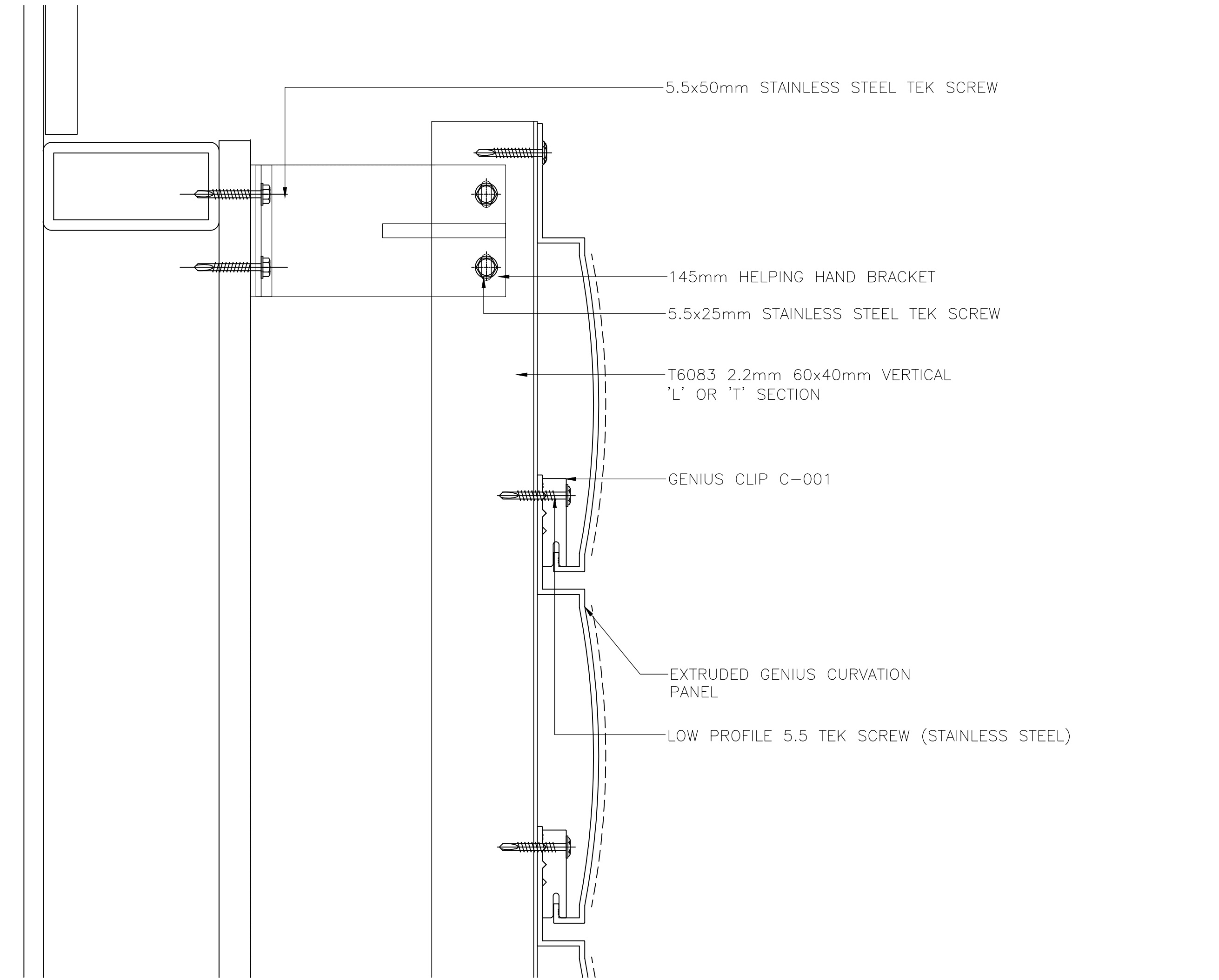
LINEAR BASE DETAIL 05



LINEAR TO PLANAR JOINT DETAIL 06



PLANAR TO CURVATION JOINT DETAIL 07



CURVATION HEAD DETAIL 08

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ISSUE FOR COMMENT

A	LJC	26/03/2013
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ISSUE FOR COMMENT – UPDATED TO SUIT INTERNAL COMMENTS

B	LJC	24/04/2013
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FINAL ISSUE

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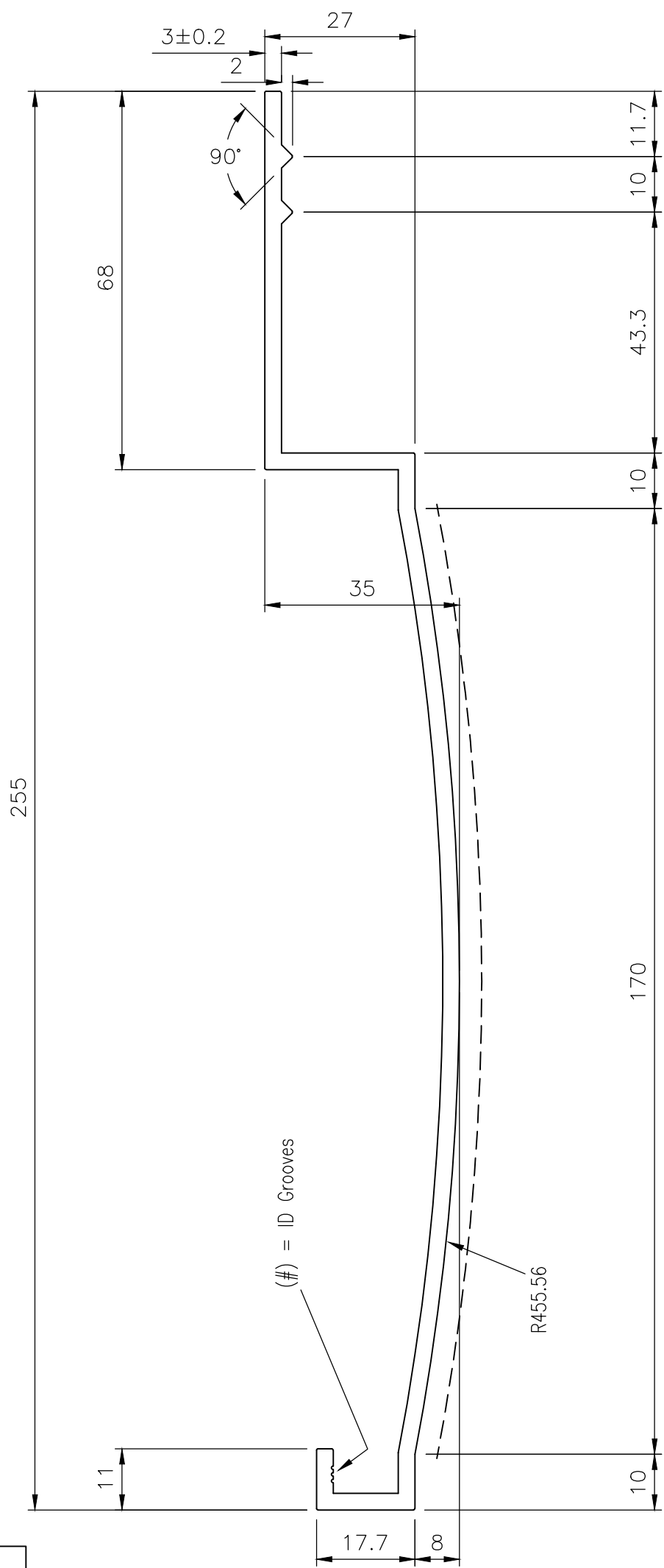
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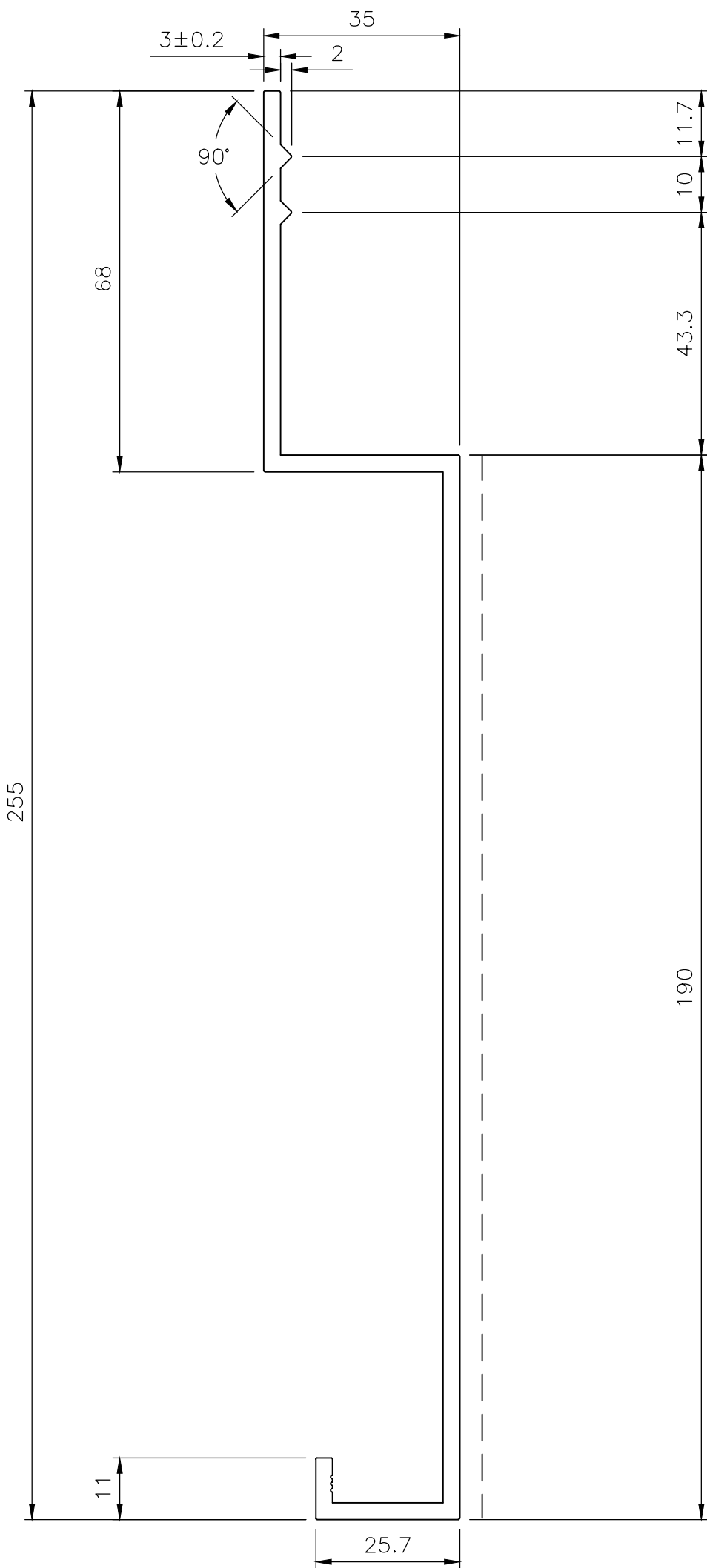
VERTICAL DETAILS THROUGH LINEAR, CURVATION AND PLANAR

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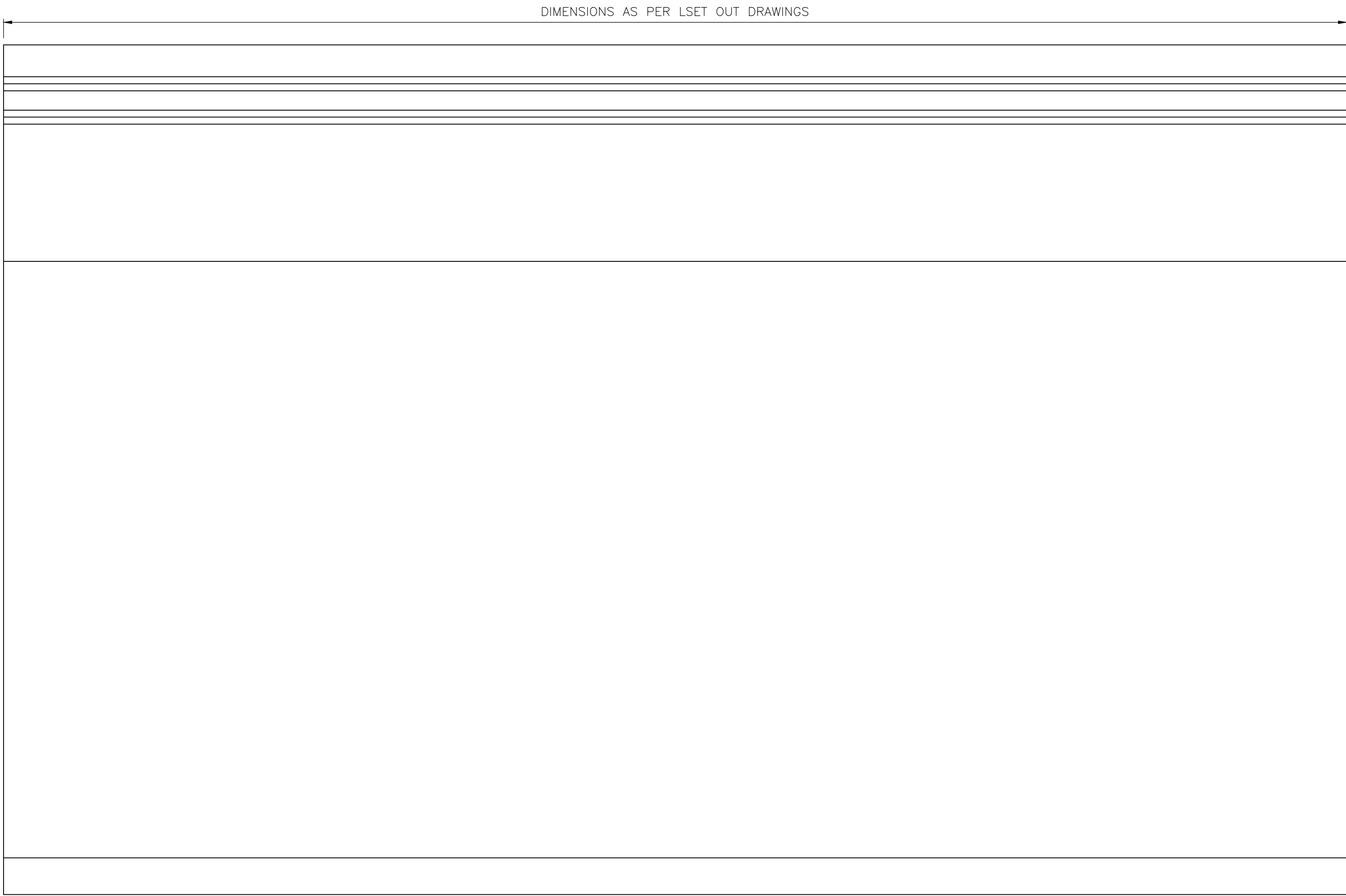
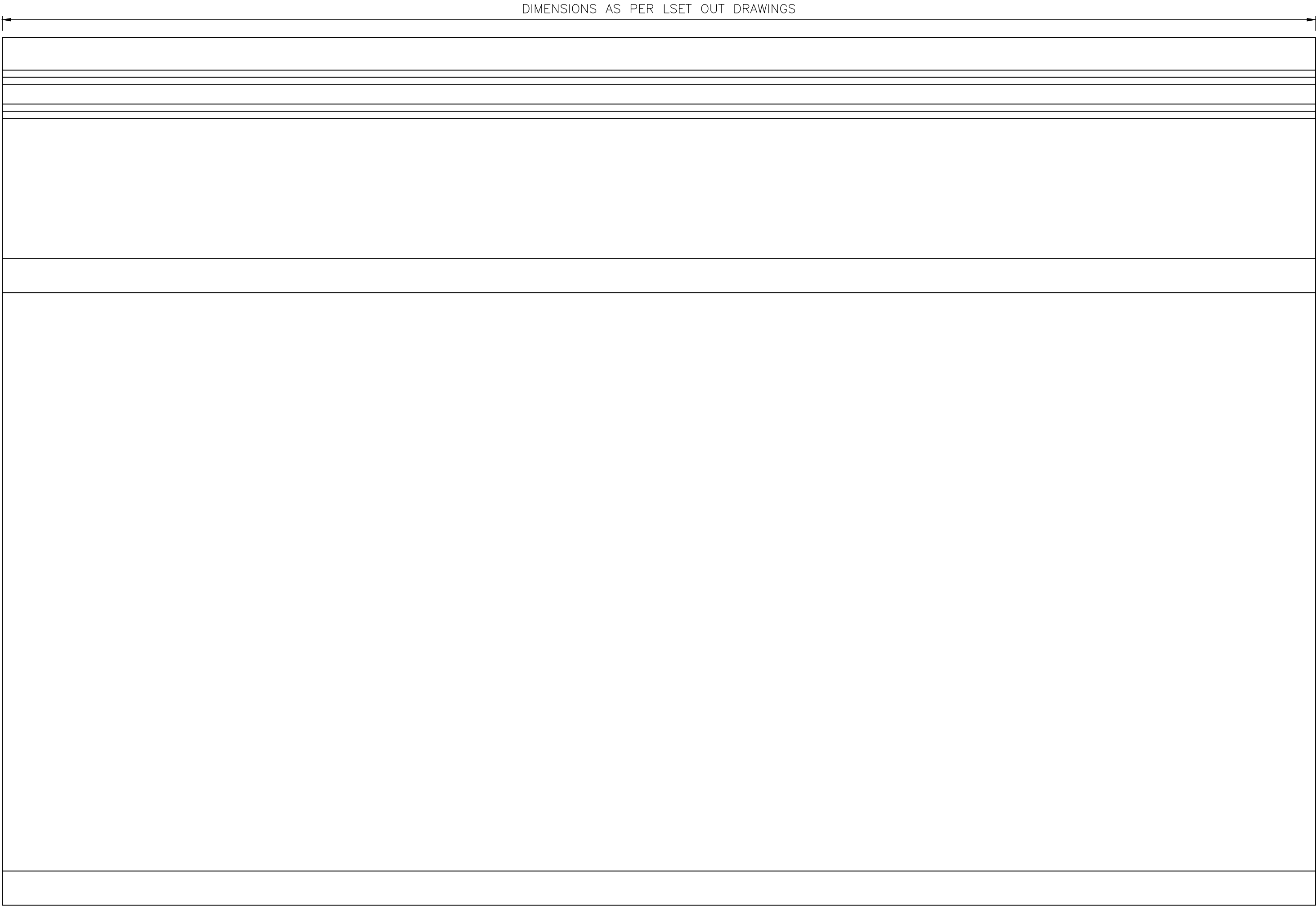
genius facades
genius



CURVATION COMPONENT PANEL



PLANAR COMPONENT PANEL



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Project Name and Address:

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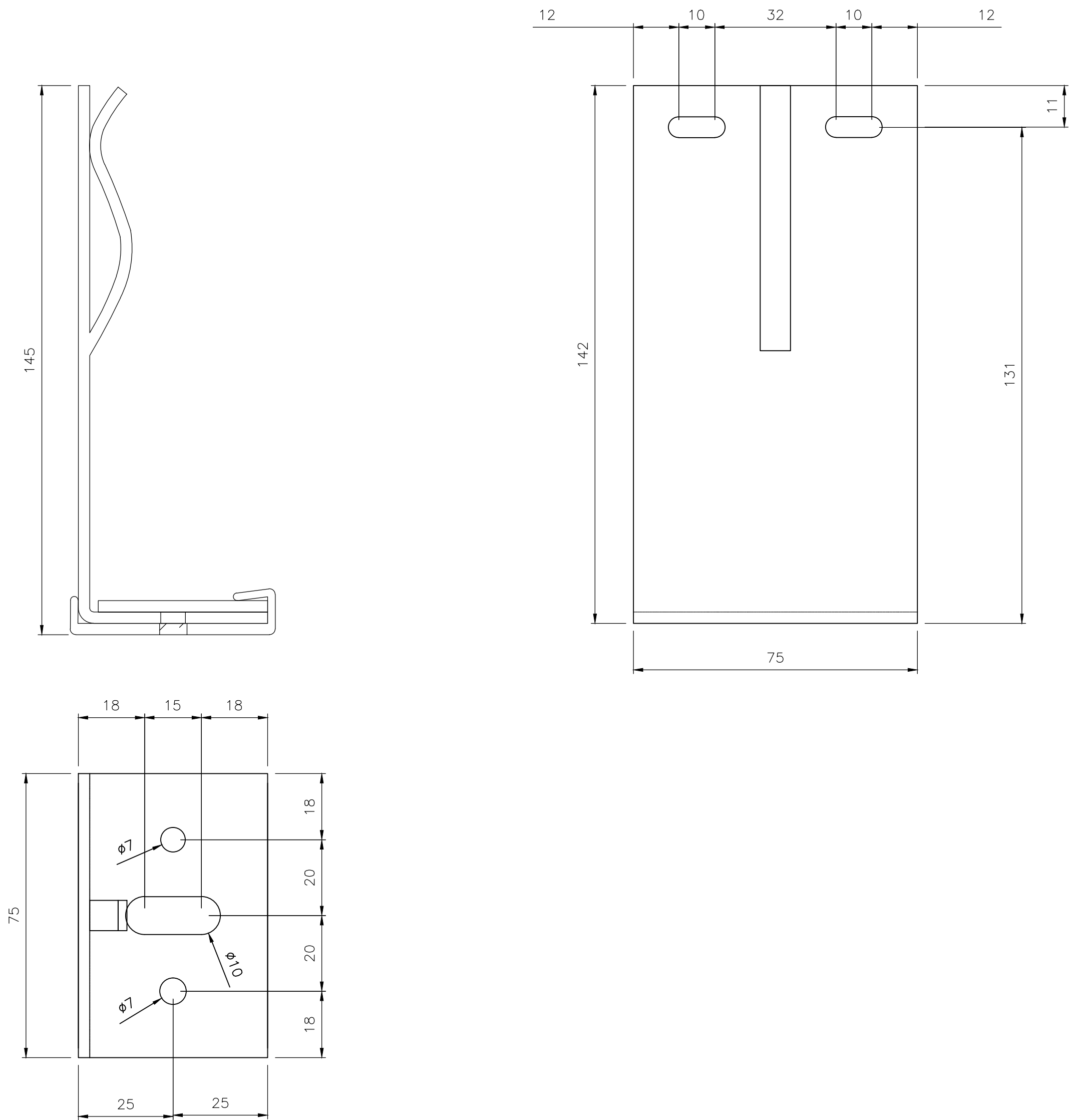
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VERTICAL DETAILS THROUGH LINEAR, CURVATION AND PLANAR

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Checked by	
Checked Date	21/03/2013
Scale	1:2
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Drawing Status	FOR INFORMATION
Drawing Reference	GENIUS–CWCT–05

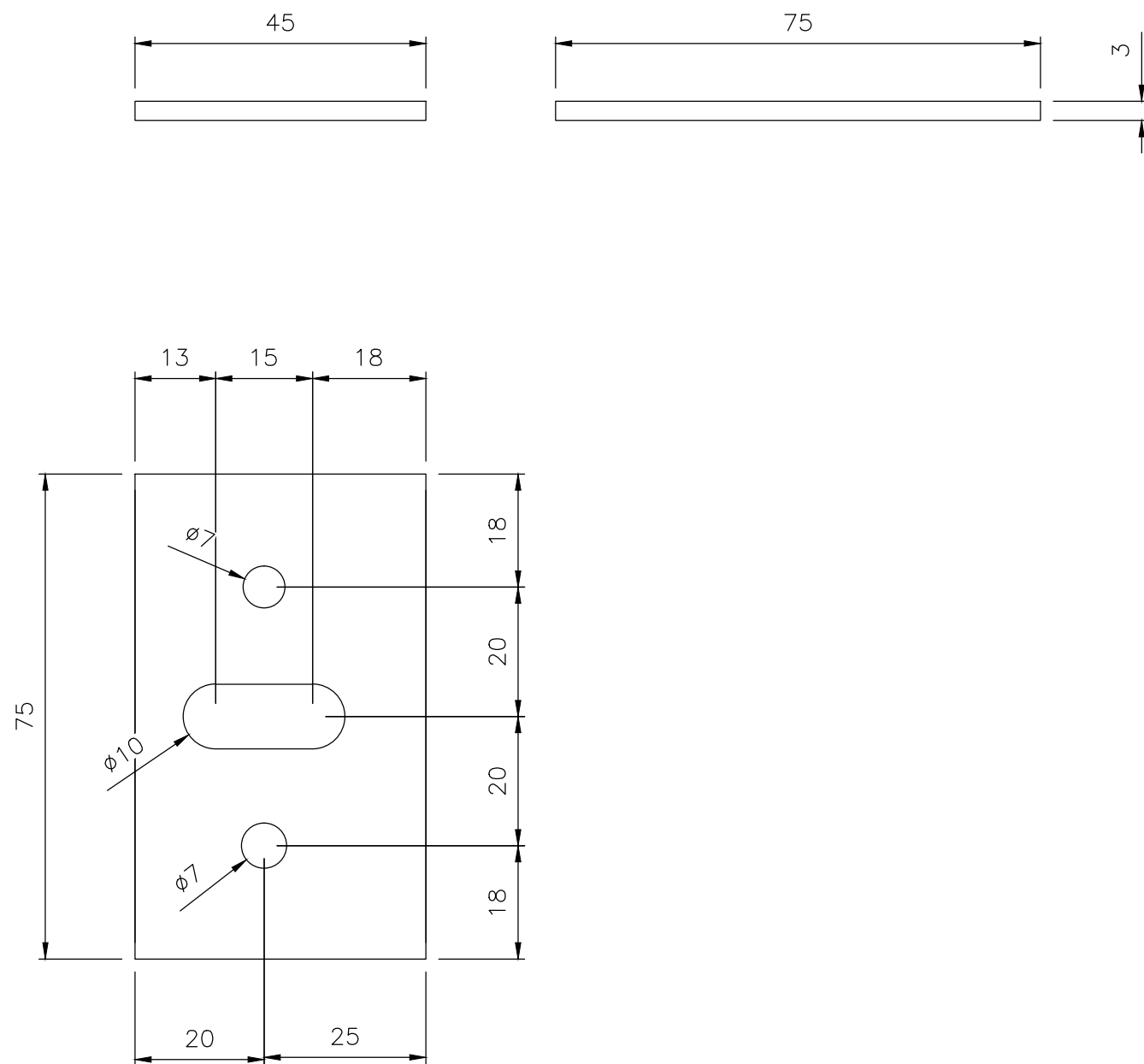


HELPING HAND BRACKET



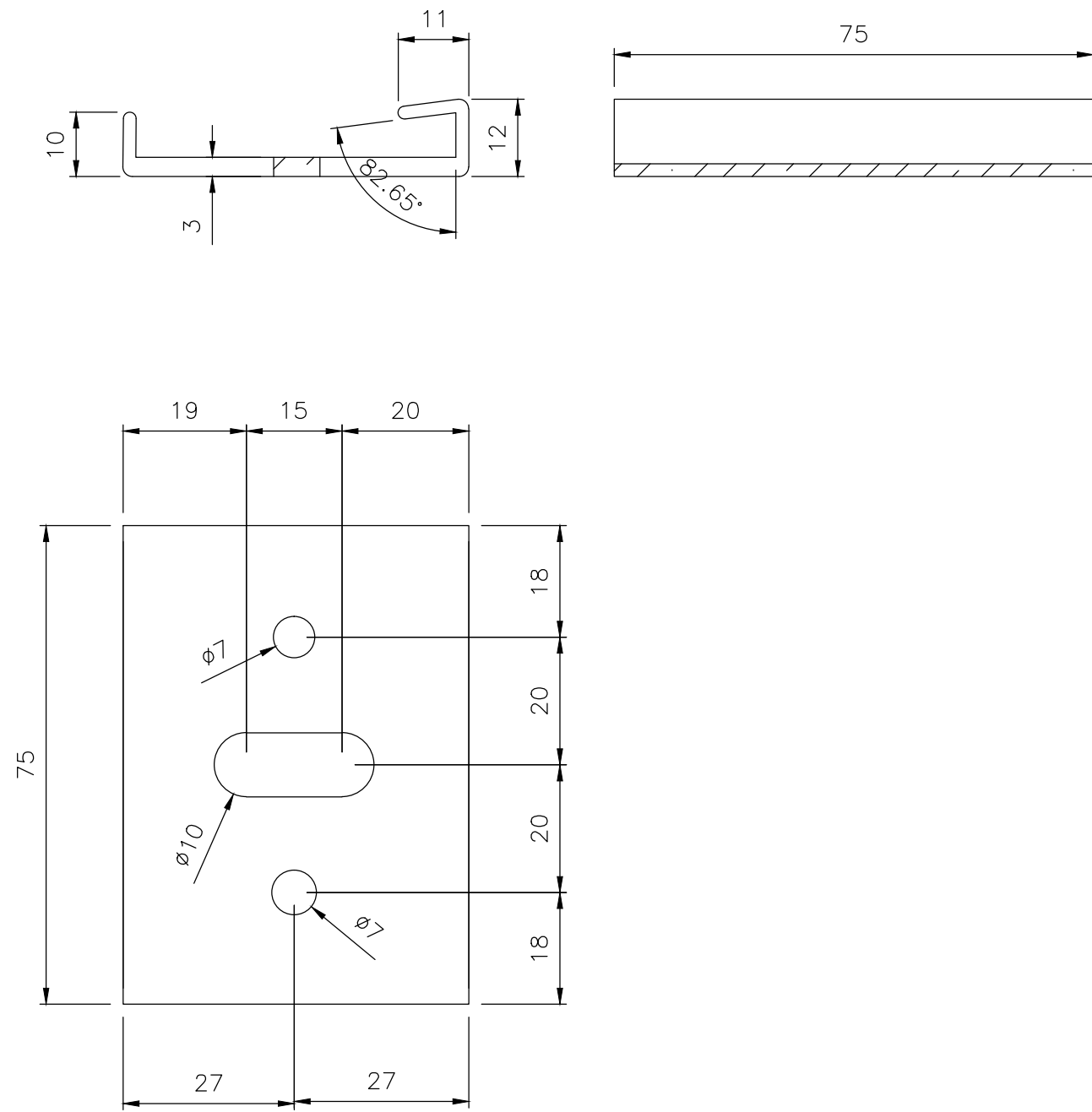
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BACKING PLATE



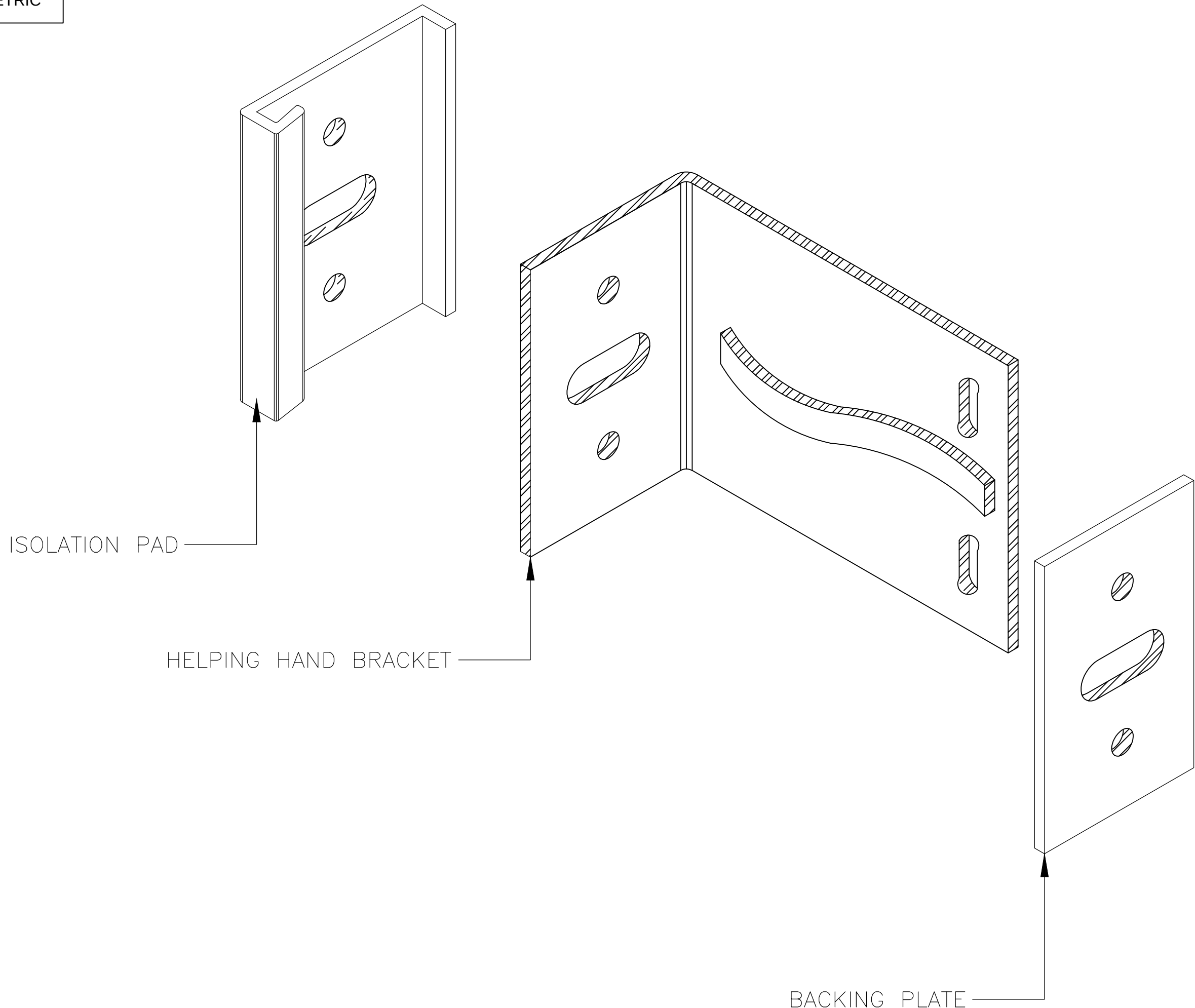
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ISOLATION PAD



MATERIAL:
2mm POLYPRO NYLON

ISOMETRIC



MATERIAL:
3mm STRUCTURAL GRADE ALUMINIUM

Site Location Plan:

WINTeCH
Drawing as supplied to WEL
BUILDING ENVELOPE TESTING

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Revisions	By:	Date:
—	LJC	21/03/2013

ISSUE FOR COMMENT

A	LJC	24/04/2013
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FINAL ISSUE

Client:

Project Name and Address:

