Appendices

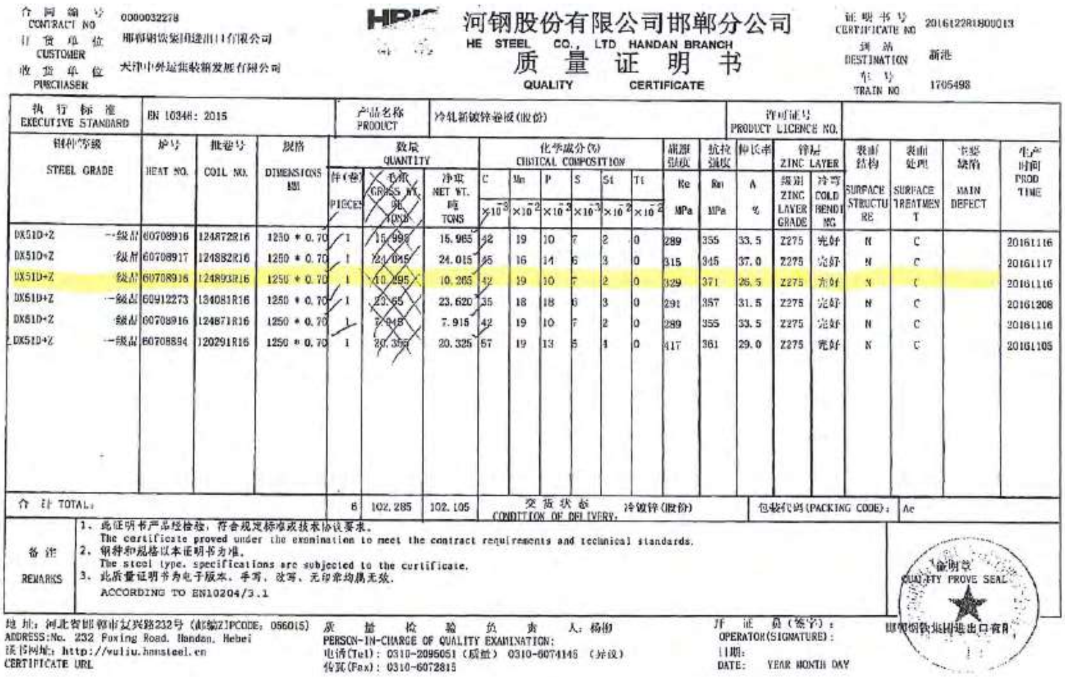
Version 12 22 January 2021

Changes:-
10.1 Frameshield 100 PDS added
10.3 Gyproc Wallboard Duplex PDS added
19.0. Typicale GRP Dormer added

Ultrapanel System Manual Appendices

1.0   Steel

- **DX51D Z275** 0.7mm steel used for cold rolled elements, clip and rail. All coil used have a certificate with certified yield values to a minimum of 275MPa. An example of a certificate is



河钢股份有限公司邯郸分公司
HE STEEL CO., LTD HANDAN BRANCH
质 量 证 明 书
QUALITY CERTIFICATE

合同编号 CONTRACT NO: 0000032278
订货单位 CUSTOMER: 邯郸钢铁集团进出口有限公司
收货单位 PURCHASER: 天津中外运集装箱发展有限公司
证明书号 CERTIFICATE NO: 2016122R1800013
到站 DESTINATION: 新港
车号 TRAIN NO: 1705498

执行标准 EXECUTIVE STANDARD: EN 10346: 2015
产品名称 PRODUCT: 冷轧热镀锌卷板(股份)
许可证号 PRODUCT LICENCE NO.:

钢种等级 STEEL GRADE	炉号 HEAT NO.	批卷号 COIL NO.	规格 DIMENSIONS MM	件(卷) PIECES	毛重 GROSS WT. 吨 TONS	净重 NET WT. 吨 TONS	C ×10⁻³	Mn ×10⁻²	P ×10⁻³	S ×10⁻³	Si ×10⁻²	Ti ×10⁻²	屈服强度 Re MPa	抗拉强度 Rm MPa	伸长率 A %	锌层级别 ZINC LAYER GRADE	冷弯 COLD BENDING	表面结构 SURFACE STRUCTURE	表面处理 SURFACE TREATMENT	主要缺陷 MAIN DEFECT	生产时间 PROD TIME
DX51D+Z 一级品	60708916	124872R16	1250 * 0.70	1	15.998	15.965	42	19	10	7	2	0	289	355	33.5	Z275	完好	N	C		20161116
DX51D+Z 一级品	60708917	124882R16	1250 * 0.70	1	24.045	24.015	45	16	14	6	3	0	315	345	37.0	Z275	完好	N	C		20161117
DX51D+Z 一级品	60708916	124893R16	1250 * 0.70	1	10.295	10.265	42	19	10	7	2	0	329	371	26.5	Z275	完好	N	C		20161116
DX51D+Z 一级品	60912273	134081R16	1250 * 0.70	1	23.65	23.620	35	18	18	6	3	0	291	357	31.5	Z275	完好	N	C		20161208
DX51D+Z 一级品	60708916	124871R16	1250 * 0.70	1	7.945	7.915	42	19	10	7	2	0	289	355	33.5	Z275	完好	N	C		20161116
DX51D+Z 一级品	60708894	120291R16	1250 * 0.70	1	20.355	20.325	57	19	13	5	4	0	417	361	29.0	Z275	完好	N	C		20161105
合计 TOTAL:				6	102.285	102.105															

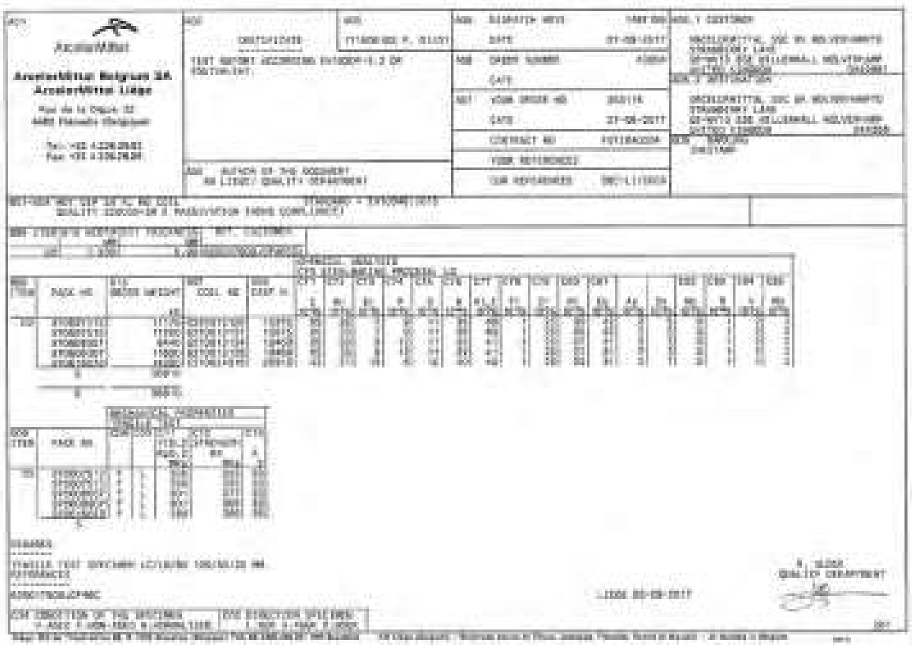
交货状态 CONDITION OF DELIVERY: 冷镀锌(股份)
包装代码(PACKING CODE): Ac

备注 REMARKS:
1. 此证明书产品经检验，符合规定标准或技术协议要求。
The certificate proved under the examination to meet the contract requirements and technical standards.
2. 钢种和规格以本证明书为准。
The steel type, specifications are subjected to the certificate.
3. 此质量证明书为电子版本，手写、改写、无印章均属无效。
ACCORDING TO EN10204/3.1

地址：河北省邯郸市复兴路232号 (邮编ZIPCODE: 056015)
ADDRESS: No. 232 Fuxing Road, Handan, Hebei
读书网址: http://vuliu.hansteel.cn
CERTIFICATE URL
质量检验负责人：杨彻
PERSON-IN-CHARGE OF QUALITY EXAMINATION:
电话(Tel): 0310-2096051 (质量) 0310-6074145 (异议)
传真(Fax): 0310-6072815
开证员(签字): OPERATOR(SIGNATURE):
日期: DATE: YEAR MONTH DAY
证明章 QUALITY PROVE SEAL
邯郸钢铁集团进出口有限

below.

- **S280 ZM250** 0.9 steel used for the construction of the beams,ridge and valley. Minimum yield value 280MPa.



Technical Information Sheet ED022

Durability of Light Steel Construction

A G J Way MEng CEng MICE

The durability of materials is an important factor in the construction solution selection process. The performance of light steel construction has been studied over many years, in a wide variety of environmental conditions, and has been found to give excellent results with long design life predictions. Light steel construction is used for many types of buildings including; residential, commercial, health care, educational and industrial.

Key benefits

The benefits of light steel construction in relation to durability are:

- Design life predictions for light steel framing in a 'warm frame' environment are in excess of 250 years.
- The NHBC and other housing warrantee providers, require a design life in excess of 60 years, and accept the use of light steel construction.
- Light steel sections are protected from corrosion by continuous hot-dip zinc coating.
- Steel does not shrink, warp or change its shape.
- Light steel construction can be used for walls, floors, roofs and suspended ground floors.
- Steel does not creep under load.
- Galvanised steel does not suffer from fungal or biological deterioration and is not susceptible to insect infestation.
- Even in uninsulated roof constructions light steel sections provide a design life in excess of 100 years.

Protection from corrosion

Corrosion occurs when the surface of bare carbon steel reacts with oxygen, water and airborne pollutants to form the complex series of oxides generically known as rust. In dry, warm environments this process does not occur.

The standard form of corrosion protection for cold-formed steel sections is the continuous hot-dip zinc coating applied as a pre-coat to the roll of strip steel from which the sections are formed. Galvanized steel strip and its coating is supplied to the specifications in BS EN 10346 and BS EN 10143.

Galvanized strip steel is usually produced with a standard Z275 coating, meaning 275 grams of zinc per square metre summed over both faces of the steel strip. This corresponds to approximately 0.02 mm overall thickness of zinc per face. Other coating thicknesses are available for special applications.

Zinc-aluminium coatings are also available, and are more commonly used in other countries such as Australia. Zinc-aluminium coating AZ150 is an acceptable alternative to Z275.

Detailed information relating to durability of light steel framing is presented in the SCI publication: *Durability of Light Steel Framing in Residential Building – Second Edition* (SCI P262).

BIM model with 'warm frame' construction

(Image courtesy of Metek UK)

Light steel extra care housing scheme

(Image courtesy of Kingspan Steel Building Solutions)

Light steel sections in an external wall application

(Image courtesy of Ayrshire Metal Products)

Durability Performance

Forms of protection

Hot-dip galvanizing provides both of the following forms of protection:

- Encapsulation - where a coherent barrier is used to exclude corrosive agencies from the surface.
- Sacrificial - where another metal, which corrodes preferentially to steel, is used in proximity to the surface.

The durability performance of galvanised light steel has been researched and assessed through the monitoring and measurement of zinc coating thickness over a period of years. The following case studies demonstrate the galvanised steel durability performance in various exposure conditions. The results from the case studies are summarised in Table 1. Further details and case studies are provided in SCI publication P262.

Student residence at Oxford Brookes university

In 1996, a student residence was constructed at Oxford Brookes University using a light steel framing system, see Figure 1. The building included innovative features

CASE STUDY LOCATION	EXPOSURE TIME (Months)	TOTAL COATING LOSS (g/m^2)	RATE OF LOSS ($g/m^2/yr$)
Oxford – Cold loft	60	0.57	0.11
	124	0.63	0.06
Oxford – Upper wall cavity	60	0.47	0.09
	124	0.45	0.04
Oxford – Lower wall cavity	60	1.25	0.25
	124	1.31	0.13
Oxford – Below ground floor slab	60	2.13	0.43
	124	2.04	0.20
Yorkshire – Roof space	81	1.00	0.15
Yorkshire – First floor walls	81	0.79	0.12
Yorkshire – Walls below windows	81	4.12	0.61
Edinburgh – Insulated cladding	57	1.83	0.38
	156	3.87	0.30
Port Talbot – Non-insulated cladding	60	6.66	1.33
	128	10.18	0.95

Table 1 Galvanising weight loss from case studies

Figure 1 Three storey student residence in Oxford

such as habitable roof systems, and a composite suspended ground floor.

Several sets of coated steel coupons were suspended in the wall cavities, loft and in the ventilated void below the suspended ground floor. These coupons were removed at intervals to assess the loss of coating weight over time. As can be seen from Figure 2 the visual appearance of the galvanised steel after 10 years exposure was excellent. A general trend is that the rate of coating loss reduces as the exposure period increases.

Modular house in Yorkshire

In 1998, two light steel modular houses were built in Gilberdyke, East Yorkshire. In 2001, steel coupons were placed in accessible areas of both houses and in 2008 several of the coupons were collected and analysed for loss of coating (see Table 1).

Cladding environments

Galvanised steel coupons were placed behind various forms of cladding system to ascertain the durability performance in partially protected environments.

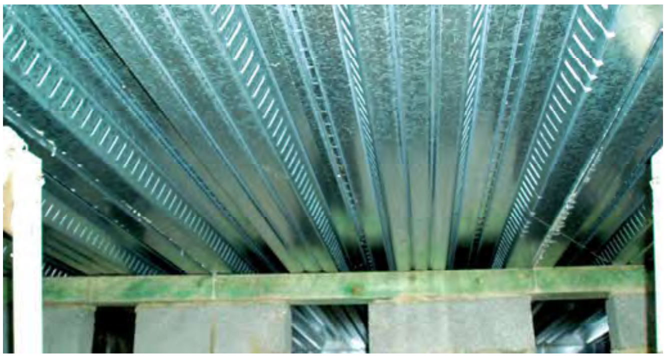


Figure 2 Galvanised steel decking supporting a suspended ground floor after 10 years exposure

Technical Guidance

Design life predictions

The case study data shows that the rates of zinc loss on galvanized steel coupons in dry environments are very low and it has been observed that the rate of zinc loss reduces with time. This is because a zinc oxide layer forms on the surface and protects the zinc beneath.

Design life predictions for galvanised steel in different applications have been established from recorded data. The design life predictions presented in Table 2 are based on the following conservative assumptions:

- Rate of zinc loss is linear over time.
- Design life duration is taken as when only 50% of the total coating weight remains.
- The rate of coating loss is taken as twice the rate observed from case studies.

Cut edges

It is generally not necessary to provide additional protection at cut edges. This is because corrosion protection to cut edges arises from the sacrificial galvanic action of the zinc adjacent to the edge. There is no practical evidence that higher levels of corrosion occur at edges.

White rust

White rust can occur on galvanised steel and is caused by moisture trapped between components during storage or transportation. For light occurrences of white rust no remedial action is required. Over time white rust deposits will slowly convert to a protective layer of zinc carbonate.

Warm frame construction

In 'warm frame' construction the light steel framing is in a warm, dry environment which ensures that the light steel components are kept above a certain temperature. This minimises the risk of condensation forming on the steel and therefore of corrosion.

To qualify as 'warm frame' construction at least 33% of the thermal insulation of the wall must be on the external side of the light steel frame. An example of a 'warm frame' wall construction is shown in Figure 3.

Accidental temporary exposure to water will not affect the design life of the light steel frame.

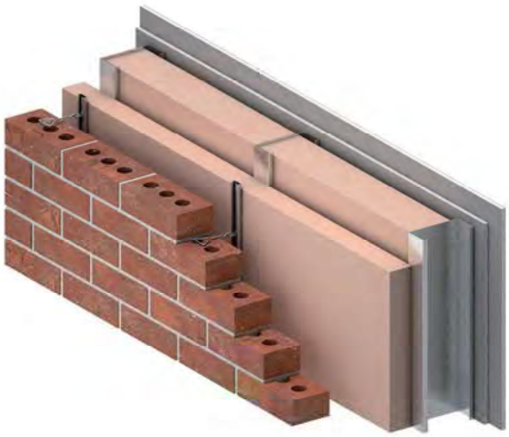


Figure 3 Typical example of warm frame construction
(Image courtesy of BW Industries)

PRODUCT APPLICATION	ENVIRONMENTAL CONDITIONS	PREDICTED DESIGN LIFE
Walls and floors in warm frame applications	No risk of water ingress or condensation	250 years
Non-load bearing stud partitions	Warm internal environment and no risk of water ingress	250 years
Infill external walls in multi-storey buildings	Warm frame and no risk of water ingress	250 years
Roof structures (insulated)	Low risk of condensation	200 years
Suspended ground floors (with over-site membrane)	Low risk of water ingress; some risk of condensation	100 years
Roof structures (uninsulated)	Some risk of condensation	100 years
Purlins and side rails supporting metal cladding	Low risk of condensation; some dust and pollution	60 years
Sub-frames to over-cladding panels	Low risk of water ingress; risk of condensation	60 years
Suspended ground floors (without over-site membrane)	Low risk of water ingress; higher risk of condensation	50 years

Note: All values are for Z275 (Total weight of zinc coating on both surfaces = 275 g/m^2).

Table 2 Predicted design life for galvanised steel in different applications

Sources of Information

The building in Figure 4 has been exposed in an un-protected condition without cladding for over 5 years. The light steel framing shows only minor signs of deterioration.

Figure 4 Light steel frame structure after 5 years exposure
(Image courtesy of Fusion and Evolusion)

Bibliography

The following publications may be referred to for more information on durability and light steel construction.

Way, A. G. J. et al
Durability of Light Steel Framing in Residential Building – Second Edition (P262)
The Steel Construction Institute, 2009

Lawson, R. M., Way, A. G. J. and Yandzio, E.
Building design using cold formed steel sections: Residential buildings (P402)
The Steel Construction Institute, 2014

BS EN 10346: 2009
Continuously hot-dip coated steel flat products. Technical delivery conditions
BSI, 2009

BS EN ISO 14713-1:2009
Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. General principles of design and corrosion resistance
BSI, 2010

Lawson, R. M.
Sustainability of steel in housing and residential buildings (P370)
The Steel Construction Institute, 2007

Other technical information sheets

The following technical information sheets give further details.

- ED010: Light Steel Solutions for All Applications
- ED011: Light Steel Residential Buildings
- ED012: Light Steel Framed Housing
- ED013: Light Steel Infill Walls
- ED014: Light Steel Modular construction
- ED015: Acoustic Performance of Light Steel Construction
- ED016: Fire Safety of Light Steel Construction
- ED019: Thermal Performance of Light Steel Construction
- ED020: Sustainability of Light Steel Construction
- ED021: Robustness of Light Steel Construction

Manufacturers

The following manufacturers are active in the light steel and modular construction sector and may be contacted for further information.

Ayrshire Metal Products Ltd. - www.ayrshire.co.uk

BW Industries Ltd. - www.bw-industries.co.uk

Fusion Building Systems - www.fusionbuild.com

Kingspan Steel Building Solutions - www.kingspanpanels.com

Metek UK Ltd. - www.metek.co.uk

SCI
Steel Knowledge

The Steel Construction Institute
Silwood Park, Ascot
SL5 7QN

T: 01344 636525
F: 01344 636370

E: publications@steel-sci.com
www.steel-sci.com

www.steelbiz.org - 24 × 7 online technical information

www.lightsteelforum.co.uk - Light Steel Forum

ED022: Durability of Light Steel Construction

E35 - Steels with Magnelis®
zinc-aluminium-magnesium coating

E35

Properties

Magnelis® is a flat carbon steel product coated on both sides with a zinc-aluminium-magnesium alloy. This alloy, composed of 93.5% zinc, 3.5% aluminium and 3% magnesium, is applied by means of a continuous hot dip galvanising process. This optimum chemical composition has been selected to provide the best results in terms of corrosion resistance.

Magnelis® is available in a very wide range of steel grades: steels for cold forming and deep drawing applications, structural steels and High Strength Low Alloy steels.

E35

Advantages

Thanks to its 3% magnesium content, Magnelis® offers self-healing on cut edges and superior corrosion resistance in chloride and ammonia atmospheres. This high corrosion resistance means that less metallic coating is required (weight reduction), which facilitates processing steps such as welding.

The zinc-rich metallic coating composition permits all the conventional processing operations possible with standard hot dip galvanised steel: bending, drawing, clinching, profiling, stamping, welding etc. The friction coefficient of Magnelis® coated steel is lower than that of standard hot dip galvanised steel, leading to reduced powdering during forming operations.

E35

Applications

Magnelis® can be used in numerous industrial applications, such as:

- Construction: structural or non-structural profiles, roofing & cladding, decking, cable trays, expanded metal, gratings, composite flooring, concrete moulds
- Road and railway infrastructure: safety barriers, protection equipment, sound insulation wall panels, walls providing protection against hail
- Agriculture and farming: barns, greenhouse structures, agricultural equipment
- Solar energy generation: structures for photovoltaic plants
- Tubular applications: structural tubes for scaffolding, road signals, poles

E35

Technical approvals for civil construction

Magnelis® is approved for use in Civil Construction by different national bodies:

- Germany: DIBt Z-30.11-51 Magnelis® ZM250 and ZM310 for KIII, and Magnelis® ZM120 for KII in accordance with DIN 55928-8
- France: CSTB Magnelis® ZM195, ZM250 and ZM310 for use in exterior applications, and Magnelis® ZM90, ZM120 and ZM310 for use in interior applications
- Sweden: Technical Approval no. SC0559-13 Magnelis® ZM310 for use in corrosivity category C5

E35

Recommendations for use

Storage

Magnelis® is supplied passivated and/or oiled to temporarily limit any risk of white rust formation. During transport and storage, all necessary precautions must be taken to keep the material dry and to prevent the formation of condensation.

Forming

The forming techniques currently used for galvanised steel are also suitable for Magnelis®. Magnelis® behaves very well during profiling operations. The coating thickness must be compatible with both the desired degree of corrosion protection and the requirements of the forming processes envisaged.

E35

Weldability

In resistance spot welding, the welding current must be suitably regulated and regularly adjusted. Electrode life can be extended by regularly stepping up the welding current and periodically dressing (machining) the electrodes. The coating thickness must be compatible with both the desired degree of corrosion protection and the requirements of the welding processes envisaged. Magnelis® can be arc welded, laser welded, brazed or high frequency welded, taking the same precautions as with galvanised steel.

E35

Coating weight and typical thickness

Magnelis®	Coating weight - double sided (g/m²)	Coating thickness (µm per side)*
ZM90	90	7
ZM120	120	10
ZM175	175	14
ZM200	200	16
ZM250	250	20
ZM310	310	25
ZM430	430	35

The density of the Magnelis® coating is 6.2 g/cm^3, due to its chemical composition.

* The coating weights in this table have been calculated with the density of Magnelis

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Brand correspondence

Structural steels

	EN 10346:2015	Old brand names
S220GD +ZM EN 10346	S220GD +ZM	S220GD +ZM
S250GD +ZM EN 10346	S250GD +ZM	S250GD +ZM
S280GD +ZM EN 10346	S280GD +ZM	S280GD +ZM
S320GD +ZM EN 10346	S320GD +ZM	S320GD +ZM
S350GD +ZM EN 10346	S350GD +ZM	S350GD +ZM
S390GD +ZM EN 10346	S390GD +ZM	S390GD AM FCE +ZM
S420GD +ZM EN 10346	S420GD +ZM	
S420GD-HyPer® +ZM**		
S450GD +ZM EN 10346	S450GD +ZM	
S450GD-HyPer® +ZM**		
S550GD +ZM EN 10346	S550GD +ZM	

** Steel grade with R_m/R_e > 1.1 in accordance with the requirements of Eurocode 3 (EN 1993-1-1)

E35

Dimensions

Structural steels

<table>
<tr><th rowspan="2">Thickness</th><th rowspan="2">Min</th><th>S220GD +ZM EN 10346, S250GD +ZM EN 10346, S280GD +ZM EN 10346</th><th>S320GD +ZM EN 10346, S350GD +ZM EN 10346</th><th>S390GD +ZM EN 10346, S420GD +ZM EN 10346, S450GD +ZM EN 10346</th><th>S420GD-HyPer® +ZM**, -</th><th>S550GD +ZM EN 10346</th></tr>
<tr><th>Max width</th><th>Max width</th><th>Max width</th><th>Max width</th><th>Max width</th></tr>
<tr><td>0.45 ≤ th</td><td>850</td><td>1300</td><td>1300</td><td>-</td><td rowspan="6">-</td><td>-</td></tr>
<tr><td>0.50 ≤ th</td><td rowspan="15">600</td><td>1500</td><td>1350</td><td>1500</td><td>1500</td></tr>
<tr><td>0.70 ≤ th</td><td>1630</td><td>1630</td><td>1630</td><td>1630</td></tr>
<tr><td>1.40 ≤ th</td><td>1600</td><td>1600</td><td>1580</td><td>1580</td></tr>
<tr><td>1.60 ≤ th</td><td>1520</td><td>1570</td><td rowspan="2">1260</td><td rowspan="2">1260</td></tr>
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<tr><td colspan="7">** Steel grade with Rm/Re > 1.1 in accordance with the requirements of Eurocode 3 (EN 1993-1-1)</td></tr>
</table>

E35

Mechanical properties

Structural steels

	Notes	Direction	Thickness (mm)	R_e (MPa)	R_m (MPa)	A_{80} (%)
S220GD +ZM EN 10346		L	0.45 - 0.5	≥ 220	≥ 300	≥ 16
			0.5 - 0.7			≥ 18
			0.7 - 6			≥ 20
S250GD +ZM EN 10346		L	0.45 - 0.5	≥ 250	≥ 330	≥ 15
			0.5 - 0.7			≥ 17
			0.7 - 6			≥ 19
S280GD +ZM EN 10346		L	0.45 - 0.5	≥ 280	≥ 360	≥ 14
			0.5 - 0.7			≥ 16
			0.7 - 6			≥ 18
S320GD +ZM EN 10346		L	0.45 - 0.5	≥ 320	≥ 390	≥ 13
			0.5 - 0.7			≥ 15
			0.7 - 6			≥ 17
S350GD +ZM EN 10346		L	0.45 - 0.5	≥ 350	≥ 420	≥ 12
			0.5 - 0.7			≥ 14
			0.7 - 6			≥ 16
S390GD +ZM EN 10346		L	0.45 - 0.5	≥ 390	≥ 460	≥ 12
			0.5 - 0.7			≥ 14
			0.7 - 6			≥ 16
S420GD +ZM EN 10346		L	0.5 - 0.7	≥ 420	≥ 480	≥ 13
			0.7 - 6			≥ 15
S420GD–HyPer® +ZM**	1	L	0.7 - 4	≥ 420	480 - 620	≥ 15
S450GD +ZM EN 10346		L	0.5 - 0.7	≥ 450	≥ 510	≥ 12
			0.7 - 6			≥ 14
S450GD–HyPer® +ZM**	1	L	0.7 - 4	≥ 450	510 - 650	≥ 15
S550GD +ZM EN 10346		L	0.5 - 3	≥ 550	≥ 560	–

** Steel grade with R_m/R_e > 1.1 in accordance with the requirements of Eurocode 3 (EN 1993–1–1)

1. Upper limit of R_m for easier piercing and screwing.

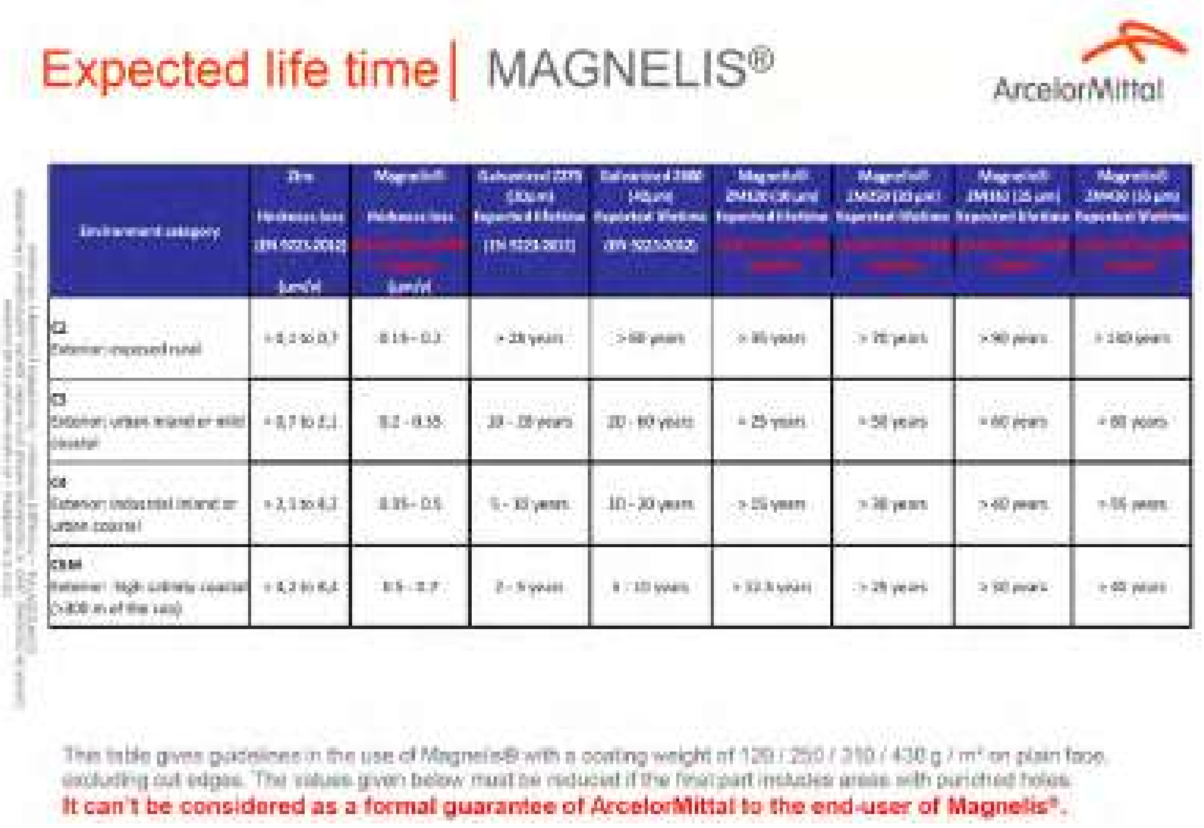
E35

Chemical composition

Structural steels

	C (%)	Mn (%)	P (%)	S (%)	Si (%)
S220GD +ZM EN 10346	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S250GD +ZM EN 10346	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S280GD +ZM EN 10346	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S320GD +ZM EN 10346	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S350GD +ZM EN 10346	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S390GD +ZM EN 10346	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S420GD +ZM EN 10346	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S420GD–HyPer® +ZM**	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S450GD +ZM EN 10346	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S450GD–HyPer® +ZM**	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60
S550GD +ZM EN 10346	≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60

** Steel grade with R_m/R_e > 1.1 in accordance with the requirements of Eurocode 3 (EN 1993-1-1)



2 Hardboard

2.1 The hardboard used is supplied by Finnish Fibreboard under the Lion Brand. The board is nominally 6mm thick and oil tempered

2.1

SUOMEN KUITULEVY OY
FINNISH FIBREBOARD LTD.

DECLARATION OF PERFORMANCE
No. FF2CPRHB.H

1. Unique identification code of the product-type:

   Lion Oil Tempered
   Lion HD Panel Board

2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4):

   Lionboard Oiltempered
   Lion-Farm Board

3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:

   General purpose board for use in humid conditions

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant Article 11(5):

   Finnish Fibreboard Ltd
   PO Box 4
   FI-18101 Heinola
   Tel. + 358 20 110 3300
   Fax + 358 20 110 3307

5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 12(2):

   Not applicable

6. System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V:

   AVPC – class 4

7. In case of the declaration of performance concerning a construction product covered by a harmonised standard:

   Not applicable

2.1

Suomen Kuitulevy Oy
Finnish Fibreboard Ltd.

8. In case of the declaration of performance concerning a construction product for which a European Technical Assessment has been issued:

   Not applicable

9. Declared performance

Property	unit	Thickness mm ≥ 3,0 to 3,5	 > 3,5 to 5,5	 > 5,5	
Bending strength	N/mm^2	35	32	30	EN 622-2
Internal bond	N/mm^2	0.60	0.60	0.30	
Moisture resistance	N/mm^2	0.30	0.30	0.25	
Swelling in thickness (24 h)	%	25	20	20	
Release of formaldehyde	class	E1	E1	E1	EN 13986:2004 + A1:2015
Reaction to fire, end use without an air gap behind the panel excl. floorings [1]	class	NPD	NPD	D-s2, d0	
Reaction to fire, end use without an air gap behind the panel, floorings [1]	class	NPD	NPD	D_{fl}-s1	
Reaction to fire, end use with a closed air gap, excl. floorings [2]	class	NPD	NPD	D-s2, d2	
Reaction to fire, end use condition any, floorings	class	Efl	Efl	Efl	
Reaction to fire, end use condition any	class	E	E	E	
Vapour resistance factor	wet cup µ	20	20	20	
Vapour resistance factor	dry cup µ	30	30	30	
Sound absorption	250-500 Hz	0.10	0.10	0.10	
Sound absorption	1000-2000 Hz	0.20	0.20	0.20	
Thermal conductivity	W/(m·K)	0.14	0.14	0.14	
Biological durability	class	2	2	2	

[1] Mounted without an air gap directly against class A1 or A2-s1, d0 products with minimum density 10 kg/m^3 or at least class D-s2, d2 products with minimum density 400 kg/m^3.
[2] Mounted with a closed air gap not more than 22 mm behind the wood-based panel. The reverse face of the cavity shall be at least A2-s1, d0 products with minimum density 10 kg/m^3.

10. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 9.
    This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

    Signed for and on behalf of the manufacturer by:

    Heinola, 28.6.2016

    Kaija Ahonen, Production Manager
    Finnish Fibreboard Ltd

3 Orientated Stand Board

3.1 The board is supplied by Norboard

- OSB/3 11mm thick
- It is used for the construction of the eaves beam and intermediate beam

3.1

Norbord Europe Ltd
Morayhill
Dalcross
Inverness IV2 7JQ
Tel: 01463 792424 Fax: 01463 791764
e-mail: info@norbord.net
website: www.norbord.com

Agrément Certificate
01/3857
Product Sheet 3

NORBORD STERLING OSB

STERLING OSB/3 FOR SHEATHING

This Agrément Certificate Product Sheet[1] relates to Sterling OSB/3 for Sheathing, a loadbearing oriented strand board for use as sheathing on timber-frame domestic and non-domestic buildings.

(1) Hereinafter referred to as 'Certificate'.

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

Structural performance — the product, when incorporated into a structure, can contribute to structural strength and stiffness by distributing the dead and imposed loads to the supporting structure (see section 6).

Behaviour in relation to fire — the product may be regarded as having a Class 3 surface spread of flame rating (see section 7).

Resistance to moisture — provided adequate precautions are taken, the product, when incorporated into a construction, should perform satisfactorily (see section 8).

Durability — the sheathing will have a life equal to that of the building in which it is installed (see section 11).

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: 30 April 2015

Brian Chamberlain
Head of Technical Excellence

Claire Curtis-Thomas
Chief Executive

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 are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

4 Expanded Polystyrene Insulation

4.1 The declaration of performance by Styrene Packaging and Insulation Ltd

4.2 The BBA certificate for Sylite 04/4102

.1

Declaration Of Performance

Stylite Plustherm
Version1: April 2019

1. Unique identification code of the product-type :
Stylite Plustherm

2. Type batch or serial number of any other element allowing identification of the construction product as required pursuant to Article 11(4) of the CPR :
See product labels

3. Intended use or uses of the construction product, in accordance with the harmonised technical specification, as forseen by the manufacturer :
Thermal Insulation for Building

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to article 11 (54) :
Styrene Packaging & Insulation Ltd, Morley Carr Road, Low Moor, Bradford, West Yorkshire, BD12 0RA

5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in article 12 (2) :
Not Applicable

6. System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V :
AVCP System 4

7. In case of the declaration of performance of the construction product covered by harmonised standard:
BS EN 13163:2012 + A1:2016

- **Name and number of notified body :** Not Applicable
- **Performed :** Not Applicable
- **Under System :** Not Applicable
- **Issued :** Not Applicable

Essential Characteristic	Performance Stylite Plustherm	Test Standards	Harmonised Technical Standard
Length	L2	822	BS EN 13163 : 2012 + A2:2016
Width	W2	822	
Thickness	T2	823	
Squareness	S2	824	
Flatness	P5	825	
Compressive Strength @ 10% deformation	CS(10)70	826	
Reaction to Fire	Euroclass E	11925-2	
Thermal Conductivity	0.030 W/mK	12667	
Bending Strength	BS 115	12089	

The performance of the product identified in points 1 and 2 is in conformity with the declared performance. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Name : Joe Edge
Position : Managing Director
Date : 03/04/2019
Low Moor, Bradford
Signed on behalf of the manufacturer :

Styrene Packaging & Insulation Ltd
Morley Carr Road
Low Moor
Bradford
West Yorkshire BD12 0RA
Tel: 01274 691777 Fax: 01274 693832
e-mail: info@styrene.biz
website: www.styrene.biz

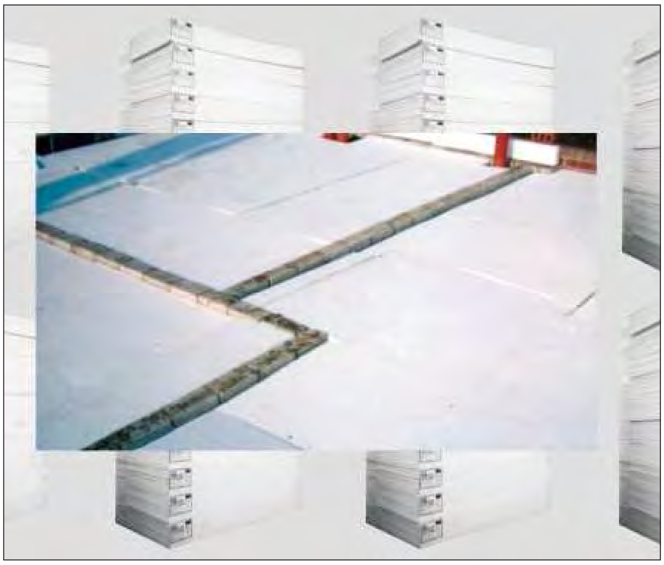
Agrément Certificate
04/4102
Product Sheet 1

SPI EXPANDED POLYSTYRENE INSULATION

STYLITE FLOORING INSULATION

This Agrément Certificate Product Sheet(1) relates to Stylite Flooring Insulation, comprising a range of expanded polystyrene (EPS) boards for insulating ground-supported or suspended concrete ground floors in new or existing dwellings or buildings of similar occupancy.

(1) Hereinafter referred to as 'Certificate'.



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 products have a declared thermal conductivity (λ_D *value*)* between 0.038 $W \cdot m^{-1} \cdot K^{-1}$ and 0.030 $W \cdot m^{-1} \cdot K^{-1}$ and floors incorporating the products can achieve typical design U values (see section 6).

Floor loading — the products, when installed in accordance with this Certificate, can support a design loading for domestic applications (see section 7).

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

Behaviour in relation to fire — the products will be contained within the floor by the overlay until the overlay itself is destroyed (see section 9).

Durability — the products are dimensionally stable and, when installed with the overlays specified in section 4.3, will remain effective as an insulating material for the life of the building in which they are incorporated (see section 11).

The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of Third issue: 11 September 2013	John Albon — Head of Approvals	Claire Curtis-Thomas
Originally certificated on 30 April 2004	Energy and Ventilation	Chief Executive

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 are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

British Board of Agrément
Bucknalls Lane
Watford
Herts WD25 9BA
tel: 01923 665300
fax: 01923 665301
e-mail: mail@bba.star.co.uk
website: www.bbacerts.co.uk

5 Adhesive

5.1 Bondloc B3278 Structural Polyurethane

A two–component reaction adhesive to the building industry .Used to join the S280 ZM250 steel to OSB/3

Technical Data Sheet

Bondloc B3278 Structural Polyurethane
Revised 02.04.13

BONDLOC™ FORMULAS THAT WORK

B3278 Structural Polyurethane

PRODUCT DESCRIPTION

B3278 is a two-component reaction adhesive for the building and automotive industry. Different pot life versions. For bonding ABS, rigid PVC, GRP, steel and aluminium.

TECHNICAL PROPERTIES

	Part A	Part B
Base	Polyurethane, two part, solvent free	
Colour	Black	Yellow-white
Density	1,2 g/cm3	1,6 g/cm3
Viscosity, Brookfield RTV	40,000 mPas	20,000 mPas
Mix Ratio by Volume	1:1	
Mix Ratio by Weight	1:1,3	
Pot Life	5/2/1 min depending on A-component (see chart beow)	
Hardness Shore D	65	

PROCESSING

Processing temperature

+15°C to +25°C

Preparation

The surfaces must be clean, dry and free of grease.
Metals must normally be pretreated and possibly sanded. Surfaces of glass fibre-reinforced plastics must also be sanded. Resin and hardener must be thoroughly mixed with a stirrer (approx. 400 revs/min) until the mixture shows a uniform colour.
Prepare tandem cartridge as instructed.

Bonding

Apply adhesive evenly with a spatula or a doctor blade to the surfaces and join them.
The thickness of the adhesive layer depends on the properties of the materials to be bonded.
By different A-components, the pot life and the bond strengths can be varied. When using B3278, the bond can be exposed to light strain after 12 hours. Final bond strength is reached after 24 hours.
High temperatures will shorten the curing time, low temperatures will lengthen it

A-component	Pot life	Handling time after
B3278/5	5 minutes	1-2 hours
B3278/2	2 minutes	30 minutes
B3278/1	1 minute	15 minutes

CLEANING

Clean tools immediately after use. Cured adhesive can only be removed mechanically.

SAFETY

Please read our Safety-Data-Sheet and the labels of each product before use.
Pay particular attention to the directions given in the Dangerous Substance Regulations.
Make sure the safety data sheet is readily available as it gives valuable information regarding the safe usage and disposal of the product and what to do in the event of an accident involving the product.

STORAGE

Do not store below +10ºC and for more than 12 months.

PRECAUTIONS

When processing B3278 avoid direct skin contact with the uncured adhesive. Wear protective gloves. Hazardous fumes may form when the product is heated or sprayed.

PRESENTATION

B3278 is available in 50ml twin gun syringe and 400ml twin gun syringe.

6 Fastener Specification

6.1 Steel screw of grade ASTM A510, grade 1022 (equivalent EN grade 4.6) with zinc coating of Electropolyseal V (1000 hr) grade and thickness of coating 20-25 microns, head diameter 8.94 mm and length 50.8 mm, used externally in the systems eg clip fixings, soffits, gable ladder

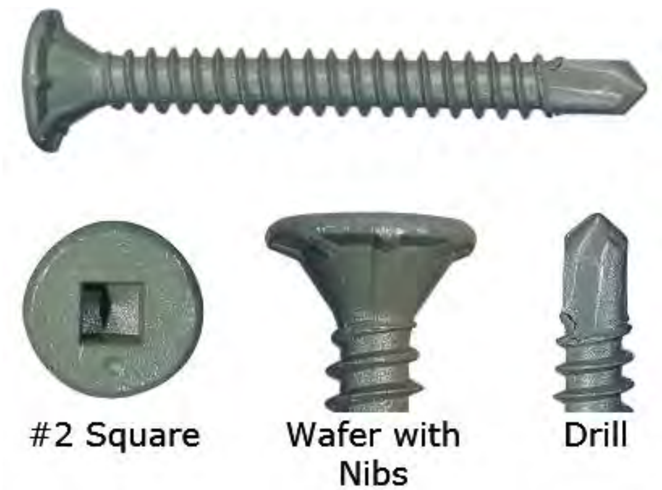
6.2 Steel screw of grade ASTM A510, grade 1022 (equivalent EN grade 4.6) with zinc coating of clear zinc (Fe/Zn 3A per ASTM F1941) grade and thickness of 2.5 microns, head diameter 8.23 mm and length 19 mm, for internal use eg clip fixing

6.3 ICC report on fastener performance

08T150WBWFDS

SCREW SPECIFICATIONS

Screw Gauge	#8
Length	1 1/2”
Recess	#2 Square
Head	Wafer with Nibs
Point	Drill
Thread Type	Fine
Finish	Exterior



Exterior Cement Board Screw

Cement board to steel fastener

APPLICATIONS

- Cement board to heavy steel
- Tile backer board to heavy steel
- Hardie® board to heavy steel

FEATURES AND BENEFITS

- Square recess provides excellent torque transmission for high torque applications
- Wafer head with nibs provides improved drivability into dense materials, ensuring proper countersink
- Fine threads provide improved holding power and thread-forming capability when driving into steel
- Forged and hardened drill point
- Exterior finish exceeds 1000 hours salt spray per ASTM B117

INSTALLATION GUIDELINES

- Use a screwdriver with a precise depth-sensitive clutch and speeds of up to 2500 RPM
- Overdriving may cause a weak connection or thread strip-out of the steel
- The drive is finished when the screw is just below the work surface
- Three full threads must extend past the base metal for an acceptable connection

08T150WBWFDS

Exterior Cement Board Screw

Cement board to steel fastener

ORDERING INFORMATION

Item Code	Gauge	Length	Thread	Finish	Quantity	Drive Type	Point	Head
08T150WBWFDS	#8	1 1/2"	Fine	Exterior	4000 Box	#2 Square	Drill	Wafer with Nibs

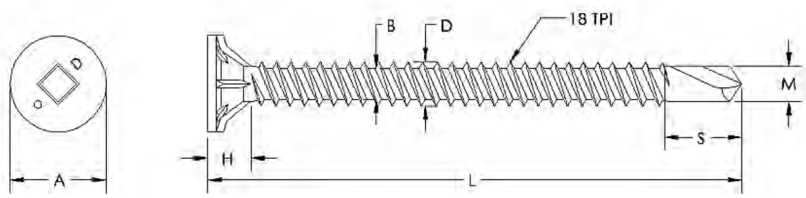
TECHNICAL INFORMATION

Ultimate Tensile (lbs)*	Torsional Strength (lbs-in)*
1735	62

*Figures represent ultimate average test results. An appropriate safety factor must be applied for design purposes

Finish	Testing Standard	Corrosion Resistance
Exterior	ASTM B117 Salt Spray Test	Over 1000 Hours without red rust

Reference Dimensions	
Length (L):	1.50 in
Head Diameter (A):	0.36 in
Head Height (H):	0.20 in
Major Diameter (D):	0.16 in
Minor Diameter (B):	0.13 in
Length of Drill (S):	0.19 in
Diameter of Drill (M):	0.13 in
Threads Per Inch (TPI):	18 threads/in



10M075CKNFDP

SCREW SPECIFICATIONS

Screw Gauge	#10
Length	3/4”
Recess	#2 Phillips
Head	Reduced Wafer
Point	Drill
Thread Type	Fine
Finish	Clear Zinc

Reduced Wafer Head Drill Point Screw

Metal to metal fastener

APPLICATIONS

- Designed for steel to steel fastening where a low profile head is desired (35 – 110 mil)

FEATURES AND BENEFITS

- Phillips recess provides smooth engagement capabilities with moderate torque transmission
- Extremely low profile head
- Fine threads provide improved holding power and thread-forming capability when driving into heavy steel
- Forged and hardened drill point
- Clear zinc finish
- ICC approval information available in ESR-3558

INSTALLATION GUIDELINES

- Use a screwdriver with a torque controlled or precise depth-sensitive clutch and speeds of up to 2500 RPM
- Overdriving may cause a weak connection or thread strip-out of the steel
- Three full threads must extend past the base metal for an acceptable connection
- Low profile head utilizes a shallow Phillips recess. Not recommended for extreme torque applications

10M075CKNFDP

Reduced Wafer Head Drill Point Screw

Metal to metal fastener

ORDERING INFORMATION

Item Code	Gauge	Length	Thread	Finish	Quantity	Drive Type	Point	Head
10M075CKNFDP	#10	3/4"	Fine	Clear Zinc	1000 Box	#2 Phillips	Drill	Reduced Wafer

TECHNICAL INFORMATION

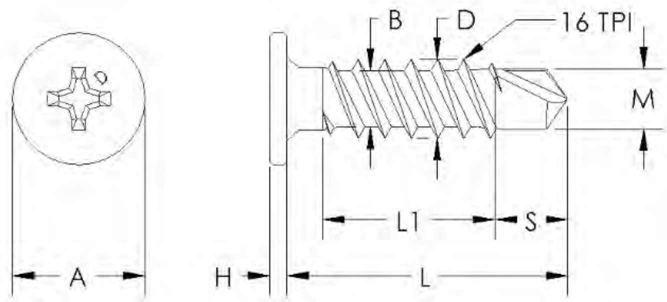
Ultimate Shear (lbs)*	Ultimate Tensile (lbs)*	Torsional Strength (lbs-in)*
1736	2426	65

Base Metal Thickness (in)	Lap Joint Shear (lbs)*	Pull Out (lbs)*	Pull Over (lbs)*
0.04	697	271	1344
0.05	832	315	1353
0.06	1337	595	1470
0.07	1455	697	1553
0.10	1533	1023	1914

*Figures represent ultimate average test results. An appropriate safety factor must be applied for design purposes

Finish	Testing Standard	Corrosion Resistance
Clear Zinc	ASTM B117 Salt Spray Test	Over 24 Hours without red rust

Reference Dimensions	
Length (L):	0.75 in
Head Diameter (A):	0.32 in
Head Height (H):	0.04 in
Major Diameter (D):	0.19 in
Minor Diameter (B):	0.14 in
Length of Thread (L1):	0.45 in
Length of Drill (S):	0.23 in
Diameter of Drill (M):	0.16 in
Threads Per Inch (TPI):	16 threads/in



Fasteners comply with ASTM C1513, as referenced in ICC report ESR-3558. They are in compliance with the 2012 and 2015 International Building code and 2012 and 2015 International Residential code.

Most Widely Accepted and Trusted

ICC-ES Evaluation Report

ICC-ES | (800) 423-6587 | (562) 699-0543 | www.icc-es.org

ESR-3558

Reissued 06/2019
This report is subject to renewal 06/2021.

DIVISION: 05 00 00—METALS
SECTION: 05 05 23—METAL FASTENINGS
DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
SECTION: 06 05 23—WOOD, PLASTIC, AND COMPOSITE FASTENINGS
DIVISION: 09 00 00—FINISHES
SECTION: 09 22 16.23—FASTENERS

REPORT HOLDER:

KYOCERA SENCO INDUSTRIAL TOOLS, INC.

EVALUATION SUBJECT:

SENCO SELF-DRILLING AND SELF-PIERCING SCREWS

"2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence"

A Subsidiary of INTERNATIONAL CODE COUNCIL

ICC-ES Evaluation Report

ESR-3558

Reissued June 2019

This report is subject to renewal June 2021.

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DIVISION: 05 00 00—METALS
Section: 05 05 23—Metal Fastenings

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 05 23—Wood, Plastic, and Composite Fastenings

DIVISION: 09 00 00—FINISHES
Section: 09 22 16.23—Fasteners

REPORT HOLDER:

KYOCERA SENCO INDUSTRIAL TOOLS, INC.

ADDITIONAL LISTEE:

SENCO BRANDS, INC.

EVALUATION SUBJECT:

SENCO SELF-DRILLING AND SELF-PIERCING SCREWS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2015, 2012 and 2009 *International Residential Code®* (IRC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Property evaluated:

Structural

2.0 USES

The Senco self-drilling and self-piercing screws are used to connect cold-formed steel members together and to connect gypsum wall board, wood or other building materials to cold-formed steel. The screws are used in engineered connections of cold-formed steel and connections prescribed by the code for cold-formed steel framing and for sheathing to steel connections.

3.0 DESCRIPTION

3.1 General:

The Senco self-drilling and self-piercing screws are tapping screws, case-hardened from carbon steel conforming to ASTM A510, Grade 1022. Tables 1A through 1D provide screw designations, model numbers, descriptions including screw nominal size, threads per inch (tpi), length, screw diameter, drive recess, head style, head diameter, point style, drilling/piercing ranges, length of load-bearing area and coatings. Screws are supplied in boxes or tubs of individual screws or in collated screw strips. See Figures 1 through 8 for depictions of the screws described in Sections 3.2 through 3.6.

3.2 PBH Self-drilling Screws:

The #6 and #8 PBH self-drilling screws comply with ASTM C954, with a type "BSD" thread design. The screws have a Phillips bugle head (PBH) style and have a clear zinc coating, a gray phosphate coating or an exterior coating, as indicated in Table 1A. See Figure 1.

3.3 PBH Self-piercing Screws:

The #6 PBH self-piercing screws comply with ASTM C1002, Type S, with a fine thread design. The screws have a Phillips bugle head (PBH) and have a clear zinc coating, a gray phosphate coating or an exterior coating, as indicated in Table 1B. See Figure 2.

3.4 PWH Self-drilling Screws:

The #8 PWH self-drilling screws comply with ASTM C1513, with a coarse thread design. The screws have a Phillips reduced wafer head (PWH) style, and have a clear zinc coating, as indicated in Table 1C. See Figure 3.

3.5 PMTH Self-piercing Screws:

The #8 PMTH self-piercing screws comply with ASTM C1513, with a coarse thread design. The screws have a Phillips modified truss head (PMTH) style, and have a clear zinc coating, as indicated in Table 1D. See Figure 4.

3.6 PMTH, SPWH, PWH, SPFH and RPFH Self-drilling Screws:

The #8 PMTH, #8 SPWH, #10 PWH, #10 SPFH and #10 and #12 RPFH self-drilling screws comply with ASTM C1513. The screws have a type "BSD" thread design. The screws have a Phillips modified truss head (PMTH) style, square pan with washer head (SPWH) style, Phillips reduced wafer head (PWH) style, square pan framing head (SPFH) style, and Rex pan framing head (RPFH) style, respectively, and have a clear zinc coating or a yellow zinc coating, as indicated in Table 1D. See Figures 5, 6, 3, 7 and 8, for PMTH, SPWH, PWH, SPFH and RPFH screws, respectively.

3.7 Cold-formed Steel:

Cold-formed steel material must comply with Section A2 of AISI S100.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Screw thread length and point style must be selected on the basis of thickness of the fastened material and thickness of the supporting steel, respectively, based on the length of load-bearing area (see Figure 9) and drilling/piercing capacity given in Table 1.

When tested for corrosion resistance in accordance with ASTM B117, the screws met the minimum requirement listed in ASTM F1941, as required by ASTM C1513, with no white corrosion after three hours and no red rust after 12 hours.

4.1.2 Prescriptive Design:

4.1.2.1 Senco PBH Self-drilling Screws (Section 3.2): These screws are recognized for use in fastening gypsum board to cold-formed steel framing 0.033 inch to 0.112 inch (0.8 to 2.8 mm) thick, in accordance with IBC Section 2506 and 2015 IRC Section R702.3.5.1 (2012 and 2009 IRC Section R702.3.6). They are also recognized for use in attaching gypsum board sheathing to cold-formed steel framing as prescribed in Section C2.2.3 of AISI S213, which is referenced in 2015 and 2012 IBC Section 2211.6 (2009 IBC Section 2210.6).

4.1.2.2 Senco PBH Self-piercing Screws (Section 3.3): These screws are recognized for use in fastening gypsum board to cold-formed steel framing less than 0.033 inch (0.84 mm) thick, in accordance with IBC Section 2506 and 2015 IRC Section R702.3.5.1 (2012 and 2009 IRC Section R702.3.6).

4.1.2.3 Senco PWH Self-drilling Screws (Section 3.4): The screws described in Section 3.4 are recognized for use where ASTM C1513 screws of the same size and head style/dimension are prescribed in the IRC and in the AISI standards referenced in 2015 and 2012 IBC Section 2211 (2009 IBC Section 2210).

4.1.3 Engineered Design: The PMTH self-piercing screws described in Section 3.5, and the PMTH, SPWH, PWH, SPFH and RPFH self-drilling screws described in Section 3.6, are recognized for use in engineered connections of cold-formed steel light-framed construction.

For the self-drilling and self-piercing screws, design of the connections must comply with Section E4 of AISI S100, using the nominal and allowable fastener tension and shear strengths for the screws shown in Table 5. Allowable connection strengths for use in Allowable Strength Design (ASD) for pull-out, pullover, and shear (bearing) capacity for common sheet steel thicknesses are provided in Tables 2, 3 and 4, respectively, based upon laboratory testing in accordance with AISI S905.

Instructions on how to calculate connection design strengths for use in Load and Resistance Factor Design (LRFD) are found in the footnotes of Tables 2, 3 and 4. For connections subject to tension, the least of the allowable pull-out, pullover, and tension fastener strength of screws found in Tables 2, 3, and 5, respectively, must be used for design. For connections subject to shear, the lesser of the allowable shear (bearing) and fastener strength found in Tables 4 and 5, respectively, must be used for design. Design provisions for tapping screw connections subjected to combined shear and tension loading are outside the scope of this report.

For screws used in framing connections, in order for the screws to be considered fully effective, the minimum spacing between the fasteners and the minimum edge distance must be three times the nominal diameter of the screws, except when the edge is parallel to the direction of the applied force, the minimum edge distance must be 1.5 times the nominal screw diameter. When the spacing between screws is two times the fastener diameter, the connection shear strength values in Table 4 must be reduced by 20 percent (Refer to Section D1.5 of AISI S200).

For screws used in applications other than framing connections, the minimum spacing between the fasteners must be three times the nominal screw diameter and the minimum edge distance and minimum end distance must be 1.5 times the nominal screw diameter. Additionally, under the 2009 IBC, when the distance to the end of the connected part is parallel to the line of the applied force, the allowable connection shear strength determined in accordance with Section E4.3.2 of Appendix A of AISI S100 must be considered.

Connected members must be checked for rupture in accordance with Section E6 of AISI S100-12 under the 2015 IBC (Section E5 of AISI S100-07/S2-10 under the 2012; Section E5 of AISI S100-07 under the 2009 IBC).

4.2 Installation:

Installation of the Senco self-drilling and self-piercing screws must be in accordance with the manufacturer's published installation instructions and this report. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.

The screws must be installed perpendicular to the work surface using a variable speed screw driving tool set to not exceed 2,500 rpm. The screw must penetrate through the supporting steel with a minimum of three threads protruding past the back side of the supporting steel.

5.0 CONDITIONS OF USE

The Senco self-drilling and self-piercing screws described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Fasteners must be installed in accordance with the manufacturer's published installation instructions and this report. If there is a conflict between the manufacturer's published installation instructions and this report, this report governs.

5.2 Connections made with the Senco screws must be designed and constructed in accordance with Section 4.0 of this evaluation report and the approved construction documents. In the case of a conflict between these documents, the more restrictive requirements govern.

5.3 The allowable loads specified in Section 4.1.3 are not to be increased when the fasteners are used to resist short-term loads, such as wind or seismic forces.

5.4 The utilization of the strength values contained in this evaluation report, for the design of diaphragm consisting of steel deck panels fastened to cold-formed steel framing, is outside the scope of this report. Diaphragms constructed using the Senco self-drilling or self-piercing screws must be recognized in a current ICC-ES evaluation report based upon the ICC-ES Acceptance Criteria for Steel Deck Roof and Floor Systems (AC43).

5.5 Use of the screws in diaphragms consisting of wood structural panels fastened to cold-formed steel is outside the scope of this report.

5.6 Drawings and calculations verifying compliance with this report and the applicable code must be submitted to the code official for approval. The drawings and calculations are to be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.

5.7 The screws are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Tapping Screw Fasteners (AC118), dated February 2016.

7.0 IDENTIFICATION

7.1 Senco self-drilling and self-piercing screws are marked with a "D" on the top of the heads, as shown in Figures 1 through 8. Packages of Senco self-drilling and self-piercing screws are labeled with the report holder's name, the fastener brand name (Senco) and model number, and the evaluation report number (ESR-3558).

7.2 The report holder's contact information is the following:

KYOCERA SENCO INDUSTRIAL TOOLS, INC.
4270 IVY POINTE BOULEVARD
CINCINNATI, OHIO 45245
(800) 543-4596
www.senco.com

7.3 The additional listee's contact information is the following:

SENCO BRANDS, INC.
4270 IVY POINTE BOULEVARD
CINCINNATI, OHIO 45245
(800) 543-4596
www.senco.com

TABLE 1A—SENCO SELF-DRILLING SCREWS (ASTM C954) FOR PRESCRIPTIVE CONNECTIONS OF GYPSUM BOARD PRODUCTS TO COLD-FORMED STEEL

DESIGNATION[1] (Nom. size – tpi x head type) (Head designation)	DESCRIPTION (Nom. size x length)	SENCO MODEL NUMBER[4]	DRIVE RECESS	HEAD DIAMETER (in.)	NOMINAL DIAMETER (in.)	DRILL POINT (Number)	DRILL CAPACITY (in.)		LENGTH OF LOAD BEARING AREA[3] (in.)	COATING[2]
							Min.	Max.		
#6-20 x Bugle (PBH)	6 x 1	06C100XY	Phillips	0.324	0.138	#2	0.035	0.090	0.697	Clear Zinc, Grey Phosphate or Exterior
	6 x 1$^1/_4$	06C125XY	Phillips	0.324	0.138	#2	0.035	0.090	0.947	
	6 x 1$^5/_8$	06C162XY	Phillips	0.324	0.138	#2	0.035	0.090	1.322	
	6 x 2	06C200XY	Phillips	0.324	0.138	#2	0.035	0.090	1.697	
#8-18 x Bugle (PBH)	8 x 2$^1/_2$	08C250XY	Phillips	0.324	0.163	#2	0.035	0.090	2.197	

TABLE 1B—SENCO SELF-PIERCING SCREWS (ASTM C1002) FOR PRESCRIPTIVE CONNECTIONS OF GYPSUM BOARD PRODUCTS TO COLD-FORMED STEEL

DESIGNATION[1] (Nom. size – tpi x head type) (Head designation)	DESCRIPTION (Nom. size x length)	SENCO MODEL NUMBER[4]	DRIVE RECESS	HEAD DIAMETER (in.)	NOMINAL DIAMETER (in.)	POINT	PIERCING CAPACITY (in.)		LENGTH OF LOAD BEARING AREA[3] (in.)	COATING[2]
							Min.	Max.		
#6-15 x Bugle (PBH)	6 x 1$^1/_4$	06B125XY	Phillips	0.324	0.138	Self-piercing	0.021	0.036	0.814	Clear Zinc, Grey Phosphate or Exterior
	6 x 1$^5/_8$	06B162XY	Phillips	0.324	0.138	Self-piercing	0.021	0.036	1.189	
	6 x 2	06B200XY	Phillips	0.324	0.138	Self-piercing	0.021	0.036	1.564	

TABLE 1C—SENCO SELF-DRILLING SCREWS (ASTM C1513) FOR PRESCRIPTIVE CONNECTIONS OF WOOD-BASED SHEATHING TO COLD-FORMED STEEL

DESIGNATION[1] (Nom. size – tpi x head type) (Head designation)	DESCRIPTION (Nom. size x length)	SENCO MODEL NUMBER	DRIVE RECESS	HEAD DIAMETER (in.)	NOMINAL DIAMETER (in.)	DRILL POINT (Number)	DRILL CAPACITY (in.)		LENGTH OF LOAD BEARING AREA[3] (in.)	COATING[2]
							Min.	Max.		
#8-18 x Reduced Wafer (PWH)	8 x 1	08G100C KNFDP	Phillips	0.324	0.164	#2	0.035	0.100	0.644	Clear Zinc

TABLE 1D—SENCO SELF-DRILLING AND SELF-PIERCING SCREWS (ASTM C1513) FOR ENGINEERED STEEL-TO-STEEL CONNECTIONS

DESIGNATION[1] (Nom. size – tpi x head type) (Head designation)	DESCRIPTION (Nom. size x length)	SENCO MODEL NUMBER	DRIVE RECESS	HEAD DIAMETER (in.)	NOMINAL DIAMETER (in.)	DRILL POINT (Number)	DRILL CAPACITY (in.)		LENGTH OF LOAD BEARING AREA[3] (in.)	COATING[2]
							Min.	Max.		
#8-15 x Modified Truss (PMTH)	8 x $^1/_2$	08M050CTRFSP	Phillips	0.350	0.164	Self-piercing	0.021	0.036	0.123	Clear Zinc
#8-18 x Modified Truss (PMTH)	8 x $^1/_2$	08M050CTRFDP	Phillips	0.350	0.164	#2	0.035	0.100	0.144	Clear Zinc
#8-18 x Pan with Washer (SPWH)	8 x 2	08X200CKADDS	Square	0.352	0.164	#2	0.035	0.100	1.621	Clear Zinc
	8 x 1$^1/_4$	08X125CKADDS	Square	0.352	0.164	#2	0.035	0.100	0.871	Clear Zinc
#10-16 x Reduced Wafer (PWH)	10 x $^3/_4$	10M075CKNFDP	Phillips	0.324	0.190	#2	0.035	0.110	0.355	Clear Zinc
#10-16 x Pan Framing (SPFH or RPFH)	10 x $^3/_4$	10M075CTMFDS	Square	0.348	0.190	#2	0.035	0.110	0.290	Clear Zinc
	10 x 1	10M100CKMFDS	Square	0.348	0.190	#2	0.035	0.110	0.540	Clear Zinc
	10 x $^5/_8$	10M062CBFFDX	Rex	0.348	0.190	#2	0.035	0.110	0.165	Clear Zinc
	10 x $^3/_4$	10M075YTFFDX	Rex	0.348	0.190	#2	0.035	0.110	0.290	Yellow Zinc
#10-22 x Pan Framing (RPFH)	10 x $^3/_4$	10M075YLFT4X	Rex	0.350	0.190	#4	0.175	0.312	0.276	Yellow Zinc
	10 x $^3/_4$	10M075YKFT4X	Rex	0.350	0.190	#4	0.175	0.312	0.276	Yellow Zinc
#12-18 x Pan Framing (RPFH)	12 x $^7/_8$	12M087YKFF4X	Rex	0.348	0.216	#4	0.175	0.312	0.370	Yellow Zinc
#12-14 x Pan Framing (RPFH)	12 x 1	12M100YKFF3X	Rex	0.348	0.216	#3	0.110	0.210	0.513	Yellow Zinc
	12 x 1$^1/_2$	12M150CTFFDX	Rex	0.348	0.216	#2	0.035	0.110	1.013	Clear Zinc

For **SI**: 1 inch = 25.4 mm.

[1]Refer to Section 3.0 and Figures 1 through 8 for head configuration abbreviations.
[2]For coating abbreviations, Clear Zinc = Fe/Zn 3A per ASTM F1941; Yellow Zinc = Fe/Zn 3C per ASTM F1941; Exterior = Fe/Zn 8AS per ASTM F1941; Grey Phosphate = Grade C coating per ASTM F1137.
[3]Refer to Figure 9 for nominal screw length (L) and length of load bearing area (LLBA) description.
[4]The letter in the X position (7th digit) denotes the coating: C = Clear Zinc, P = Grey Phosphate, W = Exterior. The letter(s) in the Y position (8th digit) denote the type of packaging: B = 4000 pcs box, K = 1000 pcs box, no letter = 1000 pcs tub.

TABLE 2—ALLOWABLE TENSILE PULL-OUT LOADS (P_{NOT}/Ω), pounds-force[1,2,3,4]

SCREW DESIGNATION	NOMINAL DIAMETER (in.)	STEEL F_U=55 Ksi Ω = 3.0		STEEL F_U=65 Ksi Ω = 3.0		
		Design Thickness of Member Not in Contact with the Screw Head (in.)				
		0.041	0.050	0.062	0.075	0.104
#8-15 x Modified Truss (PMTH)	0.164	130	167	-	-	-
#8-18 x Modified Truss (PMTH)	0.164	85	100	-	-	-
#8-18 x Pan with Washer (SPWH)	0.164	91	128	183	237	382
#10-16 x Reduced Wafer (PWH)	0.190	90	105	198	232	341
#10-16 x Pan Framing (SPFH or RPFH)	0.190	99	126	191	267	371
#10-22 x Pan Framing (RPFH)	0.190	94	100	201	250	372
#12-18 x Pan Framing (RPFH)	0.216	96	125	195	240	368
#12-14 x Pan Framing (RPFH)	0.216	87	118	176	231	390

For **SI:** 1 inch = 25.4 mm, 1 pound-force = 4.4 N, 1 ksi = 6.89 MPa.

[1]For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength of screw found in Tables 2, 3, and 5, respectively must be used for design.
[2]Nominal load values are based upon laboratory testing in accordance with AISI S905.
[3]The allowable pull-out capacity for intermediate member thicknesses can be determined by interpolating within the values in the table for the applicable steel tensile strength.
[4]To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

TABLE 3—ALLOWABLE TENSILE PULL-OVER LOADS (P_{NOV}/Ω), pounds-force[1,2,3,4]

SCREW DESIGNATION	NOMINAL DIAMETER (in.)	HEAD OR INTEGRAL WASHER DIAMETER (in.)	STEEL F_U=55 Ksi Ω = 3.0		STEEL F_U=65 Ksi Ω = 3.0		
			Design Thickness of Member in Contact with the Screw Head (in.)				
			0.041	0.050	0.062	0.075	0.104
#8-15 x Modified Truss (PMTH)	0.164	0.350	359	367	-	-	-
#8-18 x Modified Truss (PMTH)	0.164	0.350	381	385	387	387	-
#8-18 x Pan with Washer (SPWH)	0.164	0.352	477	488	488	547	557
#10-16 x Reduced Wafer (PWH)	0.190	0.324	448	451	490	518	638
#10-16 x Pan Framing (SPFH or RPFH)	0.190	0.348	502	502	788	881	881
#10-22 x Pan Framing (RPFH)	0.190	0.350	480	534	785	785	785
#12-18 x Pan Framing (RPFH)	0.216	0.348	490	490	769	873	1011
#12-14 x Pan Framing (RPFH)	0.216	0.348	495	506	766	835	1030

For **SI:** 1 inch = 25.4 mm, 1 pound-force = 4.4 N, 1 ksi = 6.89 MPa.

[1]For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength of screw found in Tables 2, 3, and 5, respectively must be used for design.
[2]Nominal load values are based upon laboratory testing in accordance with AISI S905.
[3]The allowable pullover capacity for intermediate member thicknesses can be determined by interpolating within the values in the table for the applicable steel tensile strength.
[4]To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

TABLE 4—ALLOWABLE SHEAR (BEARING) CAPACITY (P_{NS}/Ω) OF STEEL-TO-STEEL CONNECTIONS, pounds-force[1,2,3,4]

SCREW DESIGNATION	NOMINAL DIAMETER (in.)	STEEL F_U=55 Ksi Ω = 3.0		STEEL F_U=65 Ksi Ω = 3.0		
		Design Thickness of Both Connected Members (in.)				
		0.041	0.050	0.062	0.075	0.104
#8-15 x Modified Truss (PMTH)	0.164	294	334	-	-	-
#8-18 x Modified Truss (PMTH)	0.164	223	268	412	428	-
#8-18 x Pan with Washer (SPWH)	0.164	211	271	425	425	425
#10-16 x Reduced Wafer (PWH)	0.190	232	277	446	485	511
#10-16 x Pan Framing (SPFH or RPFH)	0.190	232	279	512	517	517
#10-22 x Pan Framing (RPFH)	0.190	240	263	470	550	550
#12-18 x Pan Framing (RPFH)	0.216	245	292	573	573	573
#12-14 x Pan Framing (RPFH)	0.216	261	309	544	577	606

For **SI:** 1 inch = 25.4 mm, 1 pound-force = 4.4 N, 1 ksi = 6.89 MPa.

[1]The lower of the allowable shear (bearing) and the allowable fastener shear strength found in Tables 4 and 5, respectively must be used for design.
[2]Nominal load values are based on laboratory testing in accordance with AISI S905.
[3]The allowable bearing capacity for other member thicknesses can be determined by interpolating within the values in the table for the applicable steel tensile strength.
[4]To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

TABLE 5—SCREW FASTENER STRENGTH[1,2,3,4]

SCREW DESIGNATION	NOMINAL DIAMETER (in.)	NOMINAL FASTENER STRENGTH DETERMINED BY TESTING		ALLOWABLE FASTENER STRENGTH	
		Tension, P_{ts} (lbf)	Shear, P_{ss} (lbf)	Tension (P_{ts}/Ω)[1] (lbf)	Shear (P_{ss}/Ω)[1] (lbf)
#8-15 x Modified Truss (PMTH)	0.164	1423	1132	475	377
#8-18 x Modified Truss (PMTH)	0.164	2280	1351	760	450
#8-18 x Pan with Washer (SPWH)	0.164	1927	1377	642	459
#10-16 x Reduced Wafer (PWH)	0.190	2426	1736	809	579
#10-16 x Pan Framing (SPFH or RPFH)	0.190	3175	1779	1058	593
#10-22 x Pan Framing (RPFH)	0.190	2318	1795	773	598
#12-18 x Pan Framing (RPFH)	0.216	3585	2132	1195	711
#12-14 x Pan Framing (RPFH)	0.216	2826	2076	942	692

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1 ksi = 6.89 MPa.

[1]For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength of screw found in Tables 2, 3, and 5, respectively, must be used for design.
[2]For shear connections, the lower of the allowable shear (bearing) and the allowable fastener shear strength found in Tables 4 and 5, respectively, must be used for design.
[3]See Section 4.1.3 for fastener spacing and end distance requirements.
[4]To calculate LRFD values; multiply the nominal fastener strengths by the LRFD Φ factor of 0.5.

FIGURE 1—PHILLIPS BUGLE HEAD (PBH) SELF-DRILLING SCREW (SECTION 3.2)

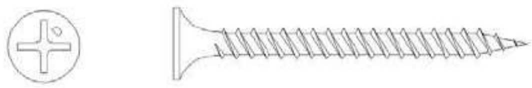

FIGURE 2—PHILLIPS BUGLE HEAD (PBH) SELF-PIERCING SCREW (SECTION 3.3)

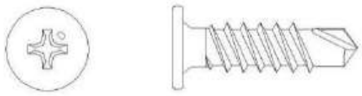

FIGURE 3—PHILLIPS REDUCED WAFER HEAD (PWH) SELF-DRILLING SCREW (SECTIONS 3.4 AND 3.6)

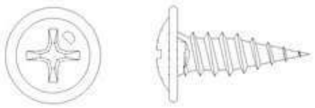

FIGURE 4—PHILLIPS MODIFIED TRUSS HEAD (PMTH) SELF-PIERCING SCREW (SECTION 3.5)

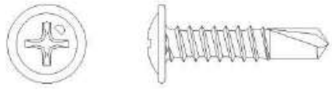

FIGURE 5—PHILLIPS MODIFIED TRUSS HEAD (PMTH) SELF-DRILLING SCREW (SECTION 3.6)

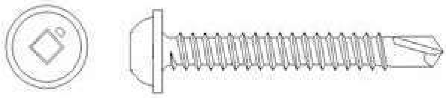

FIGURE 6—SQUARE PAN WITH WASHER HEAD (SPWH) SELF-DRILLING SCREW (SECTION 3.6)

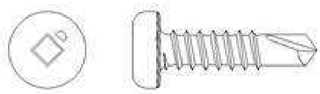

FIGURE 7—SQUARE PAN FRAMING HEAD (SPFH) SELF-DRILLING SCREW (SECTION 3.6)

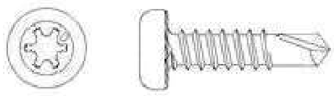

FIGURE 8—REX PAN FRAMING HEAD (RPFH) SELF-DRILLING SCREW (SECTION 3.6)

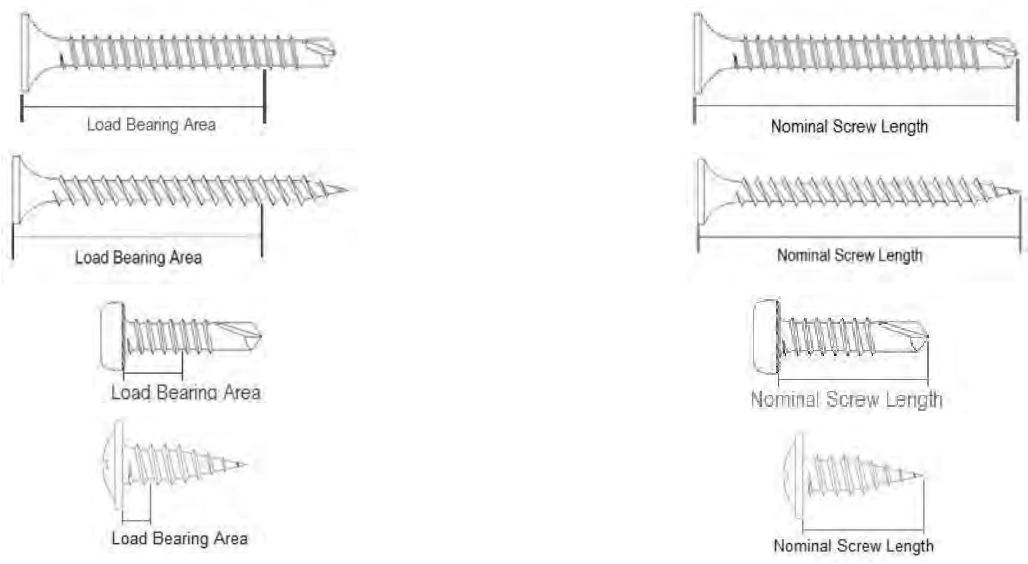

FIGURE 9—DESCRIPTION OF LENGTH OF LOAD-BEARING AREA (LLBA) AND NOMINAL SCREW LENGTH (L)

7 Rockwool Insulation

7.1 Knauf Earthwool Building Slab RT45; used in the beam

7.2 Knauf Earthwool Loft Roll 44; used in the beam, ridge and intermediate beam

7.3 ARC Cavity Stop Sock

- CSS100
- PWCSS 100
- SSL600/450

7.4 Rockwool MECH SL GR2 ; Used in party wall panel

Generic BRE Green Guide Rating A+

EN 15804 Environmental Product Declaration (EPD)

www.greenbooklive.com

KNAUF INSULATION

January 2017

Earthwool® Building Slab RS45

For a wide range of applications

Description
Earthwool Building Slab RS45 is a semi-rigid, resilient, non-combustible rock mineral wool slab manufactured in a density of 45kg/m^3.