CWCT TESTING RIG

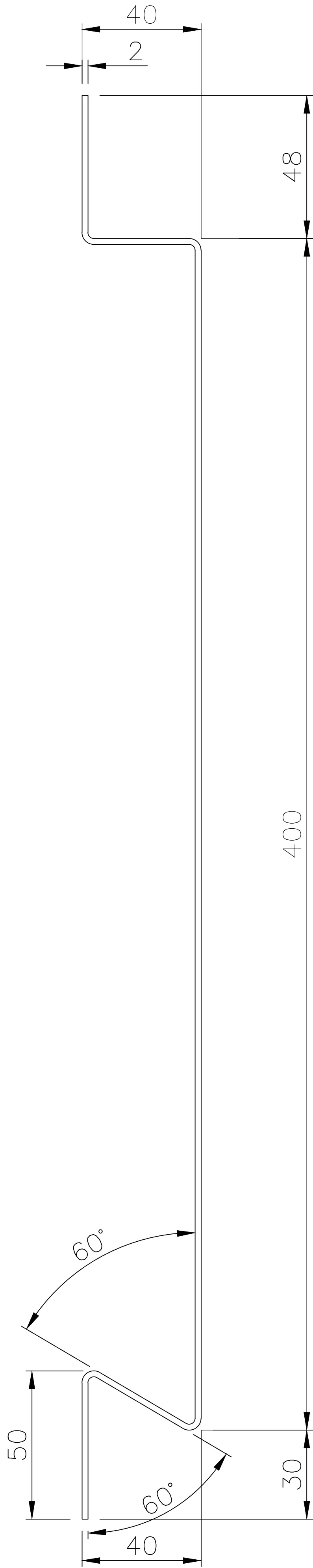
Drawing Title:

HELPING HAND BRACKET

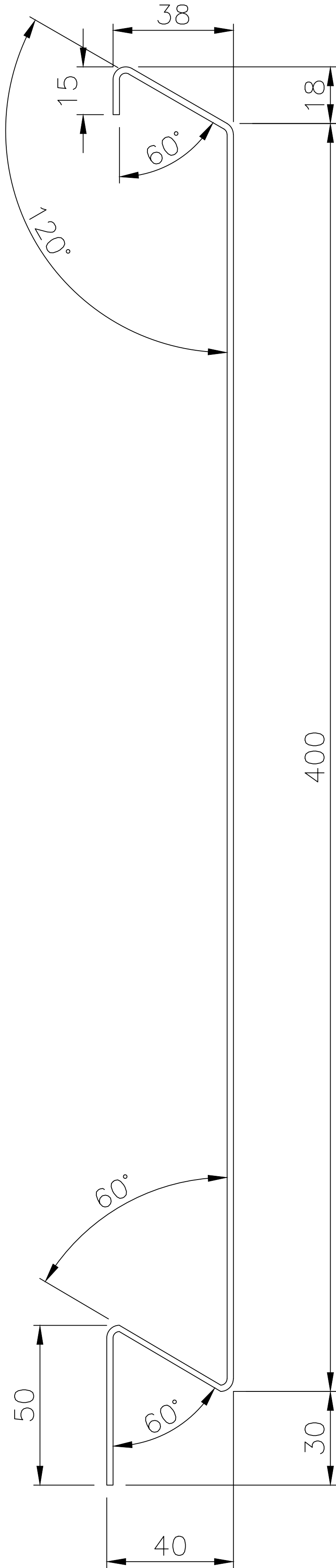
Drawn by	LUKE CRESSWELL
Drawing Date	21/03/2012
Checked by	
Checked Date	21/03/2013
Scale	1:2
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Drawing Status	FOR INFORMATION
Drawing Reference	GENIUS—CWCT—06

genius facades

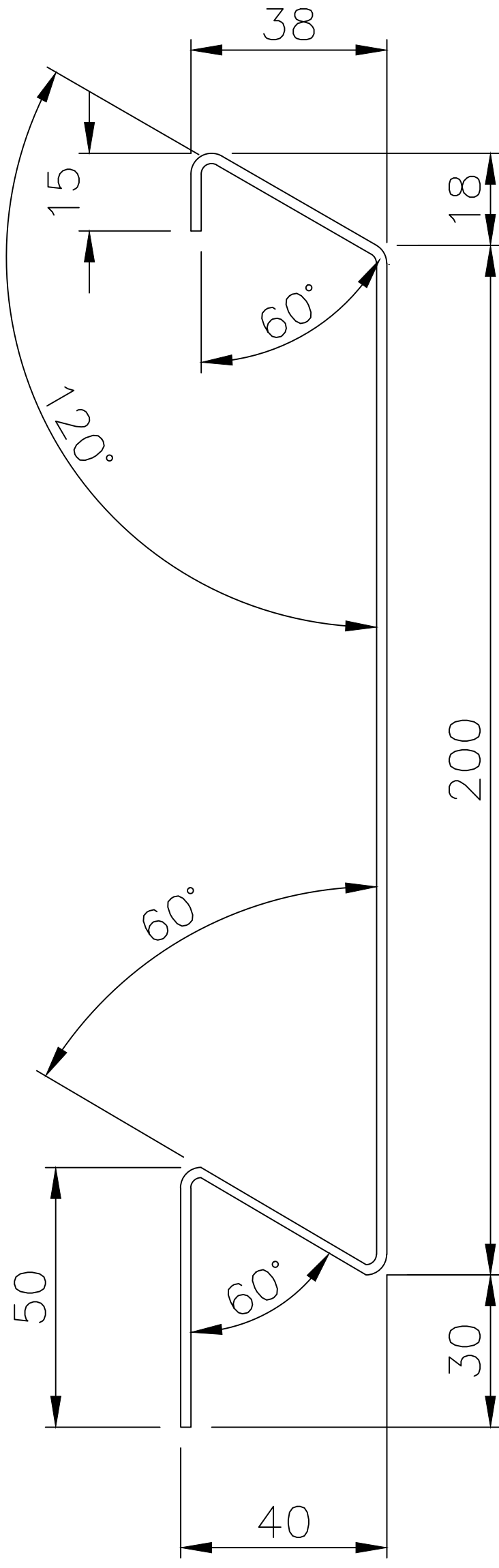
LINEAR COMPONENT TOP PANEL



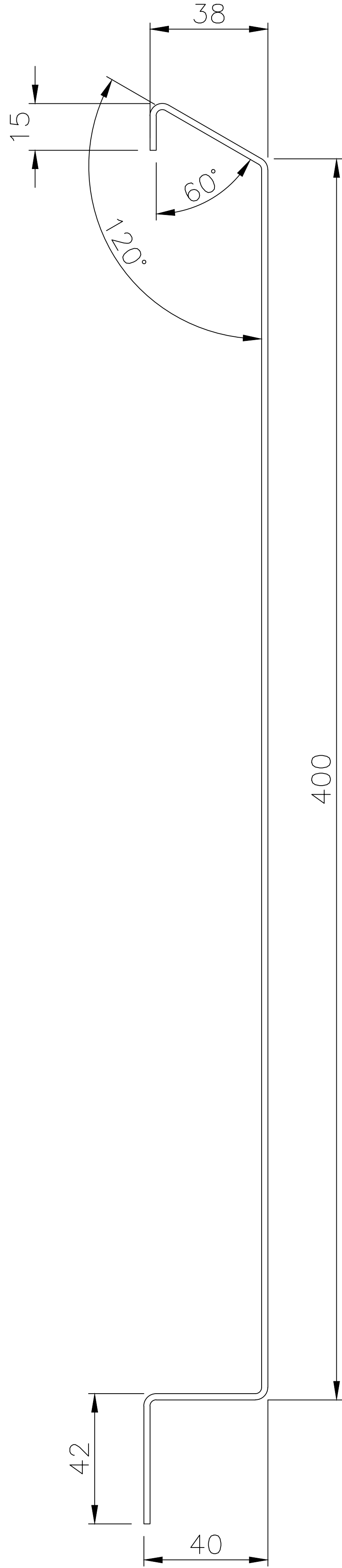
400mm LINEAR COMPONENT MID PANEL



400mm LINEAR COMPONENT MID PANEL



400mm LINEAR COMPONENT BOTTOM PANEL



Site Location Plan:

General Notes:

ALL LENGTHS AS PER SET OUR DRAWING

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Revisions	By:	Date:
–	LJC	21/03/2013

ISSUE FOR COMMENT

A	LJC	24/04/2013
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FINAL ISSUE

Client:

Project Name and Address:

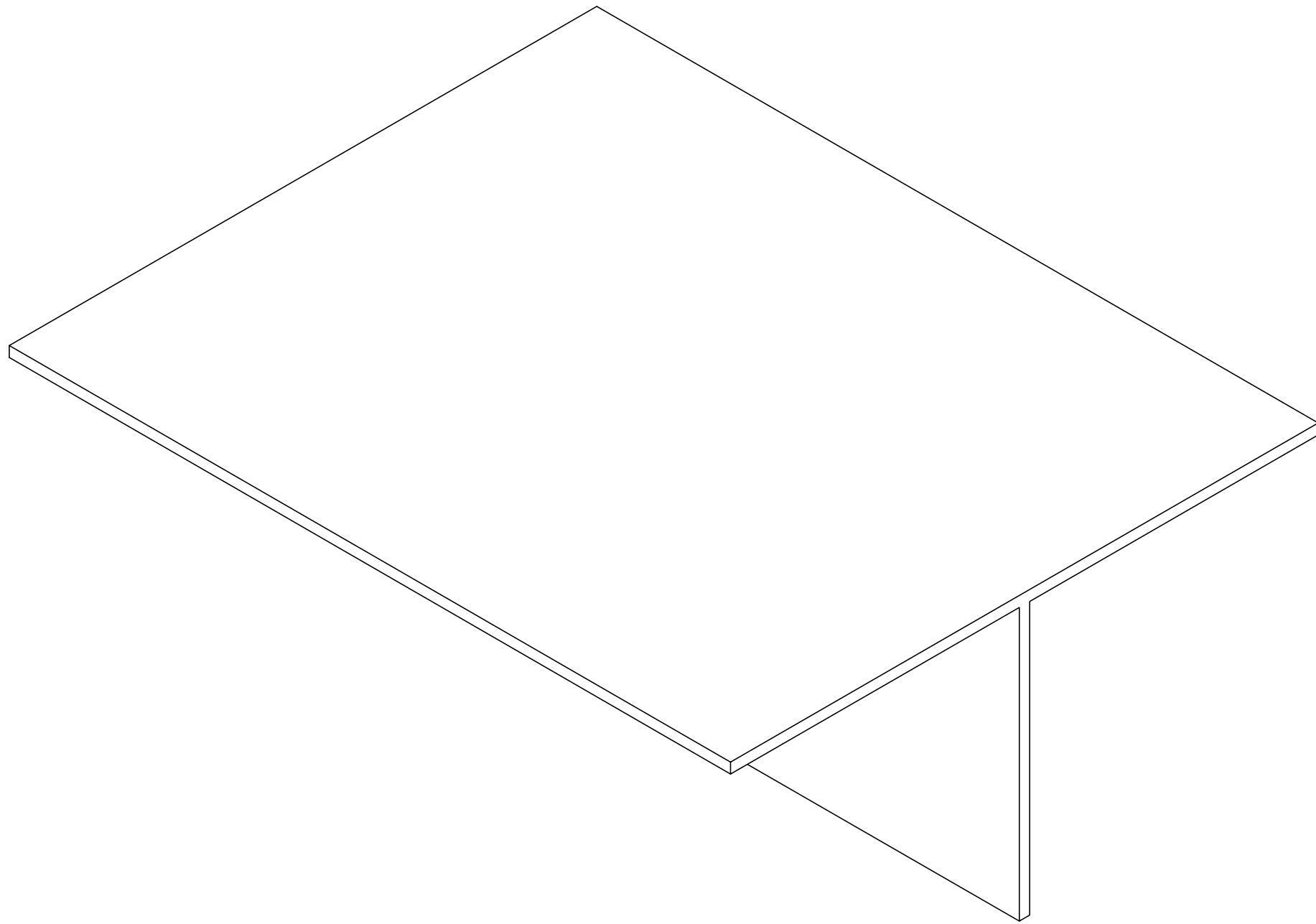
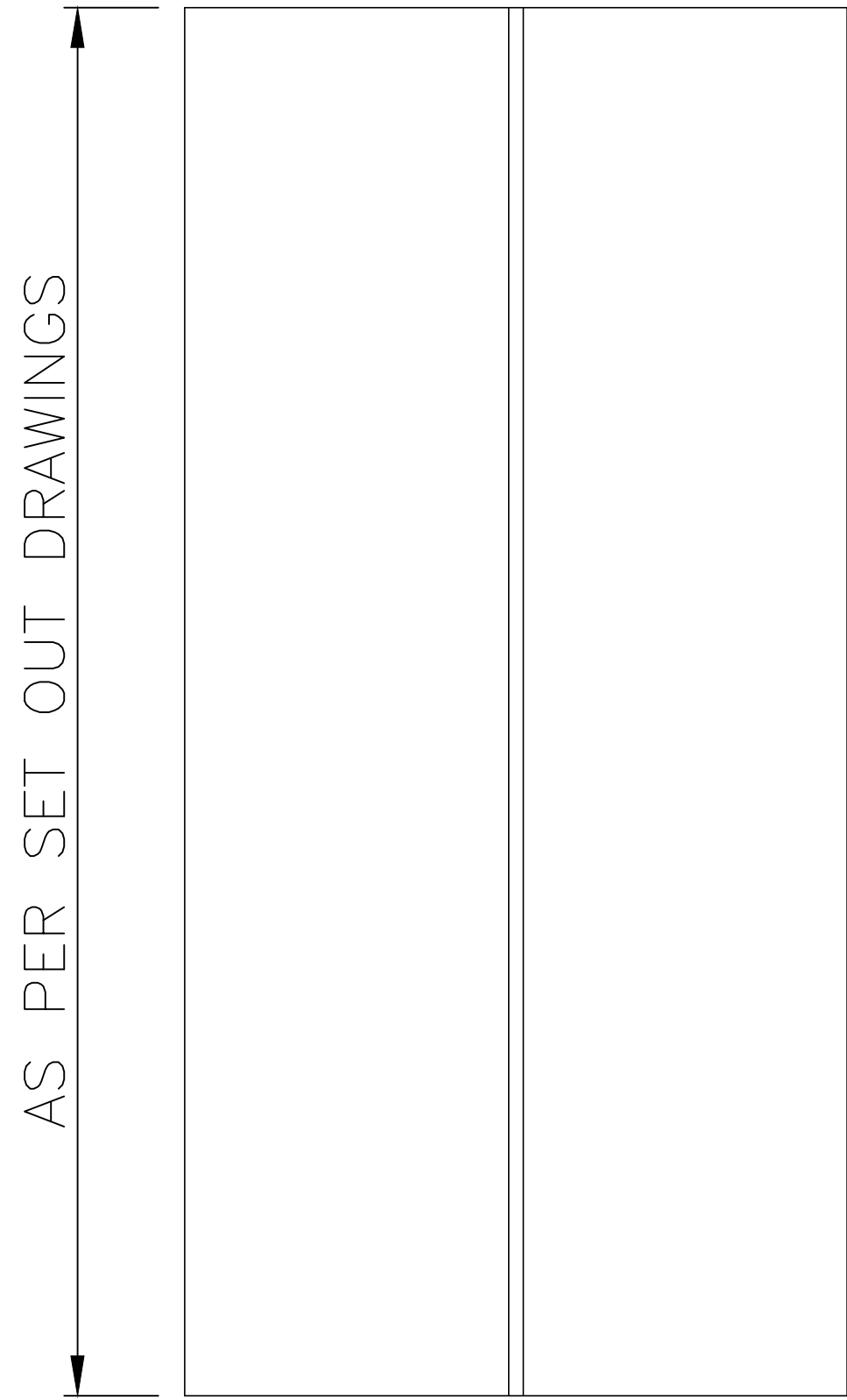
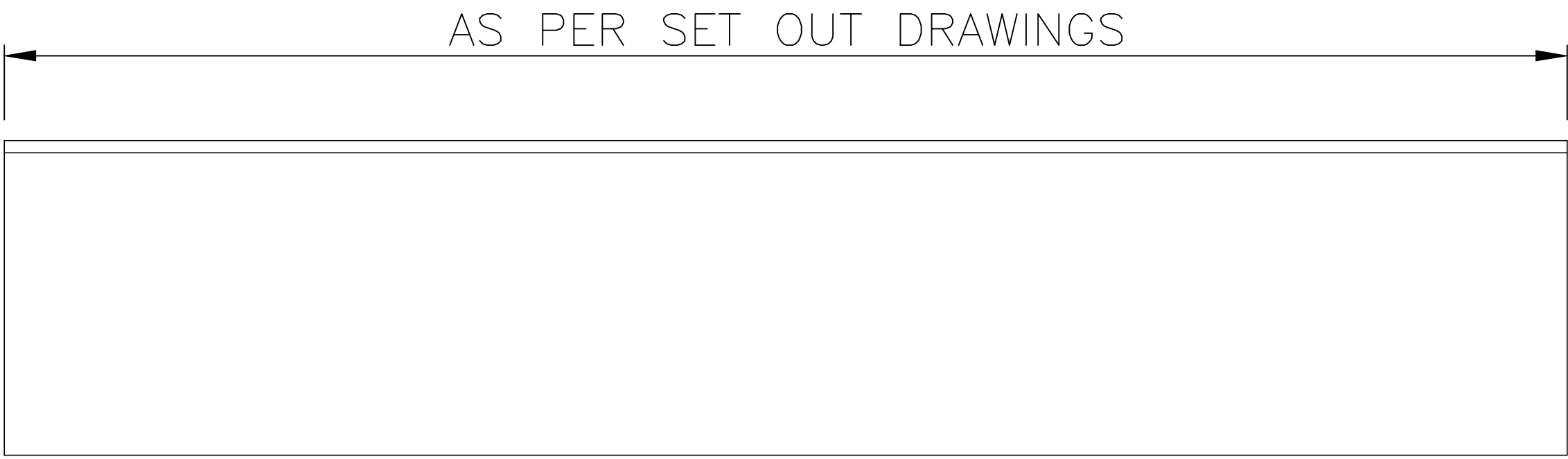
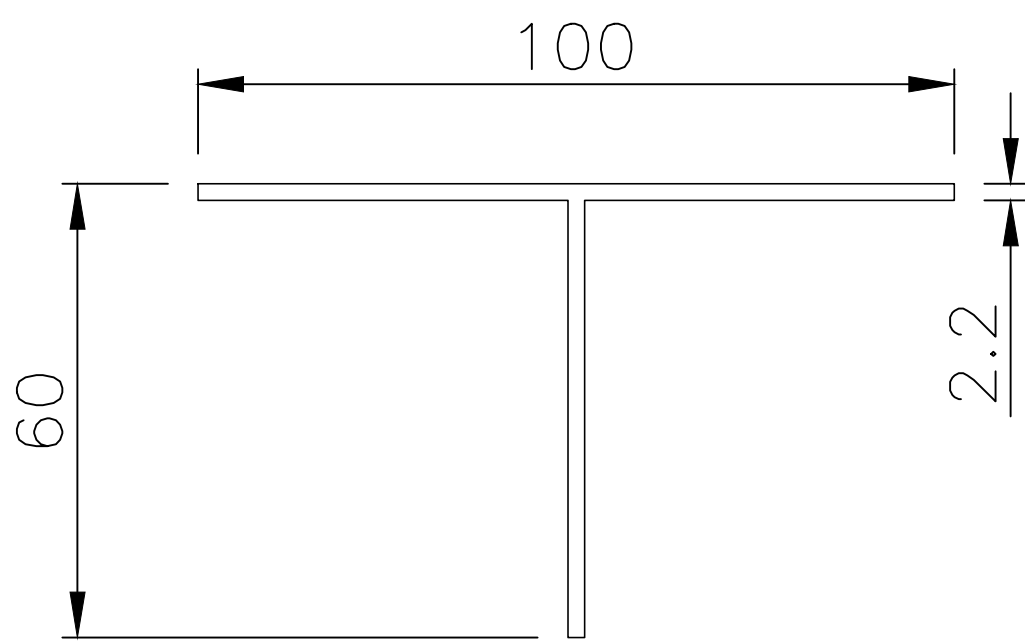
CWCT TESTING RIG

Drawing Title:

VERTICAL DETAILS THROUGH LINEAR, CURVATION AND PLANAR

Drawn by	LUKE CRESSWELL
Drawing Date	21/03/2012
Checked by	
Checked Date	21/03/2013
Scale	1:2
Sheet	A1
Drawing Status	FOR INFORMATION
Drawing Reference	GENIUS–CWCT–07

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Site Location Plan:

General Notes:
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—	LJC	21/03/2013

ISSUE FOR COMMENT

A	LJC	24/04/2013
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FINAL ISSUE

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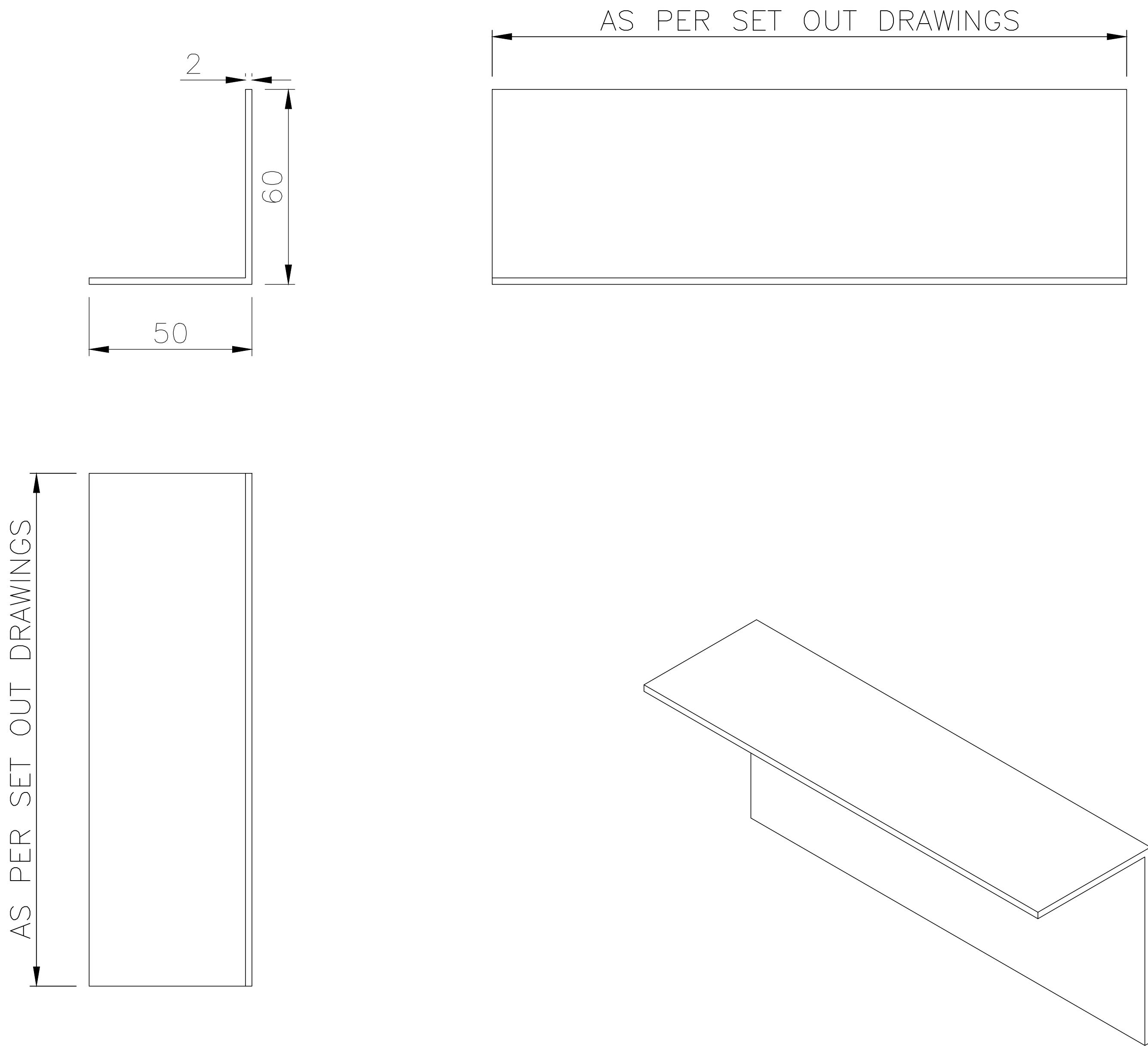
Client:

Project Name and Address:
CWCT TESTING RIG

Drawing Title:
'T' RAIL

Drawn by	LUKE CRESSWELL
Drawing Date	21/03/2012
Checked by	
Checked Date	21/03/2013
Scale	1:1
Sheet	A1
Drawing Status	FOR INFORMATION
Drawing Reference	GENIUS–CWCT–08





Site Location Plan:

General Notes:
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ISSUE FOR COMMENT

A	LJC	24/04/2013
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FINAL ISSUE

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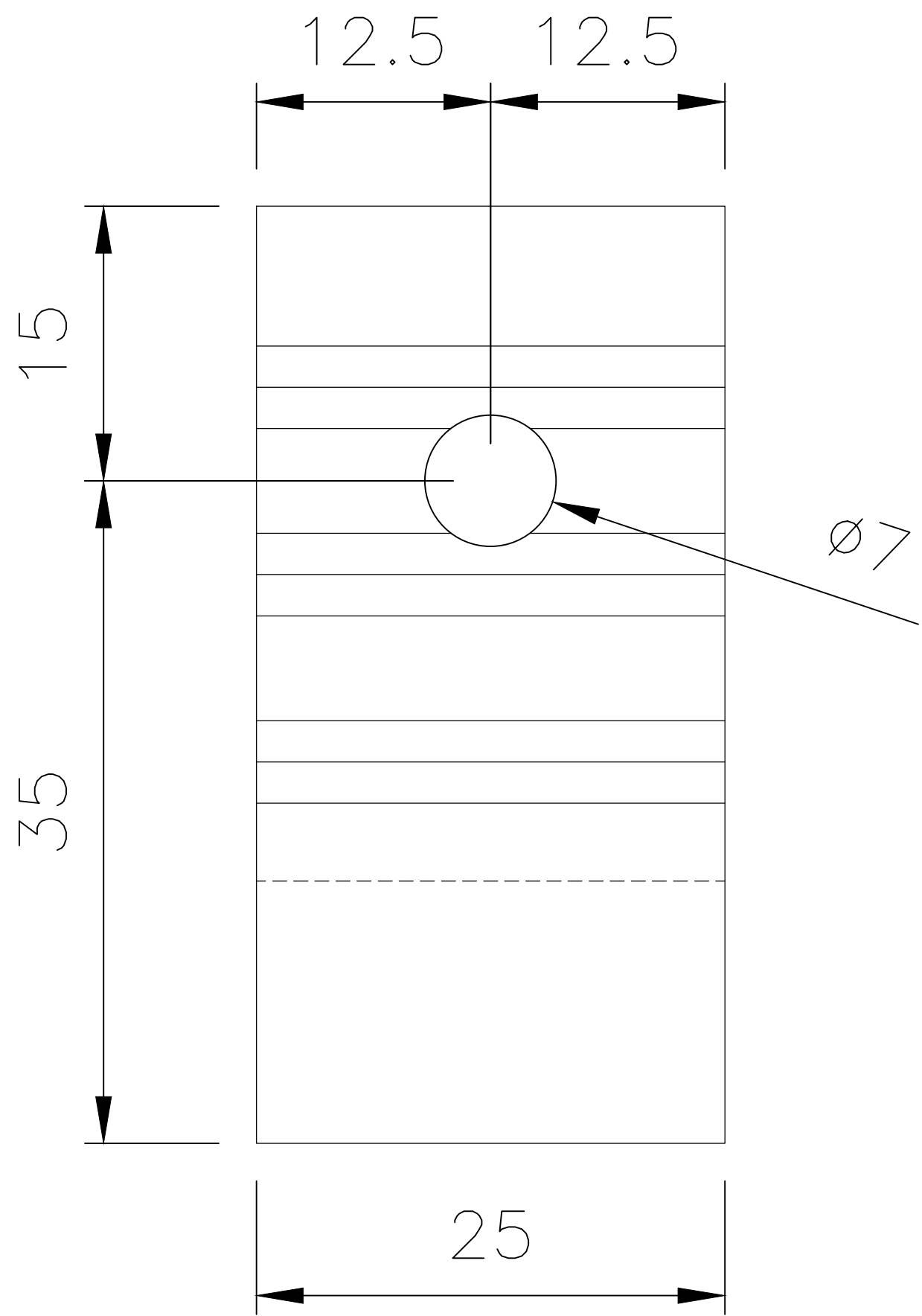
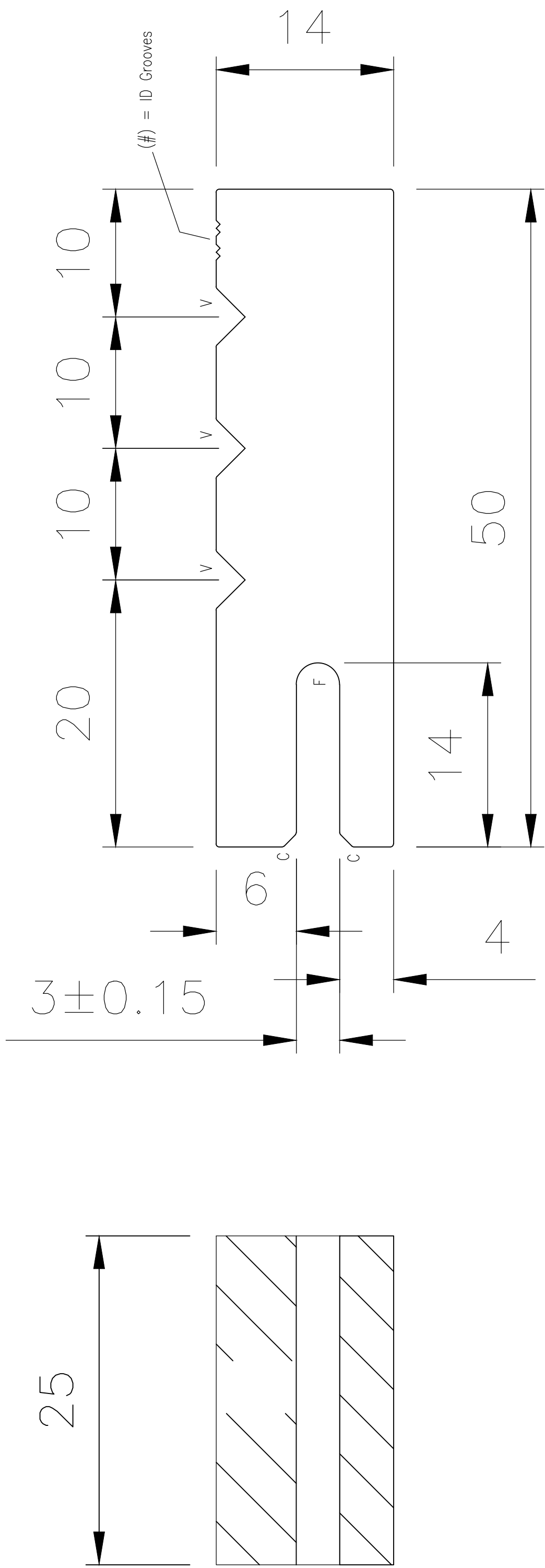
Project Name and Address:

CWCT TESTING RIG

Drawing Title:

'L' RAIL

Drawn by	LUKE CRESSWELL
Drawing Date	21/03/2012
Checked by	
Checked Date	21/03/2013
Scale	1:1
Sheet	A1
Drawing Status	FOR INFORMATION
Drawing Reference	GENIUS–CWCT–09



Site Location Plan:

General Notes:

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–	LJC	21/03/2013

ISSUE FOR COMMENT

A	LJC	24/04/2013
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FINAL ISSUE

Client:

Project Name and Address:

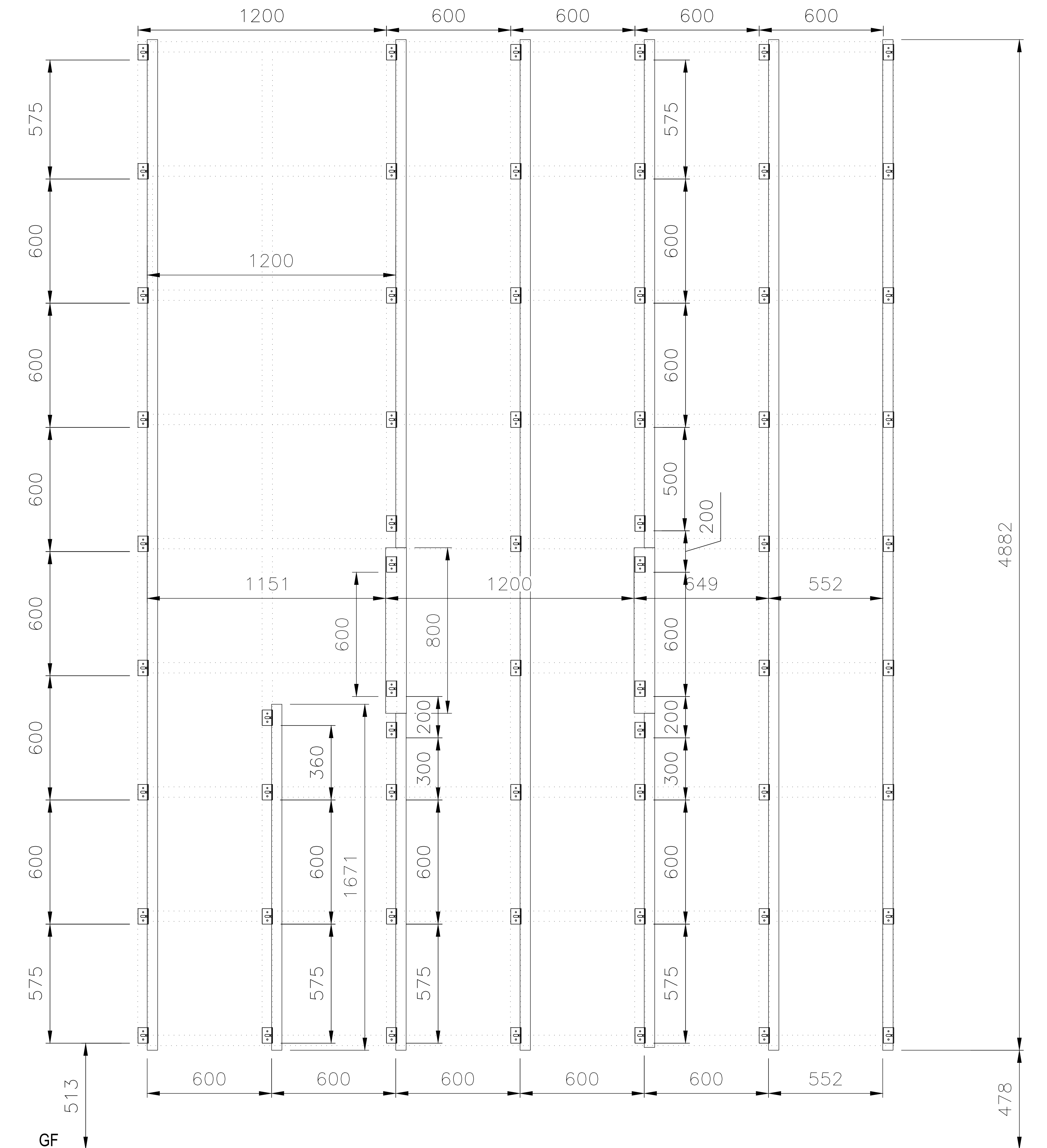
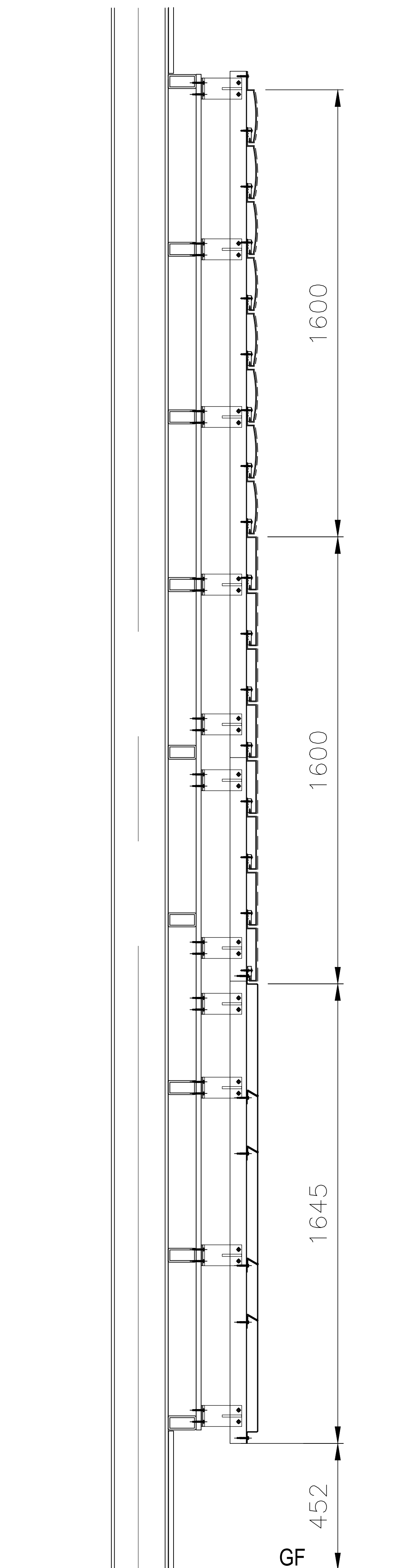
CWCT TESTING RIG

Drawing Title:

GENIUS CLIP C-001

Drawn by	LUKE CRESSWELL
Drawing Date	21/03/2012
Checked by	
Checked Date	21/03/2013
Scale	NTS
Sheet	A1
Drawing Status	FOR INFORMATION
Drawing Reference	GENIUS-CWCT-10

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APPENDIX B

Dismantling

B1. DISMANTLING

The dismantling was conducted on the 9th April 2013 by Genius Facades Ltd operatives, and was witnessed by D Price of Wintech Engineering Ltd.

When compared against the system drawings provided by Genius Facades Ltd at the time of dismantle, it was found that the system installed and tested was as per the system drawings provided.

END OF REPORT

PROJECT	The Boatmans				JOB REF. SC23-02-015-1B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Input by IS	Date 05/06/2023	Checked	Date	Approved	Date

PROJECT INFORMATION

Cladding	Other	
Thickness	4	mm
System	Face Fix	
Galv steel top hat	None	(0mm)
Substrate	Masonry	
Notes	7N/mm2 minimum block grade. Site test.	
Rail Type	60 Stem x 40 face x 2 L angle	
Bracket Type	All 88mm high	
Thermostop pad	Thermostop	
Cavity Width	120	mm
L Rail horizontal spacing	600	mm
Top hat span		mm
Rail height	1.520	m
No. of spans of rail	3	

APPLIED LOADINGS

A) Vertical Loads	
Self-weight of panel =	7.5 kg/m ²
Support system =	3.6 kg/m ²
TOTAL =	11.14 kg/m ²
B) Horizontal Loads	
Calculated wind =	1.17 kN/m ²
Check reverse load case	Yes

DEFLECTION REQUIREMENTS

Cont. span/defl ratio =	L/200
Cantilever defl. Ratio =	L/150
Max total deflection =	2 mm

SPAN DEFINITIONS (FROM BASE)

Span No.		
1	300.0 mm	Cantilever
2	920.0 mm	Supported each end
3	300.0 mm	Cantilever
Total height =	1.520 m	

Dead fix bracket pos'n	Top of	Span 1
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RESULTS

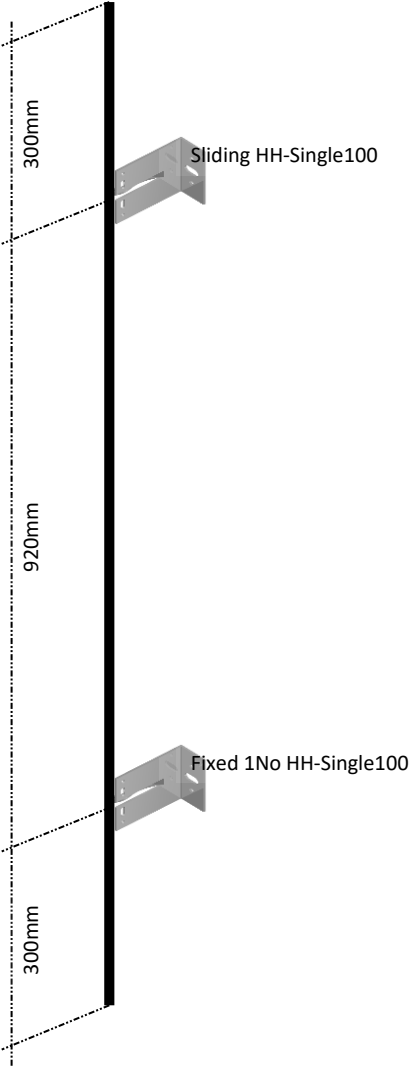
Sheeting Rail	Type	60 Stem x 40 face x 2 L angle	PASS	98%
	Max deflection	0.61 mm		
Dead load bracket	Type	HH-Single 100	PASS	70%
	Number per rail	1		
	Fixings	1 No Ejot SDF-KB-10V-E	7N/mm2 minimum block grade. Site test.	
Wind restraint bracket	Type	HH-Single 100	PASS	52%
	Number per rail	1		
	Fixings	1 No Ejot SDF-KB-10V-E	7N/mm2 minimum block grade. Site test.	

NOTES

Maximum cavity for selected components	147 mm
Minimum cavity for selected components	107 mm
Current cavity zone	120 mm
(Includes allowance for 0mm of panel fixings, 5mm thermal pad and 0mm top hat)	

PROJECT	The Boatmans				JOB REF. SC23-02-015-1B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Calc by IS	Date 05/06/2023	Checked	Date	Approved	Date

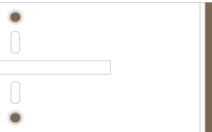
INDICATIVE ARRANGEMENT



Rail length: 1520mm
 Vertical rail: 60 Stem x 40 face x 2 L angle
 Set @ max: 600mm cts

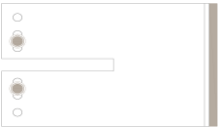
Note
 Arrangement drawing is indicative only.
 All dimensions shown represent the centreline position of the bracket (or bracket group if multiple dead load brackets are required).

DCS031 Bracket Arrangement:
 Fix Point (dead load)



Rail to bracket fixing:
 2 No JT4 4 4.8x19

Sliding Point (wind restraint & rail expansion)



Rail to bracket fixing:
 2 No JT4 4 4.8x19

PROJECT	The Boatmans				JOB REF. SC23-02-015-1B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Input by IS	Date 05/06/2023	Checked	Date	Approved	Date

PROJECT INFORMATION

Cladding	Other	
Thickness	4	mm
System	Face Fix	
Galv steel top hat	None	(0mm)
Substrate	Masonry	
Notes	7N/mm2 minimum block grade. Site test.	
Rail Type	60 Stem x 40 face x 2 L angle	
Bracket Type	All 88mm high	
Thermostop pad	Thermostop	
Cavity Width	120	mm
L Rail horizontal spacing	600	mm
Top hat span		mm
Rail height	2.240	m
No. of spans of rail	4	

APPLIED LOADINGS

A) Vertical Loads	
Self-weight of panel =	7.5 kg/m ²
Support system =	3.4 kg/m ²
TOTAL =	10.89 kg/m ²
B) Horizontal Loads	
Calculated wind =	1.17 kN/m ²
Check reverse load case	Yes

DEFLECTION REQUIREMENTS

Cont. span/defl ratio =	L/200
Cantilever defl. Ratio =	L/150
Max total deflection =	2 mm

SPAN DEFINITIONS (FROM BASE)

Span No.		
1	300.0 mm	Cantilever
2	820.0 mm	Supported each end
3	820.0 mm	Supported each end
4	300.0 mm	Cantilever
Total height =	2.240 m	

Dead fix bracket pos'tn	Top of	Span 1
-------------------------	--------	--------

RESULTS

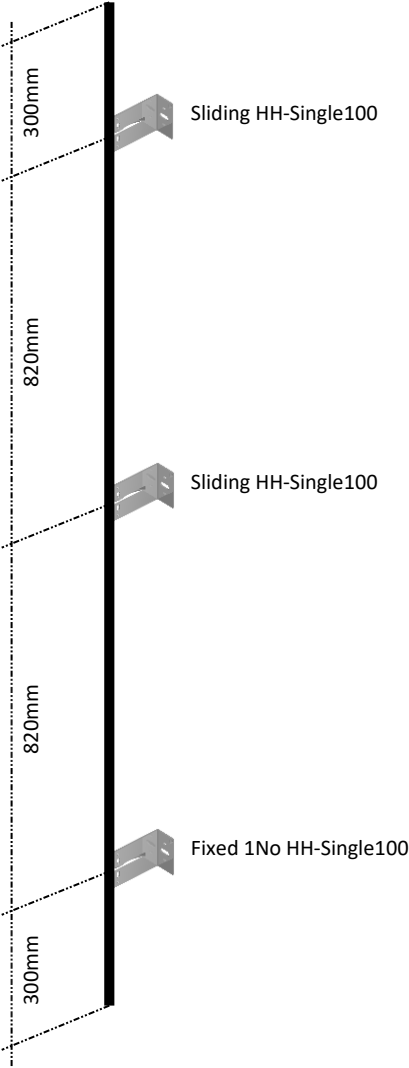
Sheeting Rail	Type	60 Stem x 40 face x 2 L angle	PASS	99%
	Max deflection	0.19 mm		
Dead load bracket	Type	HH-Single I 100	PASS	74%
	Number per rail	1		
	Fixings	1 No Ejoyt SDF-KB-10V-E	7N/mm2 minimum block grade. Site test.	
Wind restraint bracket	Type	HH-Single I 100	PASS	58%
	Number per rail	2		
	Fixings	1 No Ejoyt SDF-KB-10V-E	7N/mm2 minimum block grade. Site test.	

NOTES

Maximum cavity for selected components	147 mm
Minimum cavity for selected components	107 mm
Current cavity zone	120 mm
(Includes allowance for 0mm of panel fixings, 5mm thermal pad and 0mm top hat)	

PROJECT	The Boatmans				JOB REF. SC23-02-015-1B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Calc by IS	Date 05/06/2023	Checked	Date	Approved	Date

INDICATIVE ARRANGEMENT

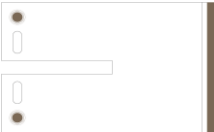


Rail length: 2240mm
 Vertical rail: 60 Stem x 40 face x 2 L angle
 Set @ max: 600mm cts

Note
 Arrangement drawing is indicative only.
 All dimensions shown represent the centreline position of the bracket (or bracket group if multiple dead load brackets are required).

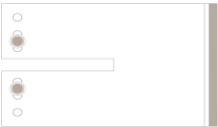
DCS031 Bracket Arrangement:

Fix Point (dead load)



Rail to bracket fixing:
 2 No JT4 4 4.8x19

Sliding Point (wind restraint & rail expansion)



Rail to bracket fixing:
 2 No JT4 4 4.8x19

PROJECT	The Boatmans				JOB REF. SC23-02-015-1B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Input by IS	Date 05/06/2023	Checked	Date	Approved	Date

PROJECT INFORMATION

Cladding	Other	
Thickness	4	mm
System	Face Fix	
Galv steel top hat	None	(0mm)
Substrate	Masonry	
Notes	7N/mm2 minimum block grade. Site test.	
Rail Type	60 Stem x 40 face x 2 L angle	
Bracket Type	All 88mm high	
Thermostop pad	Thermostop	
Cavity Width	120	mm
L Rail horizontal spacing	600	mm
Top hat span		mm
Rail height	3,120	m
No. of spans of rail	5	

APPLIED LOADINGS

A) Vertical Loads	
Self-weight of panel =	7.5 kg/m ²
Support system =	3.2 kg/m ²
TOTAL =	10.74 kg/m ²
B) Horizontal Loads	
Calculated wind =	1.17 kN/m ²
Check reverse load case	Yes

DEFLECTION REQUIREMENTS

Cont. span/defl ratio =	L/200
Cantilever defl. Ratio =	L/150
Max total deflection =	2 mm

SPAN DEFINITIONS (FROM BASE)

Span No.		
1	300.0 mm	Cantilever
2	840.0 mm	Supported each end
3	840.0 mm	Supported each end
4	840.0 mm	Supported each end
5	300.0 mm	Cantilever
Total height =	3,120 m	

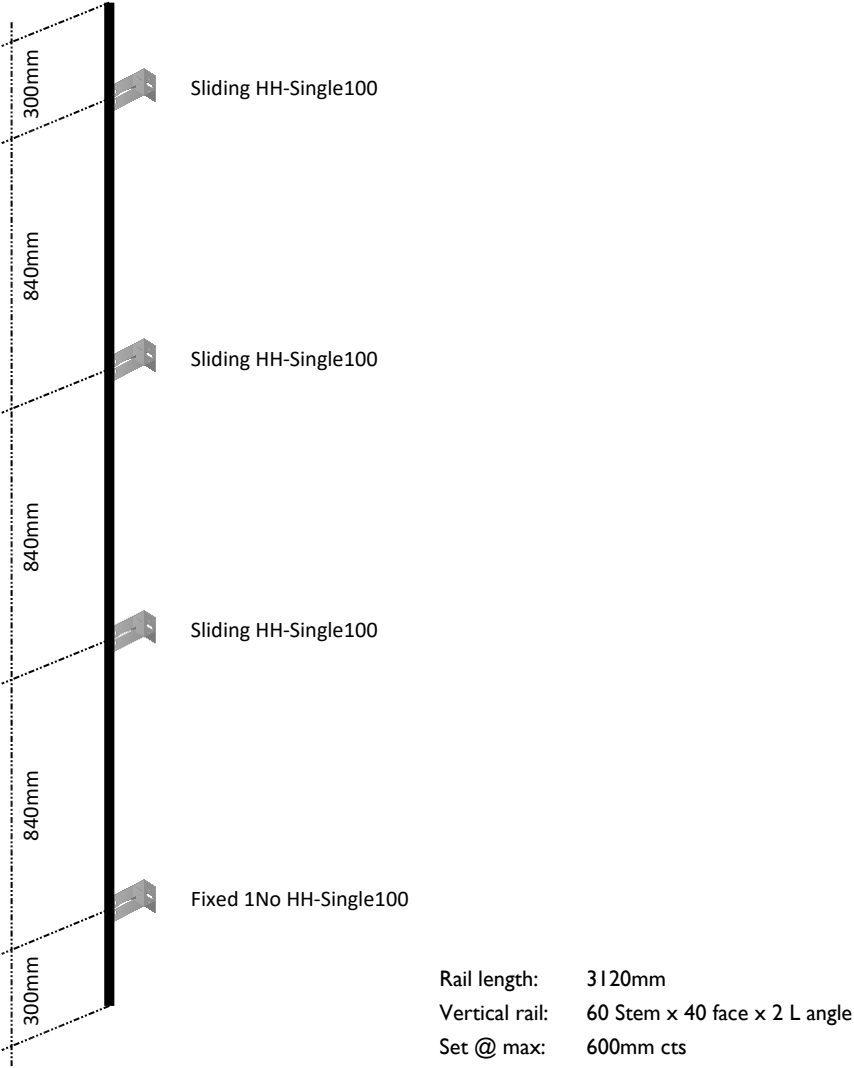
Dead fix bracket pos'tn	Top of	Span 1
-------------------------	--------	--------

RESULTS

Sheeting Rail	Type	60 Stem x 40 face x 2 L angle	PASS	99%
	Max deflection	0.24 mm		
Dead load bracket	Type	HH-Single I 100	PASS	86%
	Number per rail	1		
	Fixings	1 No Ejot SDF-KB-10V-E 7N/mm2 minimum block grade. Site test.		
Wind restraint bracket	Type	HH-Single I 100	PASS	58%
	Number per rail	3		
	Fixings	1 No Ejot SDF-KB-10V-E 7N/mm2 minimum block grade. Site test.		
NOTES	Maximum cavity for selected components		147 mm	
	Minimum cavity for selected components		107 mm	
	Current cavity zone		120 mm	
	(Includes allowance for 0mm of panel fixings, 5mm thermal pad and 0mm top hat)			

PROJECT	The Boatmans				JOB REF. SC23-02-015-1B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Calc by IS	Date 05/06/2023	Checked	Date	Approved	Date

INDICATIVE ARRANGEMENT

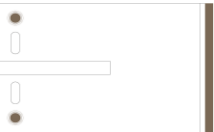


Note

Arrangement drawing is indicative only.
All dimensions shown represent the centreline position of the bracket (or bracket group if multiple dead load brackets are required).

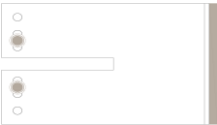
DCS031 Bracket Arrangement:

Fix Point (dead load)



Rail to bracket fixing:
2 No JT4 4 4.8x19

Sliding Point (wind restraint & rail expansion)



Rail to bracket fixing:
2 No JT4 4 4.8x19

Architectural Panel Solutions

5 Wainwright Close, Churchfields Industrial Estate,
St Leonards on Sea, East Sussex, TN38 9PP

Project details

Project Name: **The Boatmans**
 Project ID: **SC23-02-015-1B**
 Project Location: **Manchester M15 4QF**
 Designer Comments:

Author details

	By:	Date:
Authored:	IS	05/06/2023
Checked:		
Approved:		

Cladding buildup

Outer cladding:	Other	
Fixing system:	Face Fix	0 mm
Thickness:	4mm	Mass: 7.5 kg/m ²
Galvanised steel top hat:	None	Depth: 0 mm
Cavity width (face of sub-structure to back of panel):	120mm	
Thermal pad:	Thermostop	Thickness: 5 mm
Vertical rail:	60 Stem x 40 face x 2 L angle	
Brackets:	All 88mm high	
	Dead: HH-Single 100	
	Sliding: HH-Single 100	

Substrate

Type:	Masonry
	7N/mm ² minimum block grade. Site test.

Loading

Design wind load to BS EN 1991-1-4 (WL):	1.17 kN/m ²	$\gamma_w =$	1.50
Check pressure and suction?:	Yes		
Design dead load (DL):	0.11 kN/m ²	$\gamma_g =$	1.35

Constraints

Main span design deflection limit δ_{ratio} :	L/200
Cantilever end design deflection limit δ_{cant} :	L/150
Maximum absolute deflection δ_{abs} :	2 mm

Geometry

Total height of vertical rail H_{rail} :	3.12 m
Rail horizontal spacing H_{cts} :	600 mm

Set out of brackets from base of rail:**Required number of spans: 5**

Base	Free	0.000 m
Restraint 1	Fixed	0.300 m
Restraint 2	Sliding	1.140 m

Restraint 3	Sliding	1.980 m
Restraint 4	Sliding	2.820 m
Top	Free	3.120 m

Component load resistances:

60 Stem x 40 face x 2 L angle vertical rails

Moment of inertia	$I_{y,rail}$	=	(refer to rail calculations)	7.51 cm ⁴
Moment resistance	$M_{c,Rd,rail}$	=	(refer to rail calculations)	65.54 Nm
Axial resistance	$N_{c,Rd,rail}$	=	(refer to rail calculations)	8.89 kN
Shear resistance	$V_{c,Rd,rail}$	=	(refer to rail calculations)	10.08 kN

HH-Single 100 Dead load bracket

Compression resistance	$N_{c,Rd,DLB}$	=	(refer to bracket calculations)	7.28 kN
Tensile resistance	$N_{t,Rd,DLB}$	=	(refer to bracket calculations)	1.56 kN
Moment resistance	$M_{c,Rd,DLB}$	=	(refer to bracket calculations)	0.22 kNm
Shear resistance	$V_{c,Rd,DLB}$	=	(refer to bracket calculations)	0.58 kN
Fixing tensile resistance	$N_{t,fix,DLB}$	=	(refer to bracket calculations)	1.60 kN
Fixing shear resistance	$V_{fix,DLB}$	=	(refer to bracket calculations)	1.60 kN
Fixing moment resistance	$M_{fix,DLB}$	=	(refer to bracket calculations)	0.07 kNm

HH-Single 100 Sliding bracket

Compression resistance	$N_{c,Rd,SLB}$	=	(refer to bracket calculations)	8.78 kN
Tensile resistance	$N_{t,Rd,SLB}$	=	(refer to bracket calculations)	2.13 kN
Fixing tensile resistance	$N_{t,fix,SLB}$	=	(refer to bracket calculations)	1.60 kN
Fixing shear resistance	$V_{c,Rd,SLB}$	=	(refer to bracket calculations)	1.60 kN

Worst case rail tensile reaction allowable	$R_{max,t}$	=	$\min \{ V_{c,Rd,rail} ; N_{t,Rd,DLB} ; N_{t,fix,DLB} ; N_{t,fix,SLB} ; N_{t,Rd,SLB} \}$	1.56 kN
Worst case rail compressive reaction allowable	$R_{max,c}$	=	$\min \{ V_{c,Rd,rail} ; N_{c,Rd,DLB} ; N_{c,Rd,SLB} \}$	7.28 kN
Lateral line load on rails	w_{SLS}	=	$WL \cdot H_{ctc}$	0.70 kN/m
	w_{ULS}	=	$w_{ULS} \cdot Y_w$	1.06 kN/m

Basic analytical analysis:

Max span for rail deflection (single span)	=	$(384 \cdot E_{alu} \cdot I_{y,rail} / (5 \cdot \delta_{ratio} \cdot w_{sls}))^{1/3}$	1.42 m
Max span for rail abs. deflection (single span)	=	$(384 \cdot \delta_{abs} \cdot E_{alu} \cdot I_{y,rail} / (5 \cdot w_{sls}))^{1/4}$	1.03 m
Max span for rail deflection (double span)	=	$(185 \cdot E_{alu} \cdot I_{y,rail} / (\delta_{ratio} \cdot w_{sls}))^{1/3}$	1.90 m
Max span for rail abs. deflection (double span)	=	$(185 \cdot \delta_{abs} \cdot E_{alu} \cdot I_{y,rail} / (w_{sls}))^{1/4}$	1.29 m
Max span for rail deflection (multi span)	=	$(145 \cdot E_{alu} \cdot I_{y,rail} / (\delta_{ratio} \cdot w_{sls}))^{1/3}$	1.76 m
Max span for rail abs. deflection (multi span)	=	$(145 \cdot \delta_{abs} \cdot E_{alu} \cdot I_{y,rail} / (w_{sls}))^{1/4}$	1.21 m
Max span for rail moment	=	$(8 \cdot M_{c,Rd,rail} / (w_{uls}))^{1/2}$	0.70 m
Max span for rail moment (multi span)	=	$(10 \cdot M_{c,Rd,rail} / (w_{uls}))^{1/2}$	0.79 m
Max span for bracket pullout (single span)	=	$2 \cdot R_{max,t} / (w_{uls})$	2.95 m
Max span for bracket pullout (double span)	=	$8 \cdot R_{max,t} / (10 \cdot w_{uls})$	1.18 m
Max span for bracket pullout (multi span)	=	$10 \cdot R_{max,t} / (12 \cdot w_{uls})$	1.23 m

Architectural Panel Solutions

5 Wainwright Close, Churchfields Industrial Estate,
St Leonards on Sea, East Sussex, TN38 9PP

Max span for bracket compression (single span)	=	$2 \cdot R_{\max,c} / (w_{uls})$	13.79 m
Max span for bracket compression (dble span)	=	$8 \cdot R_{\max,c} / (10 \cdot w_{uls})$	5.51 m
Max span for bracket compression (multi span)	=	$10 \cdot R_{\max,c} / (12 \cdot w_{uls})$	5.74 m

Therefore, limit the span to	$L_{\max}$	=	0.80 m
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Results from full analysis

Maximum cantilever deflection =	0.00 mm	< 2mm	PASS
Minimum cantilever deflection =	-0.02 mm	< 2mm	PASS
Maximum cantilever deflection ratio =		$L / 13102$	PASS
Maximum cantilever moment (ULS) =	0.00 Nm	< 65.54	PASS
Minimum cantilever moment (ULS) =	-47.52 Nm	< 65.54	PASS
Maximum main span deflection =	0.24 mm	< 2mm	PASS
Minimum main span deflection =	0 mm	< 2mm	PASS
Maximum main span deflection ratio =		$L / 3517$	PASS
Maximum main span moment (ULS) =	36.87 Nm	< 65.54	PASS
Minimum main span moment (ULS) =	-65 Nm	< 65.54	PASS
Maximum reaction (ULS) (sliding bracket tension) =	0.91 kN	< 1.56	PASS
Minimum reaction (ULS) (sliding bracket compression) =	0.91 kN	< 7.28	PASS
Maximum reaction (ULS) (dead bracket tension) =	0.74 kN	< 1.56	PASS
Minimum reaction (ULS) (dead bracket compression) =	0.74 kN	< 7.28	PASS
Number of dead load brackets required		1	PASS

Basic Wind Load Analysis to BS EN 1991-1-4 & UK National Annex

Project post code: M15 4QF
Site location: In town

Site altitude	A	=	=	34.00 m
Map wind speed	$V_{b,map}$	=	=	23.00 m/s
Height of building to eaves	Z	=	=	24.00 m
Distance to sea		=	=	50.00 km
Distance inside town		=	=	8.00 km
Terrain category		=	=	3
Surrounding obstructions	h_{dis}	=	=	5.00 m
Altitude factor	C_{alt}	=	$1 + 0.001(C_{gec} \times A)$	1.03
Direction factor	C_{dir}	=	worst case 240 degrees	1.00
Season factor	C_{season}	=	worst case	1.00
Probability factor	C_{prob}	=	worst case	1.00
Exposure factor	$C_e(z)$	=	UK NA to EN 1991-1-4, Figure NA.7	2.82
Town exposure correction factor	$C_{e,T}$	=	UK NA to EN 1991-1-4, Figure NA.8	1
Fundamental basic wind velocity	$V_{b,0}$	=	$C_{alt} \times V_{b,map}$	23.78 m/s
Basic velocity	V_b	=	$V_{b,0} \times C_{season} \times C_{prob} \times C_{dir}$	23.78 m/s
Basic velocity pressure	q_b	=	$0.613 \times V_b^2$	0.35 kN/m ²
Peak velocity pressure	q_p	=	$q_b \times C_e(z) \times C_{e,T}$	0.98 kN/m ²
Is funnelling present?	No			
Is the building envelope ventilated?	Yes		Rainscreen	
Internal pressure coefficient $C_{p,i}$	$C_{p,i}$	=	=	0.00
External pressure coefficient $C_{p,e}$	$C_{o,e}$	=	=	1.20
Net pressure coefficient $C_{p,net}$	$C_{p,net}$	=	$C_{p,i} + C_{p,e}$	1.20
Calculation of net positive pressure		=	$q_p \times C_{p,net}$	1.17 kN/m²

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Effective inertia about y axis	$I_{y,eff,b,tc}$	=	=	2.34 cm ⁴
Effective distance to elastic NA from edge of face	$y_{gc,eff,b,tc}$	=	=	15.83 mm
Effective distance to elastic NA from base of stem	$z_{gc,eff,b,tc}$	=	=	51.93 mm
Effective elastic modulus about y axis	$W_{el,y,eff,b,tc}$	= I_y / z_{gc}	=	0.45 cm ³

Reduced cross section in y-y bending - face in compression - unreinforced unsymmetrical outstand element

Slenderness parameter of the face	$\beta_{b,tc,face}$	= W_f / t_f	=	20.00
Maximum slendernesses for section classification (EN 1999-1-1:2007 Table 6.2)	β_1	= $3 \times Eps$	=	3.75
	β_2	= $4.5 \times Eps$	=	5.63
	β_3	= $6 \times Eps$	=	7.50
	$\beta_{b,tc,face}$	> β_3		
Tensile stress at toe	σ_T	= $-\sigma_C \cdot z_{gc} / (D_s - z_{gc})$	=	-351.72
Stress ratio of ends of the stem	ψ	=	=	-2.20
Slenderness reduction	η	= EN 1999-1 Figure 6.2 Line A	=	0.25

Slenderness parameter of the compression part of the stem	$\beta_{b,tc,stem}$	= $\eta D_s / t_s$	=	7.50
Maximum slendernesses for section classification (EN 1999-1-1:2007 Table 6.2)	β_1	= $3 \times Eps$	=	3.75
	β_2	= $4.5 \times Eps$	=	5.63
	β_3	= $6 \times Eps$	=	7.50
	$\beta_{b,tc,stem}$	> β_3		

Therefore, section is classified:

CLASS 4

Determine effective section	CI_f	= (EN 1999-1-1:2007 Table 6.3)	=	10.00
	$C2_f$	= (EN 1999-1-1:2007 Table 6.3)	=	24.00
	$(CI_f / (\beta / Eps)) - (C2_f / (\beta / Eps)^2)$ but max			

	$\rho_{b,tc,face}$	= $120 / (\beta / Eps)^2$ for angle sections	=	0.47
Effective thickness of face	$t_{eff,b,tc,face}$	= $\rho_{b,tc,face} \times t_f$	=	0.94 mm
	CI_s	= (EN 1999-1-1:2007 Table 6.3)	=	10.00
	$C2_s$	= (EN 1999-1-1:2007 Table 6.3)	=	24.00
	$\rho_{b,tc,stem}$	= $(CI_s / (\beta / Eps)) - (C2_s / (\beta / Eps)^2)$	=	1.00
Effective thickness of stem part in compression	$t_{eff,b,tc,stem}$	= $\rho_{b,tc,face} \times t_f$	=	2.00 mm
Effective area	$A_{eff,b,tc}$	=	=	154.56 mm ²
Effective inertia about y axis	$I_{y,eff,b,tc}$	=	=	5.85 cm ⁴
Effective distance to elastic NA from edge of face	$y_{gc,eff,b,tc}$	=	=	5.61 mm
Effective distance to elastic NA from base of stem	$z_{gc,eff,b,tc}$	=	=	36.48 mm
Effective elastic modulus about y axis	$W_{el,y,eff,b,tc}$	= $I_y / (D_s - z_{gc})$	=	2.49 cm ³

Reduced cross section in compression

Adopt thicknesses previously calculated:

Effective thickness of stem	$t_{eff,c,stem}$	=	=	0.42 mm
Effective thickness of face	$t_{eff,c,face}$	=	=	0.94 mm
Effective area in compression	$A_{eff,c}$	=	=	61.15 mm ²
Effective distance to elastic NA from edge of face	$y_{gc,eff,c}$	=	=	12.66 mm
Effective distance to elastic NA from edge of stem	$z_{gc,eff,c}$	=	=	47.14 mm

Flexural buckling - major axis only as minor axis is restrained by cladding

Effective length in y axis	Le_{cy}	=	=	1000.00 mm
Relative slenderness in y axis	λ_{fy}	= $Le_{cy} \times ((A_{eff,c} / A_g) \cdot (f_0 \times E_{alu}))^{0.5} / (i_y \times \pi)$	=	0.69
Buckling plateau limit	λ_0	= EN 1999-1 Table 6.6	=	0.10

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Imperfection factor	α	= EN 1999-1 Table 6.6	=	0.20
	ϕ_y	=	=	0.80
Flexural buckling reduction in y axis	$\chi_{f,y}$	= $1 / (\phi_y + (\phi_y^2 - \lambda_y^2)^{0.5})$	=	0.84

Section in major axis shear

Shear slenderness	λ_s	= D_s / t_s	=	30.00
Limiting slenderness	$\lambda_{s,max}$	= $39 \times Eps$	=	48.75
Web is non-slender				

Section properties

Loading due to wind may be in either direction therefore
consider worst case moment resistance.