Application
Earthwool Building Slab RS45 is a multi-application product for use in built-up metal roofs and walls, pitched roof constructions between rafters, intermediate floors, separating floors, internal stud partitions and light steel frame infill. Earthwool Building Slab RS45 is used extensively in OEM applications for fabrication of thermal, acoustic and fire products.

Standards
Earthwool Building Slabs are manufactured in accordance with BS EN 13162, ISO 50001 Energy Management Systems, OHSAS 18001 Occupational Health and Safety Management Systems, ISO 14001 Environmental Management Systems, and ISO 9001 Quality Management Systems, as certified by Bureau Veritas.

with ECOSE® TECHNOLOGY

Performance

Thermal
The thermal conductivity of Earthwool Building Slab RS45 is 0.035 W/mK

Fire
Earthwool Building Slab RS45 is classified as Euroclass A1 (non-combustible) to BS EN 13501-1

Benefits

- Friction fits between studs, joists, rafters and bracketry
- Non-combustible
- Excellent thermal and acoustic properties

BUREAU VERITAS

Move Forward with Confidence

Earthwool® Building Slab RS45

Durability
Earthwool Building Slab RS45 is odourless, rot proof, non-hygroscopic, do not sustain vermin and will not encourage the growth of fungi, mould or bacteria.

Fire performance
Earthwool Building Slab RS45 is classified as Euroclass A1 to BS EN 13501-1, non-combustible to BS 476:Part 4:1970 (1984) and, Class 1 Surface Spread of Flame to BS 476:Part 7:1997 and Class 'O' to the Building Regulations.

Moisture resistance
Earthwool Building Slab RS45 is non-wicking when tested to BS 2972:1989:Section 12. When exposed to 90% relative humidity at 20°C, Earthwool Building Slabs absorb less than 0.004% of moisture.

Vapour resistivity
Earthwool Building Slab RS45 offers negligible resistance to the passage of water vapour and have a water vapour resistivity of 5.00MNs/g.m.

Environmental
Earthwool Building Slab RS45 represents no known threat to the environment and has zero Ozone Depletion Potential and zero Global Warming Potential. Earthwool Building Slab RS45 has a generic BRE Green Guide rating of A+ and is covered by Environmental Product Declaration BREG EN EPD No. 000095, ECO EPD Ref. No.: 000324 in accordance with the requirements of EN 15804.

Handling and storage
Earthwool Building Slab RS45 is easy to handle, install and cut to size, where necessary. Earthwool Building Slab RS45 is supplied in polythene packs which are designed for short term protection only. For longer term protection on site, the products should either be stored indoors, or under cover and off the ground. Earthwool Building Slab RS45 should not be left permanently exposed to the elements.

	Thickness (mm)	Thermal conductivity (W/mK)	Thermal resistance (m^2K/W)	Length (mm)	Width (mm)	Slabs per pack	Area per pack (m^2)
RS45	150	0.035	4.25	1200	600	3	2.16
	100	0.035	2.85	1200	600	5	3.60
	75	0.035	2.10	1200	600	6	4.32
	60	0.035	1.70	1200	600	8	5.76
	50	0.035	1.40	1200	600	10	7.20
	40	0.035	1.10	1200	600	12	8.64
	30	0.035	0.85	1200	600	16	11.52
	25	0.035	0.70	1200	600	20	14.40

Bespoke sizes
Earthwool Building Slab RS45 is available in bespoke dimensions to suit system specific requirements in thicknesses from 25 to 270mm.

KINE2980DAT - V0117

Knauf Insulation mineral wool products made with ECOSE® Technology benefit from a no added formaldehyde binder, which is up to 70% less energy intensive than traditional binders and is mainly derived from rapidly renewable materials instead of petroleum-based chemicals. The technology has been developed for Knauf Insulation's glass and rock mineral wool products, enhancing their environmental credentials without affecting the thermal, acoustic or fire performance. Insulation products made with ECOSE Technology contain no dye or artificial colours.

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Technical Support Team
Tel: 01744 766 666

Literature
Tel: 08700 668 660

For more information please visit
www.knaufinsulation.co.uk

Generic BRE Green Guide Rating A+

KNAUF INSULATION
it's time to save energy

February 2016

Earthwool® Loft Roll 44

For pitched roofs at ceiling level and suspended timber floors

Description
Earthwool Loft Roll 44 is a flexible low density glass mineral wool quilt which is lightweight, resilient and non-combustible. The rolls are 1140mm wide and partially perforated to produce either 2 rolls 570mm wide or 3 rolls 380mm wide or available in ready-cut version (2x570mm only).

Application
Earthwool Loft Roll 44 is primarily used for the thermal insulation of pitched roofs at ceiling level, it can also be used to thermally insulate floors. When used at ceiling level it is usually laid in two layers, with the first layer between the joists and the second layer over, and at right angles to the joists.

Standards
Earthwool Loft Roll 44 is manufactured in accordance with BS EN 13162, EN 50001 Energy Management Systems, OHSAS 18001 Occupational Health and Safety Management Systems, ISO 14001 Environmental Management Systems, and ISO 9001 Quality Management Systems, as certified by Bureau Veritas.

with ECOSE® TECHNOLOGY

Performance

Thermal
Earthwool Loft Roll 44 has a thermal conductivity of 0.044W/mK.

Fire
Earthwool Loft Roll 44 is classified as Euroclass A1 to BS EN 13501-1.

Benefits

- Lightweight and economic insulation quilt
- Produced for use with timber joists at 400mm and 600mm centres
- Partially cut perforations
- Provides thermal, acoustic and fire performance

Bureau Veritas
Move Forward with Confidence

Earthwool® Loft Roll 44

Durability
Earthwool Loft Roll 44 is odourless, rot proof, non-hygroscopic, does not sustain vermin and will not encourage the growth of fungi, mould or bacteria.

Vapour resistivity
Earthwool Loft Roll 44 offers negligible resistance to the passage of water vapour and has a vapour resistivity of 5.00MNs/g.m.

Environmental
Earthwool Loft Roll 44 represents no known threat to the environment and has zero Ozone Depletion Potential and zero Global Warming Potential.

Handling and storage
Earthwool Loft Roll 44 is easy to handle and install, being lightweight and easily cut to size, where necessary. It is supplied in polythene packs which are designed for short term protection only. For longer term protection on site, the product should be stored either indoors, or under cover and off the ground. Earthwool Loft Roll 44 should not be left permanently exposed to the elements.

Thickess (mm)	Thermal conductivity (W/mK)	Thermal resistance (m^2K/W)	Length (m)	Width (mm)	Area per pack (m^2)
Earthwool Loft Roll 44 (Combi-cut)					
200	0.044	4.50	5.20	1140/2x570/3x380	5.93
170	0.044	3.85	7.03	1140/2x570/3x380	8.01
150	0.044	3.40	8.05	1140/2x570/3x380	9.18
100	0.044	2.25	12.18	1140/2x570/3x380	13.89
Earthwool Loft Roll 44 (Combi-cut) Shorter Lengths					
200	0.044	4.50	3.40	1140/2x570/3x380	3.88
170	0.044	3.85	4.30	1140/2x570/3x380	4.90
150	0.044	3.40	4.90	1140/2x570/3x380	5.59
100	0.044	2.25	7.28	1140/2x570/3x380	8.30
Earthwool Loft Roll 44 (Ready-cut)					
150	0.044	3.40	8.05	2x570	9.18
100	0.044	2.25	12.18	2x570	13.89

All dimensions are nominal

Knauf Insulation mineral wool products made with ECOSE® Technology benefit from a no added formaldehyde binder, which is up to 70% less energy intensive than traditional binders and is made from rapidly renewable bio-based materials instead of petroleum-based chemicals. The technology has been developed for Knauf Insulation's glass and rock mineral wool products, enhancing their environmental credentials without affecting the thermal, acoustic or fire performance. Insulation products made with ECOSE Technology contain no dye or artificial colours.

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

Customer Service (sales)
Tel: 0844 800 0135

Technical Support Team
Tel: 01744 766 666

Literature
Tel: 08700 668 660

For more information please visit
www.knaufinsulation.co.uk

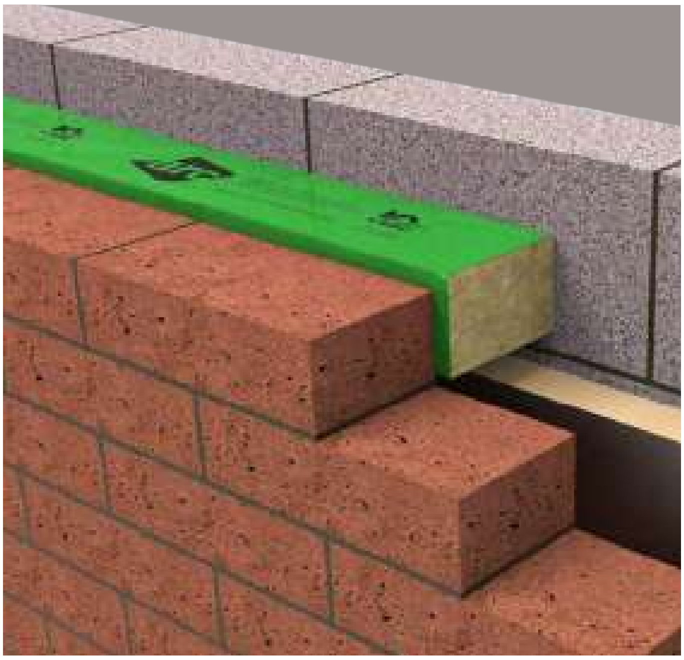
KINE1508DAT - V0216

V2 22.04.2020

CAVITY STOP SOCK

Cavity fire barrier for masonry construction

- Up to 4 hours fire integrity
- Horizontal and vertical options
- Specified in terraced, semi-detached, apartments and major projects
- Meets requirements of Robust Detail Part E and Approved Document B
- Maximum cavity width available: 300mm
- Easily installed with compression fit; no mechanical fix is required
- Third-party certificated by Certifire



registered LABC
NBS Plus
riba product selector
Exova Warringtonfire
certifire

CAVITY STOP SOCK

Application

ARC Cavity Stop Sock restricts the spread of smoke and flames within the cavity of external masonry walls. It is ideally suited for providing a cavity barrier within the external wall cavity, in line with a separating wall or floor as specified in Approved Document B, and for closing the cavity at eaves level.

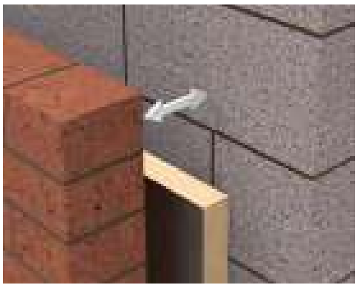
Installation

ARC Cavity Stop Sock is designed to be simply compression fitted as the brick and block work progresses. No mechanical fixing is required, with the compression fit holding the barrier in place.

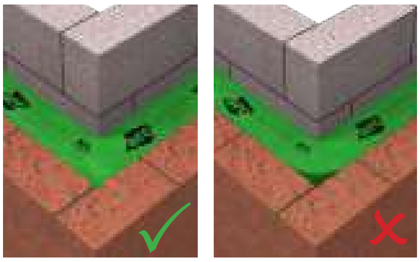
The barrier must fully fill the cavity from external brick to internal block. Any cavity insulation must be cut back at the location of the barrier, and care must be taken to ensure that the built cavity width is accurate and that the size of barrier fitted is appropriate to this.

- Vertical application: we recommend building up the internal block work first. Then progress several courses of brickwork, before installing the barrier. The brickwork can continue, building the barrier in. Care must be taken to ensure the correct compression fit is achieved.
- Horizontal application: build the brickwork up to the level the barrier will be installed, ensuring the width of the cavity is correct. Allow the brickwork to set, before push fitting the barrier in to place and under the correct compression.
- At the end of a run, or at a corner, lengths of barrier should be cut to the required length, and then tightly butt jointed ensuring no gaps remain.
- The polythene encapsulation does not contribute to the performance of the barrier, but offers weather protection and product identification. We recommend that it is left in place for these purposes, however if it becomes torn or damaged there is no cause for concern.
- You should not attempt to squash the barrier before installation. Although this can make the barrier easier to fit, it is likely to cause gaps and may damage the barrier, resulting in reduced performance.

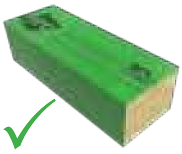
What does good look like?



The cavity width is accurate and the cavity insulation has been cut back where the barrier will be located

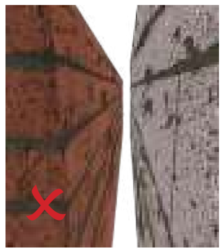


All corners and joints are tightly butt jointed. Barriers are not bent around corners.



Excess polythene is remove from joints

The cavity is clear from debris

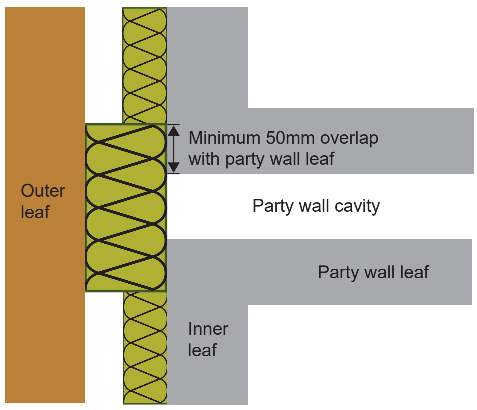


Green horizontal barrier shown; the above points can be applied to all installations regardless of size or orientation.

Party Wall Junction

ARC's Party Wall Cavity Stop Sock is designed for use at the party wall junction; fitted in the external wall cavity, with a minimum 50mm overlap either side of the party wall cavity. At 250mm wide, ARC's PWCSS range is suitable for use with party wall cavities up to 150mm wide.

These wider barriers do not require a compression fit, and are supplied with a 5mm compression to allow for site anomolies.



CAVITY STOP SOCK

Product & Packaging Specification

Product Code	Suitable for Cavity Width	Sleeve Colour	Masonry Fire Performance		Compression Required	Dimensions	Lengths per pack	Packs per pallet
			Fire Integrity	Insulation				
CSS50	50mm	Red	4 hrs	15 mins	15mm	65 x 65 x 1200mm	40	12
CSS75	75mm	Red	4 hrs	15 mins	15mm	90 x 75 x 1200mm	35	12
CSS80	80mm	Green	4 hrs	15 mins	20mm	100 x 100 x 1200mm	24	10
CSS85	85mm	Green	4 hrs	15 mins	20mm	105 x 100 x 1200mm	24	10
CSS90	90mm	Green	4 hrs	15 mins	20mm	110 x 100 x 1200mm	20	10
CSS95	95mm	Green	4 hrs	15 mins	20mm	115 x 100 x 1200mm	20	10
CSS100	100mm	Green	4 hrs	15 mins	20mm	120 x 100 x 1200mm	20	10
CSS105	105mm	Green	4 hrs	15 mins	10mm	120 x 120 x 1200mm	15	10
CSS110	110mm	Green	4 hrs	15 mins	10mm	120 x 120 x 1200mm	15	10
CSS115	115mm	Lt Blue	4 hrs	15 mins	10mm	130 x 120 x 1200mm	15	10
CSS120	120mm	Lt Blue	4 hrs	15 mins	10mm	135 x 120 x 1200mm	15	10
CSS125	125mm	Lt Blue	4 hrs	15 mins	10mm	135 x 120 x 1200mm	15	10
CSS130	130mm	Lt Blue	4 hrs	15 mins	10mm	140 x 120 x 1200mm	15	10
CSS135	135mm	Lt Blue	4 hrs	15 mins	10mm	145 x 120 x 1200mm	15	10
CSS140	140mm	Lt Blue	4 hrs	15 mins	10mm	150 x 120 x 1200mm	15	10
CSS145	145mm	Lt Blue	4 hrs	15 mins	10mm	155 x 120 x 1200mm	15	8
CSS150	150mm	Lt Blue	4 hrs	15 mins	10mm	160 x 120 x 1200mm	15	8
CSS155	155mm	Lt Blue	2 hrs	15 mins	10mm	165 x 150 x 1200mm	12	8
CSS160	160mm	Lt Blue	2 hrs	15 mins	10mm	170 x 150 x 1200mm	12	8
CSS165	165mm	Lt Blue	2 hrs	15 mins	10mm	175 x 150 x 1200mm	10	8
CSS170	170mm	Lt Blue	2 hrs	15 mins	10mm	180 x 150 x 1200mm	10	8
CSS175	175mm	Lt Blue	2 hrs	15 mins	10mm	185 x 150 x 1200mm	9	8
CSS180	180mm	Lt Blue	2 hrs	15 mins	10mm	190 x 150 x 1200mm	9	8
CSS185	185mm	Red	2 hrs	15 mins	10mm	195 x 150 x 1200mm	9	8
CSS190	190mm	Red	2 hrs	15 mins	10mm	200 x 150 x 1200mm	9	8
CSS195	195mm	Red	2 hrs	15 mins	10mm	205 x 150 x 1200mm	9	8
CSS200	200mm	Red	2 hrs	15 mins	10mm	210 x 150 x 1200mm	8	10
CSS225	225mm	Black	2 hrs	15 mins	10mm	235 x 200 x 1200mm	3	16
CSS250	250mm	Black	2 hrs	15 mins	10mm	260 x 200 x 1200mm	4	12
CSS275	275mm	Black	2 hrs	15 mins	10mm	285 x 200 x 1200mm	4	12
CSS300	300mm	Black	2 hrs	15 mins	10mm	310 x 200 x 1200mm	4	10
ARC Party Wall Cavity Stop Socks: vertical cavity fire barrier at the party wall junction								
PWCSS50	50mm	Red	4 hrs	4 hrs	Friction	55 x 250 x 1200mm	12	10
PWCSS75	75mm	Red	4 hrs	4 hrs	Friction	80 x 250 x 1200mm	10	10
PWCSS100	100mm	Red	4 hrs	4 hrs	Friction	105 x 250 x 1200mm	8	10
PWCSS125	125mm	Red	4 hrs	4 hrs	Friction	130 x 250 x 1200mm	6	10
PWCSS150	150mm	Red	4 hrs	4 hrs	Friction	155 x 250 x 1200mm	6	10
PWCSS175	175mm	Red	4 hrs	3 hrs	Friction	180 x 250 x 1200mm	4	10
PWCSS200	200mm	Red	4 hrs	3 hrs	Friction	205 x 250 x 1200mm	4	10
PWCSS225	225mm	Black	4 hrs	3 hrs	Friction	230 x 250 x 1200mm	4	10
PWCSS250	250mm	Black	4 hrs	3 hrs	Friction	255 x 250 x 1200mm	4	10
PWCSS275	275mm	Black	4 hrs	3 hrs	Friction	280 x 250 x 1200mm	2	12
PWCSS300	300mm	Black	4 hrs	3 hrs	Friction	305 x 250 x 1200mm	2	12

Can't find your size? ARC Cavity Stop Sock can be manufactured to suit any cavity width up to 300mm, including any intermediary sizes not listed above. **Call our technical experts on 0113 252 9428 to discuss your requirements.**

CAVITY STOP SOCK

Key Stats

Length supplied	1.2m	Insulation performance	Minimum 15 mins
Third-party certification	Certifire CF5403	Test standard	BS 476 Part 20
Insulation	Non-combustible rockfibre mineral wool	Construction type	Masonry
Thermal conductivity	0.037W/mK	Orientation	Vertical or horizontal
Fire rating	Up to 4 hours	Robust Detail compliance	E-WM 1-21

Fire Properties

ARC Cavity Stop Sock has been fire tested in accordance with the principles given in BS 476: Part 20: 1987, achieving up to four hours fire integrity within a masonry construction.

ARC Cavity Stop Sock is certificated by Certifire, a third-party accreditation scheme from Exova Warrington Certification. Certifire assures architects, specifiers, contractors and building owners that a correctly installed product will perform as expected.

Certifire Certificate of Approval no. CF5403.

Non-Standard Applications

Where usage falls outside of the certificated scope, for example when used with external cladding, or with an internal metal frame system, performance of the fire barrier will depend heavily upon the structural integrity and fire performance of the surrounding construction.

Specifiers must ensure all construction elements that make up part of the internal or external leaf of the wall, including support systems, are suitable for use with a cavity fire barrier for the length of fire integrity and insulation required. Particular attention must be paid to any possible deflection or distortion which could cause gaps to form between the construction and any fire barrier installed.

In the event of a fire, ARC Building Solutions Ltd cannot accept liability for failure where usage is outside of the standard application, including but not limited to, where deflection or distortion has allowed gaps to form around the barrier, or where the barrier is not fitted in accordance with the manufacturer's guidelines.

Standards

ARC Cavity Stop Sock is manufactured using rockfibre mineral wool which achieves a fire classification of Euroclass A1 as defined in BS EN 13501-1, and conforms to BS EN 13162 and EN16001 Energy Management Systems.

ARC's rockfibre mineral wool insulation has a thermal conductivity of 0.037W/mK.

Storage and Packaging

ARC Cavity Stop Sock is supplied in polythene packs which are designed for transporting and protecting the products. It is not recommended that the packs are stored in direct sunlight. When storing the barriers for longer periods of time it is recommended that the product should be stored indoors, or under cover.

Environment

No CFCs or HCFCs are involved in the manufacturing process of ARC's rockfibre mineral wool insulation. The material presents no known threat to the environment and is classed as ODP and GWP zero.

ARC Cavity Stop Sock has a Green Guide rating of A+.

Health and Safety

ARC Building Solutions has an approved Health and Safety Policy and is committed to working and supplying products safely. ARC's rockfibre mineral wool is not classed as a possible human carcinogen. We have assessed products as required by Substances Hazardous to Health Regulations (COSHH). An ARC COSHH data sheet is available and can be downloaded from ARC's website.

Any information provided within this document is intended for guidance only. Expert technical advice should be sought before specification or installation of any product. It is of particular importance to ensure that any fire barrier or fire stopping product is tested for use with the exact application intended. ARC Building Solutions Ltd cannot accept liability for failure where usage is outside of the standard application, including but not limited to, where deflection or distortion has allowed gaps to form around the barrier, or where the barrier is not fitted in accordance with the manufacturer's guidelines.

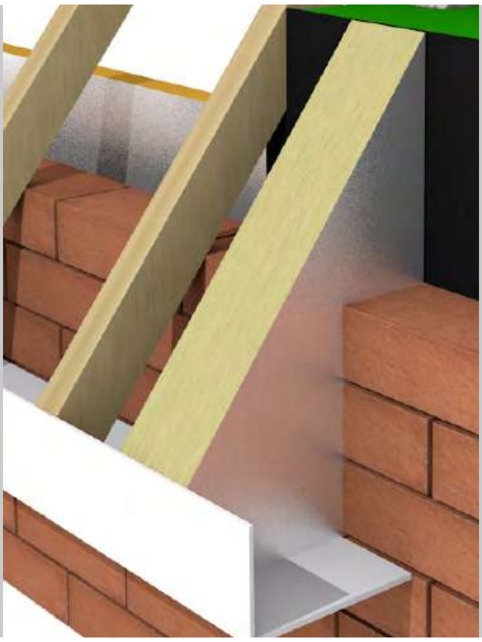
Assessed to ISO 9001 & ISO 14001

Soffit Slab

fire stopping within the soffit

key features

- Provides fire stopping within the soffit at the party wall junction
- Excellent thermal and acoustic properties
- One size fits most roof pitches and soffit dimensions
- Manufactured from foil faced mineral wool



Application

The ARC Soffit Slab is designed to fill the void within the soffit, providing a fire, thermal and acoustic barrier between dwellings. The barrier is manufactured from rockfibre mineral wool, with a foil facing to ensure an effective smoke barrier is created. An exact fit can be created to form an effective barrier at this junction.

Don't take our word for it, see our certification...

Assessed to ISO 9001 & ISO 14001

Installation

ARC Soffit Slab is easily installed. Simply cut on site to the required size, ensuring no gaps remain around the edges of the barrier once fitted within the soffit.

Fire Properties

ARC Soffit Slab complies with building regulations for fire stopping at the pitched roof party wall detail, as well as NHBC 7.2.16.

Standards

ARC Soffit Slab is manufactured using rockfibre mineral wool which achieves a fire classification of Euroclass A1 as defined in BS EN 13501-1, and conforms to BS EN 13162 and EN16001 Energy Management Systems.

ARC's rockfibre mineral wool insulation has a thermal conductivity of 0.037W/mK.

Storage and Packaging

ARC Soffit Slabs are supplied in polythene packs which are designed for transporting and protecting the products. It is not recommended that the packs are stored in direct sunlight. When storing the barriers for longer periods of time it is recommended that the product should be stored indoors, or under cover.

Environment

No CFCs or HCFCs are involved in the manufacturing process of ARC's rockfibre mineral wool insulation. The material presents no known threat to the environment and is classed as ODP and GWP zero.

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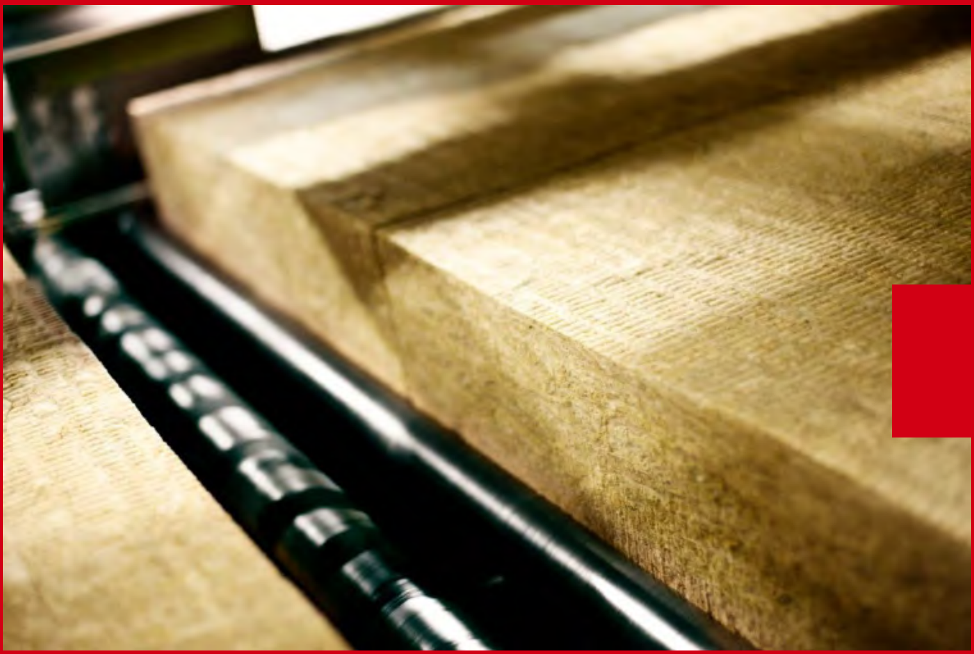
Standard Dimensions & Packaging Specification

Product Code	Dimensions	Pack Qty	Packs per Pallet
SSL600/450	450 x 600 x 100mm	8	10



ROCKWOOL
Fabrock MECH

Non-Combustible ROCKWOOL® board

For high performance core solutions

Recommended for façade, curtain wall and cladding panels

ROCKWOOL

Fabrock MECH SL GR2

Description

Fabrock MECH slabs are designed for laminate panels providing an A1 non-combustible core material for façade, cladding and glazed in panels.
The contact face of slabs must be smooth and free of dust prior to surface bonding. With a thickness range, starting at 10mm and increasing in increments of 1 mm and a tolerance of only
+/- 0.5 mm Fabrock MECH is the perfect solution for fire resistant sandwich panels for thinner sandwich panels that require a flat surface.

Advantages

- Best reaction to fire – Euroclass A1
- Non contribute to fire development
- Efficient thermal insulation
- For industrial use
- Water repellency
- Dimensional Stability
- High Sound absorption
- Easy to cut
- Low minimum order quantity
- Short lead time
- Recyclable

Standards and approval

Conform to:
- EN 13162: Thermal insulation products for buildings factory made mineral wool (MW) products - specification

Dimensions

Dimension range: Contact us for any other specific dimensions.

Product name	Size (mm)	Thicknesses
Fabrock MECH SL GR2	2000 x 600mm	on request

Tolerances
Standard Length +/- 2mm
Standard Width +8mm – 0mm
Thickness +/- 0.5 mm

Performances

Fire properties

	sign	description	norms
Combustibility	A1	Euroclass	EN 13501
Smoke or droplet class	No	Euroclass	EN 13501
Calorific value	< 2Mj/kg	Limit for A1	EN 13501
Fire resistance	>1000°C	Melting point	DIN 4102

Properties (1)

	Symbol	Description / Data	Standard
Nominal value of thermal conductivity	λ_D	0.038 W/(mk)	EN 13162
Resistance factor of water vapour diffusion	MU 1	μ = 1	EN 12086
Compressive Strength	30 kPa		
Delamination Strength	13kPa		

Recommendation of use

Keep the product dry before using.
Outdoor storage must not exceed one month in its original packaging.
Pallets must not be stacked more than the limited fulfilling manufacturers and National safety rules and product strength.

(1) Indicative values
(2) Please follow the recommendations of the adhesive suppliers and their data sheets.
(3) Doesn't contain Substances of Very High Concern
(4) Doesn't contain Ozone Depleting Substances
(5) Doesn't contain Carcinogenic Mutagen or Toxic Substances

As an environmentally conscious company, ROCKWOOL promotes the sustainable production and use of insulation and is committed to a continuous process of environmental improvement.

4 in 1

All ROCKWOOL products provide outstanding thermal protection as well as four added benefits:

- **Fire resistance**
- **Acoustic comfort**
- **Sustainable materials**
- **Durability**

Environment

Made from a renewable and plentiful naturally occurring resource, ROCKWOOL insulation saves fuel costs and energy in use and relies on trapped air for its thermal properties.

ROCKWOOL insulation does not contain (and has never contained) gases that have ozone depletion potential (ODP) or global warming potential (GWP).

ROCKWOOL products are approximately 97% recyclable.

For waste ROCKWOOL material that may be generated during installation or end of life, we are happy to discuss the individual requirements of contractors and users considering returning these materials to our factory for recycling.

Health & Safety

The safety of ROCKWOOL stone wool is confirmed by EU directive 97/96/CE: ROCKWOOL fibers are not classified as a possible human carcinogen.

No CFCs, HFCs or HCFCs are used in the manufacture of ROCKWOOL materials.

Interested ?

For more information and samples, please contact:

Email: steve.doig@rockwool.com

ROCKWOOL Limited
Chiswick Tower
389 Chiswick High Road
London
W4 4AL

8 PIR Insulation

8.1 Cellotex TB4000 25mm used in the construction of the beam

8.2 Kingspan TP10 75mm use in gable wall

Celotex TB4000

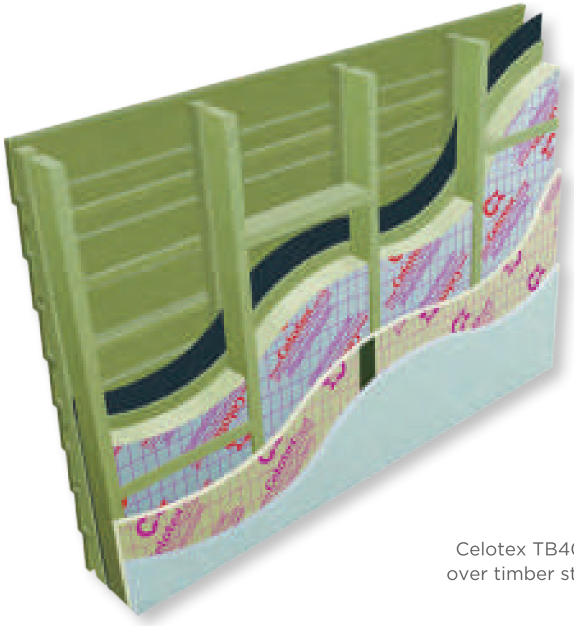
Celotex SAINT-GOBAIN

Celotex TB4000 is a multi-purpose insulation board developed to provide simple solutions for overcoming localised thermal bridges.

With low emissivity foil facings, TB4000 is manufactured from rigid polyisocyanurate (PIR) using a blowing agent that has zero ozone depletion potential (zero ODP) and low global warming potential (GWP). Our 12mm product positions Celotex as the manufacturer of the broadest range of product thicknesses, from 12-200mm.

With Celotex TB4000 you are specifying an insulation board that:

- Is suitable for use in a number of applications including roof, wall and floor systems
- Is specifically designed to eliminate thermal bridges
- Is certified under BBA certificate numbers 17/5405, 16/5352
- Includes low emissivity foil facings giving improved thermal insulation performance within cavity air spaces
- Can be used to improve reliable long-term energy savings for buildings



Celotex TB4000 over timber studs

Applications

- Pitched roofs
- Flat roofs
- Solid masonry walls
- Timber framed & steel framed systems
- Floors

Specification clause

The insulation shall be Celotex TB4000 ____mm thick comprising a polyisocyanurate rigid foam insulation core with a thermal conductivity of 0.022 W/mK with low emissivity aluminium foil facings on both sides. Celotex TB4000 is CFC/HCFC free with zero ODP, low GWP and CE marking. Celotex TB4000 is manufactured in accordance with quality management system ISO 9001 and environmental management system ISO 14001. All products must be installed in accordance with guidance issued by Celotex.

Where building regulation approval is required, you should take advice from your local building control authority and the building designer.

Technical data

Thickness (mm)	R-value (m^2K/W)	Maximum board weight (kg/m^2)
12	0.50	0.55
20	0.90	0.79
25	1.10	0.95
30	1.35	1.10
40	1.80	1.41

Physical properties

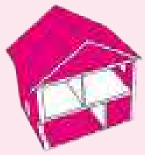
	Method	TB4000
Compressive strength	BS EN 826:2013	CS(10\Y)120
Dimensional stability	BS EN 1604 :2013	DS(70,90)3 DS(-20,-)1
Thermal conductivity	BS EN 12667:2001	0.022 W/mK
Surface spread of flame	BS 476-7:1997	Class 1
Reaction to fire	BS EN 13501-1:2007+A1:2009	E

Sustainable insulation

For further information about Celotex' sustainable insulation solutions, visit the sustainability pages of the website at celotex.co.uk

ENERGY ASSESSMENTS ...by Celotex

We have an experienced team of energy assessors who can carry out SAP calculations, water calculations, airtightness testing and much more. Contact us.



Celotex presents a comprehensive range of thermal bridging models featuring our industry leading PIR insulation products. This tool helps you identify the build-up required to reduce heat loss through a typical junction of elements or at openings. Sign up now.

A bit about us

Celotex products insulate countless buildings the length and breadth of the UK. Providing PIR insulation for over 90 years, our solutions and product development continue to make a difference not just by creating warmth and comfort but by saving energy too. Every day, thousands of professionals choose Celotex. For them, Celotex is insulation. Plus, all Celotex products come with a suite of practical online tools, as well as exceptional before and after sales service.

Typical U-values

U-values will vary depending on application. To calculate a specific U-value, please visit our online calculator at celotex.co.uk

Installation guidelines

Installation of Celotex TB4000 will depend on application type. For installation details please refer to our online 'applications' pages.

Further information

If you wish to contact Celotex, please do so through the 'contact us' page on our website.

For information regarding storage, installation and handling of Celotex products, or for health & safety information, please refer to our online 'literature' pages.

Celotex has a policy of continuous product development and reserves the right to alter product designs or specifications without prior notice.

Celotex. Lady Lane Industrial Estate, Hadleigh, Ipswich, Suffolk IP7 6BA T: 01473 820850 celotex.co.uk

Celotex SAINT-GOBAIN

Kingspan Insulation Limited
Pembridge
Leominster
Herefordshire HR6 9LA

Tel: 01544 388601 Fax: 01544 388888
e-mail: info@kingspaninsulation.co.uk
website: www.kingspaninsulation.co.uk

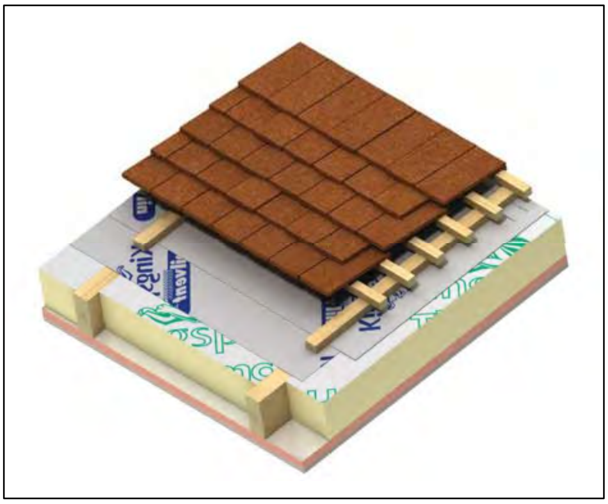
Agrément Certificate
14/5133
Product Sheet 5

KINGSPAN THERMA STRUCTURAL APPLICATIONS

KINGSPAN THERMAPITCH TP10

This Agrément Certificate Product Sheet[1] relates to Kingspan Thermapitch TP10, a rigid polyisocyanurate (PIR) board, faced on both sides with aluminium foil, for use in new and existing domestic and non-domestic pitched roof constructions where the ceiling follows the pitch of the roof and encloses a habitable space or where the ceiling is horizontal and encloses a loft space.

(1) Hereinafter referred to as 'Certificate.



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 0.022 $W{\cdot}m^{-1}{\cdot}K^{-1}$ and an aged emissivity value of 0.05 (see section 6)

Condensation risk — the product will contribute to limiting the risk of condensation (see section 7).

Behaviour in relation to fire — the product is classified as Class E to BS EN 13501-1 : 2007 (see section 8).

Durability — the product will have a life equivalent to that of the roof structure in which it is incorporated (see section 11).

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: 18 May 2017

John Albon – Head of Approvals
Construction Products

Claire Curtis-Thomas
Chief Executive

British Board of Agrément
Bucknalls Lane
Watford
Herts WD25 9BA
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9 Fire Test Results

9.1 Indicative fire test to EN 13631 BRE 9th August 2019

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9.5 LGAI Technological Center, S.A. (APPLUS) 19/20720-2153-1 and 19/20720-2153

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APPENDIX 9.1

Fire Test BRE 9 August 2019.

Project Number P1115505 – 1001

Indicative fire test to 1.5m x 1.5m Wall to EN1363-1 : 2012

Introduction

Aim of the test was to establish whether a typical wall section using the Ultrapanel system would remain intact for a minimum of 60 minutes as required when used as part of the construction of a party wall. The test sample was split into two to establish the performance when the wall is enclosed completely both sides and where one side is left exposed.

Sample specification

A cross section through the wall assembly can be see in figure 1.

The 1.5 wide section of wall was divided into 3 panels. The centre one 600mm wide the outer two 437mm wide.

Wall structure is the standard 213mm Ultrapanel with 175mm Stylite-Plustherm 70 EPS insulation.

The perimeter of the wall uses an Aluminium F – section fixed to the test frame with 6mm concrete screws at 600mm ctrs.

The wall was fixed the perimeter frame using 4.2*25mm wafer head self drilling screws.

On the fire side there was 2 layers of British Gypsum Gyproc FireLine 15mm. The first layer was fixed using 3.5 * 25mm drywall screws at 300mm ctrs. The second layer was fixed using 3.5 * 50mm drywall screws at 300mm ctrs. The edge of the board was pointed into the test frame using Dowsil 400 Firestop.

On the non fire side the first two panels were covered with British Gypsum Gyproc FireLine 15mm fixed using 3.5 * 25mm drywall screws at 300mm ctrs. The third panel was left uncovered.

Test Method

The sample was exposed to the heat in accordance with EN1363-1 : 2012. Thermocouples provided data of heat build-up. The thermocouples were placed as follow with two thermocouples in each location one half way up the panel and one ¾ of the way up the panel.

- Thermocouples 1,2 On the surface of the panel's steel rail directly behind the plasterboard on the fire side.
- Thermocouples 3,4 On the surface of the panel's steel rail directly behind the plasterboard on the non-fire side.
- Thermocouples 5,6 On the surface of the EPS of the exposed panel on the non-fire side.
- Thermocouples 7,8 On the surface of the plasterboard on the non-fire side.
- Thermocouples 9,10 On the surface of the plasterboard on the non-fire side.

File was also take during the test to record the condition of the wall.

APPENDIX 9.1

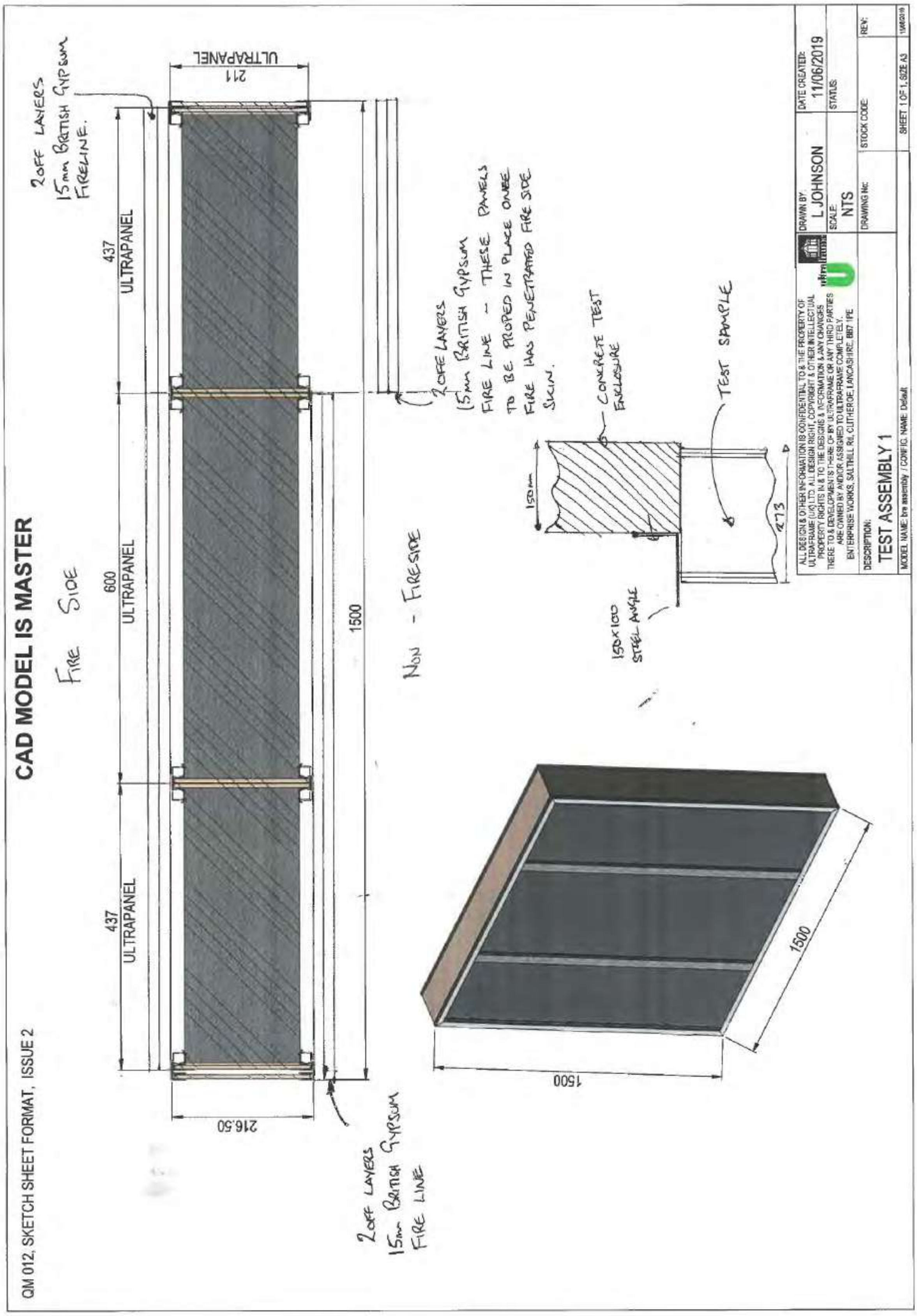
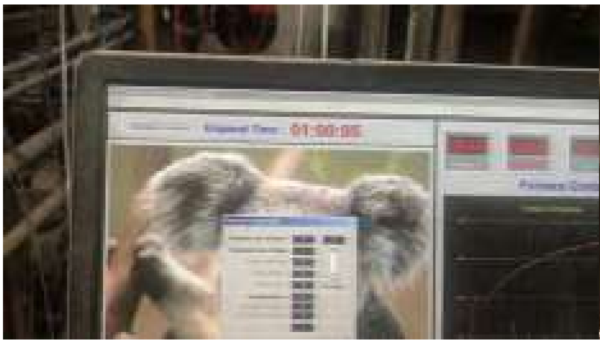


Figure 1

Results

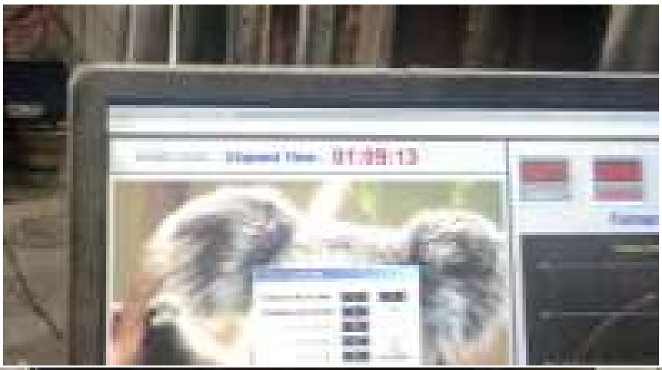
Condition of the wall after the first 60 minutes



After the First Hour of the test there was no visible deterioration of the panel from the non-fire side.

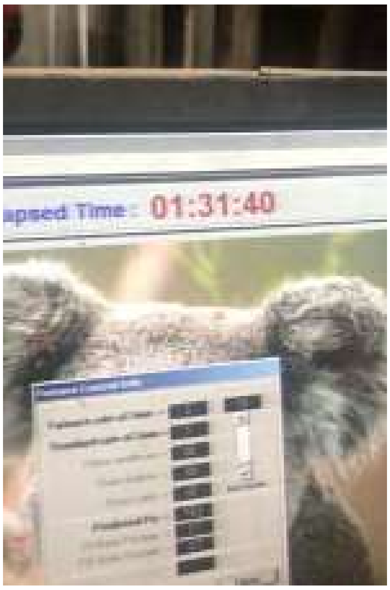
The steel on the upper section of the clip fire side was approaching 200deg C the lower section still below 100deg C. The surface of the EPS at 5 and 6 is still around ambient at 25 deg C.

After 69 Minutes 13sec



During the test the EPS had been melting from the back (one EPS goes above 100de C it starts to melt). At 69 minutes there was not enough structure in the EPS to support its weight. Note there is no visible damage to the hardboard webs.

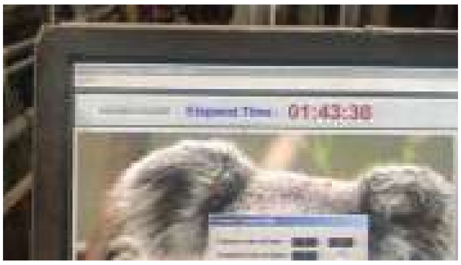
After 91 Minutes 40 sec



Slight evidence of scorching where hardboard meets the steel on the fire side

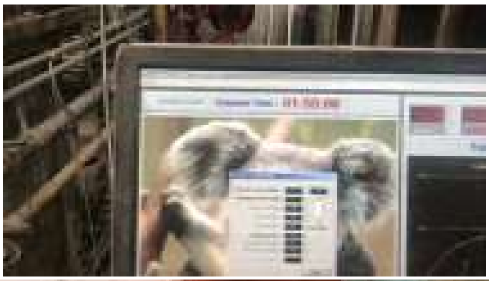
After 91 minutes the panel is still very much intact just slight evidence of scorching where the hardboard is touching the steel.

After 103 Minutes 30 sec



The scorching to the hardboard has increased slightly and there is some blackening to the clip on the non-fire side where the plasterboard meets it.

After 115 Minutes 6 sec



The molten EPS at the base of the panel ignites and sets fire to the hardboard.

Temperature Data Log

	Pressure	Furnace TC1 °C	Furnace TC2 °C	Furnace TC3 °C	Furnace TC4 °C	t/c1 (exposed frame)	t/c2 (exposed frame)	t/c3 (unexposed frame)	t/c4 (unexposed frame)	t/c5 (unexposed EPS)	t/c6 (unexposed EPS)	t/c7 (unexposed p/b)	t/c8 (unexposed p/b)	t/c9 (unexposed p/b)	t/c10 (unexposed p/b)	ambient	Mean Furn	Specified Heating curve
Time	Chan 0	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 7	Chan 8	Chan 9	Chan 10	Chan 11	Chan 12	Chan 13	Chan 14	Chan 15	Mean Furn	EN_Plate_Vert
min	Pa	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
0	0.0	25.0	25.0	25.0	26.0	26.0	25.6	24.1	24.2	23.3	23.3	23.6	23.7	23.6	23.7	22.0	20.0	20.0
5	10.8	615.0	533.0	600.0	576.0	30.9	29.8	24.0	24.1	23.9	23.7	23.7	23.9	23.8	23.8	22.0	581.0	576.0
10	18.8	685.0	624.0	688.0	649.0	62.2	54.8	25.6	24.2	24.1	24.0	24.0	24.0	24.0	23.9	22.0	661.0	678.0
15	18.3	754.0	704.0	760.0	726.0	78.1	70.8	31.3	24.4	24.4	24.1	24.9	24.2	24.7	24.1	23.0	736.0	739.0
20	19.3	795.0	754.0	798.0	769.0	82.1	75.7	39.2	24.4	24.5	24.2	26.5	24.5	25.7	24.2	23.0	779.0	781.0
25	18.4	831.0	792.0	833.0	806.0	86.9	79.2	47.9	24.6	24.5	24.0	28.4	24.5	27.0	24.3	23.0	815.0	815.0
30	21.6	860.0	827.0	866.0	838.0	90.5	84.6	58.3	24.7	24.4	24.0	30.8	24.6	29.3	24.4	23.0	847.0	842.0
35	18.5	879.0	849.0	883.0	859.0	93.4	88.8	69.9	25.3	24.5	23.8	34.2	24.7	32.6	24.3	22.0	867.0	865.0
40	18.3	899.0	870.0	902.0	879.0	95.2	91.2	78.4	26.0	24.2	23.5	41.6	24.7	42.8	24.2	22.0	887.0	885.0
45	18.9	918.0	890.0	920.0	899.0	96.6	92.7	79.1	27.6	23.9	23.7	51.7	24.9	53.4	24.3	22.0	906.0	902.0
50	17.4	935.0	909.0	936.0	917.0	104.1	93.0	81.0	33.0	24.1	23.8	57.1	27.8	57.9	25.4	22.0	924.0	918.0
55	17.7	944.0	919.0	941.0	926.0	128.0	93.7	83.2	52.7	24.7	24.0	59.4	37.1	61.4	30.5	22.0	932.0	932.0
60	17.7	958.0	934.0	957.0	942.0	198.8	97.5	80.8	68.4	25.7	24.4	60.9	47.8	62.7	44.4	22.0	947.0	945.0
65	18.5	969.0	947.0	972.0	955.0	261.2	174.0	74.6	65.5	26.6	24.9	57.7	51.7	59.1	51.1	22.0	960.0	957.0
70	19.3	981.0	961.0	983.0	970.0	295.0	245.3	80.9	71.7	84.9	70.3	59.8	50.6	63.4	50.8	22.0	973.0	968.0
75	19.9	993.0	973.0	994.0	980.0	328.8	224.2	90.3	81.8	128.5	104.8	72.3	62.1	74.7	66.7	22.0	985.0	979.0
80	18.7	993.0	975.0	992.0	982.0	364.9	195.1	109.7	87.5	63.7	26.0	75.5	71.8	76.4	75.4	22.0	985.0	988.0
85	18.6	1000.0	982.0	1000.0	989.0	400.4	207.0	180.2	97.1	38.5	24.5	77.0	75.1	78.4	77.4	22.0	992.0	997.0
90	18.8	1007.0	990.0	1008.0	996.0	454.4	225.8	215.3	173.3	29.7	24.2	80.9	78.6	82.7	81.6	23.0	1000.0	1006.0
95	17.8	1016.0	999.0	1013.0	1004.0	495.4	238.1	259.9	204.6	26.6	24.0	86.6	83.5	87.3	85.5	23.0	1008.0	1014.0
100	18.8	1023.0	1007.0	1021.0	1012.0	523.1	251.0	315.6	234.9	25.3	23.4	92.0	88.2	91.7	89.1	23.0	1015.0	1022.0
105	18.4	1030.0	1014.0	1029.0	1019.0	545.3	262.7	368.2	269.8	24.8	23.5	96.7	91.9	98.4	93.4	23.0	1023.0	1029.0
110	17.7	1036.0	1021.0	1035.0	1025.0	580.1	275.9	403.1	308.2	24.6	23.4	100.9	95.5	104.2	97.4	23.0	1029.0	1036.0
115	16.6	1044.0	1028.0	1041.0	1032.0	642.2	293.1	444.2	354.1	24.5	23.3	104.9	99.0	108.2	102.1	23.0	1036.0	1043.0

Conclusion

The test demonstrated that with the two layers of 15mm Gyproc Fireline there was no damage to the supporting structure after the target 60mins

Further more after 90 mins the structure was still intact with only slight evidence of scorching.

At 103 mins still much the same on the exposed side however some evidence of smoke coming from the covered side.

There is scope to reduce the performance of the plasterboard used on the fire side and still meet the 60min target.

Andrew Thomson

20 August 2019

bre

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BRE Global Test Report

Indicative fire resistance test on an Ultrapanel wall, tested in general accordance with EN1363-1:2012.

Prepared for: **Ultraframe (UK) Ltd**

Date: **04 September 2019**

Report Number: **P115505-1001 Issue: 1**

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Table of Contents

Summary

An indicative fire resistance test was carried out on 09 August 2019 for a duration of 115minutes on a nominal 1500mm x 1500mm x 213mm-deep wall, at the request of Ultraframe UK Ltd, at BRE Global Ltd test laboratories, Garston, Watford, UK.

The test was conducted using the BRE 1.5m cube furnace and employed the furnace heating conditions, appropriate procedures and criteria of EN 1363-1: 2012. The full requirements of the test methodology of the standard were not complied with.

The test was not conducted under the requirements of UKAS accreditation.

The test was witnessed by Mr Andrew Thomson a representative of the sponsor Ultraframe UK Ltd.

Failure of integrity & insulation occurred after 115 minutes from the start of the test with continuous surface flaming (>10 secs duration) at the unexposed face of the specimen.

The information is provided for the test sponsor's information only and should not be used to demonstrate performance against the standard nor compliance with a regulatory requirement.

1 Construction

The Ultrapanel test specimen consisted of three 175mm-thick x 1500mm-high Stylite-Plustherm 70 EPS panels. The central panel was nominally 600mm-wide, and the two side panels nominally 437mm-wide.

A perimeter frame comprising of Aluminium F section was constructed around the aperture (nominally 1500mm x 1500mm) concrete lined furnace test frame, secured to the test frame using 6mm-diameter concrete screws located at 600mm nominal centres.

The EPS panels were slotted together and secured to the perimeter frame using 4.2mm-diameter x 25mm-long wafer head self-drilling screws located at 300mm nominal centres.

The exposed (fire-side) face of the specimen was clad with two layers of 15mm-thick British Gypsum Gyproc Fireline tapered edge plasterboard, with the 1st (inner layer of board) fixed to the specimen using 3.5mm-diameter x 25mm-long drywall screws located at 300mm nominal centres and nominally 15mm in from the edges of the boards. A vertical joint on the 1st (inner) layer was located approximately 450mm from the right-hand vertical edge of the wall, as shown in photograph 6.

The 2nd (outer) layer of plasterboard was secured to the Ultrapanel using 3.5mm-diameter x 50mm-long drywall screws located at 300mm nominal centres and nominally 15mm in from the edges of the boards. The joints between the plasterboard layers were offset / staggered by 600mm to prevent coincidental joint locations, with the joint in the outer layer located nominally 450mm from the left-hand vertical edge of the wall, as shown in photograph 7.

The exposed face of the construction was completed by the addition of a bead of Dowsil 400 Firestop intumescent acrylic sealant, gunned around the perimeter edges of the outer layer of plasterboard at the junction of the plasterboard and concrete lining of the furnace test frame.

On the unexposed face of the wall specimen, the left-hand side and central EPS 70 panels were clad with one layer of 15mm-thick British Gypsum Gyproc Fireline tapered edge plasterboard, secured to the specimen using 3.5mm-diameter x 25mm-long drywall screws located at 300mm nominal centres and nominally 15mm in from the edges of the boards.

The third (right-hand side) panel as viewed was left uncovered.

2 Test

The temperature of the wall was continuously measured during the test by ten K-type chromel / alumel thermocouples, each soldered to a copper disc and covered with an insulation pad, 30mm x 30mm x 2mm thick, with the thermocouples positioned as listed below and as shown in Photographs.

T/C Ref	Location of thermocouple
1	On the exposed face steel rail, at ¾ specimen height – nominally 450mm from left-hand vertical edge (as viewed from unexposed face) – ***photograph 4.***
2	On the exposed face steel rail, at ½ specimen height – nominally 450mm from left-hand vertical edge (as viewed from unexposed face) – ***photograph 4.***
3	On the unexposed face steel rail, at ¾ specimen height – nominally 450mm from left-hand vertical edge (as viewed from unexposed face) - ***photograph 5.***
4	On the unexposed face steel rail, at ½ specimen height – nominally 450mm from left-hand vertical edge (as viewed from unexposed face) - ***photograph 5.***
5	On the unexposed surface of the EPS foam panel at ¾ specimen height – nominally 450mm from right-hand vertical edge (as viewed from unexposed face) - ***photograph 8.***
6	On the unexposed surface of the EPS foam panel at ½ specimen height – nominally 450mm from right-hand vertical edge (as viewed from unexposed face) - ***photograph 8.***
7	On the unexposed face plasterboard surface at ¾ specimen height, nominally 225mm from left-hand vertical edge - ***photograph 8.***
8	On the unexposed face plasterboard surface at ½ specimen height, nominally 225mm from left-hand vertical edge - ***photograph 8.***
9	On the unexposed face plasterboard surface at ¾ specimen height – nominally 250mm from left-hand vertical edge - ***photograph 8.***
10	On the unexposed face plasterboard surface at ½ specimen height – nominally 250mm from left-hand vertical edge - ***photograph 8.***

The exposed face temperature of the EPS foam Ultrapanel was measured by thermocouples 1 & 2.

The unexposed face temperature of the EPS foam Ultrapanel was measured by thermocouples 3, 4, 5, 6.

The unexposed face temperature of the plasterboard partition was measured by thermocouples 7, 8, 9, 10.

Observations made during the test are given in the table below.

Table 1: Observations.

Time Mins:Secs	Observation
0:00	Test started.
5:30	Exposed face: Paper facing has burnt away – glowing red embers visible across full specimen face.
16:45	Exposed face: Nominal 2mm-wide gap between edges of boards a – full height of vertical joint. Moisture droplets noted across head of visible EPS Ultrapanel (unexposed face).
36:00	Exposed face: Nominal 2mm-wide gap between edges of boards a – full height of vertical joint.
47:55	Exposed face: No significant visible change in appearance. No visible cracks / splits within outer layer of plasterboard.
62:30	Unexposed face: Nominal 10mm-diameter hole in EPS Ultrapanel – located in top Right-hand corner of panel *(photograph 10)*.
66:00	Unexposed face: Hole within EPS Ultrapanel has increased – approximately 80mm-high x 150mm-wide (*photograph 11*). Rear surface of exposed face plasterboard (inner / 1st layer) visible within the hole.
69:00	Unexposed face: Top ½ of EPS Ultrapanel has melted / disintegrated into the central wall cavity. Rear surface of exposed face plasterboard clearly visible at the unexposed specimen face (*photograph 12*).
89:10	Exposed face: Crack within outer layer of plasterboard noted down centre of board – nominally 600mm from Right-hand vertical edge (as viewed from the rear of the furnace).
115:00	Unexposed face: Failure of integrity & insulation by continuous surface flaming (*photograph 14*). Test Terminated.

The test was witnessed by Mr Andrew Thomson a representative of the sponsor Ultraframe UK Ltd.

The temperatures recorded within and on the Ultrapanel wall panel are shown plotted against time in Graph 4.

Failure of integrity & insulation occurred after 115 minutes from the start of the test with continuous surface flaming (>10 secs duration) at the unexposed face of the specimen.

The test was terminated after 115 minutes.

The specimen is shown in Figures and before, during and after test in Photographs.

bre

3 Figures

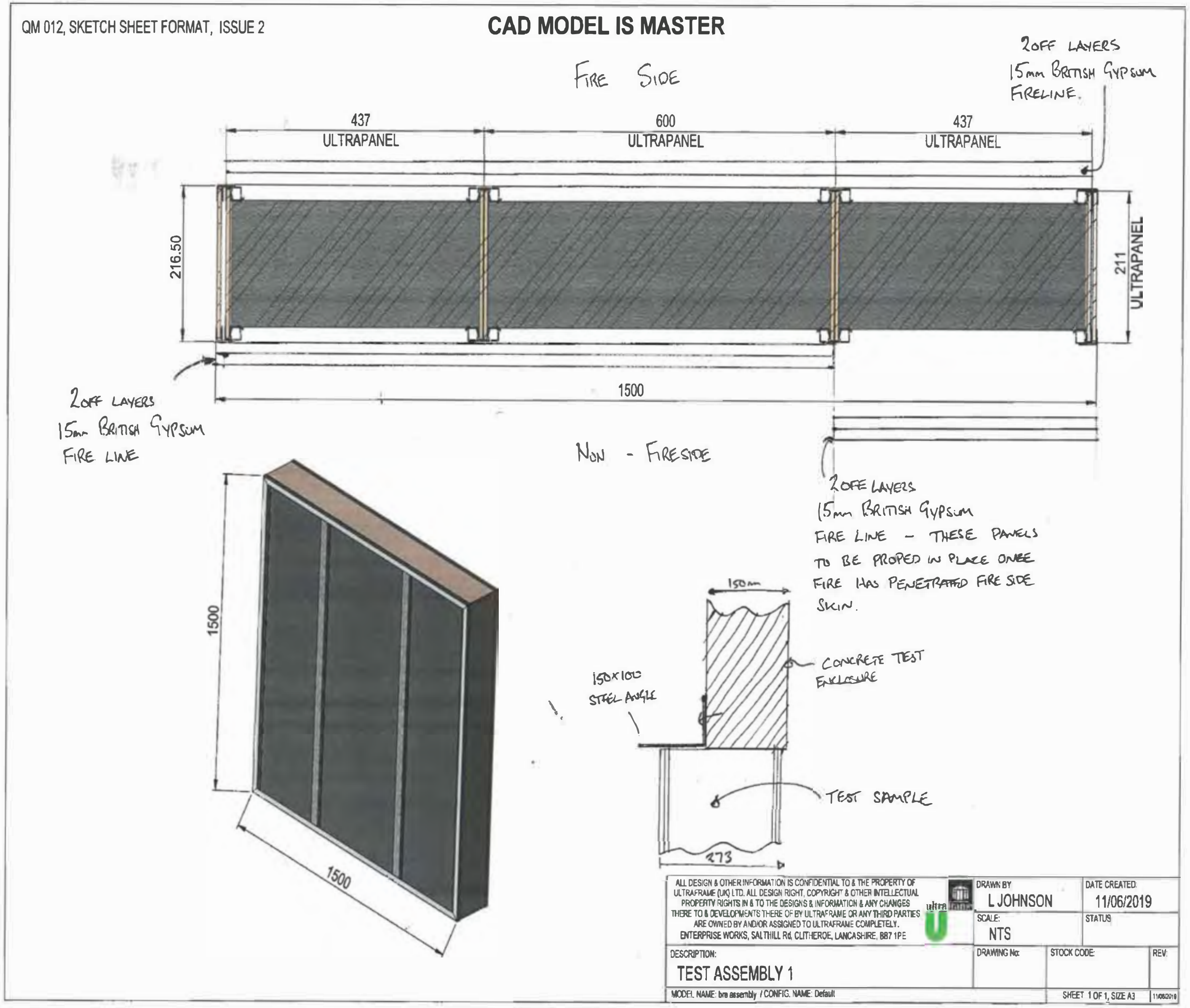
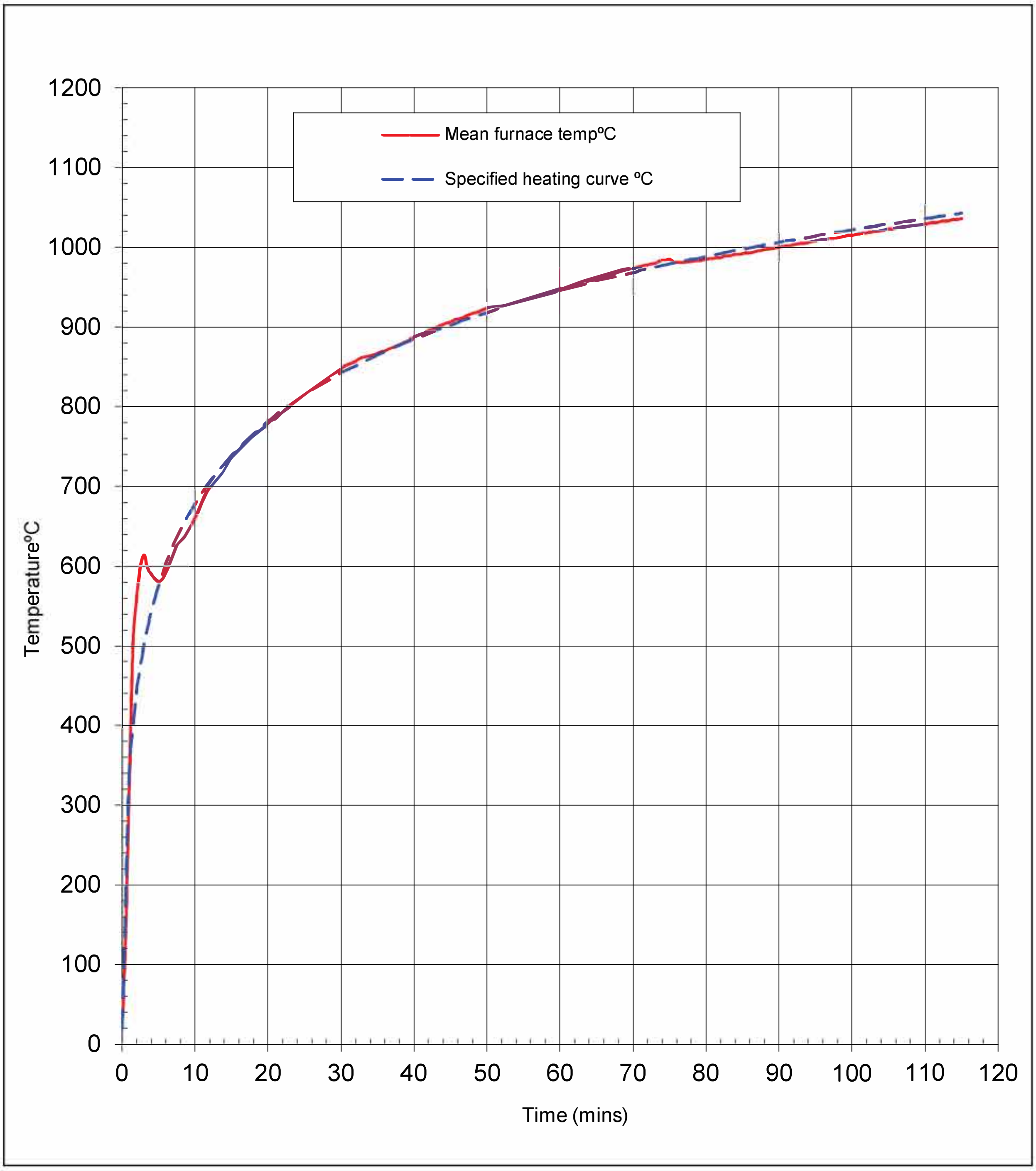
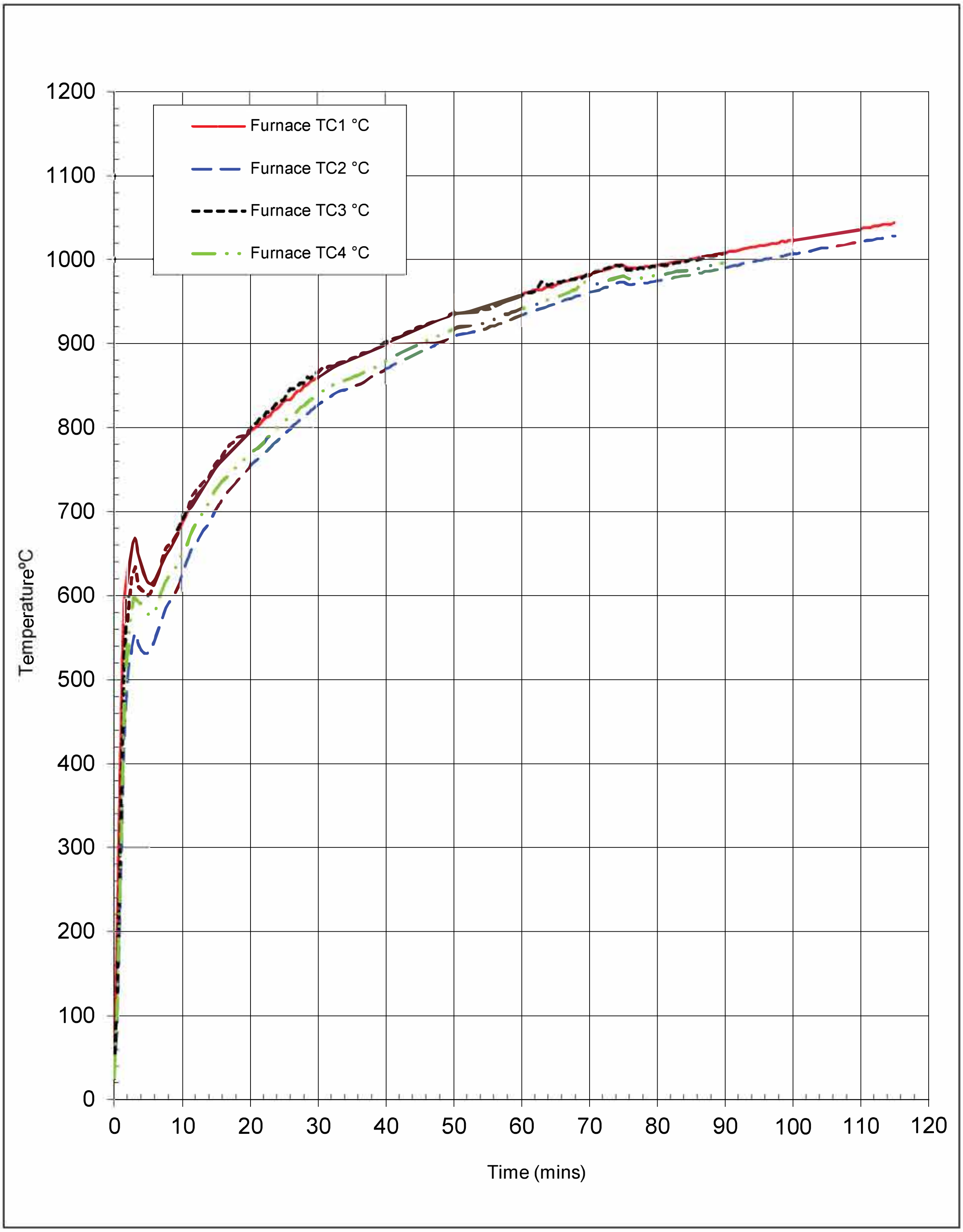


Figure 1: Construction details of 1.5m Indicative wall panel – as supplied by the sponsor.