	$M_{cy,Rd}$	= $\min\{W_{el,y,eff,b,tc} ; W_{el,y,eff,b,bc}\} \times f_0 / \gamma_{M1}$	=	65.54 Nm
Shear resistance	V_{Rd}	= $D_s \times t_s \times f_0 / (3^{0.5} \times \lambda_{M1})$	=	10.08 kN
Compression resistance	$N_{c,Rd}$	= $A_{eff,c} \times f_0 / \gamma_{M1}$	=	8.89 kN
Buckling resistance	$N_{b,Rd}$	= $A_{eff,c} \times f_0 \times \chi_{f,y} / \gamma_{M1}$	=	7.43 kN

Bracket Design

Dead fix bracket design

Geometry

Zone for rail and bracket	z_b	=	=	115 mm
Bracket to be checked:	HH-Single100			
Bracket height	h_b	=	=	88 mm
Thickness	t_b	=	=	3 mm
Outstand leg length	L_1	=	=	100 mm
Return leg length	L_2	=	=	40 mm
Bottom fold	L_3	=	=	0 mm

Material grade

6063-T6

Yield strength	f_0	=	=	160 N/mm ²
Ultimate strength	f_u	=	=	195 N/mm ²
Young's Modulus	E_{alu}	=	=	70000 N/mm ²
Density	ρ_{alu}	=	=	2700 kg/m ³
Material safety factors	γ_{M1}	=	=	1.1
	γ_{M2}	=	=	1.25
Buckling class	BC	=	=	A
Material strength parameter	Eps	=	=	$(250/f_0)^{0.5}$

Gross properties

Area	A_g	=	=	264.00 mm ²
Inertia about y axis	I_y	=	=	17.04 cm ⁴
Inertia about z axis	I_z	=	=	0.02 cm ⁴
Radius of gyration in y axis	i_y	=	=	$(I_y / A_g)^{0.5}$
Radius of gyration in z axis	i_z	=	=	$(I_z / A_g)^{0.5}$
Distance to elastic neutral axis from edge of face	y_{gc}	=	=	1.50 mm
Distance to elastic neutral axis from base of bracket	z_{gc}	=	=	44.00 mm
Elastic modulus about y axis	$W_{el,y}$	=	=	$I_y / \max(z_{gc}; h_b - z_{gc})$
Elastic modulus about z axis	$W_{el,z}$	=	=	$I_z / \max(y_{gc}; L_3 - y_{gc})$

Capacity for pullout due to wind suction

Check back leg for bending

Section modulus of back leg	$W_{pl,L2}$	=	=	$h_b \cdot t_b^2 / 4$
Moment capacity of back leg	$M_{c,Rd,L2}$	=	=	$W_{pl,L2} \cdot f_0 / \gamma_{M1}$
Pull capacity of bracket	$N_{p,Rd,L2}$	=	=	$M_{c,Rd,L2} / ((L_2 \cdot 0.5) - (t_b / 2))$

1.56 kN

Capacity for bending due to dead load

Check outstand leg for bending

Outstand leg effective section

Tensile stress at face	σ_T	=	=	$-\sigma_C (h_b - z_{gc}) / z_{gc}$
Stress ratio of ends of the leg	ψ	=	=	-1.00
	EN 1999-1 Figure 6.2 Line A for outstand			
Slenderness reduction	η	=	=	with peak compression at toe
Slenderness parameter of the stem	$\beta_{c,L1}$	=	=	$\eta h_b / t_b$

1.00

29.33

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Maximum slendernesses for section classification
(EN 1999-1-1:2007 Table 6.2)

$$\begin{aligned}\beta_1 &= 3 \times Eps &= 3.75 \\ \beta_2 &= 4.5 \times Eps &= 5.63 \\ \beta_3 &= 6 \times Eps &= 7.50 \\ \beta_{c,L1} &> \beta_3\end{aligned}$$

Therefore, section is classified:

CLASS 4

Determine effective section

$$\begin{aligned}C1 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= 10.00 \\ C2 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= 24.00 \\ &\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2); \\ \rho_{c,L1} &= 120/(\beta/Eps)^2 &= 0.38 \\ t_{eff,c,L1} &= \rho_{c,L1} \times t_b &= 1.15 \text{ mm}\end{aligned}$$

Effective thickness of outstand leg

Base fold leg effective section (if applicable)

Stress ratio of ends of the leg

$$\Psi = (\text{Uniform compression}) = 1.00$$

Slenderness reduction

$$\eta = (\text{Uniform compression}) = 1.00$$

Slenderness parameter of the stem

$$\beta_{c,L3} = \eta L_3 / t_b = 0.00$$

Maximum slendernesses for section classification
(EN 1999-1-1:2007 Table 6.2)

$$\begin{aligned}\beta_1 &= 3 \times Eps &= 3.75 \\ \beta_2 &= 4.5 \times Eps &= 5.63 \\ \beta_3 &= 6 \times Eps &= 7.50 \\ \beta_{c,L3} &< \beta_1\end{aligned}$$

Therefore, section is classified:

CLASS I

Section is fully effective

$$\begin{aligned}C1 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= \text{N/A} \\ C2 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= \text{N/A} \\ &\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2); \\ \rho_{c,L3} &= 120/(\beta/Eps)^2 &= 1.00 \\ t_{eff,c,L3} &= \rho_{c,L3} \times t_b &= 0.00 \text{ mm}\end{aligned}$$

Effective thickness of base fold

Shape properties

Effective inertia of bracket

$$I_{y,L1} = 6.52 \text{ cm}^4$$

Distance to elastic neutral axis from base of bracket

$$z_{eff,b} = 44.00 \text{ mm}$$

Elastic modulus of outstand leg

$$W_{el,eff,L1} = 1481.25 \text{ mm}^3$$

Moment capacity of outstand leg

$$M_{c,Rd,L1} = W_{el,L2} \cdot f_0 / \gamma_{m1} = 215.45 \text{ Nm}$$

Vertical load capacity of bracket

$$V_{d,Rd,L1} = M_{c,Rd,L1} / L_1 = \underline{\underline{2.15 \text{ kN}}}$$

Capacity for compression due to wind pressure

Outstand leg effective section

Stress ratio of ends of the leg

$$\Psi = (\text{Uniform compression}) = 1.00$$

Slenderness reduction

$$\eta = (\text{Uniform compression}) = 1.00$$

Slenderness parameter of the stem

$$\beta_{c,L1} = \eta h_b / t_b = 29.33$$

Maximum slendernesses for section classification
(EN 1999-1-1:2007 Table 6.2)

$$\begin{aligned}\beta_1 &= 3 \times Eps &= 3.75 \\ \beta_2 &= 4.5 \times Eps &= 5.63 \\ \beta_3 &= 6 \times Eps &= 7.50 \\ \beta_{c,L1} &> \beta_3\end{aligned}$$

Therefore, section is classified:

CLASS 4

Determine effective section

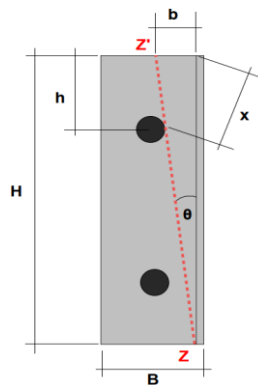
$$\begin{aligned}C1 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= 10.00 \\ C2 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= 24.00 \\ &\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2); \\ \rho_{c,L1} &= 120/(\beta/Eps)^2 &= 0.38\end{aligned}$$

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Effective thickness of outstand leg	$t_{\text{eff},c,L1}$	$= \rho_{c,L1} \times t_b$	$=$	1.15 mm
<u>Base fold leg effective section (if applicable)</u>				
Stress ratio of ends of the leg	Ψ	$=$ (Uniform compression)	$=$	1.00
Slenderness reduction	η	$=$ (Uniform compression)	$=$	1.00
Slenderness parameter of the stem	$\beta_{c,L3}$	$= \eta L_3 / t_b$	$=$	0.00
Maximum slendernesses for section classification (EN 1999-1-1:2007 Table 6.2)	β_1	$= 3.5 \times Eps$	$=$	3.75
	β_2	$= 4.5 \times Eps$	$=$	5.63
	β_3	$= 6 \times Eps$	$=$	7.50
	$\beta_{c,L3}$	$< \beta_1$		
	CLASS I			
Therefore, section is classified:	C1	$=$ (EN 1999-1-1:2007 Table 6.3)	$=$	N/A
Section is fully effective	C2	$=$ (EN 1999-1-1:2007 Table 6.3)	$=$	N/A
		$\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2)\}$		
	$\rho_{c,L3}$	$= 120/(\beta/Eps)^2\}$	$=$	1.00
Effective thickness of base fold	$t_{\text{eff},c,L3}$	$= \rho_{c,L3} \times t_b$	$=$	0.00 mm
<u>Shape properties</u>				
Effective area	$A_{\text{eff},c,L1}$	$= h_b \cdot t_{\text{eff},c,L1}$	$=$	100.99 mm ²
Effective inertia about y axis	$I_{y,\text{eff},c,L1}$	$=$	$=$	6.52 cm ⁴
Effective distance to elastic NA from edge of face	$y_{g,c,\text{eff},c,L1}$	$=$	$=$	0.57 mm
Effective distance to elastic NA from base of stem	$z_{g,c,\text{eff},c,L1}$	$=$	$=$	44.00 mm
Effective elastic modulus about y axis	$W_{\text{el},y,c,L1}$	$= I_y / z_{gc}$	$=$	1.48 cm ³
<i>Flexural buckling</i>				
Effective length in y axis	$Le_{c,y}$	$=$	$=$	115.00 mm
Effective length in z axis	$Le_{c,z}$	$=$	$=$	115.00 mm
Relative slenderness in y axis	$\lambda_{f,y}$	$= Le_{c,y} \times ((A_{\text{eff},c} / A_g) \cdot (f_0 \times E_{\text{alu}}))^{0.5} / (i_y \times \pi)$	$=$	0.04
Relative slenderness in z axis	$\lambda_{f,z}$	$= Le_{c,z} \times ((A_{\text{eff},c} \times f_0) / (A_g \times E))^{0.5} / (i_z \times \pi)$	$=$	1.25
Buckling plateau limit	λ_0	$=$ EN 1999-1 Table 6.6	$=$	0.10
Imperfection factor	α	$=$ EN 1999-1 Table 6.6	$=$	0.20
	ϕ_y	$=$	$=$	0.50
	ϕ_z	$=$	$=$	1.40
Flexural buckling reduction in y axis	$\chi_{f,y}$	$= 1 / (\phi_y + (\phi_y^2 - \lambda_y^2)^{0.5})$	$=$	1.00
Flexural buckling reduction in z axis	$\chi_{f,z}$	$= 1 / (\phi_z + (\phi_z^2 - \lambda_z^2)^{0.5})$	$=$	0.50
Compressive resistance of the outstand leg(s)	$N_{b,Rd,L1}$	$= \min[\chi_{f,y} ; \chi_{f,z}] \cdot A_{\text{eff},c,L1} \cdot f_0 / \gamma_{M1}$	$=$	7.28 kN

Bending resistance of return leg



Bending about Z-Z'

Fixing head diameter	f_h	=		=	17 mm
Distance to top fixing from top of bracket	h	=		=	44.00 mm
Distance from fixing head to outstand leg	b	=	$B/2 - (t_b - f_h/2)$	=	8.50 mm
Distance from top corner of bracket to edge of fixing	x	=	$(b^2 + h^2)^{0.5}$	=	44.81 mm
Angle of yield line relative to outstand leg	θ	=	$\tan^{-1}(b/(H-h))$	=	0.19 rads
Length of yield line Z-Z'	L_e	=	$H/\cos\theta$	=	89.63 mm
Section modulus	$W_{pl,y,l}$	=	$L_e \cdot t^2 / 4$	=	201.66 mm ³
Moment capacity	$M_{c,y,l}$	=	$W_{pl,y,l} \cdot f_0 / \gamma_{M1}$	=	29.33 Nm
Maximum vertical load for offset e	F_{max}	=	$M_{c,y,l} \cdot H / (x \cdot e) [e = e_{max} = L]$	=	0.58 kN

Shear resistance of the outstand leg(s)

Shear slenderness	λ_s	=	h_b / t_b	=	29.33
Limiting slenderness	$\lambda_{s,max}$	=	$39 \times E_{ps}$	=	48.75
Web is non-slender					
Revised shear slenderness	λ_s	=	$0.35 \cdot h_b / t_b \cdot (f_0 / E)^{0.5}$	=	0.49
	η	=	$0.7 + 0.35 (f_0 / f_{u,l})$	=	0.99
Reduction factor	ρ_v	=	BS EN 1999-1-1 cl 6.2.6.2(b)	=	0.80
Shear resistance	V_{Rd}	=	$\rho_v \times h_b \times t_b \times f_0 / (3^{0.5} \times \lambda_{M1})$	=	17.74 kN

Fixings to structure

Fixing to:	Masonry		
Fixing specification:	Ejot SDF-KB-10V-E		
Number of fixings:			1
Fixing pullout resistance	$N_{Rd,fix}$	=	kN
Fixing shear resistance	$V_{Rd,fix}$	=	kN
Fixing resultant load limit	$F_{Rd,fix}$	=	1.60 kN

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Fixing group

Pullout resistance		=	1.60 kN
Shear resistance		=	1.60 kN
Moment resistance by row	d_n Arm x Resistance	=	Moment capacity
1 - Bottom fixing	44mm x 1.60kN	=	70.22 Nm
2	0mm x 0.00kN	=	0.00 Nm
3	0mm x 0.00kN	=	0.00 Nm
4	0mm x 0.00kN	=	0.00 Nm
	Total	=	70.22 Nm

Dead load applied to bracket(s)	$F_v = H_{rail} \cdot DL \cdot \gamma_g$	=	0.27 kN
Lateral load applied to bracket(s)	$F_h =$ (from analysis)	=	0.74 kN
Vertical moment applied to bracket	$M_v = F_v \cdot L_I$	=	26.63 Nm
Max pullout on top fixing	$F_{Nmax} = M_v / \sum[d_n^2 / d_{max}] + F_h / n$	=	1.34 kN
Max shear on fixing	$F_{Vmax} = F_v / n$	=	0.27 kN

Fixing utilisation

Fixing direct pullout		=	46%
Fixing shear		=	17%
Fixing moment		=	38%
Fixing resultant load		=	86%
Overall utilisation		=	86%

Fixing to rail

Bearing capacity of 4.8mm dia fixing	$V_{Rd,r,fix} =$	=	2.25 kN
Number of fixings	$N_{r,fix} =$	=	2
Total resultant shear in fixings	$V_{Ed,fix} =$	=	0.79 kN
Fixing utilisation		=	17%

Overall worst case bracket result

Minimum number of dead fix brackets to achieve fixing

=	86%
=	1

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Restraint fix bracket design

Geometry

Zone for rail and bracket	z_b	=	=	115 mm
Bracket to be checked:				HH-Single100
Bracket height	h_b	=	=	88 mm
Thickness	t_b	=	=	3 mm
Outstand leg length	L_1	=	=	100 mm
Return leg length	L_2	=	=	40 mm
Bottom fold	L_3	=	=	0 mm

Material grade

6063-T6

Yield strength	f_0	=	=	160 N/mm ²
Ultimate strength	f_u	=	=	195 N/mm ²
Young's Modulus	E_{alu}	=	=	70000 N/mm ²
Density	ρ_{alu}	=	=	2700 kg/m ³
Material safety factors	γ_{M1}	=	=	1.1
	γ_{M2}	=	=	1.25
Buckling class	BC	=	=	A
Material strength parameter	Eps	=	=	$(250/f_0)^{0.5}$ 1.25

Gross properties

Area	A_g	=	=	264.00 mm ²
Inertia about y axis	I_y	=	=	17.04 cm ⁴
Inertia about z axis	I_z	=	=	0.02 cm ⁴
Radius of gyration in y axis	i_y	=	=	$(I_y / A_g)^{0.5}$ 25.40 mm
Radius of gyration in z axis	i_z	=	=	$(I_z / A_g)^{0.5}$ 0.87 mm
Distance to elastic neutral axis from edge of face	y_{gc}	=	=	1.50 mm
Distance to elastic neutral axis from base of bracket	z_{gc}	=	=	44.00 mm
Elastic modulus about y axis	$W_{el,y}$	=	=	$I_y / \max(z_{gc}; D_s - z_{gc})$ 3.87 cm ³
Elastic modulus about z axis	$W_{el,z}$	=	=	$I_z / \max(y_{gc}; W_f - y_{gc})$ -0.13 cm ³

Capacity for pullout due to wind suction

Check back leg for bending

Plastic modulus of back leg	$W_{pl,L2}$	=	$h_b \cdot t_b^2 / 4$	=	198 mm ³
Moment capacity of back leg	$M_{c,Rd,L2}$	=	$W_{pl,L2} \cdot f_0 / \gamma_{M1}$	=	28.80 Nm
Pull capacity of bracket	$N_{p,Rd,L2}$	=	$M_{c,Rd,L2} / ((L_2 \cdot 0.5) - (t_b / 2))$	=	2.13 kN

Capacity for compression due to wind pressure

Check outstand leg(s) for compression

Outstand leg effective section

Stress ratio of ends of the leg	Ψ	=	(Uniform compression)	=	1.00
Slenderness reduction	η	=	(Uniform compression)	=	1.00
Slenderness parameter of the stem	$\beta_{c,L1}$	=	$\eta h_b / t_b$	=	29.33
Maximum slendernesses for section classification	β_1	=	$3 \times Eps$	=	3.75
(EN 1999-1-1:2007 Table 6.2)	β_2	=	$4.5 \times Eps$	=	5.63
	β_3	=	$6 \times Eps$	=	7.50

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	$\beta_{c,L1}$	$> \beta_3$	
Therefore, section is classified:	CLASS 4		
Determine effective section	C1	= (EN 1999-1-1:2007 Table 6.3)	= 10.00
	C2	= (EN 1999-1-1:2007 Table 6.3)	= 24.00
		$\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2);$	
	$\rho_{c,L1}$	$= 120/(\beta/Eps)^2\}$	= 0.38
Effective thickness of outstand leg	$t_{eff,c,L1}$	$= \rho_{c,L1} \times t_b$	= 1.15 mm
<u>Base fold leg effective section (if applicable)</u>			
Stress ratio of ends of the leg	Ψ	= (Uniform compression)	= 1.00
Slenderness reduction	η	= (Uniform compression)	= 1.00
Slenderness parameter of the stem	$\beta_{c,L3}$	$= \eta L_3 / t_b$	= 0.00
Maximum slendernesses for section classification	β_1	$= 3 \times Eps$	= 3.75
(EN 1999-1-1:2007 Table 6.2)	β_2	$= 4.5 \times Eps$	= 5.63
	β_3	$= 6 \times Eps$	= 7.50
	$\beta_{c,L3}$	$< \beta_1$	
Therefore, section is classified:	CLASS 1		
Section is fully effective	C1	= (EN 1999-1-1:2007 Table 6.3)	= N/A
	C2	= (EN 1999-1-1:2007 Table 6.3)	= N/A
		$\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2);$	
	$\rho_{c,L3}$	$= 120/(\beta/Eps)^2\}$	= 1.00
Effective thickness of base fold	$t_{eff,c,L3}$	$= \rho_{c,L3} \times t_b$	= 0.00 mm
<u>Shape properties</u>			
Effective area	$A_{eff,c,L1}$	$= h_b \cdot t_{eff,c,L1}$	= 100.99 mm ²
Effective inertia about y axis	$I_{y,eff,c,L1}$	=	= 6.52 cm ⁴
Effective distance to elastic NA from edge of face	$y_{gc,eff,c,L1}$	=	= 0.57 mm
Effective distance to elastic NA from base of stem	$z_{gc,eff,c,L1}$	=	= 44.00 mm
Effective elastic modulus about y axis	$W_{el,y,c,L1}$	$= I_y / z_{gc}$	= 1.48 cm ³
<i>Flexural buckling</i>			
Effective length in y axis	$Le_{c,y}$	=	= 100.00 mm
Effective length in z axis	$Le_{c,z}$	=	= 100.00 mm
Relative slenderness in y axis	$\lambda_{f,y}$	$= Le_{c,y} \times (A_{eff,c} / A_g) \cdot (f_0 \times E_{allu})^{0.5} / (I_y \times \pi)$	= 0.04
Relative slenderness in z axis	$\lambda_{f,z}$	$= Le_{c,z} \times (A_{eff,c} \times f_0) / (A_g \times E)^{0.5} / (I_z \times \pi)$	= 1.09
Buckling plateau limit	λ_0	= EN 1999-1 Table 6.6	= 0.10
Imperfection factor	α	= EN 1999-1 Table 6.6	= 0.20
	ϕ_y	=	= 0.49
	ϕ_z	=	= 1.19
Flexural buckling reduction in y axis	$\chi_{f,y}$	$= 1 / (\phi_y + (\phi_y^2 - \lambda_y^2)^{0.5})$	= 1.00
Flexural buckling reduction in z axis	$\chi_{f,z}$	$= 1 / (\phi_z + (\phi_z^2 - \lambda_z^2)^{0.5})$	= 0.60
Compressive resistance of the outstand leg(s)	$N_{b,Rd,L1}$	$= \min[\chi_{f,y}; \chi_{f,z}] \cdot A_{eff,c,L1} \cdot f_0 / \gamma_{MI}$	= 8.78 kN

Fixing to substrate:

Fixing to:

Masonry

Fixing specification:

Ejot SDF-KB-10V-E

Number of fixings:

1

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Fixing pullout resistance	$N_{Rd,fix}$	=	=	kN
Fixing shear resistance	$V_{Rd,fix}$	=	=	kN
Fixing resultant load limit	$F_{Rd,fix}$	=	=	1.60 kN

Fixing group

Pullout resistance		=	1.60 kN
Shear resistance		=	1.60 kN

Lateral load applied to bracket(s)	F_h	= (from analysis)	=	0.91 kN
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Fixing utilisation

Fixing direct pullout		=	57%
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Fixing to rail

Bearing capacity of 4.8mm dia fixing	$V_{Rd,r,fix}$	=	=	2.25 kN
Number of fixings	$N_{r,fix}$	=	=	2
Total resultant shear in fixings	$V_{Ed,fix}$	=	=	0.91 kN
Fixing utilisation		=	=	20%

Architectural PANEL SOLUTIONS Downer® System Calculations	PROJECT	The Boatmans				JOB REF. SC23-02-015-2B	
	LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
		Input by IS	Date 05/06/2023	Checked	Date	Approved	Date

PROJECT INFORMATION

Cladding	Other	
Thickness	4	mm
System	Face Fix	
Galv steel top hat	None	(0mm)
Substrate	Fixing design by others - through holes	
Notes	Design to loading advised below	
Rail Type	60 Stem x 40 face x 2 L angle	
Bracket Type	All 88mm high	
Thermostop pad	Thermostop	
Cavity Width	140	mm
L Rail horizontal spacing	600	mm
Top hat span		mm
Rail height	1.520	m
No. of spans of rail	3	

APPLIED LOADINGS

A) Vertical Loads	
Self-weight of panel =	7.5 kg/m ²
Support system =	3.6 kg/m ²
TOTAL =	11.14 kg/m ²
B) Horizontal Loads	
Calculated wind =	1.17 kN/m ²
Check reverse load case	Yes

DEFLECTION REQUIREMENTS

Cont. span/defl ratio =	L/200
Cantilever defl. Ratio =	L/150
Max total deflection =	2 mm

SPAN DEFINITIONS (FROM BASE)

Span No.		
1	300.0 mm	Cantilever
2	920.0 mm	Supported each end
3	300.0 mm	Cantilever
Total height =		1.520 m

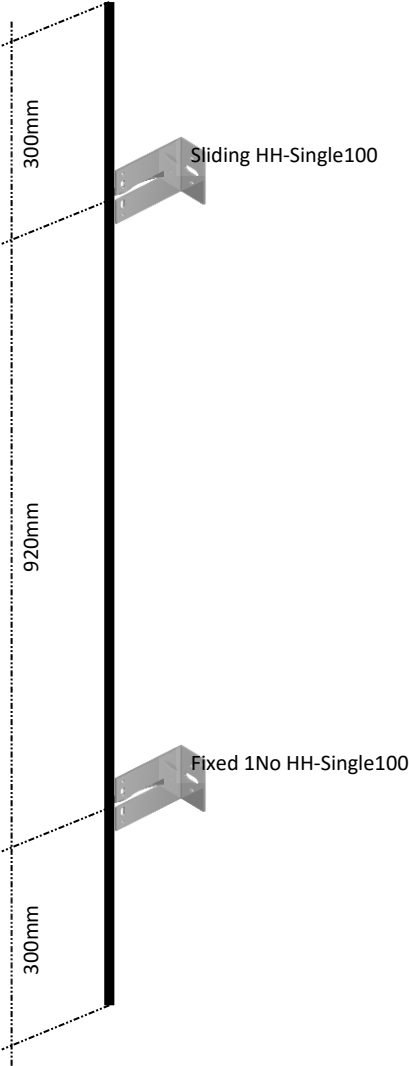
Dead fix bracket pos'n	Top of	Span 1
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RESULTS

Sheeting Rail	Type	60 Stem x 40 face x 2 L angle	PASS	98%
	Max deflection	0.61 mm		
Dead load bracket	Type	HH-Single100	PASS	18%
	Number per rail	1		
	Fixings	2No Client to specify	Design to loading advised below	
	Peak load in fixing to structure:	Pullout = 0.59 kN ULS	Shear =	0.07 kN ULS
Wind restraint bracket	Type	HH-Single100	PASS	14%
	Number per rail	1		
	Fixings	2No Client to specify	Design to loading advised below	
	Peak load in fixing to structure:	Pullout = 0.40 kN ULS		
NOTES	Maximum cavity for selected components		147 mm	
	Minimum cavity for selected components		107 mm	
	Current cavity zone		140 mm	
	(Includes allowance for 0mm of panel fixings, 5mm thermal pad and 0mm top hat)			

PROJECT	The Boatmans				JOB REF. SC23-02-015-2B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Calc by IS	Date 05/06/2023	Checked	Date	Approved	Date

INDICATIVE ARRANGEMENT



Rail length:

1 520mm

Vertical rail:

60 Stem x 40 face x 2 L angle

Set @ max:

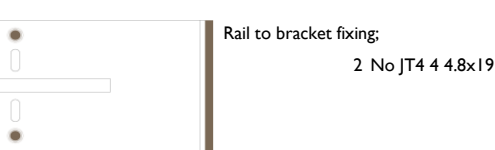
600mm cts

Note

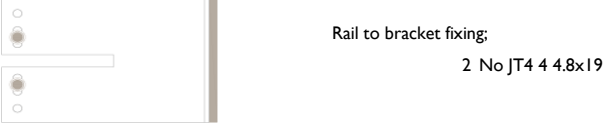
Arrangement drawing is indicative only.
All dimensions shown represent the centreline position of the bracket (or bracket group if multiple dead load brackets are required).

DCS031 Bracket Arrangement:

Fix Point (dead load)



Sliding Point (wind restraint & rail expansion)



PROJECT	The Boatmans				JOB REF. SC23-02-015-2B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Input by IS	Date 05/06/2023	Checked	Date	Approved	Date

PROJECT INFORMATION

Cladding	Other	
Thickness	4	mm
System	Face Fix	
Galv steel top hat	None	(0mm)
Substrate	Fixing design by others - through holes	
Notes	Design to loading advised below	
Rail Type	60 Stem x 40 face x 2 L angle	
Bracket Type	All 88mm high	
Thermostop pad	Thermostop	
Cavity Width	140	mm
L Rail horizontal spacing	600	mm
Top hat span		mm
Rail height	2.240	m
No. of spans of rail	4	

APPLIED LOADINGS

A) Vertical Loads	
Self-weight of panel =	7.5 kg/m ²
Support system =	3.4 kg/m ²
TOTAL =	10.89 kg/m ²
B) Horizontal Loads	
Calculated wind =	1.17 kN/m ²
Check reverse load case	Yes

DEFLECTION REQUIREMENTS

Cont. span/defl ratio =	L/200
Cantilever defl. Ratio =	L/150
Max total deflection =	2 mm

SPAN DEFINITIONS (FROM BASE)

Span No.		
1	300.0 mm	Cantilever
2	820.0 mm	Supported each end
3	820.0 mm	Supported each end
4	300.0 mm	Cantilever
Total height =	2.240 m	

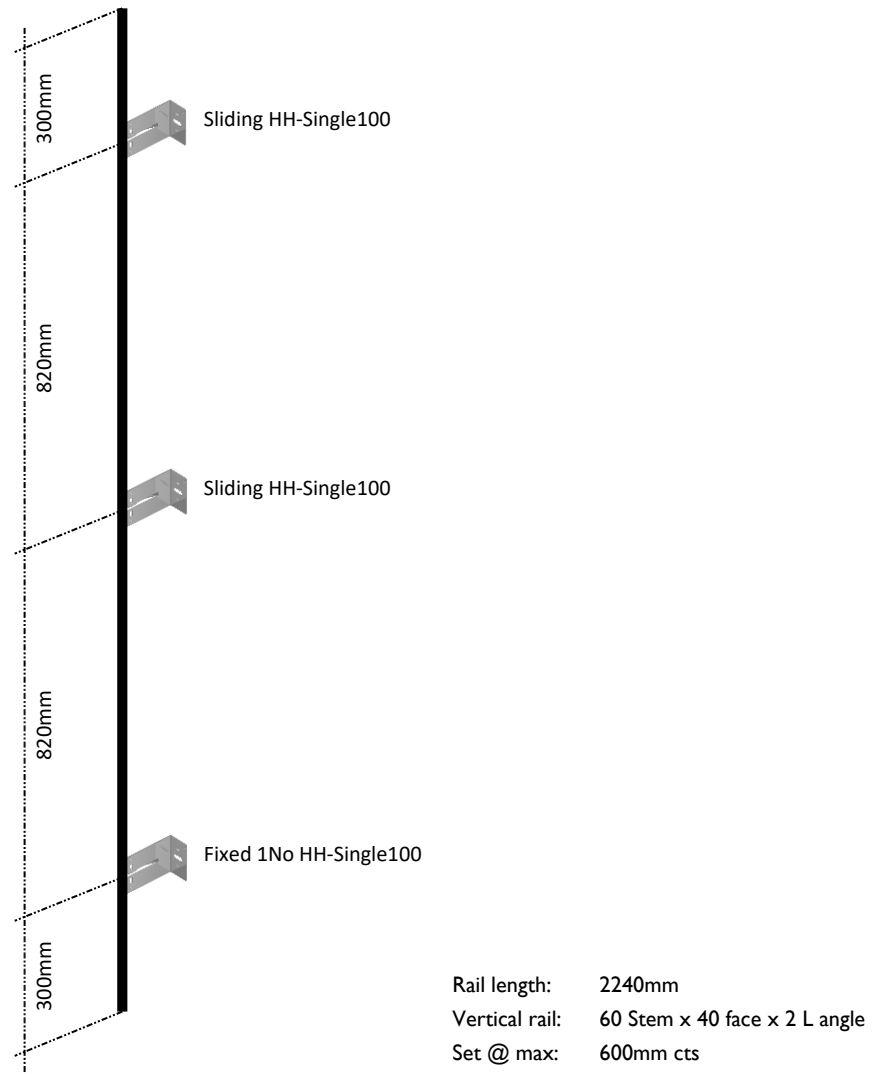
Dead fix bracket pos'n	Top of	Span 1
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RESULTS

Sheeting Rail	Type	60 Stem x 40 face x 2 L angle	PASS	99%
	Max deflection	0.19 mm		
Dead load bracket	Type	HH-Single I 100	PASS	20%
	Number per rail	1		
	Fixings	2No Client to specify	Design to loading advised below	
	Peak load in fixing to structure:	Pullout = 0.63 kN ULS	Shear = 0.10 kN ULS	
Wind restraint bracket	Type	HH-Single I 100	PASS	16%
	Number per rail	2		
	Fixings	2No Client to specify	Design to loading advised below	
	Peak load in fixing to structure:	Pullout = 0.45 kN ULS		
NOTES	Maximum cavity for selected components 147 mm			
	Minimum cavity for selected components 107 mm			
	Current cavity zone 140 mm			
	(Includes allowance for 0mm of panel fixings, 5mm thermal pad and 0mm top hat)			

PROJECT	The Boatmans				JOB REF. SC23-02-015-2B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Calc by IS	Date 05/06/2023	Checked	Date	Approved	Date

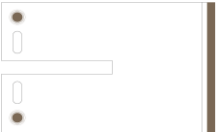
INDICATIVE ARRANGEMENT



Note
Arrangement drawing is indicative only.
All dimensions shown represent the centreline position of the bracket (or bracket group if multiple dead load brackets are required).

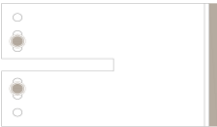
DCS031 Bracket Arrangement:

Fix Point (dead load)



Rail to bracket fixing:
2 No JT4 4 4.8x19

Sliding Point (wind restraint & rail expansion)



Rail to bracket fixing:
2 No JT4 4 4.8x19

PROJECT	The Boatmans				JOB REF. SC23-02-015-2B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Input by IS	Date 05/06/2023	Checked	Date	Approved	Date

PROJECT INFORMATION

Cladding	Other	
Thickness	4	mm
System	Face Fix	
Galv steel top hat	None	(0mm)
Substrate	Fixing design by others - through holes	
Notes	Design to loading advised below	
Rail Type	60 Stem x 40 face x 2 L angle	
Bracket Type	All 88mm high	
Thermostop pad	Thermostop	
Cavity Width	140	mm
L Rail horizontal spacing	600	mm
Top hat span		mm
Rail height	3.120	m
No. of spans of rail	5	

APPLIED LOADINGS

A) Vertical Loads	
Self-weight of panel =	7.5 kg/m ²
Support system =	3.2 kg/m ²
TOTAL =	10.74 kg/m ²
B) Horizontal Loads	
Calculated wind =	1.17 kN/m ²
Check reverse load case	Yes

DEFLECTION REQUIREMENTS

Cont. span/defl ratio =	L/200
Cantilever defl. Ratio =	L/150
Max total deflection =	2 mm

SPAN DEFINITIONS (FROM BASE)

Span No.		
1	300.0 mm	Cantilever
2	840.0 mm	Supported each end
3	840.0 mm	Supported each end
4	840.0 mm	Supported each end
5	300.0 mm	Cantilever
Total height =	3.120 m	

Dead fix bracket pos'n	Top of	Span 1
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RESULTS

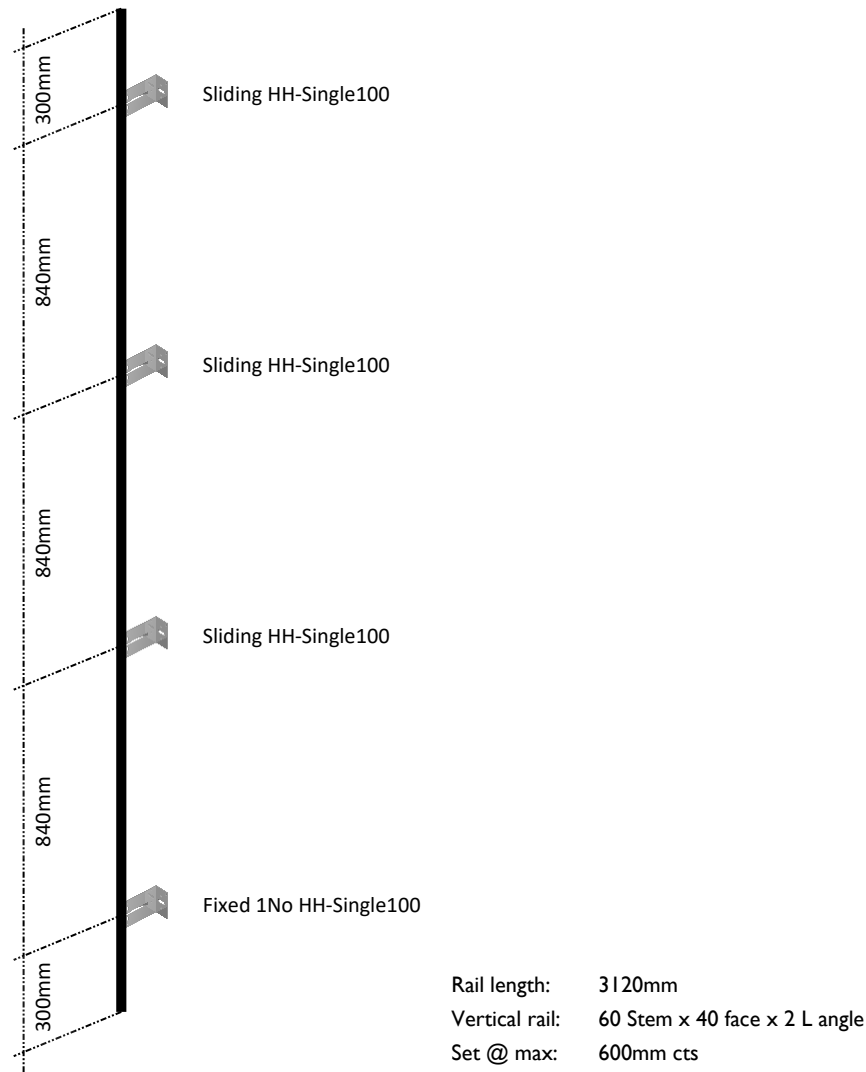
Sheeting Rail	Type	60 Stem x 40 face x 2 L angle	PASS	99%
	Max deflection	0.24 mm		
Dead load bracket	Type	HH-Single 100	PASS	28%
	Number per rail	1		
	Fixings	2No Client to specify	Design to loading advised below	
	Peak load in fixing to structure:	Pullout = 0.73 kN ULS	Shear = 0.13 kN ULS	
Wind restraint bracket	Type	HH-Single 100	PASS	16%
	Number per rail	3		
	Fixings	2No Client to specify	Design to loading advised below	
	Peak load in fixing to structure:	Pullout = 0.45 kN ULS		

NOTES

Maximum cavity for selected components	147 mm
Minimum cavity for selected components	107 mm
Current cavity zone	140 mm
(Includes allowance for 0mm of panel fixings, 5mm thermal pad and 0mm top hat)	

PROJECT	The Boatmans				JOB REF. SC23-02-015-2B	
LOCATION	Manchester M15 4QF				DATE: 05/06/2023	
	Calc by IS	Date 05/06/2023	Checked	Date	Approved	Date

INDICATIVE ARRANGEMENT

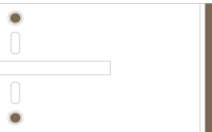


Note

Arrangement drawing is indicative only.
All dimensions shown represent the centreline position of the bracket (or bracket group if multiple dead load brackets are required).

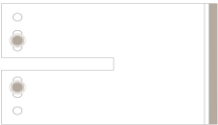
DCS031 Bracket Arrangement:

Fix Point (dead load)



Rail to bracket fixing:
2 No JT4 4 4.8x19

Sliding Point (wind restraint & rail expansion)



Rail to bracket fixing:
2 No JT4 4 4.8x19

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Project details

Project Name: **The Boatmans**
 Project ID: **SC23-02-015-2B**
 Project Location: **Manchester M15 4QF**
 Designer Comments:

Author details

	By:	Date:
Authored:	IS	05/06/2023
Checked:		
Approved:		

Cladding buildup

Outer cladding:	Other	
Fixing system:	Face Fix	0 mm
Thickness:	4mm	Mass: 7.5 kg/m ²
Galvanised steel top hat:	None	Depth: 0 mm
Cavity width (face of sub-structure to back of panel):	140mm	
Thermal pad:	Thermostop	Thickness: 5 mm
Vertical rail:	60 Stem x 40 face x 2 L angle	
Brackets:	All 88mm high	
	Dead: HH-Single 100	
	Sliding: HH-Single 100	

Substrate

Type:	Fixing design by others - through holes	1.5 mm
	Design to loading advised below	

Loading

Design wind load to BS EN 1991-1-4 (WL):	1.17 kN/m ²	$\gamma_w =$	1.50
Check pressure and suction?:	Yes		
Design dead load (DL):	0.11 kN/m ²	$\gamma_g =$	1.35

Constraints

Main span design deflection limit δ_{ratio} :	L/200
Cantilever end design deflection limit δ_{cant} :	L/150
Maximum absolute deflection δ_{abs} :	2 mm

Geometry

Total height of vertical rail H_{rail} :	3.12 m
Rail horizontal spacing H_{cts} :	600 mm

Set out of brackets from base of rail:**Required number of spans: 5**

Base	Free	0.000 m
Restraint 1	Fixed	0.300 m
Restraint 2	Sliding	1.140 m

Restraint 3	Sliding	1.980 m
Restraint 4	Sliding	2.820 m
Top	Free	3.120 m

Component load resistances:
60 Stem x 40 face x 2 L angle vertical rails

Moment of inertia	$I_{y,rail}$	=	(refer to rail calculations)	7.51 cm ⁴
Moment resistance	$M_{c,Rd,rail}$	=	(refer to rail calculations)	65.54 Nm
Axial resistance	$N_{c,Rd,rail}$	=	(refer to rail calculations)	8.89 kN
Shear resistance	$V_{c,Rd,rail}$	=	(refer to rail calculations)	10.08 kN

HH-Single 100 Dead load bracket

Compression resistance	$N_{c,Rd,DLB}$	=	(refer to bracket calculations)	5.66 kN
Tensile resistance	$N_{t,Rd,DLB}$	=	(refer to bracket calculations)	1.56 kN
Moment resistance	$M_{c,Rd,DLB}$	=	(refer to bracket calculations)	0.22 kNm
Shear resistance	$V_{c,Rd,DLB}$	=	(refer to bracket calculations)	0.96 kN
Fixing tensile resistance	$N_{t,fix,DLB}$	=	(fixing design by others)	0.00 kN
Fixing shear resistance	$V_{fix,DLB}$	=	(fixing design by others)	0.00 kN
Fixing moment resistance	$M_{fix,DLB}$	=	(fixing design by others)	0.00 kNm

HH-Single 100 Sliding bracket

Compression resistance	$N_{c,Rd,SLB}$	=	(refer to bracket calculations)	8.78 kN
Tensile resistance	$N_{t,Rd,SLB}$	=	(refer to bracket calculations)	2.13 kN
Fixing tensile resistance	$N_{t,fix,SLB}$	=	(fixing design by others)	0.00 kN
Fixing shear resistance	$V_{c,Rd,SLB}$	=	(fixing design by others)	0.00 kN

Worst case rail tensile reaction allowable	$R_{max,t}$	=	$\min \{ V_{c,Rd,rail} ; N_{t,Rd,DLB} ; N_{t,fix,DLB} ; N_{t,fix,SLB} ; N_{t,Rd,SLB} \}$	1.56 kN
Worst case rail compressive reaction allowable	$R_{max,c}$	=	$\min \{ V_{c,Rd,rail} ; N_{c,Rd,DLB} ; N_{c,Rd,SLB} \}$	5.66 kN

Lateral line load on rails	w_{SLS}	=	$WL \cdot H_{ctc}$	0.70 kN/m
	w_{ULS}	=	$w_{ULS} \cdot Y_w$	1.06 kN/m

Basic analytical analysis:

Max span for rail deflection (single span)	=	$(384 \cdot E_{alu} \cdot I_{y,rail} / (5 \cdot \delta_{ratio} \cdot w_{sls}))^{1/3}$	1.42 m
Max span for rail abs. deflection (single span)	=	$(384 \cdot \delta_{abs} \cdot E_{alu} \cdot I_{y,rail} / (5 \cdot w_{sls}))^{1/4}$	1.03 m
Max span for rail deflection (double span)	=	$(185 \cdot E_{alu} \cdot I_{y,rail} / (\delta_{ratio} \cdot w_{sls}))^{1/3}$	1.90 m
Max span for rail abs. deflection (double span)	=	$(185 \cdot \delta_{abs} \cdot E_{alu} \cdot I_{y,rail} / (w_{sls}))^{1/4}$	1.29 m
Max span for rail deflection (multi span)	=	$(145 \cdot E_{alu} \cdot I_{y,rail} / (\delta_{ratio} \cdot w_{sls}))^{1/3}$	1.76 m
Max span for rail abs. deflection (multi span)	=	$(145 \cdot \delta_{abs} \cdot E_{alu} \cdot I_{y,rail} / (w_{sls}))^{1/4}$	1.21 m
Max span for rail moment	=	$(8 \cdot M_{c,Rd,rail} / (w_{uls}))^{1/2}$	0.70 m
Max span for rail moment (multi span)	=	$(10 \cdot M_{c,Rd,rail} / (w_{uls}))^{1/2}$	0.79 m
Max span for bracket pullout (single span)	=	$2 \cdot R_{max,t} / (w_{uls})$	2.95 m
Max span for bracket pullout (double span)	=	$8 \cdot R_{max,t} / (10 \cdot w_{uls})$	1.18 m
Max span for bracket pullout (multi span)	=	$10 \cdot R_{max,t} / (12 \cdot w_{uls})$	1.23 m

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Max span for bracket compression (single span)	=	$2 \cdot R_{\max,c} / (w_{uls})$	10.71 m
Max span for bracket compression (dble span)	=	$8 \cdot R_{\max,c} / (10 \cdot w_{uls})$	4.28 m
Max span for bracket compression (multi span)	=	$10 \cdot R_{\max,c} / (12 \cdot w_{uls})$	4.46 m

Therefore, limit the span to	$L_{\max}$	=	0.80 m
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Results from full analysis

Maximum cantilever deflection =	0.00 mm	< 2mm	PASS
Minimum cantilever deflection =	-0.02 mm	< 2mm	PASS
Maximum cantilever deflection ratio =		$L / 13102$	PASS
Maximum cantilever moment (ULS) =	0.00 Nm	< 65.54	PASS
Minimum cantilever moment (ULS) =	-47.52 Nm	< 65.54	PASS
Maximum main span deflection =	0.24 mm	< 2mm	PASS
Minimum main span deflection =	0 mm	< 2mm	PASS
Maximum main span deflection ratio =		$L / 3517$	PASS
Maximum main span moment (ULS) =	36.87 Nm	< 65.54	PASS
Minimum main span moment (ULS) =	-65 Nm	< 65.54	PASS

Number of dead load brackets required	I	PASS
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Basic Wind Load Analysis to BS EN 1991-1-4 & UK National Annex

Project post code: M15 4QF
Site location: In town

Site altitude	A	=	=	34.00 m
Map wind speed	$V_{b,map}$	=	=	23.00 m/s
Height of building to eaves	Z	=	=	24.00 m
Distance to sea		=	=	50.00 km
Distance inside town		=	=	8.00 km
Terrain category		=	=	3
Surrounding obstructions	h_{dis}	=	=	5.00 m
Altitude factor	C_{alt}	=	$1 + 0.001(C_{gec} \times A)$	1.03
Direction factor	C_{dir}	=	worst case 240 degrees	1.00
Season factor	C_{season}	=	worst case	1.00
Probability factor	C_{prob}	=	worst case	1.00
Exposure factor	$C_e(z)$	=	UK NA to EN 1991-1-4, Figure NA.7	2.82
Town exposure correction factor	$C_{e,T}$	=	UK NA to EN 1991-1-4, Figure NA.8	1
Fundamental basic wind velocity	$V_{b,0}$	=	$C_{alt} \times V_{b,map}$	23.78 m/s
Basic velocity	V_b	=	$V_{b,0} \times C_{season} \times C_{prob} \times C_{dir}$	23.78 m/s
Basic velocity pressure	q_b	=	$0.613 \times V_b^2$	0.35 kN/m ²
Peak velocity pressure	q_p	=	$q_b \times C_e(z) \times C_{e,T}$	0.98 kN/m ²
Is funnelling present?	No			
Is the building envelope ventilated?	Yes		Rainscreen	
Internal pressure coefficient $C_{p,i}$	$C_{p,i}$	=	=	0.00
External pressure coefficient $C_{p,e}$	$C_{o,e}$	=	=	1.20
Net pressure coefficient $C_{p,net}$	$C_{p,net}$	=	$C_{p,i} + C_{p,e}$	1.20
Calculation of net positive pressure		=	$q_p \times C_{p,net}$	1.17 kN/m²

Sheeting Rail Design

Rail type		=	60 Stem x 40 face x 2 L angle	
Material		=	6063-T6	
Yield strength	f_0	=		160 N/mm ²
Ultimate strength	f_u	=		195 N/mm ²
Young's Modulus	E_{alu}	=		70000 N/mm ²
Density	ρ_{alu}	=		2700 kg/m ³
Material safety factors	γ_{M1}	=		1.1
	γ_{M2}	=		1.25
Buckling class	BC	=		A
Gross cross section				
Stem Depth	D_s	=		60 mm
Face Width	W_f	=		40 mm
Stem Thickness	t_s	=		2 mm
Face Thickness	t_f	=		2 mm
Gross properties				
Area	A_g	=		196.00 mm ²
Inertia about y axis	I_y	=		7.51 cm ⁴
Inertia about z axis	I_z	=		2.77 cm ⁴
Radius of gyration in y axis	i_y	=	$(I_y / A_g)^{0.5}$	19.57 mm
Radius of gyration in z axis	i_z	=	$(I_z / A_g)^{0.5}$	11.90 mm
Distance to elastic neutral axis from edge of face	y_{gc}	=		8.76 mm
Distance to elastic neutral axis from base of stem	z_{gc}	=		41.24 mm
Elastic modulus about y axis	$W_{el,y}$	=	$I_y / \max(z_{gc}; D_s - z_{gc})$	1.82 cm ³
Elastic modulus about z axis	$W_{el,z}$	=	$I_z / \max(y_{gc}; W_f - y_{gc})$	0.89 cm ³
Reduced effective section properties				
Material strength parameter	Eps	=	$(250/f_0)^{0.5}$	1.25
Reduced cross section in y-y bending - stem in compression - unreinforced unsymmetrical outstand element				
Tensile stress at face	σ_T	=	$-\sigma_C (D_s - z_{gc}) / z_{gc}$	-72.78
Stress ratio of ends of the stem	ψ	=		-0.45
			EN 1999-1-1 Figure 6.2 Line B for outstand with	
Slenderness reduction	η	=	peak compression at toe	1.00
Slenderness parameter of the stem	$\beta_{b,bc,stem}$	=	$\eta D_s / t_s$	30.00
Maximum slendernesses for section classification	β_1	=	$3 \times Eps$	3.75
(EN 1999-1-1:2007 Table 6.2)	β_2	=	$4.5 \times Eps$	5.63
	β_3	=	$6 \times Eps$	7.50
	$\beta_{b,bc,stem}$	>	β_3	
Therefore, section is classified:	CLASS 4			
Determine effective section	C1	=	(EN 1999-1-1:2007 Table 6.3)	10.00
	C2	=	(EN 1999-1-1:2007 Table 6.3)	24.00
	$\rho_{b,bc,stem}$	=	$\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2); 120/(\beta/Eps)^2\}$	0.21
Effective thickness of compression segment of stem	$t_{eff,b,bc,stem}$	=	$\rho_{b,bc,stem} \times t_s$	0.42 mm
Effective area	$A_{eff,b,bc}$	=		102.58 mm ²

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Effective inertia about y axis	$I_{y,eff,b,tc}$	=	=	2.34 cm ⁴
Effective distance to elastic NA from edge of face	$y_{gc,eff,b,tc}$	=	=	15.83 mm
Effective distance to elastic NA from base of stem	$z_{gc,eff,b,tc}$	=	=	51.93 mm
Effective elastic modulus about y axis	$W_{el,y,eff,b,tc}$	= I_y / z_{gc}	=	0.45 cm ³

Reduced cross section in y-y bending - face in compression - unreinforced unsymmetrical outstand element

Slenderness parameter of the face	$\beta_{b,tc,face}$	= W_f / t_f	=	20.00
Maximum slendernesses for section classification (EN 1999-1-1:2007 Table 6.2)	β_1	= $3 \times Eps$	=	3.75
	β_2	= $4.5 \times Eps$	=	5.63
	β_3	= $6 \times Eps$	=	7.50
	$\beta_{b,tc,face}$	> β_3		
Tensile stress at toe	σ_T	= $-\sigma_C \cdot z_{gc} / (D_s - z_{gc})$	=	-351.72
Stress ratio of ends of the stem	ψ	=	=	-2.20
Slenderness reduction	η	= EN 1999-1 Figure 6.2 Line A	=	0.25

Slenderness parameter of the compression part of the stem	$\beta_{b,tc,stem}$	= $\eta D_s / t_s$	=	7.50
Maximum slendernesses for section classification (EN 1999-1-1:2007 Table 6.2)	β_1	= $3 \times Eps$	=	3.75
	β_2	= $4.5 \times Eps$	=	5.63
	β_3	= $6 \times Eps$	=	7.50
	$\beta_{b,tc,stem}$	> β_3		

Therefore, section is classified:

CLASS 4

Determine effective section	CI_f	= (EN 1999-1-1:2007 Table 6.3)	=	10.00
	$C2_f$	= (EN 1999-1-1:2007 Table 6.3)	=	24.00
		$(CI_f / (\beta / Eps)) - (C2_f / (\beta / Eps)^2)$ but max		

	$\rho_{b,tc,face}$	= $120 / (\beta / Eps)^2$ for angle sections	=	0.47
Effective thickness of face	$t_{eff,b,tc,face}$	= $\rho_{b,tc,face} \times t_f$	=	0.94 mm
	CI_s	= (EN 1999-1-1:2007 Table 6.3)	=	10.00
	$C2_s$	= (EN 1999-1-1:2007 Table 6.3)	=	24.00
	$\rho_{b,tc,stem}$	= $(CI_s / (\beta / Eps)) - (C2_s / (\beta / Eps)^2)$	=	1.00
Effective thickness of stem part in compression	$t_{eff,b,tc,stem}$	= $\rho_{b,tc,face} \times t_f$	=	2.00 mm
Effective area	$A_{eff,b,tc}$	=	=	154.56 mm ²
Effective inertia about y axis	$I_{y,eff,b,tc}$	=	=	5.85 cm ⁴
Effective distance to elastic NA from edge of face	$y_{gc,eff,b,tc}$	=	=	5.61 mm
Effective distance to elastic NA from base of stem	$z_{gc,eff,b,tc}$	=	=	36.48 mm
Effective elastic modulus about y axis	$W_{el,y,eff,b,tc}$	= $I_y / (D_s - z_{gc})$	=	2.49 cm ³

Reduced cross section in compression

Adopt thicknesses previously calculated:

Effective thickness of stem	$t_{eff,c,stem}$	=	=	0.42 mm
Effective thickness of face	$t_{eff,c,face}$	=	=	0.94 mm
Effective area in compression	$A_{eff,c}$	=	=	61.15 mm ²
Effective distance to elastic NA from edge of face	$y_{gc,eff,c}$	=	=	12.66 mm
Effective distance to elastic NA from edge of stem	$z_{gc,eff,c}$	=	=	47.14 mm

Flexural buckling - major axis only as minor axis is restrained by cladding

Effective length in y axis	Le_{cy}	=	=	1000.00 mm
Relative slenderness in y axis	λ_{fy}	= $Le_{cy} \times ((A_{eff,c} / A_g) \cdot (f_0 \times E_{alu}))^{0.5} / (i_y \times \pi)$	=	0.69
Buckling plateau limit	λ_0	= EN 1999-1 Table 6.6	=	0.10

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Imperfection factor	α	= EN 1999-1 Table 6.6	=	0.20
	ϕ_y	=	=	0.80
Flexural buckling reduction in y axis	$\chi_{f,y}$	= $1 / (\phi_y + (\phi_y^2 - \lambda_y^2)^{0.5})$	=	0.84

Section in major axis shear

Shear slenderness	λ_s	= D_s / t_s	=	30.00
Limiting slenderness	$\lambda_{s,max}$	= $39 \times Eps$	=	48.75
Web is non-slender				

Section properties

Loading due to wind may be in either direction therefore
consider worst case moment resistance.

	$M_{cy,Rd}$	= $\min\{W_{el,y,eff,b,tc} ; W_{el,y,eff,b,bc}\} \times f_0 / \gamma_{M1}$	=	65.54 Nm
Shear resistance	V_{Rd}	= $D_s \times t_s \times f_0 / (3^{0.5} \times \lambda_{M1})$	=	10.08 kN
Compression resistance	$N_{c,Rd}$	= $A_{eff,c} \times f_0 / \gamma_{M1}$	=	8.89 kN
Buckling resistance	$N_{b,Rd}$	= $A_{eff,c} \times f_0 \times \chi_{f,y} / \gamma_{M1}$	=	7.43 kN

Bracket Design

Dead fix bracket design

Geometry

Zone for rail and bracket	z_b	=	=	135 mm
Bracket to be checked:	HH-Single 100			
Bracket height	h_b	=	=	88 mm
Thickness	t_b	=	=	3 mm
Outstand leg length	L_1	=	=	100 mm
Return leg length	L_2	=	=	40 mm
Bottom fold	L_3	=	=	0 mm

Material grade

6063-T6

Yield strength	f_0	=	=	160 N/mm ²
Ultimate strength	f_u	=	=	195 N/mm ²
Young's Modulus	E_{alu}	=	=	70000 N/mm ²
Density	ρ_{alu}	=	=	2700 kg/m ³
Material safety factors	γ_{M1}	=	=	1.1
	γ_{M2}	=	=	1.25
Buckling class	BC	=	=	A
Material strength parameter	Eps	=	=	$(250/f_0)^{0.5}$ 1.25

Gross properties

Area	A_g	=	=	264.00 mm ²
Inertia about y axis	I_y	=	=	17.04 cm ⁴
Inertia about z axis	I_z	=	=	0.02 cm ⁴
Radius of gyration in y axis	i_y	=	=	$(I_y / A_g)^{0.5}$ 25.40 mm
Radius of gyration in z axis	i_z	=	=	$(I_z / A_g)^{0.5}$ 0.87 mm
Distance to elastic neutral axis from edge of face	y_{gc}	=	=	1.50 mm
Distance to elastic neutral axis from base of bracket	z_{gc}	=	=	44.00 mm
Elastic modulus about y axis	$W_{el,y}$	=	=	$I_y / \max(z_{gc}; h_b - z_{gc})$ 3.87 cm ³
Elastic modulus about z axis	$W_{el,z}$	=	=	$I_z / \max(y_{gc}; L_3 - y_{gc})$ 0.13 cm ³

Capacity for pullout due to wind suction

Section modulus of back leg	$W_{pl,L2}$	=	$h_b \cdot t_b^2 / 4$	=	198 mm ³
Moment capacity of back leg	$M_{c,Rd,L2}$	=	$W_{pl,L2} \cdot f_0 / \gamma_{M1}$	=	28.80 Nm
Pull capacity of bracket	$N_{p,Rd,L2}$	=	$M_{c,Rd,L2} / ((L_2 \cdot 0.5) - (t_b / 2))$	=	1.56 kN

Capacity for bending due to dead load

Outstand leg effective section

Tensile stress at face	σ_T	=	$-\sigma_C (h_b - z_{gc}) / z_{gc}$	=	-160.00 N/mm ²
Stress ratio of ends of the leg	ψ	=	=	=	-1.00
	EN 1999-1 Figure 6.2 Line A for outstand				
Slenderness reduction	η	=	with peak compression at toe	=	1.00
Slenderness parameter of the stem	$\beta_{c,L1}$	=	$\eta h_b / t_b$	=	29.33

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Maximum slendernesses for section classification
(EN 1999-1-1:2007 Table 6.2)

$$\begin{aligned}\beta_1 &= 3 \times Eps &= 3.75 \\ \beta_2 &= 4.5 \times Eps &= 5.63 \\ \beta_3 &= 6 \times Eps &= 7.50 \\ \beta_{c,L1} &> \beta_3\end{aligned}$$

Therefore, section is classified:

CLASS 4

Determine effective section

$$\begin{aligned}C1 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= 10.00 \\ C2 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= 24.00 \\ &\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2); \\ \rho_{c,L1} &= 120/(\beta/Eps)^2 &= 0.38 \\ t_{eff,c,L1} &= \rho_{c,L1} \times t_b &= 1.15 \text{ mm}\end{aligned}$$

Effective thickness of outstand leg

Base fold leg effective section (if applicable)

Stress ratio of ends of the leg

$$\Psi = (\text{Uniform compression}) = 1.00$$

Slenderness reduction

$$\eta = (\text{Uniform compression}) = 1.00$$

Slenderness parameter of the stem

$$\beta_{c,L3} = \eta L_3 / t_b = 0.00$$

Maximum slendernesses for section classification
(EN 1999-1-1:2007 Table 6.2)

$$\begin{aligned}\beta_1 &= 3 \times Eps &= 3.75 \\ \beta_2 &= 4.5 \times Eps &= 5.63 \\ \beta_3 &= 6 \times Eps &= 7.50 \\ \beta_{c,L3} &< \beta_1\end{aligned}$$

Therefore, section is classified:

CLASS I

Section is fully effective

$$\begin{aligned}C1 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= \text{N/A} \\ C2 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= \text{N/A} \\ &\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2); \\ \rho_{c,L3} &= 120/(\beta/Eps)^2 &= 1.00 \\ t_{eff,c,L3} &= \rho_{c,L3} \times t_b &= 0.00 \text{ mm}\end{aligned}$$

Effective thickness of base fold

Shape properties

Effective inertia of bracket

$$I_{y,L1} = 6.52 \text{ cm}^4$$

Distance to elastic neutral axis from base of bracket

$$z_{eff,b} = 44.00 \text{ mm}$$

Elastic modulus of outstand leg

$$W_{el,eff,L1} = 1481.25 \text{ mm}^3$$

Moment capacity of outstand leg

$$M_{c,Rd,L1} = W_{el,L2} \cdot f_0 / \gamma_{m1} = 215.45 \text{ Nm}$$

Vertical load capacity of bracket

$$V_{d,Rd,L1} = M_{c,Rd,L1} / L_1 = \underline{\underline{2.15 \text{ kN}}}$$

Capacity for compression due to wind pressure

Outstand leg effective section

Check outstand leg(s) for compression

Stress ratio of ends of the leg

$$\Psi = (\text{Uniform compression}) = 1.00$$

Slenderness reduction

$$\eta = (\text{Uniform compression}) = 1.00$$

Slenderness parameter of the stem

$$\beta_{c,L1} = \eta h_b / t_b = 29.33$$

Maximum slendernesses for section classification
(EN 1999-1-1:2007 Table 6.2)

$$\begin{aligned}\beta_1 &= 3 \times Eps &= 3.75 \\ \beta_2 &= 4.5 \times Eps &= 5.63 \\ \beta_3 &= 6 \times Eps &= 7.50 \\ \beta_{c,L1} &> \beta_3\end{aligned}$$

Therefore, section is classified:

CLASS 4

Determine effective section

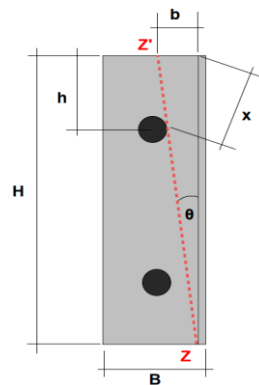
$$\begin{aligned}C1 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= 10.00 \\ C2 &= (\text{EN 1999-1-1:2007 Table 6.3}) &= 24.00 \\ &\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2); \\ \rho_{c,L1} &= 120/(\beta/Eps)^2 &= 0.38\end{aligned}$$

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Effective thickness of outstand leg	$t_{\text{eff},c,L1}$	$= \rho_{c,L1} \times t_b$	$=$	1.15 mm
<u>Base fold leg effective section (if applicable)</u>				
Stress ratio of ends of the leg	Ψ	$=$ (Uniform compression)	$=$	1.00
Slenderness reduction	η	$=$ (Uniform compression)	$=$	1.00
Slenderness parameter of the stem	$\beta_{c,L3}$	$= \eta L_3 / t_b$	$=$	0.00
Maximum slendernesses for section classification (EN 1999-1-1:2007 Table 6.2)	β_1	$= 3.5 \times Eps$	$=$	3.75
	β_2	$= 4.5 \times Eps$	$=$	5.63
	β_3	$= 6 \times Eps$	$=$	7.50
	$\beta_{c,L3}$	$< \beta_1$		
	CLASS I			
Therefore, section is classified:	C1	$=$ (EN 1999-1-1:2007 Table 6.3)	$=$	N/A
Section is fully effective	C2	$=$ (EN 1999-1-1:2007 Table 6.3)	$=$	N/A
		$\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2);$		
	$\rho_{c,L3}$	$= 120/(\beta/Eps)^2\}$	$=$	1.00
Effective thickness of base fold	$t_{\text{eff},c,L3}$	$= \rho_{c,L3} \times t_b$	$=$	0.00 mm
<u>Shape properties</u>				
Effective area	$A_{\text{eff},c,L1}$	$= h_b \cdot t_{\text{eff},c,L1}$	$=$	100.99 mm ²
Effective inertia about y axis	$I_{y,\text{eff},c,L1}$	$=$	$=$	6.52 cm ⁴
Effective distance to elastic NA from edge of face	$y_{g,c,\text{eff},c,L1}$	$=$	$=$	0.57 mm
Effective distance to elastic NA from base of stem	$z_{g,c,\text{eff},c,L1}$	$=$	$=$	44.00 mm
Effective elastic modulus about y axis	$W_{\text{el},y,c,L1}$	$= I_y / z_{gc}$	$=$	1.48 cm ³
<i>Flexural buckling</i>				
Effective length in y axis	$Le_{c,y}$	$=$	$=$	135.00 mm
Effective length in z axis	$Le_{c,z}$	$=$	$=$	135.00 mm
Relative slenderness in y axis	$\lambda_{f,y}$	$= Le_{c,y} \times ((A_{\text{eff},c} / A_g) \cdot (f_0 \times E_{\text{allu}}))^{0.5} / (i_y \times \pi)$	$=$	0.05
Relative slenderness in z axis	$\lambda_{f,z}$	$= Le_{c,z} \times ((A_{\text{eff},c} \times f_0) / (A_g \times E))^{0.5} / (i_z \times \pi)$	$=$	1.47
Buckling plateau limit	λ_0	$=$ EN 1999-1 Table 6.6	$=$	0.10
Imperfection factor	α	$=$ EN 1999-1 Table 6.6	$=$	0.20
	ϕ_y	$=$	$=$	0.50
	ϕ_z	$=$	$=$	1.71
Flexural buckling reduction in y axis	$\chi_{f,y}$	$= 1 / (\phi_y + (\phi_y^2 - \lambda_y^2)^{0.5})$	$=$	1.00
Flexural buckling reduction in z axis	$\chi_{f,z}$	$= 1 / (\phi_z + (\phi_z^2 - \lambda_z^2)^{0.5})$	$=$	0.38
Compressive resistance of the outstand leg(s)	$N_{b,Rd,L1}$	$= \min[\chi_{f,y} ; \chi_{f,z}] \cdot A_{\text{eff},c,L1} \cdot f_0 / \gamma_{M1}$	$=$	5.66 kN

Bending resistance of return leg



Bending about Z-Z'

Fixing head diameter	f_h	=		=	10 mm
Distance to top fixing from top of bracket	h	=		=	24.00 mm
Distance from fixing head to outstand leg	b	=	$B/2 - (t_b - f_h/2)$	=	12.00 mm
Distance from top corner of bracket to edge of fixing	x	=	$(b^2 + h^2)^{0.5}$	=	26.83 mm
Angle of yield line relative to outstand leg	θ	=	$\tan^{-1}(b/(H-h))$	=	0.19 rads
Length of yield line Z-Z'	L_e	=	$H/\cos\theta$	=	89.53 mm
Section modulus	$W_{pl,yI}$	=	$L_e \cdot t^2 / 4$	=	201.45 mm ³
Moment capacity	$M_{c,yI}$	=	$W_{pl,yI} \cdot f_0 / \gamma_{M1}$	=	29.30 Nm
Maximum vertical load for offset e	F_{max}	=	$M_{c,yI} \cdot H / (x \cdot e) [e = e_{max} = LI]$	=	0.96 kN

Shear resistance of the outstand leg(s)

Shear slenderness	λ_s	=	h_b / t_b	=	29.33
Limiting slenderness	$\lambda_{s,max}$	=	$39 \times E_{ps}$	=	48.75
Web is non-slender					
Revised shear slenderness	λ_s	=	$0.35 \cdot h_b / t_b \cdot (f_0 / E)^{0.5}$	=	0.49
	η	=	$0.7 + 0.35 (f_0 / f_{uI})$	=	0.99
Reduction factor	ρ_v	=	BS EN 1999-1-1 cl 6.2.6.2(b)	=	0.80
Shear resistance	V_{Rd}	=	$\rho_v \times h_b \times t_b \times f_0 / (3^{0.5} \times \lambda_{M1})$	=	17.74 kN

Fixings to structure

Fixing to:

Fixing design by others - through holes

Fixing specification:

Client to specify

Number of fixings:

2

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Fixing group

Pullout resistance

Shear resistance

Moment resistance by row

 d_n Arm

1 - Bottom fixing

24mm

2

64mm

3

0mm

4

0mm

Dead load applied to bracket(s)

$$F_v = H_{\text{rail}} \cdot DL \cdot \gamma_g = 0.27 \text{ kN}$$

Lateral load applied to bracket(s)

$$F_h = (\text{from analysis}) = 0.74 \text{ kN}$$

Vertical moment applied to bracket

$$M_v = F_v \cdot L_I = 26.63 \text{ Nm}$$

Max pullout on top fixing

$$F_{N\text{max}} = M_v / \sum[d_n^2 / d_{\text{max}}] + F_h / n = 0.73 \text{ kN}$$

Max shear on fixing

$$F_{V\text{max}} = F_v / n = 0.13 \text{ kN}$$

Fixing to rail

Bearing capacity of 4.8mm dia fixing

$$V_{Rd,r,\text{fix}} = 2.25 \text{ kN}$$

Number of fixings

$$N_{r,\text{fix}} = 2$$

Total resultant shear in fixings

$$V_{Ed,\text{fix}} = 0.79 \text{ kN}$$

Fixing utilisation

$$= 17\%$$

Overall worst case bracket result

$$= 28\%$$

Minimum number of dead fix brackets to achieve fixing

$$= 1$$

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Restraint fix bracket design

Geometry

Zone for rail and bracket	z_b	=		=	135 mm
Bracket to be checked:			HH-Single100		
Bracket height	h_b	=		=	88 mm
Thickness	t_b	=		=	3 mm
Outstand leg length	L_1	=		=	100 mm
Return leg length	L_2	=		=	40 mm
Bottom fold	L_3	=		=	0 mm

Material grade

6063-T6

Yield strength	f_0	=		=	160 N/mm ²
Ultimate strength	f_u	=		=	195 N/mm ²
Young's Modulus	E_{alu}	=		=	70000 N/mm ²
Density	ρ_{alu}	=		=	2700 kg/m ³
Material safety factors	γ_{M1}	=		=	1.1
	γ_{M2}	=		=	1.25
Buckling class	BC	=		=	A
Material strength parameter	Eps	=	$(250/f_0)^{0.5}$	=	1.25

Gross properties

Area	A_g	=		=	264.00 mm ²
Inertia about y axis	I_y	=		=	17.04 cm ⁴
Inertia about z axis	I_z	=		=	0.02 cm ⁴
Radius of gyration in y axis	i_y	=	$(I_y / A_g)^{0.5}$	=	25.40 mm
Radius of gyration in z axis	i_z	=	$(I_z / A_g)^{0.5}$	=	0.87 mm
Distance to elastic neutral axis from edge of face	y_{gc}	=		=	1.50 mm
Distance to elastic neutral axis from base of bracket	z_{gc}	=		=	44.00 mm
Elastic modulus about y axis	$W_{el,y}$	=	$I_y / \max(z_{gc}; D_s - z_{gc})$	=	3.87 cm ³
Elastic modulus about z axis	$W_{el,z}$	=	$I_z / \max(y_{gc}; W_f - y_{gc})$	=	-0.13 cm ³

Capacity for pullout due to wind suction

Check back leg for bending

Plastic modulus of back leg	$W_{pl,L2}$	=	$h_b \cdot t_b^2 / 4$	=	198 mm ³
Moment capacity of back leg	$M_{c,Rd,L2}$	=	$W_{pl,L2} \cdot f_0 / \gamma_{M1}$	=	28.80 Nm
Pull capacity of bracket	$N_{p,Rd,L2}$	=	$M_{c,Rd,L2} / ((L_2 \cdot 0.5) - (t_b / 2))$	=	2.13 kN

Capacity for compression due to wind pressure

Check outstand leg(s) for compression

Outstand leg effective section

Stress ratio of ends of the leg	Ψ	=	(Uniform compression)	=	1.00
Slenderness reduction	η	=	(Uniform compression)	=	1.00
Slenderness parameter of the stem	$\beta_{c,L1}$	=	$\eta h_b / t_b$	=	29.33
Maximum slendernesses for section classification	β_1	=	$3 \times Eps$	=	3.75
(EN 1999-1-1:2007 Table 6.2)	β_2	=	$4.5 \times Eps$	=	5.63
	β_3	=	$6 \times Eps$	=	7.50

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St Leonards on Sea, East Sussex, TN38 9PP