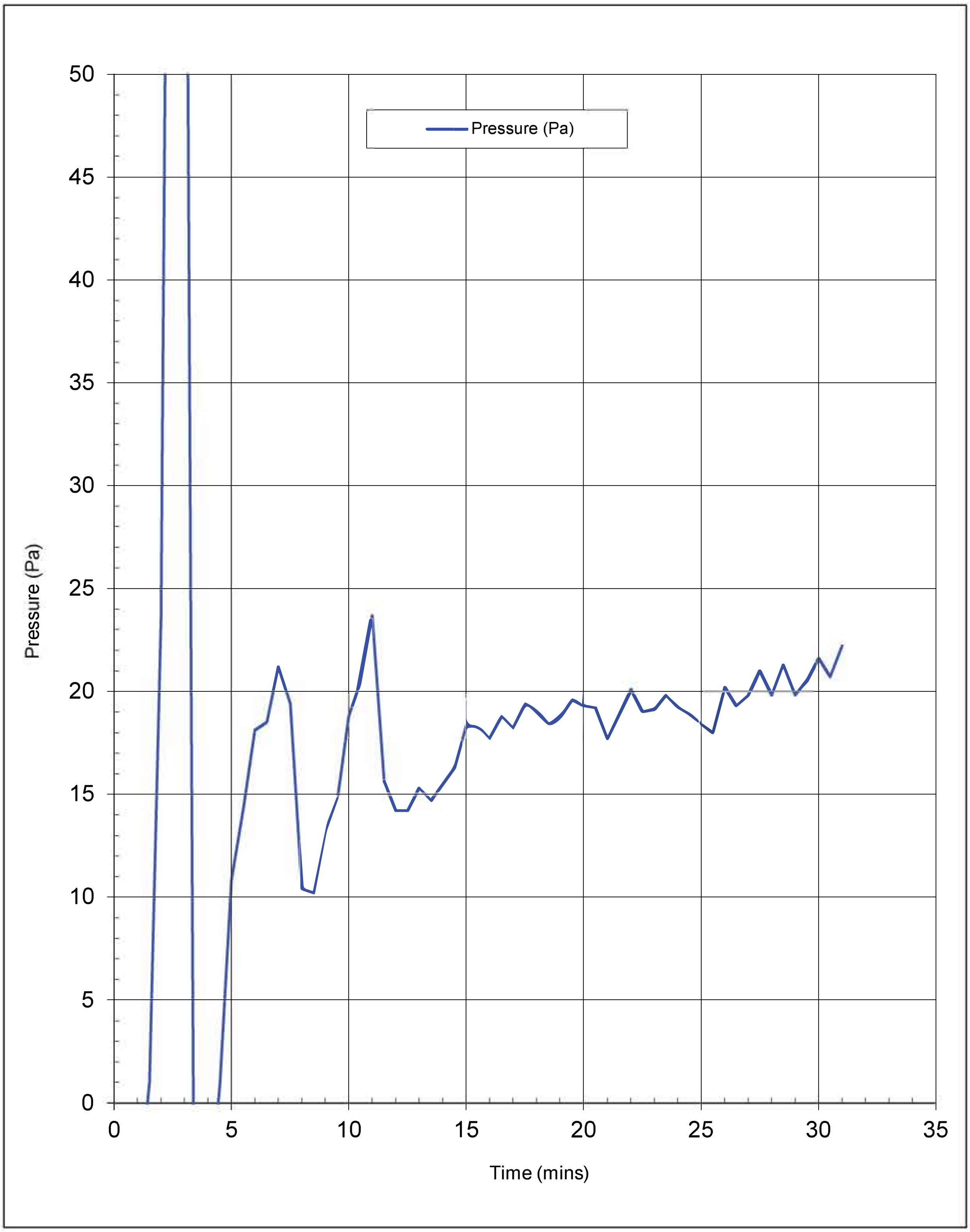
4 Graphs



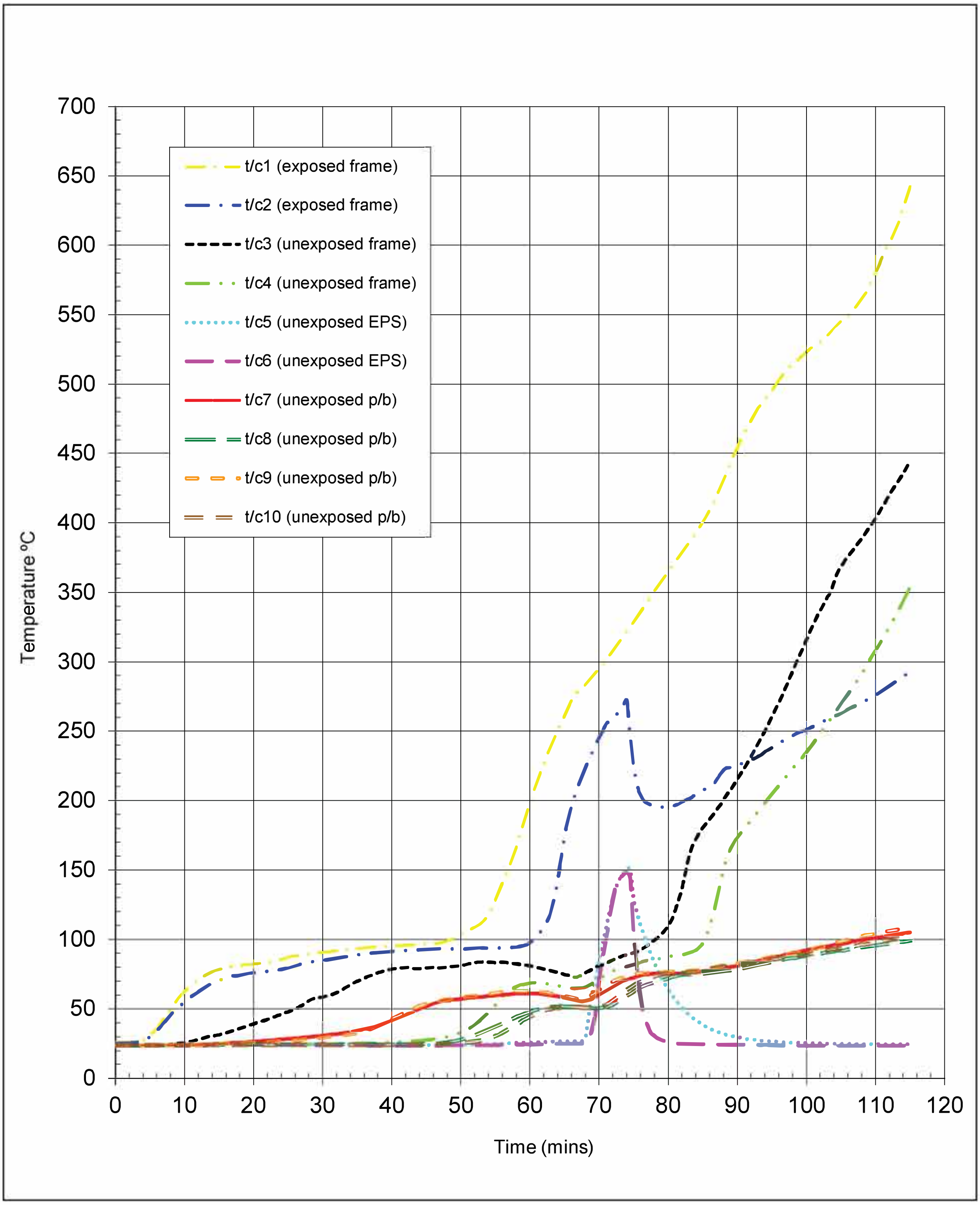
Graph 1: Specified furnace curve and the mean furnace temperature recorded by the 4 furnace thermocouples.



Graph 2: Temperature recorded by each individual furnace thermocouple.

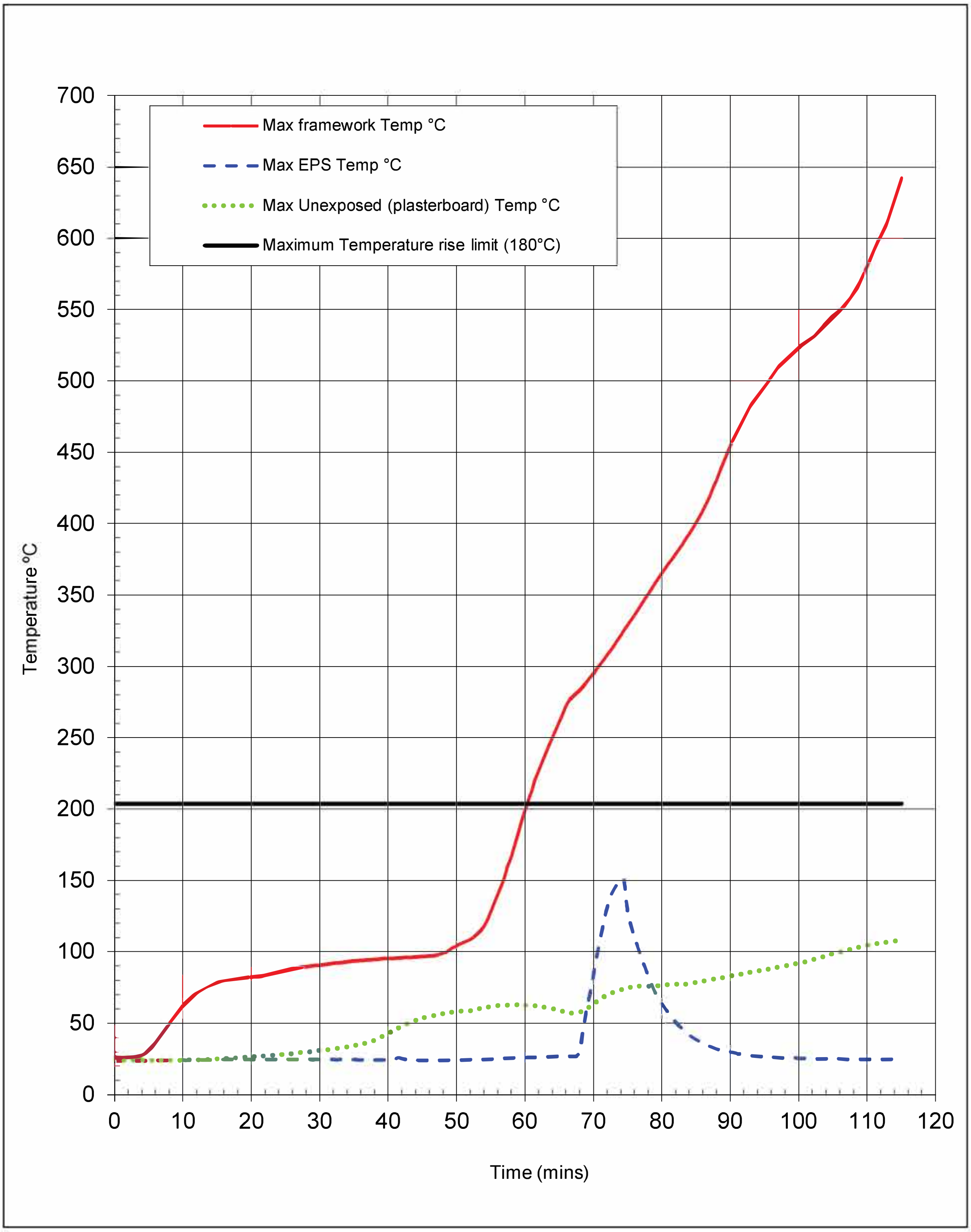


Graph 3: Pressure maintained in the furnace.



Graph 4: Temperatures recorded by all the thermocouples attached to the specimen.

Note: Thermocouples 1 - 4 were attached to the framework of EPS panel.



Graph 5: Maximum temperatures recorded on the test specimen with maximum, (180°C) temperature rise limit for unexposed face plasterboard included for comparison.

5 Photographs

Photographs 1 & 2: Ultrapanel profiles

Photograph 3: Installation of Ultrapanel wall test specimen (unexposed face view).

Photograph 4: Exposed face of view of Ultrapanel wall – showing installation locations of thermocouples 1 & 2.

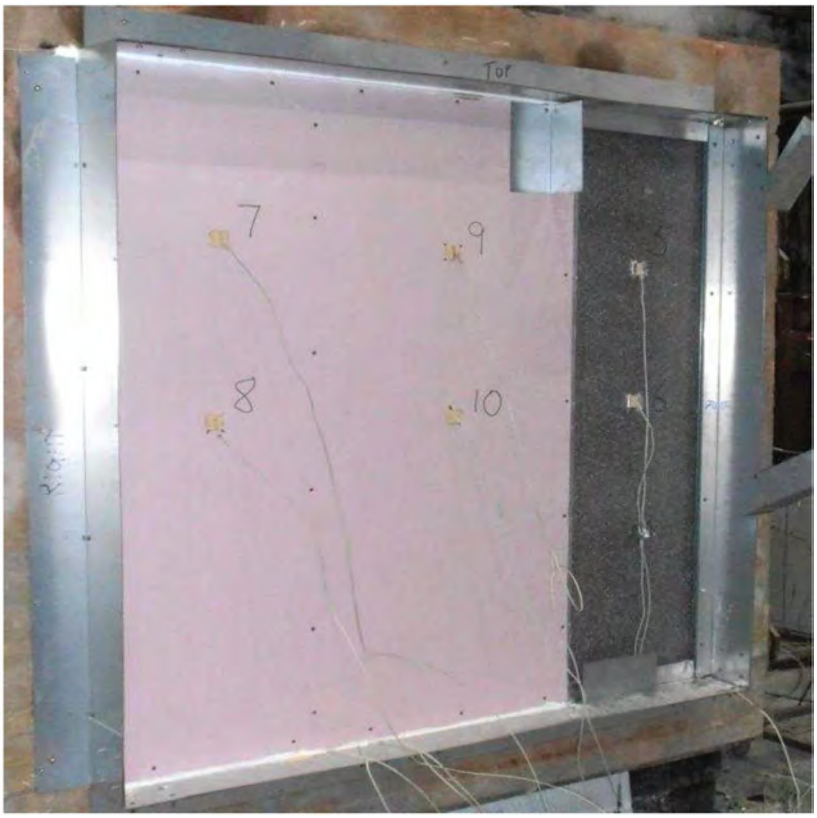
Photograph 5: Unexposed face of view of Ultrapanel wall – showing installation locations of thermocouples 3 & 4.

Photograph 6: Exposed face of Ultrapanel wall– during installation of 1st (inner) layer of plasterboard.

Photograph 7: Exposed face of Ultrapanel wall - after installation of 2nd (outer) layer of plasterboard and prior to the start of the test.

APPENDIX 9.1

Photograph 8: Unexposed face of Ultrapanel wall – before the start of the test (with location of thermocouples 5 – 10 shown attached to the specimen).



Photograph 9: Unexposed face of Ultrapanel wall – 50 minutes after the start of the test.

Photograph 10: Unexposed face of Ultrapanel wall – 62 minutes after the start of the test.

Photograph 11: Unexposed face of Ultrapanel wall – 66 minutes after the start of the test.

Photograph 12: Unexposed face of Ultrapanel wall – 69 minutes after the start of the test.

Photograph 13: Unexposed face of Ultrapanel wall – 90 minutes after the start of the test.

Photograph 14: Unexposed face of Ultrapanel wall – 115 minutes after the start of the test (immediately prior to test termination).

Photograph 15: View of internal wall cavity after test – from the unexposed face.

Photograph 16: Exposed face view of Ultrapanel wall - after test.

Report Ends

APPENDIX 9.2

Fire Test BRE 18 June 2019.

Project Number P1115505 – 1000

Indicative fire test to 1.5m x 1.5m Wall to EN1363-1 : 2012

Introduction

Aim of the test was to establish whether a typical wall section using the Ultrapanel system would remain intact for a minimum of 30 minutes as required when used as part of the construction of a wall. The test sample was split into two to establish the performance when the wall is enclosed completely both sides and where one side is left exposed.

Sample specification

A cross section through the wall assembly can be see in figure 1.

The 1.5 wide section of wall was divided into 3 panels. The centre one 600mm wide the outer two 437mm wide.

Wall structure is the standard 213mm Ultrapanel with 175mm Stylite-Plustherm 70 EPS insulation.

The perimeter of the wall uses an Aluminium F – section fixed to the test frame with 6mm concrete screws at 600mm ctrs.

The wall was fixed the perimeter frame using 4.2*25mm wafer head self drilling screws.

On the fire side there was 1 layers of Fermacell 15mm. This was fixed using 3.9 * 30mm fermacell drill tipped screws 150mm ctrs. The edge of the board was pointed into the test frame using Dowsil 400 Firestop.

On the non-fire side the first two panels were covered with Fermacell 15mm board fixed using 3.9 * 30mm feermacell drill tipped screws at 150mm ctrs. The third panel was left uncovered.

Test Method

The sample was exposed to the heat in accordance with EN1363-1 : 2012. Thermocouples provided data of heat build-up. The thermocouples were placed as follow with two thermocouples in each location one half way up the panel and one ¾ of the way up the panel.

- Thermocouples 1,2 On the surface of the panel's steel rail directly behind the plasterboard on the fire side.
- Thermocouples 3,4 On the surface of the EPS of the enclosed panel on the non-fire side.
- Thermocouples 5,6 On the surface of the EPS of the exposed panel on the non-fire side.
- Thermocouples 7,8 On the surface of the plasterboard on the non-fire side.
- Thermocouples 9,10 On the surface of the plasterboard on the non-fire side.

Film was also taken during the test to record the condition of the wall.

APPENDIX 9.2

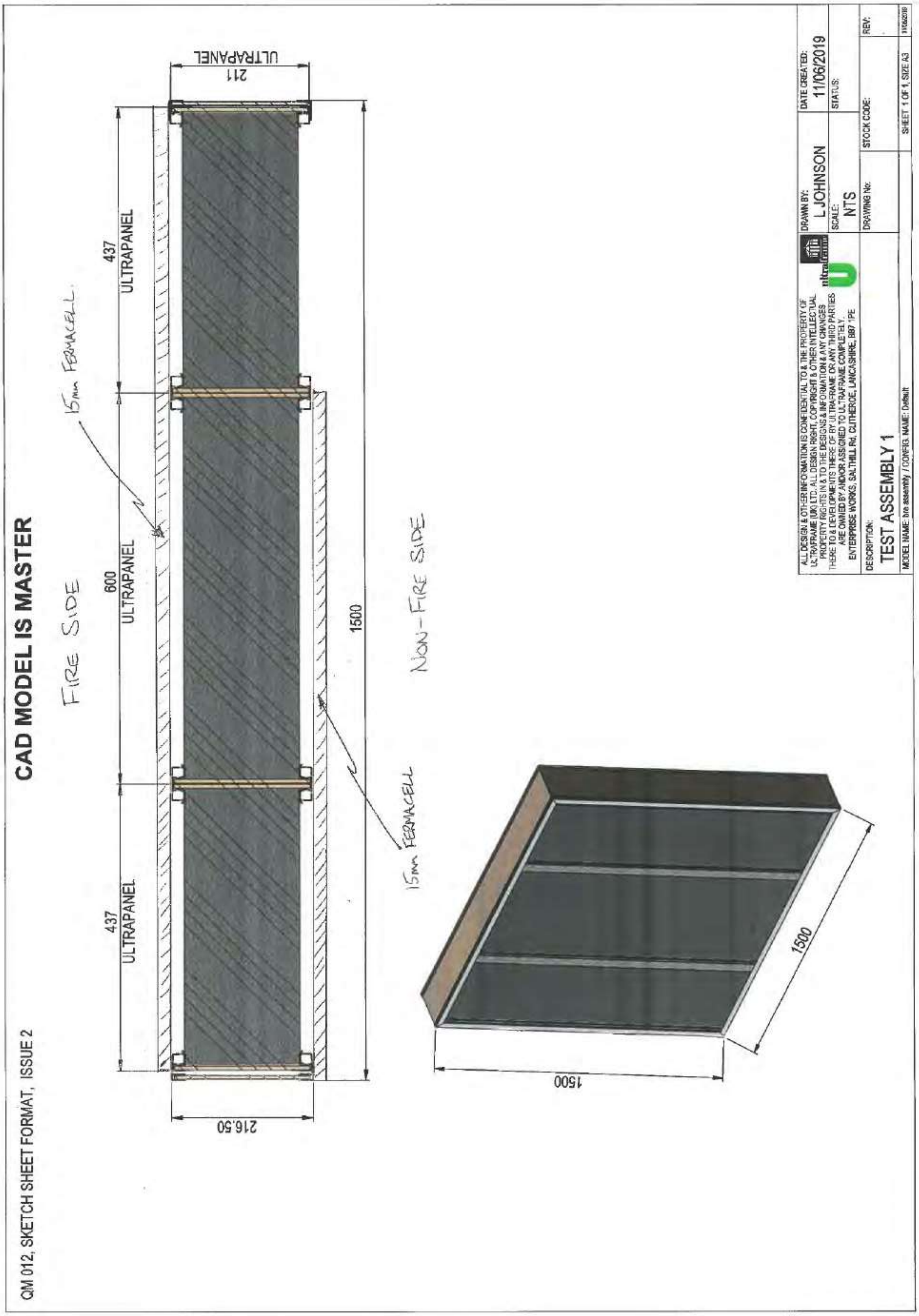


Figure 1

Results

P115505-1000

Ultraframe 1.5m

Observations

Observations made during the test are given in Table: *Observations* below. Unless otherwise stated they are of the non-fire face. Any references to left and right are as viewed from the non-fire face.

Table: Observations

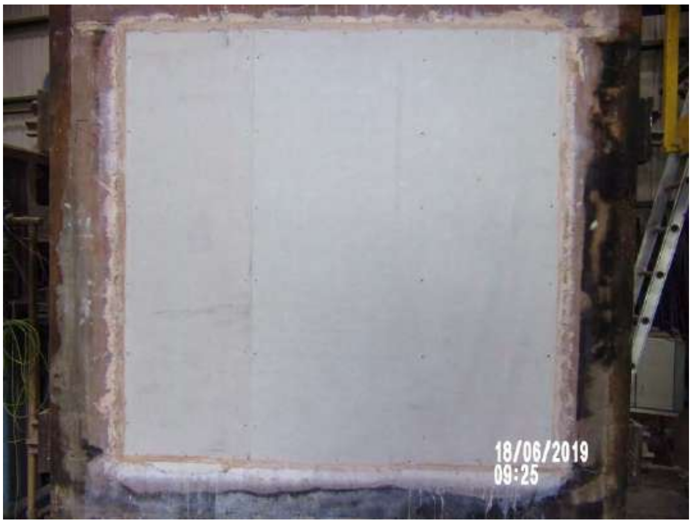
Time min	 s	Observation
0	00	Test started
5	00	Moisture vapour issuing from gap at right-hand side of board on non-fire face
16	00	Grey smoke included with the water vapour
17	00	No cracks present in boards on fire-side face
23	00	Volume of smoke issuing from gap at right-hand side of board on non-fire face increased
21	00	Some blue smoke included with the grey smoke
24	00	Horizontal crack developed across the wider fire-side face board at approx. 800mm above the base
25	00	Significant increase in volume of smoke
27	00	Polystyrene withdrew from the top edge by up to approx. 50mm. Horizontal crack developed across the narrower fire-side face board at approx. 500mm above the base
29	00	Polystyrene disintegrated over its full height.
30	15	Cotton-wool test pad ignited immediately on application to now-visible gap due to the disintegration of the polystyrene on the wall portion unboarded on the non-fire face (**integrity failure**)
30	40	A pre-made closure plate was fitted into position over the unboarded right-hand portion of the panel
32	00	Gap, 5mm wide, developed in board over narrower fire-side face
38	00	Sustantial volume of grey smoke issuing from perimeter of wall
38	00	Flames issuing from top edge of wall
45	00	Gap, approx. 100mm x 1.5m developed, through to the furnace along the top edge of the wall with substantial fierce flames issuing

Time		Observation
45	00	Test stopped.

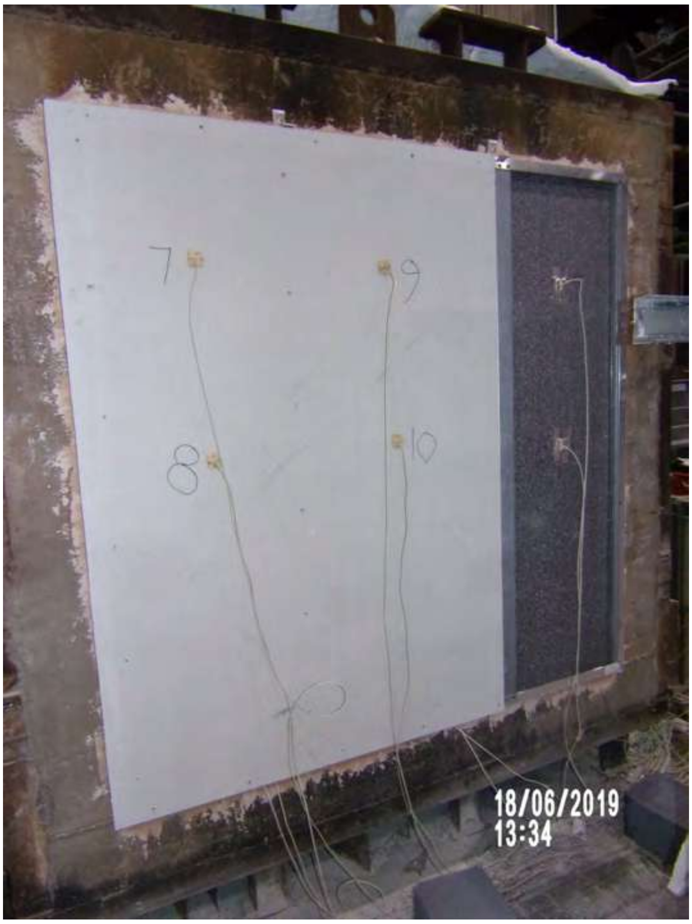
Integrity failure first occurred after 30min from the start of the test.

The construction after test is shown in Photos.

Condition of the wall before test



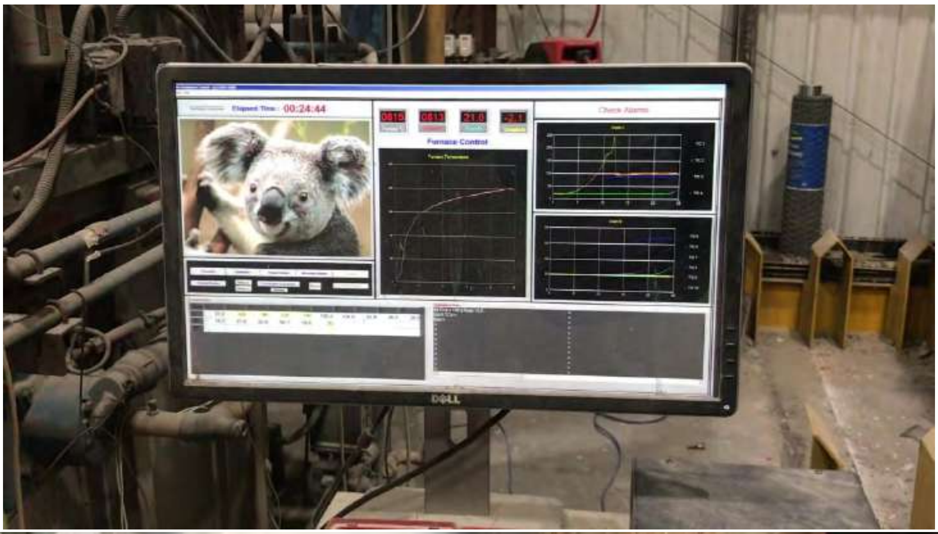
Panel mounted in test frame fire side



Panel mounted in test frame non-fire side

Side view of wall in the frame showing the wall side projecting beyond the test frame

After 24 Minutes 44sec

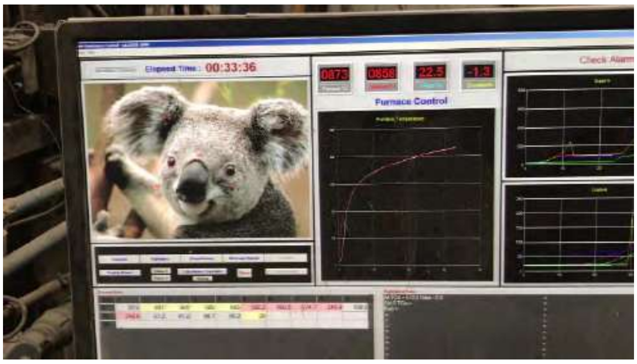


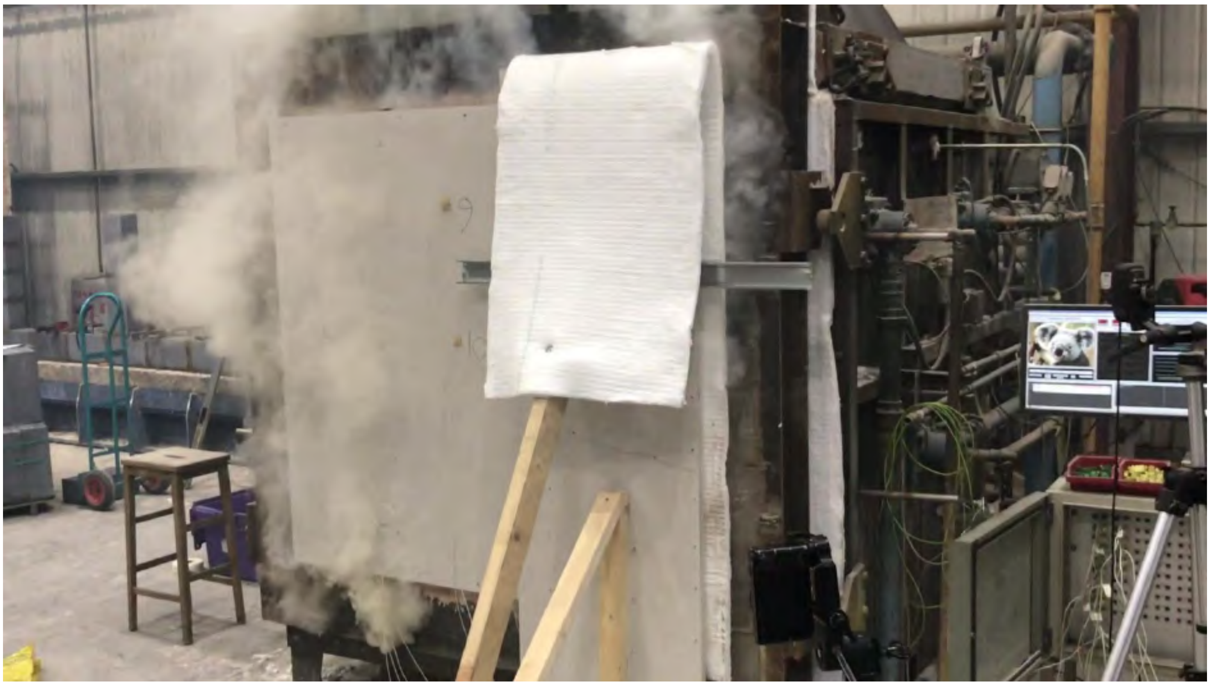
After 26 minute all of the EPS is intact but there is steam being emmitted

After 31 Minutes

Although the board failed after 30 minutes the supporting structure still has full integrity.

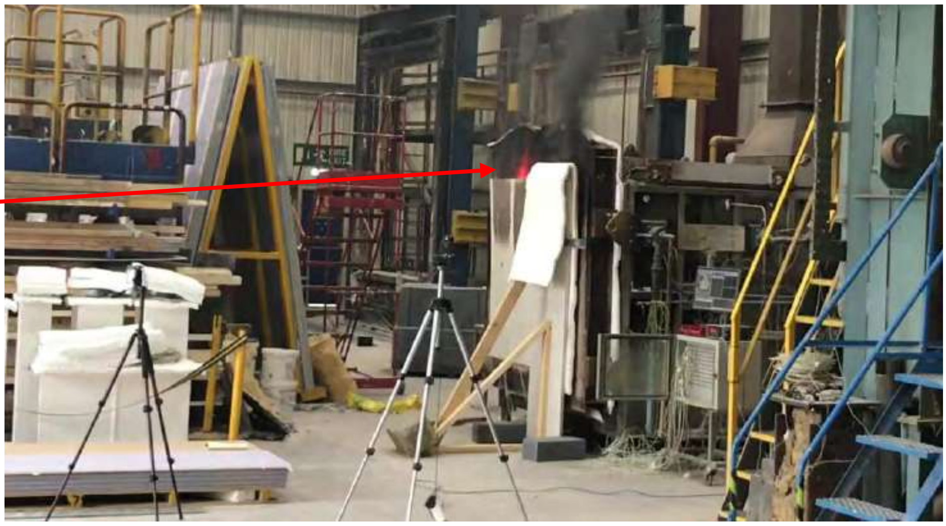
After 33 Minutes 36 sec





Once the fireside board had failed the panel was closed up to see how the whole wall performed.

There was a crack in the Fermacell board which cause failure after 30 minutes panel



Unfortunately as the test progressed fire managed to make its way around the edge of the panel

APPENDIX 9.2

Temperature Data Log

	Furn	Furn	Furn	T/C 1	T/C 2	T/C 3	T/C 4	T/C 5	T/C 6	T/C 7	T/C 8	T/C 9	T/C 10	TypeK	Actual mea	Specified c	Deviation	Top Limit	Low Limit	Max Hi 0	Rate Hi 0
20	20	21	21	19.6	19.6	20.3	20.1	20	19.8	20.3	20.1	20.2	20.1	20	20	20	0	15	-15	20.3	0
613	528	629	537	39.1	34.7	20.6	20.2	19.9	19.6	20.2	20.1	20.2	20	20	576	576	-21.12	15	-15	39.1	2.5
709	662	705	666	97.4	90.1	80.4	20.8	19.9	19.6	32.6	20.3	20.7	20.1	20	685	678	-7.8	15	-15	97.4	1.739998
757	718	760	720	99.7	95.3	87.9	21.2	19.9	19.6	59.1	20.5	21.8	19.9	20	738	739	-4.43	12.5	-12.5	99.7	0.519989
794	762	797	761	100.6	98.8	88.5	21.6	20.2	19.5	67.6	21.3	32.6	19.8	20	778	781	-3.21	10	-10	100.6	0.539993
832	799	837	800	135.3	106.1	83.2	58.2	20.9	19.7	67.5	34.3	57.3	19.8	20	817	815	-2.48	7.5	-7.5	135.3	7.12001
856	829	863	830	572.2	338.7	437.5	145.2	68.2	186.2	83	55.7	95.3	51.8	20	844	842	-1.89	5	-5	572.2	48.03995
902	887	906	897	610.5	376.2	388.9	251.1	100.6	267.9	97.8	88.3	105.4	93.7	20	898	865	-1.36	4.585	-4.585	610.5	6.300018
875	865	884	898	768	516.7	290.6	291.8	69	297	121.3	99.7	121.8	103.4	20	880	885	-0.82	4.17	-4.17	768	9.780029
945	922	967	971	811	769.9	302.9	379.6	48.5	369.4	248.6	119	230.2	126.2	20	951	902	-0.77	3.755	-3.755	811	-2.03998
945	914	958	990	816.9	787.7	302.8	378.3	47	398.2	272	121.2	256.2	128.4	20	951	904	-0.69	3.7135	-3.7135	816.9	20.67999

Conclusion

The test demonstrated that with the one layer of 15mm Fermacell there was no damage to the supporting structure after the target 30mins

Recommend a change to how the wall if fixed to the supporting test frame in future tests

Andrew Thomson

19 August 2019

Test Report No. 18905A

Sponsor

Ultraframe Ltd.
Salthill Road, Clitheroe BB7 1 PE
Lancashire
UK

Trade name of the roof covering

UltraRoof 380 Alternate Panel

Manufacturer of the roof covering

Ultraframe Ltd.
Salthill Road, Clitheroe BB7 1 PE
Lancashire
UK

Supplier of the roof covering

Ultraframe Ltd.
Salthill Road, Clitheroe BB7 1 PE
Lancashire
UK

Nature of the tests

Fire Tests on Building Materials and Structures – Classification and method of test for External Fire Exposure to Roofs, according to BS 476 - Part 3 (2004).

PREPARED BY	APPROVED BY
Steven Van Renterghem (Signature) Project assistent Ghent 2018.07.31 15:20:22 +02'00'	Bart Sette (Signature) General Manager Gent 2018.07.31 18:42:30 +02'00'

This report consists of 11 pages including 2 annexes

This document is the original version of this test report and is written in English.

This report may be used only literally and completely for publications. - For publications of certain texts, in which this report is mentioned, our permission must be obtained in advance.
The authenticity of the electronic signatures is assured by Belgium Root CA.

1. DATA CONCERNING THE TEST SPECIMENS

Type of specimen: Covering and sealing systems including any insulating layers or vapour barriers.

The firm Ultraframe Ltd., Salthill Road, Clitheroe BB7 1 PE, Lancashire, UK has provided the laboratory, on 25/01/2018, with 5 mounted roof specimens. These roof specimens were prepared conform to the prescriptions of the above-mentioned standard. The laboratory did not supervise the specimen fabrication. Reason build-up samples at sponsor: practical reasons.

Sampling by	:	ULTRAFRAME LTD (Neil Bailey)
Sampling date	:	18/01/2018
Sample ID	:	ULTRAROOF 380 test samples
Production place	:	ULTRAFRAME LTD
Production line	:	ULTRAFRAME LTD
Production date	:	18/01/2018
Identification within the quality system	:	None

2. DESCRIPTION OF THE TEST ROOF DECK

This description is based on information given by the sponsor.

	Nominal value	Measured value
SYSTEM AS SUCH		
Description	The tested overall composite is named "UltraRoof 380 Alternate Panel" and has a total thickness of 270 mm and a surface weight of 33 kg/m². The assembly consists of Polypropylene tile (layer A) screwed onto a polypropylene breather membrane (layer B), an OSB board (layer C), galvanized mild steel strip coil (layer D and F), oil tempered hardboard and EPS (layer E) and a 12,5 mm plasterboard (layer G). The different layers are adhered and fixed by different metal clips, as shown in the schematic below. The edges of the specimen are protected by a wooden OSB Board. The different layers are described below.	

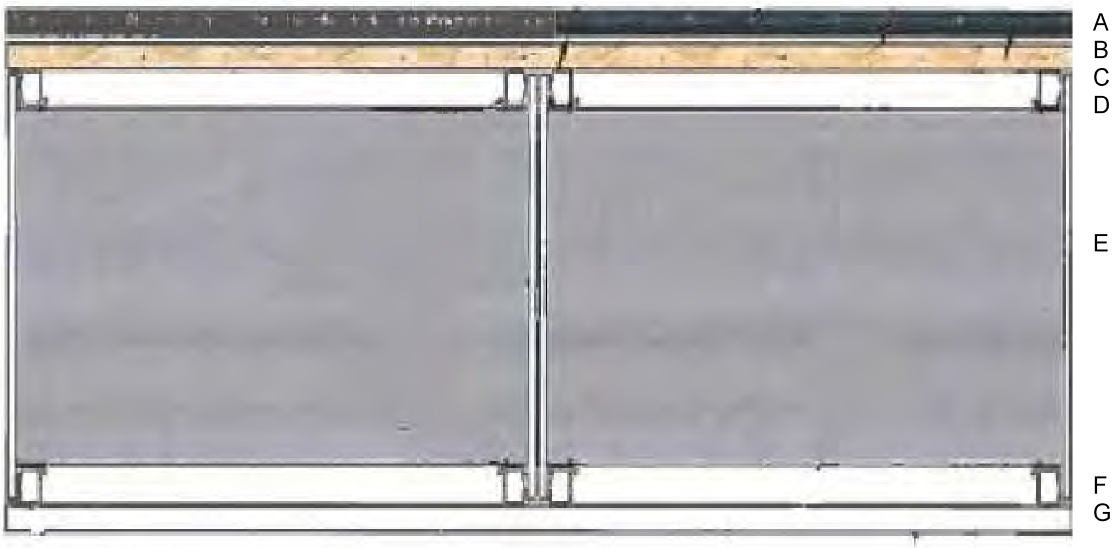


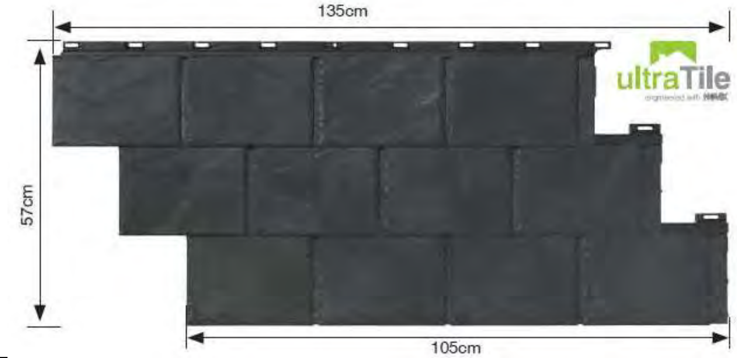
Figure 1: Scheme of the tested configurations. The configuration has 7 different layers which are described below.

	Nominal value	Measured value
LAYER G: SUPPORTING DECK		
Material	12,5 mm foil backed plasterboard. The board is backed with a vapour control membrane and the gypsum is bonded to strong paper liners and backed with an additional metalised polyester film.	
Thickness (mm)	12,5	(2)
Density (kg/m³)	640	(2)
Surface weight (g/m²) facing	Not communicated by the supplier	(2)
Surface weight (g/m²) backing	Not communicated by the supplier	(2)
Flame retardants	No	(1)
Reaction to fire according to EN 13501-1	B-s1,d0	

(1) Not verifiable (2) Not verified due to a lack of reference material

	Nominal value	Measured value
LAYER D AND F: STEEL RAIL		
Product reference	Galvanised mild steel stripcoil	
Trade name	DX51D + Z275 S275	
Thickness (mm)	0,7	(2)
Density (kg/m³)	7750	(2)
Fixing method	Screwed	
LAYER E: EPS AND HARDBOARD		
Material	EPS insulation layer with in the middle a double oil hardboard	
EPS layer		
Material	Expanded Polystyrene without facing/backing	
Manufacturer	Various	
Supplier	Ultraframe Ltd.	
Trade name	PLUSTHERM 70	
Colour	Grey	
Thickness (mm)	176	(2)
Density (kg/m³) of the core material	16	(2)
Flame retardants	No	(1)
Fixing method	Mechanically held	
Reaction to fire according to EN 13501-1	Not communicated by the supplier	
Double oil hardboard		
Material	Double oil tempered hardboard placed in the middle of the specimen	
Manufacturer	Various	
Supplier	Ultraframe Ltd.	
Trade name	OIL TEMPERED HARDBOARD	
Thickness (mm)	6	(2)
Density (kg/m³) of the core material	1000	(2)
Flame retardants	No	(1)
Fixing method	Mechanically clinched	
Reaction to fire according to EN 13501-1	Not communicated by the supplier	
LAYER C: WOOD PARTICLE BOARD		
Material	Orientated strand board	
Manufacturer	Egger	
Supplier	Ultraframe Ltd.	
Thickness (mm)	11	(2)
Density (kg/m³)	600	(2)
Flame retardants	No	(1)
Fixing method	Mechanically fixed	
LAYER A AND B: ROOF COVERING		
1.1. First layer		
Material	Breather membrane, three layer, non-woven spunbonded polypropylene membrane	
Trade name	BREATHER MEMBRANE (specific membrane known by the laboratory)	
Supplier	Ultraframe Ltd.	
Reinforcement	None	
Thickness (mm)	0,6	(2)
Surface weight (g/m²)	165	(2)
Flame retardants	No	(1)
Fixing method	Stapled	

(1) Not verifiable (2) Not verified due to a lack of reference material

	Nominal value	Measured value
1.2. Top layer		
Material	Injection moulded Polypropylene interlocking roof tile	
Trade name	Ultratile	
Manufacturer	Novik	
Supplier	Ultraframe Ltd.	
Colour	Carbon grey	
Overall thickness (mm)	2	(2)
Overall Surface weight (g/m²)	4000	(2)
Flame retardants	Yes	(1)
Detail of a tile		
Fixing method	Mechanically fixed every ± 15 cm	

(1) Not verifiable (2) Not verified due to a lack of reference material

Position of the specimen:

The specimens were tested in the pitched position (45°).

Conditioning, according to EN 13238, § 4.2 to constant mass.

Start of conditioning : 25/01/2018

End of conditioning : 15/02/2018

3. TEST RESULTS AND OBSERVATIONS

a) Calibration

Calibration date: 15/02/2018

FOR THE SPREAD OF FLAME TEST WITH BURNING BRANDS AND SUPPLEMENTARY RADIANT HEAT (STAGE 2)

Burner No:	1	2	3	4
Heatflux (kW/m²)	8,0	7,9	3,6	3,5
Criterium (kW/m²)	8,5±1,0	8,5±1,0	3,5±1,0	3,5±1,0

FOR THE PENETRATION TEST WITH BURNING BRANDS, WIND AND SUPPLEMENTARY RADIANT HEAT (STAGE 3)

Burner No:	1	2	3	4
Heatflux (kW/m²)	12,7	13,0	12,0	12,5
Criterium (kW/m²)	12±1,5	12±1,5	12±1,5	12±1,5

b) Test results

Test date: 15/02/2018

Room temperature at start of tests (°C): 20

Roof pitch: 45°

PRELIMINARY IGNITION TEST WITH BURNING BRANDS (STAGE 1)

Specimen No:	1	Criteria
Duration of flaming after withdrawal of the test flame (min:sec)	0:00	< 5min
Maximum flame spread distance (mm)	90	< 380mm
Time to fire penetration (min:sec)	Did not penetrate	No penetration
Nature of the penetration	N.a.	-

SPREAD OF FLAME TEST WITH BURNING BRANDS AND SUPPLEMENTARY RADIANT HEAT (STAGE 2)

Specimen No:	2	3	4	Average	Criteria
Maximum downwards flame spread distance (mm)	840	(*)	(*)	840	≤ 533mm
Duration of flaming after withdrawal of the test flame (min:sec)	45:32	(*)	(*)	(*)	-
Additional observations: carbonization and melting Marked variability between the specimen: None					

PENETRATION TEST WITH BURNING BRANDS, WIND AND SUPPLEMENTARY RADIANT HEAT (STAGE 3)

Specimen No:	5	6	7	Average	Criteria
Time to fire penetration (min:sec)	Did not penetrate	Did not penetrate	Did not penetrate	Did not penetrate	30min or 60min
Nature of the penetration	N.a.	N.a.	N.a.	-	-
Additional observations: carbonization and melting Marked variability between the specimen: None					

(-) not applicable - not detected

(*) In report 18600H an official test has been performed onto a similar build-up (main difference between the build-ups is the presence of wooden battens in 18600H). During the stage 2 tests (in 18600H) a spread of flame of 840 mm has been reached for all 3 samples. Based on these results and PD 476-3:2012, only one test according to stage 2 of BS 476 has been performed instead of standard 3 tests. As the spread of flame is 840 mm (maximum observable flame spread) as well, no change in classification has been observed.

Photo of the test specimen before and after the test: annex 1.

4. CLASSIFICATION AND DIRECT FIELD OF APPLICATION RESULTS

a) Classification

The test results relate only to the behaviour of the product under the particular conditions of the test. These results are not intended to be the sole criterion for assessing the potential fire hazard of the material in use.

The test results are only valid for the specimens of the product as they have been tested.

Small differences in the composition or thickness of the specimen may significantly affect the performance during the test and may therefore invalidate the test results.

In order to obtain test results which are representative for the product which is supplied or used, the conformity between the test specimen and the product should be assured. This is the role of the manufacturer and/or the supplier.

The system '**Ultraroof 380 Alternate Panel**', as described in § 2 and under the conditions of the test **is classified in class EXT.S.A.C**, according to the British Standard BS 476 - Part 3 – 2004, clause 4 (see Annex 2).

b) Roof pitch

The roof as described has been tested with a roof pitch of 45°.

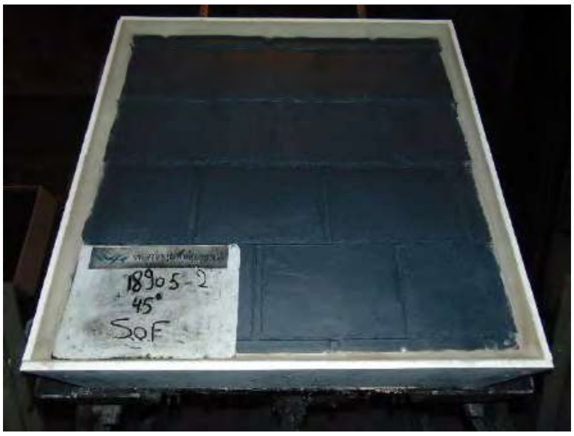
The test results apply to roofs with a pitch of > 10°, as defined in § 4.10.1 of the standard.

<u>Photo of the test specimen before and after the test</u>

Specimen 1: Before

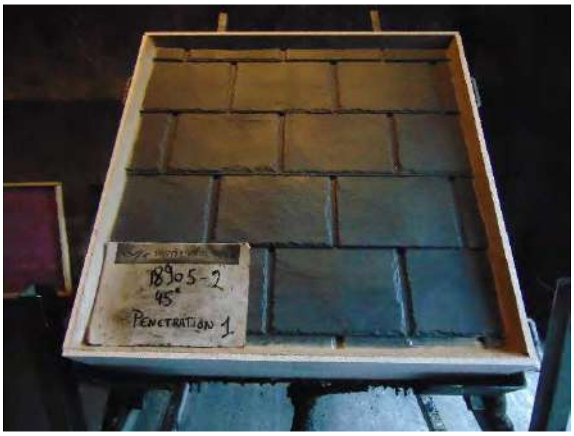
After

Specimen 2: Before



After

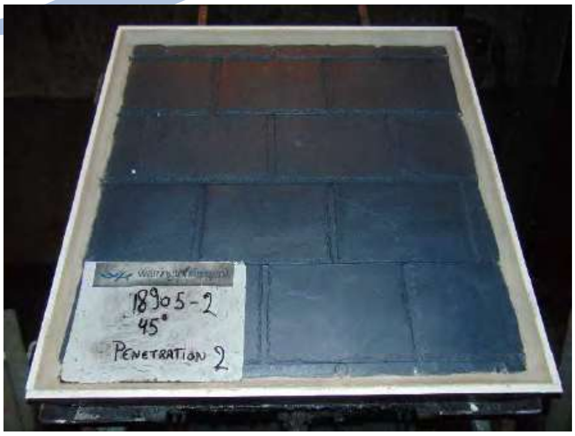
Specimen 5: Before



After

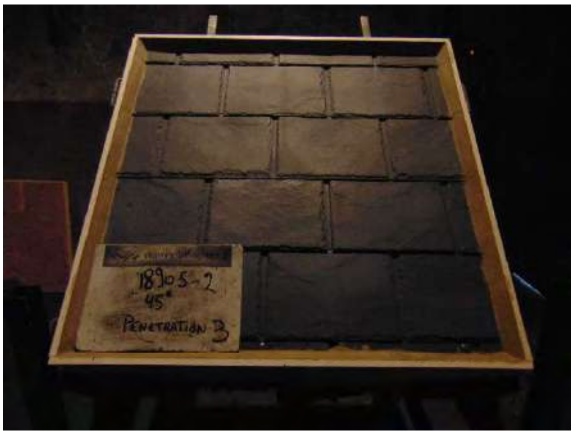
Photo of the test specimen before and after the test

Specimen 6: Before



After

Specimen 7: Before



After

Classification Of Specimens

The following is reproduced from Clause 4 of BS 476: Part 3: 2004.

4 Classification

4.1 *Roof system*

Roof systems shall be designated by the letters EXT.F or EXT.S to indicate whether the test results apply to a flat (horizontal) or an inclined roof system, respectively

4.2 Fire Resistance of roof system

4.2.1 *Coding system*

Roof systems subject to conditions of external fire shall be classified according to both the time of penetration and the distance of spread of flame along their external surface.

Each category designation shall consist of two letters, e.g. AA, AC, BB, these being determined as specified in 4.22 and 4.23

4.2.2 *Fire penetration (first letter)*

A. Those specimens that have not been penetrated within one hour
B. Those specimens that are penetrated in not less than 30 min.
C. Those specimens that are penetrated in less than 30 min.
D. Those specimens that are penetrated in the preliminary flame test

4.2.3 *Spread of flame (second letter)*

A. Those specimens on which there is no spread of flame
B. Those specimens on which the spread of flame is less than or equal to 533mm, with averaged results rounded up or down to the whole number, as normally practised
C. Those specimens on which the spread of flame is greater than 533mm, with averaged results rounded up or down to the whole number, as normally practised
D. Those specimens that continue to burn for five minutes after withdrawal of the test flame or spread more than 381mm across the region of burning in the preliminary test.

4.2.4 *Suffix "X"*

Attention shall be drawn to dripping from the underside of the specimen, any mechanical failure, and any development of holes, by adding a suffix "X" to the designation to denote that one or more of these took place during the test.

EXAMPLE 1 EXT.F.AA is a flat roofing system with one hour fire penetration resistance on which there was no spread of flame.

EXAMPLE 2 EXT.S.CCX is an inclined roofing system with less than 30 min fire penetration resistance, on which the spread of flame exceeded 533mm and further deterioration took place.

Title:
Classification report of a wall exposed to fire on one of its faces according to the European Standard EN 13501-2:2016 "Fire classification of construction products and building elements. Part 2: Classification using data from fire resistance tests, excluding ventilation services".

ENSAYOS
Nº 9/LE895

Classified sample:

- A wall with reference Ultrapanel 60 min supplied by Ultraframe; (reference provided by the sponsor).

File number: 19/20720-2153-1

Petitioner
ULTRAFRAME (UK) LTD
ENTERPRISE WORKS, SALTHILL ROAD
BB7 1PE CLITHEROE (UK)

Report Date:
February 14th 2020

Tested on:
November 4th 2019

This document consists of 4 pages.

LGAI Technological Center S.A. Inscrita en el registro Mercantil de Barcelona, Tomo 35.803, Folio1, Hoja Nº B-266.627 Inscripción 1ª C.I.F. : A-63207492

1. - INTRODUCTION

This Fire Resistance Classification report defines the classification of a wall of 3000 x 3000 mm (width x height) with reference:

Reference Laboratory	Reference provided by the sponsor
19/2153-A	Ultrapanel 60 min

2. - DETAILS OF THE CLASSIFIED ELEMENT

2.1. - Type of function

The tested element is defined as a loadbearing division. Its function is to withstand loadbearing capacity, integrity and thermal insulation criteria in accordance with clause 5 of the Standard EN 13501-2:2016.

2.2. - Description

A full description of the tested element is indicated in the test report in which is based the classification indicated in paragraph 5 of this current report.

3. - TEST REPORT

The current classification report is based on the following test report:

File number: 19/20720-2153
Issued on: 14th of February, 2020
Test carried on: 4th November, 2019

4. - TEST RESULTS

4.1. - Test Standard:

EN 1365-1:2012/AC 2013: Fire resistance tests for loadbearing elements-Part 1: Walls.

This standard corresponds to the current version on test date. Results obtained in this test are the ones used in this classification report.

4.2. - Exposure conditions

Temperature/time curve	$T = 345 \log_{10} (8t + 1) + 20$
Exposure conditions	Two layers of gypsum plasterboards with ref. Gyproc FireLine by British Gypsum of 15 mm thick.
Number of exposed sides	1
Applied load	35 KN/lineal metre.
Support conditions	Both vertical edges free. Sample fixed by the bottom edge to the support frame.

4.3. - Result table

	Failure minute	Reason
Integrity	-	It is maintained throughout the entire test, 62 minutes.
Thermal insulation	-	It is maintained throughout the entire test, 62 minutes.
Loadbearing capacity	-	It is maintained throughout the entire test, 62 minutes.

5. - CLASSIFICATION

In accordance with paragraph 7.3.2 of EN 13501-2:2016 classification of classified element is:

A wall with reference Ultrapanel 60 min	REI 60

The decision rule taken to give declaration of conformity with the specification or standard consists in meeting the requirements when the result of the measurement does not exceed the specification limit.

6. - FIELD OF DIRECT APPLICATION (in accordance with paragraph 13 of Standard EN 1365-1:2012/AC 2013).

The results of the fire test and the obtained classification of the tested element are directly applicable to similar constructions where one or more of the changes listed below are made and the construction continues to comply with the appropriate design code for its stiffness and stability:

Feature	Tested sample *	Allowed modification
Height	- 3000 mm.	- Decrease is allowed.
Thickness	- 247 mm.	- Increase is allowed.
Thickness of component material	- Two layers of gypsum plasterboards with ref. Gyproc FireLine by British Gypsum of 15 mm thick. - Ultrapanel is composed by: • Expanded polystyrene board with reference Stylite Plustherm Flooring Insulation by SPI of 174 mm thick. • Hard fibreboard with ref. LION Oil Tempered™ by Suomen Kuitulevy Oy of 207 mm width and 6 mm thick.	- Increase is allowed.

Panel/boards dimensions	- See test report*.	- Decrease dimensions of panels but not thickness.
Stud spacing	- Not applicable.	- Not applicable.
Distance of fixing centres	- See test report*	- Decrease in distance of fixing centres.
Horizontal joints	- Tested with horizontal joints from at 600 mm from the top and bottom edge on the exposed side to fire (see test report nº19/20720-2153)	- Increase in the number of horizontal joints.
Load applied	- 35 KN/linear metre.	- Decrease is allowed.
Width	- 3000 mm.	- Increase is allowed.

* The reference values of the tested sample not indicated in this section are described in section 3 "Tested sample" of the File Number. 19/20720-2153.

The modifications allowed in the field of direct application are based on data provided by the sponsor. LGAI Technological Center S.A. is not responsible for this documentation and/or information.

The validity period is stated in the product's certification system.

This document does not represent any approval or certification of the product.

Fire Resistance Testing Technician
LGAI Technological Center, S.A.

Fire Laboratory Responsible
LGAI Technological Center, S.A.

The results of the tests carried out refer only and exclusively to the samples tested, and in the moment and under the conditions indicated herein.

LGAI is not responsible for the information supplied by the sponsor.

Title:
Classification report of a wall exposed to fire on one of its faces according to the European Standard EN 13501-2:2016 "Fire classification of construction products and building elements. Part 2: Classification using data from fire resistance tests, excluding ventilation services".

Classified sample:
- A wall with reference Ultrapanel 30 min supplied by Ultraframe; (reference provided by the sponsor).

File number: 19/21511-2680-1

Sponsor :
ULTRAFRAME (UK) LTD
ENTERPRISE WORKS, SALTHILL ROAD
BB7 1PE CLITHEROE (UK)

Report Date:
February 14th 2020

Tested on:
December 23th 2019

LGAI Technological Center S.A. Inscrita en el registro Mercantil de Barcelona, Tomo 35.803, Folio1, Hoja Nº B-266.627 Inscripción 1ª C.I.F. : A-63207492

1. - INTRODUCTION

This Fire Resistance Classification report defines the classification of a wall of 3000 x 3000 mm (width x height) with reference:

Reference Laboratory	Reference provided by the sponsor
19/2680-A	Ultrapanel 30 min

2. - DETAILS OF THE CLASSIFIED ELEMENT

2.1. - Type of function

The tested element is defined as a loadbearing division. Its function is to withstand loadbearing capacity, integrity and thermal insulation criteria in accordance with clause 5 of the Standard EN 13501-2:2016.

2.2. - Description

A full description of the tested element is indicated in the test report in which is based the classification indicated in paragraph 5 of this current report.

3. - TEST REPORT

The current classification report is based on the following test report:

File number: 19/21511-2680
Issued on:14th of February, 2020
Test carried on: 23th December, 2019

4. - TEST RESULTS

4.1. - Test Standard:

EN 1365-1:2012/AC 2013: Fire resistance tests for loadbearing elements-Part 1: Walls.

This standard corresponds to the current version on test date. Results obtained in this test are the ones used in this classification report.

4.2. - Exposure conditions

Temperature/time curve	$T = 345 \log_{10} (8t + 1) + 20$
Exposure conditions	One layer of plasterboards with ref. Gyproc WallBoard by British Gypsum of 15 mm thick.
Number of exposed sides	1
Applied load	35 KN/lineal metre.
Support conditions	Both vertical edges free. Sample fixed by the bottom edge to the support frame.

4.3. - Result table

	Failure minute	Reason
Integrity	31	Sustained flame appears on zone B.
Thermal insulation	31	Integrity fails.
Loadbearing capacity	-	It is maintained throughout the entire test, 35 minutes.

5. - CLASSIFICATION

In accordance with paragraph 7.3.2 of EN 13501-2:2016 classification of classified element is:

A wall with reference Ultrapanel 30 min	REI 30

The decision rule taken to give declaration of conformity with the specification or standard consists in meeting the requirements when the result of the measurement does not exceed the specification limit.

6. – FIELD OF DIRECT APPLICATION (in accordance with paragraph 13 of Standard EN 1365-1:2012/AC 2013).

The results of the fire test and the obtained classification of the tested element are directly applicable to similar constructions where one or more of the changes listed below are made and the construction continues to comply with the appropriate design code for its stiffness and stability:

Feature	Tested sample *	Allowed modification
Height	- 3000 mm.	- Decrease is allowed.
Thickness	- 231 mm.	- Increase is allowed.
Thickness of component material	- One layer of plasterboards with ref. Gyproc WallBoard by British Gypsum of 15 mm thick. - Ultrapanel composed by: • Expanded polystyrene board with reference Stylite Plustherm Flooring Insulation by SPI of 174 mm thick. • Hard fibreboard with ref. LION Oil Tempered™ by Suomen Kuitulevy Oy of 207 mm width and 6 mm thick.	- Increase is allowed.

	- Spundbonded polypropylene membrane ref. Frameshield 100 by Protoc Group of 0.5 mm thick.	
Panel/boards dimensions	- See test report*.	- Decrease dimensions of panels but not thickness.
Stud spacing	- Not applicable.	- Not applicable.
Distance of fixing centres	- See test report*	- Decrease in distance of fixing centres.
Horizontal joints	- Tested with horizontal joints at 600 mm from the top and bottom edge on the exposed side to fire (see test report nº19/21511-2680).	- Increase in the number of horizontal joints.
Load applied	- 35 KN/linear metre.	- Decrease is allowed.
Width	- 3000 mm.	- Increase is allowed.

* The reference values of the tested sample not indicated in this section are described in section 3 "Tested sample" of the File Number. 19/21511-2680.

The modifications allowed in the field of direct application are based on data provided by the sponsor. LGAI Technological Center S.A. is not responsible for this documentation and/or information.

The validity period is stated in the product's certification system.

This document does not represent any approval or certification of the product.

Fire Resistance Testing Technician
LGAI Technological Center, S.A.

Fire Laboratory Responsible
LGAI Technological Center, S.A.

The results of the tests carried out refer only and exclusively to the samples tested, and in the moment and under the conditions indicated herein.

LGAI is not responsible for the information supplied by the sponsor.

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BRE Global Test Report

Fire resistance test report on a 3000mm x 3000mm loadbearing wall comprising of an Ultraframe Ultrapanel wall with the exposed face clad in two layers of 15mm thick Gyproc Fireline plasterboard tested in accordance with EN1365-1:2012.

Prepared for: **Ultraframe (UK) Ltd**

Date: **12 August 2020**

Report Number: **P115505-1003 Issue: 1**

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APPENDIX 9.

bre

Prepared by

Name Simon Lane

Position Senior Consultant

Date 12 August 2020

Signature

Authorised by

Name Tony Baker

Position Laboratory Manager

Date 12 August 2020

Signature

Table of Contents

Summary

An Ultraframe (UK) Ltd partition wall, nominally 3000mm x 3000mm, was submitted to a fire resistance test carried out in accordance with European Standard EN 1365-1:2012 (with reference to EN 1363-1:2012[2] and EN 1363-1:2020[3]) on 05 June 2020 at BRE Watford for a duration of 69 minutes The test was carried out with the wall under a total vertical load of 105kN (35kN/m) as prescribed by the sponsor.

With reference to EN 1363-1:2020[3], the main change in the standard (compared with EN 1363-1:2012[2]) is a redefinition for the load bearing capacity criterion.

The loadbearing capacity criterion for vertical elements remains unchanged.

The partition comprised of five Ultraframe Ultrapanels with the exposed face clad with two layers of 15mm thick Gyproc Fireline plasterboard.

The wall was found to achieve the following results:

Loadbearing capacity		69 minutes	
Integrity:	- sustained flaming:	69 minutes	(taken as time of loadbearing failure)
	- gap gauge:	69 minutes	(taken as time of loadbearing failure)
	- cotton pad:	69 minutes	(taken as time of loadbearing failure)
Insulation:		69 minutes	(taken as time of loadbearing failure)

1 Objective

A test was carried out in accordance with EN 1365-1:2012 to determine the fire resistance of an Ultraframe (UK) Ltd partition wall comprising of five Ultrapanels with the exposed face clad with two layers of 15mm thick Gyproc Fireline plasterboard.

2 Test construction

2.1 General

Assembly of the wall was completed on 02 June 2020. When finished it was installed into a furnace test frame by BRE as described in Test Arrangement.

The construction is shown in Figures and before the test in Photos.

The materials used to construct the wall specimen were supplied by the sponsor. BRE was not involved in the selection of the specimen in any way and the results relate only to the samples as received.

External and accessible components were dimensionally/visually verified by BRE Global to correspond to client supplied constructional data. Detailed constructional data relating to the specimen were not independently verified by BRE Global, the validity of the test results are conditional on the accuracy of that data.

Twenty-five K-type chromel/alumel thermocouples were fitted to the unexposed surface of the test specimen.

2.2 Components

2.2.1 Ultrapanels

Each panel comprised 75mm thick x 588mm wide x 3000mm long Plustherm insulation with a 6mm thick oil tempered hardboard attached along each long edge to give a finished width of 600mm to each panel. A profiled steel rail was attached to the oil tempered hardboards using rivets at 75mm spacing which in turn gripped into the Plustherm insulation using a barb. The purpose of this steel rail was to enable the friction fitting of the steel panel clips to join the individual panels together to form a continuous partition wall. The finished panel width was 113mm. The Ultrapanels are shown in Figures.

2.2.2 Plasterboard

15mm thick Gyproc Fireline plasterboard was supplied in sheets of 2400mm x 1200mm, with two layers on the exposed side of the test specimen with staggered joints as per drawings.

A representative sample of board was marked “F-EN520 Gypsum Plasterboard Gyproc Fireline 31 236 19:02:02 2400 x 1200 x 15 mm SE”.

2.2.3 Panel steel clips

The panels were joined together using profiled 0.70mm thick steel panel clips. The full panel clips were labelled “Ultraframe WPPC600/1” and the half panel clips were labelled “Ultraframe WPPC600/2”. The panel clips are shown in Figures.

2.2.4 Additional steel components

The top and bottom edges of the connected Ultrapanels panels were secured using a 50mm x 50mm x 0.9mm thick L shaped angle on both sides.

On the unexposed face a 100mm wide 0.9mm thick steel cross brace was used to strengthen the panels.

On the exposed face the horizontal plasterboard joints were backed in both layers by British Gypsum Gypframe backing straps labelled “LE12 6HX British Gypsum GFT1 2400mm Gypframe CE 13 EN14195 01008 08 19081 RF A1 YS 210Nm”.

2.2.5 Fixings

The plasterboard was fixed to the steel panel clips and top and bottom angles using 4Trade drywall screws with a black phosphate finish, 3.5mm x 25mm for the inner layer and 3.5mm x 42mm for the outer layer. For both the inner and outer layer horizontal plasterboard joints, the 3.5mm x 25mm drywall screws were used to fix into the Gypframe backing straps. The L shaped channels and crossbrace were fixed to the steel clips using Senco Duraspin 5.5mm x 19mm wafer head fixings labelled “55WS19MC”.

2.2.6 Joint filler

All the horizontal plasterboard joints in both plasterboard layers on the exposed face were filled with Dow Dowsil 400 firestop fire rated intumescent acrylic sealant.

2.3 Assembly

2.3.1 Ultrapanels

The five panels were joined together using the full panel clips for the middle three joints and the half panel clips were fitted along both outer edges. The clips were friction fitted over the steel rails along each Ultrapanel long edge to form a nominally 3000mm wide test specimen. The 50mm L shaped angles were then attached to the panel clips on both sides of the test specimen along the top and bottom with two of the Senco Duraspin 5.5mm x 19mm wafer head fixings at each intersection.

2.4 Exposed face

Two layers of 15mm thick Gyproc Fireline plasterboard were fixed to the steel panel clips and top and bottom angles and the Gypframe backing strap behind the horizontal joints on the exposed face of the assembled Ultrapanels using the 3.5mm x 25mm drywall screws on the inner layer at 300mm spacing on the edges and field of the boards and 3.5mm x 42mm for the outer layer at 150mm spacing on the edges and 300mm in the field of the boards. For both the inner and outer layer horizontal plasterboard joints, the 3.5mm x 25mm drywall screws were used to fix into the Gypframe backing straps at 150mm spacing.

All the horizontal plasterboard joints on the exposed face were filled with Dow Dowsil 400 firestop fire rated intumescent acrylic sealant.

The construction pattern of staggered joints was confirmed to match that shown in Figures.

2.5 Unexposed face

The Unexposed face was left uncovered with the Plustherm insulation within the Ultrapanels forming the unexposed face. The cross brace was then attached to the panel clips diagonally across the unexposed face using four Senco Duraspin 5.5mm x 19mm wafer head fixings at each intersection.

3 Conditioning

Representative samples of the 15mm thick Gyproc Fireline were taken during construction, weighed and then oven-dried in order to determine the free moisture content by weight loss technique. The free moisture content and weight is given in Table1: *Moisture content and weights*

Table 1: Moisture content and weights.

	Oven drying temperature	Moisture content % by dry weight	kg/m^2	Density
Gyproc Fireline 15mm	50ºC	0.57	12.88	839.52 kg/m^3

4 Test Procedure

4.1 General

The test was carried out on 05 June 2020 in accordance with EN 1365-1:2012[1] and was witnessed by Andrew Thomson representing the sponsor Ultraframe (UK) Ltd. The ambient temperature at the start of the test was 15°C and the initial mean surface temperature recorded on the unexposed face of the wall by the mean 5 thermocouples was 16.2ºC.

4.2 Test arrangement

The wall was installed within the aperture, nominally 3000mm-high x 3050mm-wide, of a heavily reinforced concrete test frame.

The load was applied from below the specimen via six hydraulic rams acting on the inverted steel channel, which spread the load over the base of the wall. The inverted channel measured 100mm x 300mm x 100mm with flange and web thicknesses of 8mm and 16mm respectively.

The wall was pinched between the steel-channel beam and the concrete soffit of the test frame aperture where the head of the wall was bedded on mortar.

The two vertical sides of the wall remained unrestrained. Calcium magnesium silicate blanket was used to seal the gap between the vertical sides of the wall and the test frame and overlapping onto the bottom edge of the wall on the fire-side face to protect the test equipment below the wall.

4.3 Loading

The vertical load applied to the wall as prescribed by the sponsor was 105kN which equated to 35kN/m.

In order to impose the full prescribed test load, the load applied by the rams was greater than the prescribed load by a magnitude equal to the self-weight of the wall and inverted channel. This offset was applied automatically by the load application procedure

4.4 Furnace control

The furnace temperature was measured by means of eight plate thermometers arranged symmetrically in the furnace with their measuring junctions nominally 100mm from the fire-side face of the specimen. The furnace was controlled to comply with the heating regime specified in European Standard EN 1363-1:2012[2] and EN 1363-1:2020[3].

The mean temperature recorded is plotted against time in Graphs together with the specified curve for comparison.

The furnace pressure was monitored at a point 2.4m above the base of the wall. The pressure was controlled to be 15Pa ±3Pa at this level resulting in the height of the neutral pressure plane being at 0.5m above the base of the wall. The furnace pressure recorded is plotted against time in Graphs.

4.5 Temperature measurements on the unexposed face

Twenty-five K-type thermocouples each covered with an insulating pad were fixed to the unexposed face of the specimen to measure its temperature continuously during the test. Their locations are shown in Photos.

Thermocouples 1, 2, 3, 4 and 5 (standard five) were used to calculate the mean unexposed face temperature, all the thermocouples were used to determine the maximum unexposed face temperature

4.6 Deflection measurements

The vertical deflection of the wall was measured during the test by two transducers positioned one below each end of the steel channel beam. The mean vertical deflection was calculated from these two transducers.

The horizontal deflection of the wall was measured throughout the test by two transducers connected, via fine steel wire, to the centre of the wall and mid-height of the right-hand side (as viewed from the unexposed face).

5 Results

5.1 Observations

Observations made during the test are given in Table 2: *Observations* below. Any references to left and right are as viewed from the unexposed face.

Table 2: Observations.

Mins	Observations
-15.00	Load applied to partition wall
0:00	Test started.
10:00	Still dark within the furnace. Lower horizontal plasterboard joints just visible and both still tight. No change to unexposed face.
15:00	Vertical plasterboard joints on the exposed face opened up slightly between fixings. Horizontal plasterboard joints still tight.
24:00	Horizontal and vertical plasterboard joints beginning to open up within the furnace, the right-hand horizontal joint more so than the others along with fine cracks beginning to form around the fixings.
26:30	Vertical crack forming in the centre of the exposed full width plasterboard on the right-hand side above the horizontal plasterboard joint.
28:00	Right-hand horizontal plasterboard joint within the furnace has opened up more with more pronounced cracks formed around the fixings. The other horizontal and vertical joints remain slightly open but stable.
31:30	On the unexposed face white smoke is issuing in the vicinity of thermocouple 9. The Plustherm insulation within the Ultrapanel is beginning to bend outwards along their horizontal joints creating gaps.
34:00	Thermocouple 10 on the unexposed face falls off as the Plustherm insulation distorts further. Volume and density of white smoke from vicinity of thermocouple 9 gradually increasing along with smoke from top of the specimen now.

Mins	Observations
36:00	Gaps in Plustherm insulation opening up along every horizontal panel joint on the unexposed face now as the insulation shrinks back.
40:00	Within the furnace the vertical crack in the centre of the right-hand plasterboard has opened up to approx. 15-20mm. The top central horizontal plasterboard joint has now opened up especially towards the right-hand side with cracking around fixings visible. All exposed face plasterboards appear to be still attached.
43:30	On the unexposed face the Plustherm insulation is bowing out in every location creating wide gaps with white smoke continuing to issue from the same locations.
50:00	Within the furnace the right-hand vertical and horizontal plasterboard joints have opened up to 15-20mm wide and the top horizontal joint up to 10-15mm wide at the right-hand end. The left-hand vertical joint has opened up only slightly.
60:00	No change to unexposed face.
62:00	The Plustherm insulation on the unexposed face is now beginning to melt and shrivel up
66:00	The Plustherm insulation is now shrivelling and falling out of the Ultrapanels, on to the floor in front of the furnace.
69:38	Loadbearing failure of the partition and simultaneous flaming from the right-hand side at ¾ height.
69:45	Test Terminated

The construction after test is shown in Photos.

5.2 Temperature recorded on the unexposed face

The maximum temperature recorded on the unexposed face of the wall is shown plotted against time in Graph 6 together with the mean temperature, calculated from thermocouples 1, 2, 3, 4, and 5 (standard five).

Neither the mean temperature rise limit, (140ºC rise), nor the maximum temperature rise limit, (180ºC rise), for insulation were exceeded during the test.

5.3 Deflection recorded

5.3.1 Vertical deflection

The vertical deflection of the wall, as recorded by the two transducers positioned under the bottom left and the bottom right corners of the wall, is shown plotted against time in Graph 8

Positive and negative values denote the vertical deflection of the wall (expansion & contraction respectively).

The average deflection recorded from the two transducers shows extension of the wall height up to a maximum of 0.45mm, recorded after 39 minutes from the start of the test, after which the wall began to contract.

Failure of loadbearing capacity occurred after 69 completed minutes of test due to collapse of the test specimen.

5.3.2 Horizontal defection

The horizontal deflection of the wall recorded during the test by linear displacement transducers attached to the centre of the wall and at mid height of the right-hand vertical edge, 50mm in from the edge, with deflection shown plotted against time in Graph 7.

Positive and negative values denote specimen movement toward and away from the furnace respectively.

The maximum deflection (measured at the centre of the specimen) was 92.2mm towards the furnace, recorded after 69 minutes from the start of the test, after loadbearing failure at test termination.

The maximum deflection (Measured on the right hand side of the specimen) was 81mm towards the furnace, after 69 minutes from the start of the test, after loadbearing failure at test termination.

6 Performance criteria

The standards (ref 1, 2 and 3 state that a loaded wall is regarded as having a fire resistance (expressed in minutes) that is equal to the elapsed time (in completed minutes) between the commencement of heating and either the termination of heating, or the time of failure with respect to the relevant criteria.

6.1 Loadbearing capacity

Failure is deemed to occur when the test specimen loses its ability to support the test load. This shall be taken as when one of the following criteria have been exceeded by the mean vertical deflection:

For vertically loaded elements:

Limiting vertical contraction (negative elongation), $C = \frac{h}{100}$ mm $C = \frac{3000}{100}$ mm C = ***30mm***

or

Limiting vertical rate of contraction (negative elongation), $\frac{dC}{dt} = \frac{3h}{1000}$ mm/min = $\frac{9000}{1000}$ = ***9mm/min***

Where *h* is the initial height in millimetres of the test specimen.

6.2 Integrity

Failure is deemed to occur:

a) When collapse or sustained flaming for not less than 10s on the unexposed face occurs;

b) When cracks, gaps or fissures allow flames or hot gases to cause flaming or glowing of a cotton fibre pad, when applied for a maximum of 30s;

c) When a 6mm-diameter gap gauge can penetrate through a gap into the furnace and be moved in the gap for a distance of at least 150mm;

d) When a 25mm-diameter gap gauge can penetrate through a gap into the furnace

e) When loadbearing failure occurs.

6.3 Insulation

Failure is deemed to occur:

a) When the mean unexposed face temperature increases by more than 140°C above its initial value;

b) When the temperature recorded at any position (including the roving thermocouple) on the unexposed face is in excess of 180°C above the initial mean unexposed face temperature;

c) When integrity failure occurs.

7 Conclusion

An Ultraframe (UK) Ltd Ultrapanel partition loadbearing wall, as described in this report, was submitted to a fire resistance test carried out in accordance with European Standard EN 1365-1:2012 for a duration of 69 min. The test was carried out with the wall under a total imposed load of 105kN (35kN/m).

The wall was found to achieve the following performance:

Loadbearing capacity		69 minutes	
Integrity:	- sustained flaming:	69 minutes	(taken as time of loadbearing failure)
	- gap gauge:	69 minutes	(taken as time of loadbearing failure)
	- cotton pad:	69 minutes	(taken as time of loadbearing failure)
Insulation:		69 minutes	(taken as time of loadbearing failure)

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in EN 1363-1, and where appropriate EN 1363-2. Any significant deviation with respect to size, construction details, loads, stresses, edge or end conditions other than those

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

8 Field of direct application of results

The standard[1] states that the results of the fire test are directly applicable to similar constructions where one or more of the changes listed below are made and the construction continues to comply with the appropriate design code for its stiffness and its stability.

a) Decrease in height.

b) Increase in the thickness of the wall.

c) Increase in the thickness of component materials.

d) Decrease in linear dimensions of boards or dimensions of panels except thickness.

e) Decrease in stud spacing.

f) Decrease in distance of fixing centres.

g) Increase in the number of horizontal joints when tested with one joint not more than 500mm ± 150mm from the top edge

h) Decrease in the applied load.

i) Increase in the width, provided that the test specimen was tested at full width or 3m wide, whichever is the larger.

9 References

1. Fire resistance tests for loadbearing elements. Part 1: Walls. EN 1365-1: 2012. British Standards Institution, London, 2012.
2. Fire resistance tests. Part 1: General requirements. EN 1363-1: 2012. British Standards Institution, London, 2012.
3. Fire resistance tests. Part 1: General requirements. EN 1363-1: 2020. British Standards Institution, London, 2020.