	$\beta_{c,L1}$	$> \beta_3$	
Therefore, section is classified:	CLASS 4		
Determine effective section	C1	= (EN 1999-1-1:2007 Table 6.3)	= 10.00
	C2	= (EN 1999-1-1:2007 Table 6.3)	= 24.00
		$\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2);$	
	$\rho_{c,L1}$	$= 120/(\beta/Eps)^2\}$	= 0.38
Effective thickness of outstand leg	$t_{eff,c,L1}$	$= \rho_{c,L1} \times t_b$	= 1.15 mm
<u>Base fold leg effective section (if applicable)</u>			
Stress ratio of ends of the leg	Ψ	= (Uniform compression)	= 1.00
Slenderness reduction	η	= (Uniform compression)	= 1.00
Slenderness parameter of the stem	$\beta_{c,L3}$	$= \eta L_3 / t_b$	= 0.00
Maximum slendernesses for section classification	β_1	$= 3 \times Eps$	= 3.75
(EN 1999-1-1:2007 Table 6.2)	β_2	$= 4.5 \times Eps$	= 5.63
	β_3	$= 6 \times Eps$	= 7.50
	$\beta_{c,L3}$	$< \beta_1$	
Therefore, section is classified:	CLASS 1		
Section is fully effective	C1	= (EN 1999-1-1:2007 Table 6.3)	= N/A
	C2	= (EN 1999-1-1:2007 Table 6.3)	= N/A
		$\min\{(C1/(\beta/Eps)) - (C2/(\beta/Eps)^2);$	
	$\rho_{c,L3}$	$= 120/(\beta/Eps)^2\}$	= 1.00
Effective thickness of base fold	$t_{eff,c,L3}$	$= \rho_{c,L3} \times t_b$	= 0.00 mm
<u>Shape properties</u>			
Effective area	$A_{eff,c,L1}$	$= h_b \cdot t_{eff,c,L1}$	= 100.99 mm ²
Effective inertia about y axis	$I_{y,eff,c,L1}$	=	= 6.52 cm ⁴
Effective distance to elastic NA from edge of face	$y_{gc,eff,c,L1}$	=	= 0.57 mm
Effective distance to elastic NA from base of stem	$z_{gc,eff,c,L1}$	=	= 44.00 mm
Effective elastic modulus about y axis	$W_{el,y,c,L1}$	$= I_y / z_{gc}$	= 1.48 cm ³
<u>Flexural buckling</u>			
Effective length in y axis	$Le_{c,y}$	=	= 100.00 mm
Effective length in z axis	$Le_{c,z}$	=	= 100.00 mm
Relative slenderness in y axis	$\lambda_{f,y}$	$= Le_{c,y} \times (A_{eff,c} / A_g) \cdot (f_0 \times E_{alul})^{0.5} / (I_y \times \pi)$	= 0.04
Relative slenderness in z axis	$\lambda_{f,z}$	$= Le_{c,z} \times (A_{eff,c} \times f_0) / (A_g \times E)^{0.5} / (I_z \times \pi)$	= 1.09
Buckling plateau limit	λ_0	= EN 1999-1 Table 6.6	= 0.10
Imperfection factor	α	= EN 1999-1 Table 6.6	= 0.20
	ϕ_y	=	= 0.49
	ϕ_z	=	= 1.19
Flexural buckling reduction in y axis	$\chi_{f,y}$	$= 1 / (\phi_y + (\phi_y^2 - \lambda_y^2)^{0.5})$	= 1.00
Flexural buckling reduction in z axis	$\chi_{f,z}$	$= 1 / (\phi_z + (\phi_z^2 - \lambda_z^2)^{0.5})$	= 0.60
Compressive resistance of the outstand leg(s)	$N_{b,Rd,L1}$	$= \min[\chi_{f,y}; \chi_{f,z}] \cdot A_{eff,c,L1} \cdot f_0 / \gamma_{MI}$	= 8.78 kN

Fixing to substrate:

Fixing to:

Fixing design by others - through holes

Fixing specification:

Client to specify

Number of fixings:

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Fixing pullout resistance	$N_{Rd,fix}$	=	=	0.00 kN
Fixing shear resistance	$V_{Rd,fix}$	=	=	0.00 kN
Fixing resultant load limit	$F_{Rd,fix}$	=	=	0.00 kN

Lateral load applied to bracket(s)	F_h	= (from analysis)	=	0.91 kN
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Client to specify fixing to suit loads below:

Pullout per fixing (ULS)	N_{fix}	= F_h / n	=	0.45 kN
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Fixing to rail

Bearing capacity of 4.8mm dia fixing	$V_{Rd,r,fix}$	=	=	2.25 kN
Number of fixings	$N_{r,fix}$	=	=	2
Total resultant shear in fixings	$V_{Ed,fix}$	=	=	0.91 kN
Fixing utilisation			=	<u><u>20%</u></u>

EC-Safety data sheet Based Upon (1907/2006/EC) and CLP Regulation (EC) 1272/2008, and Reach additions Jan 2022

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Section 1. Identification of Substance/ Preparation and the Company description

- 1.1 Product identifier:**
Cortex 0220FR Class A1 Breather Membrane
- 1.2 Relevant identified uses of the product and uses advised against**
Breathable building wrap
- 1.3 Details of the supplier of the safety Data sheet**
OBEX Protection Ltd
Unit 12, Horn Hill Road, Nunnery Park
Worcester, WR4 0SX
Telephone: +44 (0) 1905 337800
(9am to 5pm Mon-Fri)
Email: sales@obexuk.com
- 1.4 Emergency Telephone Number**
+44 (0) 1905 337800 Mon to Fri, 9am to 5pm

Section 2. Hazards Identification

- 2.1 Classification of substance or mixture**
This material is classed as a non-hazardous article.
- 2.2 Label Elements**
- none
- 2.3 Other hazards**
- see section 3 (possible dangers)

Section 3. Composition/Information about components

- 3.1 Description**
Products made from continuous filament glass fibres with a diameter of 9 µm . The fabric is treated with organic and inorganic binders. The fabric has a maximum finish content of 3%.
- 3.2 Mixtures**
Ingredients
Fibrous Glass, E-glass 99 % CAS-No. 65997-17-3

3. Possible dangers

Inhalation

The inhalation of dust and fibres may cause short-term irritation of the mouth, nose and throat.

Eye contact with dust and fibres may cause short-term mechanical irritation.

Skin contact with stainless steel wire, dust and fibres may cause abrasion, itching and short-term irritations.

Section 4. First-aid measures

4.1 Description of First aid measures

General comments - When handled correctly, first aid measures are not necessary.

Please note the comment under points 7 and 8.

Inhalation

Move person to fresh air. Seek medical attention if irritation persists.

Eye contact

Flush eyes with running water. Seek medical attention if irritation persists.

Skin contact

Wash with mild soap and running water. To avoid further irritation, do not rub or scratch affected areas. Rubbing and scratching may force fibres into skin. Seek medical attention if irritation persists.

Ingestion

Ingestion of this material is unlikely. If it does occur, watch the person for several days to make sure that intestinal blockage does not occur.

4.2 Most important symptoms and effects, both acute and delayed

None.

4.3 No special treatment necessary

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Section 5. Firefighting measures

- 5.1 Suitable extinguishing media**
Water, Dry Powder, CO₂, Foam
- 5.2 Unsuitable extinguishing media for safety reasons:**
no restrictions known
Section 4. First-aid measures
Section 5. Firefighting measures
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EC-Safety data sheet Based Upon (1907/2006/EC) and CLP Regulation (EC) 1272/2008, and Reach additions Jan 2022
- 5.3 Particular dangers from the product, its combustion products, or gas liberated.**
Because of the low finish content, the material can be considered to be non-combustible. The finish will decompose at high temperature such as found in a warehouse fire. Typical Combustion products would be carbon dioxide, carbon monoxide and decomposition products of incomplete incineration.
- 5.4 Particular protective equipment when fighting fire:**
Carry self-contained breathing apparatus

Section 6. Measures in case of accidental release

- 6.1 Personal precautions**
Not applicable due to the finished nature of this product, see section 13 re waste disposal

Section 7. Handling and storage

- 7.1 Instructions and precautions for safe handling including technical protective measures:**
Severe mechanical loading of the fabrics can lead to the generation of dust and fly that may produce irritation. Contact with the skin may lead to local skin irritation. Should the situation arise, local extraction measures are advisable. See also point 8.

Information on fire and explosion protection
none

- 7.2 Condition for safe storage**
Requirements for storage rooms dry
Non-compatible materials/restrictions on co-storage none
Storage instructions do not stack unsecured
Particular requirements for electrical plant and appliances none
Measures to prevent build-up of static charge none
Storage class not applicable
- 7.3 Specific End uses**
For Industrial insulation

Section 8. Exposure controls and personal protective measures

- 8.1 Control measures to limit and monitor exposure**
not applicable
Additional information for the design of the technical plant
not applicable
- 8.2 Exposure controls**
General Components with limit values/ classification which are specific to the place of work and have to be monitored (to TRGS 900) in connection with point 7.1
General national limit value
(Fine dust)
Additional information / measuring method
Our products do not contain fibres with a diameter below 9µm. They present therefore only a possible irritant in the form of fly.
- 8.3 Personal protective equipment**
When the recommended measures (see point 7.1) are complied with, there is no need for personal protective equipment.
Respiratory:
If exclusive exposure to fly and dust is identified, the use of an F1 respirator is recommended.
Eye protection:
In the case of severe fly and dust creation protective dust goggles should be worn.

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Skin protection:

Loose fitting long sleeved shirt, long pants and gloves.

General protection and hygiene measures:

Wash hands prior to breaks and at the end of the working day. Persons with sensitive skin should use a fat-based protective cream. Avoid close-fitting working clothes.

10.5 Incompatible materials

– None known.

10.6 Hazardous decomposition products

In case of a fire, small quantities of decomposition products from the combustion of the finish. See section 5.

Section 9. Physical and chemical properties

9.1 Information on basic Physical and chemical properties

Form/State solid

Colour white fiber glass fabric, finished with an organo-silane.

Odour odourless

9.20 pH-value (2 g in 100 ml water, 20 °C) n.a.

9.21 Boiling point n.a.

9.22 Softening point 846 °C to 1100 °C

9.23 Flash point n.a.

9.24 Flammability n.a.

9.25 Ignition temperature n.a.

9.26 Self-ignition n.a.

9.27 Explosion danger n.a.

9.28 Explosive limits lower: n.a./ upper: n.a.

9.29 Fire propagation characteristics n.a.

9.30 Vapour pressure n.a.

9.31 Density (20 °C) 2.0-2.6 g/cm³

9.32 Solubility in water n.a.

9.33 Solubility in oil n.a.

9.34 Dispersion coefficient in octanol/water n.a.

9.35 Other Information-none

11. Toxicological information

11.1.1 Acute toxicity

No acute toxicity data is available for this product, but an assessment of physio-chemical properties.

Acute Oral Toxicity measurement (ATE)

ATEmix (oral: > 2000 mg/Kg)

Section 10. Stability and reactivity

11.Toxicological information

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EC-Safety data sheet Based Upon (1907/2006/EC) and CLP Regulation (EC) 1272/2008, and Reach additions Jan 2022

11.1.2 Skin irritation.

For this endpoint no toxicological test data is available for the whole product.

11.1.3 Respiratory sensitization

Fibreglass continuous filament is a mechanical irritants. Breathing fibre glass dust and fibres may cause short-term irritation of the mouth, nose throat and skin.

11.1.4 Germ cell mutagenicity or Carcinogenic risk

European Commission Directive 97/69/EC, amendment to Directive 67/548/EEC which concerns classification, packing and labelling of hazardous substances does not include commercial glass fibres as having carcinogenic risk. The continuous filament glass fibre contained in our fabrics is “non-respirable”. Products that are chopped, crushed or severely mechanically processed during manufacture or use may contain a very small amount of respirable glass fibre-like fragments. According to available exposure-monitoring data, the atmospheric loading in the workspace air of such fibre-like glass fragments

Section 10. Stability and reactivity

10.1 Reactivity

– If stored and handled under normal conditions no reactions either non-hazardous or hazardous are known, the product is inert.

10.2 Chemical stability and the possibility of hazardous reactions

- Stable and inert

10.4 Conditions to avoid

– None known.

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is extremely low or not detectable. Fibrous glass is not subject to the Ordinance on Hazardous Substances, shown in the German TRGS 900 and TRGS 905. ACGIH: A4 – not classifiable as a human carcinogen. IARC: Group 3 – not classifiable with respect to human carcinogenicity. Practical experiences When handled and used properly no effects deleterious to health are known.

11.1.5 Long term toxicity

There is no known chronic health effects connected with long-term use or contact with this product.

12. Ecological information

12.1 Toxicity Assessment

No expected damaging effects to aquatic organisms

12.2 Persistence and biodegradability

Biologically non degradable

E glass is not biodegradable. Finishes are organic materials which slowly and only partially dissolve by natural agents like water. As the concentration of the ingredients and their solubility are very low, our fabrics are considered to have no adverse ecotoxicological effects.

12.3 Mobility in soil

Insoluble in water

12.4 Other adverse effects

None are known and our products do not contain heavy metals, PBB / PBDE or PCB.

13. Disposal considerations

13.1.1 Waste treatment methods

Recommendation: The waste product code needs to be established with the responsible local authority.

Waste Product code No. (Preferably)
EAK-No. 101103

Waste name

Fibre Glass Material

Duty of proof

no

13.1.2 Uncleansed packaging

Remove fibre remnants from packaging and recycle according to packaging guidelines.

13.1.3

Glass fibres waste cannot be destroyed by incineration and can damage incinerators by the formation of a vitrified mass.

14.

Transport regulations (cross-border / inland)

14.1

Road ADR, Railway RID, Transport by sea IMDG-code, Air transport ICAO-TI/IATA-DGR- For all these standards this product is **not regulated for transport**.

Our continuous filament glass fabrics are not considered as hazardous goods by transport regulations a packing group and do not need special procedures under any regulations. **They are not qualified by a UNO number.**

15. Regulations

15.1 Regulatory information

Continuous filament glass fabrics do not require hazardous product labelling. They do not contain hazardous ingredients. As textile glass fibre products are not dangerous goods, they do not need labelling with R – and S – Phrases.

15.2 Chemical safety assessment

As a non-hazardous product Coated glass fabrics do not require labelling under **CLP Regulation (EC) 1272/2008**

According to the legislation and ECHA guidance we are not obliged to register as this product is not covered by the scope of the legislation.

16. Other information

Recommendation: Protect the product from dampness. N.B.: The information provided describes matters relevant to safety to the best of our current knowledge. It neither constitutes quality characteristics nor absolves you from personal responsibility when handling OBEX membranes and/or from observing legal regulations and conditions.



CORTEX®
Fire Rated Sealing System



Technical Data Sheet: Cortex 0220FR Class A1 Breather Membrane

Product Description

Cortex 0220FR is a highly UV resistant external breather membrane for use in facades and other construction applications which achieves a fire classification of A1 according to EN 13501-1.

The membrane features watertight yet breathable technology which facilitates the escape of moisture and the prevention of interstitial condensation. Cortex 0220FR can be applied directly onto many surfaces such as sheathing board, concrete or insulation and is suitable for many facade types.

Technical Data

Colour	White
Fire Classification	A1 (EN 13501-1)
Roll size	1500mm x 50m
Thickness	0.20 ± 0.05mm
Tensile strength	Longitudinal: 3828 N/50mm Transverse: 1992 N/50mm
Tear strength	Longitudinal: 356 N Transverse: 424N
Low temperature flexibility	-40°C
UV resistance	High
Water tightness	Class W2 (EN 1928)
Water vapour transmission (Sd)	0.03 (EN ISO 12572)
Vapour resistance	0.15 MNs/g
Melting point	800°C

Note: It is the responsibility of the user to carry out compatibility checks.

Obex Protection has a team of experienced technical service representatives who can provide additional assistance in the selection and specification of products. No liability can be accepted for the information provided in this leaflet, although it is published in good faith and believed to be correct. Obex Protection Ltd reserves the right to alter product specifications without prior notice, in line with its company policy of continuous development and improvement.



Supplied with the Cortex 0825 Installation Kit.



CORTEX®
Fire Rated Sealing System

For more product information, call us with your enquiry on **01905 337800** or email **sales@obexuk.com**

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Testing. Advising. Assuring.

Title:

CLASSIFICATION OF
REACTION TO FIRE
PERFORMANCE
IN ACCORDANCE WITH
EN 13501-1:2007+A1: 2009

Notified Body No:

0833

Product Name:

"Rainscreen Slab"

Report No:

WF 407368

Issue No:

1

Prepared for:

Knauf Insulation Limited
PO Box 10
Stafford Road
St Helens
Merseyside
WA10 3NS

Date:

22nd November 2018



1. Introduction

This classification report defines the classification assigned to “Rainscreen Slab”, a mineral wool insulation, in accordance with the procedures given in EN 13501-1:2007+A1: 2009.

2. Details of classified product

2.1 General

The product, “Rainscreen Slab”, a mineral wool insulation, is defined as being suitable for construction applications.

2.2 Product description

The product, “Rainscreen Slab”, a mineral wool insulation, is fully described below and in the test reports provided in support of classification listed in Clause 3.1.

Generic type	Mineral Wool Insulation
Product reference	“Rainscreen Slab”
Name of manufacturer	Knauf Insulation
Colour reference	“Brown”
Thickness	40mm (stated by sponsor) 47.21mm (determined by Exova Warringtonfire)
Density	50kg/m ³ (stated by sponsor) 46.07kg/m ³ (determined by Exova Warringtonfire)
Generic type of resin	“ECOSE”
Product reference of resin	“ET 3”
Amount of resin	2.5%
Generic type of oil	Mineral Oil
Product reference of oil	“Sasol Hydrowax 88”
Amount of oil	1.0 % of resin
Flame retardant details	See Note 1 below
Brief description of manufacturing process	Raw materials are melted with coke fuel in a cupola. The melt is streamed onto a set of spinning wheels to produce fibres. Binder is then applied and cooled fibres are collected to produce a primary mat. The material is then conveyed into an oven where the binder is cured to produce a board. The board is the trimmed to width, cut to length abs packaged for the customer.

Note 1: The sponsor of the test has confirmed that no flame retardant additives were utilised in the production of the product.

3. Test reports & test results in support of classification

3.1 Test reports

Name of Laboratory	Name of sponsor	Test reports/extended application report Nos.	Test method / extended application rules & date
Exova Warringtonfire	Knauf Insulation Limited	WF 403956	EN ISO 1182
Exova Warringtonfire	Knauf Insulation Limited	WF 403955	EN ISO 1716

3.2 Test results

Test method & test number	Parameter	No. tests	Results	
			Continuous parameter - mean (m)	Compliance parameters
EN ISO 1182	ΔT	5	8.6	Compliant
	Δm		4.24	
	t_f		Nil	
EN ISO 1716	PCS (a), (e)	3	1.2214MJ/kg	Compliant

4. Classification and field of application

4.1 Reference of classification

This classification has been carried out in accordance with clause 8 and 9 of EN 13501-1:2007+A1: 2009.

4.2 Classification

The product, "Rainscreen Slab", a mineral wool insulation, in relation to its reaction to fire behaviour is classified:

Reaction to fire classification: A1 / A1_{FL}

4.3 Field of application

This classification is valid for the following end use applications:

- i) Construction applications

This classification is also valid for the following product parameters:

Product thickness	Any thickness allowed
Product density	No variation allowed
Product composition	No variation allowed

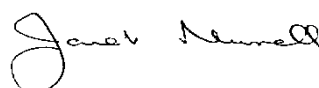
SIGNED



Matthew Dale

Senior Certification Engineer

APPROVED



Janet Murrell

Technical Manager
on behalf of **Exova Warringtonfire**

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Agrément Certificate

19/5609

Product Sheet 3

KNAUF INSULATION

ROCKSILK RAINSCREEN SLAB FOR CAVITY WALLS

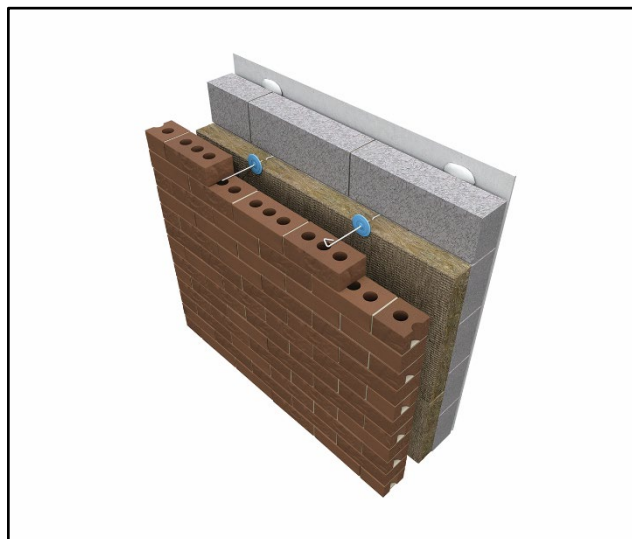
This Agrément Certificate Product Sheet⁽¹⁾ relates to Rocksilk⁽²⁾ RainScreen Slab for Cavity Walls, a mineral wool insulation slab for use as partial-fill thermal insulation in new external masonry or reinforced concrete cavity walls of domestic and non-domestic buildings, without height restriction (additional requirements apply for buildings above 25 metres). The product is installed during construction.

(1) Hereinafter referred to as 'Certificate'.

(2) Rocksilk is a registered trademark.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.



KEY FACTORS ASSESSED

Thermal performance — the product has a declared thermal conductivity (λ_D) of $0.034 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ (see section 6).

Water resistance — the product will resist the transfer of water across the cavity (see section 7).

Condensation — the product can contribute to limiting the risk of condensation (see section 8).

Behaviour in relation to fire — the product has a reaction to fire classification of Class A1 to BS EN 13501-1 : 2007 (see section 9).

Durability — the product is durable, rot proof, water resistant and sufficiently stable to remain effective as insulation for the life of the building in which it is incorporated (see section 12).

The BBA has awarded this Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 25 April 2022

Hardy Giesler
Chief Executive Officer

The BBA is a UKAS accredited certification body – Number 113.

The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers MUST check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA directly.

Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.

British Board of Agrément

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Watford
Herts WD25 9BA

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clientservices@bbacerts.co.uk
www.bbacerts.co.uk

Regulations

In the opinion of the BBA, Rocksilk RainScreen Slab for Cavity Walls, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



The Building Regulations 2010 (England and Wales) (as amended)

Requirement: Comment:	B3(4)	Internal fire spread (structure) The product is unrestricted by this Requirement. See section 9.1 of this Certificate.
Requirement: Comment:	B4(1)	External fire spread The product is unrestricted by this Requirement. See section 9.1 of this Certificate.
Requirement: Comment:	C2(a)	Resistance to moisture The product can contribute to satisfying this Requirement. See section 7.1 of this Certificate.
Requirement: Comment:	C2(b)	Resistance to moisture The product can contribute to satisfying this Requirement. See section 7.2 of this Certificate.
Requirement: Comment:	C2(c)	Resistance to moisture The product can contribute to satisfying this Requirement. See sections 8.1, 8.2 and 8.4 of this Certificate.
Requirement: Comment:	L1(a)(i)	Conservation of fuel and power The product can contribute to satisfying this Requirement. See sections 6.1 and 6.2 of this Certificate.
Regulation: Comment:	7(1)	Materials and workmanship The product is acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation: Comment:	7(2)	Materials and workmanship The product is unrestricted by this Regulation. See section 9.1 of this Certificate.
Regulation:	26	CO₂ emission rates for new buildings
Regulation:	26A	Fabric energy efficiency rates for new dwellings (applicable to England only)
Regulation:	26A	Primary energy consumption rates for new buildings (applicable to Wales only)
Regulation:	26B	Fabric performance values for new dwellings (applicable to Wales only)
Comment:		The product can contribute to satisfying these Regulations. See sections 6.1 and 6.2 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation: Comment:	8(1)	Durability, workmanship and fitness of materials The product is acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	2.4	Cavities
Comment:		The product is unrestricted by this Standard, with reference to clauses 2.4.2 ⁽¹⁾⁽²⁾ , 2.4.4 ⁽¹⁾ and 2.4.6 ⁽²⁾ . See section 9.1 of this Certificate.

Standard: Comment:	2.6	Spread to neighbouring buildings The product is unrestricted by this Standard, with reference to clauses 2.6.5 ⁽¹⁾ and 2.6.6 ⁽²⁾ . See section 9.1 of this Certificate.
Standard: Comment:	3.4	Moisture from the ground The product can contribute to satisfying this Standard, with reference to clauses 3.4.1 ⁽¹⁾⁽²⁾ and 3.4.5 ⁽¹⁾⁽²⁾ . See section 7.1 of this Certificate.
Standard: Comment:	3.10	Precipitation The product can contribute to satisfying this Standard, with reference to clauses 3.10.1 ⁽¹⁾⁽²⁾ and 3.10.3 ⁽¹⁾⁽²⁾ . See section 7.2 of this Certificate.
Standard: Comment:	3.15	Condensation The product can contribute to satisfying this Standard, with reference to clauses 3.15.1 ⁽¹⁾⁽²⁾ , 3.15.4 ⁽¹⁾⁽²⁾ and 3.15.5 ⁽¹⁾⁽²⁾ . See sections 8.1, 8.2 and 8.5 of this Certificate.
Standard: Comment:	6.1(b)	Carbon dioxide emissions The product can contribute to satisfying this Standard, with references to clauses, or parts of, 6.1.1 ⁽¹⁾ , 6.1.2 ⁽²⁾ , 6.1.3 ⁽¹⁾ , 6.1.4 ⁽¹⁾ , 6.1.6 ⁽¹⁾⁽²⁾ and 6.1.8 ⁽²⁾ . See sections 6.1 and 6.2 of this Certificate.
Standard: Comment:	6.2	Building insulation envelope The product can contribute to satisfying this Standard, with references to clauses, or parts of, 6.2.1 ⁽¹⁾⁽²⁾ , 6.2.3 ⁽¹⁾ , 6.2.4 ⁽¹⁾⁽²⁾ , 6.2.5 ⁽²⁾ , 6.2.6 ⁽¹⁾⁽²⁾ , 6.2.7 ⁽¹⁾ , 6.2.8 ⁽²⁾ , 6.2.9 ⁽¹⁾⁽²⁾ , 6.2.10 ⁽¹⁾ , 6.2.11 ⁽¹⁾⁽²⁾ , 6.2.12 ⁽²⁾ and 6.2.13 ⁽¹⁾⁽²⁾ . See sections 6.1 and 6.2 of this Certificate.
Standard: Comment:	7.1(a)(b)	Statement of sustainability The product can contribute to satisfying the relevant requirements of Regulation 9, Standards 1 to 6, and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. In addition, the product can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾], 7.1.6 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾] and 7.1.7 ⁽¹⁾⁽²⁾ [Aspect 1 ⁽¹⁾⁽²⁾]. See section 6.1 of this Certificate.
Regulation: Comment:	12	Building standards applicable to conversions Comments in relation to the product under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ .

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).



The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation: Comment:	23	Fitness of materials and workmanship The product is acceptable. See section 11 and the <i>Installation</i> part of this Certificate.
Regulation: Comment:	28(a)	Resistance to moisture and weather The product can contribute to satisfying this Regulation. See section 7.1 of this Certificate.
Regulation: Comment:	28(b)	Resistance to moisture and weather The product can contribute to satisfying this Regulation. See section 7.2 of this Certificate.

Regulation: Comment:	29	Condensation The product can contribute to satisfying this Regulation. See sections 8.1 and 8.2 of this Certificate.
Regulation: Comment:	35(4)	Internal fire spread - structure The product is unrestricted by this Regulation. See section 9.1 of this Certificate.
Regulation: Comment:	36(a)	External fire spread (structure) The product is unrestricted by this Regulation. See section 9.1 of this Certificate.
Regulation: Comment:	39(a)(i)	Conservation measures The product can contribute to satisfying this Regulation. See sections 6.1 and 6.2 of this Certificate.
Regulation: Comment:	40(2)	Target carbon dioxide emission rate The product can contribute to satisfying this Regulation. See sections 6.1 and 6.2 of this Certificate.

Construction (Design and Management) Regulations 2015

Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See section: *3 Delivery and site handling (3.3)* of this Certificate.

Additional Information

NHBC Standards 2022

In the opinion of the BBA, subject to a 50 mm minimum residual cavity being maintained, NHBC accepts the use of Rocksilk RainScreen Slab for Cavity Walls, provided it is installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Chapter 6.1 *External Masonry Walls*.

CE marking

The Certificate holder has taken the responsibility of CE marking the product in accordance with harmonised European Standard BS EN 13162 : 2012.

Technical Specification

1 Description

Rocksilk RainScreen Slab for Cavity Walls comprises slabs of rigid rock mineral wool (MW) treated with a water-repellent additive; the slabs have the nominal characteristics shown in Table 1.

Table 1 Nominal characteristics

Characteristic (unit)	Value
Length (mm)	1200
Width (mm)	455
Thickness (mm) ⁽¹⁾	50, 80, 100, 150 and 220
Edge profile	Square

(1) Other slab thicknesses within the above range are available on request.

2 Manufacture

2.1 The slabs are manufactured from molten rock which is spun into rock mineral wool. A thermosetting binder is added, and the material is collected in the form of a blanket which is folded back (upon itself) to give the required product density. The blanket is then cured in a heated oven to form the required product, which is cut, trimmed and packaged.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Knauf Insulation Ltd has been assessed and registered as meeting the requirements of ISO 9001 : 2015 and ISO 14001 : 2015 by TÜV NORD (Certificates 44 100 190742 and 44 104 190742 respectively).

3 Delivery and site handling

3.1 Slabs are delivered to site in polythene-wrapped packs. Each pack contains a label with the Certificate holder's name, slab dimensions and the BBA logo incorporating the number of this Certificate.

3.2 On site, the product should be stored clear of the ground on a clean level surface and preferably under cover to protect it from prolonged exposure to moisture or mechanical damage.

3.3 It is recommended that dust masks, gloves and long-sleeved clothing are worn when cutting and handling the product. Large-scale machining should be connected to a dust-extraction system.

3.4 Damaged, contaminated or wet slabs must not be used.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Rocksilk RainScreen Slab for Cavity Wall application.

Design Considerations

4 Use

4.1 Rocksilk RainScreen Slab for Cavity Walls is satisfactory for use as partial fill cavity wall insulation and is effective in reducing the thermal transmittance (U value) of external cavity walls with reinforced concrete or masonry inner leaves (where masonry includes clay and calcium silicate bricks, concrete blocks, and natural and reconstituted stone blocks) and a masonry outer leaf. The product is for use in new domestic and non-domestic buildings without height restriction (additional requirements apply above 25 metres). It is essential that walls are designed and constructed to incorporate the precautions given in this Certificate to prevent moisture penetration.

4.2 Two layers of slabs can also be installed if necessary in order to achieve the required U values (see section 6.2). In this case, vertical joints between the outer slabs must be staggered to those of the inner slabs.

4.3 As with other forms of cavity wall insulation, where buildings need to comply *with NHBC Standards 2022*, specifiers should observe the requirements of that document.

4.4 Buildings subject to the national Building Regulations should be designed and constructed in accordance with the relevant recommendations of:

- BS 8000-3 : 2020
- BS EN 845-1 : 2013
- BS EN 1992-1-1 : 2004 and its UK National Annex
- BS EN 1992-1-2 : 2004 and its UK National Annex
- BS EN 1996-1-1 : 2005 and its UK National Annex
- BS EN 1996-1-2 : 2005 and its UK National Annex
- BS EN 1996-2 : 2006 and its UK National Annex
- BS EN 1996-3 : 2006 and its UK National Annex.

4.5 Other new buildings not subject to these Regulations should also be built in accordance with the Standards given in section 4.4.

4.6 Cavity wall ties with insulation-retaining fixings and, if required, any additional ties to BS EN 845-1 : 2013 and PD 6697 : 2019 should be used for structural stability in accordance with BS EN 1996-1-1 : 2005, BS EN 1996-2 : 2006 and BS EN 1996-3 : 2006.

4.7 The use of cavity battens and/or boards during construction is strongly recommended to prevent bridging by mortar droppings.

4.8 It is recommended that installation is continuous up to the highest level on each wall. The cavity must be capped in brick, block or suitable board material.

4.9 Care must be taken in the overall design and construction of walls incorporating the product to ensure the provision of appropriate:

- cavity trays and damp-proof courses (dpc)
- cavity barriers/closers and fire stopping
- resistance to the ingress of precipitation, moisture and dangerous gases from the ground
- resistance to sound transmission when flanking separating walls and floors.

Buildings up to and including 25 metres high

4.10 The residual cavity width to be maintained during construction is 50 mm. This may reduce to 25 mm in isolated areas due to individual construction features (a minimum of 50 mm residual cavity width is required by the *NHBC Standards 2022*). This may be achieved by designing a cavity width which takes into account the dimensional tolerances of the components which make up the wall (by reference to the British Standards relating to the bricks, blocks and batts), or by using the data from the respective manufacturers. Allowances may need to be made for the quality of building operatives and the degree of site supervision or control available, and for the limitations in respect of exposure of the proposed building (as set out in Table 2 of this Certificate).

Table 2 Maximum allowable total exposure factors of different constructions

Construction	Maximum allowable exposure factor (E) ⁽¹⁾
All external masonry walls protected by: rendering (to BS EN 13914-1 : 2016); tile hanging; slate hanging; or timber, plastic or metal weatherboarding or cladding	No restriction
One or more external masonry walls constructed from facing clay brickwork or natural stone, (the porosity of which exceeds 20% by volume). Mortar joints must be flush-pointed or weatherstruck	100
One or more external masonry walls constructed from calcium silicate bricks, concrete blocks, reconstituted stone, or natural stone (the porosity of which is less than 20% by volume), or any material with raked mortar joints	88

(1) To BS 5618 : 1985

4.12 From ground level, the maximum height of continuous cavity walls must not exceed 12 metres; above 12 metres, the maximum height of continuous cavity walls must not exceed 7 metres. In both cases, breaks should be in the form of continuous horizontal cavity trays and weepholes discharging to the outside.

4.13 An external render coat or other suitable finish should be applied in locations where such application would be normal practice; care should be taken to ensure that the residual cavity is not bridged by mortar.

Buildings over 25 metres in height

4.14 The width of the residual clear cavity to be achieved is to be in excess of 50 mm, and the following additional requirements apply:

- the specifier must take extra care when detailing to ensure that the introduction of the insulation does not affect the weather resistance of the wall. Above average site supervision is recommended during installation of the product
- where, for structural reasons, the cavity width is reduced, eg by the intrusion of ring beams, a minimum residual cavity width of 25 mm must be maintained and extra care must be taken with fixings and weatherproofing, eg by the inclusion of cavity trays with weepholes.

5 Practicability of installation

The product is designed to be installed by a competent general builder, or a contractor, experienced with this type of product.

6 Thermal performance



6.1 Calculations of the thermal transmittance (U value) should be carried out in accordance with BS EN ISO 6946 : 2017 and BRE Report BR 443 : 2019 using the insulation's declared thermal conductivity (λ_D) of $0.034 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$.

6.2 The U value of a completed wall will depend on the insulation thickness, cavity width, number and type of fixings and the insulating value of the substrate masonry and its internal finish. Calculated U values for sample constructions are given in Table 3.