10 Figures

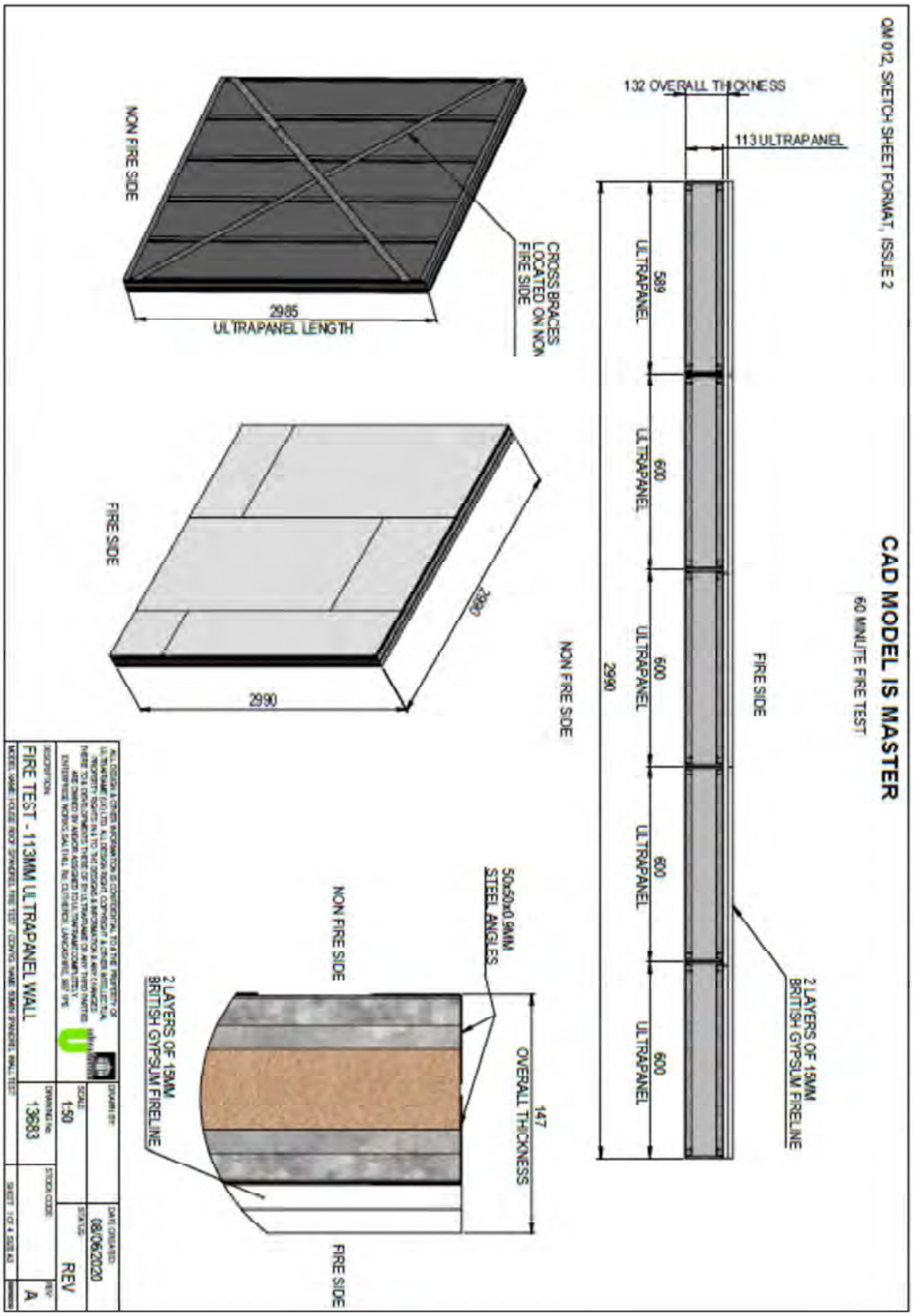


Figure 1: Test Construction detail [1] – as supplied by Ultraframe (UK) Ltd.

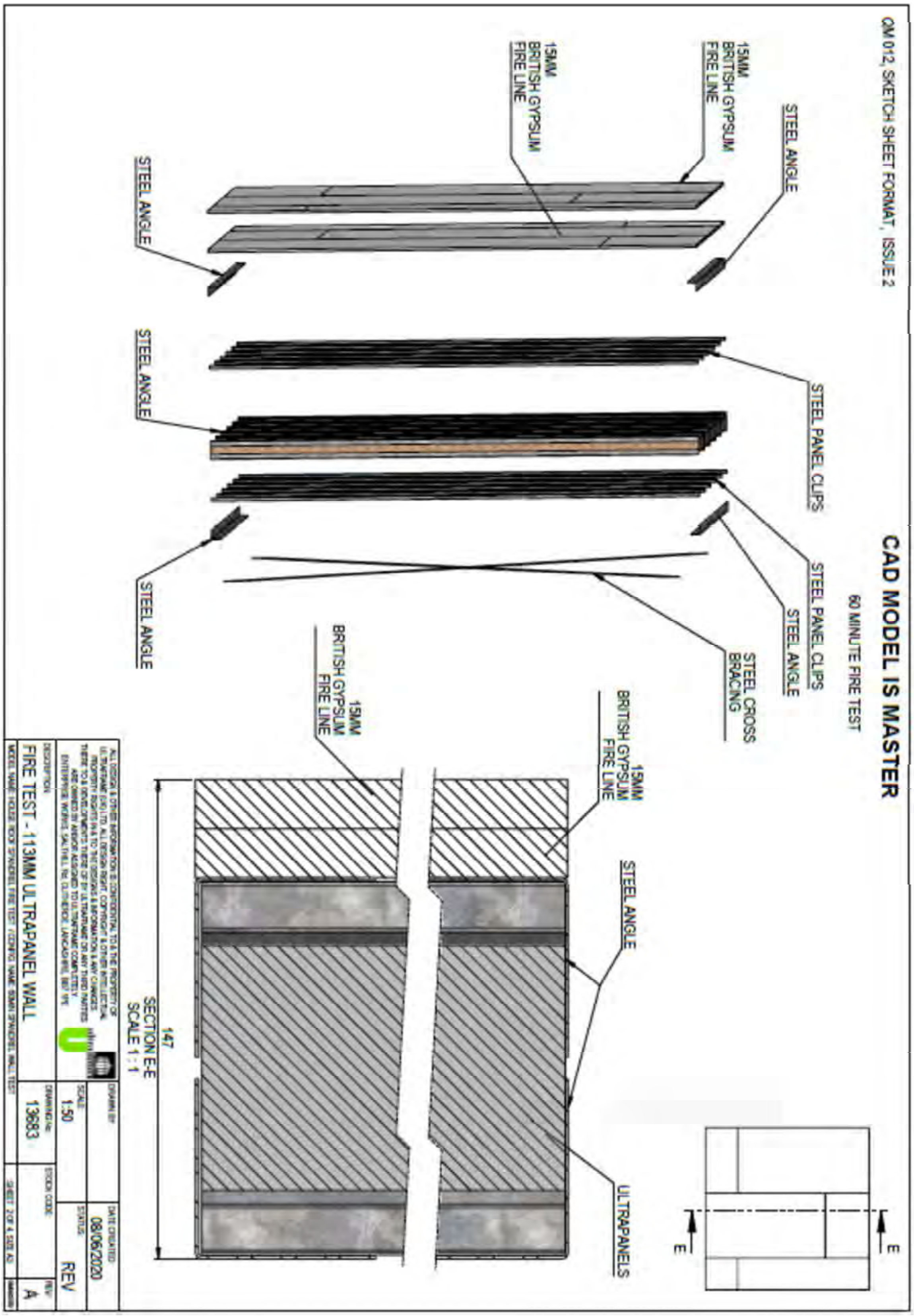


Figure 2: Test Construction detail [2] – as supplied by Ultraframe (UK) Ltd.

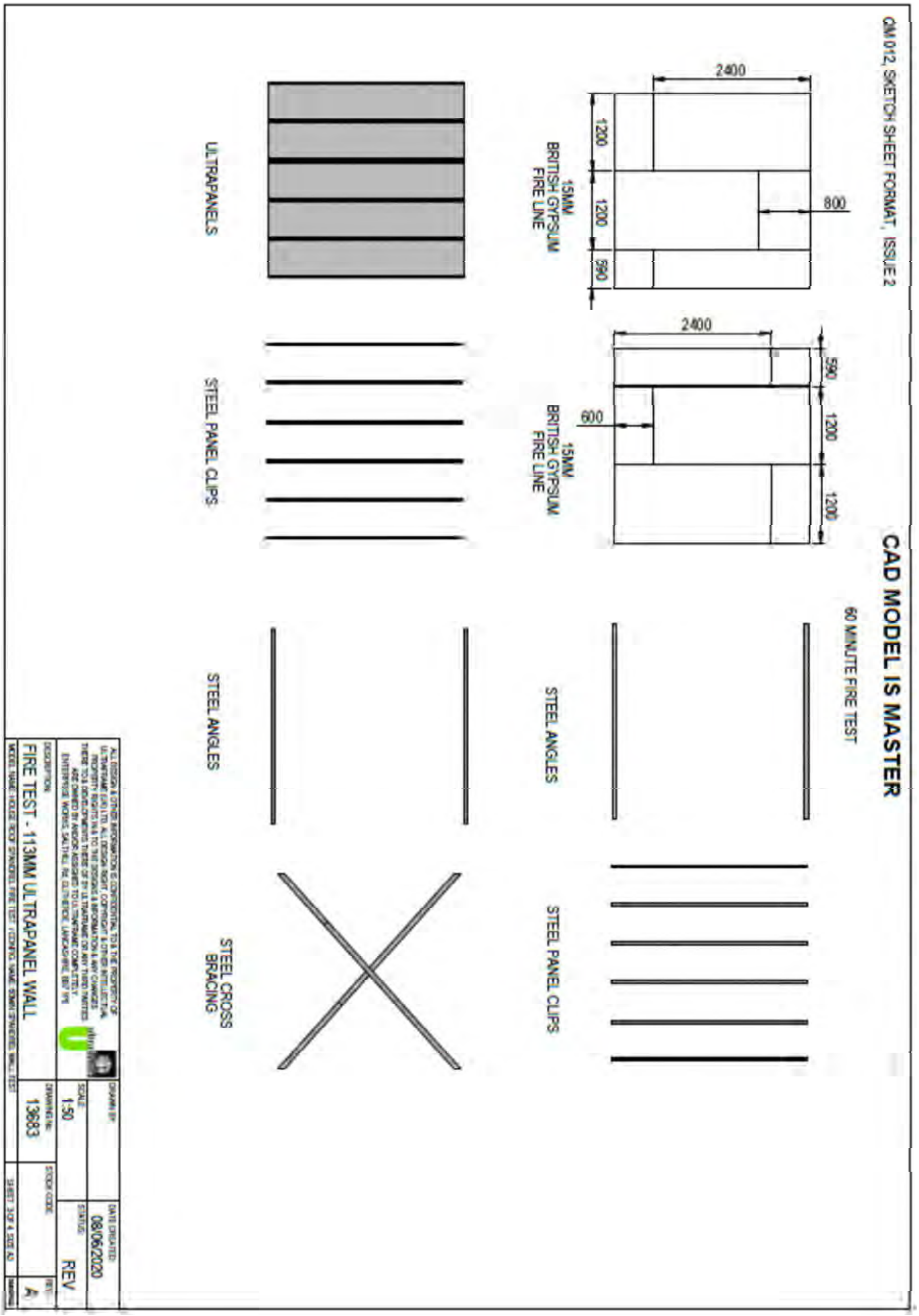


Figure 3: Test Construction detail [3] – as supplied by Ultraframe (UK) Ltd.

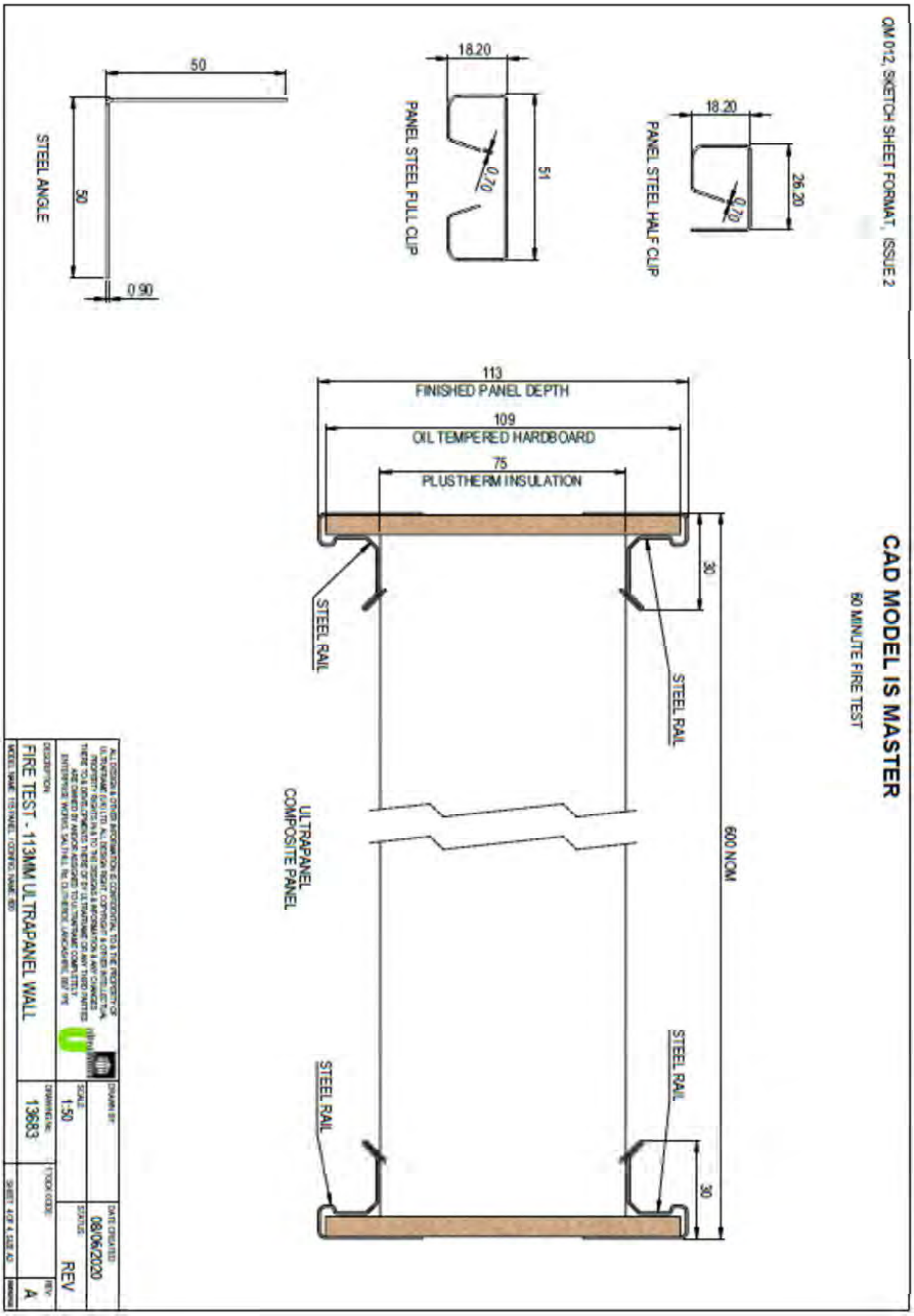
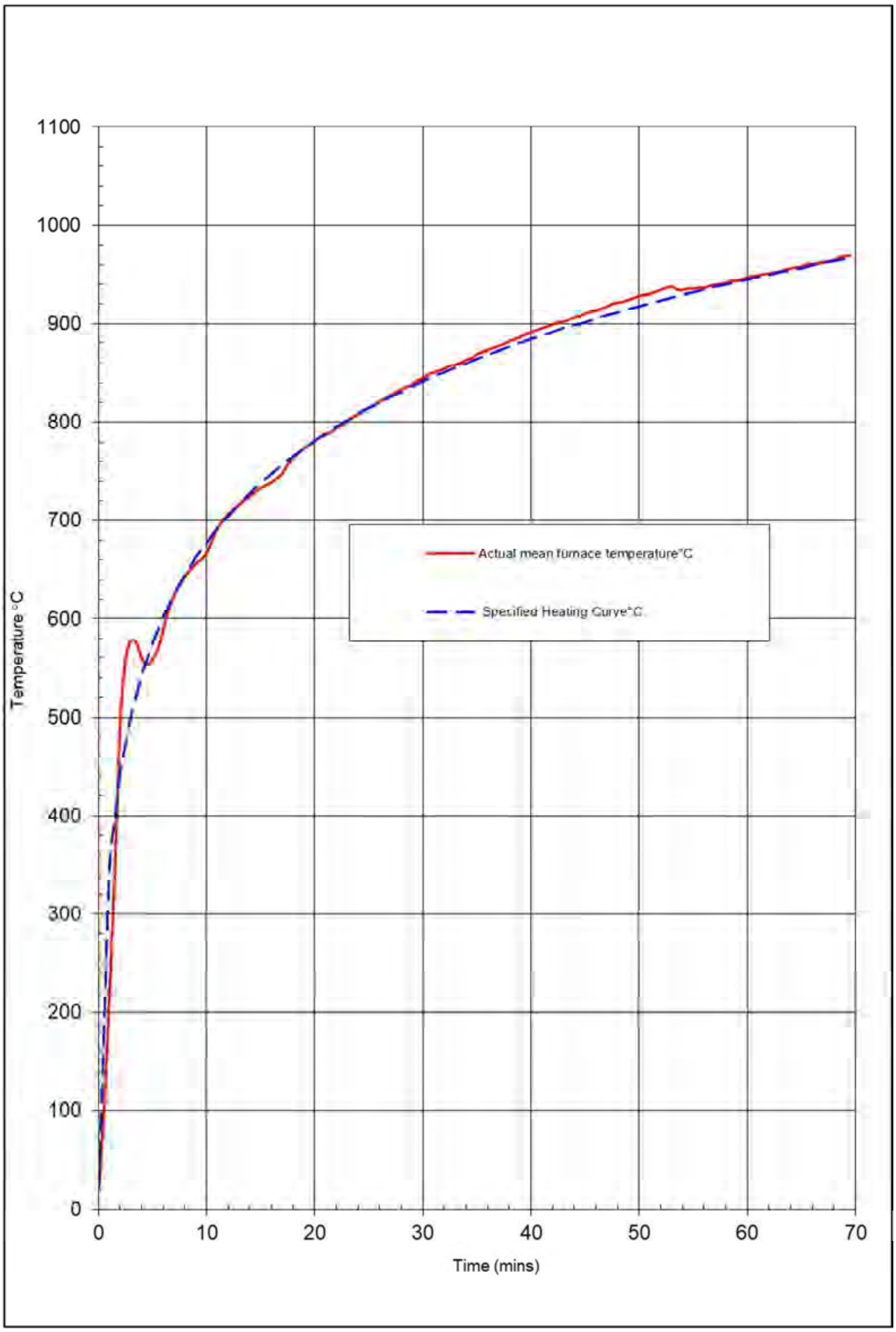
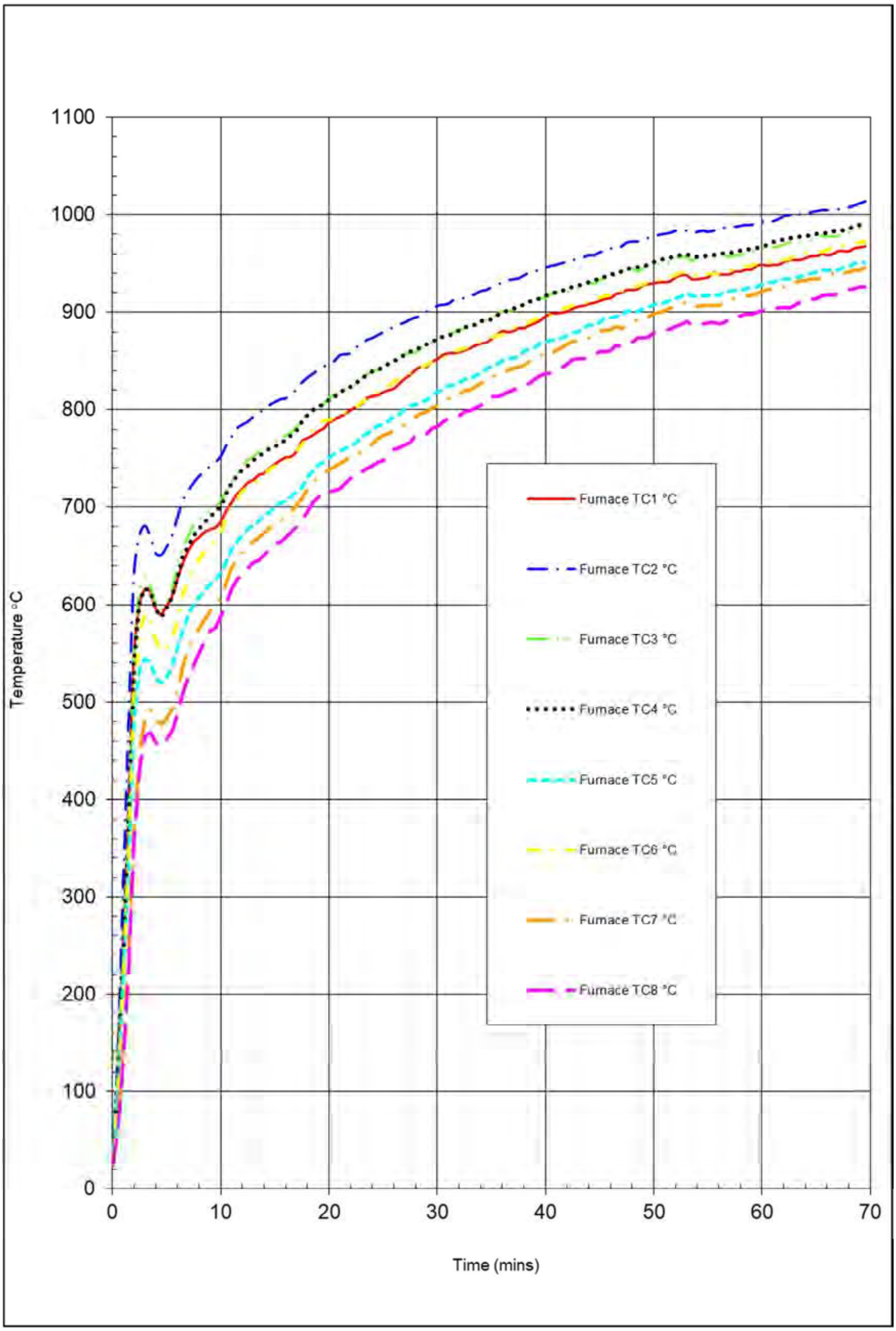


Figure 4: Test Construction detail [4] – as supplied by Ultraframe (UK) Ltd.

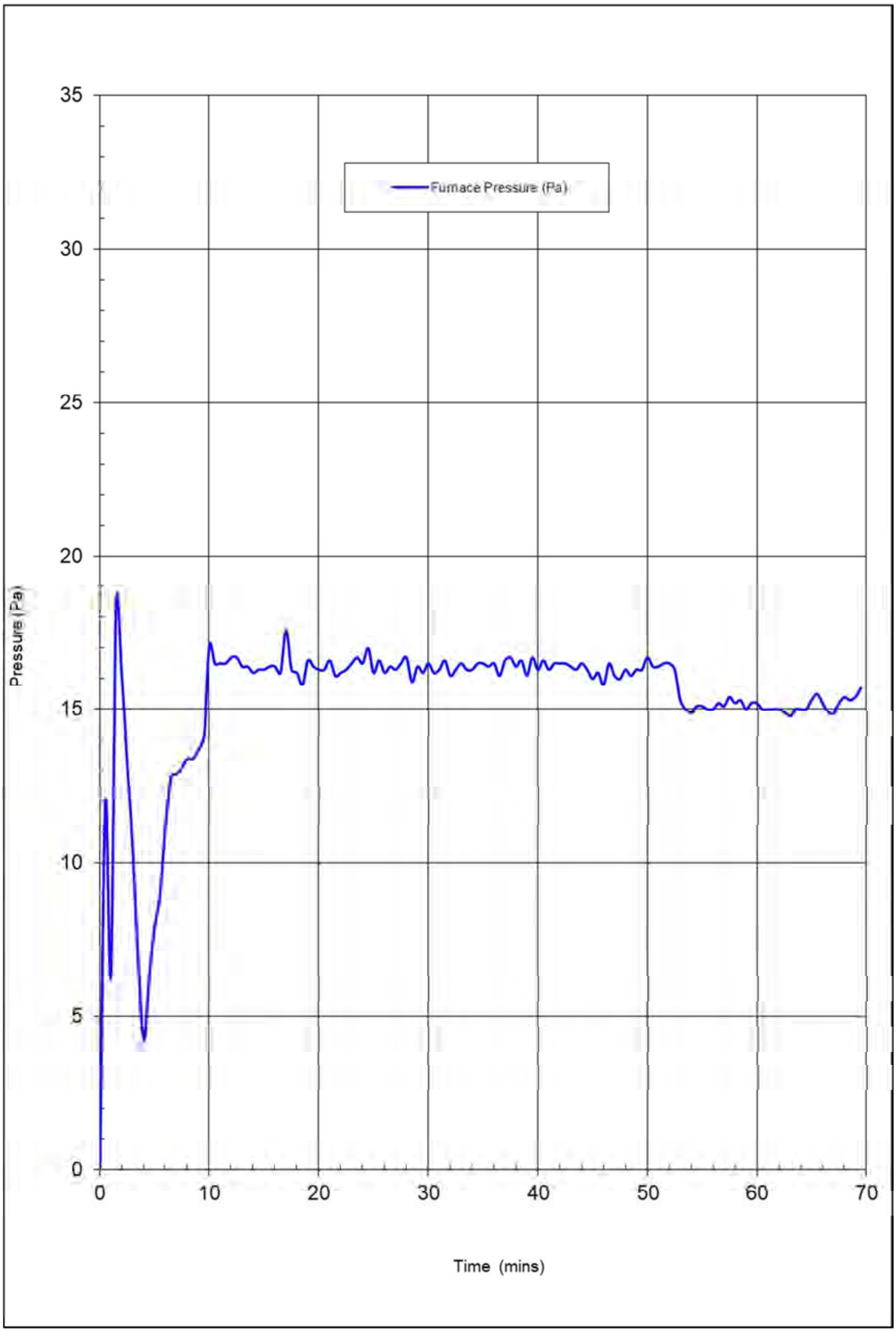
11 Graphs



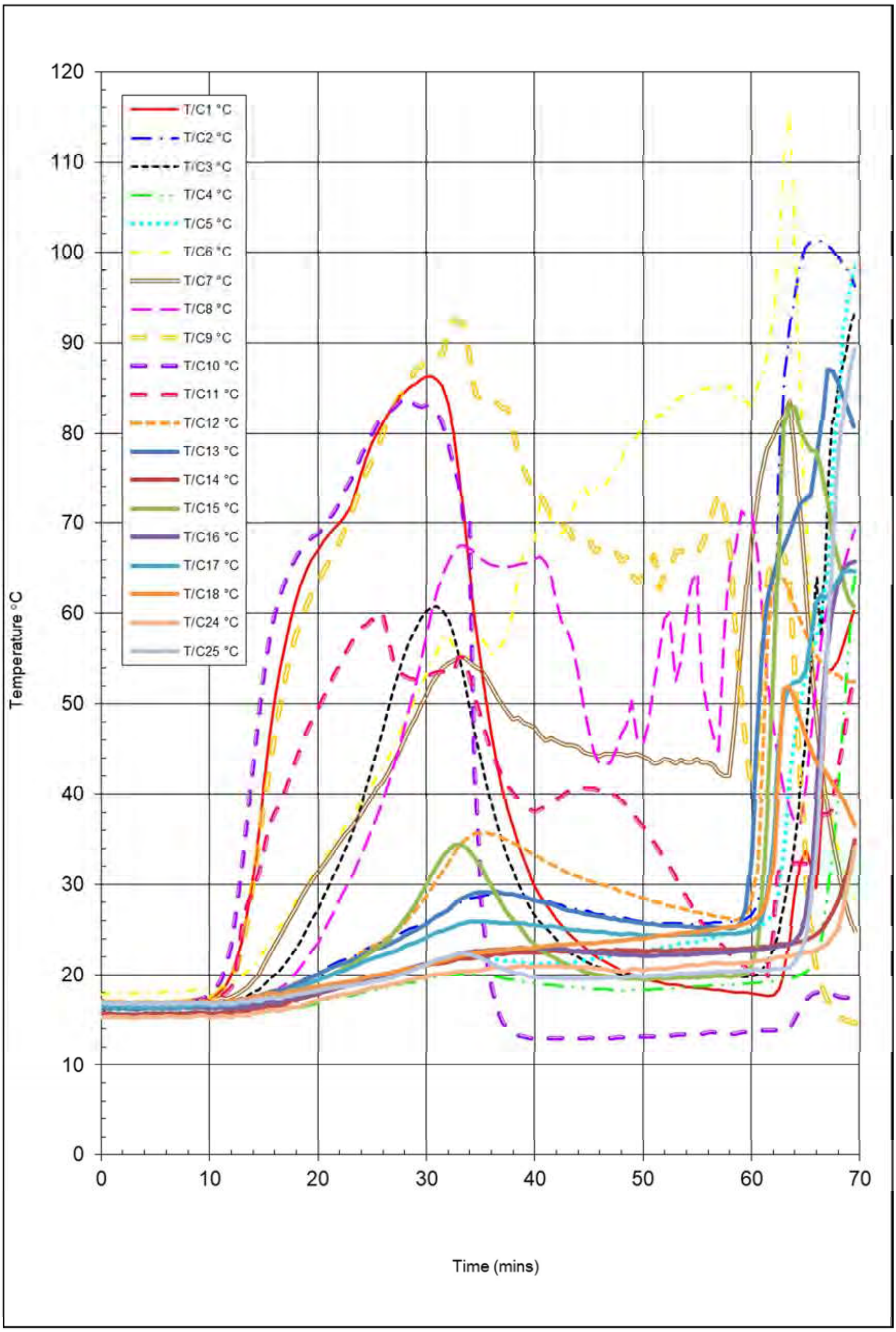
Graph 1: Mean furnace temperature with specified heating curve



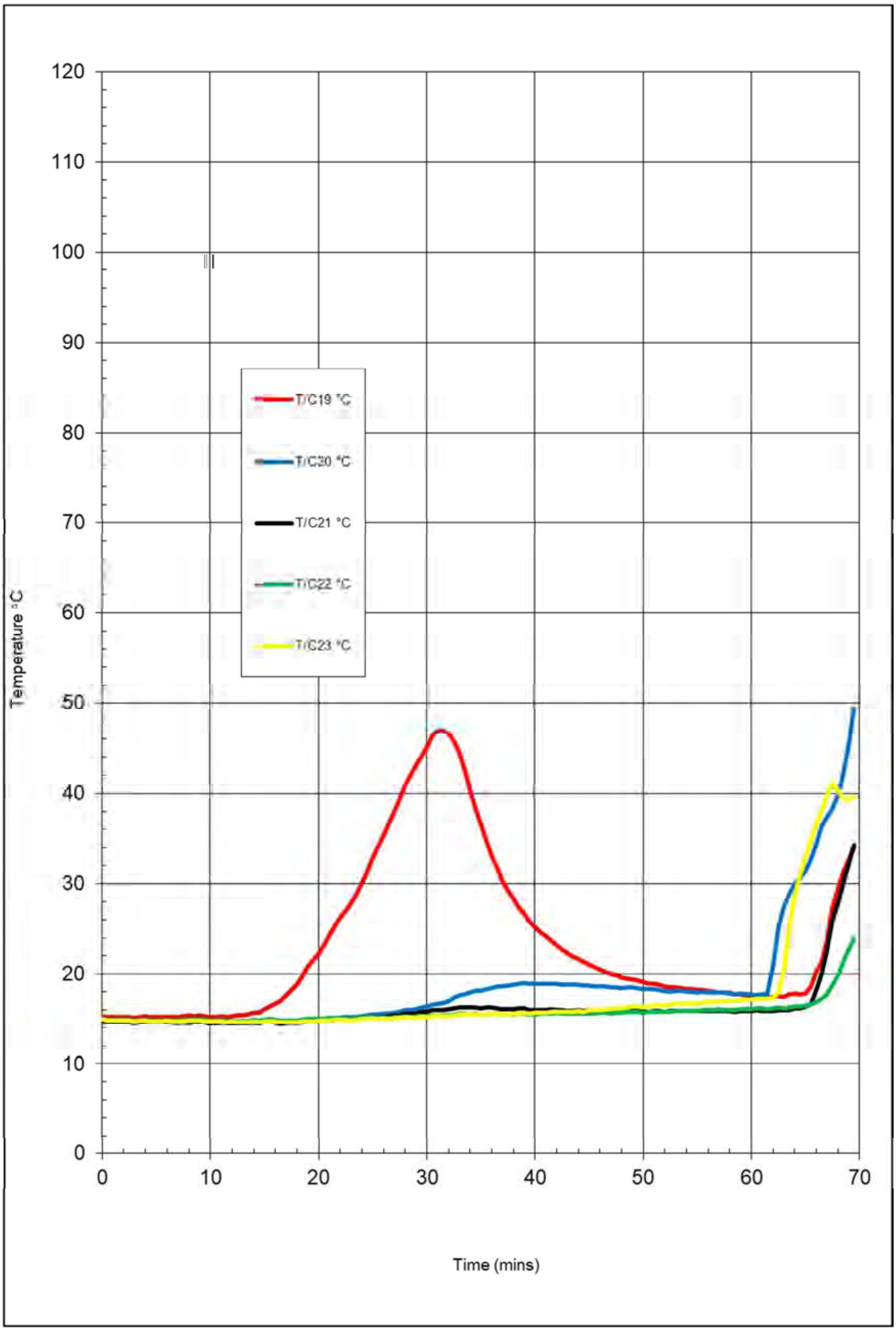
Graph 2: Individual furnace thermocouples temperatures



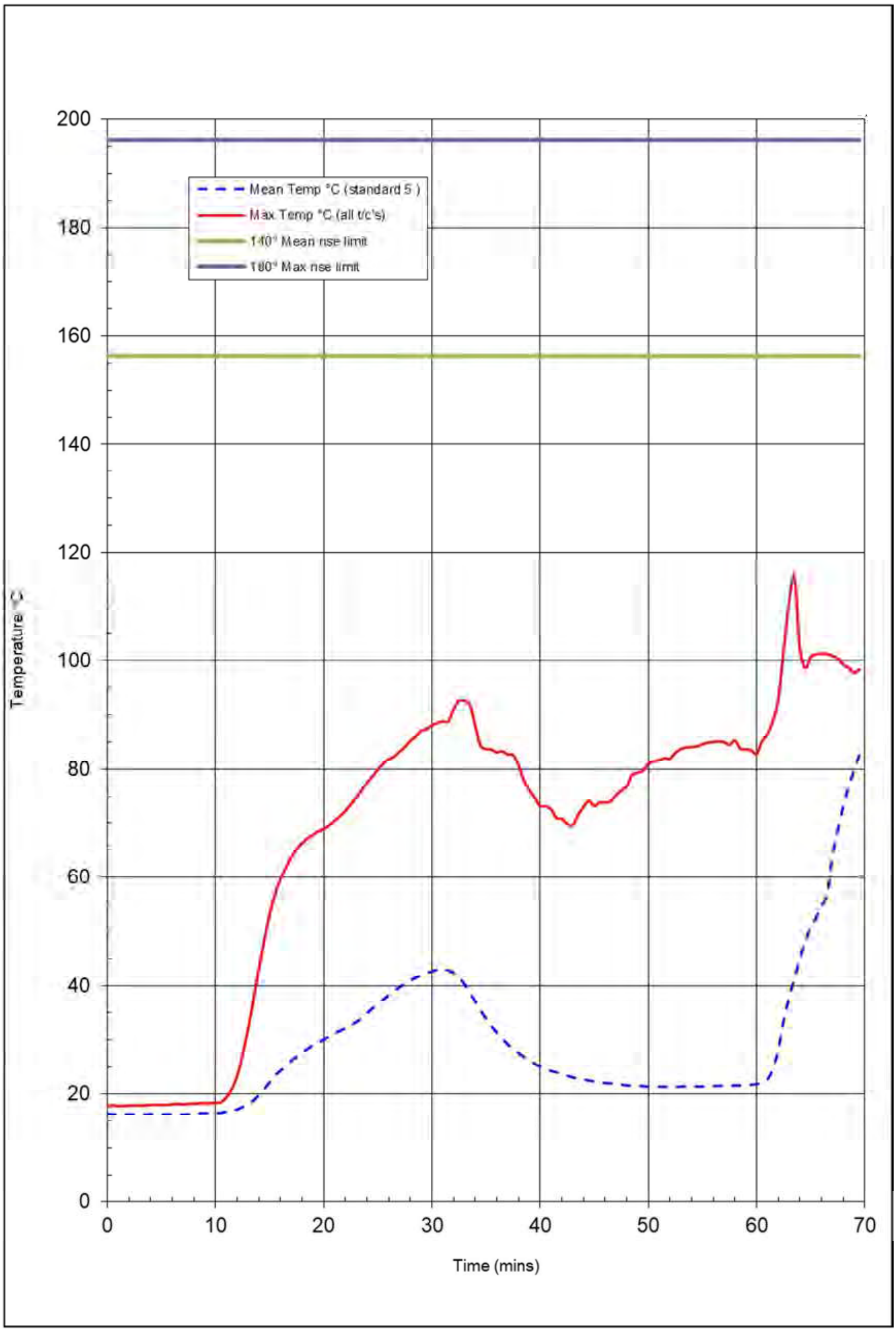
Graph 3: Mean furnace pressure



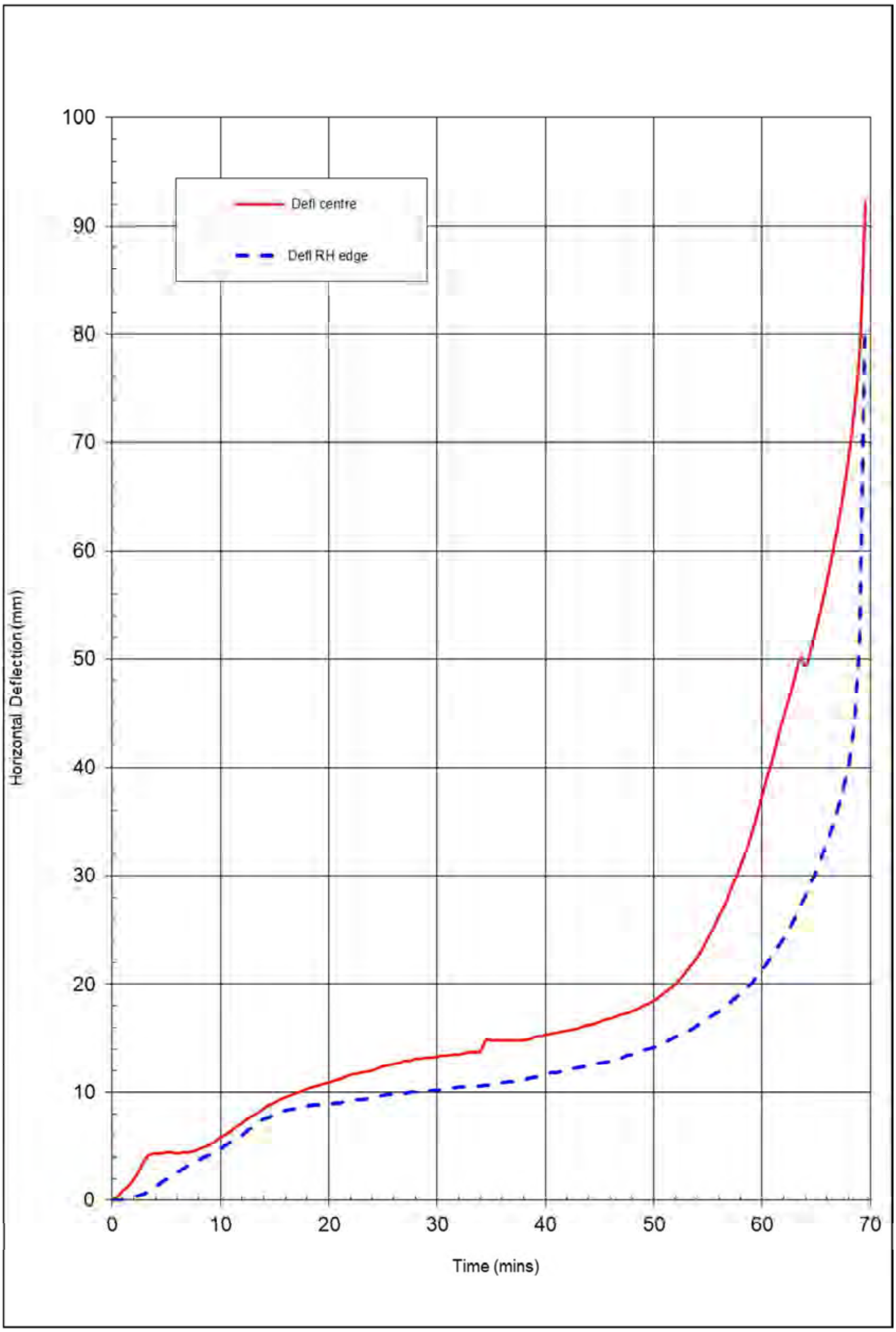
Graph 4: Unexposed surface thermocouple temperatures.



Graph 5: Crossbrace surface thermocouple temperatures.

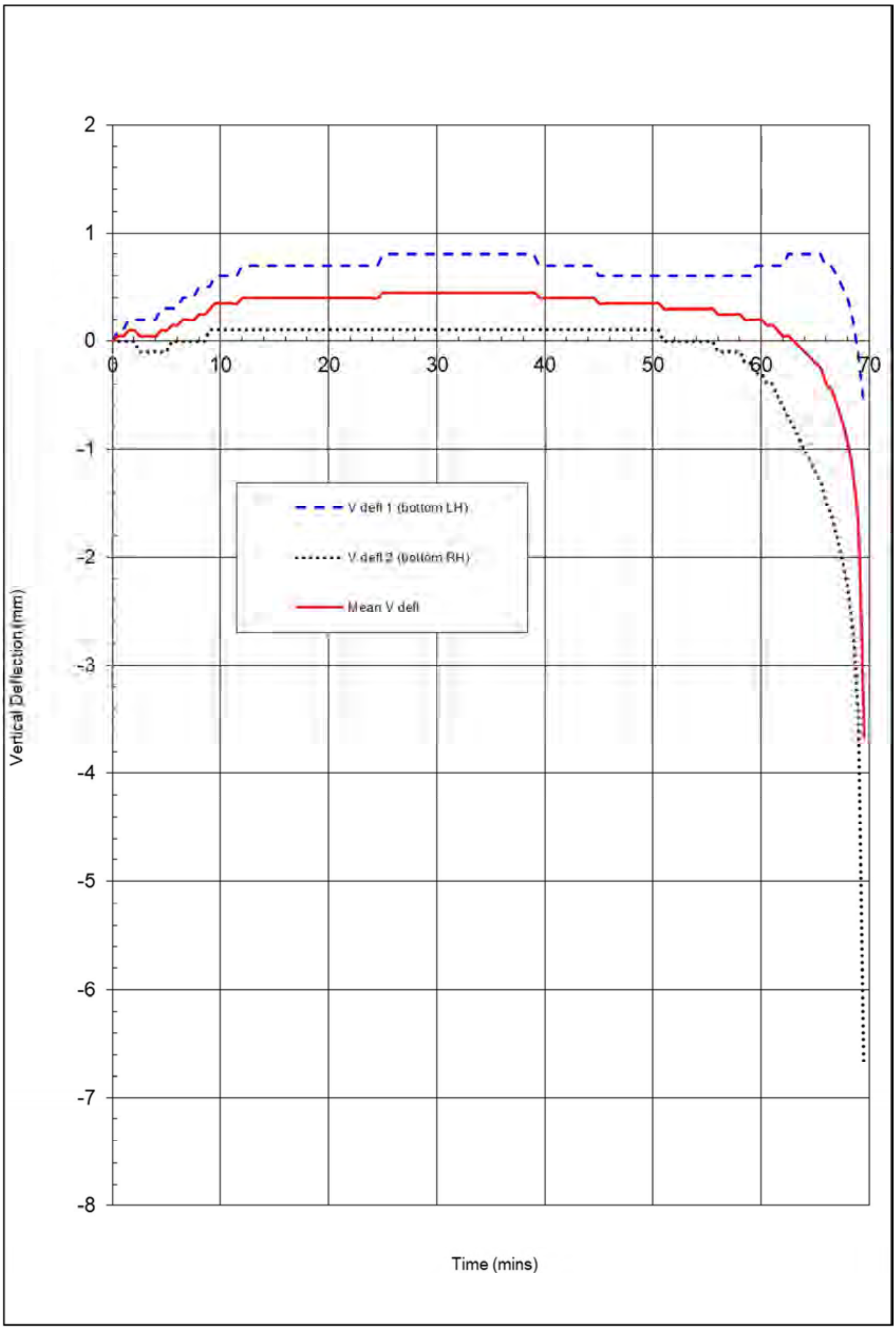


Graph 6: Mean and max temperature for unexposed surface thermocouples.



Graph 7: Horizontal deflection

Note: Positive values indicate movement towards the furnace

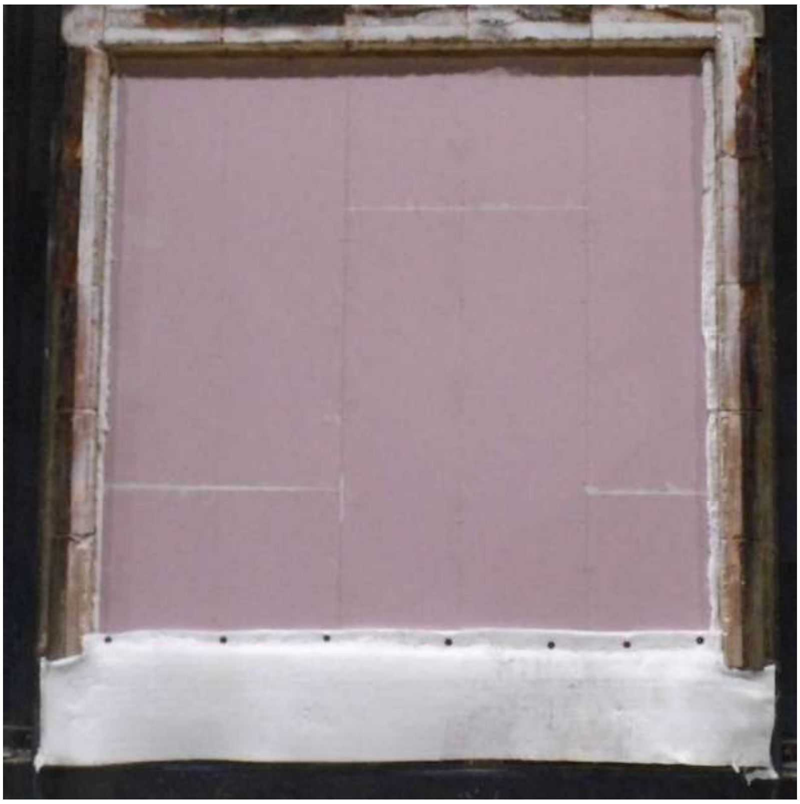


Graph 8: Vertical deflection recorded

Note: Positive values indicate expansion of the sample whilst under load

12 Photos

Photograph 1: Unexposed face of test specimen before test showing thermocouple and deflection locations.

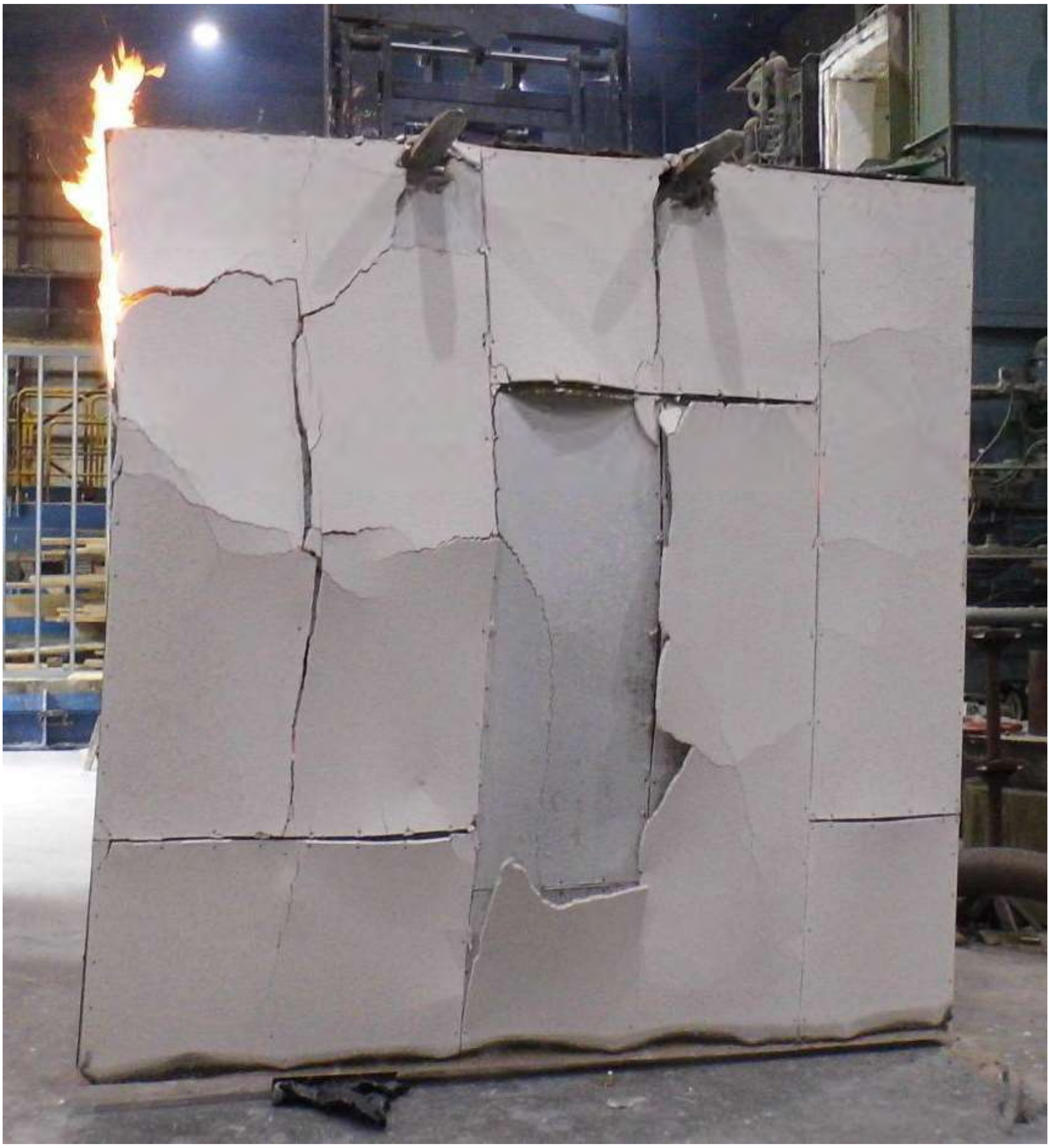


Photograph 2: Exposed face of test specimen before test.

Photograph 3: Unexposed face of test specimen before test.

Photograph 4: Unexposed face of test specimen at point of loadbearing failure after 69 completed minutes of test

Photograph 5: Unexposed face of test specimen after test



Photograph 6: Exposed face of test specimen after test

Report Ends

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BRE Global Test Report

Fire resistance test report on a 3000mm x 3000mm loadbearing wall comprising of an Ultraframe Ultrapanel wall with the exposed face clad with a layer of 15mm thick Gyproc Wallboard tested in accordance with EN1365-1:2012.

Prepared for:	**Ultraframe (UK) Ltd**
Date:	**18 August 2020**
Report Number:	**P115505-1004 Issue: 1**

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APPENDIX 9.

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Date	18 August 2020
Signature	

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Summary

An Ultraframe (UK) Ltd partition wall, nominally 3000mm x 3000mm, was submitted to a fire resistance test carried out in accordance with European Standard EN 1365-1:2012 (with reference to EN 1363-1:2012[2] and EN 1363-1:2020[3]) on 13 July 2020 at BRE Watford for a duration of 36 minutes The test was carried out with the wall under a total vertical load of 60kN (20kN/m) as prescribed by the sponsor.

With reference to EN 1363-1:2020[3], the main change in the standard (compared with EN 1363-1:2012[2]) is a redefinition for the load bearing capacity criterion.

The loadbearing capacity criterion for vertical elements remains unchanged.

The partition comprised of five Ultraframe Ultrapanels with the exposed face clad with a layer of 15mm thick Gyproc Wallboard.

The wall was found to achieve the following results:

Loadbearing capacity		35 minutes
Integrity:	- sustained flaming:	35 minutes (taken as time of loadbearing failure)
	- gap gauge:	35 minutes (taken as time of loadbearing failure)
	- cotton pad:	35 minutes (taken as time of loadbearing failure)
Insulation:		35 minutes (taken as time of loadbearing failure)

1 Objective

A test was carried out in accordance with EN 1365-1:2012 to determine the fire resistance of an Ultraframe (UK) Ltd partition wall comprising of five Ultrapanels with the exposed face clad with a layer of 15mm thick Gyproc Wallboard.

2 Test construction

2.1 General

Assembly of the wall was completed on 9 July 2020. When finished it was installed into a furnace test frame by BRE as described in Test Arrangement.

The construction is shown in Figures and before the test in Photos.

Fourteen K-type chromel/alumel thermocouples were fitted to the unexposed surface of the test specimen.

BRE was not involved in the selection of the specimen in any way and the result relates to the specimen as received.

External and accessible components were dimensionally/visually verified by BRE Global to correspond to client supplied constructional data. Detailed constructional data relating to the specimen were not independently verified by BRE Global, the validity of the test results are conditional of the accuracy of that data.

2.2 Components

2.2.1 Ultrapanels

Each panel comprised 75mm thick x 588mm wide x 3000mm long Kingspan Therma insulation with a 6mm thick oil tempered hardboard attached along each long edge to give a finished width of 600mm to each panel. A profiled steel rail was attached to the oil tempered hardboards using rivets at 75mm spacing which in turn gripped into the Kingspan Therma insulation using a barb. The purpose of this steel rail was to enable the friction fitting of the steel panel clips to join the individual panels together to form a continuous partition wall. The finished panel width was 113mm. The Ultrapanels are shown in Figures.

2.2.2 Wallboard

15mm thick Gyproc Wallboard was supplied in sheets of 2400mm x 1200mm, with one layer on the exposed side of the test specimen with joints as per drawings.

A representative sample of board was marked “A-EN520 Gypsum Plasterboard Gyproc Wallboard 2400 x 1200 x 15 mm TE 26 333 19 22:03”.

2.2.3 Panel steel clips

The panels were joined together using profiled 0.70mm thick steel panel clips. The full panel clips were labelled “Ultraframe WPPC600/1” and the half panel clips were labelled “Ultraframe WPPC600/2”. The panel clips are shown in Figures.

2.2.4 Additional steel components

The top and bottom edges of the connected Ultrapanels panels were secured using a 50mm x 50mm x 0.9mm thick L shaped angle on both sides.

On the unexposed face a 100mm wide 0.9mm thick steel cross brace was used to strengthen the panels.

On the exposed face the horizontal Wallboard joints were backed by British Gypsum Gypframe backing straps labelled “LE12 6HX British Gypsum GFT1 2400mm Gypframe CE 13 EN14195 01008 08 19081 RF A1 YS 210Nm”.

2.2.5 Fixings

The Wallboard was fixed to the steel panel clips and top and bottom angles using 4Trade 3.5mm x 25mm drywall screws with a black phosphate finish at 150mm spacing around the perimeter and 300mm in the field of the boards. The L shaped channels and crossbrace were fixed to the steel panel clips using Senco Duraspin 5.5mm x 19mm wafer head fixings labelled “55WS19MC”.

2.2.6 Joint filler

The horizontal Wallboard joints on the exposed face were filled with Dow Dowsil 400 firestop fire rated intumescent acrylic sealant.

All the joints on the exposed face were then covered with Gyproc joint tape and filled with two layers of Gyproc joint filler with all the exposed screw heads dotted with the same.

2.3 Assembly

2.3.1 Ultrapanels

The five panels were joined together using the full panel clips for the middle three joints and the half panel clips were fitted along both outer edges. The clips were friction fitted over the steel rails along each Ultrapanel long edge to form a nominally 3000mm wide test specimen. The 50mm L shaped angles were then attached to the panel clips on both sides of the test specimen along the top and bottom with two of the Senco Duraspin 5.5mm x 19mm wafer head fixings at each intersection.

2.4 Exposed face

A layer of 15mm thick Gyproc Wallboard was fixed to the steel panel clips and top and bottom angles and the Gypframe backing strap behind the horizontal joints on the exposed face of the assembled Ultrapanels using the 3.5mm x 25mm drywall screws at 150mm spacing on the perimeter and 300mm spacing in the field of the boards

All the horizontal plasterboard joints on the exposed face were filled with Dow Dowsil 400 firestop fire rated intumescent acrylic sealant.

All the joints on the exposed face were then covered with Gyproc joint tape and filled with two layers of Gyproc joint filler with all the exposed screw heads dotted with the same.

The construction pattern of the joints was confirmed to match that as shown in Figures.

2.5 Unexposed face

The cross brace was then attached to the panel clips diagonally across the unexposed face using four Senco Duraspin 5.5mm x 19mm wafer head fixings at each intersection.

3 Conditioning

Representative samples of the 15mm thick Gyproc Wallboard were taken during construction, weighed and then oven-dried in order to determine the free moisture content by weight loss technique. The free moisture content and weight is given in Table1: *Moisture content and weights.*

Table 1: Moisture content and weights.

	Oven drying temperature	Moisture content % by dry weight	kg/m^2	Density
Gyproc Wallboard 15mm	50ºC	0.61	10.79	699.8 kg/m^3

4 Test Procedure

4.1 General

The test was carried out on 13 July 2020 in accordance with EN 1365-1:2012[1] and was witnessed by Andrew Thomson representing the sponsor Ultraframe (UK) Ltd. The ambient temperature at the start of the test was 18°C and the initial mean surface temperature recorded on the unexposed face of the wall by the mean 5 thermocouples was 18.5ºC.

4.2 Test arrangement

The wall was installed within the aperture, nominally 3000mm-high x 3050mm-wide, of a heavily reinforced concrete test frame.

The load was applied from below the specimen via six hydraulic rams acting on the inverted steel channel, which spread the load over the base of the wall. The inverted channel measured 100mm x 300mm x 100mm with flange and web thicknesses of 8mm and 16mm respectively.

The wall was pinched between the steel-channel beam and the concrete soffit of the test frame aperture where the head of the wall was bedded on mortar.

The two vertical sides of the wall remained unrestrained. Calcium magnesium silicate blanket was used to seal the gap between the vertical sides of the wall and the test frame and overlapping onto the bottom edge of the wall on the fire-side face to protect the test equipment below the wall.

4.3 Loading

The vertical load applied to the wall as prescribed by the sponsor was 60kN which equated to 20kN/m.

In order to impose the full prescribed test load, the load applied by the rams was greater than the prescribed load by a magnitude equal to the self-weight of the wall and inverted channel. This offset was applied automatically by the load application procedure

4.4 Furnace control

The furnace temperature was measured by means of eight plate thermometers arranged symmetrically in the furnace with their measuring junctions nominally 100mm from the fire-side face of the specimen. The furnace was controlled to comply with the heating regime specified in European Standard EN 1363-1:2012[2] and EN 1363-1:2020[3]

The mean temperature recorded is plotted against time in Graphs together with the specified curve for comparison.

The furnace pressure was monitored at a point 2.4m above the base of the wall. The pressure was controlled to be 15Pa ±3Pa at this level resulting in the height of the neutral pressure plane being at 0.5m above the base of the wall. The furnace pressure recorded is plotted against time in Graphs.

4.5 Temperature measurements on the unexposed face

Fourteen K-type thermocouples each covered with an insulating pad were fixed to the unexposed face of the specimen to measure its temperature continuously during the test. Their locations are shown in Photos.

Thermocouples 1, 2, 3, 4 and 5 (standard five) were used to calculate the mean unexposed face temperature, all the thermocouples were used to determine the maximum unexposed face temperature.

4.6 Deflection measurements

The vertical deflection of the wall was measured during the test by two transducers positioned one below each end of the steel channel beam. The mean vertical deflection was calculated from these two transducers.

The horizontal deflection of the wall was measured throughout the test by two transducers connected, via fine steel wire, to the centre of the wall and mid-height of the right-hand side (as viewed from the unexposed face).

5 Results

5.1 Observations

Observations made during the test are given in Table 2: *Observations* below. Any references to left and right are as viewed from the unexposed face.

Table 2: Observations.

Mins	Observations
-15.00	Load applied to partition wall
0:00	Test started.
5:00	In the furnace joint compound and tape is still covering the plasterboard joints on the exposed face.
8:00	Joint compound now beginning to fall away from the exposed face plasterboard joints.
9:00	No change to the unexposed face.
12:00	Remnants of joint compound still attached but most of the joints are now exposed to the furnace. All joints horizontal and vertical still tight.
16:00	Vertical crack in the centre of the lower central plasterboard along the line of the steel clip underneath.
16:30	Virtually all the exposed plasterboard joints are now exposed, all still tight both horizontal and vertical.
18:20	Light smoke on the unexposed face at ¾ specimen height from the vicinity of steel clip 4 from the left.
20:44	Amount and density of smoke gradually increasing from steel clip 4 from the left at ¾ specimen height.
24:00	Light smoke now from top angles in several locations. No change in overall appearance of unexposed face.

Mins	Observations
25:30	Within the furnace fierce flaming has commenced and all exposed face plasterboard joints, horizontal and vertical, have opened up
26:30	No change in appearance of the unexposed face.
27:30	Vertical cracks now on all exposed face plasterboards within the furnace across the whole of the visible specimen.
28:30	The unexposed face is now bowing noticeably towards the furnace.
29:30	Still fierce flaming within the furnace, all exposed face plasterboard joints torn open up to 30mm between fixings and extensive cracking around the fixing points.
31:40	The surface of the Kingspan Therma insulation on the unexposed face is becoming crinkly and slightly tarnished in several areas.
33:30	Within the furnace all plasterboards appear to be still attached to the steel clips.
34:00	The Kingspan Therma insulation within the Ultrapanels is now bowing in even more towards the furnace and the steel clips between the panels are also bending towards the furnace.
35:20	Dark dense smoke has now suddenly appeared in large volumes from behind steel clips 3 and 4 from the left just above ½ specimen height.
35:51	Wall collapses unable to bear the load and catches fire on the left-hand edge. Loadbearing failure.
36:12	Test terminated.

The construction after test is shown in Photos.

5.2 Temperature recorded on the unexposed face

The maximum temperature recorded on the unexposed face of the wall is shown plotted against time in Graph 6 together with the mean temperature, calculated from thermocouples 1, 2, 3, 4, and 5 (standard five).

Neither the mean temperature rise limit, (140ºC rise), nor the maximum temperature rise limit, (180ºC rise), for insulation were exceeded during the test.

5.3 Deflection recorded

5.3.1 Vertical deflection

The vertical deflection of the wall, as recorded by the two transducers positioned under the bottom left and the bottom right corners of the wall, is shown plotted against time in Graph 7.

Positive and negative values denote the vertical deflection of the wall (expansion & contraction respectively).

The average deflection recorded from the two transducers showed vertical contraction (negative elongation), of the wall height up to a maximum of 36.8mm, recorded after 36 minutes from the start of the test immediately before the test was terminated.

The vertical rate of contraction (negative elongation), showed a maximum rate of 30.8mm/minute, recorded after 36 minutes from the start of the test immediately before the test was terminated.

Failure of loadbearing capacity occurred after 35 completed minutes of test.

5.3.2 Horizontal defection

The horizontal deflection of the wall recorded during the test by linear displacement transducers attached to the centre of the wall and at mid height of the right-hand vertical edge, 50mm in from the edge, with deflection shown plotted against time in Graph 6.

Positive and negative values denote specimen movement toward and away from the furnace respectively.

The maximum deflection (measured at the centre of the specimen) was 184.8mm towards the furnace, recorded after 36 minutes from the start of the test, immediately before the test was terminated.

The maximum deflection (Measured on the right-hand side of the specimen) was 3.7mm towards the furnace after 36 minutes from the start of the test, immediately before the test was terminated.

6 Performance criteria

The standards (ref 1, 2 and 3) state that a loaded wall is regarded as having a fire resistance (expressed in minutes) that is equal to the elapsed time (in completed minutes) between the commencement of heating and either the termination of heating, or the time of failure with respect to the relevant criteria.

6.1 Loadbearing capacity

Failure is deemed to occur when the test specimen loses its ability to support the test load. This shall be taken as when one of the following criteria have been exceeded by the mean vertical deflection:

For vertically loaded elements:

Limiting vertical contraction (negative elongation), $C = \frac{h}{100}$ mm $C = \frac{3000}{100}$ mm C = ***30mm***

or

Limiting vertical rate of contraction (negative elongation), $\frac{dC}{dt} = \frac{3h}{1000}$ mm/min = $\frac{9000}{1000}$ = ***9mm/min***

Where *h* is the initial height in millimetres of the test specimen.

6.2 Integrity

Failure is deemed to occur:

a) When collapse or sustained flaming for not less than 10s on the unexposed face occurs;

b) When cracks, gaps or fissures allow flames or hot gases to cause flaming or glowing of a cotton fibre pad, when applied for a maximum of 30s;

c) When a 6mm-diameter gap gauge can penetrate through a gap into the furnace and be moved in the gap for a distance of at least 150mm;

d) When a 25mm-diameter gap gauge can penetrate through a gap into the furnace

e) When loadbearing failure occurs.

6.3 Insulation

Failure is deemed to occur:

a) When the mean unexposed face temperature increases by more than 140°C above its initial value;

b) When the temperature recorded at any position (including the roving thermocouple) on the unexposed face is in excess of 180°C above the initial mean unexposed face temperature;

c) When integrity failure occurs.

7 Conclusion

An Ultraframe (UK) Ltd Ultrapanel partition loadbearing wall, as described in this report, was submitted to a fire resistance test carried out in accordance with European Standard EN 1365-1:2012 for a duration of 36 minutes. The test was carried out with the wall under a total imposed load of 60kN (20kN/m).

The wall was considered symmetrical and was found to achieve the following performance:

Loadbearing capacity		35 minutes
Integrity:	- sustained flaming:	35 minutes (taken as time of loadbearing failure)
	- gap gauge:	35 minutes (taken as time of loadbearing failure)
	- cotton pad:	35 minutes (taken as time of loadbearing failure)
Insulation:		35 minutes (taken as time of loadbearing failure)

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in EN 1363-1, and where appropriate EN 1363-2. Any significant deviation with respect to size, construction details, loads, stresses, edge or end conditions other than those

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

8 Field of direct application of results

The standard[1] states that the results of the fire test are directly applicable to similar constructions where one or more of the changes listed below are made and the construction continues to comply with the appropriate design code for its stiffness and its stability.

a) Decrease in height.

b) Increase in the thickness of the wall.

c) Increase in the thickness of component materials.

d) Decrease in linear dimensions of boards or dimensions of panels except thickness.

e) Decrease in stud spacing.

f) Decrease in distance of fixing centres.

g) Increase in the number of horizontal joints when tested with one joint not more than 500mm ± 150mm from the top edge.

h) Decrease in the applied load.

i) Increase in the width, provided that the test specimen was tested at full width or 3m wide, whichever is the larger.

9 References

1. Fire resistance tests for loadbearing elements. Part 1: Walls. EN 1365-1: 2012. British Standards Institution, London, 2012.
2. Fire resistance tests. Part 1: General requirements. EN 1363-1: 2012. British Standards Institution, London, 2012.
3. Fire resistance tests. Part 1: General requirements. EN 1363-1: 2020. British Standards Institution, London, 2020.

10 Figures

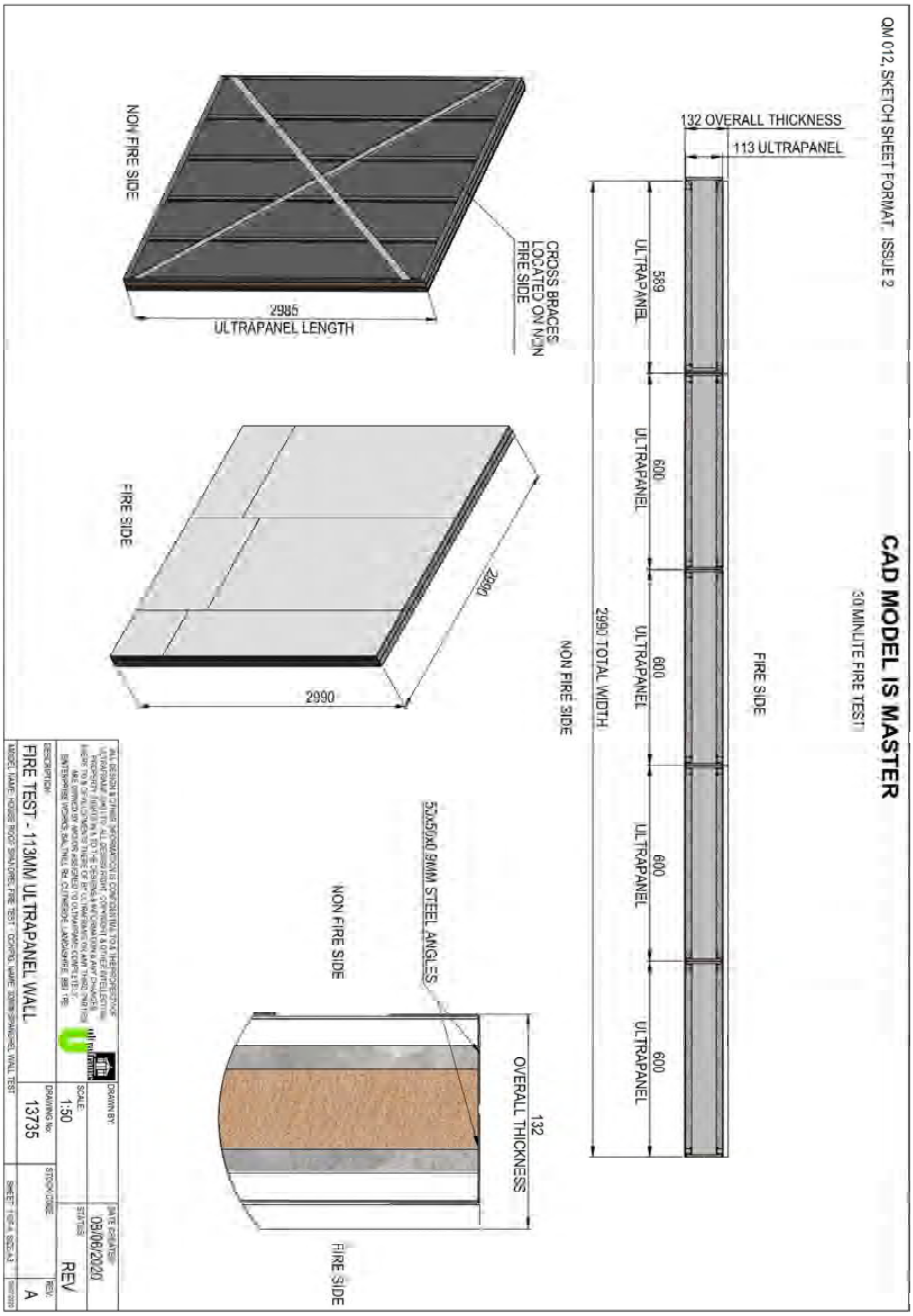


Figure 1: Test Construction detail [1] – as supplied by Ultraframe (UK) Ltd.

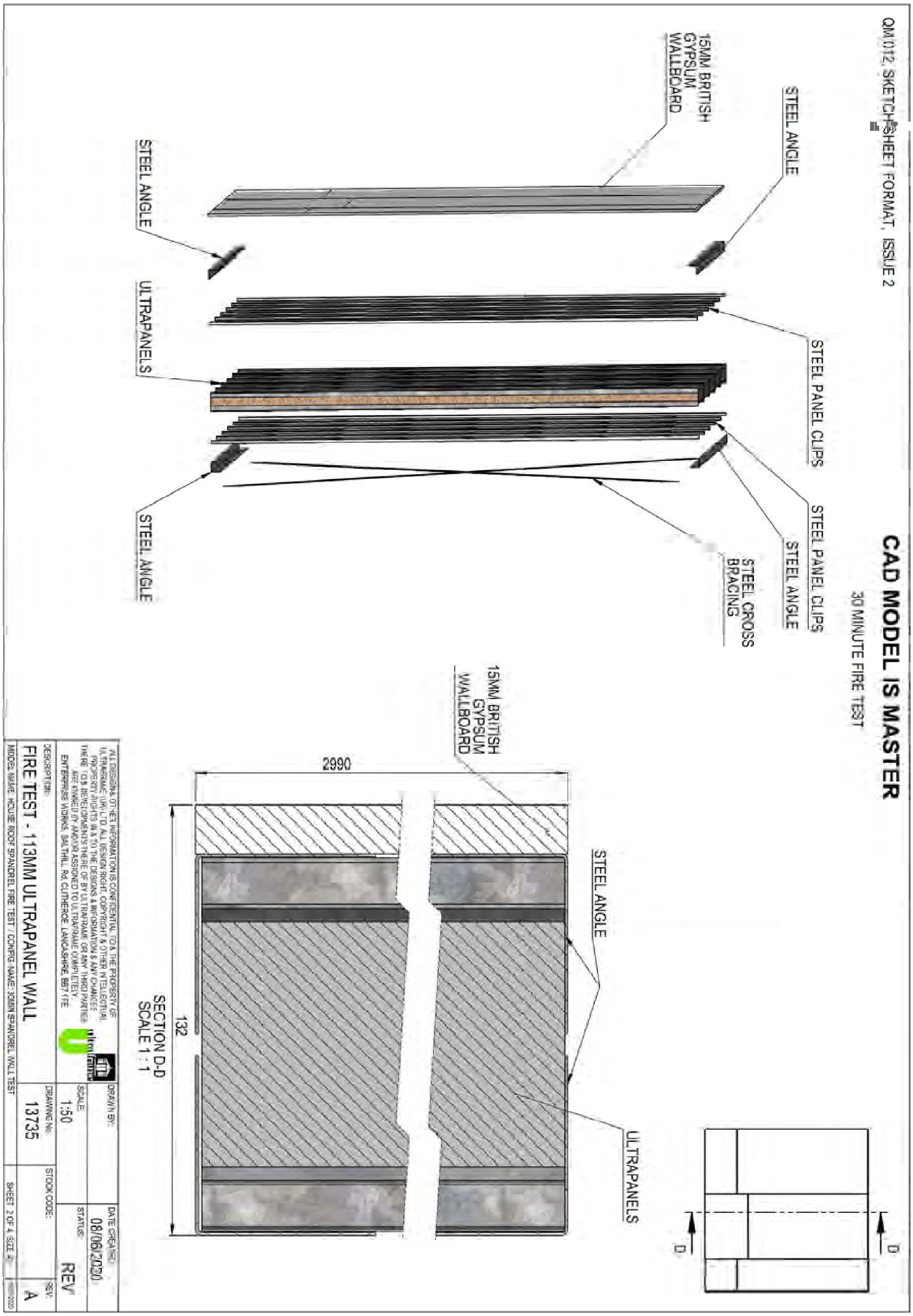


Figure 2: Test Construction detail [2] – as supplied by Ultraframe (UK) Ltd.