Table 3 Example cavity wall U values⁽¹⁾

U value requirement (W·m ⁻¹ ·K ⁻¹) ⁽¹⁾	Insulation thickness (mm)		
	13 mm dense plaster ⁽²⁾ 100 mm dense block ⁽³⁾	Plasterboard on dabs ⁽⁴⁾ 100 mm AAC block ⁽⁵⁾	150 mm Reinforced Concrete ⁽⁶⁾
0.17	180 ⁽⁷⁾	150	180 ⁽⁷⁾
0.18	180 ⁽⁷⁾	150	180 ⁽⁷⁾
0.20	150	130 ⁽⁷⁾	150
0.21	150	130 ⁽⁷⁾	150
0.22	150	130 ⁽⁷⁾	130 ⁽⁷⁾
0.23	130 ⁽⁷⁾	100	130 ⁽⁷⁾
0.25	130 ⁽⁷⁾	100	130 ⁽⁷⁾
0.26	130 ⁽⁷⁾	100	130 ⁽⁷⁾
0.27	130 ⁽⁷⁾	80	100
0.28	100	80	100
0.30	100	80	100
0.35	80	80	80

(1) Assumes fixings correction for fully penetrating stainless steel ($\lambda = 17 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) cavity wall ties at 2.5 m^2 with a cross-sectional area of 12.5 mm^2 and a 50 mm air cavity ($R = 0.180 \text{ m}^2 \cdot \text{K}^{-1} \cdot \text{W}^{-1}$). Construction includes 102.5 mm thick brick outer leaf ($\lambda = 0.77 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$).

(2) 13 mm plaster thermal conductivity ($\lambda = 0.57 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$).

(3) 100 mm dense block and mortar thermal conductivity 93.4% ($\lambda = 1.13 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) and 6.6% ($\lambda = 0.88 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) respectively.

(4) 15 mm air cavity ($R = 0.170 \text{ m}^2 \cdot \text{K}^{-1} \cdot \text{W}^{-1}$) bridged at 20% with plasterboard adhesive ($\lambda = 0.43 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) and 12.5 mm Plasterboard thermal conductivity ($\lambda = 0.25 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$).

(5) 100 mm AAC block and mortar thermal conductivity 93.4% ($\lambda = 0.12 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) and 6.6% ($\lambda = 0.88 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) respectively.

(6) 150 mm reinforced concrete with 1% steel ($\lambda = 2.3 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) 15 mm air cavity ($R = 0.170 \text{ m}^2 \cdot \text{K}^{-1} \cdot \text{W}^{-1}$) bridged at 20% with plasterboard adhesive ($\lambda = 0.43 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) and 15 mm Plasterboard thermal conductivity ($\lambda = 0.25 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$).

(7) Thickness achieved with two layers of insulation.

6.3 Care must be taken in the overall design and construction of junctions with other elements and openings to minimise thermal bridges and air infiltration. Detailed guidance can be found in the documents supporting the national Building Regulations.

7 Water resistance



7.1 When the product is used in situations where it bridges the dpc in walls, dampness from the ground will not pass through to the inner leaf provided the wall is detailed in accordance with the requirements and provisions of the national Building Regulations.

7.2 Constructions incorporating the product, and built in accordance with the Standards listed in section 4.4, will resist the transfer of precipitation to the inner leaf and satisfy the national Building Regulations.

7.3 In all situations it is particularly important to ensure during installation that:

- cavity wall ties are installed correctly, are thoroughly clean and slope downwards towards the outer face of the construction
- excess mortar is cleaned from the cavity face of the leading leaf and any debris removed from the cavity
- mortar droppings are cleaned from the exposed edges of installed slabs
- insulation slabs are properly installed and butt-jointed
- installation is carried out to the highest level on each wall, or the top edge of the insulation is protected by a cavity tray
- a cavity tray, stop-ends and weepholes are provided at lintel level
- cavity battens and/or boards are used during construction to prevent bridging by mortar droppings
- damp-proof course (dpc) membranes at ground level do not project into the cavity (as they can form a trap for mortar bridging)
- raked or recessed mortar joints are avoided in very severe exposure areas.

8 Condensation

Interstitial condensation



8.1 Walls will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2021, and the relevant guidance.

8.2 For the purposes of assessing the risk of interstitial condensation, the water vapour resistance factor (μ) of the insulation may be taken as 1.

8.3 A vapour control layer (VCL) should be used in all constructions, should the condensation risk analysis show this is necessary.

8.4 If the product is to be used in the external walls of rooms expected to have high humidity, care must be taken to provide adequate permanent ventilation to avoid possible problems from the formation of interstitial condensation.

Surface condensation



8.5 In England and Wales, walls will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $0.7 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point, and the junctions with other elements are designed in accordance with the guidance referred to in section 6.3 of this Certificate.



8.6 In Scotland, wall constructions will be acceptable when the thermal transmittance (U value) does not exceed $1.2 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point, and the junctions with other elements are designed in accordance with the guidance referred to in BS 5250 : 2021. Further guidance may be obtained from BRE Report BR 262 : 2002 and section 6.3 of this Certificate.

9 Behaviour in relation to fire



9.1 The product is classified as Class A1 in accordance with BS EN 13501-1 : 2007⁽¹⁾, and is not subject to any restriction on building height or proximity to boundaries.

(1) Report no. 355031, Date: 28 July 2015. Exova Warringtonfire.

9.2 Designers should refer to the relevant national Building Regulations and guidance for detailed conditions of use, particularly in respect of requirements for substrate fire performance, cavity barriers/closers, fire stopping of service penetrations and combustibility limitations for other materials and components used in the overall wall construction.

10 Maintenance

As the product is confined within the wall cavity and has suitable durability, maintenance is not required (see section 11).

11 Durability



The product is unaffected by the normal conditions in a wall, and is durable, rot proof, water resistant and sufficiently stable to remain effective as insulation for the life of the building.

Installation

12 General

12.1 The Certificate holder will provide on-site demonstrations on request, to ensure correct installation from the outset.

12.2 Adequate supervision of the installation should be maintained and the Certificate holder must have right of access to site to ensure correct installation.

12.3 It is recommended that the internal leaf is constructed ahead of the external leaf, as the slabs are fastened to the cavity face of the internal leaf. Slabs must not be pushed into a completed cavity.

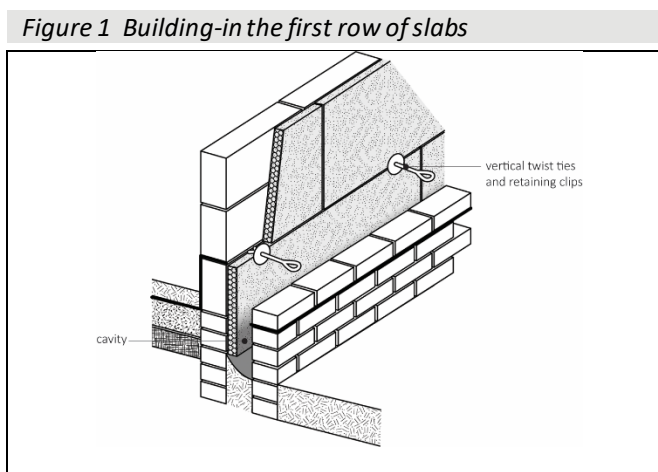
12.4 Vertical joints in the slabs must be staggered and all joints tightly butted. Where protrusions occur in the cavity, the slabs should be carefully cut to fit.

12.5 If installation of the slabs is terminated below the highest level of the wall, the top edge of the insulation must be protected by a cavity tray and alternate perpend joints raked out, to provide adequate drainage of water from the tray.

12.6 Where required, door and window reveals should incorporate a cavity barrier/closer. It is recommended that BBA-approved cavity barriers/closers are used.

13 Procedure

13.1 Walls are constructed in the conventional manner, with the first row of wall ties where the insulation is to begin, but not on the dpc, and at approximately 600 mm horizontal spacing. Any mortar snots on the ties or cavity tray should be cleaned. The first run of slabs may commence below the dpc level to provide some edge insulation for the floor (see Figure 1).

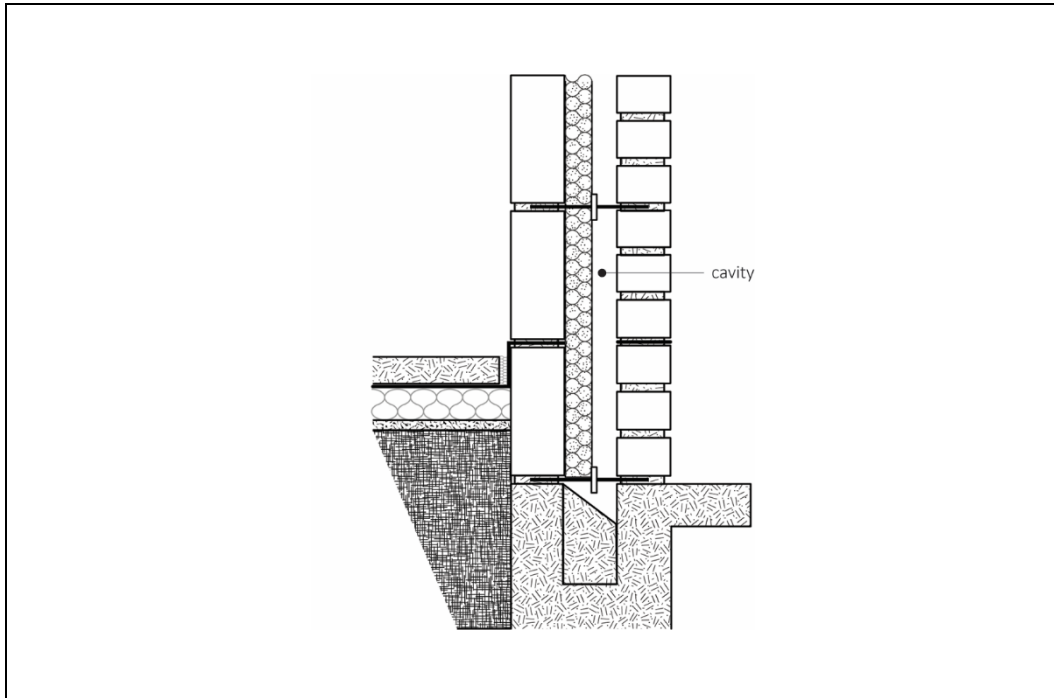


13.2 A section of the leading leaf is built up to a course above the next row of wall ties, which are placed at the usual spacing of 450 mm vertically and not more than 900 mm horizontally. Excess mortar should be cleaned from the cavity face of the internal leaf.

13.3 The slabs are compressed slightly and placed between the upper and lower wall ties to form a closely butt-jointed run and held in place behind insulation retaining clips (see Figure 1).

13.4 Wall ties need to be inserted so they slope downwards towards the external leaf, ensuring the drip of the tie is located halfway across the residual cavity width to shed water away from the internal leaf (see Figure 2). It is also important that the first row of slabs are not in contact with the ground.

Figure 2 Partial fill wall tie detail



13.5 The following leaf is then built up to the same level as the slabs, with a minimum 50 mm cavity maintained between the slabs and the external leaf (see Figure 2).

13.6 Successive sections of wall, incorporating wall ties, are constructed and the slabs installed.

13.7 Slabs should be installed to the highest level of each wall (see section 12.5).

Mortar droppings

13.8 After each section of the wall leaf is built, excess mortar should be removed and mortar droppings cleaned from exposed edges of the installed product before installation of the next section. Use of a cavity board or a cavity batten will protect the installed product edges and help to keep the cavity clean as the following leaf is built (see Figure 4).

Figure 3 Use of a cavity board when clearing off mortar

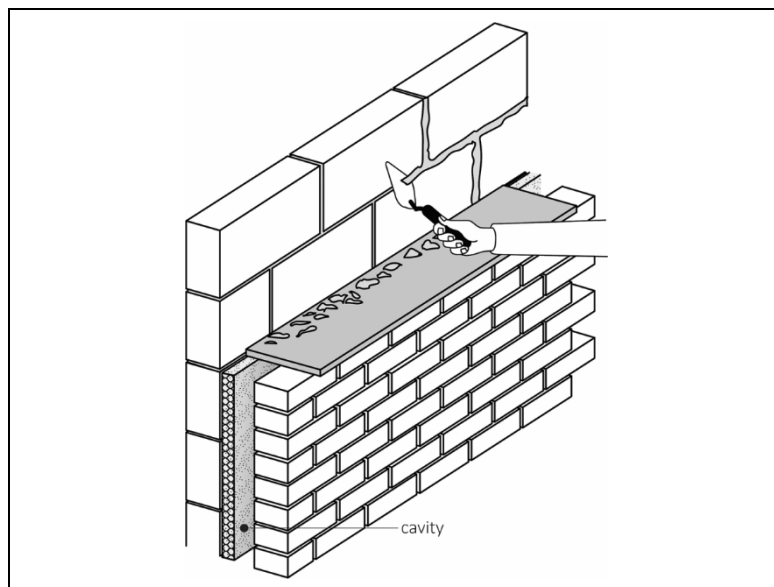
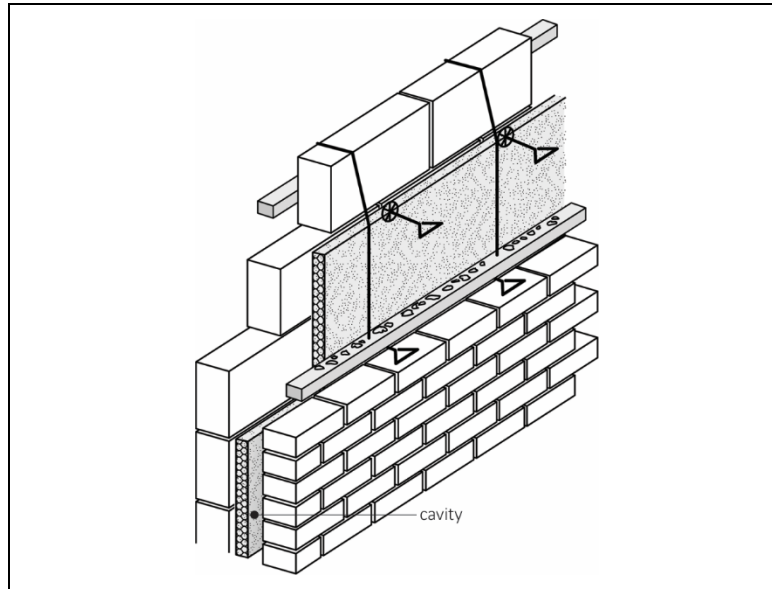


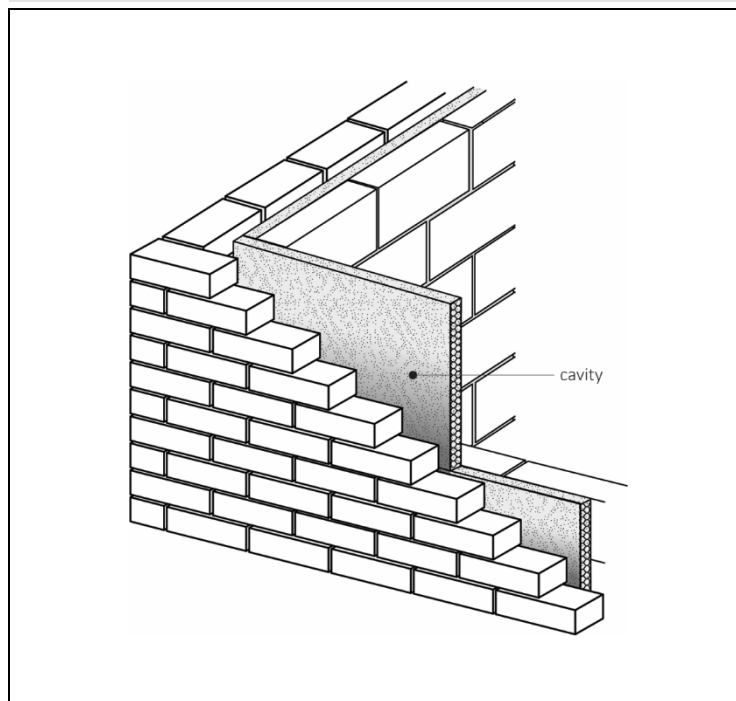
Figure 4 Use of cavity battens



Corners

13.9 Slabs should be closely butted at corners (see Figure 5) to avoid cold bridges (uncut slabs should be used for this purpose).

Figure 5 Slabs at corner detail



Wall openings

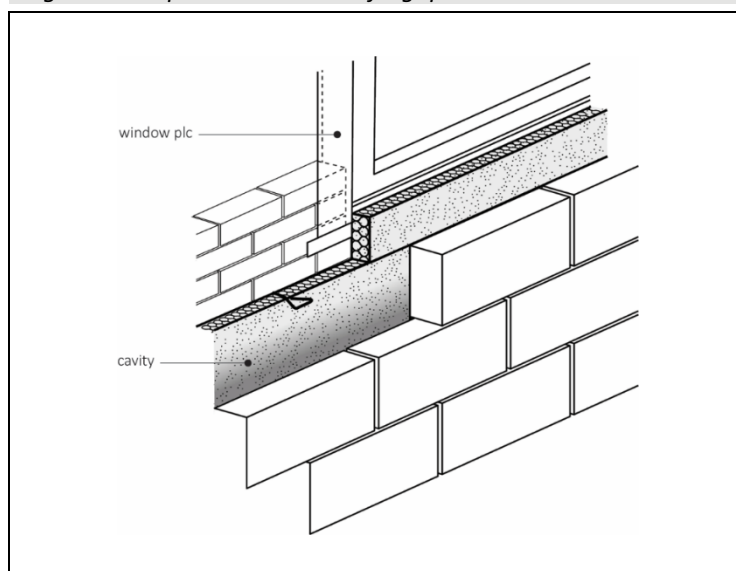
13.10 Where openings such as doors and windows are in close proximity, it is recommended that a continuous lintel or cavity tray is used. Individual lintels or cavity trays should have stop ends and be adequately drained. Slabs should be cut to butt tightly against the cavity barrier/closer/dpc.

Cut pieces

13.11 Slabs can be cut, using a sharp knife or fine-toothed saw, to fit around windows, doors, apertures, air bricks etc. The slabs can also be cut at angles to create chamfered samples to fit around lintels. It is essential that cut pieces of

slab completely fill the spaces for which they are intended and are adequately secured; gaps must not be left in the insulation (see Figure 6).

Figure 6 *Cut pieces are used to fill gaps*



13.12 Small pieces of slab must be fitted, with the fibre layer parallel to the plane of the wall, so their faces (not their edges) are against the face of the wall.

Multi layers (when required)

13.13 When installing multi layers of slabs, a similar procedure must be followed as for the single layer (see sections 13.1 to 13.12). The first layer is fitted against the outer masonry leaf followed by the second layer. The vertical joints in the second layer must not be coincident with the vertical joints in the first layer.

13.14 For cavities exceeding 150 mm, the Certificate holder's instructions must be followed regarding the type of ties to be used, and the installation should be carried out in accordance with BS EN 1996-1-2 : 2005, BS EN 1996-2 : 2006 and BS EN 1996-3 : 2006.

Protection

13.15 Exposed areas of slabs should always be covered at the end of the day's work or in driving rain.

13.16 All building involving the product, particularly interrupted work, must conform to BS EN 1996-2 : 2006, *Clauses 3.2 Acceptance, handling and storage of materials* and *3.6 Curing and protective procedures during execution*.

Technical Investigations

14 Tests

Results of tests were assessed to determine:

- reaction to fire
- thermal conductivity
- dimensional stability
- short term water absorption
- slab dimensions.

15 Investigations

15.1 Existing data on durability and properties in relation to fire were evaluated.

15.2 A calculation was undertaken to confirm the declared thermal conductivity value (λ_D).

15.3 A series of U value calculations was carried out.

15.4 A condensation risk analysis was carried out.

15.5 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

Bibliography

BS 5250 : 2021 *Management of moisture in buildings. Code of practice*

BS 5618 : 1985 *Code of practice for thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with urea-formaldehyde (UF) foam systems*

BS 8000-3 : 2020 *Workmanship on construction sites. Masonry. Code of practice*

BS EN 845-1 : 2013 + A1 : 2016 *Specification for ancillary components for masonry — Wall ties, tension straps, hangers and brackets*

BS EN 1992-1-1 : 2004 + A1 : 2014 *Eurocode 2: Design of concrete structures — General rules and rules for buildings*
NA + A2 : 14 to BS EN 1992-1-1 : 2004 + A1 : 2014 *UK National Annex to Eurocode 2: Design of concrete structures — General rules and rules for buildings*

BS EN 1992-1-2 : 2004 + A1 : 2019 *Eurocode 2: Design of concrete structures — General rules — Structural fire design*
NA to BS EN 1992-1-2 : 2004 *UK National Annex to Eurocode 2: Design of concrete structures — General rules — Structural fire design*

BS EN 1996-1-1 : 2005 + A1 : 2012 *Eurocode 6 — Design of masonry structures — General rules for reinforced and unreinforced masonry structures*
NA to BS EN 1996-1-1 : 2005 + A1 : 2012 *UK National Annex to Eurocode 6 — Design of masonry structures — General rules for reinforced and unreinforced masonry structures*

BS EN 1996-1-2 : 2005 *Eurocode 6 — Design of masonry structures — General rules — Structural fire design*
NA to BS EN 1996-1-2 : 2005 *UK National Annex to Eurocode 6 — Design of masonry structures — General rules — Structural fire design*

BS EN 1996-2 : 2006 *Eurocode 6 — Design of masonry structures — Design considerations, selection of materials and execution of masonry*
NA to BS EN 1996-2 : 2006 *UK National Annex to Eurocode 6 — Design of masonry structures — Design considerations, selection of materials and execution of masonry*

BS EN 1996-3 : 2006 *Eurocode 6 — Design of masonry structures — Simplified calculation methods for unreinforced masonry structures*
NA + A1 : 2014 to BS EN 1996 - 3 : 2006 *UK National Annex to Eurocode 6 — Design of masonry structures — Simplified calculation methods for unreinforced masonry structures*

BS EN 13162 : 2012 + A1 : 2015 *Thermal insulation products for buildings — Factory made mineral wool (MW) products — Specification*

BS EN 13501-1 : 2007 + A1 : 2009 *Fire classification of construction products and building elements — Classification using test data from reaction to fire tests*

BS EN 13914-1 : 2016 *Design, preparation and application of external rendering and internal plastering — External rendering*

BS EN ISO 6946 : 2017 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*

ISO 9001 : 2015 *Quality management systems — Requirements*

ISO 14001 : 2015 *Environmental Management systems — Requirements with guidance for use*

PD 6697 : 2019 *Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2*

BRE Report BR 262 : 2002 *Thermal insulation : avoiding risks*

BRE Report BR 443 : 2019 *Conventions for U-value calculations*

16 Conditions

16.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

16.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

16.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

16.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

16.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

16.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.

ROCKSILK® RAINSCREEN SLAB AND BGV

February 2022



APPLICATIONS



DESCRIPTION

Rocksilk® RainScreen Slab is a BBA certified Rock Mineral Wool slab designed for use as sheathing insulation in rainscreen façade systems and as a partial fill insulation in masonry cavities. It is suitable for use in all buildings of any height.

It is non-combustible with the best possible Euroclass A1 reaction to fire classification, and is manufactured using our unique bio-based binder, ECOSE® Technology.

PERFORMANCE

Thermal

Thermal conductivity: 0.034 W/mK

Fire

Classification: Euroclass A1 to BS EN 13501-1

Vapour resistivity

Water vapour resistivity: 5.00 MNs/g.m

Wind Load

Wind fatigue testing 3.6kPa / (76m/s)

FEATURES AND BENEFITS

- ✓ BBA Certified (certificate 19/5609) for use in multiple build-ups so it can be specified with confidence.
- ✓ Supported by BS EN ISO 10211 compliant 3D U-value calculation service to accurately ensure buildings perform as specified
- ✓ Made with a water-repellent additive - slabs will maintain their integrity while exposed on site.
- ✓ Slabs are engineered to adapt to minor imperfections in the substrates.
- ✓ Suitable for use on all buildings including those above 18m in height.

SPECIFICATIONS

Thickness (mm)	Thermal conductivity (W/mK)	Thermal resistance (m ² K/W)	Length (mm)	Width (mm)	Pieces per pack	Area per pack (m ²)	Packs per pallet	Product code
220	0.034	6.45	1200	455	2	1.092	15	756635
210	0.034	6.15	1200	455	2	1.092	15	756633
200	0.034	5.85	1200	455	2	1.092	15	756631
150	0.034	4.40	1200	455	3	1.638	15	756630
140	0.034	4.20	1200	455	3	1.638	15	756629
110	0.034	3.20	1200	455	4	2.184	15	756628
100	0.034	2.90	1200	455	4	2.184	15	756627
90	0.034	2.60	1200	455	5	2.73	15	756626
80	0.034	2.35	1200	455	5	2.730	15	756625
75	0.034	2.20	1200	455	6	3.276	15	756503
60	0.034	1.75	1200	455	7	3.822	15	756528
50	0.034	1.45	1200	455	8	4.368	15	756500

CERTIFICATIONS, CLASSIFICATIONS AND INDUSTRY STANDARDS



ROCKSILK® RAINSCREEN SLAB AND BGV

February 2022

SPECIFICATIONS

Thickness (mm)	Thermal conductivity (W/mK)	Thermal resistance (m ² K/W)	Length (mm)	Width (mm)	Pieces per pack	Area per pack (m ²)	Packs per pallet	Product code
250	0.034	7.35	1200	600	2	1.440	10	656411
240	0.034	7.05	1200	600	2	1.440	10	656410
230	0.034	6.75	1200	600	2	1.440	12	656409
220	0.034	6.45	1200	600	2	1.440	12	656408
210	0.034	6.15	1200	600	2	1.440	12	640933
200	0.034	5.85	1200	600	2	1.440	12	640930
190	0.034	5.55	1200	600	2	1.440	12	652477
180	0.034	5.25	1200	600	3	2.160	10	640927
170	0.034	5.00	1200	600	3	2.160	10	651506
165	0.034	4.85	1200	600	3	2.160	10	658742
160	0.034	4.70	1200	600	3	2.160	10	651512
155	0.034	4.55	1200	600	3	2.160	12	658741
150	0.034	4.40	1200	600	3	2.160	12	640921
140	0.034	4.10	1200	600	3	2.160	12	651513
130	0.034	3.80	1200	600	3	2.160	12	651499
125	0.034	3.65	1200	600	4	2.880	10	658740
120	0.034	3.50	1200	600	4	2.880	10	640916
110	0.034	3.20	1200	600	4	2.880	12	650811
100	0.034	2.90	1200	600	4	2.880	12	640914
90	0.034	2.60	1200	600	5	3.600	12	650810
80	0.034	2.35	1200	600	5	3.600	12	650809
75	0.034	2.20	1200	600	6	4.320	12	640911
70	0.034	2.05	1200	600	6	4.320	12	650808
60	0.034	1.75	1200	600	7	5.040	12	650807
50	0.034	1.45	1200	600	8	5.760	12	640909
150 (BGV)*	0.034	4.40	1200	600	3	2.160	12	640959
120 (BGV)*	0.034	3.50	1200	600	4	2.880	10	640949
100 (BGV)*	0.034	2.90	1200	600	4	2.880	12	640935

* Black Glass Veil All dimensions are nominal. Other thicknesses between 50-250mm are available on request.

CERTIFICATIONS, CLASSIFICATIONS AND INDUSTRY STANDARDS



ROCKSILK® RAINSCREEN SLAB AND BGV

February 2022

ADDITIONAL INFORMATION

Durability

Rocksilk® RainScreen Slab is odourless, rot proof, non-hygroscopic, does not sustain vermin and will not encourage the growth of fungi, mould or bacteria. The product will have a life equivalent to that of the wall structure in which it is incorporated.

Application

Rocksilk® RainScreen Slab is used for the thermal insulation of rainscreen façade systems and partially filled masonry cavities. Rocksilk® RainScreen Slab is lightweight but rigid enough to resist the compression forces generated when fixing the insulation slabs to the buildings substrate. The water repellent additive in Rocksilk® RainScreen Slab provides a further line of defence against rain penetration. Rocksilk® RainScreen Slab is recommended for use in rainscreen façade systems using a timber, SFS, masonry or reinforced concrete substrate.

Rocksilk® RainScreen Slab is also recommended for use in partial fill applications, against a steel, timber or masonry inner leaf with a masonry outer façade.

Standards and Certification

Rocksilk® RainScreen Slab has been assessed by the British Board of Agrément (BBA) under Certificate 19/5609 PS1 for use in rainscreen façade systems on new and existing timber, steel-frame, reinforced concrete or masonry walls. Rocksilk® RainScreen Slab is also assessed under Certificate 19/5609 PS2 for use in new and existing partially filled steel frame or timber frame walls with a masonry outer façade. Rocksilk® RainScreen Slab is further assessed under Certificate 19/5609 PS3 for use as partial fill insulation on new external masonry or reinforced concrete cavity walls. Rocksilk® RainScreen Slab is approved to be used in situations where it bridges the DPCs of the inner and outer leaf because it does not absorb water by capillary action. It is certified for thicknesses from 50mm to 250mm. The certification offers contractors and specifiers utmost confidence that Rocksilk® RainScreen Slab is fit for its intended use and will have a life equivalent to that of the wall structure in which it is incorporated, provided that it is stored and installed correctly.

Rocksilk® RainScreen Slab is manufactured in accordance with BS EN 13162, ISO 50001 Energy Management Systems, ISO 14001 Environmental Management Systems, and ISO 9001 Quality Management Systems, as certified by TÜV Nord.

Real Performance

Glass and Rock Mineral Wool are easier to install correctly than other insulants such as rigid boards because they adapt to any slight imperfections in the substrate and knit together, eliminating any air gaps. Evidence shows the absence of air gaps is crucial to achieving real performance in the relevant application.

Environmental

Rocksilk® RainScreen Slab contains no ozone-depleting substances or greenhouse gases. For further environmental information consult the relevant Environmental Product Declaration, available on our website.

Moisture

The physical and chemical characteristics of the fibres are unaltered by wetting. Therefore the thermal properties of Rocksilk® RainScreen Slab are not affected by exposure to moisture and the product will perform as expected once dry.

Thermal performance

The U-value of a proprietary rainscreen façade system is dependent on the degree of thermal bridging in the system. Calculations should be created using 2D or 3D modelling programs which comply with the methodologies detailed in BS EN ISO 10211.

We offer 3D numerically modelled U-value calculations compliant with BS EN ISO 10211 under the BBA/TIMSA U-value and Condensation Risk Analysis Competence Scheme.

Handling and storage

Rocksilk® RainScreen Slab is easy to handle and install, being lightweight and easily cut to size, where necessary. Rocksilk® RainScreen Slab is supplied in recyclable polythene packs which are designed for short term protection only. For longer term protection on site, the product should either be stored indoors, or under cover and off the ground. Rocksilk® RainScreen Slab should not be left permanently exposed to the elements.



ECOSE® Technology is our unique bio-based binder, that is used in the manufacture of all of our Glass Mineral Wool products and the majority of our Rock Mineral Wool products, to bind insulation strands together. ECOSE® Technology contains no added formaldehyde or phenol. It is made from natural raw materials that are rapidly renewable and is 70% less energy-intensive to manufacture than traditional binders, so it is more environmentally-friendly. Products made with ECOSE® Technology are soft to touch and easy to handle. They generate low levels of dust and VOCs and have been awarded the Eurofins Gold Certificate for Indoor Air Comfort.

Knauf Insulation Ltd

PO Box 10, Stafford Road, St.Helens, Merseyside, WA10 3NS. UK

Customer Service: 01744 766 766 Technical Support Team: 01744 766 666

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KINE1517DAT-V0222

challenge.
create.
care.

BREEAM CREDITS USING KNAUF INSULATION ROCK MINERAL WOOL PRODUCTS

BREEAM (Building Research Establishment Environmental Assessment Methodology) is a voluntary standard that defines high performance green buildings which are healthier, more environmentally responsible and are more cost-effective across their full lives. Using independent assessors, BREEAM examines criteria covering a range of issues in sections that evaluate: management processes, health and wellbeing, energy, transport, water, materials, waste, land use and ecology, pollution and innovation.

KNAUF INSULATION **Rock Mineral Wool** products can put you on the right track for the highest result for BREEAM certification.