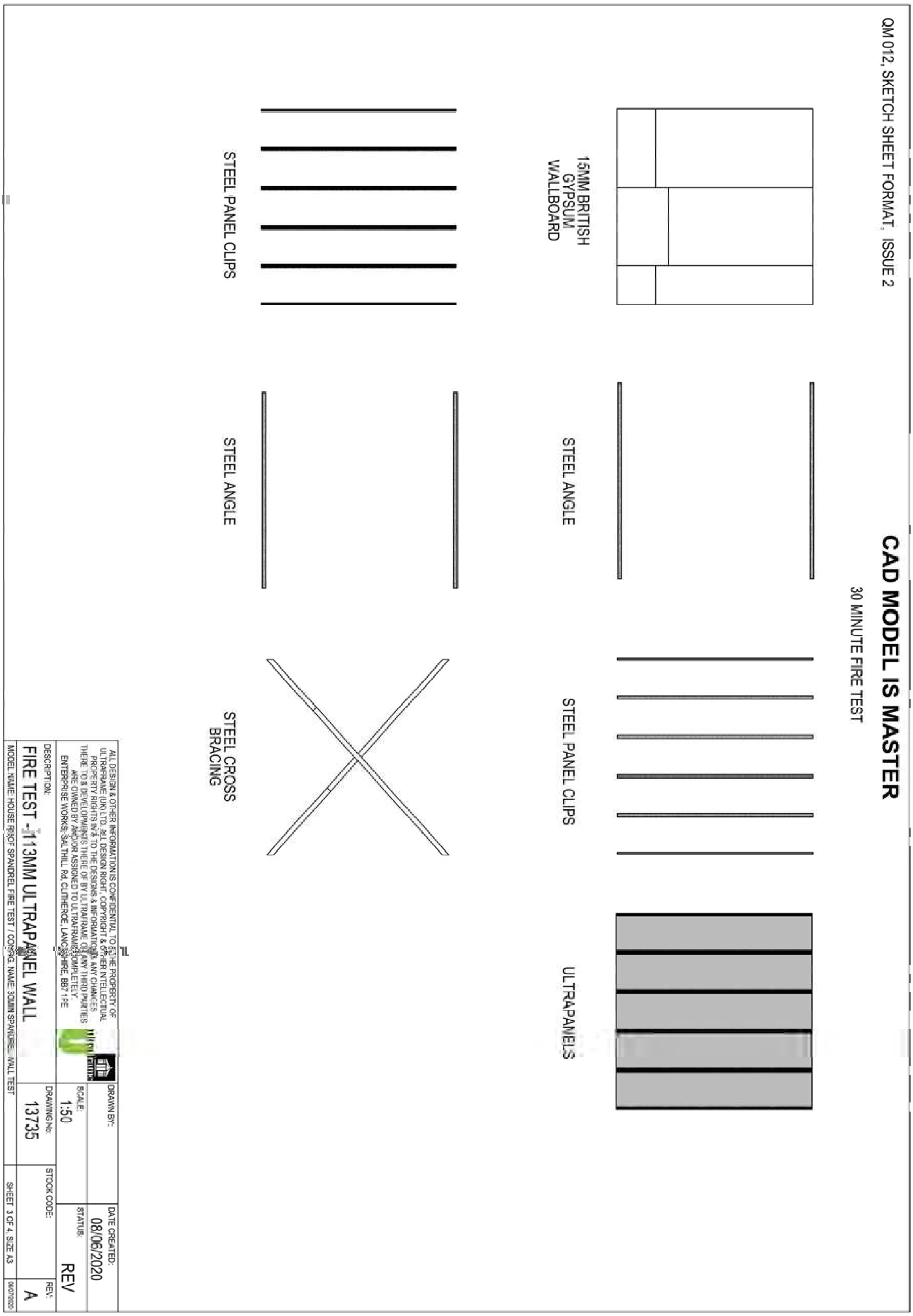


Figure 3: Test Construction detail [3] – as supplied by Ultraframe (UK) Ltd.

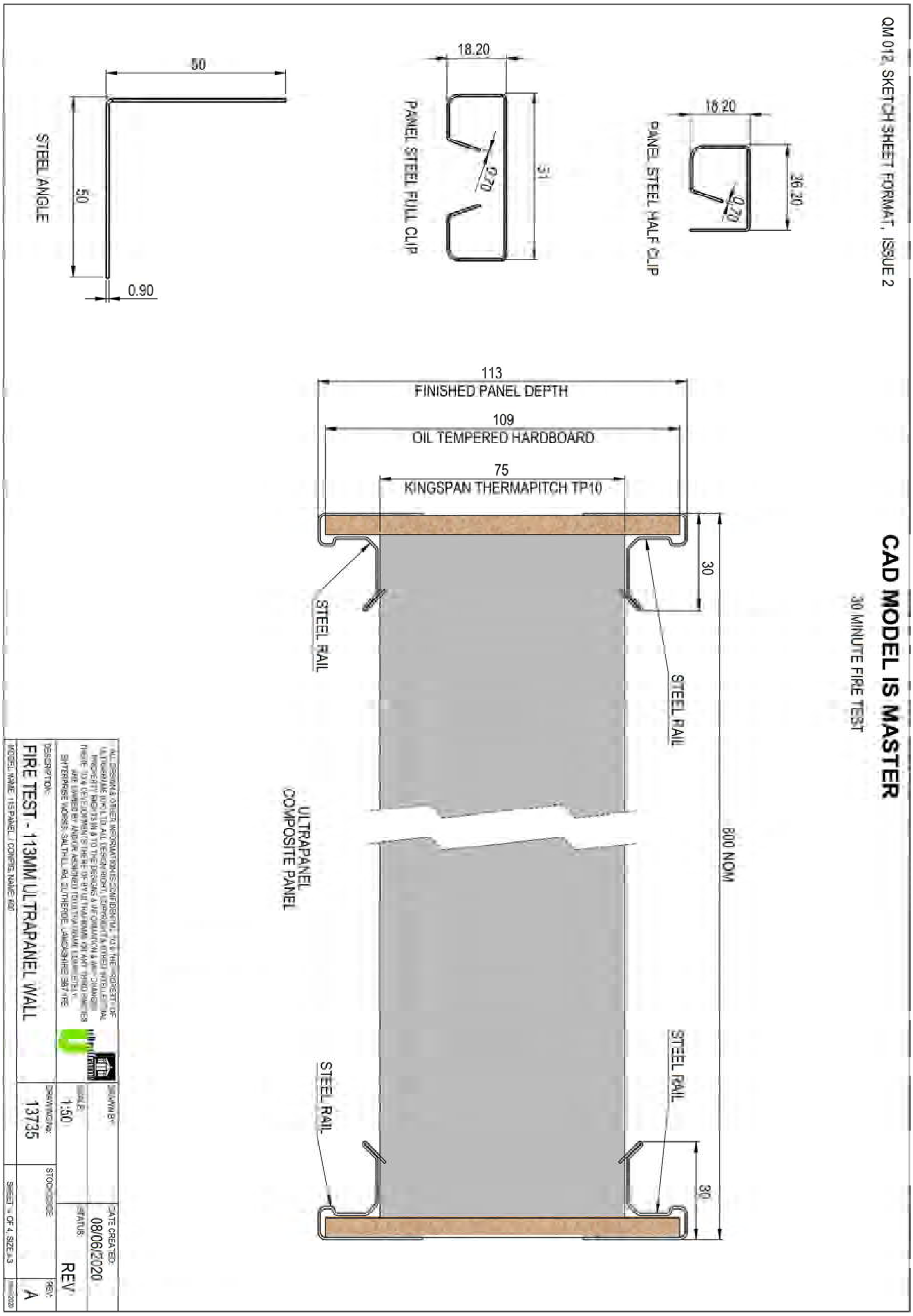
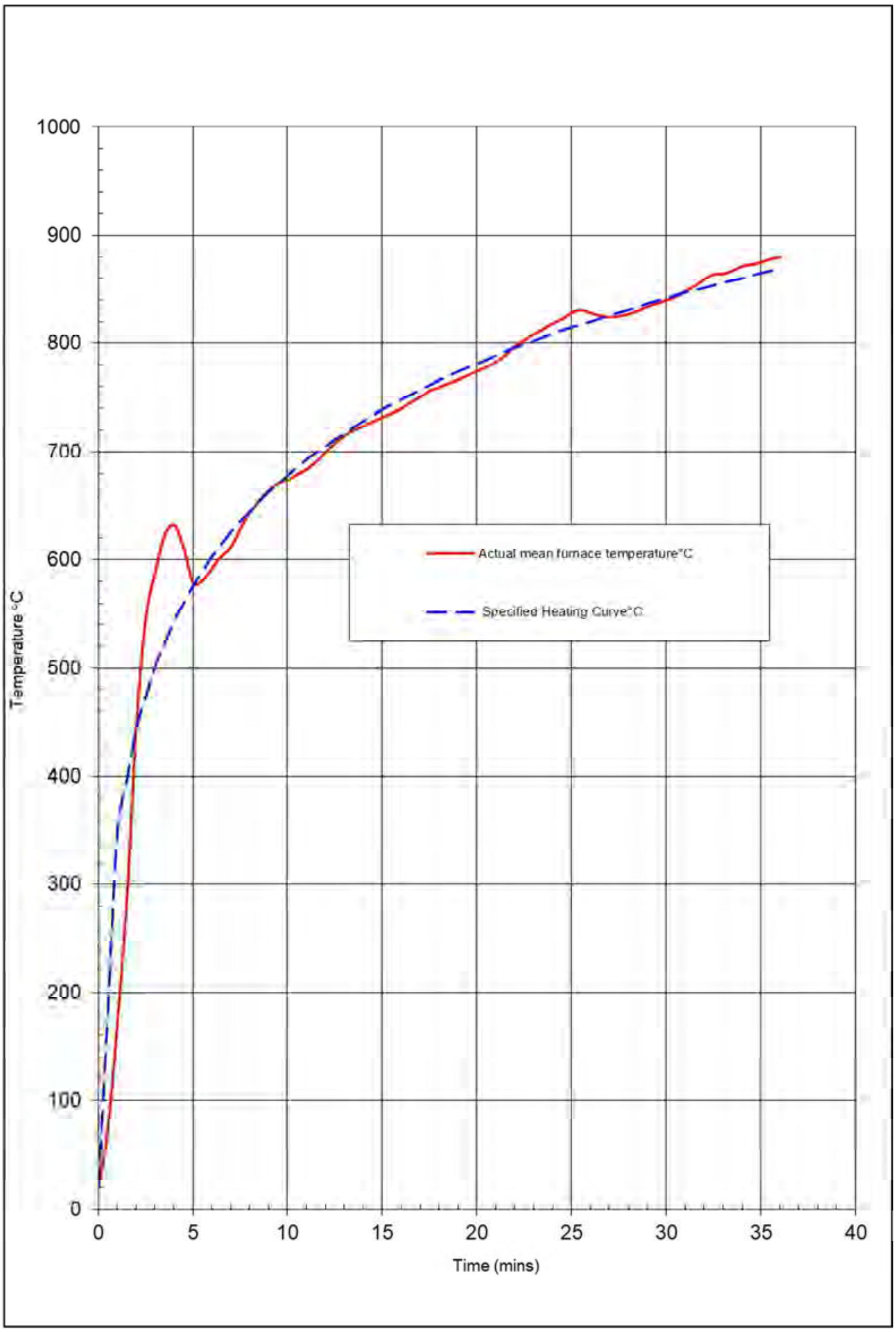
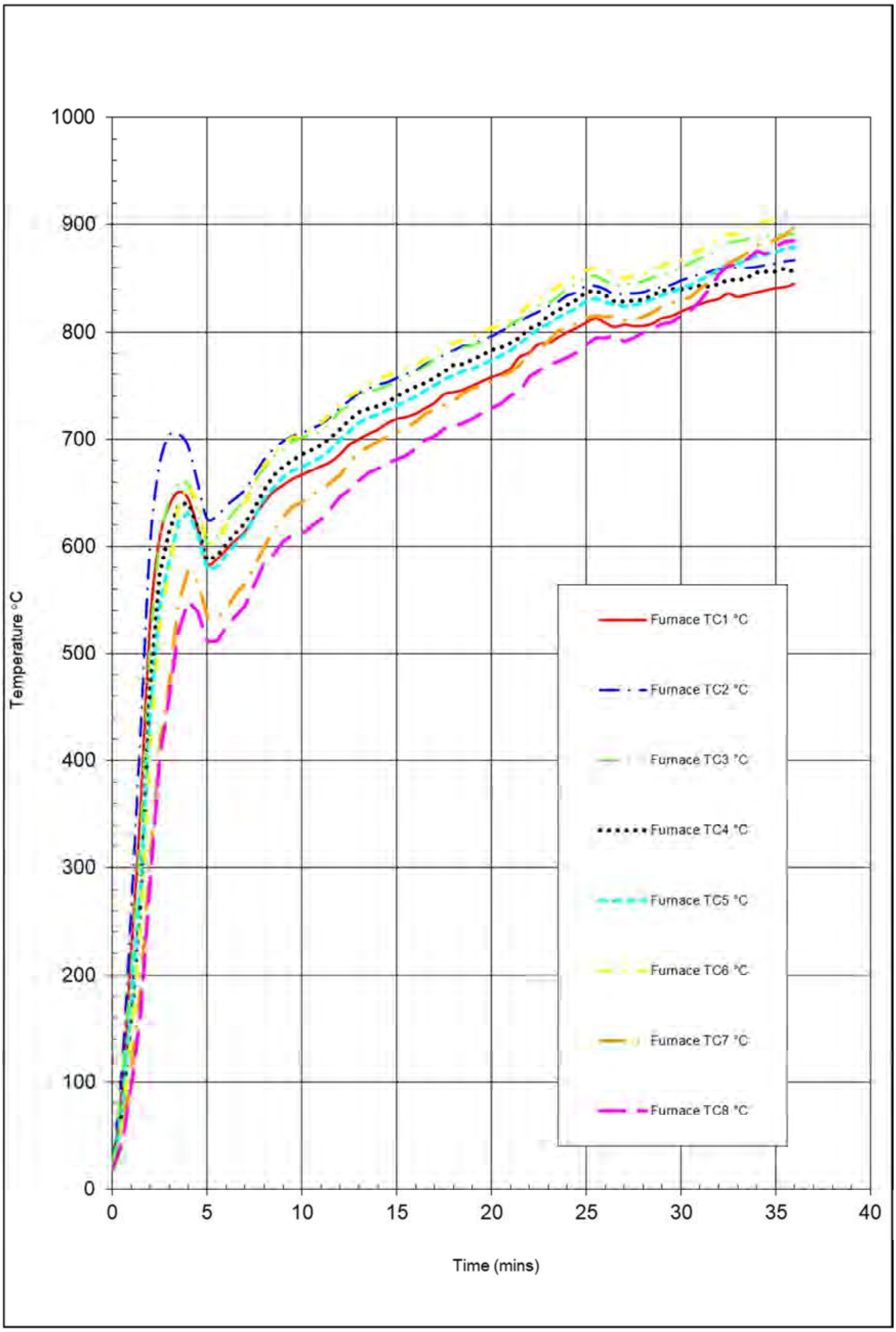


Figure 4: Test Construction detail [4] – as supplied by Ultraframe (UK) Ltd.

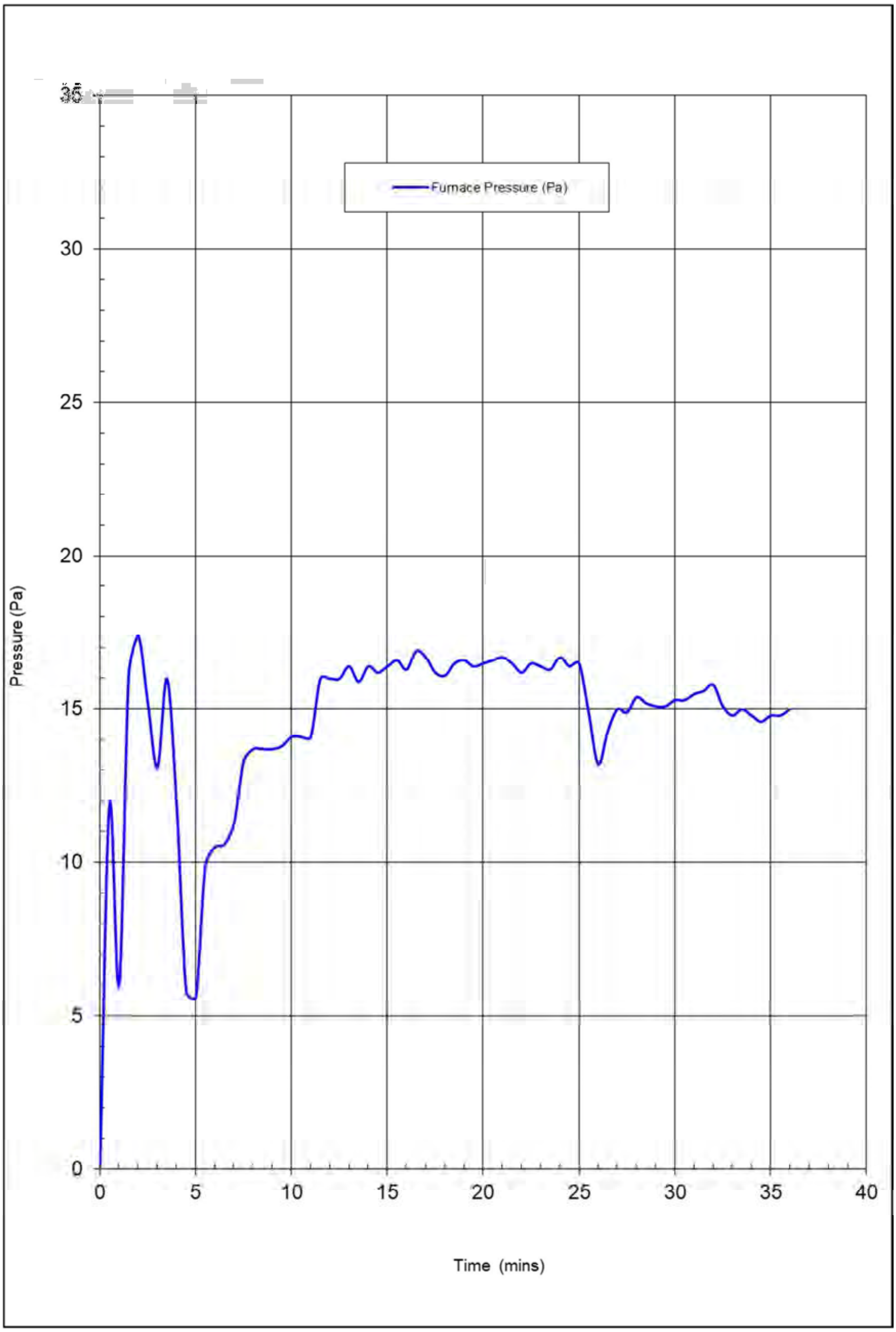
11 Graphs



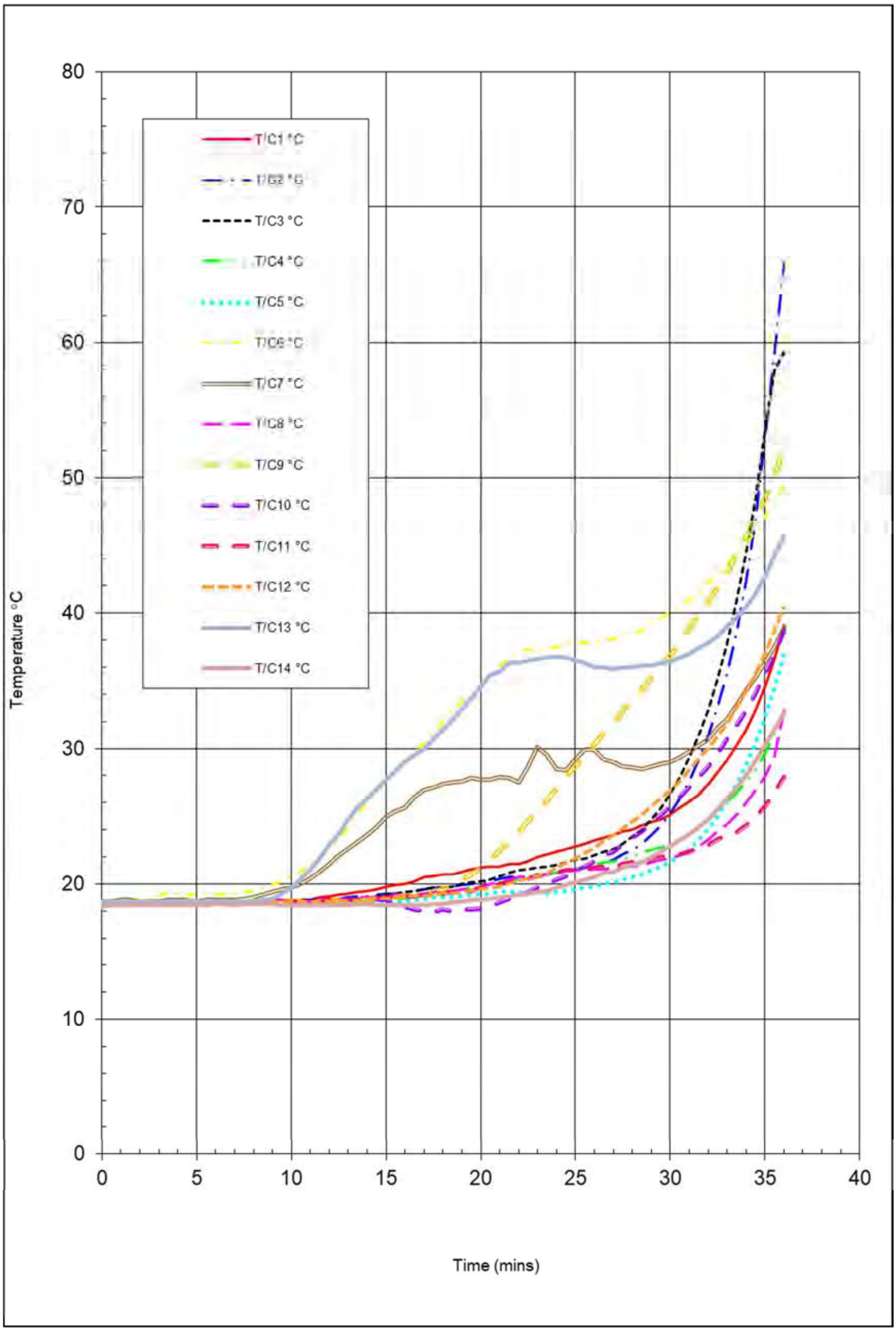
Graph 1: Mean furnace temperature with specified heating curve.



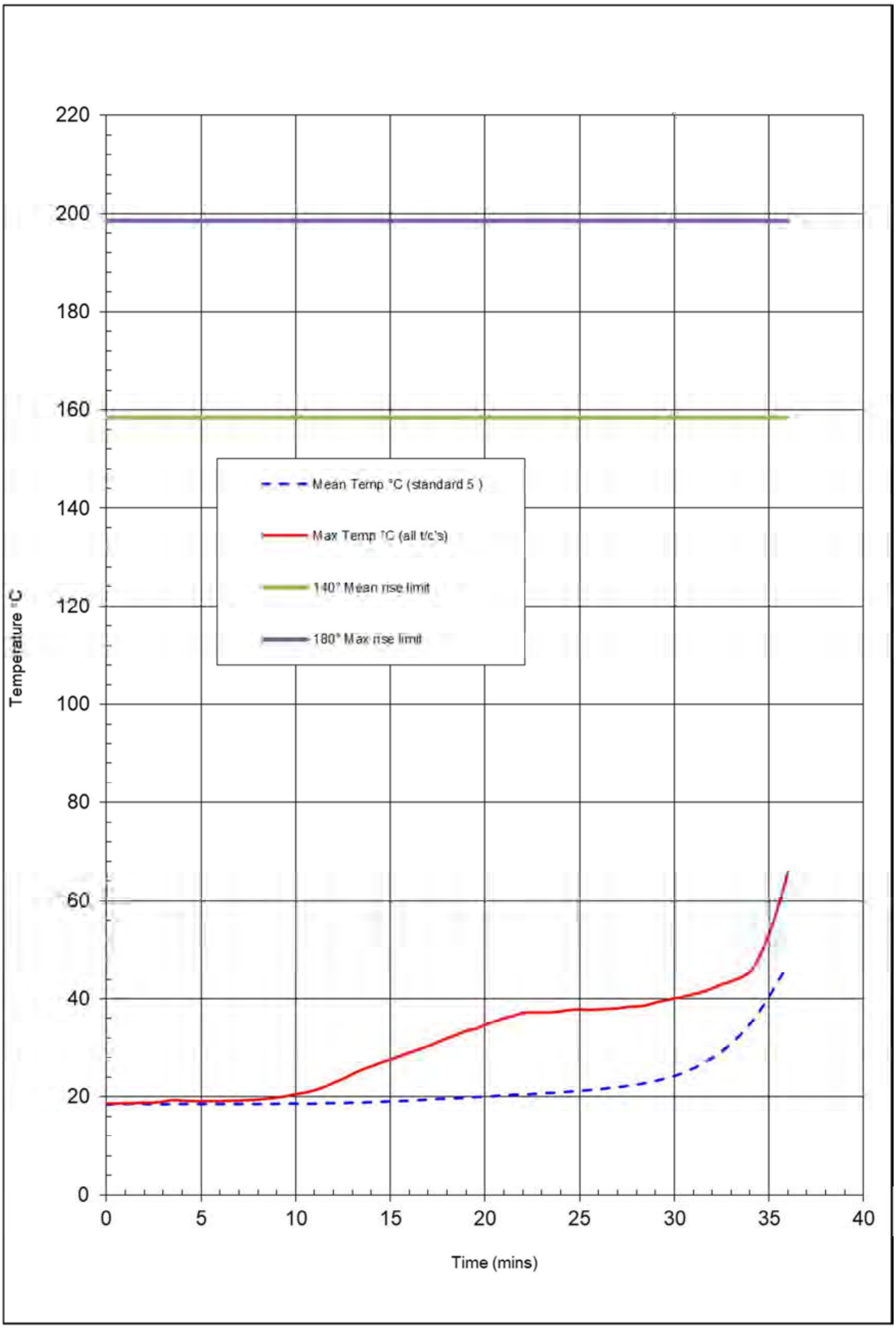
Graph 2: Individual furnace thermocouples temperatures.



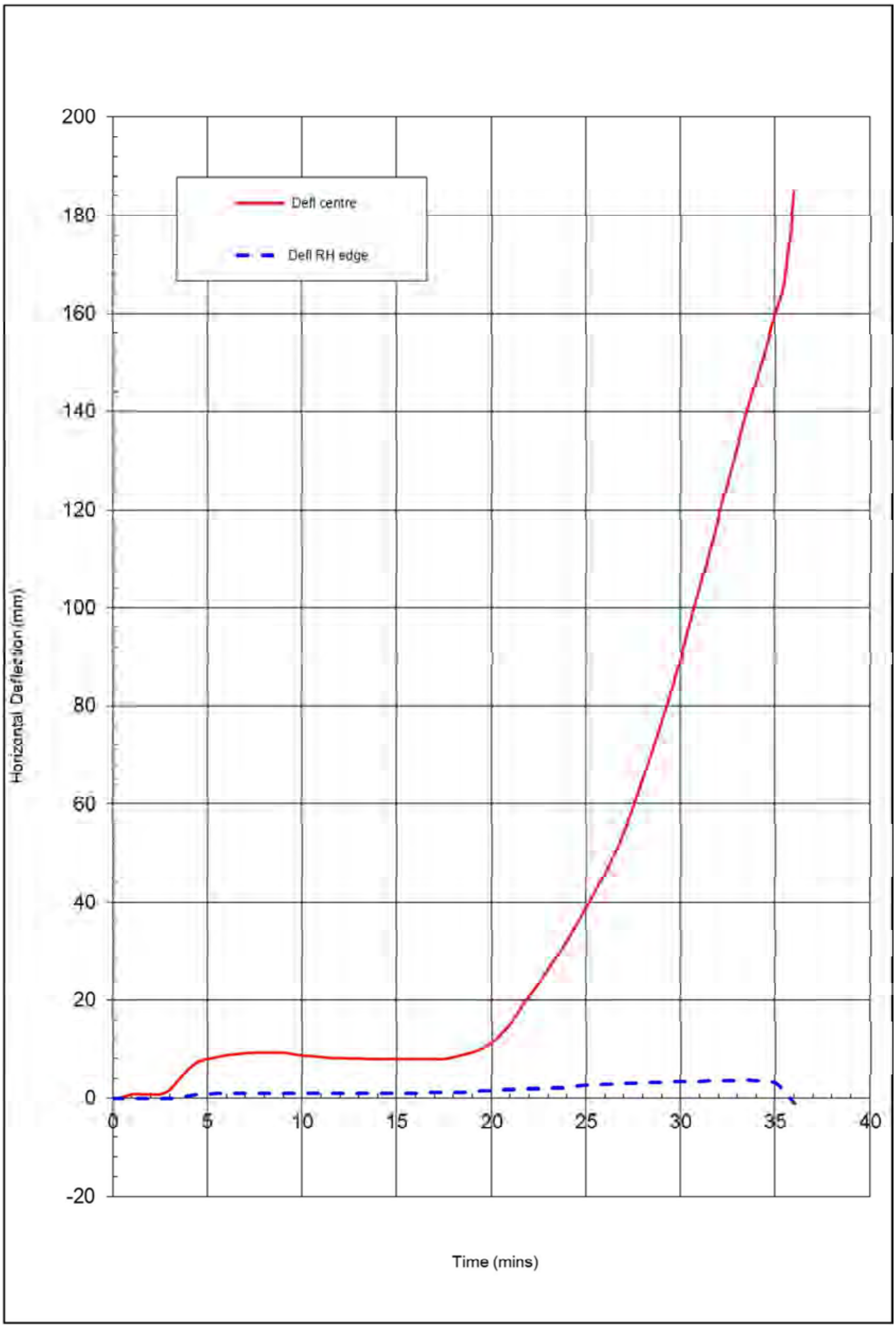
Graph 3: Mean furnace pressure.



Graph 4: Unexposed surface thermocouple temperatures.

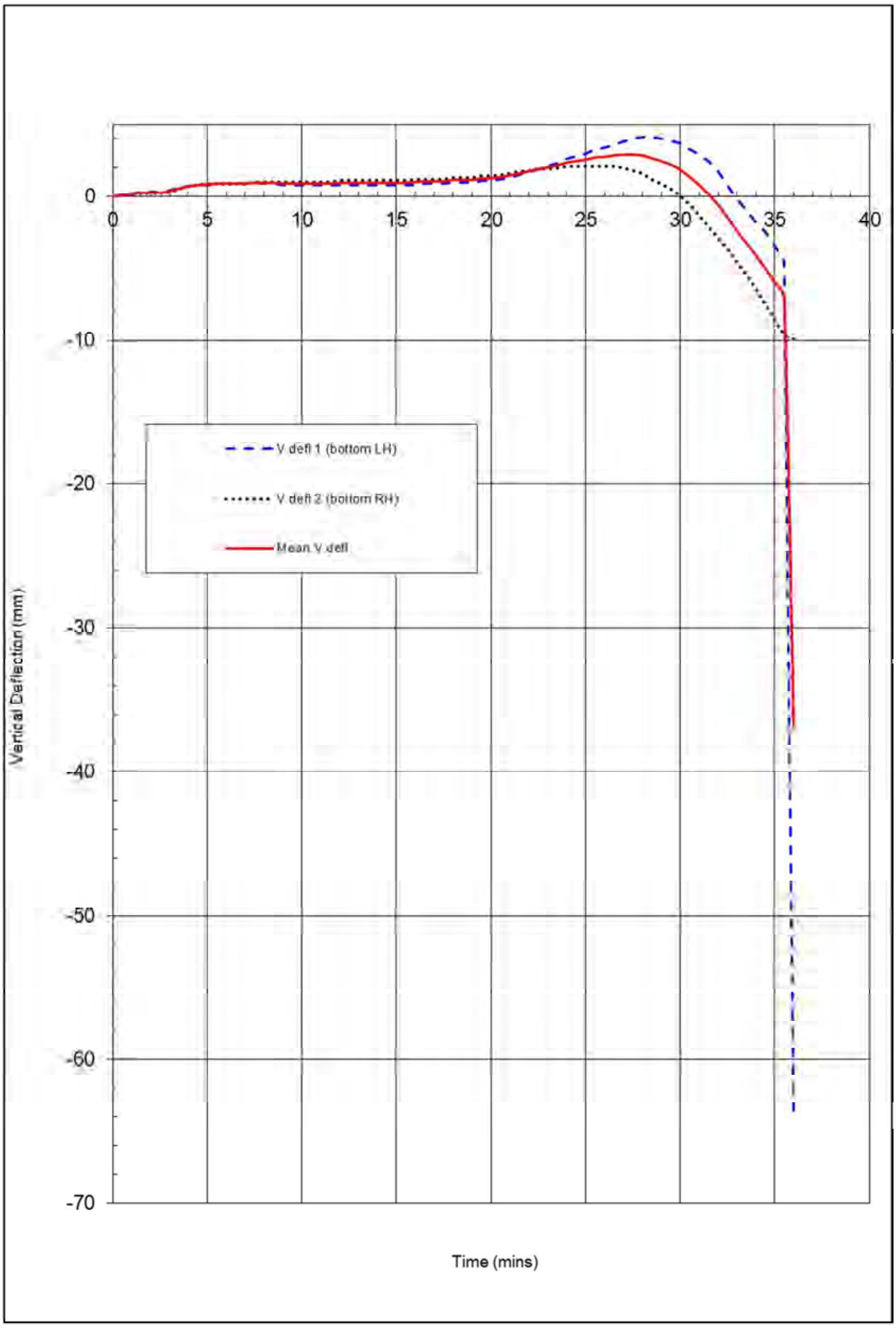


Graph 5: Mean and max temperature for unexposed surface thermocouples.



Graph 6: Horizontal deflection.

Note: Positive values indicate movement towards the furnace.



Graph 7: Vertical deflection recorded.

Note: Positive values indicate expansion of the sample whilst under load.

12 Photographs

Photograph 1: Unexposed face of test specimen before test showing thermocouple and deflection locations.

Photograph 2: Exposed face of test specimen before test.

Photograph 3: Unexposed face of test specimen before test.

Photograph 4: Unexposed face of test specimen at moment of loadbearing failure after 35 completed minutes of test.

Photograph 5: Unexposed face of test specimen after termination of test

Photograph 6: Exposed face of test specimen after test.

Report Ends

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BRE Global Test Report

Fire resistance test report on a loadbearing Ultraframe Ultrapanel wall with the unexposed face clad with two layers of 15mm thick Gyproc Fireline plasterboard tested in accordance with EN1365-1:2012.

Prepared for:	**Ultraframe (UK) Ltd**
Date:	**21 December 2020**
Report Number:	**P115505-1005 Issue: 1**

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Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Table of Contents

Summary

An Ultraframe (UK) Ltd partition wall, nominally 3000mm x 3000mm, was submitted to a fire resistance test carried out in accordance with European Standard EN 1365-1:2012 (with reference to EN 1363-1:2012[2] and EN 1363-1:2020[3]) on 13 November 2020 at BRE Watford for a duration of 116.5 minutes. The test was carried out with the wall under a total vertical load of 15kN (5kN/m) as prescribed by the sponsor.

With reference to EN 1363-1:2020[3], the main change in the standard (compared with EN 1363-1:2012[2]) is a redefinition for the load bearing capacity criterion.

The loadbearing capacity criterion for vertical elements remains unchanged.

The partition comprised of five Ultraframe Ultrapanels with the unexposed face clad with two layers of 15mm thick Gyproc Fireline plasterboard.

The wall was found to achieve the following results:

Loadbearing capacity		116 minutes
Integrity:	- sustained flaming:	116 minutes (taken as time of loadbearing failure)
	- gap gauge:	116 minutes (taken as time of loadbearing failure)
	- cotton pad:	116 minutes (taken as time of loadbearing failure)
Insulation:		116 minutes (taken as time of loadbearing failure)

1 Objective

A test was carried out in accordance with EN 1365-1:2012 to determine the fire resistance of an Ultraframe (UK) Ltd partition wall comprising of five Ultraframe Ultrapanels with the unexposed face clad with two layers of 15mm thick Gyproc Fireline plasterboard.

2 Test construction

2.1 General

Assembly of the wall was completed on 10 November 2020. When finished it was installed into a furnace test frame by BRE as described in Test Arrangement.

The construction is shown in Figures and before the test in Photos.

Eighteen K-type chromel/alumel thermocouples were fitted to the unexposed surface of the test specimen.

BRE was not involved in the selection of the specimen in any way and the result relates to the specimen as received.

External and accessible components were dimensionally/visually verified by BRE Global to correspond to client supplied constructional data. Detailed constructional data relating to the specimen were not independently verified by BRE Global, the validity of the test results are conditional of the accuracy of that data.

2.2 Components

2.2.1 Ultrapanels

Each panel comprised 588mm wide x 2000mm long x 75mm thick Rockwool Fabrock MECH non-combustible board batts cut to size with 6mm thick Siniat Multipurpose Panel fibre reinforced calcium silicate building board attached along each long edge to give a finished width of 600mm to each panel. A profiled steel rail was attached to the Siniat Multipurpose Panel using rivets at 75mm spacing which in turn gripped into the Rockwool Fabrock MECH boards using a barb. The purpose of this steel rail was to enable the friction fitting of the steel panel clips to join the individual panels together to form a continuous partition wall. The finished panel thickness was 113mm. The Ultrapanels are shown in Figures.

2.2.2 Plasterboard

15mm thick Gyproc Fireline plasterboard was supplied in sheets of 2400mm x 1200mm, with two layers on the unexposed side of the test specimen with joints as per drawings.

A representative sample of board was marked “F-EN520 Gypsum Plasterboard Gyproc Fireline 2400 x 1200 x 15 mm SE 31 177 20 20:16”. Manufactured by British Gypsum Ltd.

2.2.3 Panel steel clips

The panels were joined together using profiled 0.70mm thick steel panel clips. The full panel clips were labelled “Ultraframe WPPC600/1” and the half panel clips were labelled “Ultraframe WPPC600/2”. The panel clips are shown in Figures.

2.2.4 Additional steel components

The top and bottom edges of the connected Ultrapanels panels were secured using a 50mm x 50mm x 0.9mm thick L shaped angle on both sides.

On the exposed face a 100mm wide 0.9mm thick steel cross brace was used to strengthen the panels.

On the unexposed face the horizontal Wallboard joints in both plasterboard layers were backed by British Gypsum Gypframe backing straps labelled “LE12 6HX British Gypsum GFT1 2400mm Gypframe CE 13 EN14195 01008 08 19081 RF A1 YS 210Nm”.

2.2.5 Fixings

The Gyproc Fireline plasterboard was fixed to the steel panel clips and top and bottom angles using Easydrive 3.5mm x 25mm drywall screws, for the inner layer and Easydrive 3.5mm x 42mm drywall screws for the outer layer, with a black phosphate finish, at 150mm spacing around the perimeter and 300mm in the field of the boards. The L shaped channels and crossbrace were fixed to the steel panel clips using Senco Duraspin 5.5mm x 19mm wafer head fixings labelled “55WS19MC”.

2.2.6 Joint filler

The horizontal Fireline joints on the exposed face were filled with Dow Dowsil 400 firestop fire rated intumescent acrylic sealant.

2.3 Assembly

2.3.1 Ultrapanels

The five panels were joined together using the full panel clips for the middle three joints and the half panel clips were fitted along both outer edges. The clips were friction fitted over the steel rails along each Ultrapanel long edge to form a nominally 3000mm wide test specimen. The 50mm L shaped angles were then attached to the panel clips on both sides of the test specimen along the top and bottom with two of the Senco Duraspin 5.5mm x 19mm wafer head fixings at each intersection.

2.4 Exposed face

The cross brace was then attached to the panel clips diagonally across the unexposed face using four Senco Duraspin 5.5mm x 19mm wafer head fixings at each intersection.

2.5 Unexposed face

Two layers of 15mm thick Gyproc Fireline plasterboard were attached to the steel panel clips and top and bottom angles over the assembled Ultrapanels on the unexposed face. The Gypframe backing strap was placed behind the horizontal joints on both layers of plasterboard, which were fixed using 3.5mm x 25mm drywall screws for the inner layer and 3.5mm x 42mm drywall screws for the outer layer, at 150mm spacing on the perimeter and 300mm spacing in the field of the boards. All the joints in the two layers of plasterboard were offset to avoid joints coinciding as shown in figures.

All the horizontal plasterboard joints on the exposed face were filled with Dow Dowsil 400 firestop fire rated intumescent acrylic sealant.

The construction pattern of the joints was confirmed to match that as shown in Figures.

3 Conditioning

All the test materials arrived either preassembled or pre-cut, so there were no conditioning samples available.

4 Test Procedure

4.1 General

The test was carried out on 13 November 2020 in accordance with EN 1365-1:2012[1] and was witnessed by Andrew Thomson representing the sponsor Ultraframe (UK) Ltd. The ambient temperature at the start of the test was 16°C and the initial mean surface temperature recorded on the unexposed face of the wall by the mean 5 thermocouples was 19.0ºC.

4.2 Test arrangement

The wall was installed within the aperture, nominally 3000mm-high x 3050mm-wide, of a heavily reinforced concrete test frame.

The load was applied from below the specimen via six hydraulic rams acting on the inverted steel channel, which spread the load over the base of the wall. The inverted channel measured 100mm x 300mm x 100mm with flange and web thicknesses of 8mm and 16mm respectively.

The wall was pinched between the steel-channel beam and the concrete soffit of the test frame aperture where the head of the wall was bedded on mortar.

The two vertical sides of the wall remained unrestrained. Calcium magnesium silicate blanket was used to seal the gap between the vertical sides of the wall and the test frame and overlapping onto the bottom edge of the wall on the fire-side face to protect the test equipment below the wall.

4.3 Loading

The vertical load applied to the wall as prescribed by the sponsor was 15kN which equated to 5kN/m.

In order to impose the full prescribed test load, the load applied by the rams was greater than the prescribed load by a magnitude equal to the self-weight of the wall and inverted channel. This offset was applied automatically by the load application procedure

4.4 Furnace control

The furnace temperature was measured by means of eight plate thermometers arranged symmetrically in the furnace with their measuring junctions nominally 100mm from the fire-side face of the specimen. The furnace was controlled to comply with the heating regime specified in European Standard EN 1363-1:2012[2] and EN 1363-1:2020[3]

The mean temperature recorded is plotted against time in Graphs together with the specified curve for comparison.

The furnace pressure was monitored at a point 2.4m above the base of the wall. The pressure was controlled to be 15Pa ±3Pa at this level resulting in the height of the neutral pressure plane being at 0.5m above the base of the wall. The furnace pressure recorded is plotted against time in Graphs.

4.5 Temperature measurements on the unexposed face

Eighteen K-type thermocouples each covered with an insulating pad were fixed to the unexposed face of the specimen to measure its temperature continuously during the test. Their locations are shown in Photos.

Thermocouples 1, 2, 3, 4 and 5 (standard five) were used to calculate the mean unexposed face temperature, all the thermocouples were used to determine the maximum unexposed face temperature.

4.6 Deflection measurements

The vertical deflection of the wall was measured during the test by two transducers positioned one below each end of the steel channel beam. The mean vertical deflection was calculated from these two transducers.

The horizontal deflection of the wall was measured throughout the test by two transducers connected, via fine steel wire, to the centre of the wall and mid-height of the right-hand side (as viewed from the unexposed face).

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5 Results

5.1 Observations

Observations made during the test are given in Table 2: *Observations* below. Any references to left and right are as viewed from the unexposed face.

Table 2: Observations.

Mins/secs	Observations
-15:00	Load applied to partition wall
0:00	Test started.
8:30	No change to the appearance of the specimen within the furnace.
9:30	Centre of the unexposed face bowing noticeably towards the furnace now.
11:00	Continuous light white smoke coming from the top of the unexposed face.
17:30	Specimen stable and visually unchanged within the furnace.
23:00	Right hand central steel clip buckling sideways in the top half of the specimen within the furnace.
25:00	Left hand central steel clip appears to have sprung away from the top half of the specimen on the exposed face within the furnace.
26:00	No visual change to the unexposed face. Smoke from top of the specimen has subsided and the face seems to be deflecting away from the furnace now.
60:00	The specimen is stable within the furnace and no change to the unexposed face.
85:00	Light smoke from the junction of the right hand vertical and horizontal plasterboard joints at ¾ specimen height on the unexposed face.
90:00	Light smoke now from the junction of the left hand vertical and horizontal plasterboard joints at ¼ specimen height on the unexposed face.
110:00	Specimen noticeably bowing out on the lower ¼ of the left-hand side with the horizontal plasterboard joint widening to approx. 10mm between fixings.
116:40	Sudden loadbearing failure as left-hand side of specimen fails and the whole wall jumps out of the furnace.
116:50	Test terminated.

The construction after test is shown in Photos.

5.2 Temperature recorded on the unexposed face

The maximum temperature recorded on the unexposed face of the wall is shown plotted against time in Graph 5 together with the mean temperature, calculated from thermocouples 1, 2, 3, 4, and 5 (standard five).

Neither the mean temperature rise limit, (140ºC rise), nor the maximum temperature rise limit, (180ºC rise), for insulation were exceeded during the test.

5.3 Deflection recorded

5.3.1 Vertical deflection

The vertical deflection of the wall, as recorded by the two transducers positioned under the bottom left and the bottom right corners of the wall, is shown plotted against time in Graph 7.

Positive and negative values denote the vertical deflection of the wall (expansion & contraction respectively).

The average deflection recorded from the two transducers showed vertical contraction (negative elongation), of the wall height up to a maximum of 4.4mm, recorded after 116.5 minutes from the start of the test immediately before the test was terminated.

The vertical rate of contraction (negative elongation), showed a maximum rate of 6.65mm/minute, recorded after 116.5 minutes from the start of the test immediately before the test was terminated.

Failure of loadbearing capacity occurred after 116 completed minutes of test.

5.3.2 Horizontal defection

The horizontal deflection of the wall recorded during the test by linear displacement transducers attached to the centre of the wall and at mid height of the right-hand vertical edge, 50mm in from the edge, with deflection shown plotted against time in Graph 6.

Positive and negative values denote specimen movement toward and away from the furnace respectively.

The maximum deflection (measured at the centre of the specimen) was 50.5mm towards the furnace, recorded after 9 minutes from the start of the test.

The maximum deflection (Measured on the right-hand side of the specimen) was 41.6mm towards the furnace after 11 minutes from the start of the test.

6 Performance criteria

The standards (ref 1, 2 and 3) state that a loaded wall is regarded as having a fire resistance (expressed in minutes) that is equal to the elapsed time (in completed minutes) between the commencement of heating and either the termination of heating, or the time of failure with respect to the relevant criteria.

6.1 Loadbearing capacity

Failure is deemed to occur when the test specimen loses its ability to support the test load. This shall be taken as when one of the following criteria have been exceeded by the mean vertical deflection:

For vertically loaded elements:

Limiting vertical contraction (negative elongation), $C = \frac{h}{100}$ mm $C = \frac{3000}{100}$ mm C = ***30mm***

or

Limiting vertical rate of contraction (negative elongation), $\frac{dC}{dt} = \frac{3h}{1000}$ mm/min = $\frac{9000}{1000}$ = ***9mm/min***

Where h is the initial height in millimetres of the test specimen.

6.2 Integrity

Failure is deemed to occur:

a) When collapse or sustained flaming for not less than 10s on the unexposed face occurs;

b) When cracks, gaps or fissures allow flames or hot gases to cause flaming or glowing of a cotton fibre pad, when applied for a maximum of 30s;

c) When a 6mm-diameter gap gauge can penetrate through a gap into the furnace and be moved in the gap for a distance of at least 150mm;

d) When a 25mm-diameter gap gauge can penetrate through a gap into the furnace

e) When loadbearing failure occurs.

6.3 Insulation

Failure is deemed to occur:

a) When the mean unexposed face temperature increases by more than 140°C above its initial value;

b) When the temperature recorded at any position (including the roving thermocouple) on the unexposed face is in excess of 180°C above the initial mean unexposed face temperature;

c) When integrity failure occurs.

7 Conclusion

An Ultraframe (UK) Ltd Ultrapanel partition loadbearing wall, as described in this report, was submitted to a fire resistance test carried out in accordance with European Standard EN 1365-1:2012 for a duration of 116.5 minutes. The test was carried out with the wall under a total imposed load of 15kN (5kN/m).

The wall was considered symmetrical and was found to achieve the following performance:

Loadbearing capacity		116 minutes
Integrity:	- sustained flaming:	116 minutes (taken as time of loadbearing failure)

- gap gauge:	116 minutes (taken as time of loadbearing failure)
- cotton pad:	116 minutes (taken as time of loadbearing failure)
Insulation:	116 minutes (taken as time of loadbearing failure)

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in EN 1363-1, and where appropriate EN 1363-2. Any significant deviation with respect to size, construction details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

8 Field of direct application of results

The standard[1] states that the results of the fire test are directly applicable to similar constructions where one or more of the changes listed below are made and the construction continues to comply with the appropriate design code for its stiffness and its stability.

a) Decrease in height.

b) Increase in the thickness of the wall.

c) Increase in the thickness of component materials.

d) Decrease in linear dimensions of boards or dimensions of panels except thickness.

e) Decrease in stud spacing.

f) Decrease in distance of fixing centres.

g) Increase in the number of horizontal joints when tested with one joint not more than 500mm ± 150mm from the top edge.

h) Decrease in the applied load.

i) Increase in the width, provided that the test specimen was tested at full width or 3m wide, whichever is the larger.

9 References

1. Fire resistance tests for loadbearing elements. Part 1: Walls. EN 1365-1: 2012. British Standards Institution, London, 2012.

2. Fire resistance tests. Part 1: General requirements. EN 1363-1: 2012. British Standards Institution, London, 2012.

3. Fire resistance tests. Part 1: General requirements. EN 1363-1: 2020. British Standards Institution, London, 2020.

10 Figures

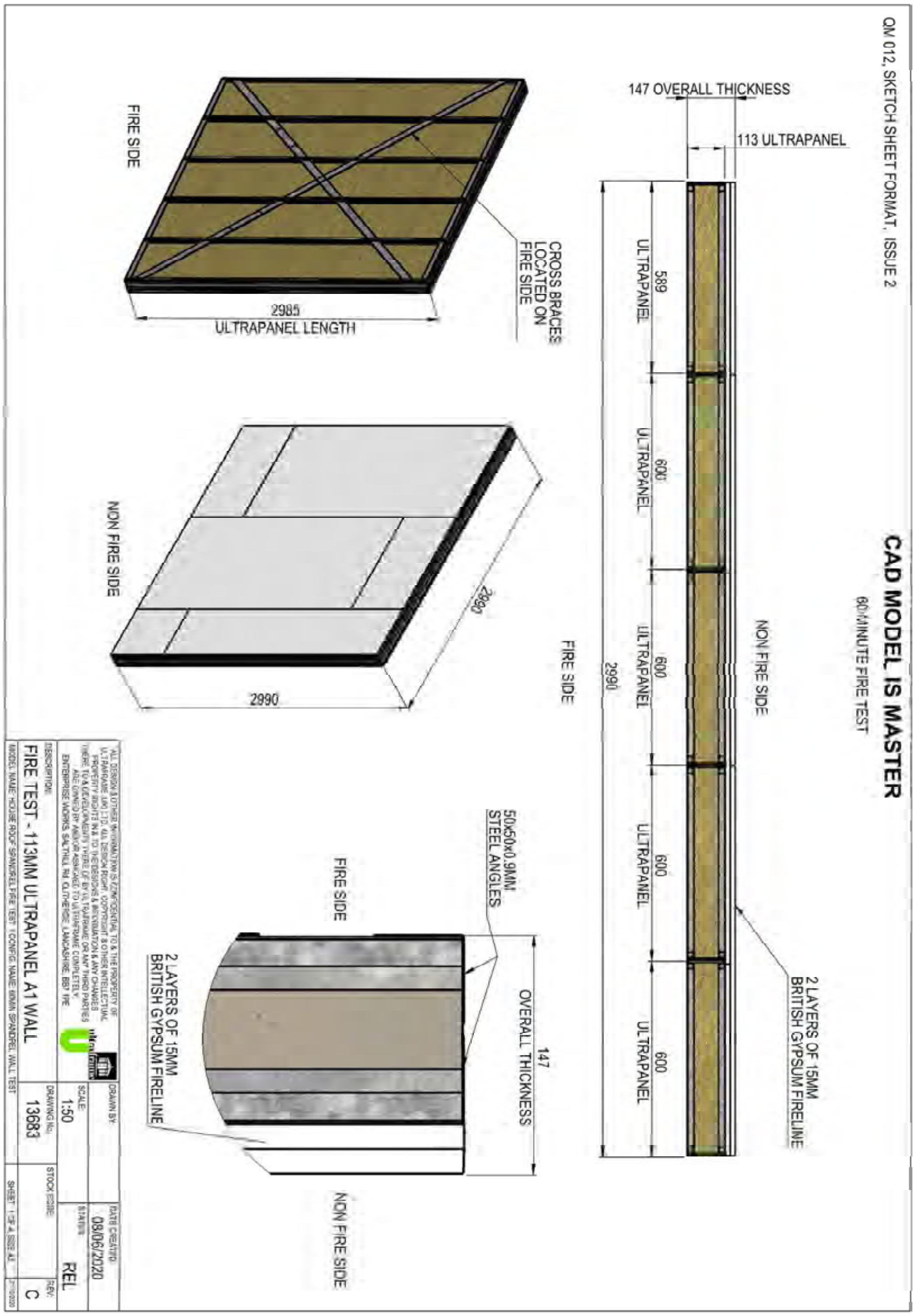


Figure 1: Test Construction detail [1] – as supplied by Ultraframe (UK) Ltd.

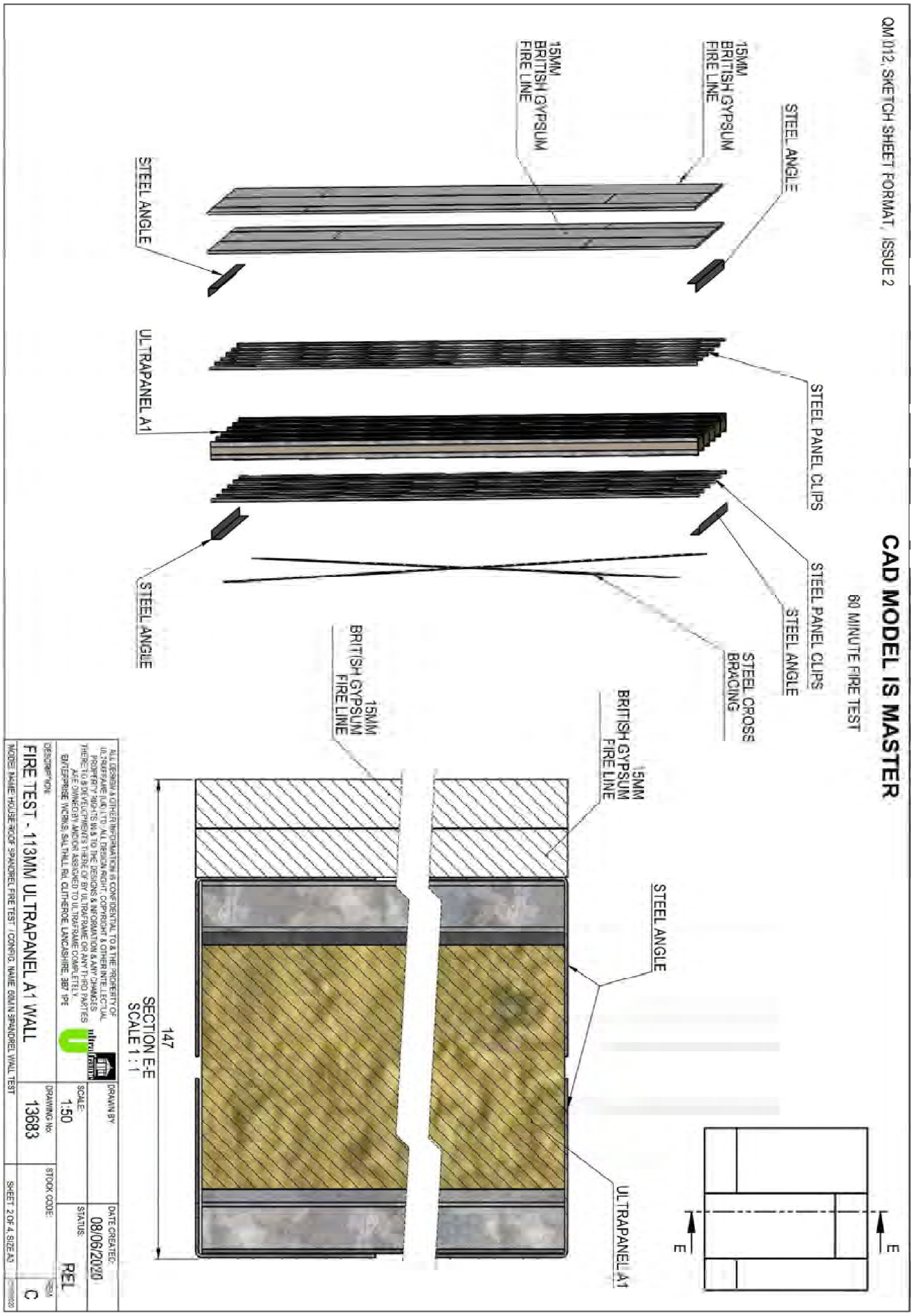


Figure 2: Test Construction detail [2] – as supplied by Ultraframe (UK) Ltd.

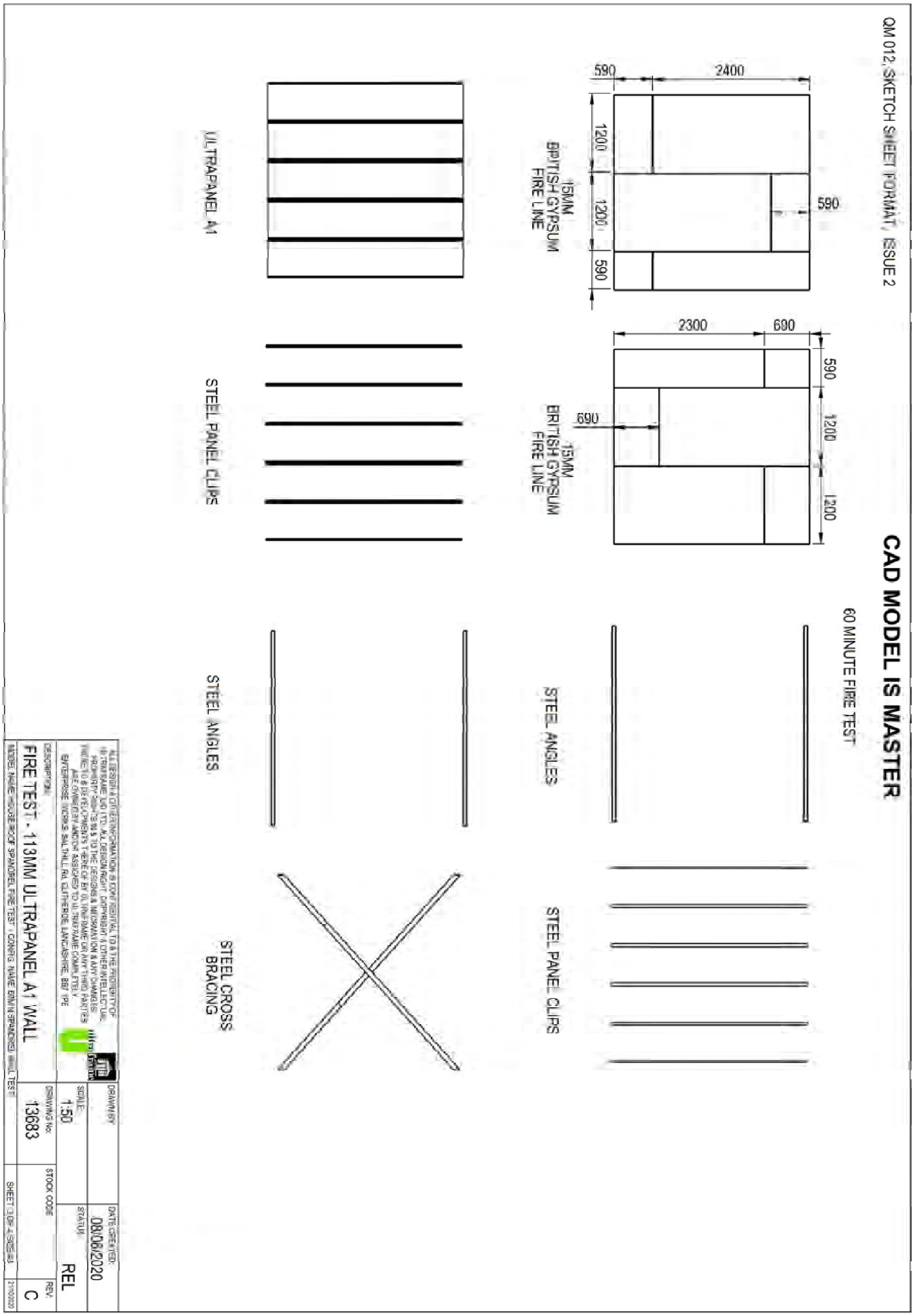


Figure 3: Test Construction detail [3] – as supplied by Ultraframe (UK) Ltd.

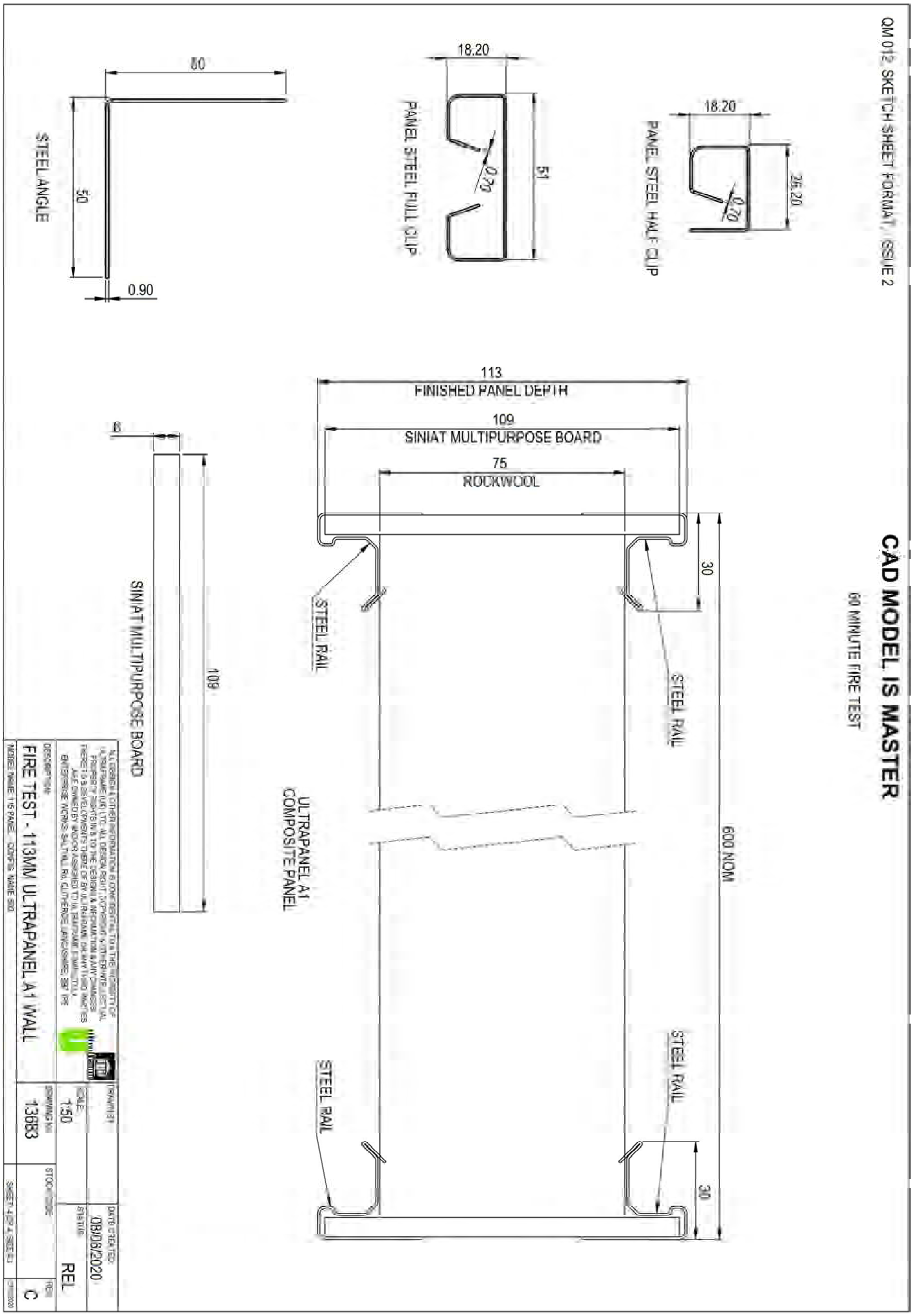
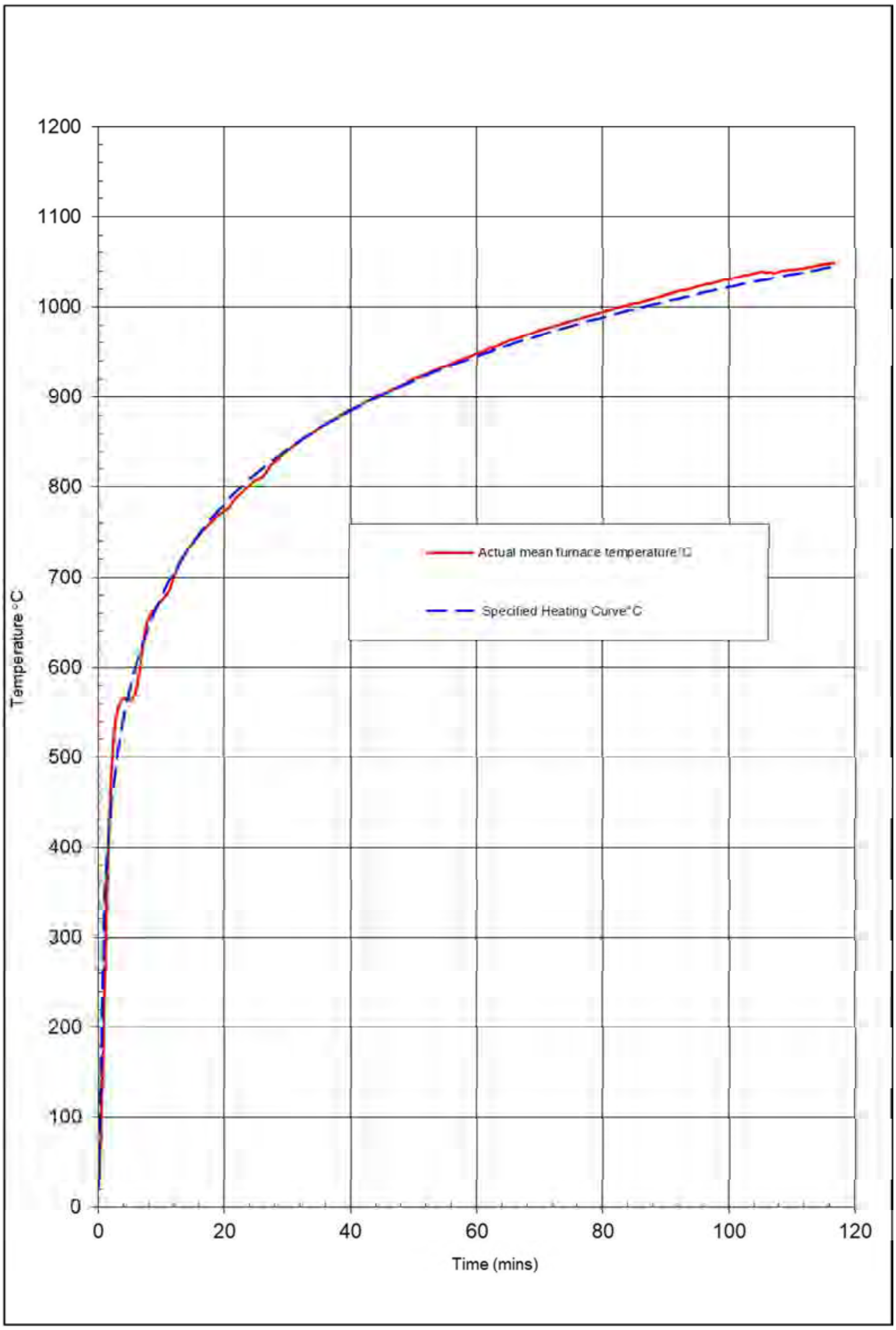
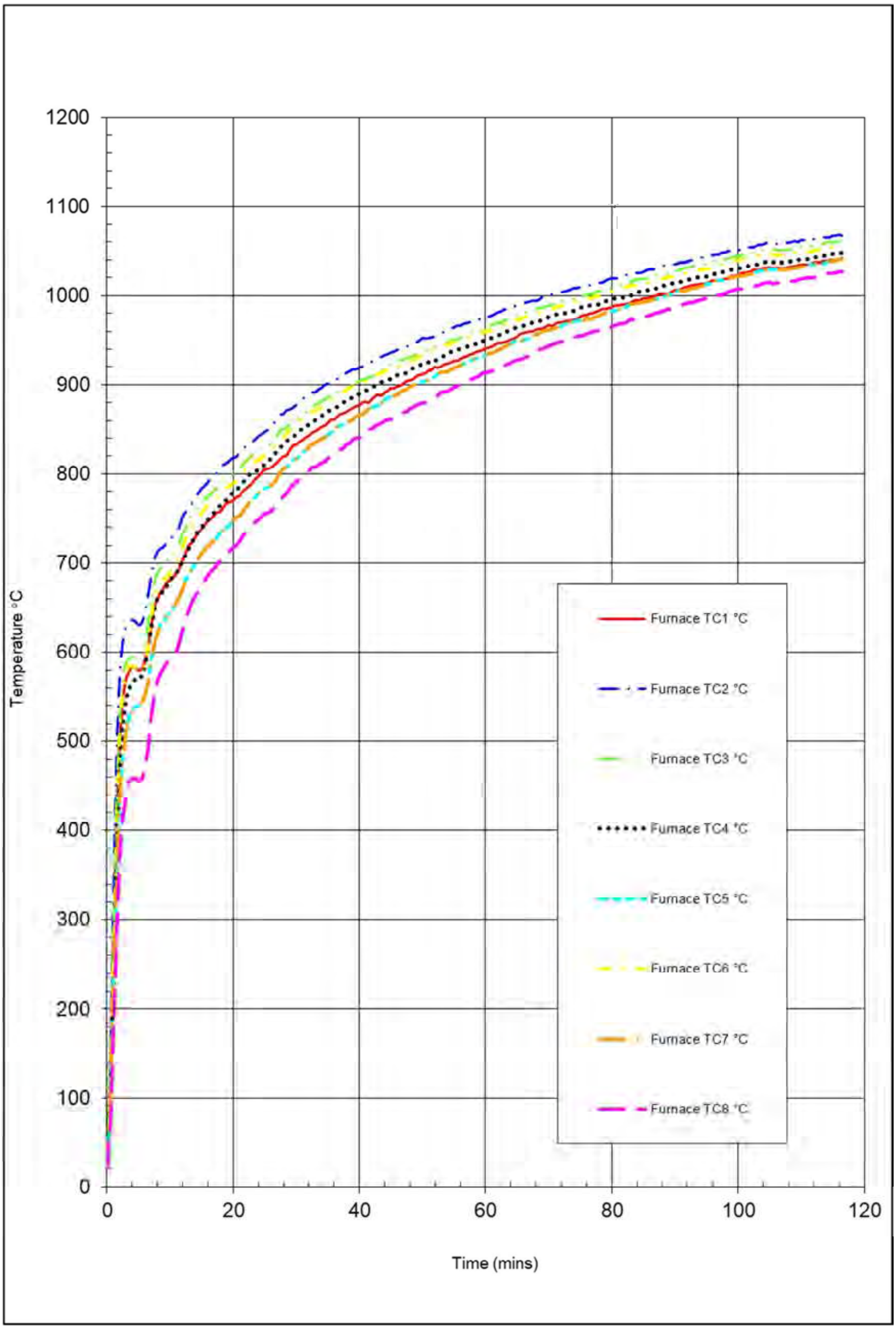


Figure 4: Test Construction detail [4] – as supplied by Ultraframe (UK) Ltd.

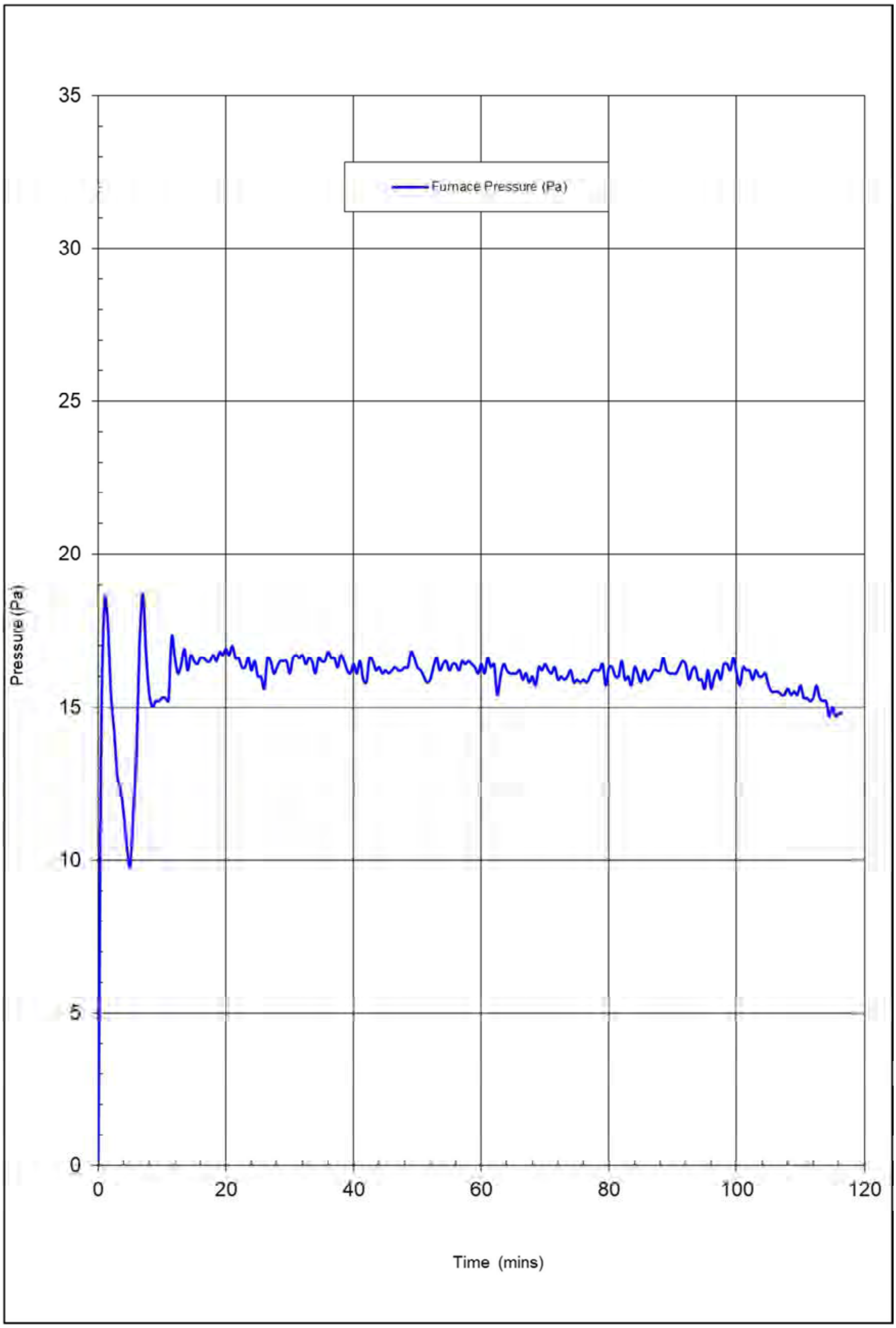
11 Graphs



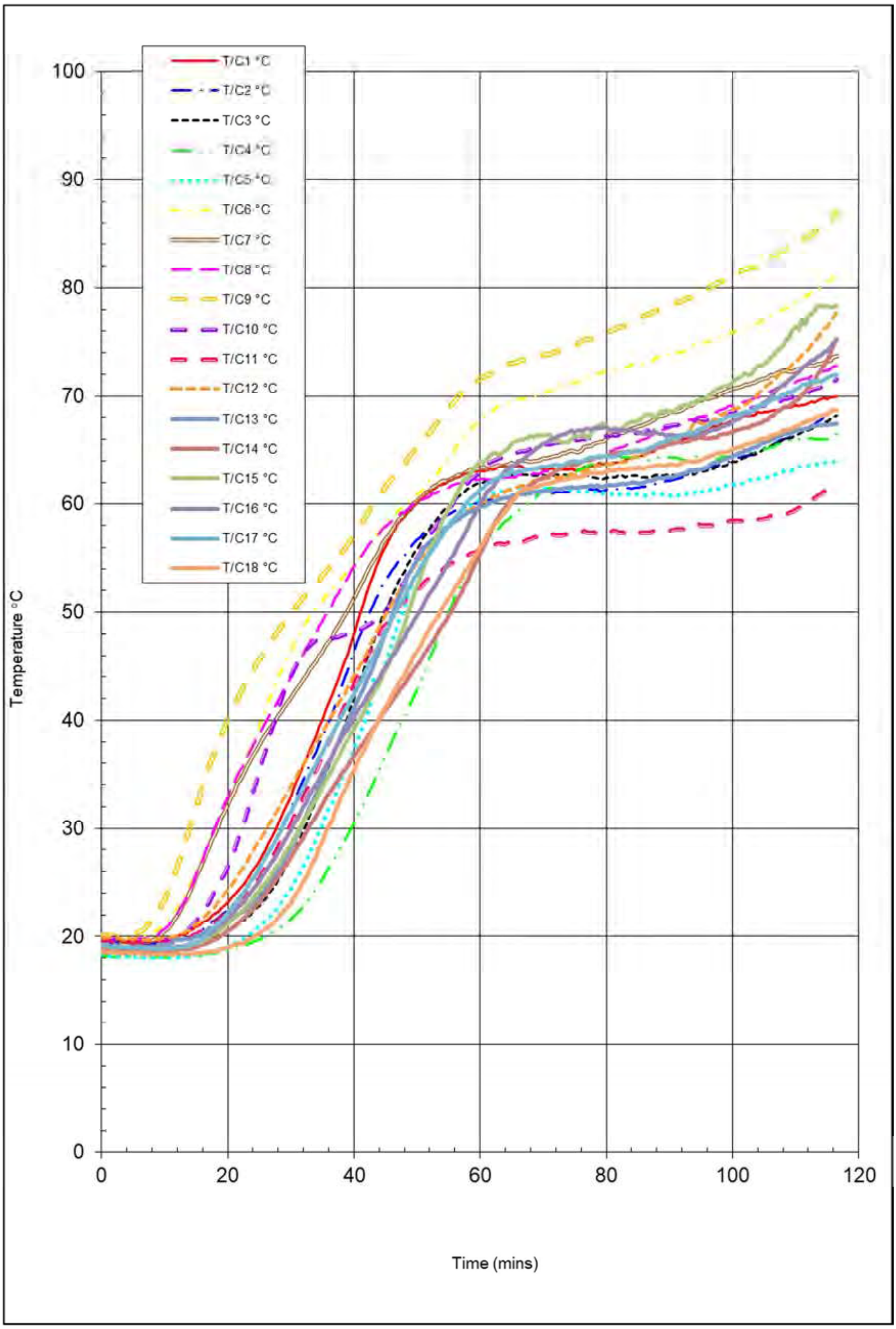
Graph 1: Mean furnace temperature with specified heating curve.



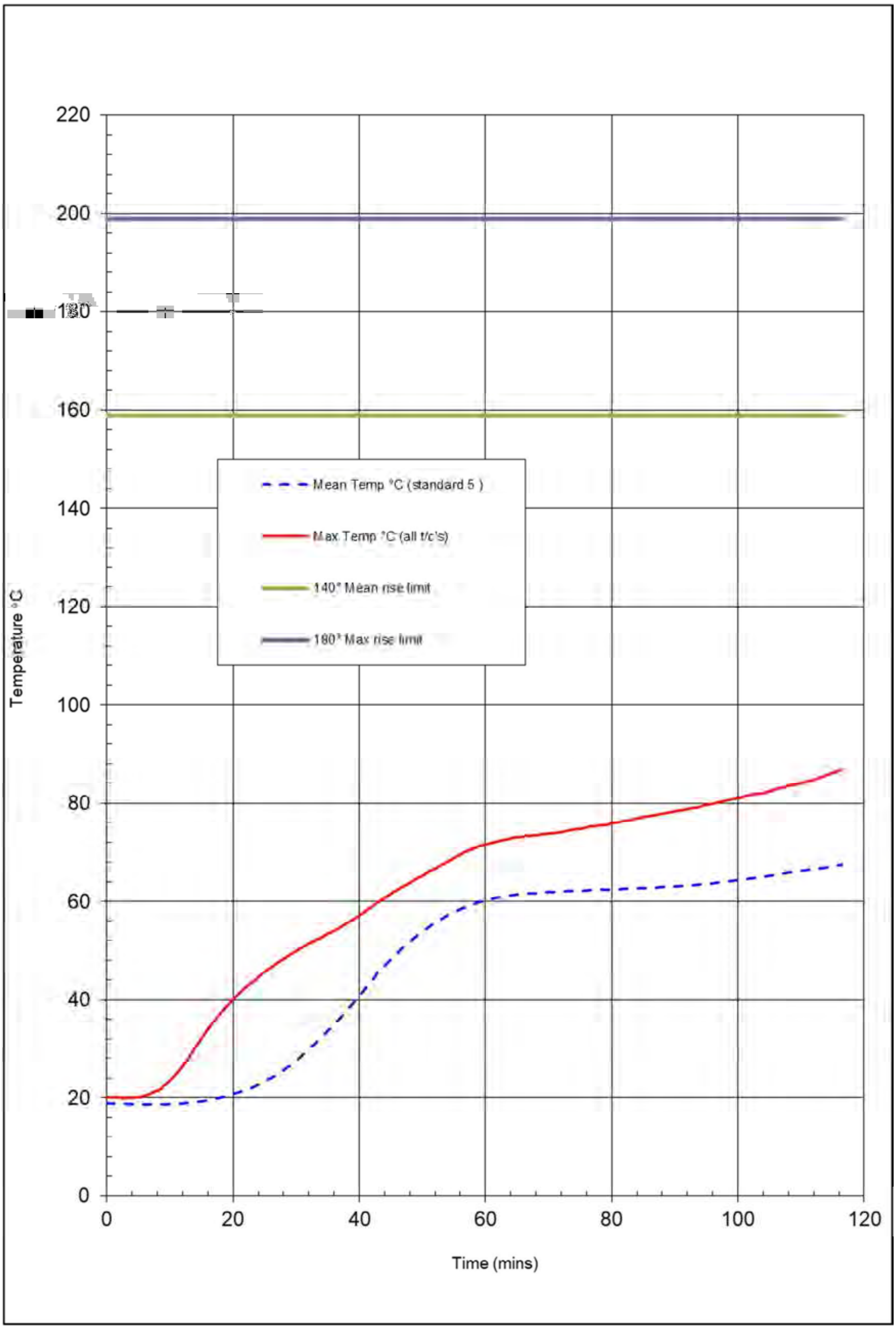
Graph 2: Individual furnace thermocouples temperatures.



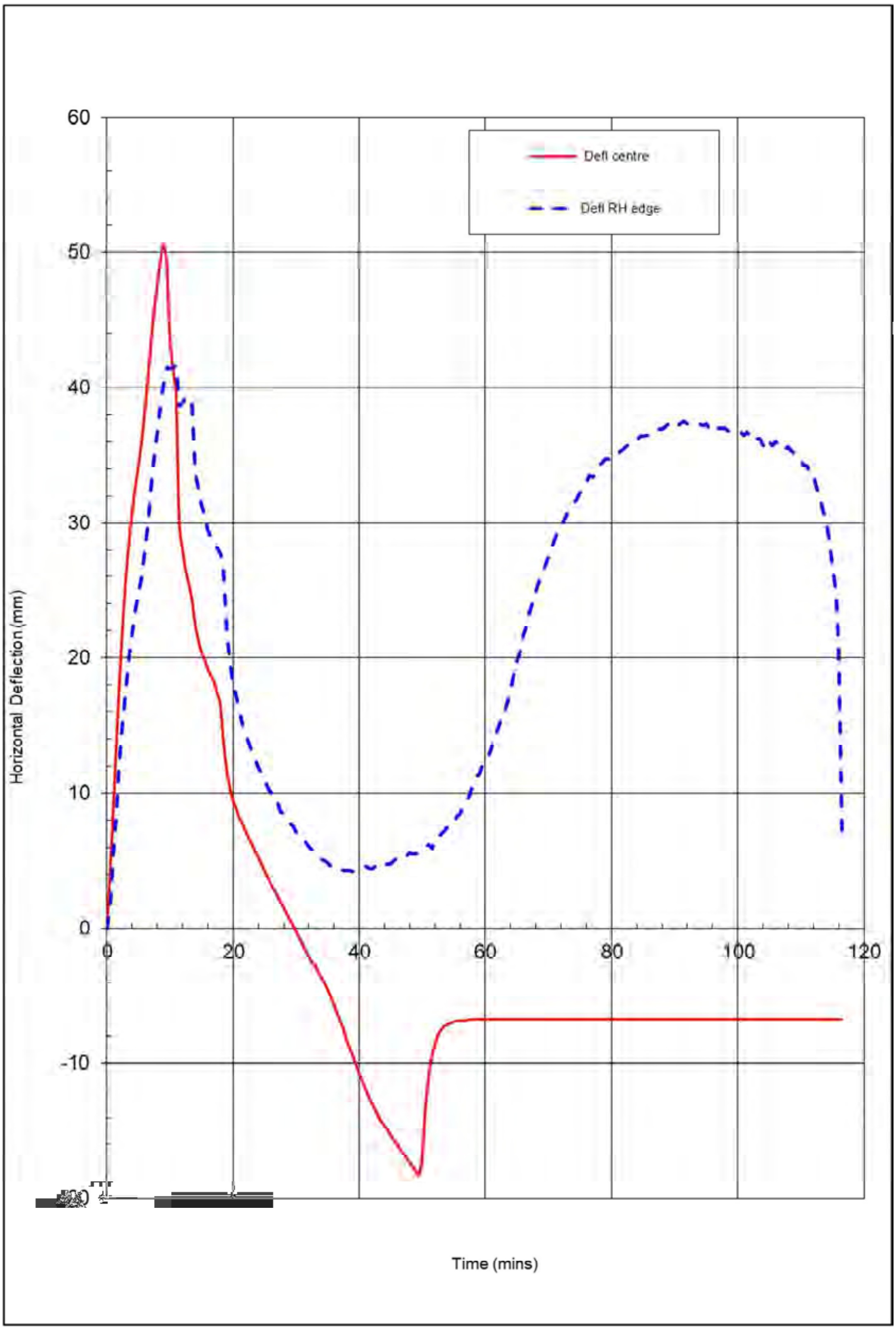
Graph 3: Mean furnace pressure.



Graph 4: Unexposed surface thermocouple temperatures.

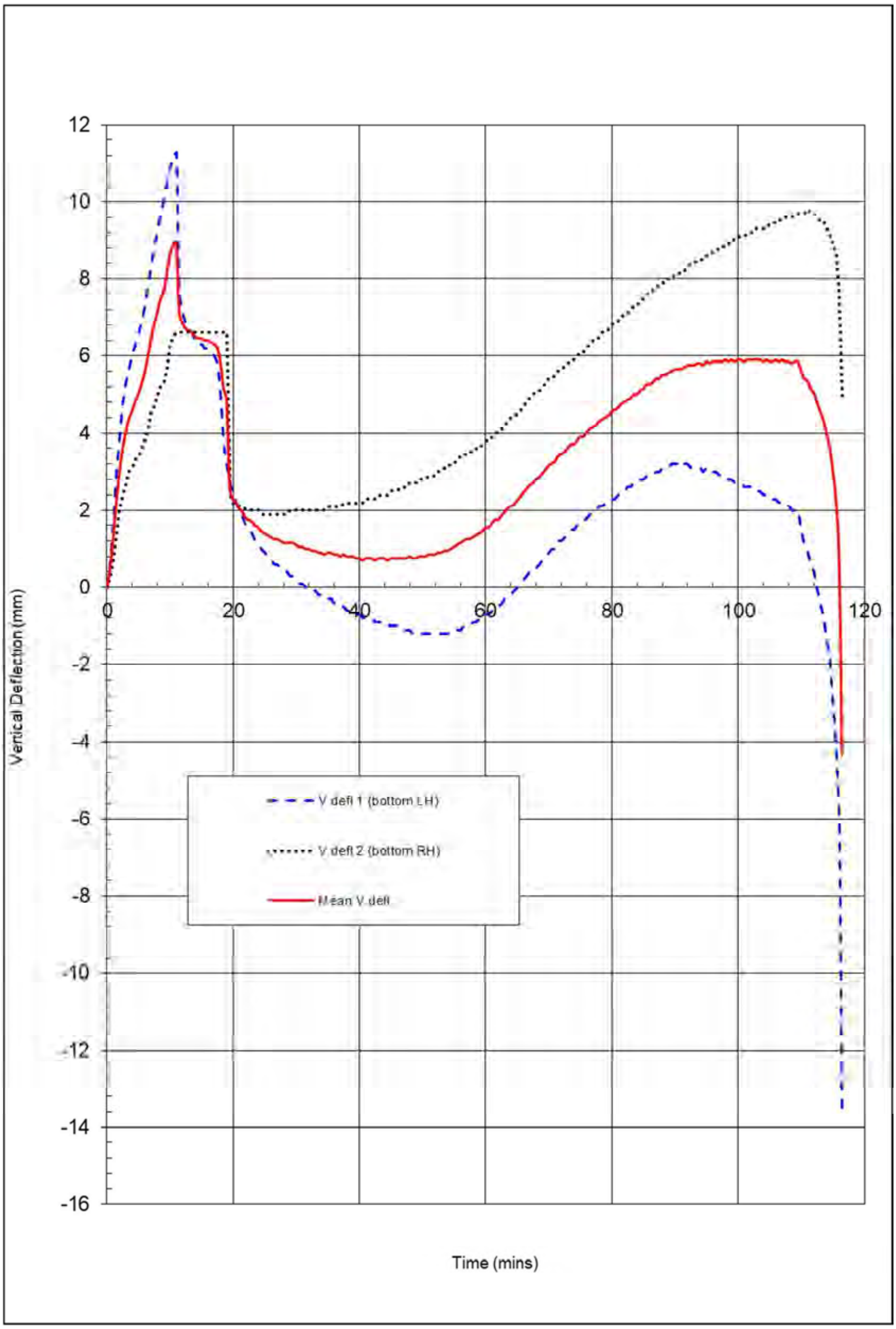


Graph 5: Mean and max temperature for unexposed surface thermocouples.



Graph 6: Horizontal deflection.

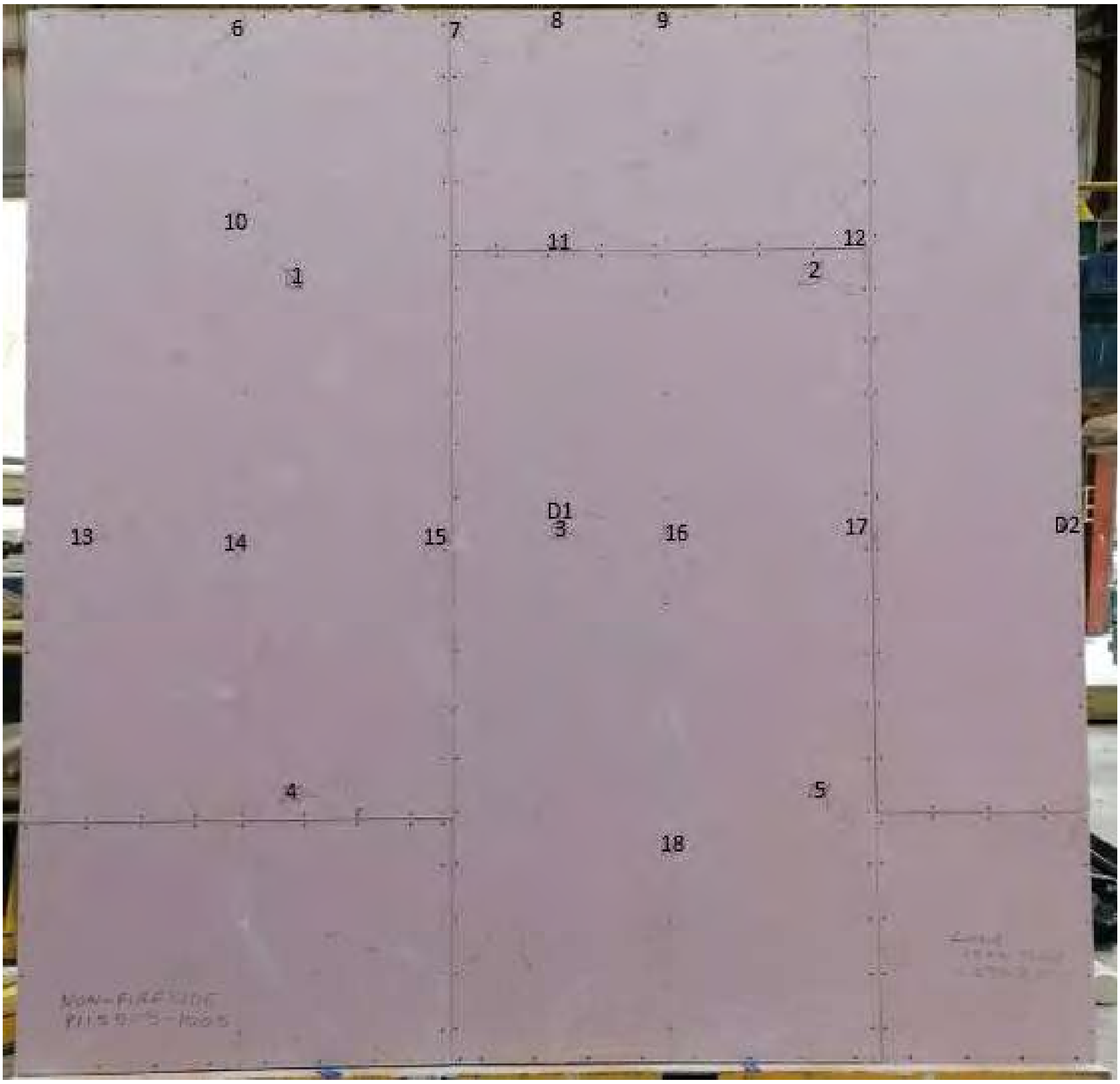
Note: Positive values indicate movement towards the furnace.



Graph 7: Vertical deflection recorded.

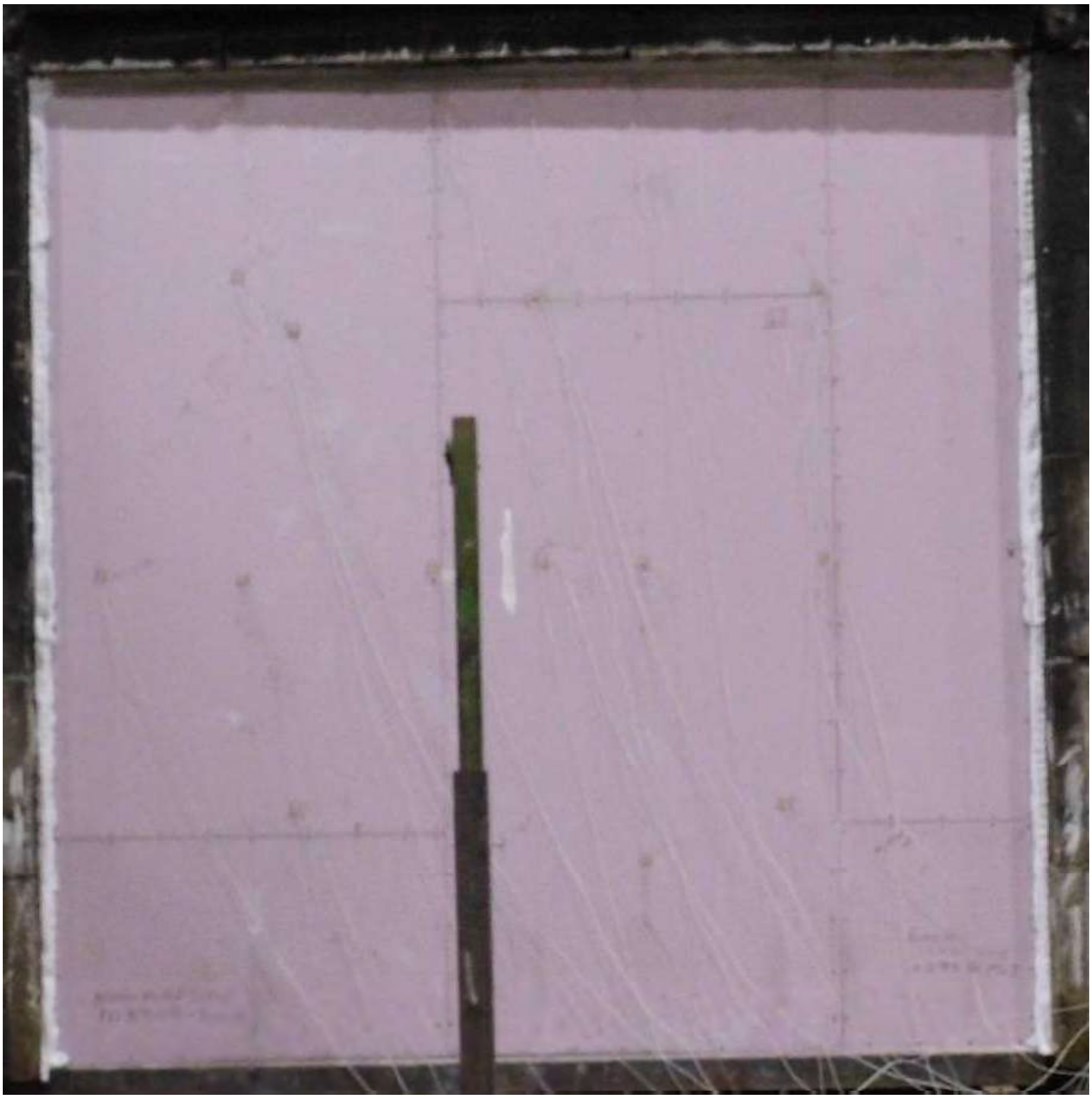
Note: Positive values indicate expansion of the sample whilst under load.

12 Photographs

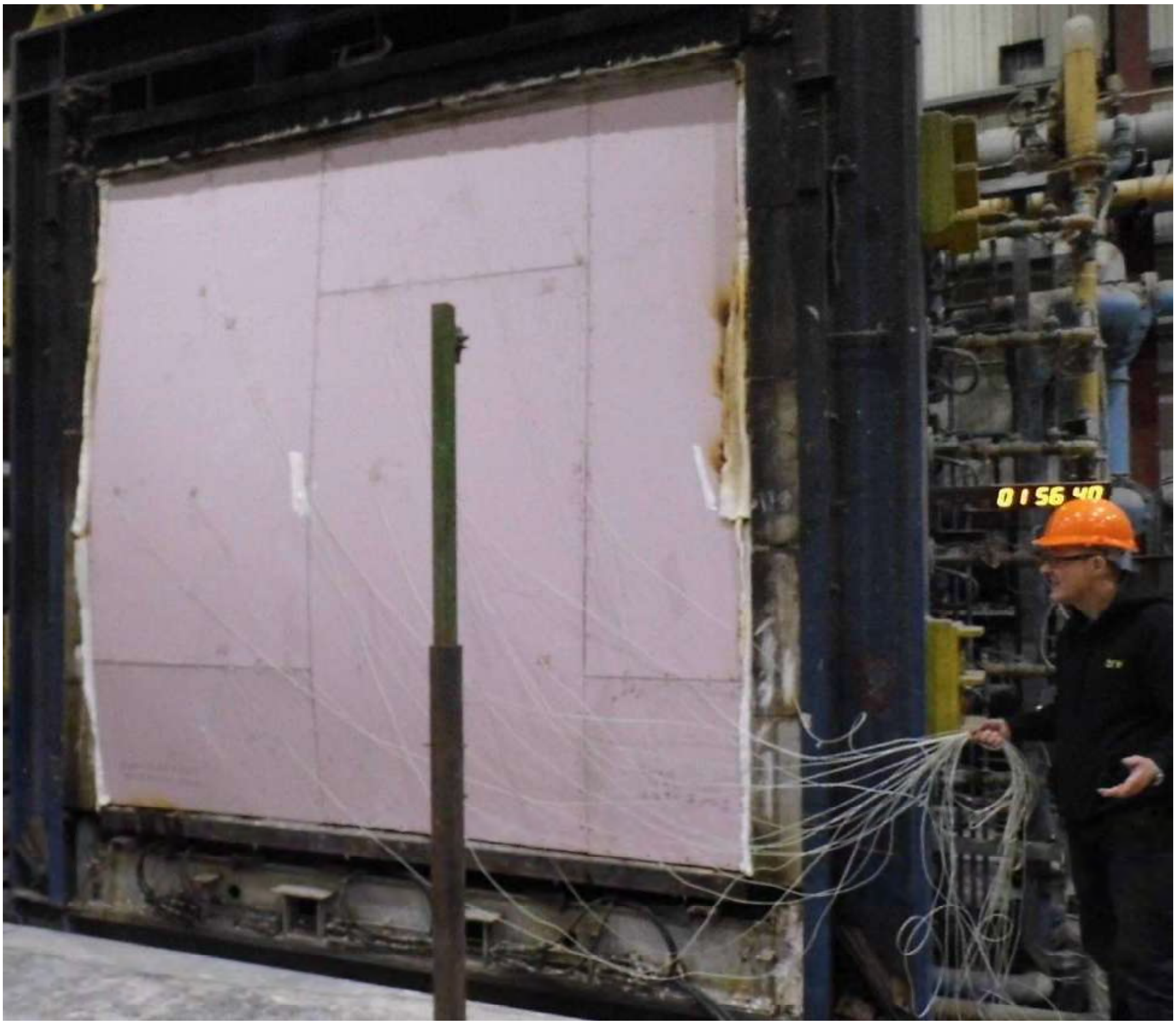


Photograph 1: Unexposed face of test specimen before test showing thermocouple and deflection locations.

Photograph 2: Exposed face of test specimen before test.



Photograph 3: Unexposed face of test specimen before test.



Photograph 4: Unexposed face of test specimen at moment of loadbearing failure after 116 completed minutes of test.

Photograph 5: Unexposed face of test specimen after the specimen jumped off the front of the furnace at termination of the test

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Photograph 6: Remnants of test specimen after test.

Report Ends

10 Resistence to moisture

10.1 Frameshield 100 used on external spandrel panel

10.2 Daltex RoofTX (roof membrane not supplied)

10.3 Vapour control layer Gyproc Duplex Wallboard

Frameshield 100

CONDENSATION CONTROL

DESCRIPTION

Frameshield 100 is a spunbonded polypropylene material developed primarily as a breather membrane for use in timber frame wall and light steel frame applications. Applied in the factory during manufacture or on site, Frameshield 100 affords effective protection of timber frames during construction against wind-driven rain, snow and dust. Once completed, the high water vapour permeability of Frameshield 100 allows the controlled escape of vapour from within the timber frame whilst restricting the ingress of rain and moisture.

Frameshield 100 conforms to BS 4016:1997 (Specification for Building Papers, Breather Type) and its vapour resistance factor of 0.03 MNs/g is less than the maximum permitted in NHBC requirements. Used in accordance with this NHBC Practice Note, Frameshield 100 provides a superior quality permanent wall breather membrane.

Exclusively developed and produced for The A. Proctor Group to carefully determined specifications by Britain's only spunbonded fabric manufacturer, Don and Low Nonwovens Ltd , Forfar, Scotland.

WALL BREATHER MEMBRANE

Frameshield 100 is produced by the continuous extrusion of polypropylene fibres which are then spun and bonded together with a combination of heat and pressure.

Installed in accordance with the NHBC requirements, Frameshield 100 will comply with all current UK Building Regulations.

CHARACTERISTICS

Thickness	0.5 mm
Weight	100 g/m^2
Roll Length	100m
Roll Width	2.7, 1.5 (black) or 1.4m
Colour	Green / Grey Others Available

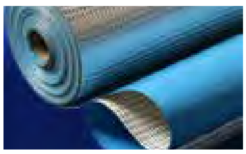
Quality control checks are carried out on the incoming materials, during production and on the finished product.

Quality control checks on the finished product include:

- Weight
- Tensile strength & elongation
- Tear
- Water resistance

COMPLEMENTARY PRODUCTS

Wraptite Tape
Air tightness tape, tear resistant with high vapour permeability for internal and external applications. Fully bonds to all standard substrates.



Vapour Control Layer
Reinforced polythene and polythene/foil VCLs

Wraptite-FZ
Vapour permeable air barrier membrane for use at floor junctions.

PHYSICAL PROPERTIES

Property		Test Method	Mean Results	
Vapour Resistance		BS 3177 EN 12572 (Sd)	0.03MNs/g 0.006m	
Colour		Various		
Mass per unit area		EN 1849-2	$100g/m^2$	
Reaction to Fire		EN 13501-1	Class E	
Water penetration	Before ageing: After ageing:	EN 1928	Class W2 Class W2	
Tensile Strength	Before ageing: After ageing:	EN 12311-1	MD 240N MD 200N	CD 180N CD 150N
Elongation	Before ageing: After ageing:	EN 12311-1	MD 85% MD 45%	CD 100% CD 60%
Tear resistance		EN 12310-1	MD 135N	CD 145N
Flexibility at low temperature		EN 1109	No cracking at minus 60°C	

APPLICATION DETAILS

Supplied in roll form, Frameshield 100 should be fixed to frames with austenitic stainless steel nails or staples at centres no more than 500mm. On areas where sheets are required to be lapped, the following dimensions must be adhered to:

Vertical Laps - not less than 150mm
Horizontal laps - not less than 100mm

Ensure integrity of Frameshield 100 by overlapping upper layers over lower layers and staggering vertical joints. Protect timber at wall plate level and mark stud positions for wall tie fixings. Once applied to the wall, Frameshield 100 should be covered within 3 months.

Frameshield 100 must be installed in accordance with the manufacturer's instructions and recommendations.

Don & Low Ltd
Glamis Road
Forfar
Angus DD8 1EY

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e-mail: nonwovens@donlow.co.uk
website: www.donlow.co.uk

Agrément Certificate
03/4003
Product Sheet 1

DON & LOW ROOF TILE UNDERLAYS

BREATHABLE DALTEX ROOFTX FOR USE IN WARM NON-VENTILATED AND COLD VENTILATED ROOFS

This Agrément Certificate Product Sheet(1) relates to Breathable Daltex RoofTX(2), roof tile underlays for use in warm non-ventilated and cold ventilated pitched roof systems.

(1) Hereinafter referred to as 'Certificate'.
(2) Daltex and RoofTX are registered trademarks of Don & Low Limited.

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

Weathertightness — as part of a complete roof, the products will resist the passage of water and wind-blown snow and dust into the interior of the building (see section 6).

Risk of condensation — the products are low water vapour resistance (Type LR) underlays and can be used as part of warm non-ventilated and cold ventilated pitched roof systems (see section 7).

Wind loading — when installed on appropriately spaced battens, the products' physical properties are adequate to resist the wind loads imposed on the underlay. The products will reduce the wind uplift forces acting on the roof covering (see section 8).

Strength — the products have adequate strength to resist the loads associated with installation of the roof (see section 9).

Durability — under the normal conditions found in a roof space, the products will have a service life comparable to traditional roof tile underlays (see section 12).

The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of Tenth issue: 7 November 2017

Originally certificated on 7 March 2003

John Albon – Head of Approvals
Construction Products

Claire Curtis-Thomas
Chief Executive

Gyproc WallBoard DUPLEX

Product Data Sheet

Introduction

Used for wall and ceiling linings where vapour control and plasterboard lining are required in one fixing operation.

Product description

Gyproc WallBoard backed with a vapour control membrane. Gyproc WallBoard DUPLEX consists of an aerated gypsum core encased in, and firmly bonded to, strong paper liners and backed with an additional metalised polyester film. Gyproc WallBoard DUPLEX is a plasterboard that is suitable for drylining internal surfaces.

This plasterboard is one of the products within our plasterboard range that is certified to *BES 6001* achieving a rating of 'Excellent'.

BES 6001 Responsible Sourcing www.greenbooklive.com

Board performance

Fire protection

Plasterboard linings provide good fire protection owing to the unique behaviour of the non-combustible gypsum core when subjected to high temperatures. For the purposes of the national Building Regulations, plasterboard is designated a 'material of limited combustibility' (Approved Document B). The surfaces of Gyproc WallBoard DUPLEX are designated Class 0 (for the purposes of national Building Regulations). Please refer to the table below.

Fire resistance

Please refer to the appropriate **White Book** product or systems section for information on the fire resistance of building elements lined with Gyproc WallBoard.
The substitution of Gyproc WallBoard with the same thickness of Gyproc WallBoard DUPLEX will not change the fire performance.

Reaction to fire test performance

Standard	Performance
BS 476: Part 6: 1989 Method of test for fire propagation for products.	*Index of performance (I) not exceeding 12 and a sub-index (i1) not exceeding 6.*
BS 476: Part 7: 1997 Surface spread of flame tests for materials.	*Class 1 (both sides).*
EN 13501-1: 2007 + A1: 2009.	*Classified without further testing as B-s1, d0.*

Thermal conductivity

λ Gyproc WallBoard DUPLEX - 0.19W/mK

Effect of temperature

Gyproc WallBoard DUPLEX is unsuitable for use in areas subject to continuously damp or humid conditions and must not be used to isolate dampness. Plasterboards are not suitable for use in temperatures above 49°C, but can be subjected to freezing conditions without risk of damage.

Effect of condensation

The thermal insulation and ventilation requirements of national Building Regulations aim to reduce the risk of condensation and mould growth in new buildings. However, designers should take care to eliminate all possibility of problems caused by condensation, particularly in refurbishment projects.

Board colour

- Ivory face paper
- Metalised polyester film reverse

Board printing

Face - screw centre markings 'x'.
Edge - product code, EAN number,
board thickness x width x length, edge type.

Board range

Width mm	Length mm	Edge type
12.5mm Board		Kg/m² = 8.0 R (m²K/W) = 0.41[1]
900	1800	S/E
1200	2400	T/E S/E
	2700, 3000	T/E
15mm Board		Kg/m² = 9.8 R (m²K/W) = 0.42[1]
1200	2400	T/E

[1] Including 25mm minimum air space.

T/E = Tapered Edge **S/E** = Square Edge

Board types

T/E - with Gyproc jointing materials for taped and filled joints or application of Thistle BoardFinish or Thistle MultiFinish plaster.
S/E - for plaster application, Artex Texture Finish or undecorated applications.

Application and installation

General

It is important to observe appropriate health and safety legislation when working on site i.e. personal protective clothing and equipment, etc. The following notes are intended as general guidance only. In practice, consideration must be given to design criteria requiring specific project solutions.

Handling

Manual off-loading of this product should be carried out with care to avoid unnecessary strain. For further information please refer to the Manual Handling section of the Site Book or Manual Handling Guide, available to download from british-gypsum.com.

Cutting

This product may be cut using a plasterboard saw or by scoring with a sharp knife and snapping the board over a straight edge. Holes for switch or socket boxes should be cut out before the boards are fixed using a utility saw or sharp knife. When cutting boards, power and hand tools should be used with care and in accordance with the manufacturers' recommendations. Power tools should only be used by people who have been instructed and trained to use them safely. Appropriate personal protective equipment should be used.

Fixing

Fix boards with decorative side out to receive joint treatment or a skim plaster finish. Lightly butt boards together. Never force boards into position. Install fixings not closer than 13mm from cut edges and 10mm from bound edges. Position cut edges to internal angles whenever possible, removing paper burrs with fine sandpaper. Stagger horizontal and vertical board joints between layers by a minimum of 600mm. Locate boards to the centre line of framing where this supports board edges or ends.

Plastering

The face (ivory) of Gyproc WallBoard DUPLEX can be plastered with either Thistle BoardFinish or Thistle MultiFinish. There should be the minimum of delay between completion of the lining and the commencement of plastering.

Jointing

Gyproc jointing materials produce durable joint reinforcement and a smooth, continuous, crack-resistant surface ready for priming and final decoration. A number of jointing specifications are available to suit the board type, method of application, and site preference.

Decoration

After the joint treatment has dried, decoration, including any decorator's preparatory work, should follow with the minimum delay.

Product standards

EN 14190: 2014 Gypsum plasterboard, products for reprocessing – definitions, requirements and test methods.

Maintenance

Repair

Minor damage - Lightly sand the surface to remove burrs and fill flush with Gyproc Easi-Fill or Gyproc Easi-Fill 45, or two of Gyproc Joint Cement. When dry, apply Gyproc Drywall Primer or Gyproc Drywall Sealer to leave the surface ready for decoration.

Deep indents resulting from impact - Check the plasterboard core to ensure that it is not shattered. If intact, apply a coat of Gyproc Joint Filler, or Gyproc Easi-Fill or Gyproc Easi-Fill 45, followed by the procedure for repairing minor damage as outlined above, once set / dry.

Damaged core and / or broken edges (non-performance situations only) - Remove the damaged area of core. Score the liner approximately 10mm away from the sound plaster around the damaged area, and peel the paper liner away. Apply Thistle GypPrime or PVA to seal the core and surrounding liner. Bulk fill the hole with a stiff mix of Gyproc Easi-Fill or Gyproc Easi-Fill 45, or Gyproc Joint Filler, and strike off flush. Apply Gyproc Easi-Fill or Gyproc Easi-Fill 45, or two applications of Gyproc Joint Cement, once the filler is set / dry. When dry, apply Gyproc Drywall Primer or Gyproc Drywall Sealer (only suitable in non-performance situations.

Extensive damage - When the damage is more extensive, it may be necessary to replace that area of plasterboard. It is important that the replacement board is of the same type as specified and installed. Cut out the affected area back to the nearest framing member. Replace the plasterboard, accurately cutting and screw fixing the same type and thickness of plasterboard. Fill edge joints, then tape and finish in the recommended way. Treat the finished surface with Gyproc Drywall Primer or two coats of Gyproc Sealer, if specified for vapour control purposes. Redecorate as required.

NB It is essential that repairs are made 'like for like'. If the finish is skim plaster, jointing materials must not be used in the repair.

Date of previous version: January 2014.

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Training enquiries: 0844 561 8810

ISO 9001 Quality Management FM550533
ISO 14001 Environmental Management EMS543324
OHSAS 18001 Occupational Health and Safety Management OHS550586
ISO 50001 Energy Management ENMS606206

11 Energy Efficiency

11.1 Thermal transition report prepared by Andrew Dunne Evolusion Innovation

Revision V11 11 December 2020

Thermal Transmittance Report

Prepared for *Ultraframe*

Reference: Ultraframe Typical Details TM Report V0					
Issue	Date of Issue	Status of Issue	Originator	Checked by	Verified by
V3	18.10.19	INFORMATION ONLY	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name:
V4	21.10.19	INFORMATION ONLY	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name:
V5	27.02.2020	INFORMATION ONLY	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name:
V6	02.03.2020	INFORMATION ONLY	Name: R.Kelly Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.
V7	24.03.2020	INFORMATION ONLY	Name: R.Kelly Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.
V8	23.10.2020	INFORMATION ONLY	Name: R.Kelly Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.
V9	05.11.2020	INFORMATION ONLY	Name: R.Kelly Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.
V10	10.12.2020	INFORMATION ONLY	Name: R.Kelly Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.
V11	10.12.2020	INFORMATION ONLY	Name: R.Kelly Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.
V12	10.12.2020	INFORMATION ONLY	Name: R.Kelly Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.	Name: A. Dunne Title: Building Physics Engineer.
Office Address: Evolusion Innovation Limited, Bank House, Main Street Innishannon, Co. Cork. Telephone: +353 (21) 4701599 www.evolusioninnovation.com					

Contents

Introduction

Ultraframe have requested that Evolusion Innovation Ltd perform thermal modelling calculations for a range of junctions. Thermal modelling is carried out both to calculate psi values and examine if surface condensation risk is predicted.

Evolusion Innovation Ltd used PsiTherm 2D 2014 and PsiTherm 3D 2014 thermal modelling software to determine the U Value and f_{RSI}-value for a range of building junctions in accordance with the requirements of BRE Report BR 497 Conventions for calculating linear thermal transmittance and temperature factors.

Condensation Risk Analysis calculations have been run against Edinburgh High Occupancy profile with return period of '1 in 20', as per BS 52520 Table D.2 for roof elements. All other junctions and elements have been run against London (Heathrow); Humidity class according BS EN ISO 13788 annex A: Dwellings with high occupancy.

Methodology

Evolusion Innovation Ltd built 3D thermal models of the junctions in accordance with the drawings provided by the design team. Internal and external temperatures are applied to the relevant surfaces of the model, and the software calculates the heat flow through the materials and bridging elements, to determine the heat energy loss from inside to outside and the surface temperatures on the inner surfaces of the building. The formulas for calculating surface condensation risk are then used to determine if f_{RSI}-value is above or below the limits set out in IP 106 and Technical Guidance Document Part L 2011. f_{RSI}-value must be above 0.75 at the coldest point (must be above 15 degrees Celsius) on any internal face of the junction modelled for residential areas and 0.5 (must be above 10 degrees Celsius) for commercial. Note: Modelling U Value calculation output is relevant for the purpose of Thermal Modelling only. Actual U Value output is detailed within the Elemental U Value section.

Limitations:

With steady state thermal modelling, where critical surface temperatures are predicted, calculation results are based on a constant temperature difference of 20 Degrees C between inside and outside. Internal Relative Humidity is assumed to be a constant. Therefore, it is critical in real world (dynamic) applications of the insulation product(s) that internal temperatures and internal relative humidity levels are controlled and maintained, while adequate levels of ventilation are provided to all building types to avoid the occurrence of surface and interstitial condensation occurring at any detail modelled therein. Note also that the control of water vapour and moisture movement within the building fabric is not considered in the scope of this report. WUFI Analysis should be considered for flat roof constructions, this form of analysis has not been considered within the scope of this report. The suitability of installing steel outside the hardboard has not been assessed nor have ventilation rates been considered within the scope of this report. Fire, Acoustics and Air Tightness have not been considered within the scope of this report.

Thermal Conductivities of Materials Used

Material key:

Name	Thermal conductivity
plasterboard	0.250 W/(mK)
OSB	0.130 W/(mK)
Softwood	0.130 W/(mK)
20mm Vertical Cavity	0.122 W/(mK)
Hardboard	0.120 W/(mK)
EPS 0.030	0.030 W/(mK)
20mm Horizontal Cavity	0.108 W/(mK)
(Indicative) FF Insulation (pumped bead or similar approved)	0.033 W/(mK)
Rockwool Loft Roll 44	0.044 W/(mK)
Celotex TB4000	0.022 W/(mK)

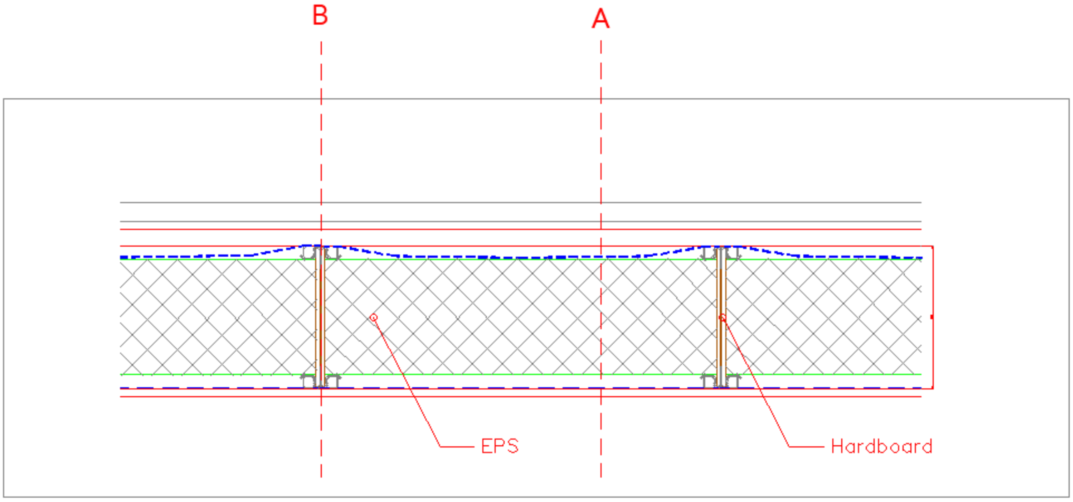
Boundary Conditions Used

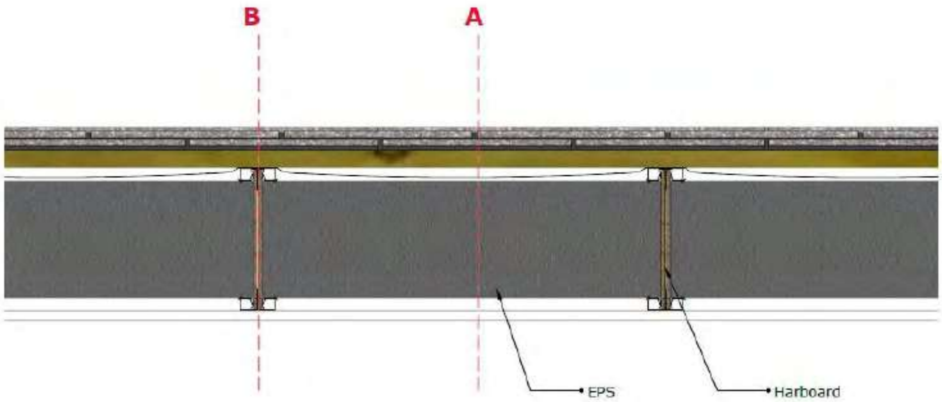
Internal Boundary Conditions @ 20°C		
Boundary Condition	**R_{si} (Psi Parameter)**	**R_{si} (f_{rsi} Parameter)**
Horizontal	0.13	0.25
Downward	0.17	0.25
Upward	0.1	0.25
External Boundary Conditions @ 0°C		
Boundary Condition	**R_{se} (Psi Parameter)**	**R_{se} (f_{rsi} Parameter)**
External (General)	0.04	0.04
Sheltered (Horizontal)	0.13	0.13
Sheltered (Upward)	0.1	0.1

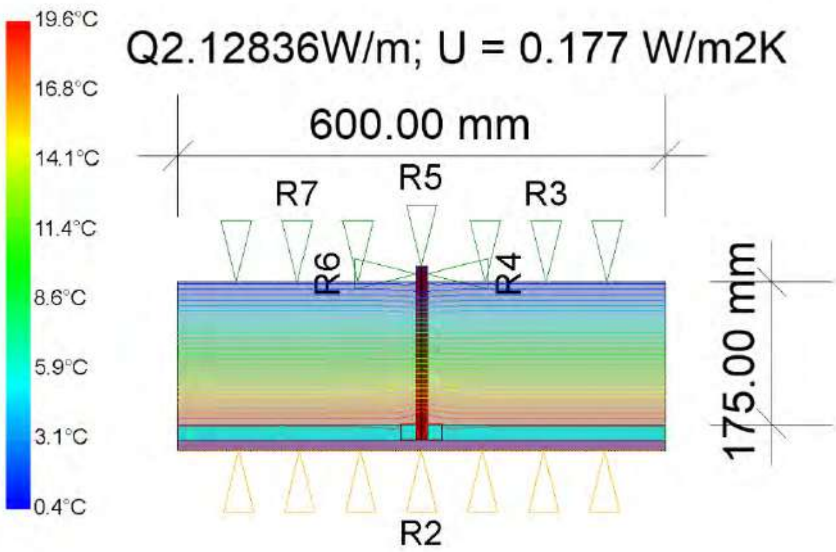
Ultraframe Psi Value Summary					
Detail No./Name & Description	**Modelling U_F (W/m²K)**	**Modelling U_W (W/m²K)**	**Modelling U_R (W/m²K)**	**Psi Values based on thermal modelling (W/m K)**	**f_{Rsi}**
Ridge Detail	N/A	N/A	0.168	0.025	0.878
Eaves Detail	N/A	0.27*	0.168	-0.0001	0.919
Parapet Detail (Ultraframe Wall)	N/A	0.15	0.16	0.029	0.89
Dormer Roof Verge	N/A	0.27*	0.13	0.043	0.90
Dormer Roof – Main Roof Junction	N/A	N/A	0.16/ 0.13	0.022	0.94
Dormer Roof – Dormer Wall Junction	N/A	0.28*	0.19	0.051	0.81
Dormer Wall – Main Roof Junction	N/A	0.28*	0.16	0.006	0.85
Dormer Roof – Window Head	N/A	0.27*	N/A	0.002	0.94
Dormer Roof – Window Cill	N/A	0.24*	0.16	-0.018	0.93
Rooflight Jamb	N/A	N/A	0.16	0.063	0.87
Rooflight Head/Cill	N/A	N/A	0.16	0.043	0.90
Window Head	N/A	0.25*	N/A	0.048	0.84
Window Cill	N/A	0.25*	N/A	0.053	0.83
Window Jamb	N/A	0.25*	N/A	0.040	0.88

***Note:** Relevant Part L should be checked against to verify that minimum U Value requirements are met.

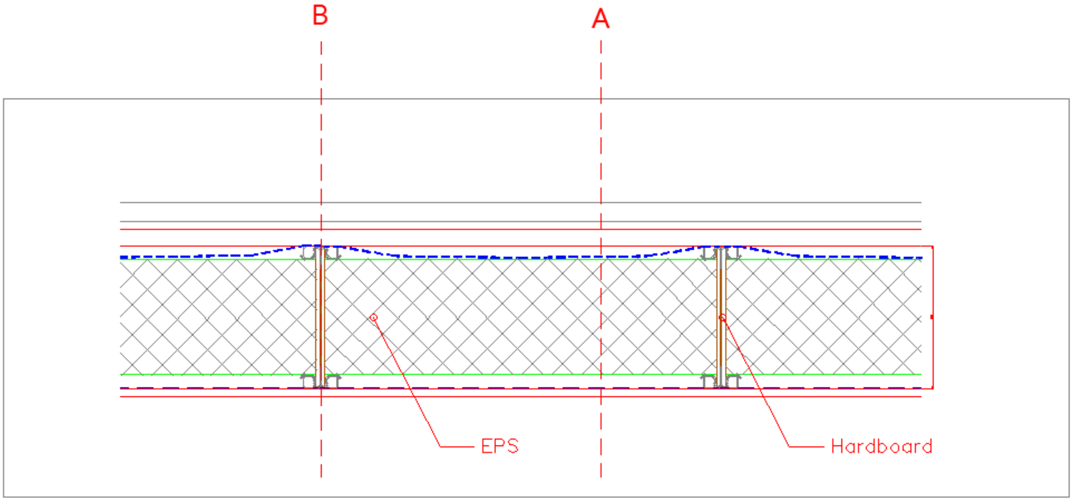
Elemental U Value Calculation of the Ultraframe Panel

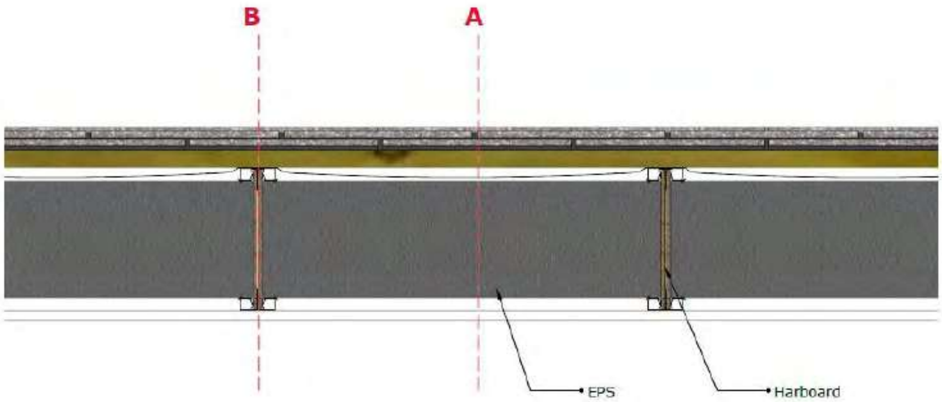


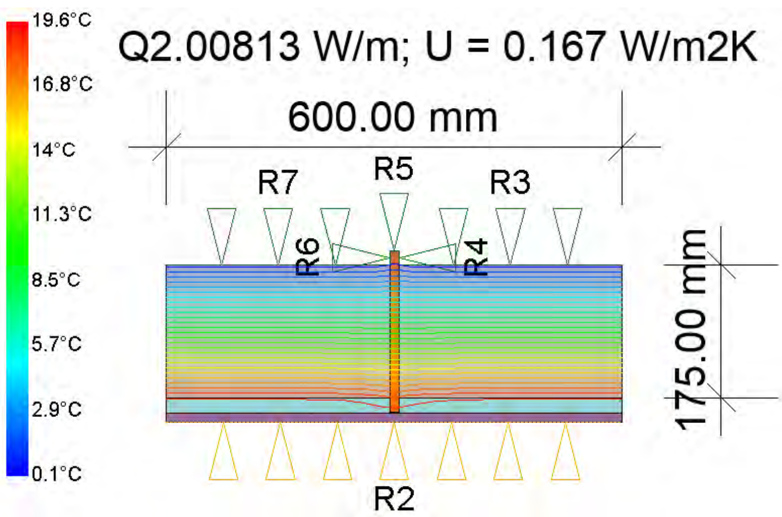




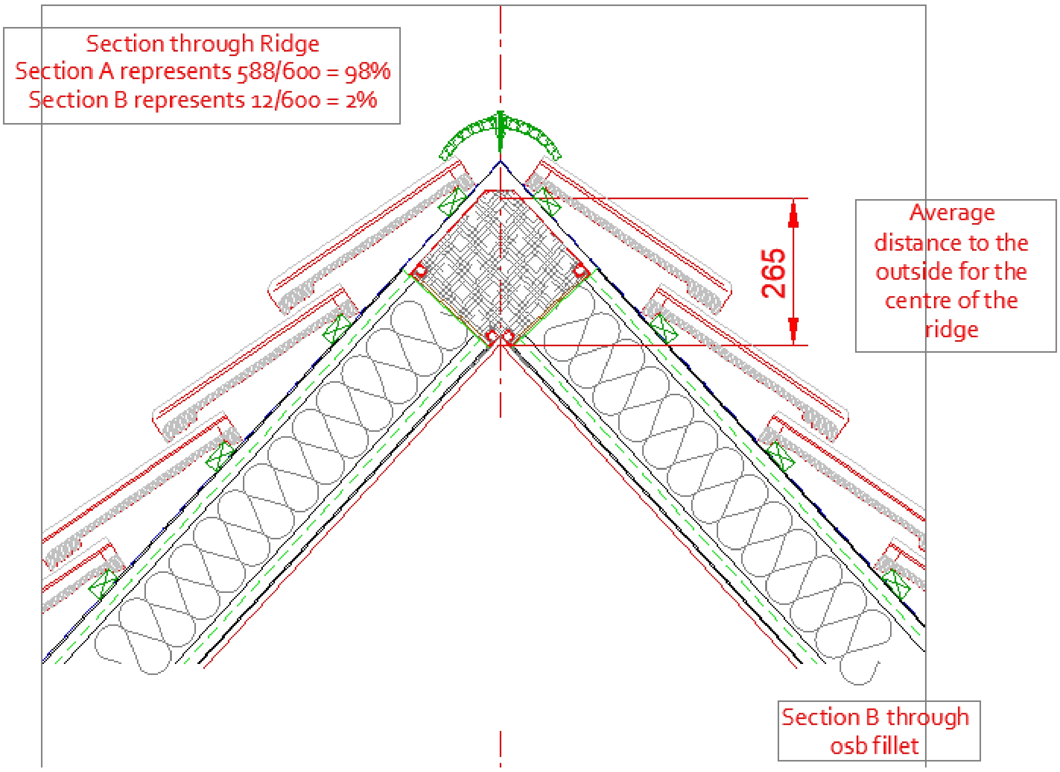
Modelling U Value Calculation of the Ultraframe Panel

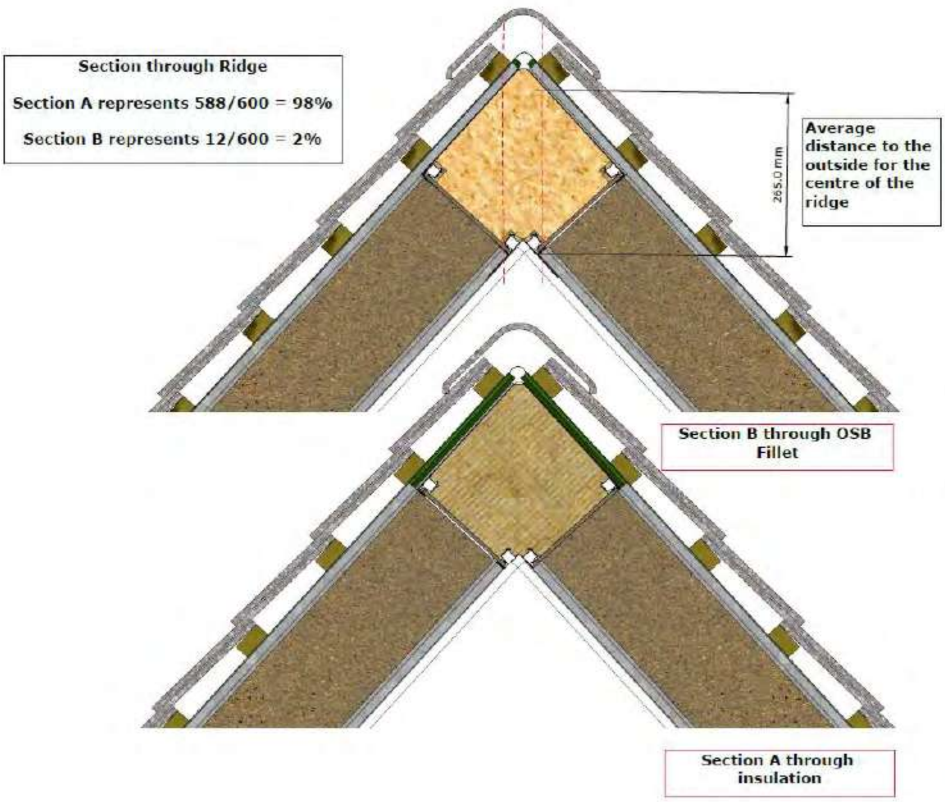




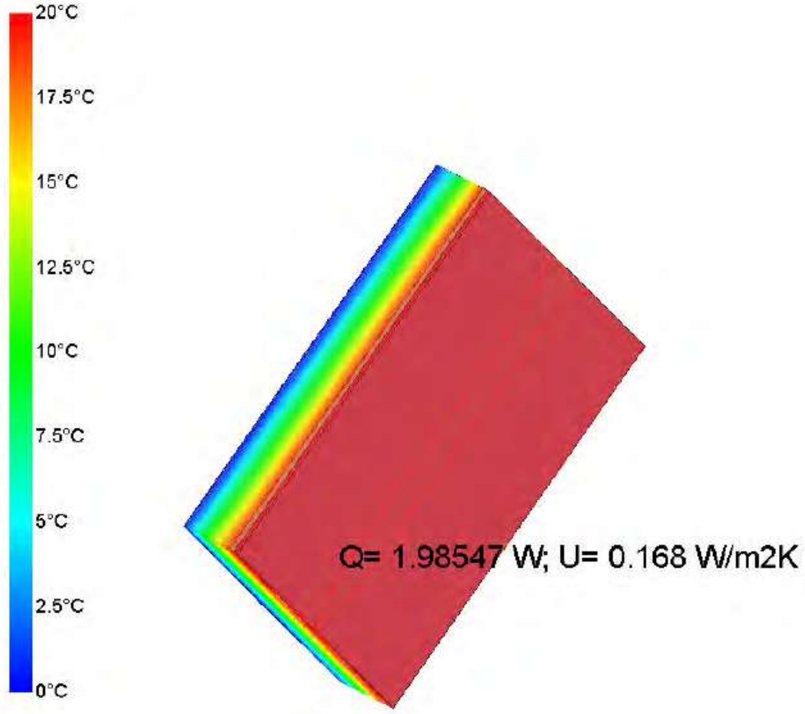


Ridge Detail (3-D TM)



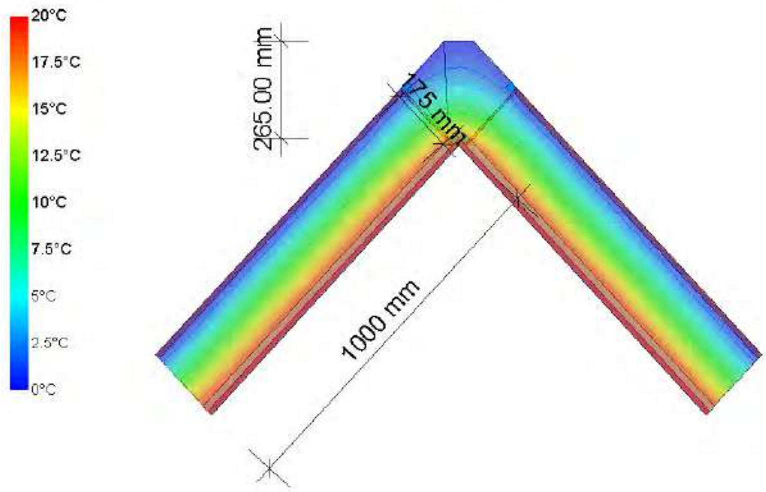


Modelling U Value for Ridge Detail

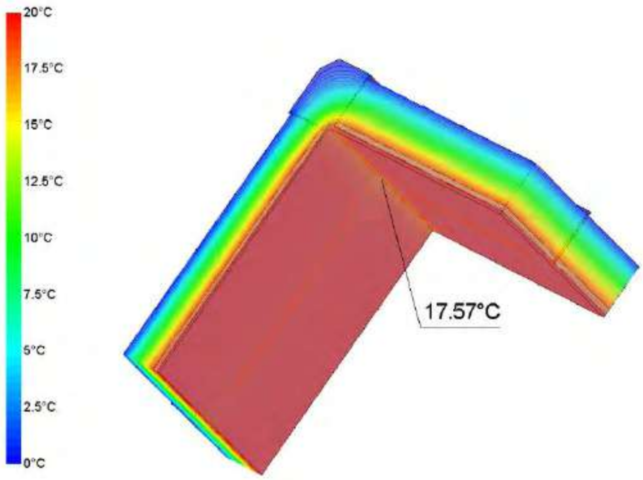


Ultraframe panel with 175mm EPS (0.03 W/m.K)

Ridge Detail Thermal Model Psi Value and f_{Rsi} Value



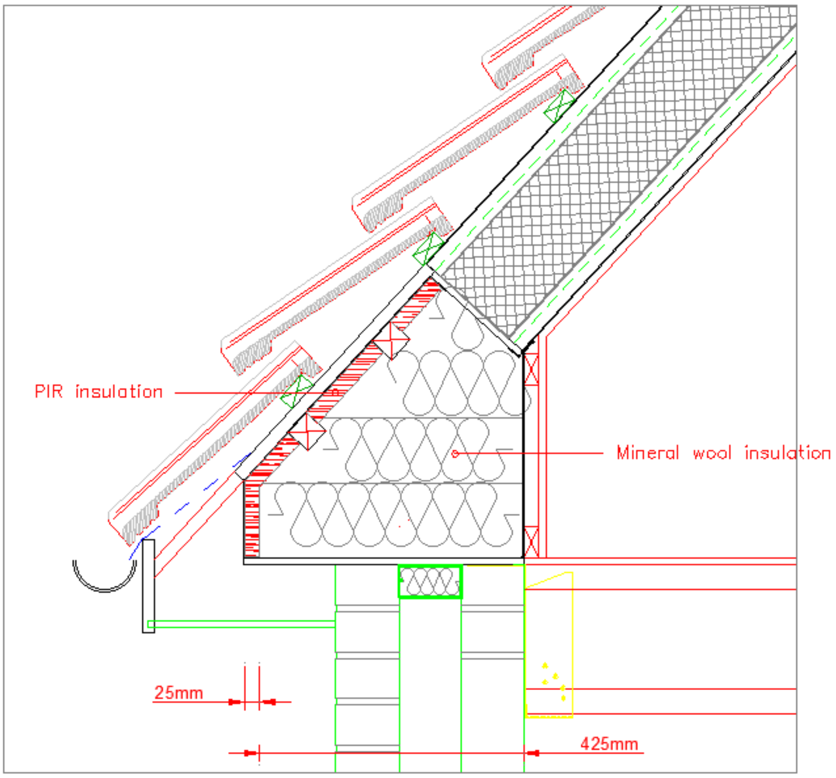
Q=	4.33253	W	(from model)
L_m=	0.6	m	(Length of model)
Q=	**7.220883333**	**W/m**	
U1=	0.168	W/m^2K	
L1=	1	m	(Full internal dim.)
U2=	0.168	W/m^2K	
L2=	1	m	
Ψ=	$\frac{Q}{\Delta T}$ -	∑(U1L1 + U2L2)	
Ψ=	**0.025044167**	**W/m K**	

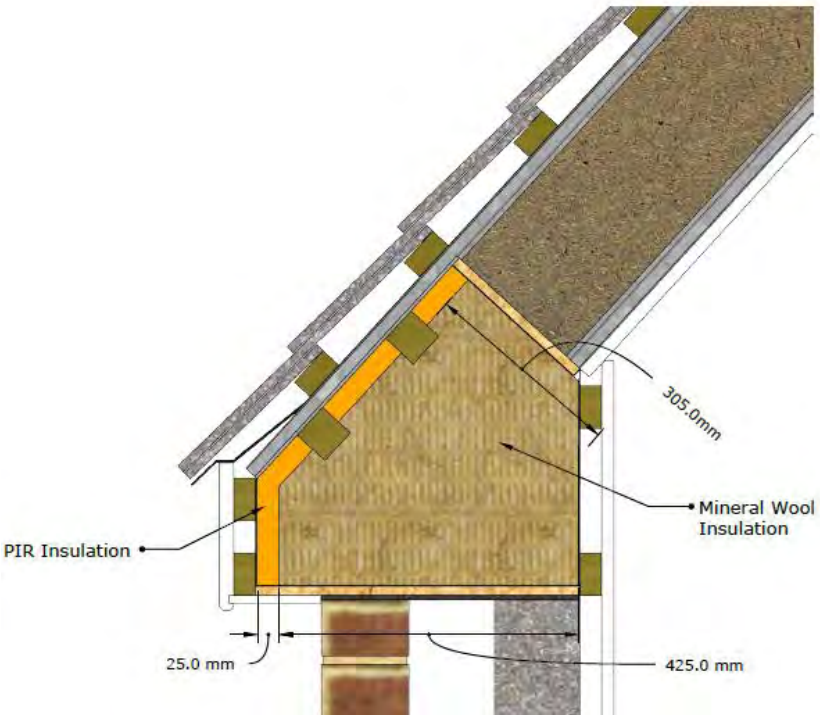


f_{Rsi} = 0.88 > 0.75

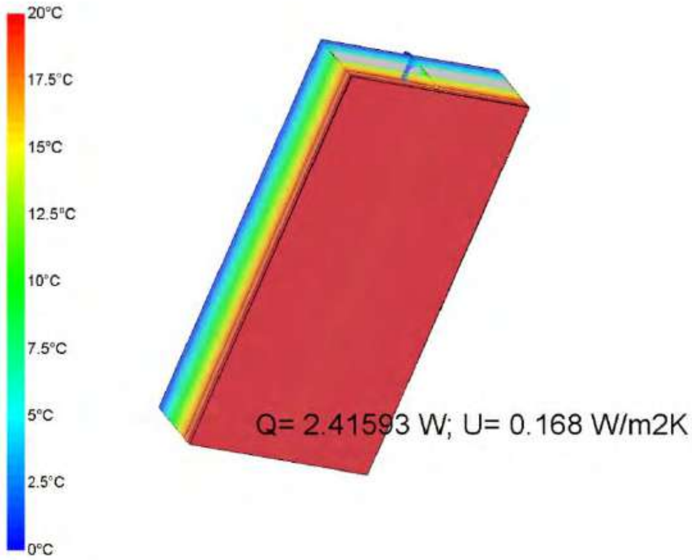
Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.937 > 0.75

Eaves Detail (3-D TM)





Modelling Roof U Value for Eaves Detail

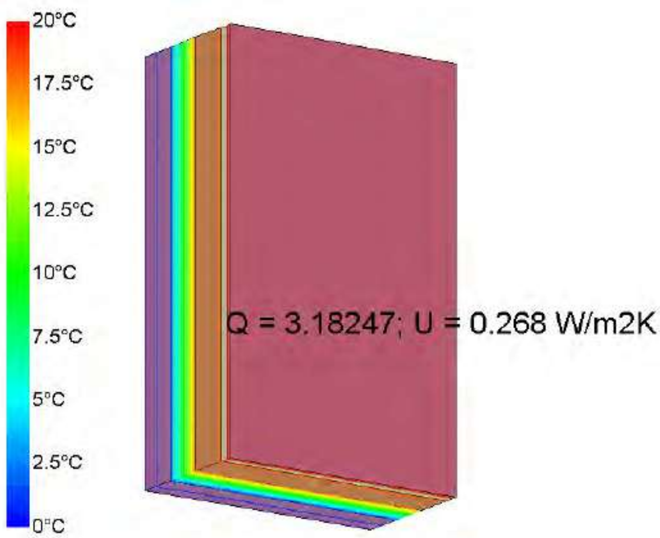


Ultraframe panel with 175mm EPS (0.03 W/m.K)

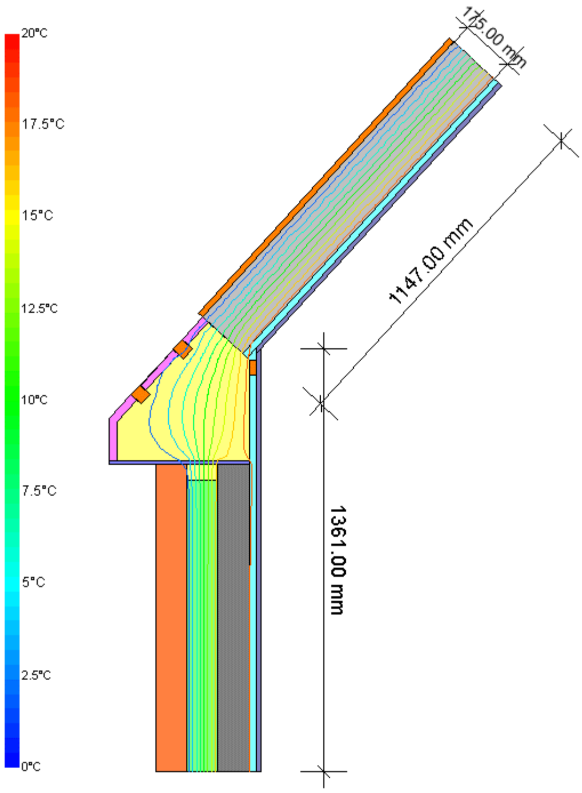
Modelling Wall U Value for Eaves Detail

Indicative Wall Construction (from internal to external):

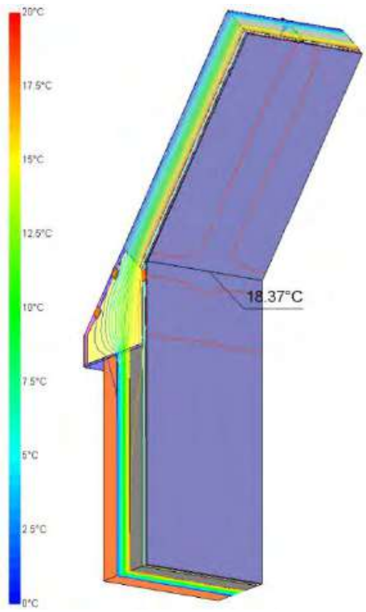
- 12.5mm plasterboard (0.25 W/m.K)
- 25mm cavity (0.136 W/m.K)
- 100mm block inner leaf (1.33 W/m.K)
- (Indicative) FF Insulation (pumped bead or similar approved) (0.033 W/m.K)
- 100mm brick outer leaf (0.77 W/m.K)



Eaves Detail Thermal Model Psi Value and f_{Rsi} Value



Q=	6.68862	W	(from model)
L_m=	0.6	m	(Length of model)
Q=	**11.1477**	**W/m**	
U1=	0.268	W/m^2K	
L1=	1.361	m	(Full internal dim.)
U2=	0.168	W/m^2K	
L2=	1.147	m	
Ψ=	Q -	∑(U1L1 + U2L2)	
	ΔT		
Ψ=	**-0.0001**	**W/m K**	

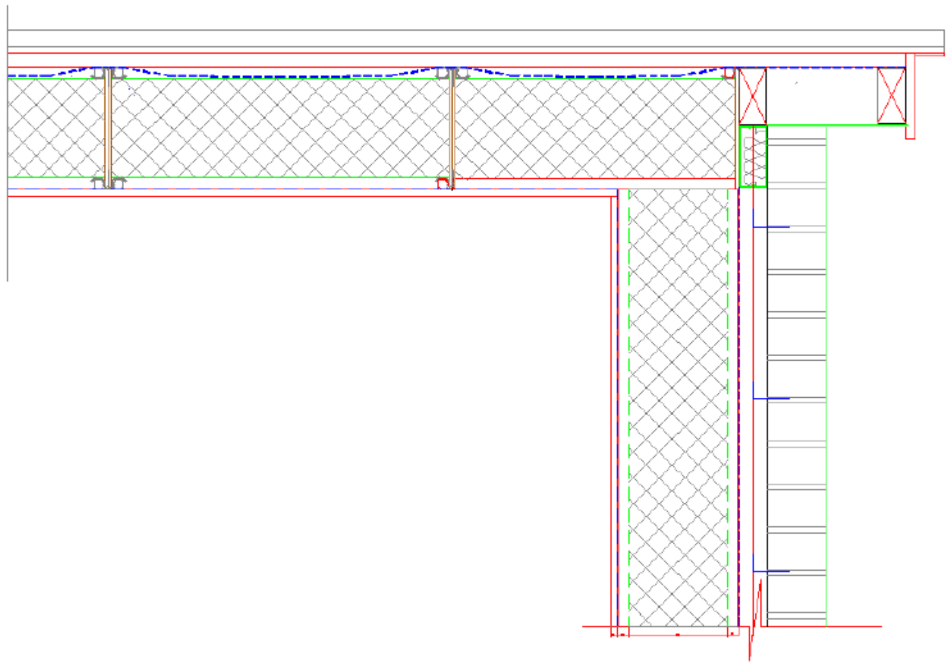


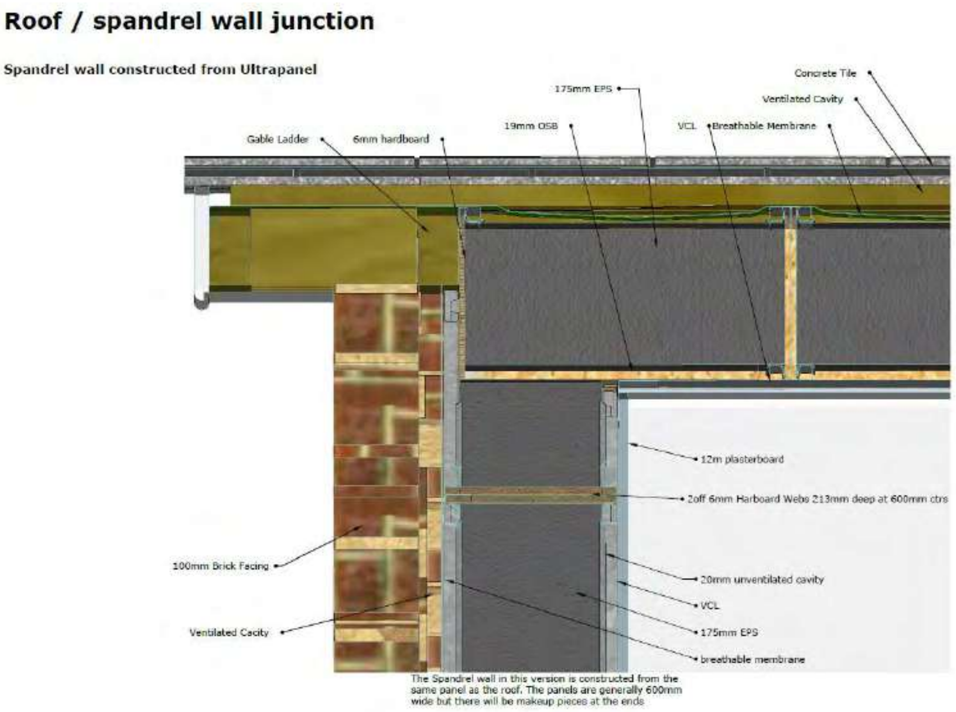
f_{Rsi} = 0.919 > 0.75

Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.951 > 0.75

Parapet Detail

Ultrapanel Wall

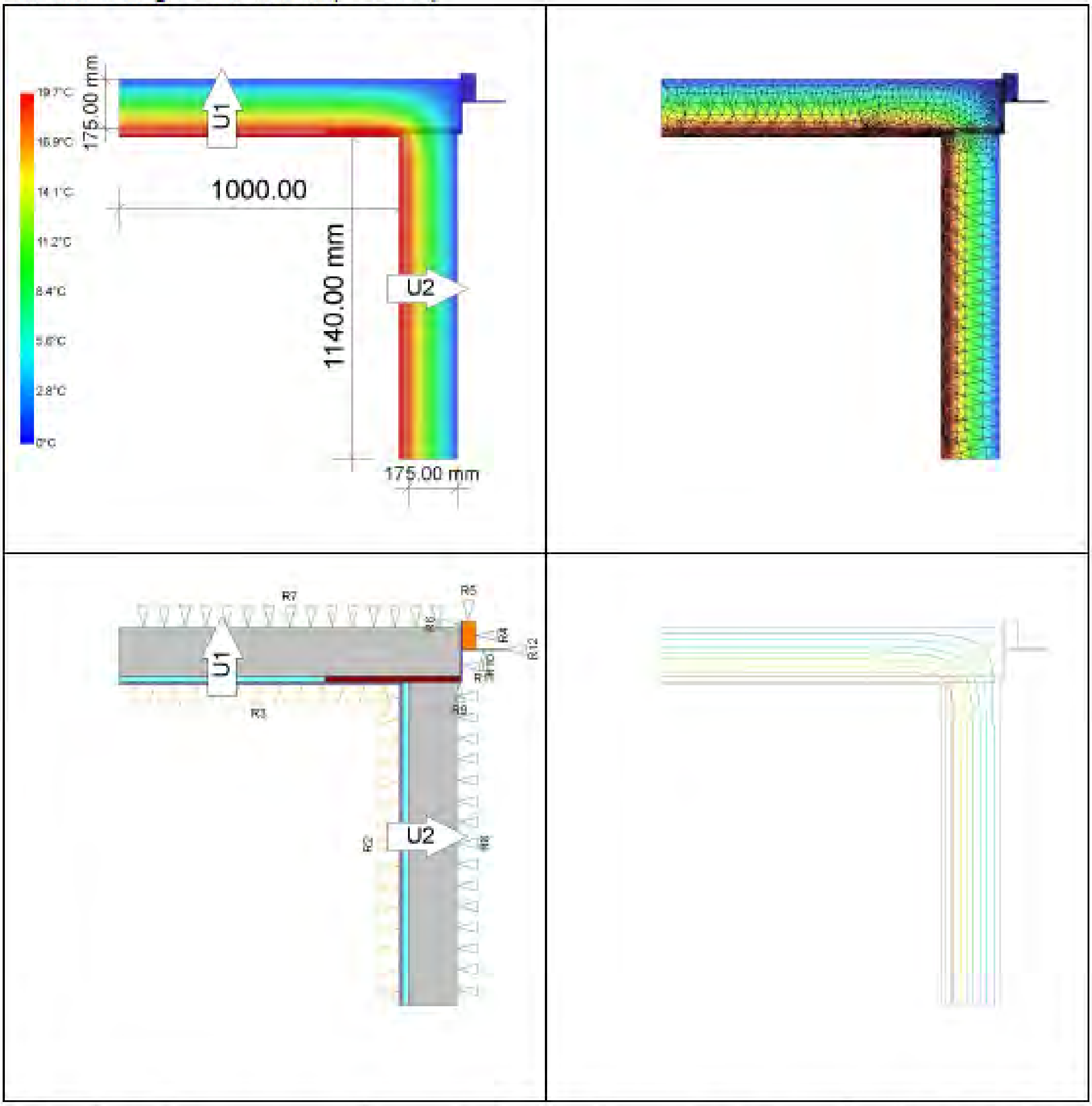




Parapet Detail (Ultraframe Wall) Psi Value

Note: Adequate ventilation should be applied within cavity between ultraframe wall panel and brick outer leaf & cavity between ultraframe roof panel and concrete tiles