BREEAM 2018 Credit Category code	Assessment criteria and definition	Knauf Insulation Products contribution	Contributes towards
Hea 02 Indoor air quality	Emissions from building products: The insulation materials are one of the 5 product types that needs to meet the emission limits. The following requirements are of application for insulation products: • Formaldehyde $\leq 0.06 \text{ mg/m}^3$; • Total VOC $\leq 1.0 \text{ mg/m}^3$; Post-construction indoor air quality Measurement: The total VOC and formaldehyde are measured and reported (thresholds for averaged formaldehyde concentration level $\leq 100 \mu\text{g/m}^3$ over 30 minutes and for averaged TVOC $\leq 300 \mu\text{g/m}^3$ over 8 hours).	Rock Mineral Wool Earthwool products manufactured using ECOSE® Technology meet the requirements as they have no added formaldehyde and have the best possible Eurofins Gold[1] Certificate for Indoor Air Comfort.	1 credit
Hea 04 Thermal comfort	To ensure that appropriate thermal comfort levels are achieved through design, and that controls are selected to maintain a thermally comfortable environment for occupants.	Thermal modelling can be facilitated through products BIM files available online at www.knaufinsulation.co.uk	1 credit
Hea 05 Acoustic performance	To insure the building's acoustic performance, including sound insulation, meets the appropriate standards for its purpose.	Products performance aims to reduce indoor ambient noise level and reverberation times in order to comply with regulations or good practices standards.	1 – 2 credits
Ene 01 Reduction of energy use and carbon emissions	To recognise and encourage buildings designed to minimise operational energy demand, primary energy consumption and CO ₂ emissions.	Rock Mineral Wool Earthwool products manufactured using ECOSE® Technology help reducing all 3 parameters by reducing operational energy demand which feeds through to lower primary energy consumption and CO ₂ emissions.	4 credits
Mat 01 Building life cycle assessment (LCA)	To reduce the burden on the environment from construction products by recognising and encouraging measures to optimise construction product use and the selection of products with a low environmental impact (including embodied carbon), over the life cycle of the building	Manufacturer EPD data in building LCA tools may be used in the building LCAs submitted for Mat 01. Environmental Product Declarations (EPD) containing these data are available for all Knauf Insulation products.	7 credits for the LCA
Mat 02 Environmental Product Declarations (EPD)	To encourage availability of robust and comparable data on the impact of construction products through the provision of EPD.	Product- and manufacturer-specific EN 15804- compliant, 3rd party verified Environmental Product Declarations (EPD) are available for all Knauf Insulation products. This allows maximum points in the Mat 02 scoring for each Knauf Insulation EPD.	1 credit
Mat 03 Responsible sourcing of construction products	To recognise and encourage the specification and procurement of responsibly sourced construction (RSC) products.	All Knauf Insulation products are covered by our certification to BES 6001 (BRE Framework Standard for Responsible Sourcing), which is a BREEAM-recognised responsible sourcing certifications scheme.	3 credits
Wst 01 Construction waste management	To reduce construction waste by encouraging reuse, recovery and best practice waste management practices to minimise waste going to landfill.	Packaging is recyclable. Product offcuts can also be used as filling on working site. Both can help with achievement of the diversion from landfill benchmark	1 credits
Pol 05 Noise attenuation	To reduce the likelihood of noise, arising from fixed installations on the new development, affecting nearby noise-sensitive buildings.	Attenuation of noise sources by use of acoustic insulation products, such as Earthwool Acoustic Floor Slab.	1 credit

¹ www.product-testing.eurofins.com

3-D U-value Calculation by Finite Element Analysis

Calculation Method: BS EN ISO 10211

Project Summary

Project Name	The Boatmans
Project Address	42 City Rd East, Manchester, M15 4QF
Wall Type	Wall Type 1 (Masonry) v2
Wall Area (m ²)	400m ²
Target U-Value (W/m ² K)	0.30
Company Name	Façade Design Services
Company Address	191 Shirley Road, Southampton, Hampshire, SO15 3FG
Contact Name	Daniel Leavey
Telephone	+44 (0)7886 281989
Email	daniel@facadedesignservices.com
Knauf Insulation Contact	Callum Augustine
Knauf Insulation Email	Callum.augustine@knaufinsulation.com

Figure 1 – Material Layers

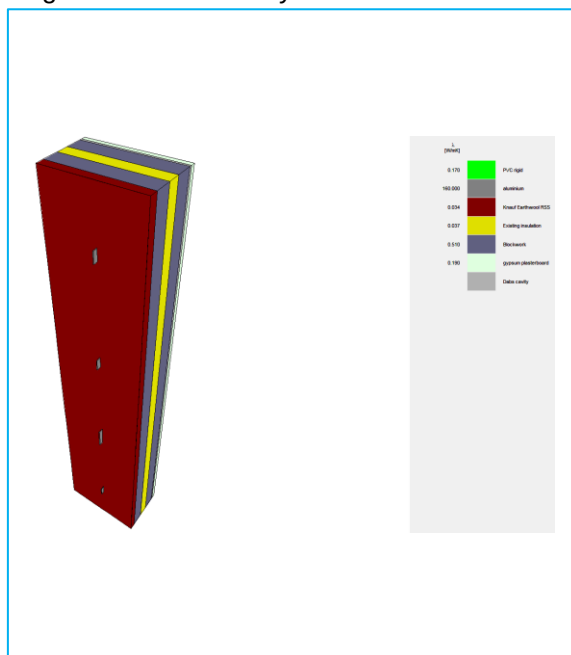
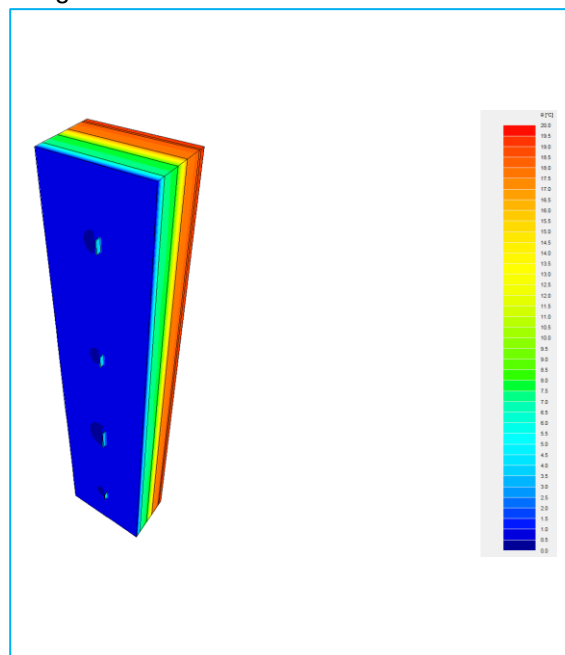


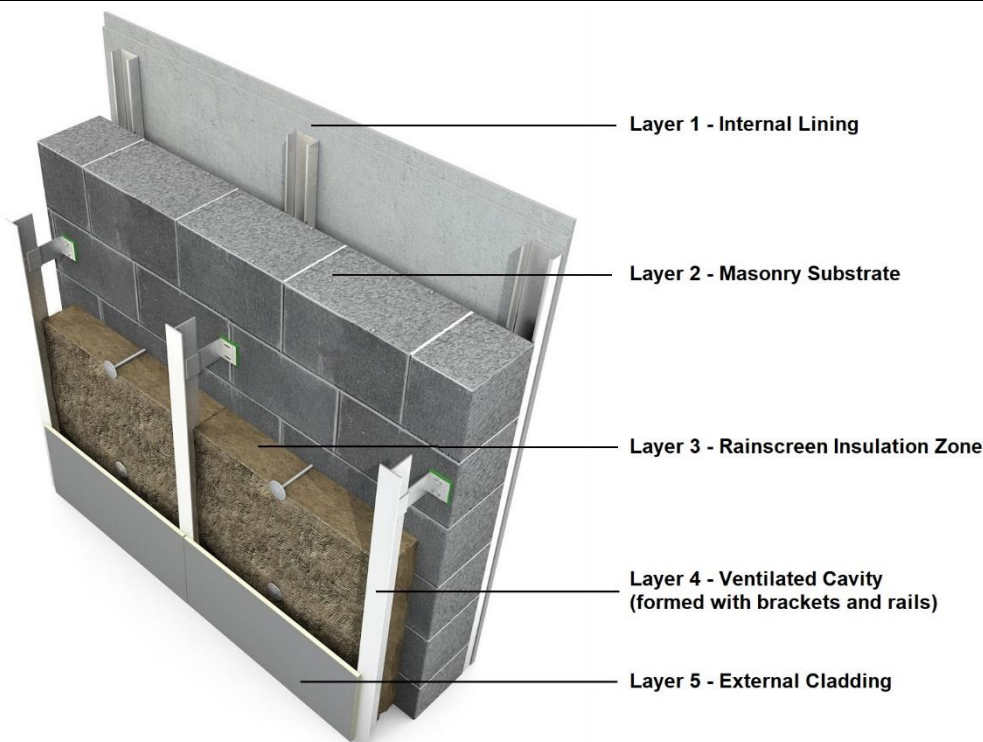
Figure 2 – Heat Flows



Width of model	0.600m	Height of model	2.940m
Internal surface resistance	0.13m ² K/W	External surface resistance	0.13m ² K/W
Heat Flow (Q)	8.3979W	Area (A)	1.764m ²
Internal temperature (Ti)	20°C	External temperature (Te)	0°C
U-value = Q/A x (Ti - Te)	8.3979/35.28		
U-value (rounded)	0.24W/m²K		

3-D U-value Calculation by Finite Element Analysis Calculation Method: BS EN ISO 10211

Through-Wall Construction



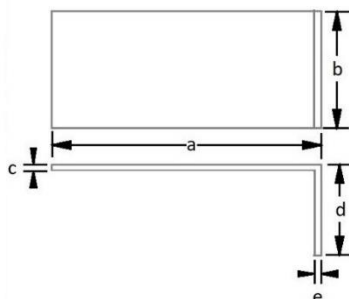
*The model above is a representation of a typical build-up. The table below shows the actual materials and thicknesses in the calculation.

Layer	Description	Thickness (mm)	Thermal Conductivity (W/mK)
1a	Standard Wallboard (2x12.5mm)	25.0	0.190
1b	Airspace/ plaster dabs	15.0	R-value
2	Medium Dense Block	100.0	0.510
3	Existing Insulation (assumed K=0.037)	75.0	0.037
4a	Medium Dense Block	100.0	0.510
4b	Obex A1 Breather Membrane	-	-
5	Knauf Insulation Rocksilk® RainScreen Slab tightly fitted around 'helping hand' brackets	50.0	0.034
6	Ventilated Cavity	50.0	R-value
7	Rainscreen Cladding Panel	-	-

3-D U-value Calculation by Finite Element Analysis

Calculation Method: BS EN ISO 10211

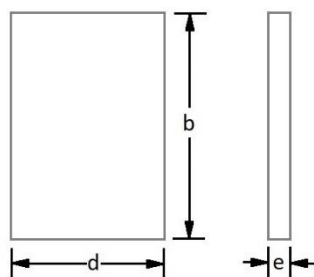
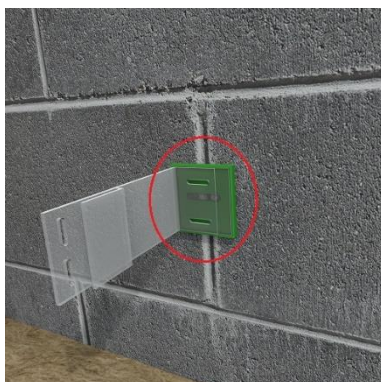
Bracket in Layers 5 & 6



Manufacturer; Nvelope
Material; Aluminium
Conductivity; $\lambda=160\text{W/mK}$

a = Insulation thickness + 30mm
b (single) = 75mm
b (double) = 150mm
c = 5mm
d = 62mm
e = 4mm

Isolation Pad in layer 5



Manufacturer; Nvelope
Material; PVC
Conductivity; $\lambda=0.17\text{W/mK}$

b (single) = 75mm
b (double) = 150mm
d = 62mm
e = 5mm

Wall Ties in layer 3



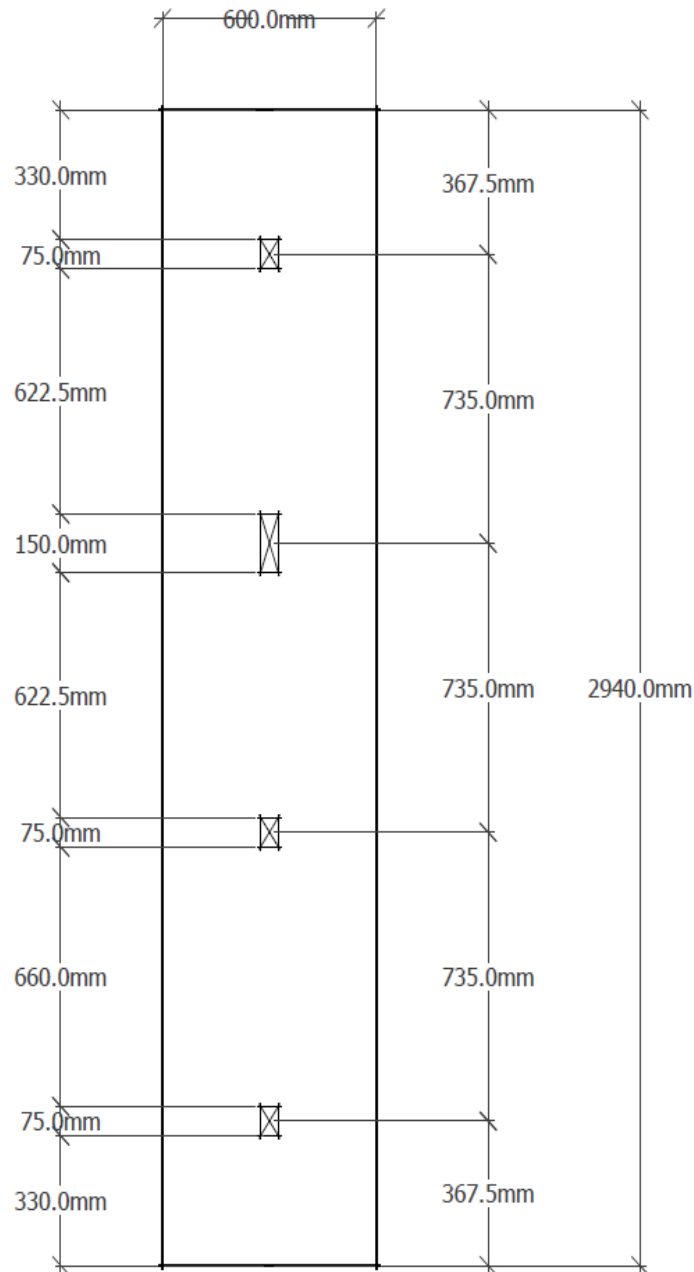
Material; Stainless Steel
Conductivity; $\lambda=17.0\text{W/mK}$

Number per m^2 = 2.5
Cross Sectional area mm^2 = 12.5

3-D U-value Calculation by Finite Element Analysis

Calculation Method: BS EN ISO 10211

Bracket Layout in layers 5 & 6

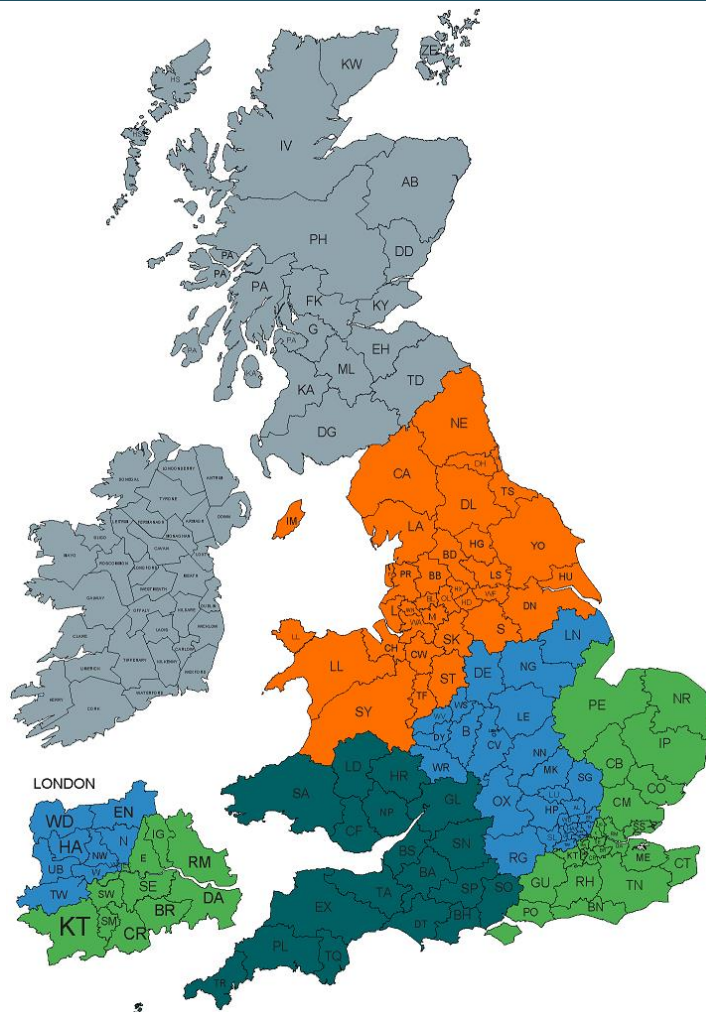


Model width (h) = see diagram
Model height (v) = see diagram

3-D U-value Calculation by Finite Element Analysis Calculation Method: BS EN ISO 10211

Contact Us

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3-D U-value Calculation by Finite Element Analysis Calculation Method: BS EN ISO 10211

Useful Links



[Book a CPD](#)



[Rocksilk® RainScreen Slab – Specify in NBS](#)



[11 Reasons to Specify Rocksilk® RainScreen Slab](#)



[Rocksilk® RainScreen Slab - Product Datasheet](#)



[Rocksilk® RainScreen Slab - BBA Certificate - 19/5609 Product Sheet 1](#)



[Rocksilk® RainScreen Slab - BBA Certificate - 19/5609 Product Sheet 2](#)



[Rocksilk® RainScreen Slab - BREEAM Helpsheet](#)



[Rocksilk® RainScreen Slab - Environmental Product Declaration](#)



[Rocksilk® RainScreen Slab - Declaration of Performance](#)



[Rocksilk® RainScreen Slab - Design Guide](#)



[Design out Risk with Rocksilk® RainScreen Slab](#)



[Rocksilk® RainScreen Slab - Safety Data Sheet](#)

3-D U-value Calculation by Finite Element Analysis

Calculation Method: BS EN ISO 10211

Project Summary

Project Name	The Boatmans
Project Address	42 City Rd East, Manchester, M15 4QF
Wall Type	Wall Type 2 (Timber) v2
Wall Area (m²)	400m2
Target U-Value (W/m²K)	0.30
Company Name	Façade Design Services
Company Address	191 Shirley Road, Southampton, Hampshire, SO15 3FG
Contact Name	Daniel Leavey
Telephone	+44 (0)7886 281989
Email	daniel@facadedesignservices.com
Knauf Insulation Contact	Callum Augustine
Knauf Insulation Email	Callum.augustine@knaufinsulation.com

Figure 1 – Material Layers

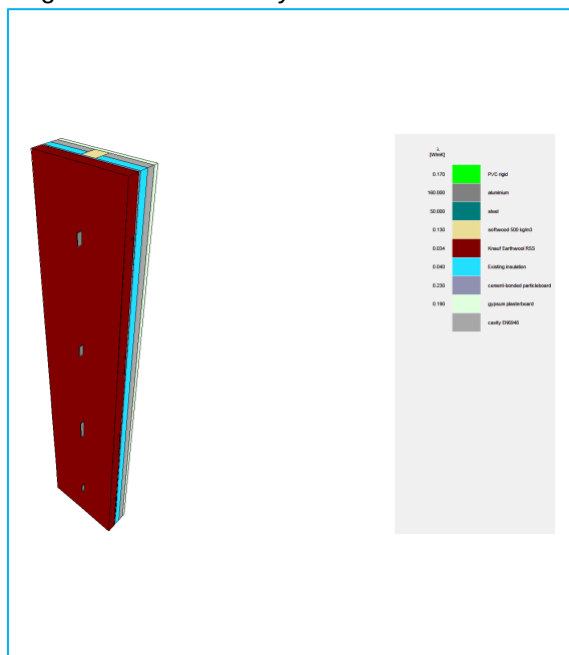
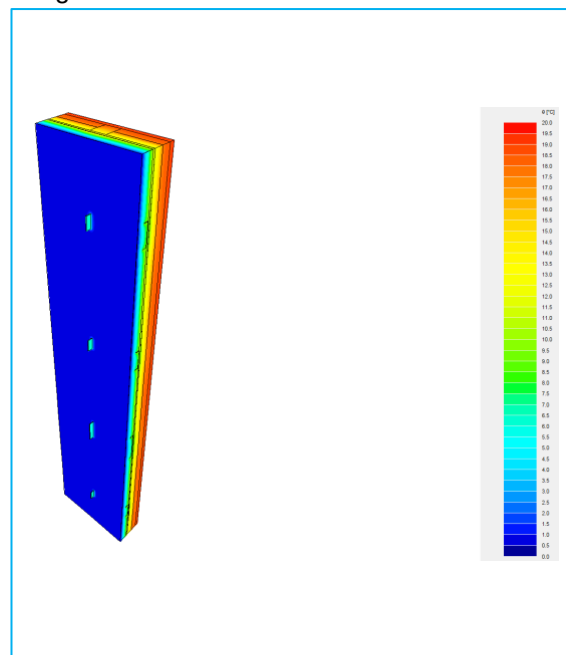


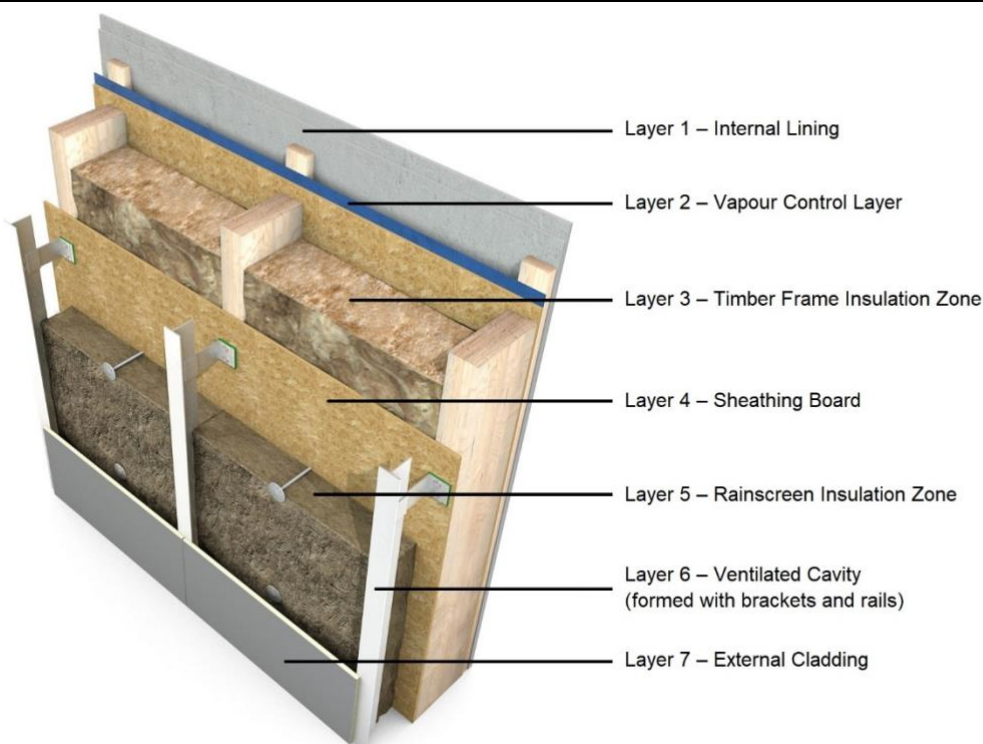
Figure 2 – Heat Flows



Width of model	0.600m	Height of model	2.940m
Internal surface resistance	0.13m²K/W	External surface resistance	0.13m²K/W
Heat Flow (Q)	10.4799W	Area (A)	1.764m²
Internal temperature (Ti)	20°C	External temperature (Te)	0°C
U-value = Q/A x (Ti - Te)	10.4799/35.28		
U-value (rounded)	0.30W/m²K		

3-D U-value Calculation by Finite Element Analysis Calculation Method: BS EN ISO 10211

Through-Wall Construction



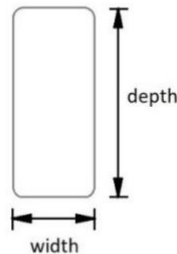
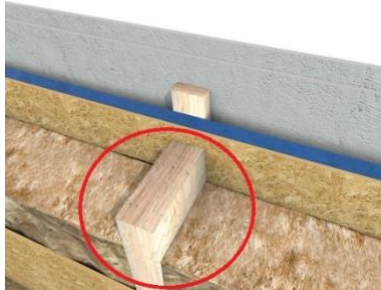
*The model above is a representation of a typical build-up. The table below shows the actual materials and thicknesses in the calculation.

Layer	Description	Thickness (mm)	Thermal Conductivity (W/mK)
1	2x12.5mm Standard Wallboard	25.0	0.190
2	Vapour Control Layer	-	-
3a	Un-ventilated cavity (remainder of studs)	50.0	R-value
3b	Existing Insulation (assumed $K=0.040$) tightly fitted between timber studs (15% bridged with timber)	50.0	0.040
4a	Cement Board	12.0	0.230
4b	Breather Membrane	-	-
5	Knauf Insulation Rocksilk® RainScreen Slab tightly fitted around 'helping hand' brackets	70.0	0.034
6	Ventilated Cavity	50.0	R-value
7	Rainscreen Cladding Panel	-	-

3-D U-value Calculation by Finite Element Analysis

Calculation Method: BS EN ISO 10211

Timber studs in Layer 3a & 3b

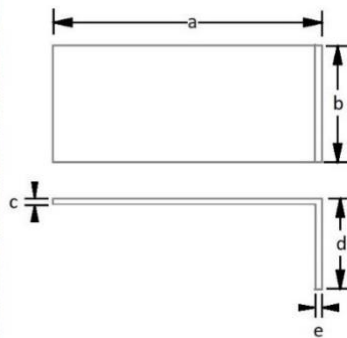


Material: Timber
Thermal Conductivity; $\lambda=0.13\text{W/mK}$
Dimensions; (depth x width)

Depth; 100mm x 38mm*

(*Calculated at 100mm x 90mm to approximate 15% timber bridging as per BR443)

Bracket in Layers 5 & 6



Manufacturer; Nvelope
Material; Aluminium
Conductivity; $\lambda=160\text{W/mK}$

a = Insulation thickness + 30mm

b (single) = 75mm

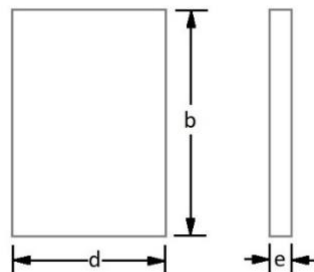
b (double) = 150mm

c = 5mm

d = 62mm

e = 4mm

Isolation Pad in layer 5



Manufacturer; Nvelope
Material; PVC
Conductivity; $\lambda=0.17\text{W/mK}$

b (single) = 75mm

b (double) = 150mm

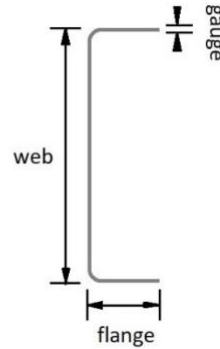
d = 62mm

e = 5mm

3-D U-value Calculation by Finite Element Analysis
Calculation Method: BS EN ISO 10211

Fixing rail in Layer 5 (C-channel)

Used when the bracket layout doesn't line up with the SFS studs. Used for lighter cladding panels.



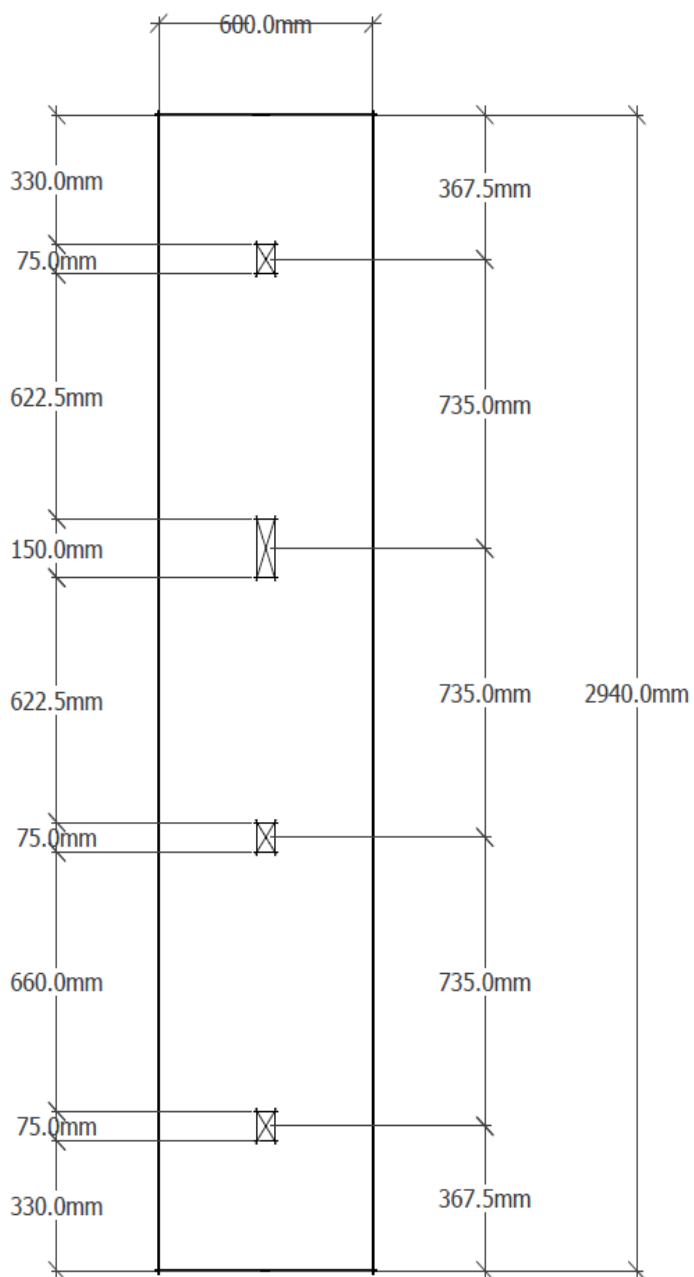
Material; Galvanized
Steel
Thermal Conductivity;
 $\lambda=50\text{W/mK}$

Gauge = 2mm
Web (single) = 130mm
Web (double) = 210mm
Flange = 30mm

3-D U-value Calculation by Finite Element Analysis

Calculation Method: BS EN ISO 10211

Bracket Layout in layers 5 & 6

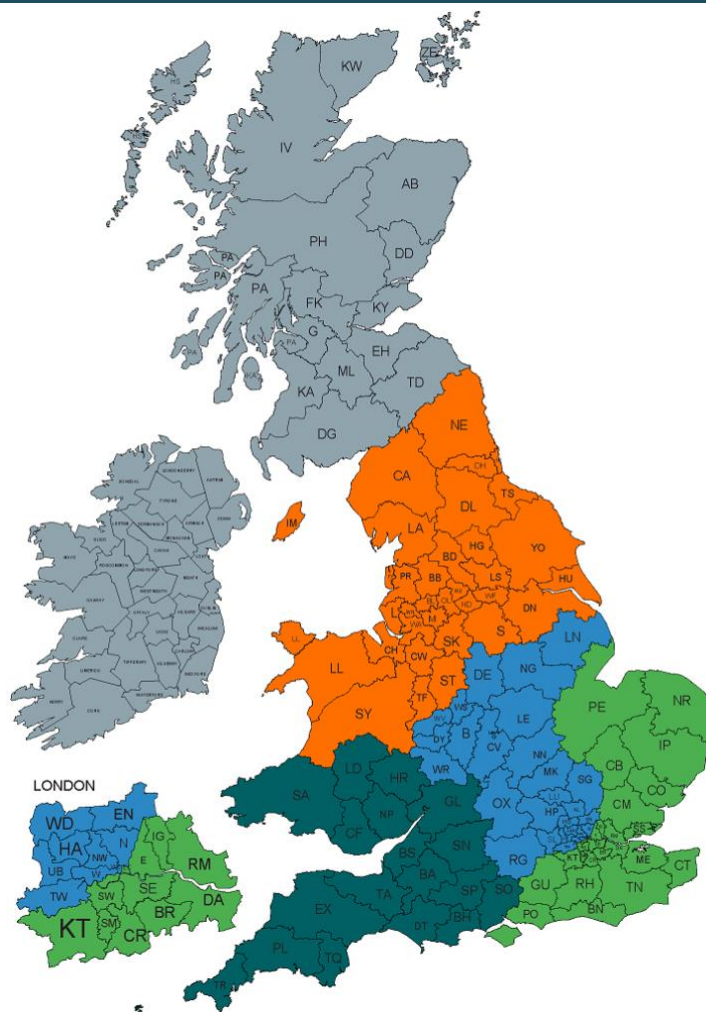


Model width (h) = see diagram
Model height (v) = see diagram

3-D U-value Calculation by Finite Element Analysis Calculation Method: BS EN ISO 10211

Contact Us

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Title:

CLASSIFICATION OF
REACTION TO FIRE
PERFORMANCE
IN ACCORDANCE WITH
EN 13501-1:2007+A1: 2009.

Notified Body No:

0833

Product Name:

"Genius Secret Cladding"

Report No:

WF 334063

Issue No:

2

Prepared for:

Simco EFS
Leamore Lane
Walsall
WS2 7DQ

Date:

11th December 2013

Revised:

21st January 2019



1. Introduction

This classification report defines the classification assigned to “Genius Secret Cladding”, a powder coated aluminium panel product, in accordance with the procedures given in EN 13501-1:2007+A1: 2009.

2. Details of classified product

2.1 General

The product, “Genius Secret Cladding”, a powder coated aluminium panel product, is defined as being suitable for construction applications.

2.2 Product description

The product, “Genius Secret Cladding”, a powder coated aluminium panel product, is fully described below and in the test reports provided in support of classification listed in Clause 3.1.

General description		A coated aluminium panel mechanically fixed to a metal substructure
Product reference of composite		“Genius Secret Cladding”
Thickness of composite		3mm (Stated by sponsor) 3.04mm (determined by Warringtonfire)
Weight per unit area of composite		9.9kg/m ² (Stated by sponsor) 10.54kg/m ² (determined by Warringtonfire)
Top coat Variant 1 (test face)	Generic type	Polyester based powder coating
	Product reference	“Synthatec Premium”
	Name of manufacturer	Valspar
	Colour reference	“White”
	Number of coats	One
	Specific gravity	See Note 1 below
	Application rate	0.08kg/m ²
	Application thickness	60 – 100 microns
	Application method	Spray
	Curing process	20 minutes at 200°C
	Flame retardant details	See Note 1 below
Top coat Variant 2 (test face)	Generic type	Polyester based powder coating
	Product reference	“RM-9010”
	Name of manufacturer	Adapta Color SL
	Colour reference	“Various”
	Number of coats	One
	Specific gravity	See Note 1 below
	Application rate	1300 kg/m ³
	Application thickness	80 microns
	Application method	Spray
	Curing process	20 minutes at 200°C
	Flame retardant details	See Note 1 below
Aluminium	Generic type	Aluminium

	Product reference	"Genius Framework"
	Name of manufacturer	Genius Facades
	Thickness	2mm and above
	Weight per unit area	2.6kg/m ²
	Flame retardant details	This component is inherently flame retardant
Air space details		A 180mm ventilated cavity was situated between the reverse face of each specimen and the calcium silicate backing board (as specified in EN 13238: 2010)
Brief description of manufacturing process		See Note 1 below

Note 1: The sponsor was unable to provide this information.

3. Test reports & test results in support of classification

3.1 Test reports

Name of Laboratory	Name of sponsor	Test reports/extended application report Nos.	Test method / extended application rules & date
Warringtonfire	Simco EFS	WF 334704	EN ISO 1716 summary report
Warringtonfire	Simco EFS	WF 333886	EN ISO 1716
Warringtonfire	Simco EFS	WF 335759	EN 13823
AIDIMA	Adapta Color SL	0906119-01 CL	EN13501-1
AIDIMA	Adapta Color SL	0907036-05 CL	EN13501-1

3.2 Test results

Test method & test number	Parameter	No. tests	Results	
			Continuous parameter - mean (m)	Compliance parameters
EN ISO 1716	Coating - PCS (b and c)	3	(b) 19.6066MJ/kg (c) 1.5685 MJ/m ²	Compliant
	Adapta Coating - PCS (b and c)	3	(b) 18.76MJ/kg (c) 1.93 MJ/m ²	Compliant
	Aluminium - PCS (a)	3	0.0000	Compliant
	For the product as a whole PCS (e)	Summary result	0.59 – 1.1	Compliant

Note 1: The product did not pass the requirements for PCS (b), however, the product is deemed to be compliant if in accordance with Table 1, Note C of EN 13501-1, any external non-substantial component having a PCS (c) $\leq 2.0 \text{ MJ/m}^2$, provided that the product satisfies the following criteria of EN 13823: FIGRA $\leq 20 \text{ W/s}$ & LFS <edge of specimen & THR $\leq 4.0 \text{ MJ}$ & S1 & d0				
EN 13823	FIGRA _{0.2MJ}	3	1.10 - 1.21	Compliant
	FIGRA _{0.4MJ}		1.10 - 1.21	Compliant
	THR _{600s}		0.34 – 0.55	Compliant
	LFS		Nil	Compliant
	SMOGRA		0.00	Compliant
	TSP _{600s}		7.45 – 26.0	Compliant

4. Classification and field of application

4.1 Reference of classification

This classification has been carried out in accordance with clause 8 of EN 13501-1:2007+A1: 2009.

4.2 Classification

The product, “Genius Secret Cladding”, a powder coated aluminium panel product, in relation to its reaction to fire behaviour is classified:

Reaction to fire classification: A1

4.3 Field of application

This classification is valid for the following end use applications:

- i) Construction applications

This classification is also valid for the following product parameters:

Overall coating thickness	Shall not exceed the thickness described
Overall coating weight per unit area	No variation allowed
Product composition	No variation allowed
Product configuration	No variation allowed
Substrate thickness	2mm or greater

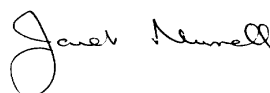
SIGNED



.....
Matthew Dale

Certification Engineer

APPROVED



.....
Janet Murrell

Technical Manager
on behalf of **warringtonfire**

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