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)
U2	U2	1.140 m	0.16 W/(m²K)	F_e (1.00)

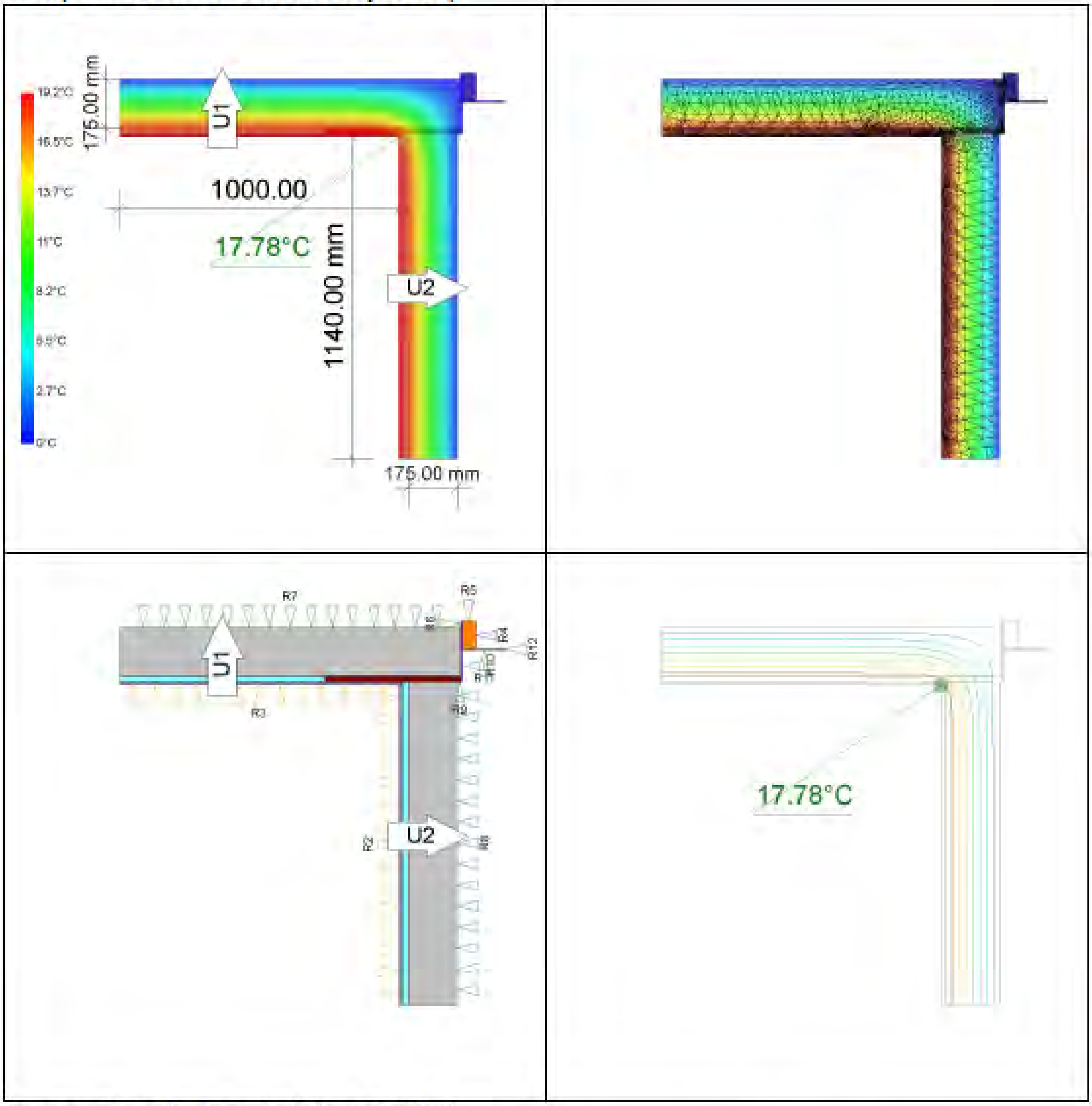
Thermal bridges calculation

Ψ = +0.029 W/(mK)

Parapet Detail (Ultraframe Wall) f_{Rsi} Value

Note: Adequate ventilation should be applied within cavity between ultraframe wall panel and brick outer leaf & cavity between ultraframe roof panel and concrete tiles

Temperature factor calculation (*f*-value)



Temperature factor calculation (*f*-value)

Nr.	Name	Length	U-value	Correction factor
U1	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)
U2	U2	1.140 m	0.16 W/(m²K)	F_e (1.00)

$$f_{RSI} = 0.89 > 0.75$$

Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.934 > 0.75

Dormer Roof Junctions

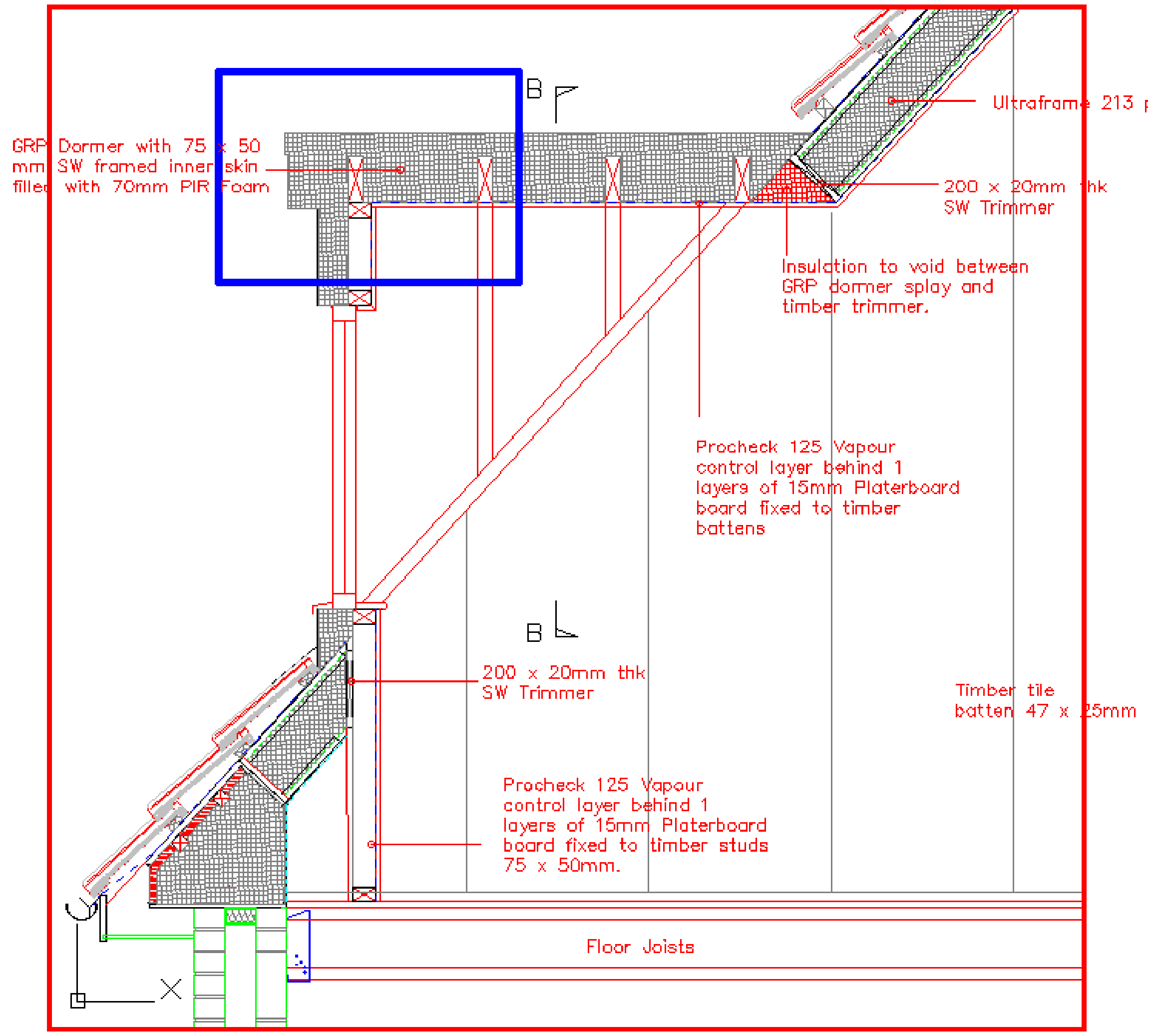
Dormer Roof Verge

Indicative Wall Construction (from internal to external):

- 15mm plasterboard (0.25 W/m.K)
- 75mm cavity (0.407 W/m.K); studs not modelled as per BR 497 Issue 2
- 100mm EPS (0.033 W/m.K)

Indicative Roof Construction (from internal to external):

- 15mm plasterboard (0.25 W/m.K)
- 150mm EPS (0.03 W/m.K) between 50mm wide joists
- 80mm EPS (0.03 W/m.K)



Section A-A

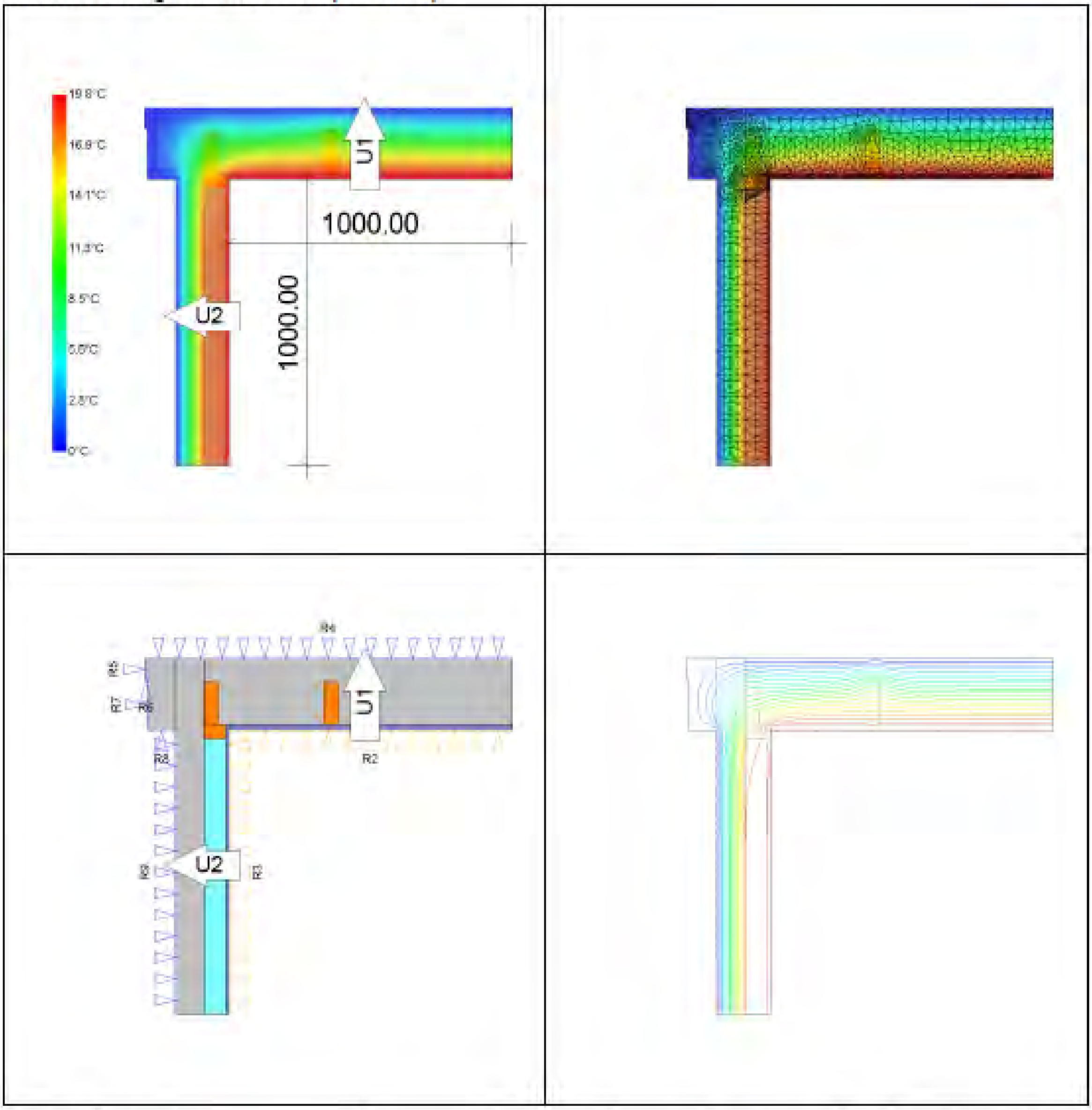
Dormer Roof Verge Psi Report

Building project:

Psi-Therm 2D

Date: 18.10.2019

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U1	1.000 m	0.13 W/(m²K)	F_e (1.00)
U2	U2	1.000 m	0.27 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = +0.043 W/(mK)

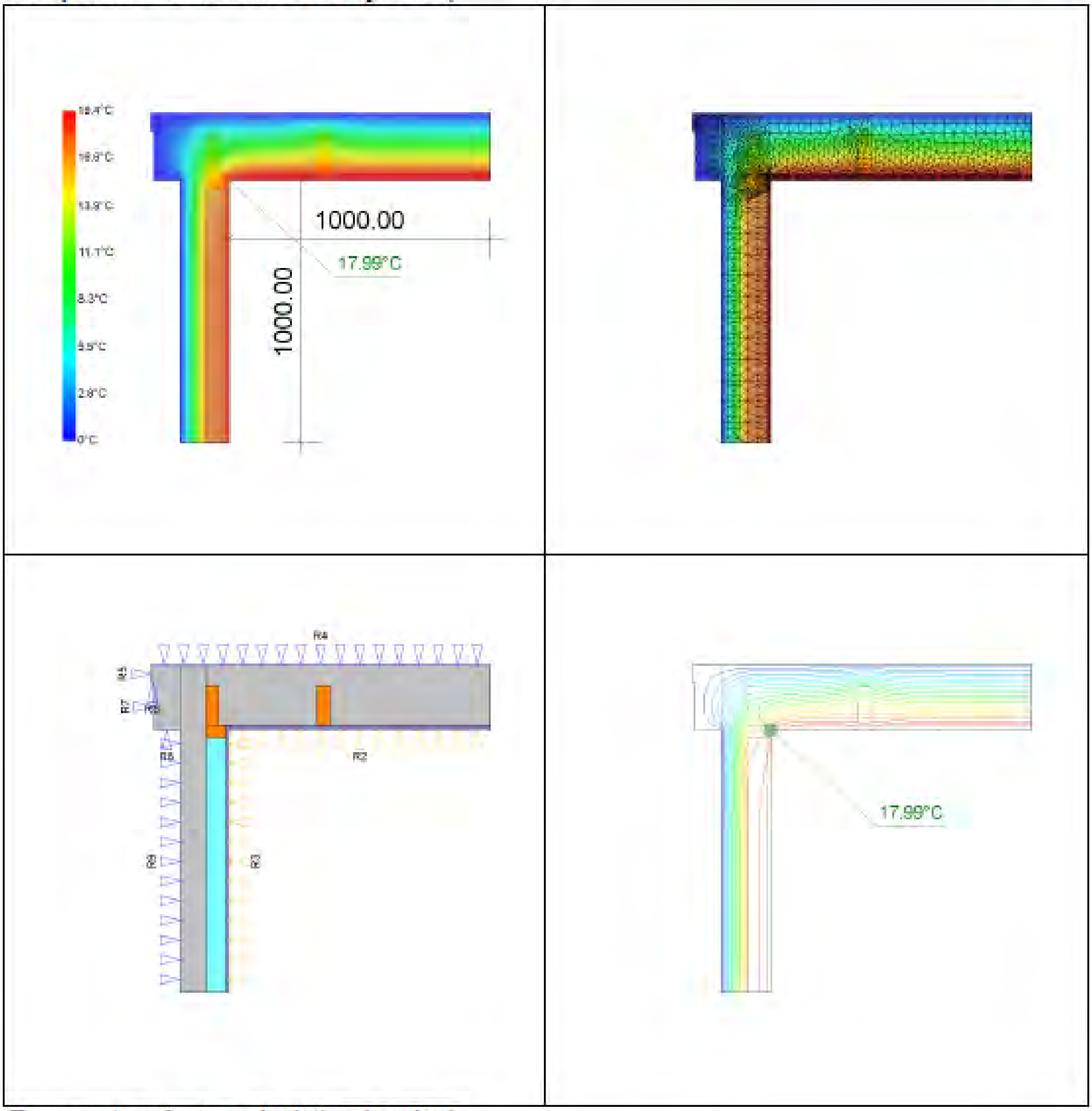
Dormer Roof Verge f_{RSI} Report

Project:

Psi-Therm 2D

Date: 18.10.2019

Temperature factor calculation (f-value)



Temperature factor calculation (f-value)

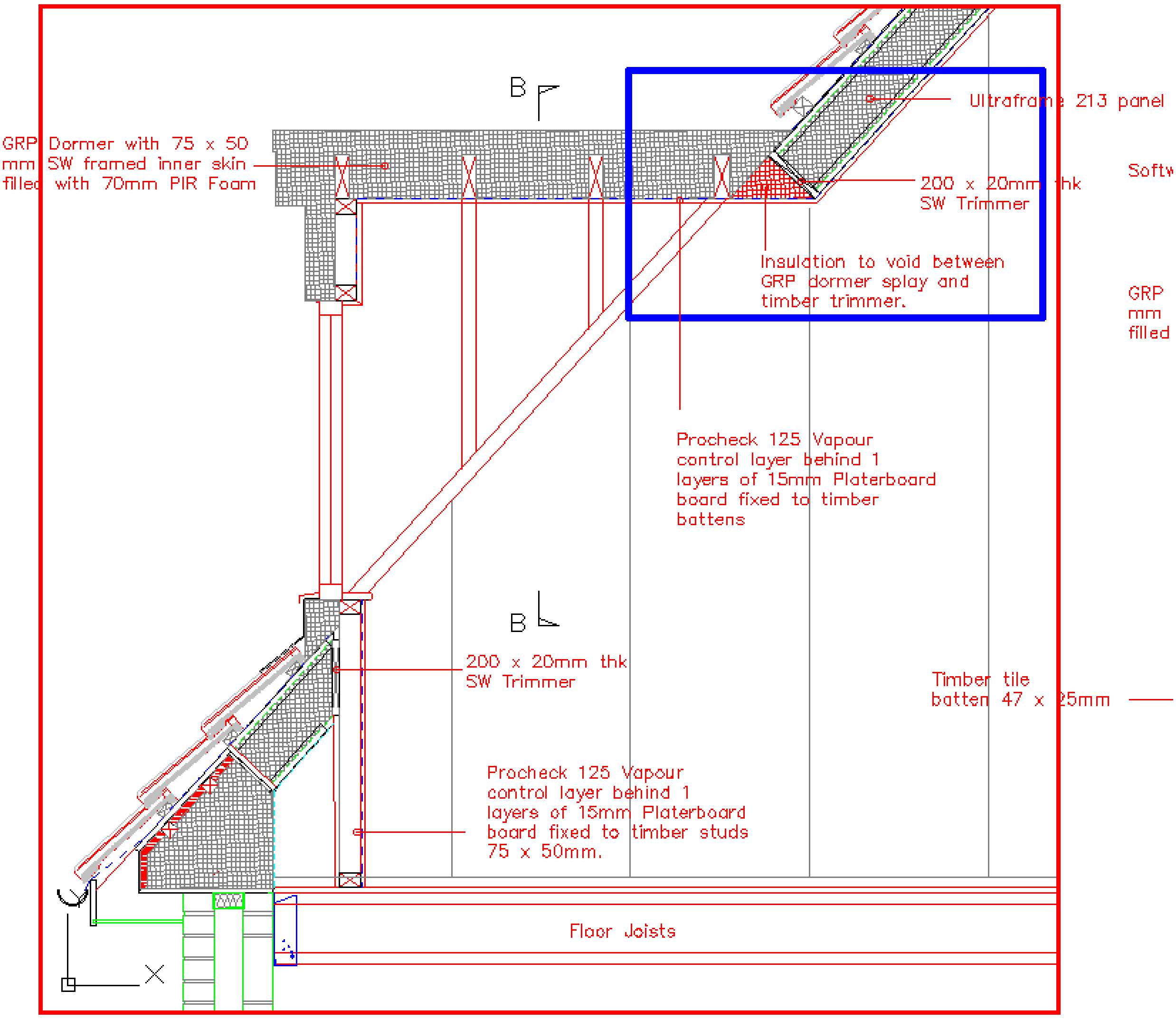
$$f_{RSI} = 0.90 > 0.75$$

Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.943 > 0.75

Dormer – Main Roof Junction

Indicative Flat Roof Construction (from internal to external):

- 15mm plasterboard (0.25 W/m.K)
- 150mm EPS (0.03 W/m.K) between 50mm wide joists
- 80mm EPS (0.03 W/m.K)



Section A-A

Scale 1:20

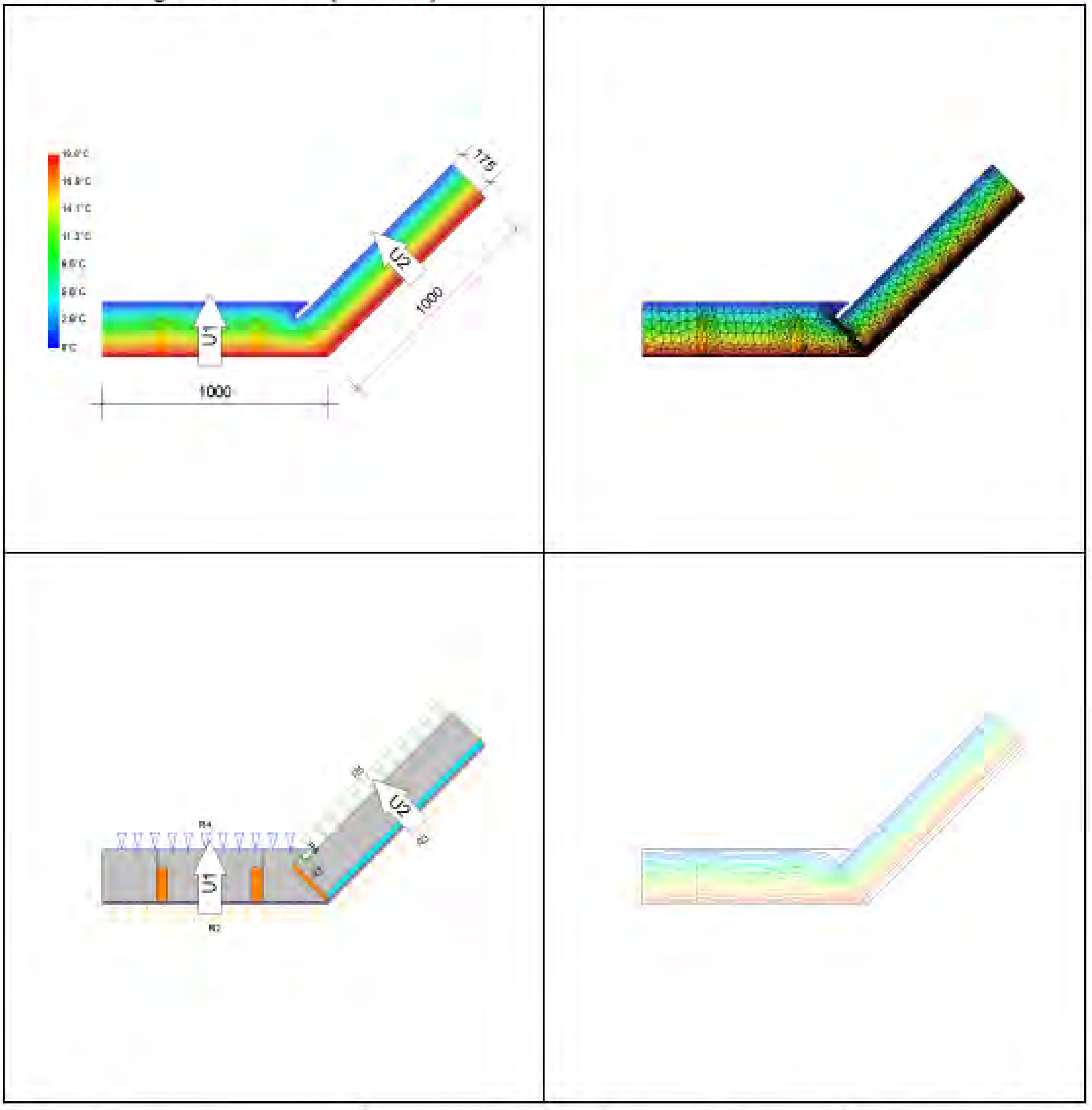
Dormer -Main Roof Psi Report

Building project:

Psi-Therm 2D

Date: 18.10.2019

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U1	1.000 m	0.13 W/(m²K)	F_e (1.00)
U2	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = +0.022 W/(mK)

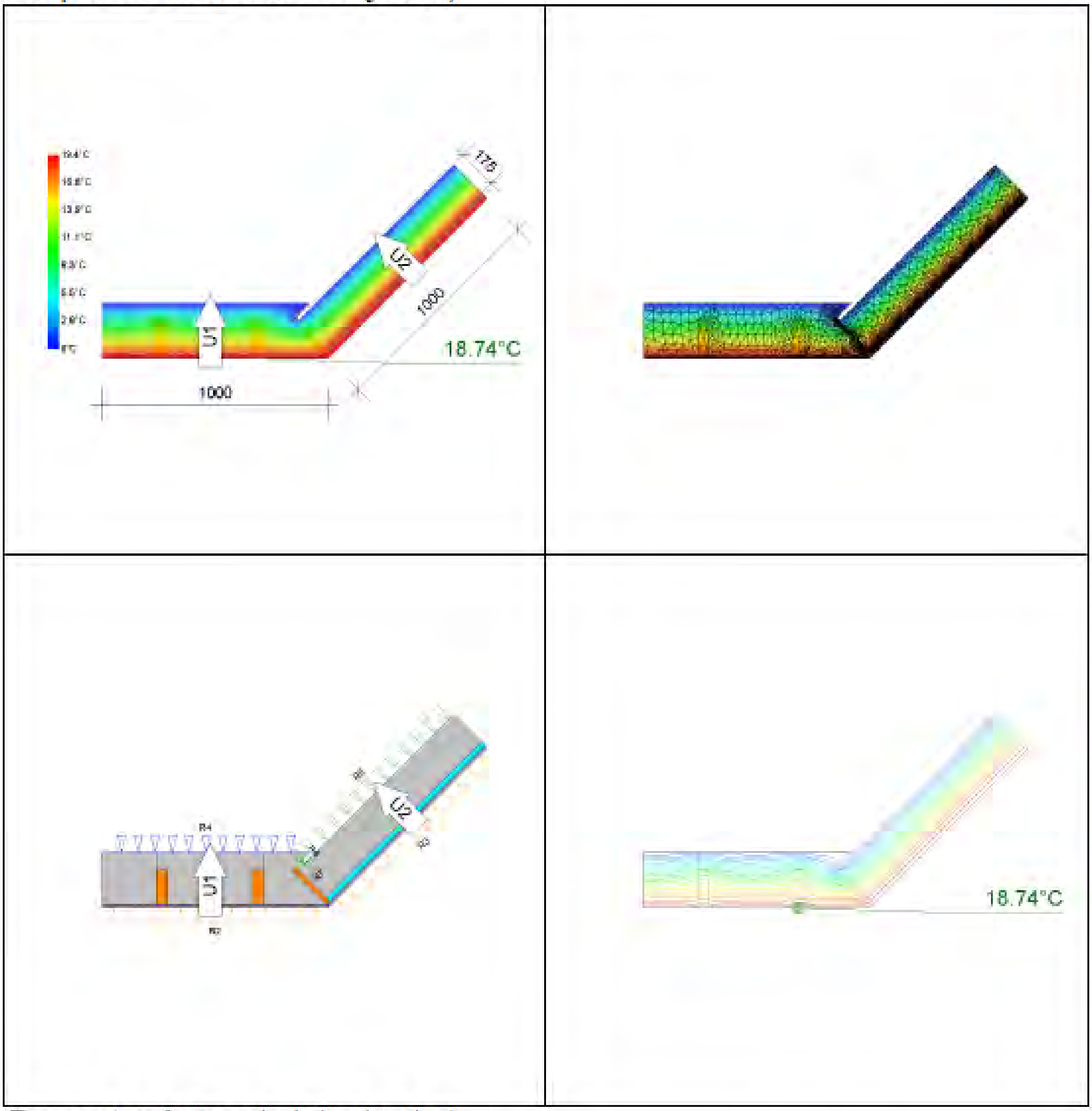
Dormer Roof - Main Roof f_{RSI} Report

Project:

Psi-Therm 2D

Date: 18.10.2019

Temperature factor calculation (f-value)



Temperature factor calculation (f-value)

Nr.	Name	Length	U-value	Correction factor
U1	U1	1.000 m	0.13 W/(m²K)	F_e (1.00)
U2	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)

$$f_{RSI} = 0.94 > 0.75$$

Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.969 > 0.75

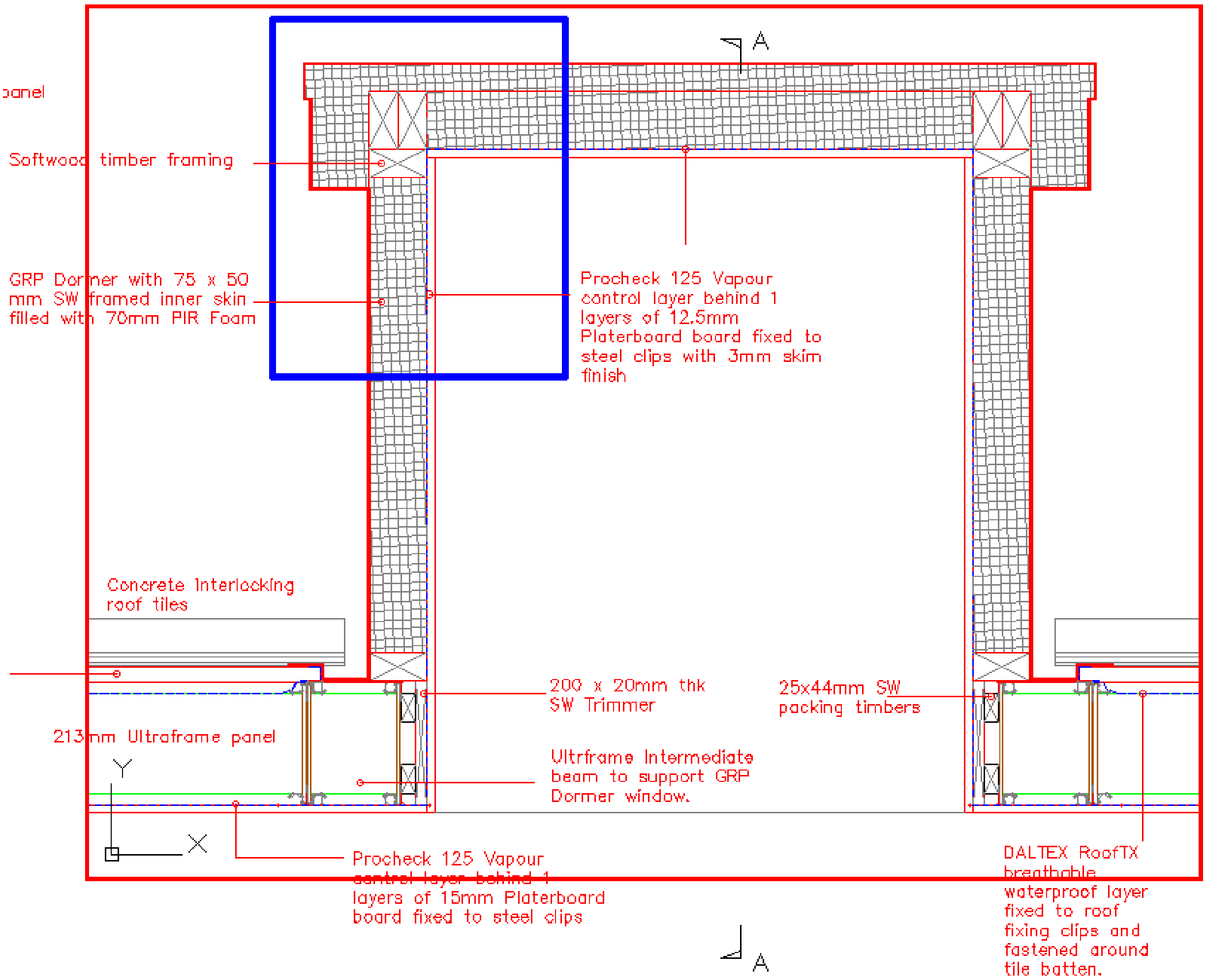
Dormer Roof – Dormer Wall Junction

Indicative Wall Construction (from internal to external):

- 15mm plasterboard (0.25 W/m.K)
- 100mm EPS (0.033 W/m.K); studs not modelled as per BR 497 Issue 2

Indicative Roof Construction (from internal to external):

- 15mm plasterboard (0.25 W/m.K)
- 100mm EPS (0.03 W/m.K) between 50mm wide joists
- 50mm EPS (0.03 W/m.K)



Section B-B

Scale 1:10

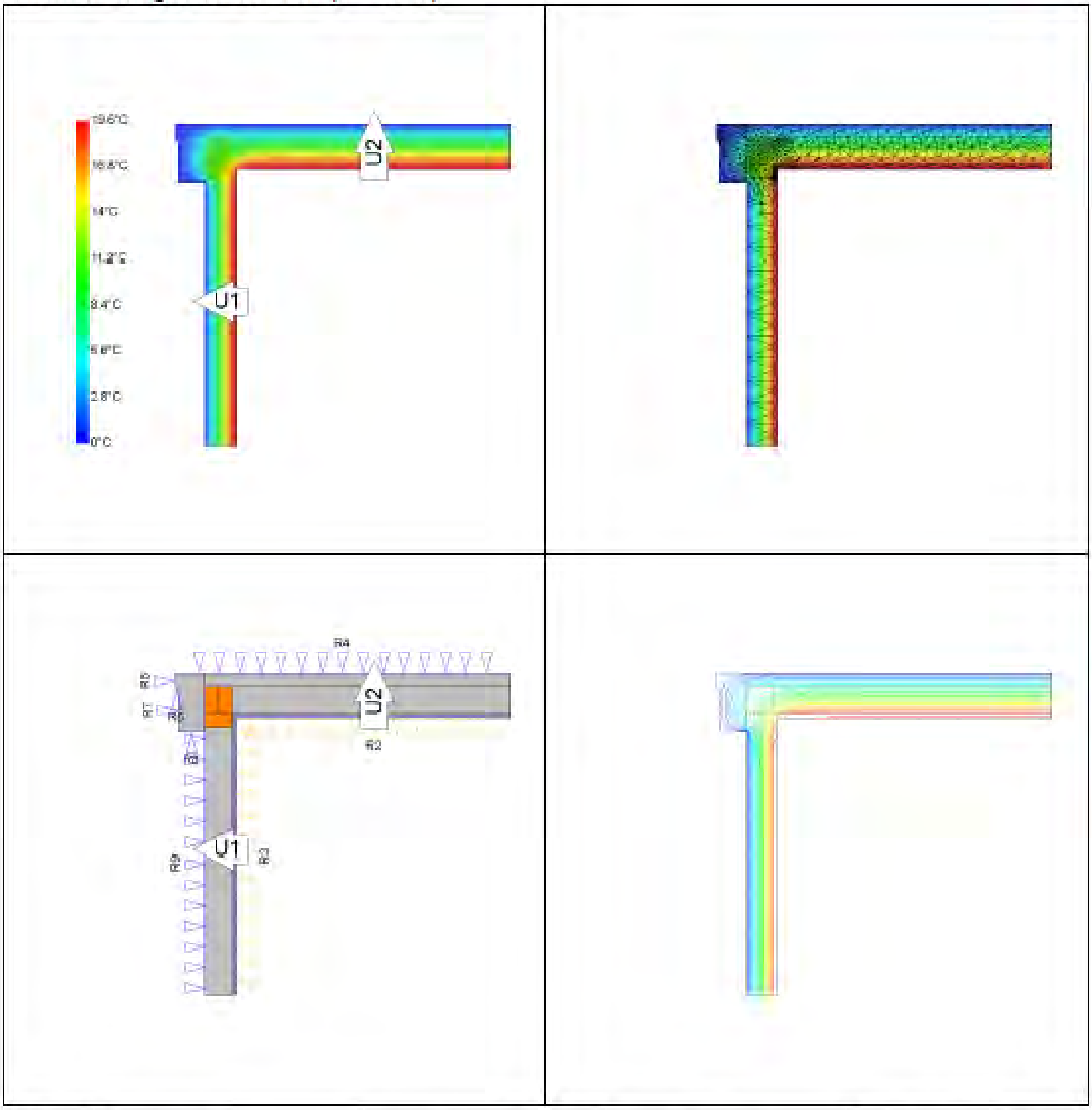
Dormer Roof – Dormer Wall Junction Psi Report

Building project:

Psi-Therm 2D

Date: 18.10.2019

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U1	1.000 m	0.28 W/(m²K)	F_e (1.00)
U2	U2	1.000 m	0.19 W/(m²K)	F_e (1.00)

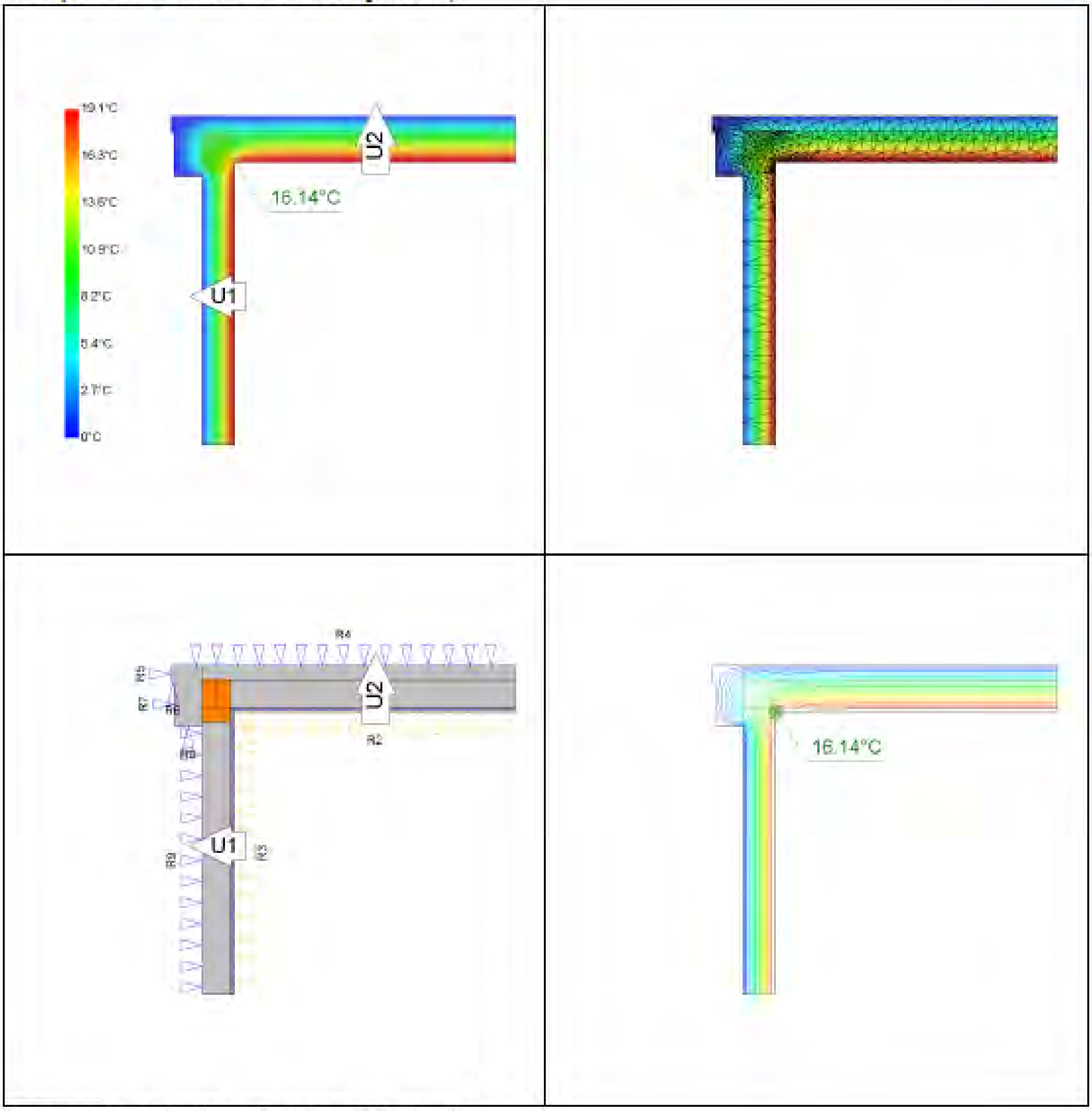
Thermal bridges calculation

$\Psi = +0.051$ W/(mK)

Dormer Roof – Dormer Wall Junction f_{RSI} Report

Project:	Psi-Therm 2D	VISION
Date: 18.10.2019		

Temperature factor calculation (f-value)



Temperature factor calculation (f-value)

Nr.	Name	Length	U-value	Correction factor
U1	U1	1.000 m	0.28 W/(m²K)	F_e (1.00)
U2	U2	1.000 m	0.19 W/(m²K)	F_e (1.00)

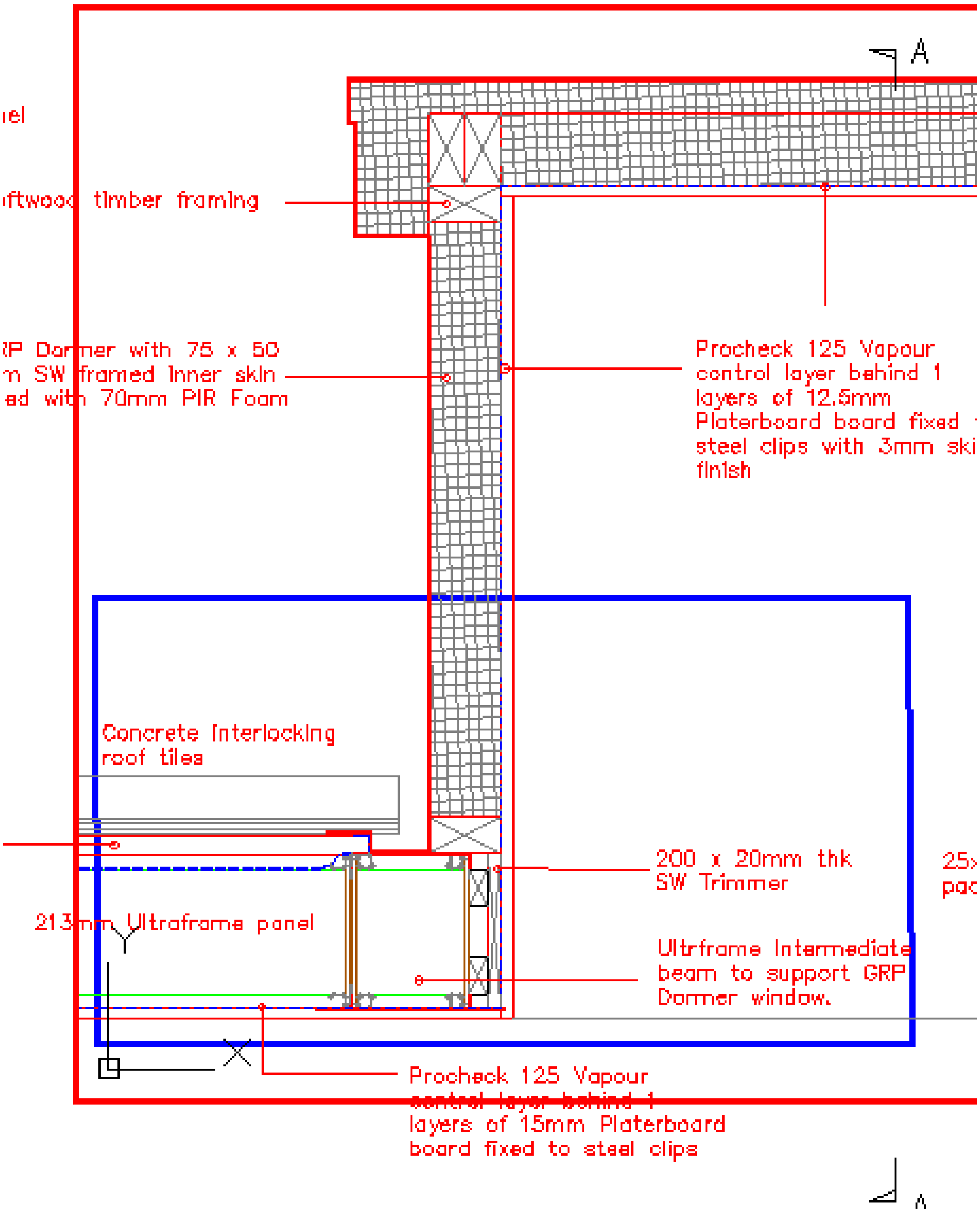
$$f_{RSI} = 0.81 > 0.75$$

Note: If using psi parameters for internal Boundary Conditions, $f_{Rsi} = 0.943 > 0.75$

Dormer Wall – Main Roof Junction

Indicative Wall Construction (from internal to external):

- 15mm plasterboard (0.25 W/m.K)
- 100mm EPS (0.033 W/m.K); studs not modelled as per BR 497 Issue 2



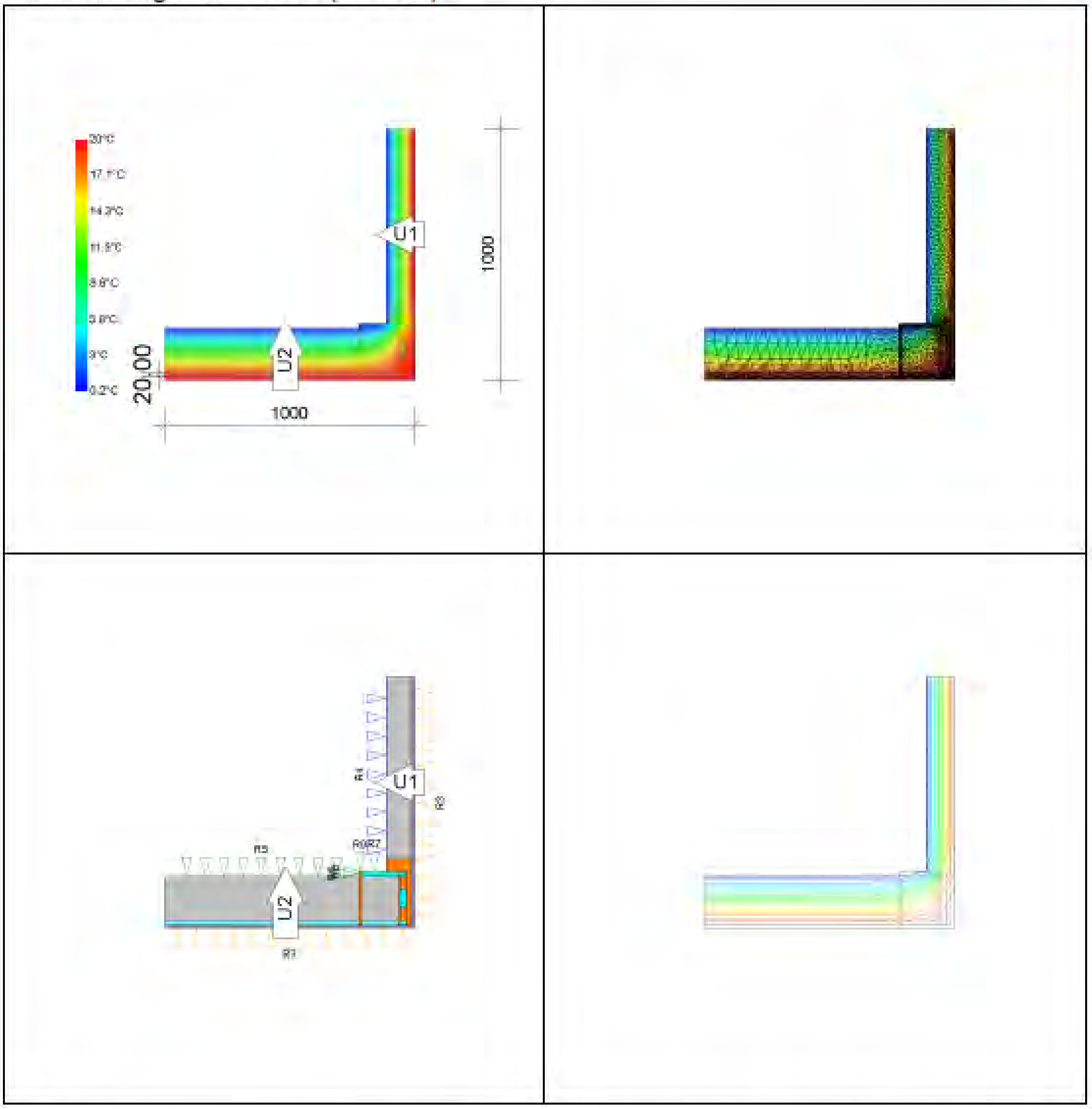
Dormer Wall – Main Roof Junction Psi Report

Building project:

Psi-Therm 2D

Date: 21.10.2019

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U1	1.000 m	0.28 W/(m²K)	F_e (1.00)
U2	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = +0.006 W/(mK)

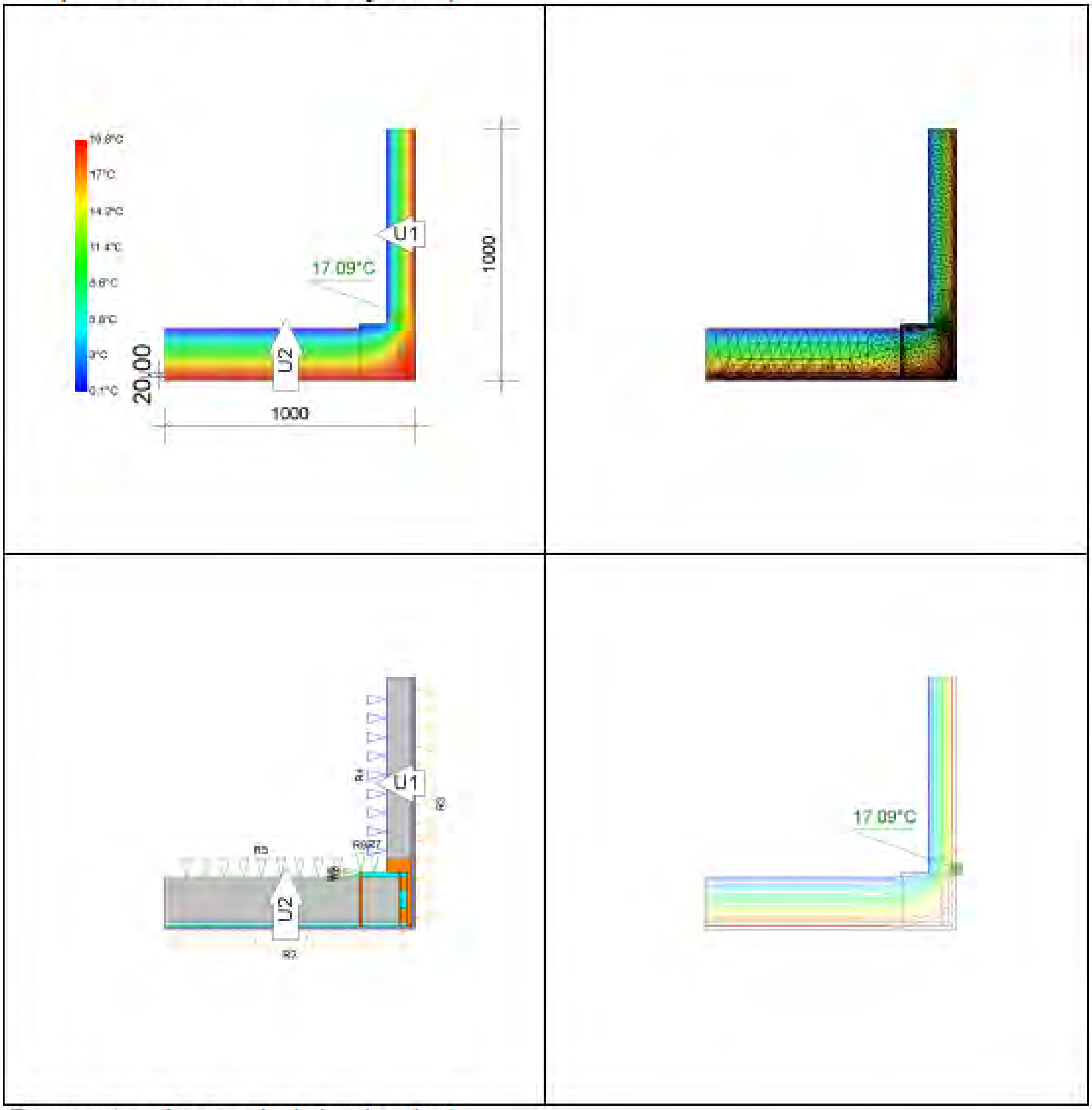
Dormer Wall – Main Roof Junction f_{RSI} Report

Project:

Psi-Therm 2D

Date: 21.10.2019

Temperature factor calculation (f-value)



Temperature factor calculation (f-value)

Nr.	Name	Length	U-value	Correction factor
U1	U1	1.000 m	0.28 W/(m²K)	F_e (1.00)
U2	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)

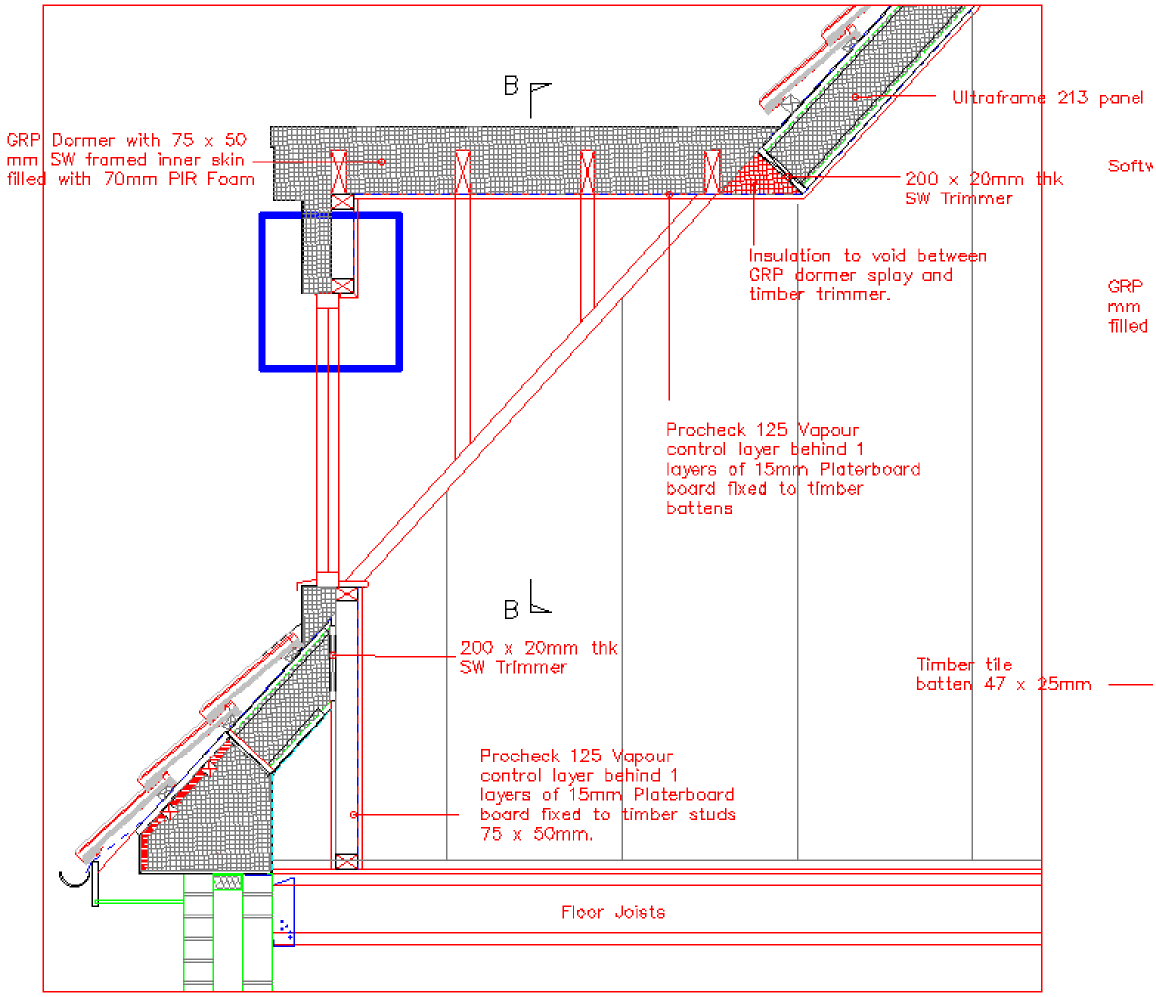
f_{RSI} = 0.85 > 0.75

Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.912 > 0.75

Dormer Roof – Window Head

Indicative Wall Construction (from internal to external):

- 15mm plasterboard (0.25 W/m.K)
- 75mm cavity (0.407 W/m.K); studs not modelled as per BR 497 Issue 2
- 100mm EPS (0.033 W/m.K)



Section A-A

Scale 1:20

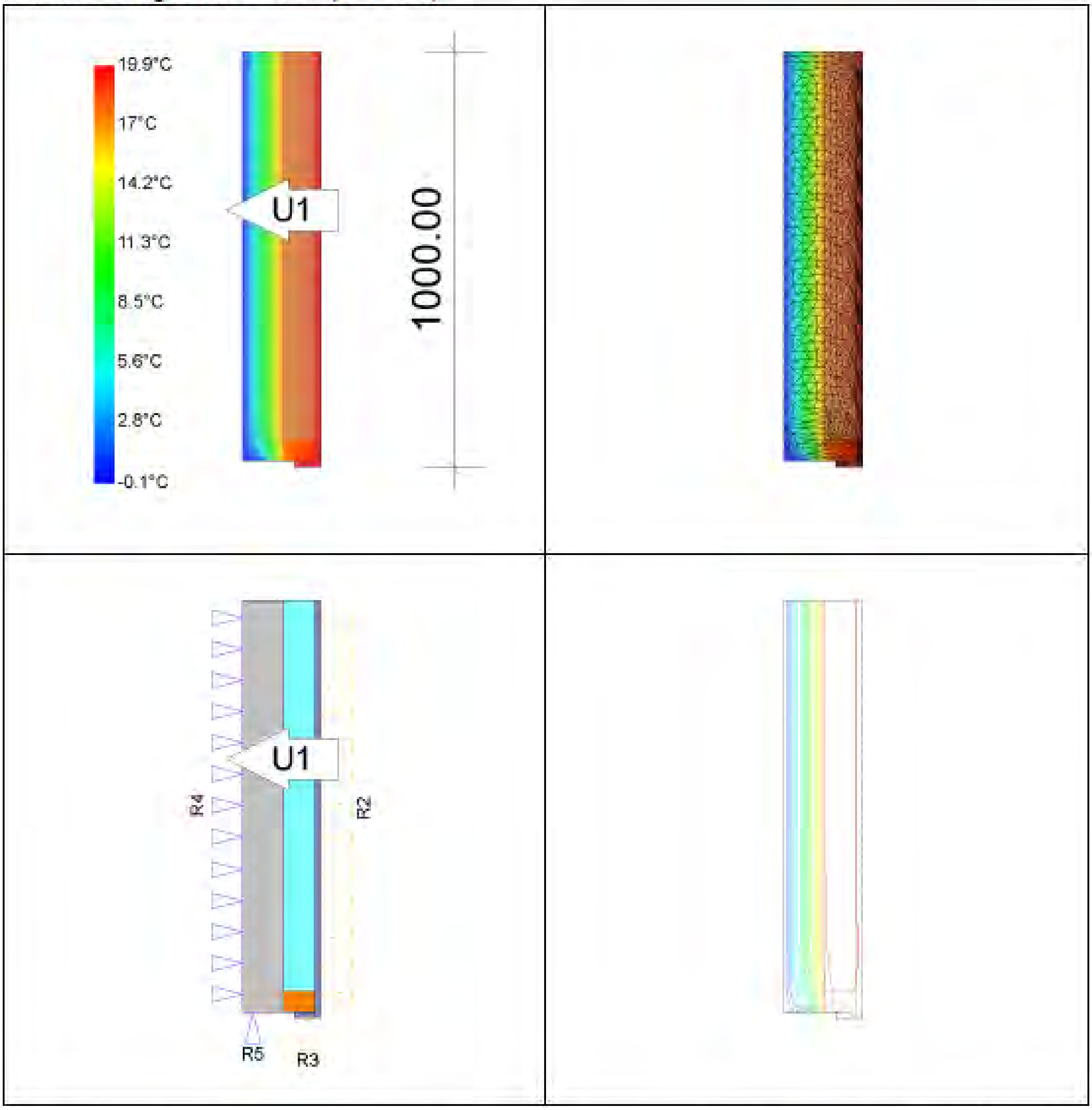
Dormer Roof – Window Head Psi Report

Building project:

Psi-Therm 2D

Date: 18.10.2019

Thermal bridges calculation (Ψ-Value)

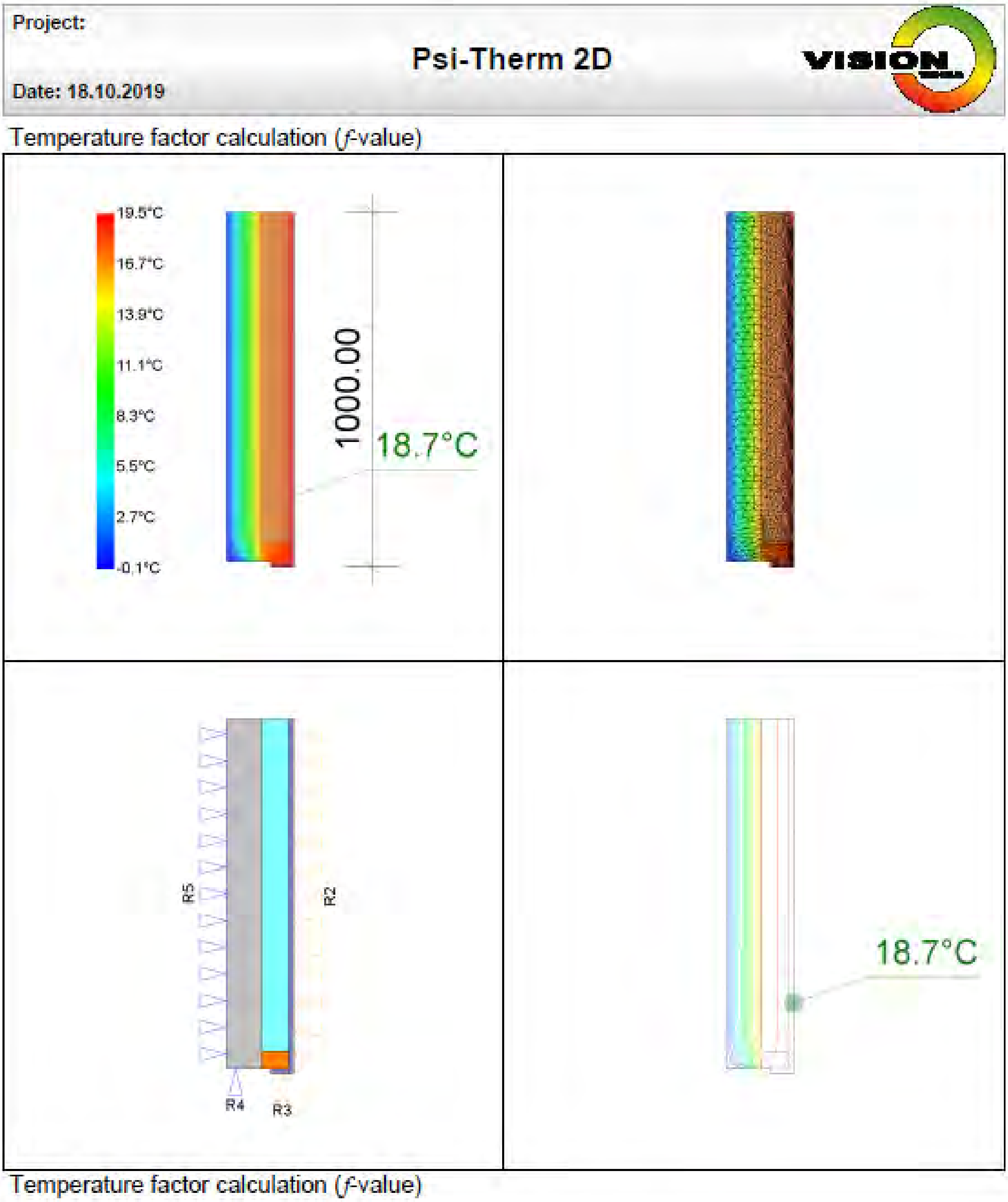


Nr.	Description	Length	U-value	Correction factor
U1	U1	1.000 m	0.27 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = +0.002 W/(mK)

Dormer Roof – Window Head f_{RSI} Report



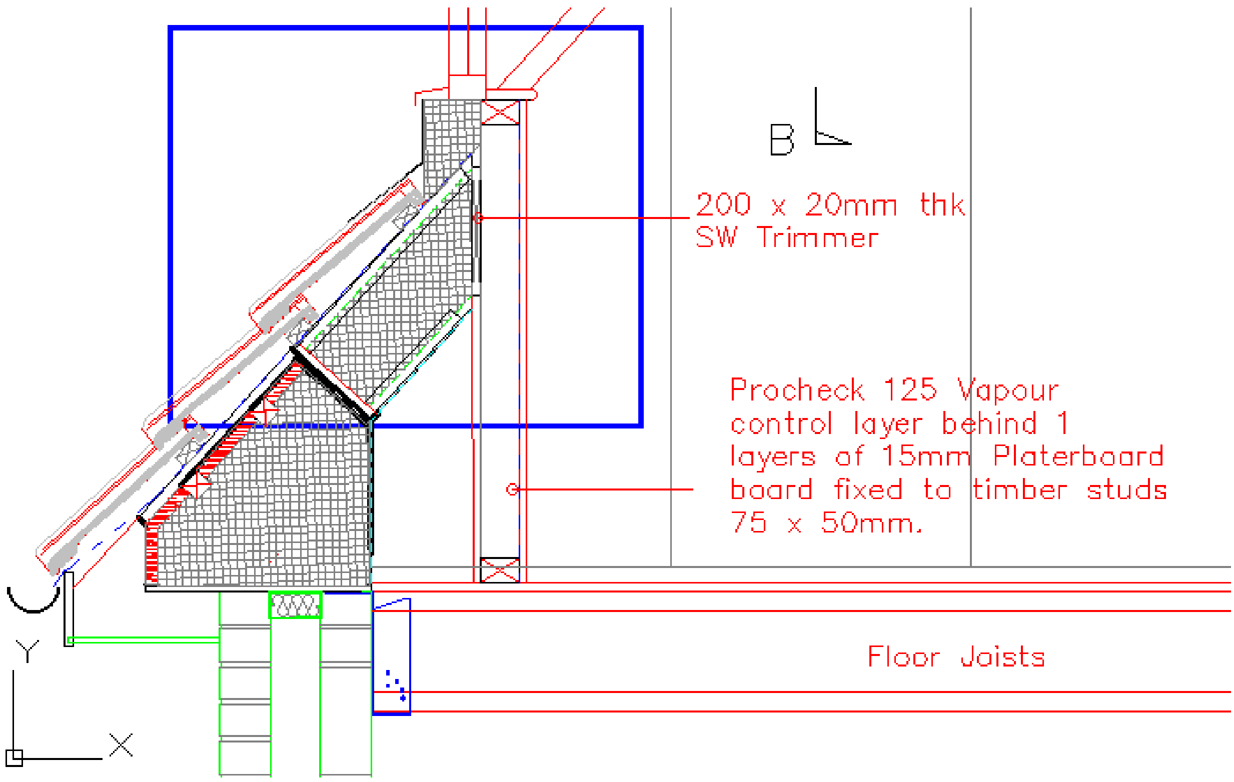
$$f_{RSI} = 0.94 > 0.75$$

Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.965 > 0.75

Dormer Roof – Window Cill

Indicative Wall Construction (from internal to external):

- 15mm plasterboard (0.25 W/m.K)
- 75mm cavity (0.407 W/m.K); studs not modelled as per BR 497 Issue 2
- 115mm EPS (0.033 W/m.K)



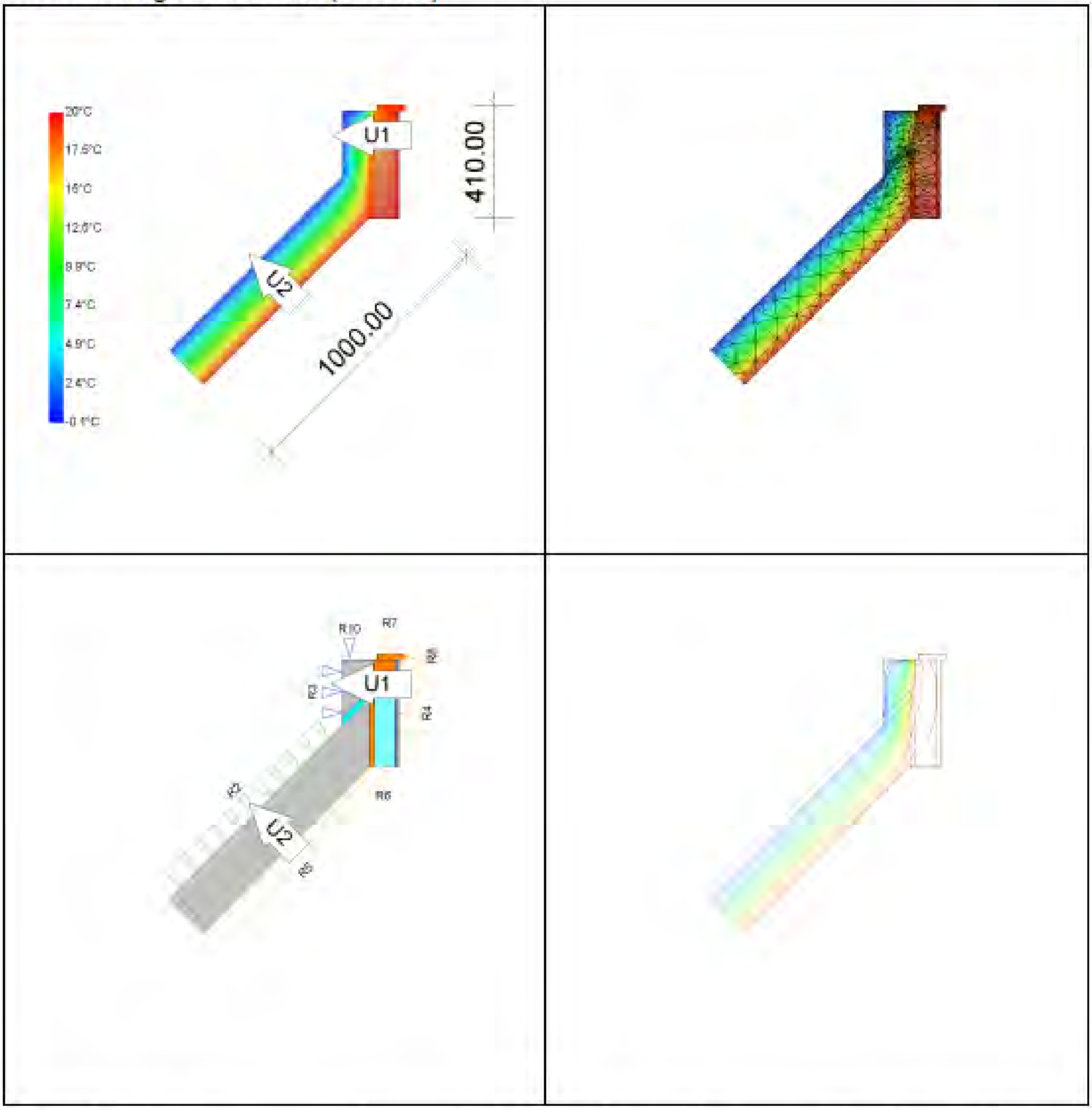
Dormer Roof – Window Cill Psi Report

Building project:

Psi-Therm 2D

Date: 21.10.2019

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U2	0.410 m	0.24 W/(m²K)	F_e (1.00)
U2	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = -0.018 W/(mK)

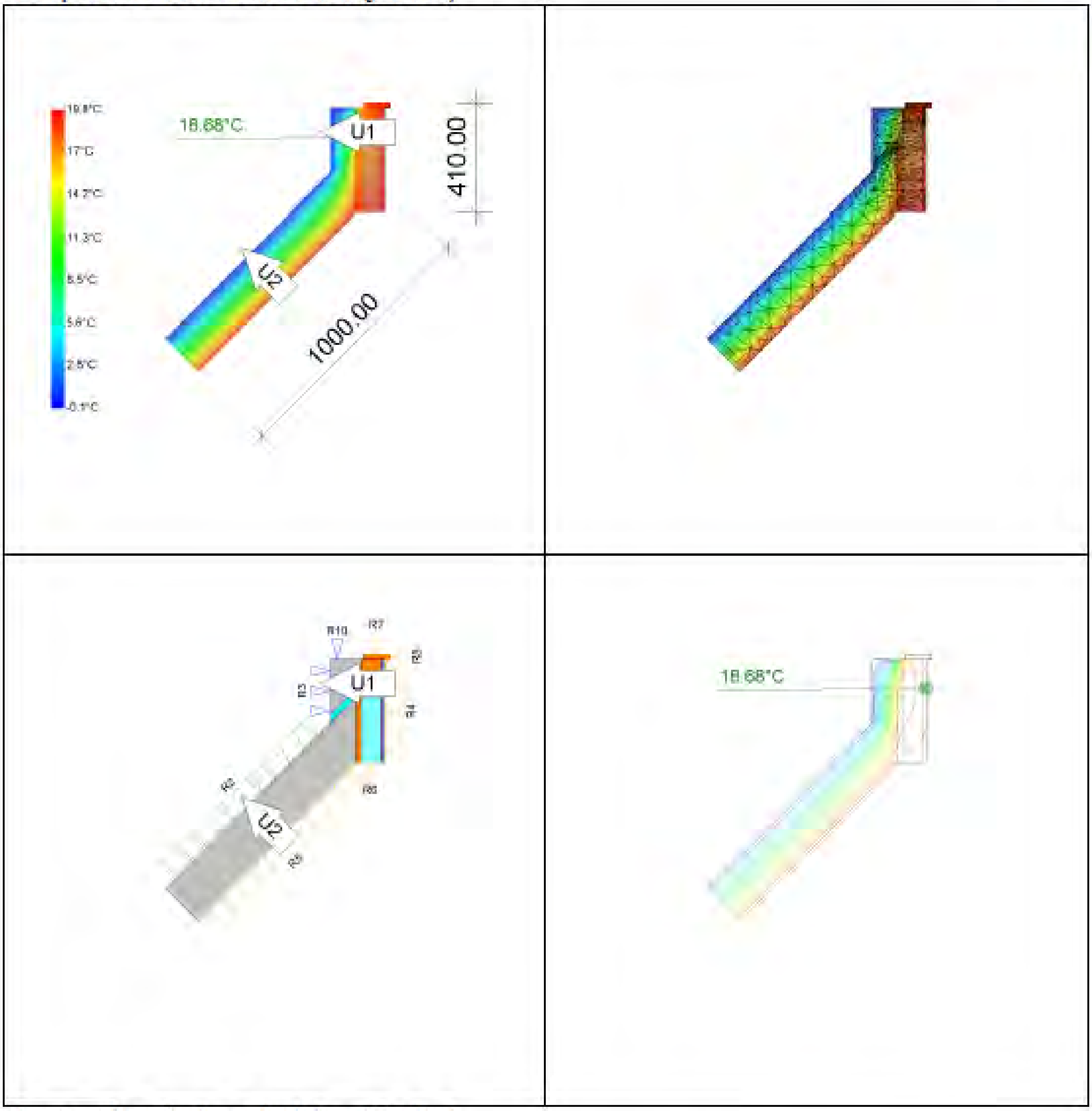
Dormer Roof – Window Cill f_{RSI} Report

Project:

Psi-Therm 2D

Date: 21.10.2019

Temperature factor calculation (f-value)



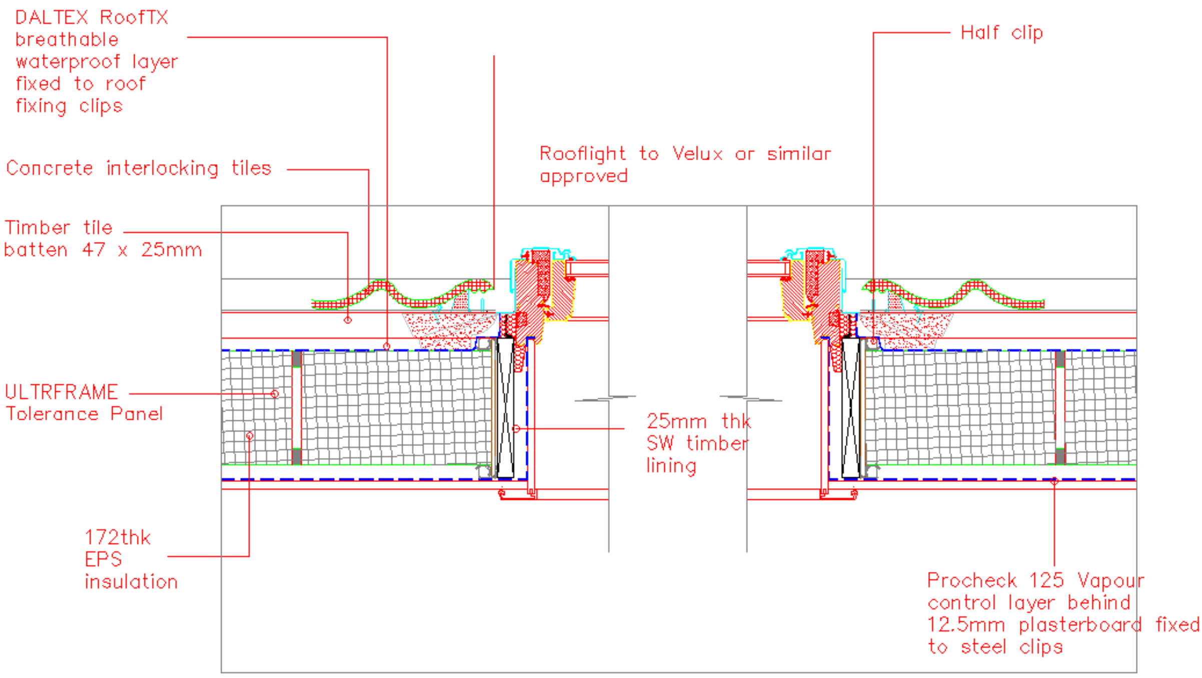
Temperature factor calculation (f-value)

Nr.	Name	Length	U-value	Correction factor
U1	U2	0.410 m	0.24 W/(m²K)	F_e (1.00)
U2	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)

$$f_{RSI} = 0.93 > 0.75$$

Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.962 > 0.75

Rooflight Jamb



Typical Velux Jamb Section

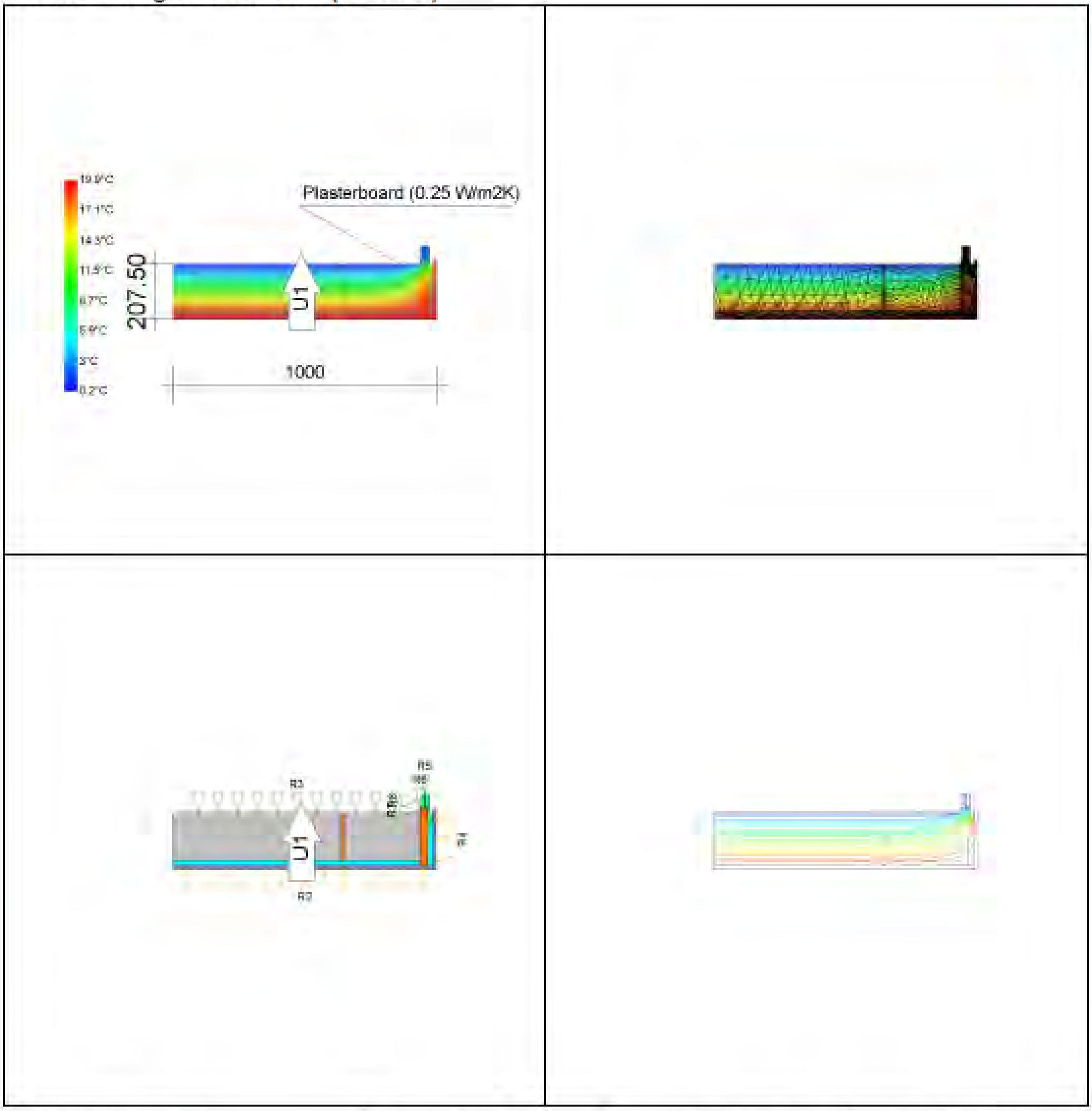
Rooflight Jamb Psi Report

Building project:

Psi-Therm 2D

Date: 21.10.2019

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = +0.063 W/(mK)

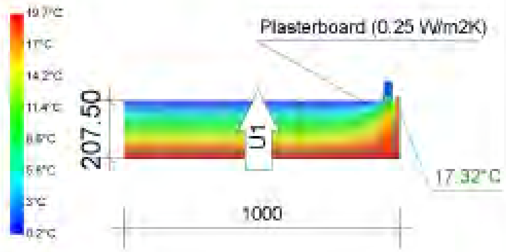
Rooflight Jamb Frsi Report

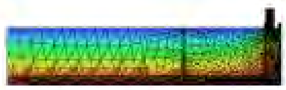
Project:

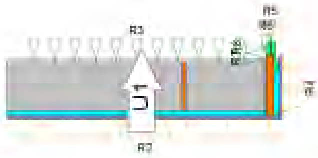
Psi-Therm 2D

Date: 21.10.2019

Temperature factor calculation (f-value)







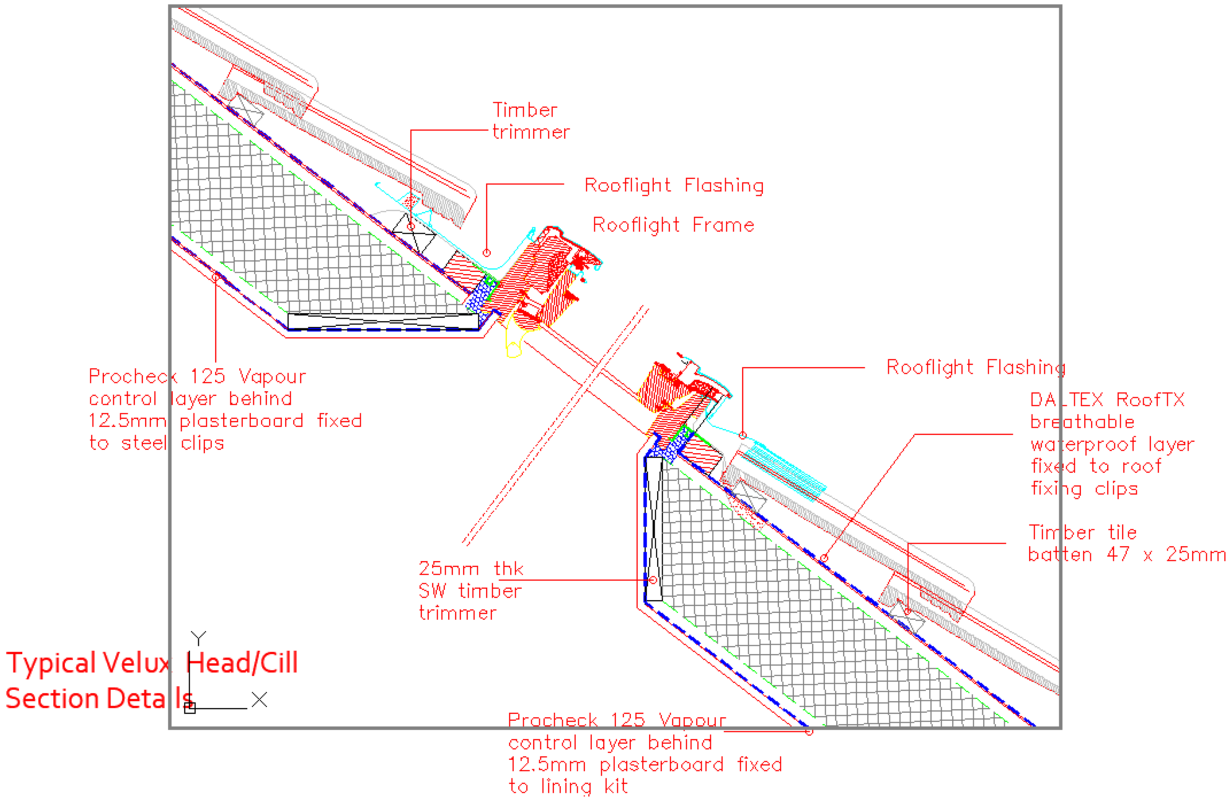
Temperature factor calculation (f-value)

Nr.	Name	Length	U-value	Correction factor
U1	U2	1.000 m	0.16 W/(m²K)	F_e (1.00)

$$f_{RSI} = 0.87 > 0.75$$

Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.919 > 0.75

Rooflight Head / Cill



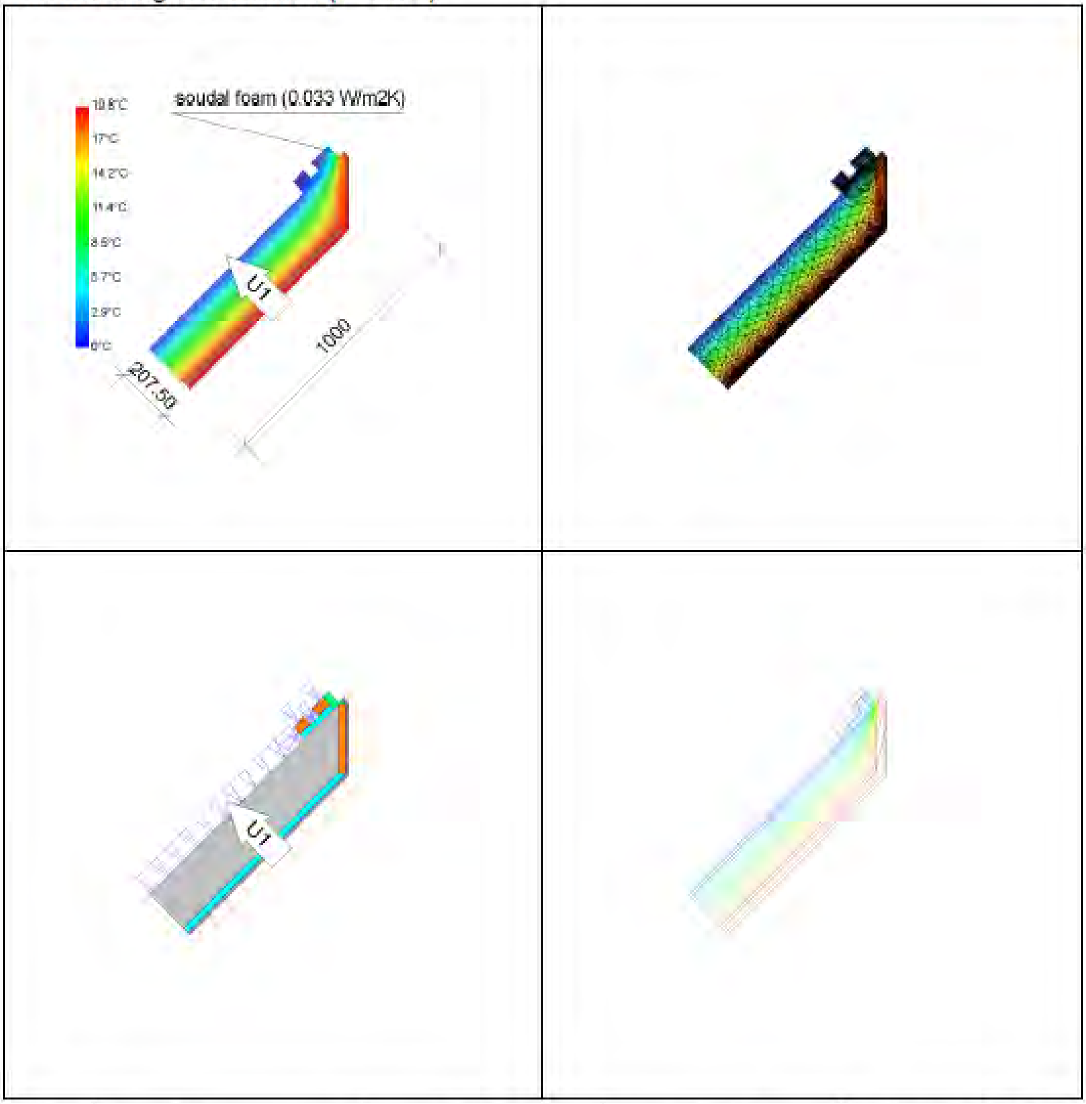
Rooflight Head/Cill Psi Report

Building project:

Psi-Therm 2D

Date: 21.10.2019

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U1	1.000 m	0.16 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = +0.043 W/(mK)

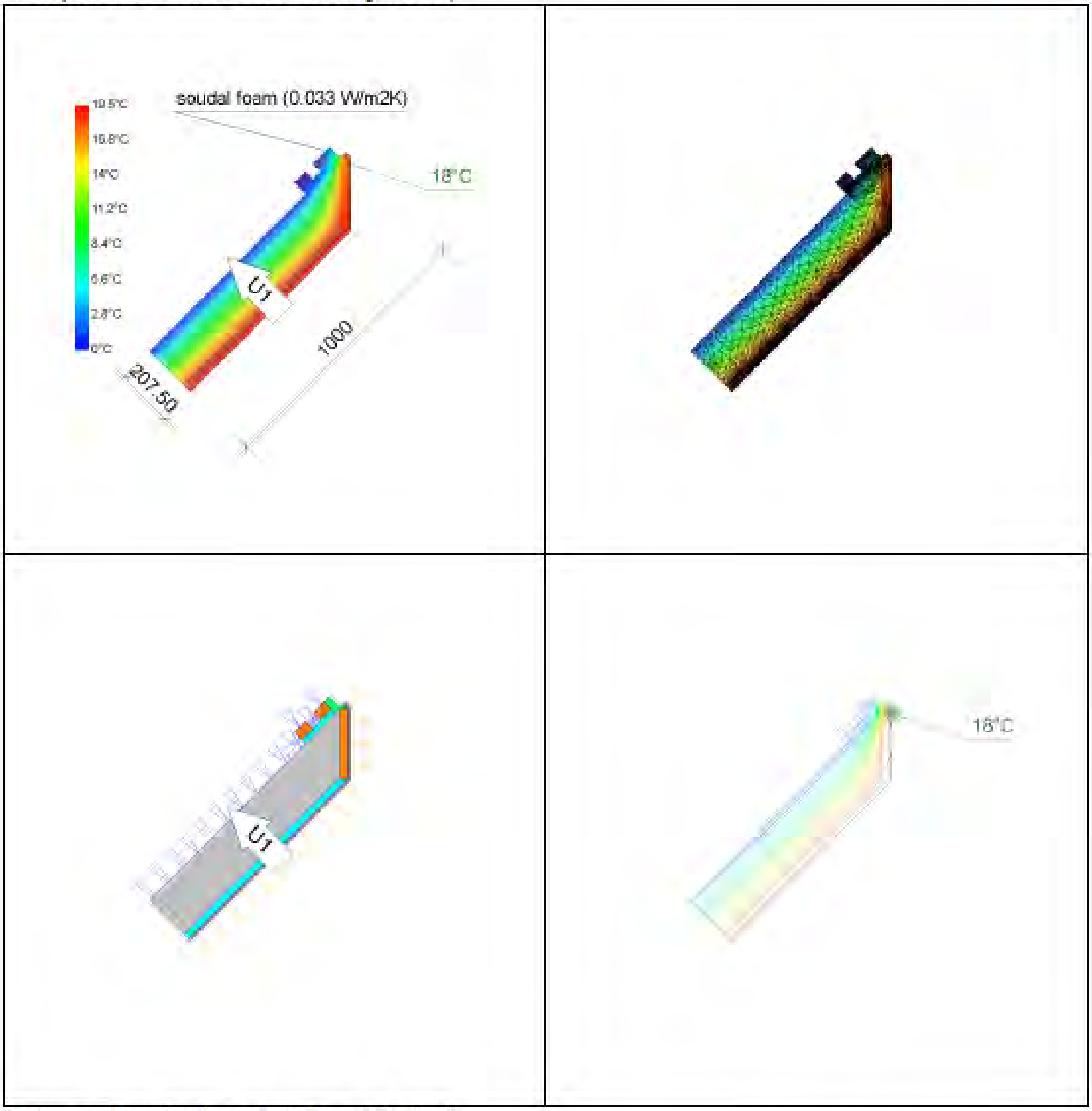
Rooflight Head/Cill Frsi Report

Project:

Psi-Therm 2D

Date: 21.10.2019

Temperature factor calculation (f-value)



Temperature factor calculation (f-value)

Nr.	Name	Length	U-value	Correction factor
U1	U1	1.000 m	0.16 W/(m²K)	F_e (1.00)

$$f_{RSI} = 0.90 > 0.75$$

Note: If using psi parameters for internal Boundary Conditions, f_{Rsi} = 0.917 > 0.75

Appendix A: CRA Calculations

Note re Assumptions: With all CRA calculations, the Breather Membrane is not detailed in the output, both in roof and wall elements. Within Condensation Risk Analysis software: foil face of plasterboard is assumed unpenetrated, and joints are assumed to be taped and sealed. It is also assumed, that within all wall and roof elements, that a ventilated cavity exists immediately outside EPS and a ventilated air layer circulates in and around zone in which timber/steel is proud of EPS (exposed timber). CRA calculations are not valid unless this the case and elements may be at risk of failing CRA assessment if assumptions are non-applicable.

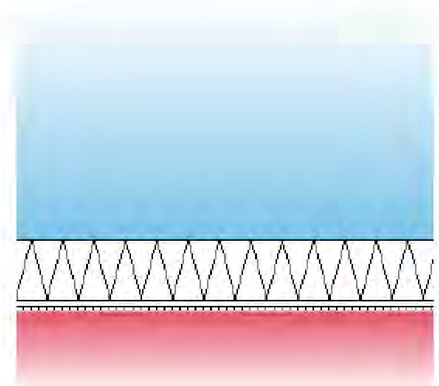
Ultraframe Roof Ridge (Roof Element)

BuildDesk U 3.4

Ultraframe Roof Ridge w foil faced PB

Documentation of the component — 10. December 2020
Calculation according BS EN ISO 13788 — Page 1/17
Source: **own catalogue - Pitched roofs**
Component: **Ultraframe Roof Ridge w foil faced PB**

OUTSIDE



INSIDE

The list of material layers shown below may differ from those in the U-value calculation printout. Only material layers which are used in the Condensation Risk Analysis are listed.

This calculation of the Condensation risk analysis according to BS EN ISO 13788:2002 has been performed on a construction containing inhomogeneous layers. This calculation is only valid through the selected section. It is advisable that you should also select the alternative position and recalculate the Condensation Risk Analysis for a more complete assessment of the construction.

The CRA calculation for pitched roofs can be very unreliable and caution should be used when interpreting these results. For further guidance the user is advised to follow the recommendation of BS 5250:202 (currently under review).

Assignment: Pitched roof < 70°, with insulation between rafters

Name	Thickn. [m]	lambda [W/(mK)]	Q	μ [-]	Q	sd [m]	R [m²K/W]
Expanded polystyrene (EPS)	0.1750	0.030	E	60.00	E	10.50	5.8333
Unventilated airspace large: upwards heat flow	0.0200	0.122	D	1.00	D	0.02	0.1643
Gyproc Wallboard DUPLEX 12.5mm	0.0125	0.190	D	970.00	D	12.13	0.0658

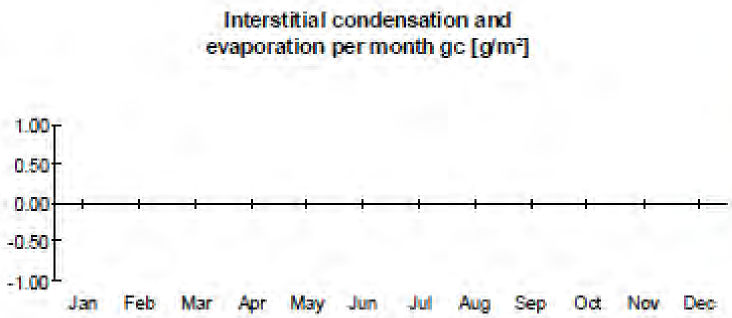
Q .. The physical values of the building materials has been graded by their level of quality. These 5 levels are the following
A .. A: Data is entered and validated by the manufacturer or supplier. Data is continuously tested by 3rd party.
B .. B: Data is entered and validated by the manufacturer or supplier. Data is certified by 3rd party
C .. C: Data is entered and validated by the manufacturer or supplier.
D .. D: Information is entered by BuildDesk without special agreement with the manufacturer, supplier or others.
E .. E: Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

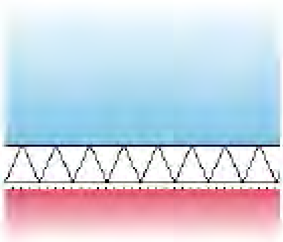
Source: own catalogue - Pitched roofs
Component: Ultraframe Roof Ridge w foil faced PB

Condensation risk analysis - summary of main results
Calculation according BS EN ISO 13788

✔ Surface temperature to avoid critical surface moisture:
No danger of mould growth is expected.

✔ Interstitial condensation:
No condensation is predicted at any interface in any month.





Component, condensation range

CRA calculations according to BS EN ISO 13788:2002 are used as a guide in predicting interstitial condensation. This methodology uses some simplifications of the dynamic processes involved and subsequently does have some limitations. Further information can be found in Information Paper IP 2/05 'Modelling and controlling interstitial condensation in buildings" Feb 2005.

The CRA calculation for pitched roofs can be very unreliable and caution should be used when interpreting these results. For further guidance the user is advised to follow the recommendation of BS 5250:202 (currently under review).

Ultraframe Roof Ridge (Roof Junction)

BuildDesk U 3.4

Ultraframe Roof Ridge Junction CRA

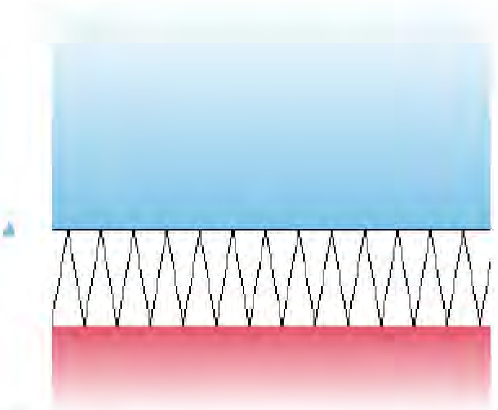
Documentation of the component — 28. October 2020

Calculation according BS EN ISO 13788 — Page 1/17

Source: **own catalogue - Pitched roofs**

Component: **Ultraframe Roof Ridge Junction**

OUTSIDE



INSIDE

The list of material layers shown below may differ from those in the U-value calculation printout. Only material layers which are used in the Condensation Risk Analysis are listed.

This calculation of the Condensation risk analysis according to BS EN ISO 13788:2002 has been performed on a construction containing inhomogeneous layers. This calculation is only valid through the selected section. It is advisable that you should also select the alternative position and recalculate the Condensation Risk Analysis for a more complete assessment of the construction.

The CRA calculation for pitched roofs can be very unreliable and caution should be used when interpreting these results. For further guidance the user is advised to follow the recommendation of BS 5250:202 (currently under review).

Assignment: Pitched roof < 70°, with insulation between rafters

Name	Thickn. [m]	lambda [W/(mK)]	Q	μ [-]	Q	sd [m]	R [m²K/W]
Steel	0.0009	50.000	D	999999.00	D	900.00	0.0000
Mineral wool batt - General Purpose (S) 0.04	0.2650	0.040	E	1.00	E	0.27	6.6250
Steel	0.0009	50.000	D	999999.00	D	900.00	0.0000

Q .. The physical values of the building materials has been graded by their level of quality. These 5 levels are the following

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E .. E: Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

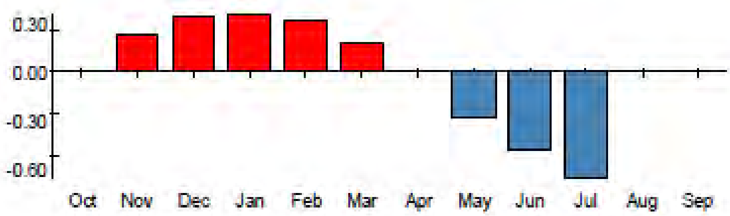
Condensation risk analysis - summary of main results
Calculation according BS EN ISO 13788

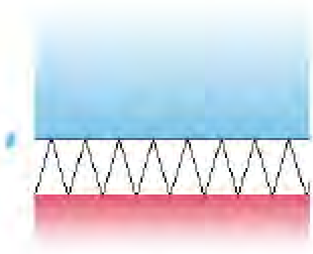
Surface temperature to avoid critical surface moisture:
No danger of mould growth is expected.

Interstitial condensation occurs, but all the condensate is predicted to evaporate during the summer months.

The risk of degradation of building materials and deterioration of thermal performance as a consequence of the calculated maximum amount of moisture shall be considered according to regulatory requirements and other guidance in product standards.

Interstitial condensation and evaporation per month gc [g/m²]





Component, condensation range

CRA calculations according to BS EN ISO 13788:2002 are used as a guide in predicting interstitial condensation. This methodology uses some simplifications of the dynamic processes involved and subsequently does have some limitations. Further information can be found in Information Paper IP 2/05 'Modelling and controlling interstitial condensation in buildings" Feb 2005.

The CRA calculation for pitched roofs can be very unreliable and caution should be used when interpreting these results. For further guidance the user is advised to follow the recommendation of BS 5250:202 (currently under review).

Ultraframe Roof Eaves (Roof/Wall Junction)

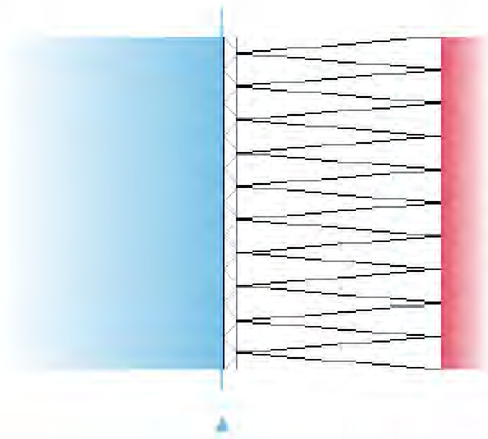
BuildDesk U 3.4

Ultraframe Wall Eaves Junction CRA

Documentation of the component
Calculation according BS EN ISO 13788
Source: **own catalogue - External walls**
Component: **Ultraframe Wall Eaves Junction CRA**

28. October 2020
Page 1/17

OUTSIDE INSIDE



The list of material layers shown below may differ from those in the U-value calculation printout. Only material layers which are used in the Condensation Risk Analysis are listed.

This calculation of the Condensation risk analysis according to BS EN ISO 13788:2002 has been performed on a construction containing inhomogeneous layers. This calculation is only valid through the selected section. It is advisable that you should also select the alternative position and recalculate the Condensation Risk Analysis for a more complete assessment of the construction.

Assignment: External wall

Name	Thickn. [m]	lambda [W/(mK)]	Q	μ [-]	Q	sd [m]	R [m²K/W]
Steel	0.0009	50.000	D	999999.00	D	900.00	0.0000
Softwood Timber [500 kg/m³]	0.0250	0.130	D	20.00	D	0.50	0.1923
Mineral wool batt - General Purpose (S) 0.04	0.4200	0.040	E	1.00	E	0.42	10.5000
Steel	0.0009	50.000	D	999999.00	D	900.00	0.0000

Q .. The physical values of the building materials has been graded by their level of quality. These 5 levels are the following
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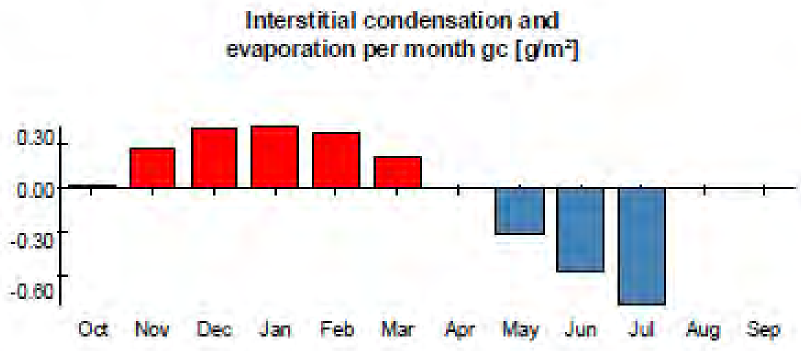
E .. E: Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

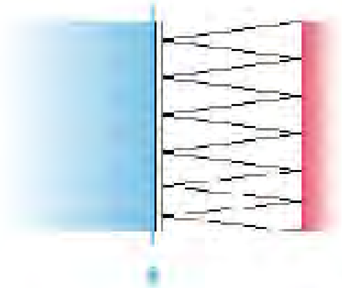
Condensation risk analysis - summary of main results
Calculation according BS EN ISO 13788

Surface temperature to avoid critical surface moisture:
No danger of mould growth is expected.

Interstitial condensation occurs, but all the condensate is predicted to evaporate during the summer months.

The risk of degradation of building materials and deterioration of thermal performance as a consequence of the calculated maximum amount of moisture shall be considered according to regulatory requirements and other guidance in product standards.





Component, condensation range

CRA calculations according to BS EN ISO 13788:2002 are used as a guide in predicting interstitial condensation. This methodology uses some simplifications of the dynamic processes involved and subsequently does have some limitations. Further information can be found in Information Paper IP 2/05 "Modelling and controlling interstitial condensation in buildings" Feb 2005.

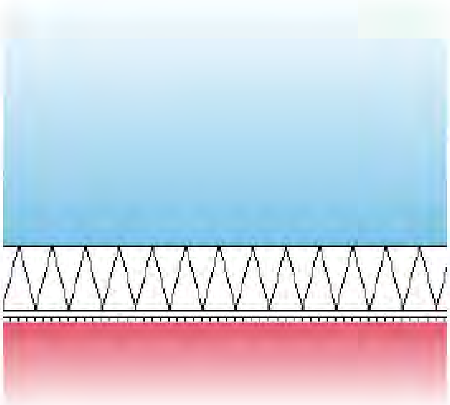
Ultraframe Roof Parapet Section 1 (Roof Element)

BuildDesk U 3.4

Ultraframe Roof Parapet Section 1 w foil faced PB V2

Documentation of the component — 10. December 2020
Calculation according BS EN ISO 13788 — Page 1/17
Source: **own catalogue - Flat roofs**
Component: **Ultraframe Roof Parapet Section 1 w foil faced PB**

OUTSIDE



INSIDE

The list of material layers shown below may differ from those in the U-value calculation printout. Only material layers which are used in the Condensation Risk Analysis are listed.

This calculation of the Condensation risk analysis according to BS EN ISO 13788:2002 has been performed on a construction containing inhomogeneous layers. This calculation is only valid through the selected section. It is advisable that you should also select the alternative position and recalculate the Condensation Risk Analysis for a more complete assessment of the construction.

Assignment: Flat roof

Name	Thickn. [m]	lambda [W/(mK)]	Q	μ [-]	Q	sd [m]	R [m²K/W]
Expanded polystyrene (EPS)	0.1750	0.030	E	60.00	E	10.50	5.8333
Unventilated airspace small: upwards heat flow	0.0200	0.122	D	1.00	D	0.02	0.1643
Gyproc Wallboard DUPLEX 12.5mm	0.0125	0.190	D	970.00	D	12.13	0.0658

Q .. The physical values of the building materials has been graded by their level of quality. These 5 levels are the following
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E .. E: Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

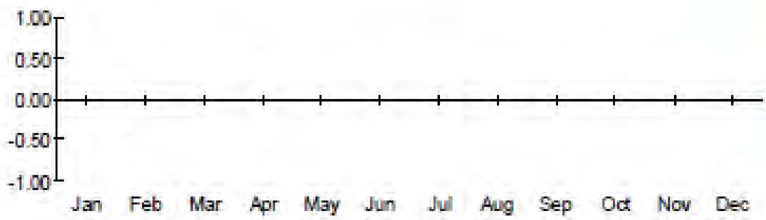
Documentation of the component
Calculation according BS EN ISO 13788
Source: own catalogue - Flat roofs
Component: **Ultraframe Roof Parapet Section 1 w foil faced PB**

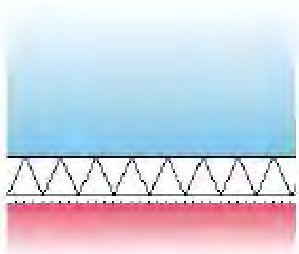
Condensation risk analysis - summary of main results
Calculation according BS EN ISO 13788

Surface temperature to avoid critical surface moisture:
No danger of mould growth is expected.

Interstitial condensation:
No condensation is predicted at any interface in any month.

Interstitial condensation and evaporation per month gc [g/m²]





Component, condensation range

CRA calculations according to BS EN ISO 13788:2002 are used as a guide in predicting interstitial condensation. This methodology uses some simplifications of the dynamic processes involved and subsequently does have some limitations. Further information can be found in Information Paper IP 2/05 'Modelling and controlling interstitial condensation in buildings" Feb 2005.

Ultraframe Roof Parapet Section 2 (Roof Element)

BuildDesk U 3.4

Ultraframe Roof Parapet Section 2 w foil faced PB V2

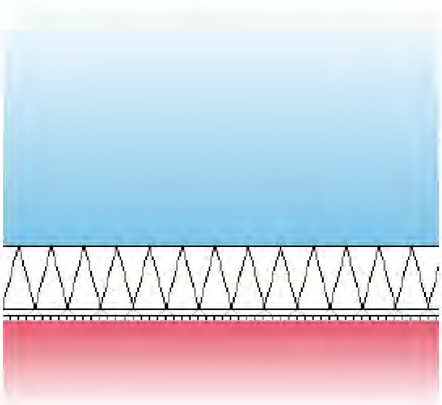
Documentation of the component | 10. December 2020

Calculation according BS EN ISO 13788 | Page 1/17

Source: **own catalogue - Flat roofs**

Component: **Ultraframe Roof Parapet Section 2 w foil faced PB**

OUTSIDE



INSIDE

The list of material layers shown below may differ from those in the U-value calculation printout. Only material layers which are used in the Condensation Risk Analysis are listed.

This calculation of the Condensation risk analysis according to BS EN ISO 13788:2002 has been performed on a construction containing inhomogeneous layers. This calculation is only valid through the selected section. It is advisable that you should also select the alternative position and recalculate the Condensation Risk Analysis for a more complete assessment of the construction.

Assignment: Flat roof

Name	Thickn. [m]	lambda [W/(mK)]	Q	µ [-]	Q	sd [m]	R [m²K/W]
Expanded polystyrene (EPS)	0.1750	0.030	E	60.00	E	10.50	5.8333
Oriented strand board (OSB)	0.0190	0.130	D	30.00	D	0.57	0.1462
Gyproc Wallboard DUPLEX 12.5mm	0.0125	0.190	D	970.00	D	12.13	0.0658

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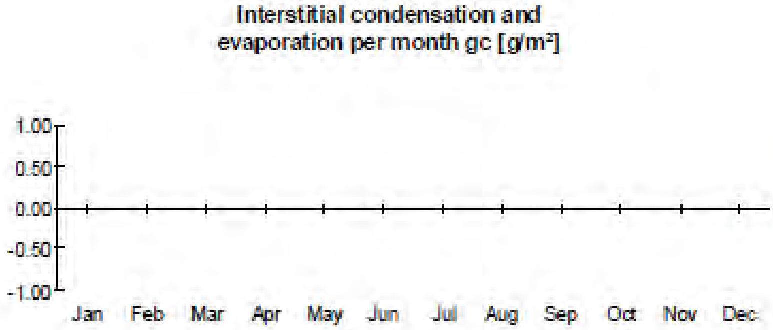
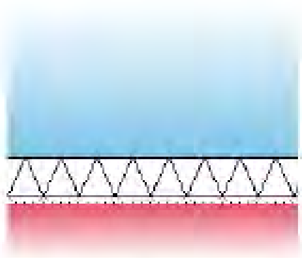
Condensation risk analysis - summary of main results
Calculation according BS EN ISO 13788

Surface temperature to avoid critical surface moisture:
No danger of mould growth is expected.

Interstitial condensation:
No condensation is predicted at any interface in any month.





Component, condensation range

CRA calculations according to BS EN ISO 13788:2002 are used as a guide in predicting interstitial condensation. This methodology uses some simplifications of the dynamic processes involved and subsequently does have some limitations. Further information can be found in Information Paper IP 2/05 'Modelling and controlling interstitial condensation in buildings" Feb 2005.

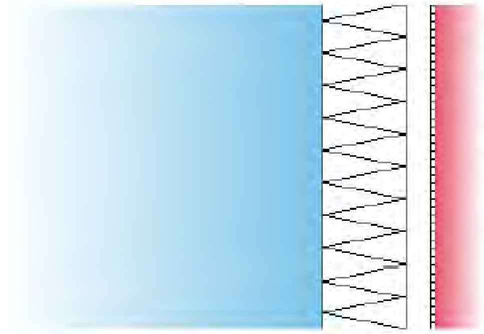
Ultraframe Wall Panel

BuildDesk U 3.4

Ultraframe Wall Panel w foil faced PB

Documentation of the component 10. December 2020
Calculation according BS EN ISO 13788 Page 1/17
Source: **own catalogue - External walls**
Component: **Ultraframe Wall Panel w foil faced PB**

OUTSIDE INSIDE



The list of material layers shown below may differ from those in the U-value calculation printout. Only material layers which are used in the Condensation Risk Analysis are listed.

This calculation of the Condensation risk analysis according to BS EN ISO 13788:2002 has been performed on a construction containing inhomogeneous layers. This calculation is only valid through the selected section. It is advisable that you should also select the alternative position and recalculate the Condensation Risk Analysis for a more complete assessment of the construction.

Assignment: External wall

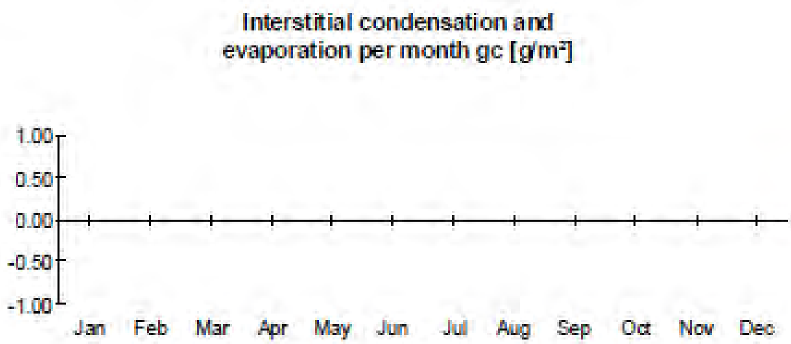
Name	Thickn. [m]	lambda [W/(mK)]	Q	μ [-]	Q	sd [m]	R [m²K/W]
Expanded polystyrene (EPS)	0.1750	0.030	E	60.00	E	10.50	5.8333
Normal cavity - 50 mm, unventilated	0.0500	0.278	D	1.00	D	0.05	0.1799
Gyproc Wallboard DUPLEX 12.5mm	0.0125	0.190	D	970.00	D	12.13	0.0658

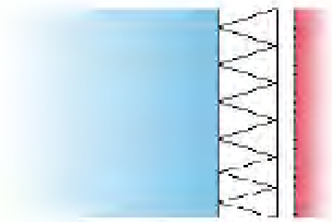
Q .. The physical values of the building materials has been graded by their level of quality. These 5 levels are the following
A .. A: Data is entered and validated by the manufacturer or supplier. Data is continuously tested by 3rd party.
B .. B: Data is entered and validated by the manufacturer or supplier. Data is certified by 3rd party
C .. C: Data is entered and validated by the manufacturer or supplier.
D .. D: Information is entered by BuildDesk without special agreement with the manufacturer, supplier or others.
E .. E: Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

Condensation risk analysis - summary of main results
Calculation according BS EN ISO 13788

Surface temperature to avoid critical surface moisture:
No danger of mould growth is expected.

Interstitial condensation:
No condensation is predicted at any interface in any month.



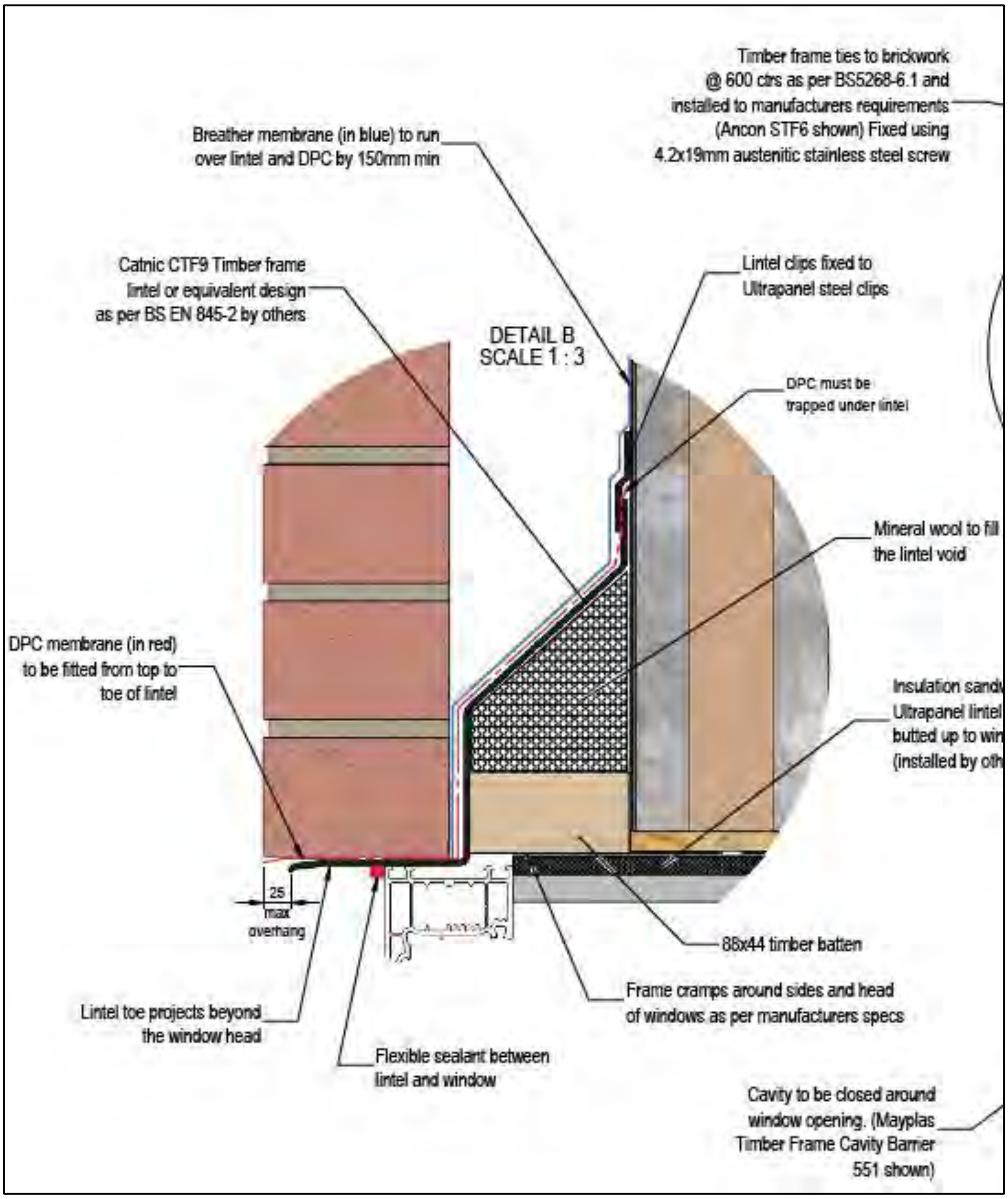


Component, condensation range

CRA calculations according to BS EN ISO 13788:2002 are used as a guide in predicting interstitial condensation. This methodology uses some simplifications of the dynamic processes involved and subsequently does have some limitations. Further information can be found in Information Paper IP 2/05 'Modelling and controlling interstitial condensation in buildings" Feb 2005.

Appendix B: Gable Wall Window Related Thermal Models

Window Head



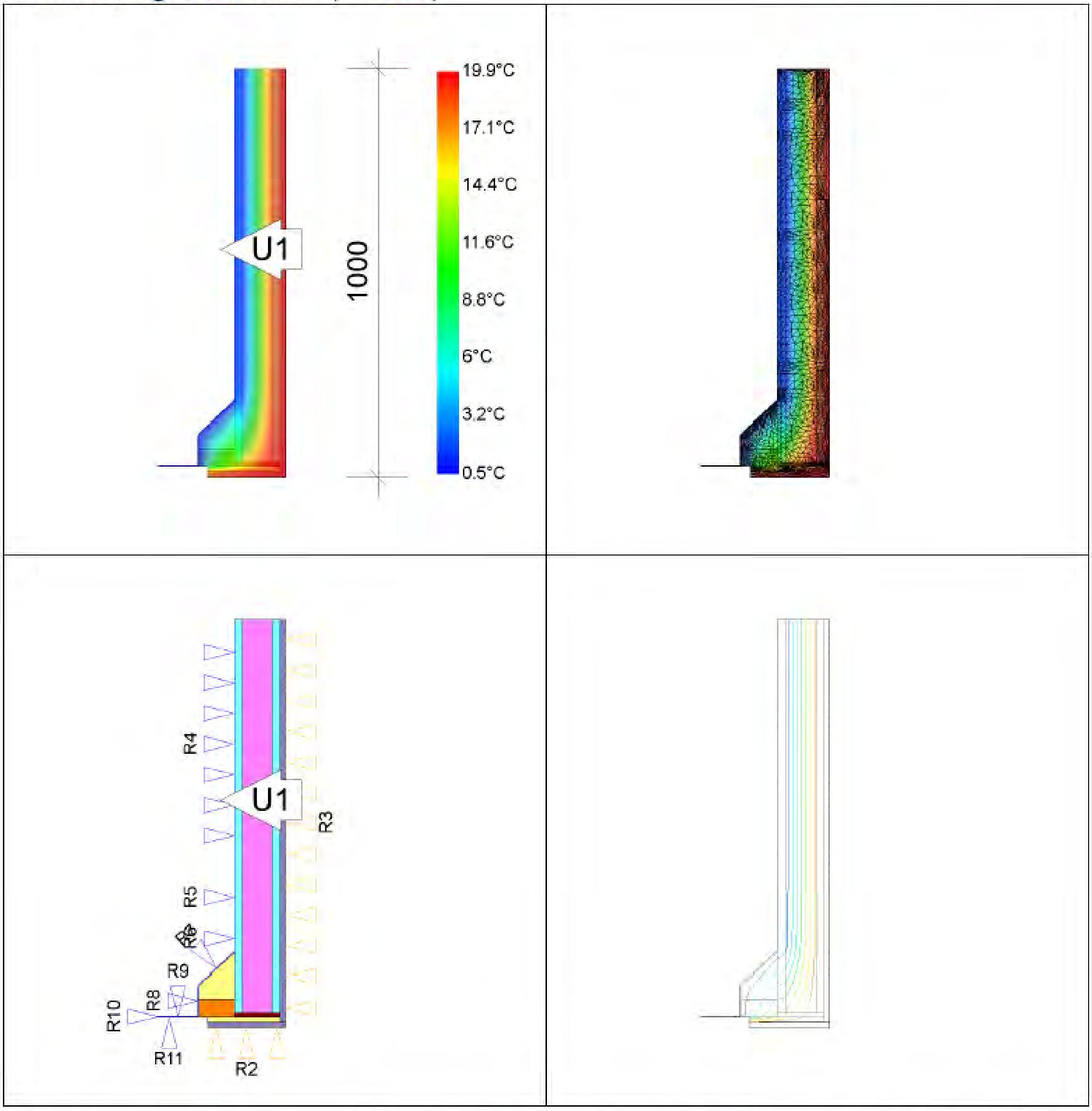
Window Head Psi Report

Building project:

Psi-Therm 2D

Date: 22.10.2020

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U1	1.000 m	0.25 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = +0.048 W/(mK)

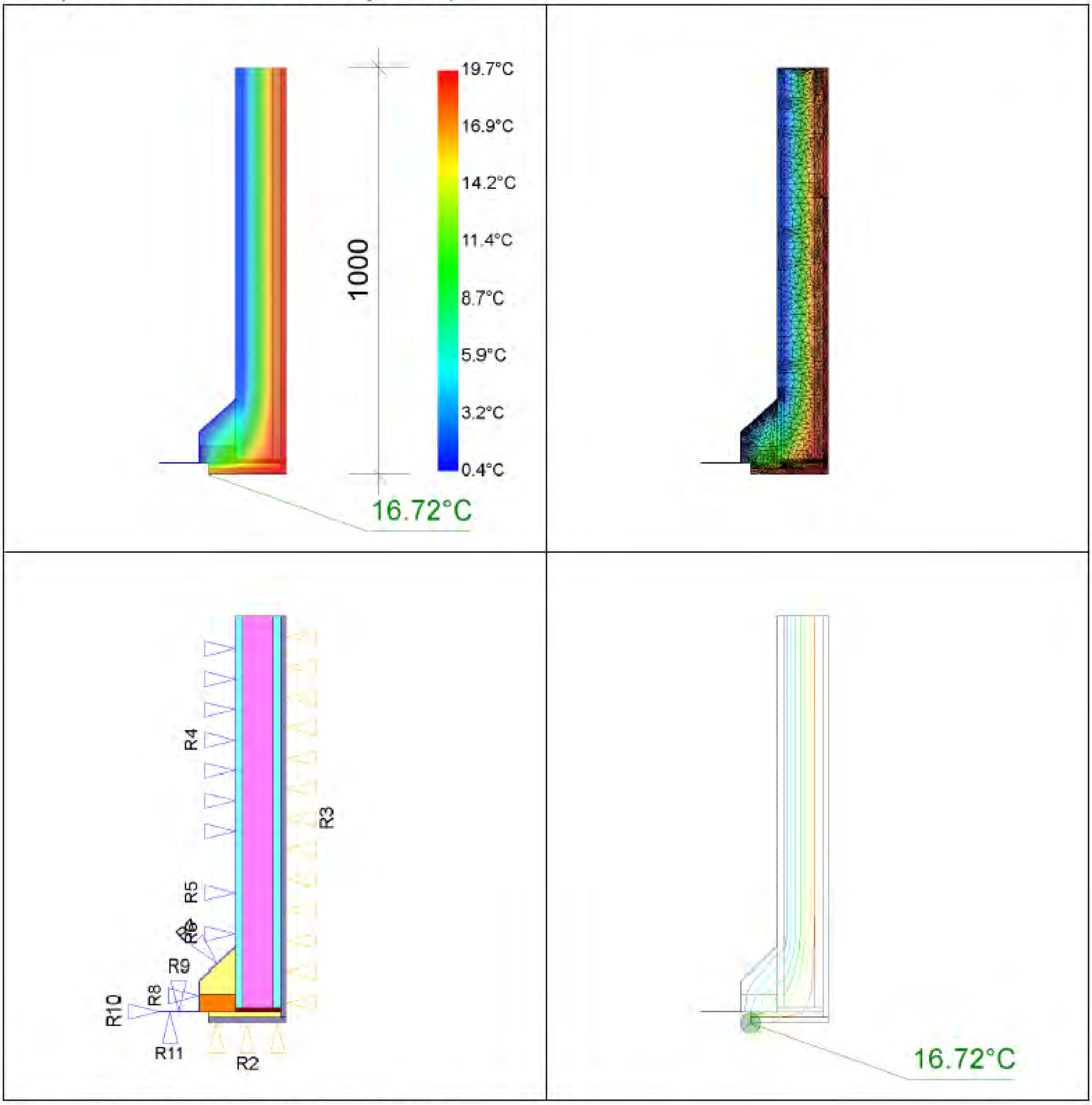
Window Head Frsi Report

Project:

Psi-Therm 2D

Date: 22.10.2020

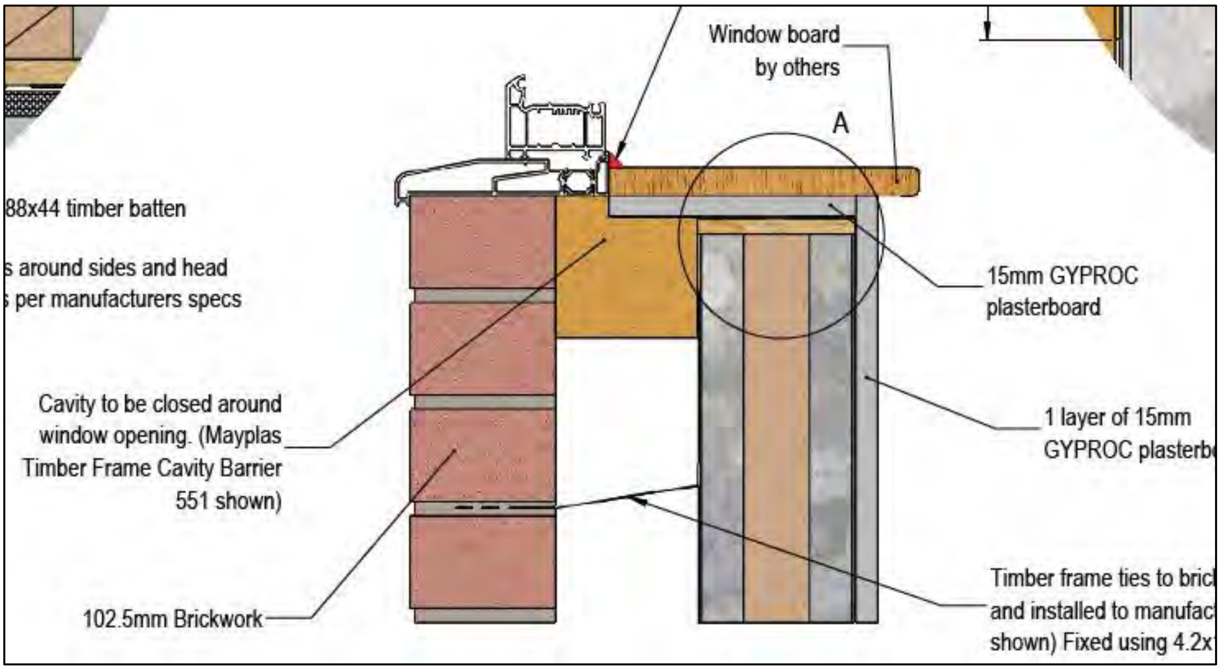
Temperature factor calculation (f-value)



Temperature factor calculation (f-value)

$$f_{RSI} = 0.84 > 0.75$$

Window Cill



Window board
by others
A
88x44 timber batten
s around sides and head
s per manufacturers specs
15mm GYPROC
plasterboard
Cavity to be closed around
window opening. (Mayplas
Timber Frame Cavity Barrier
551 shown)
1 layer of 15mm
GYPROC plasterb
Timber frame ties to bric
and installed to manufac
shown) Fixed using 4.2x
102.5mm Brickwork

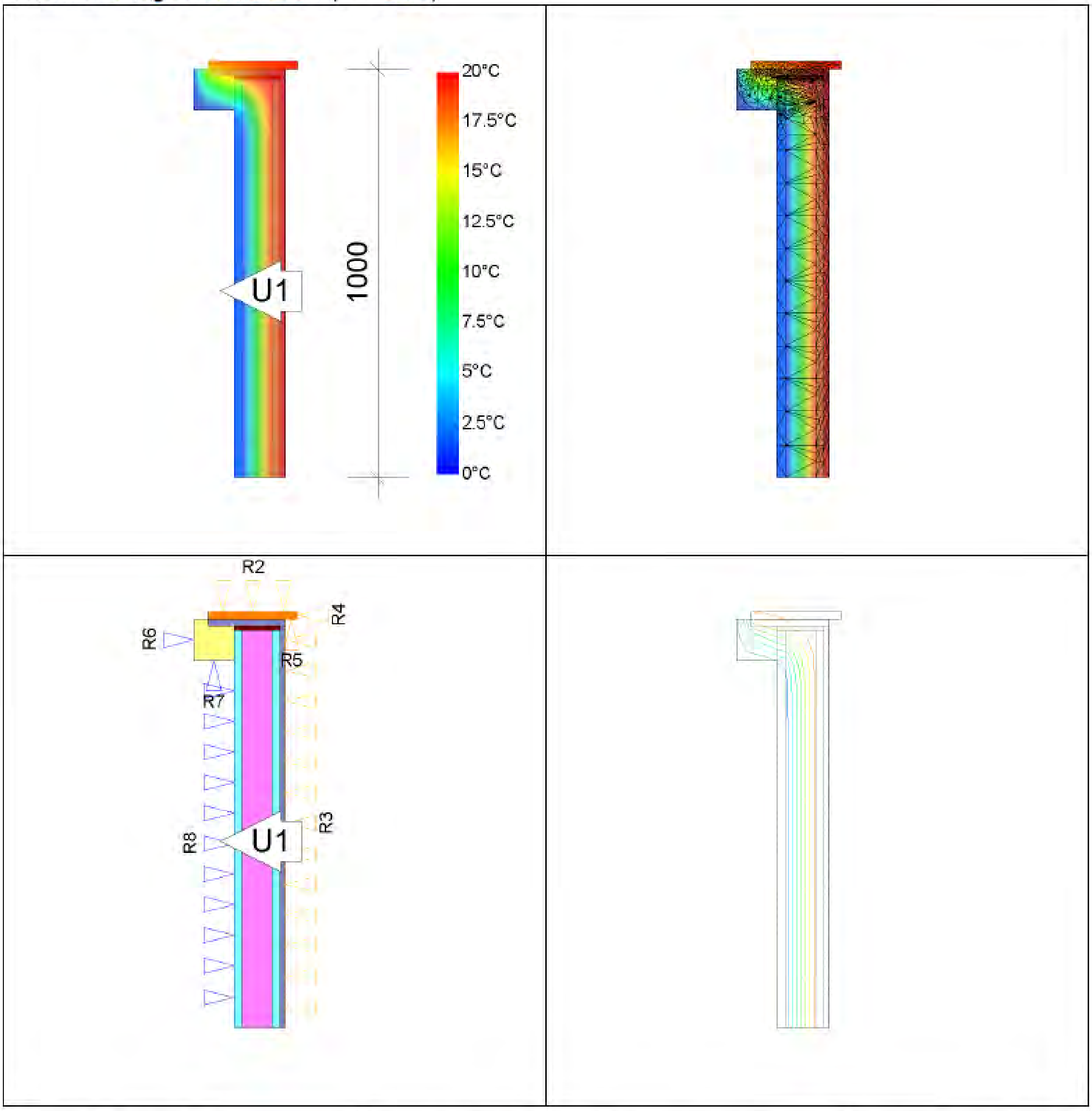
Window Cill Psi Report

Building project:

Psi-Therm 2D

Date: 22.10.2020

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U1	1.000 m	0.25 W/(m²K)	F_e (1.00)

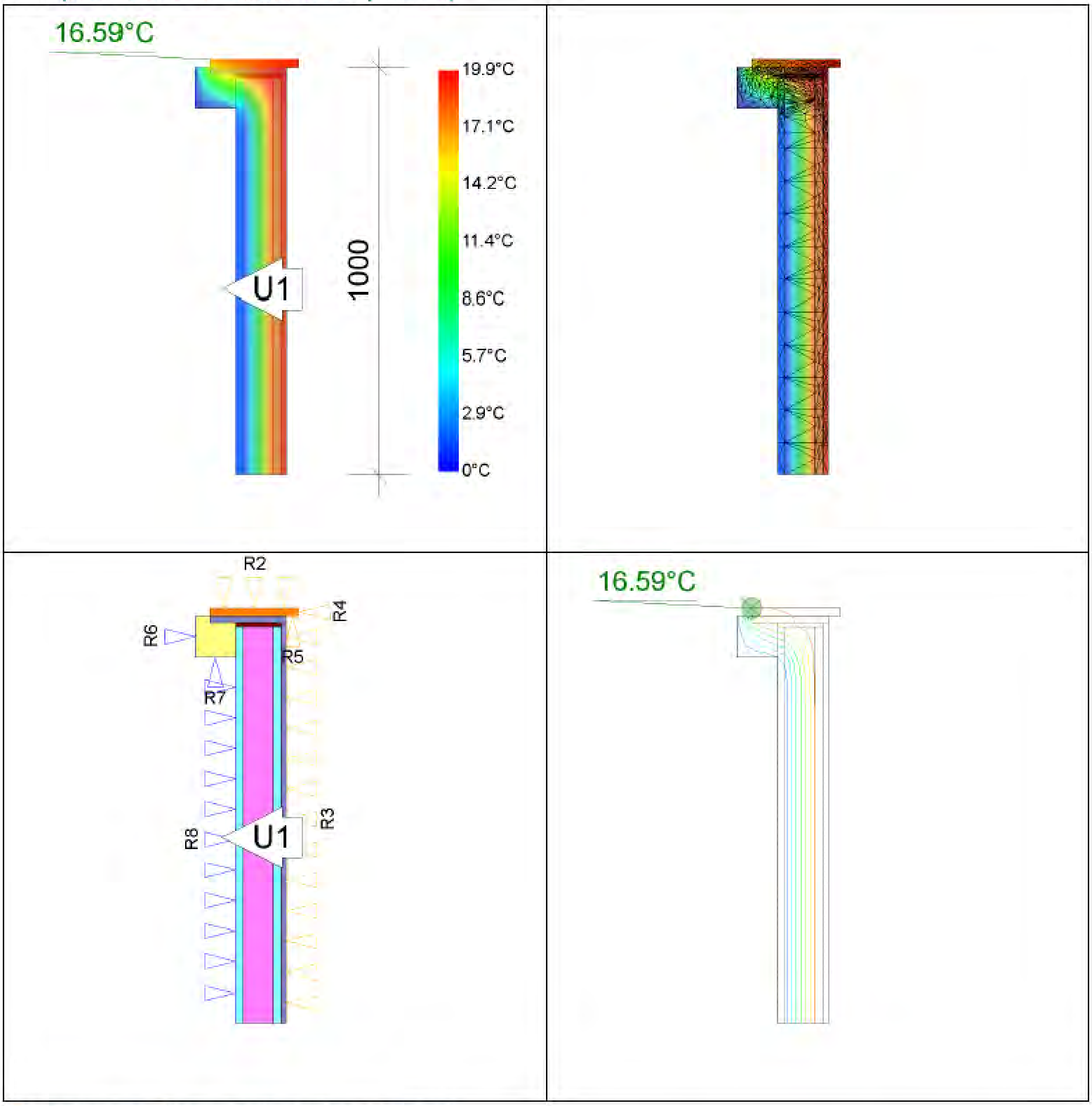
Thermal bridges calculation

Ψ = +0.053 W/(mK)

Window Cill Frsi Report

Project:	Psi-Therm 2D	Evolusion Innovation
Date: 22.10.2020		

Temperature factor calculation (f-value)

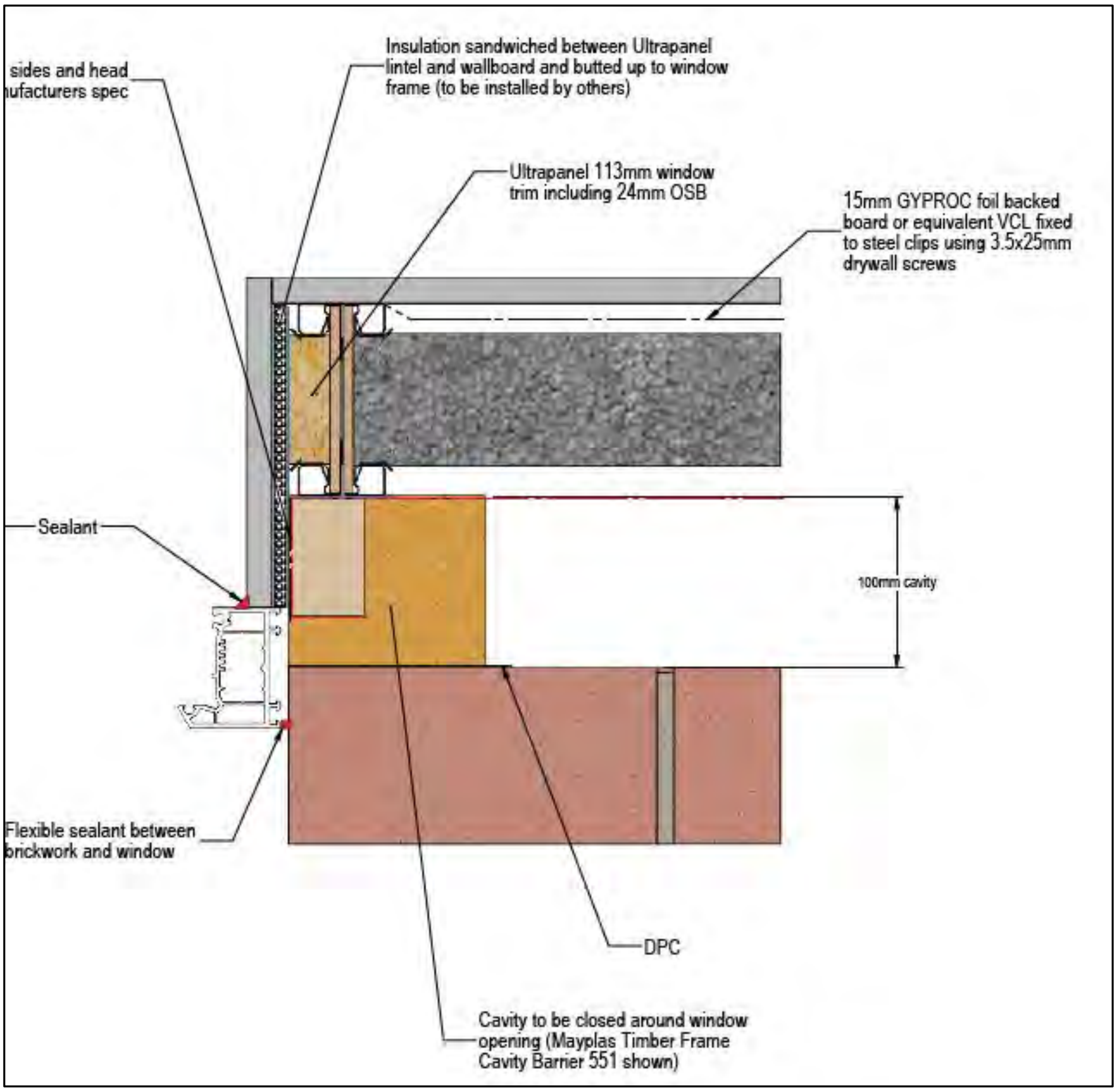


Temperature factor calculation (f-value)

Nr.	Name	Length	U-value	Correction factor
U1	U1	1.000 m	0.25 W/(m²K)	F_e (1.00)

$$f_{RSI} = 0.83 > 0.75$$

Window Jamb



sides and head
ufacturers spec
Insulation sandwiched between Ultrapanel lintel and wallboard and butted up to window frame (to be installed by others)
Ultrapanel 113mm window trim including 24mm OSB
15mm GYPROC foil backed board or equivalent VCL fixed to steel clips using 3.5x25mm drywall screws
Sealant
100mm cavity
Flexible sealant between brickwork and window
DPC
Cavity to be closed around window opening (Mayplas Timber Frame Cavity Barrier 551 shown)

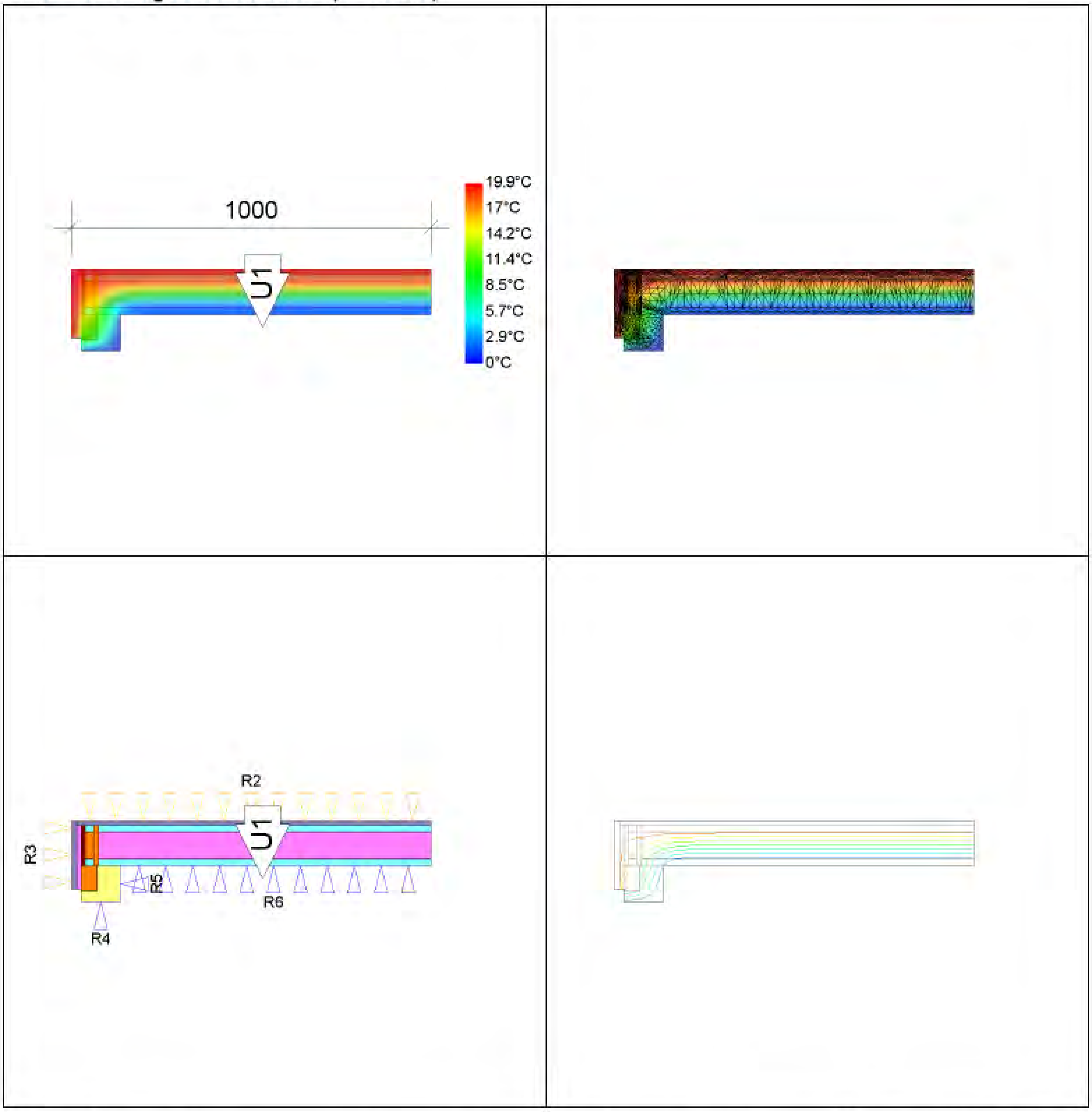
Window Jamb Psi Report

Building project:

Psi-Therm 2D

Date: 22.10.2020

Thermal bridges calculation (Ψ-Value)



Nr.	Description	Length	U-value	Correction factor
U1	U1	1.000 m	0.25 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = +0.040 W/(mK)

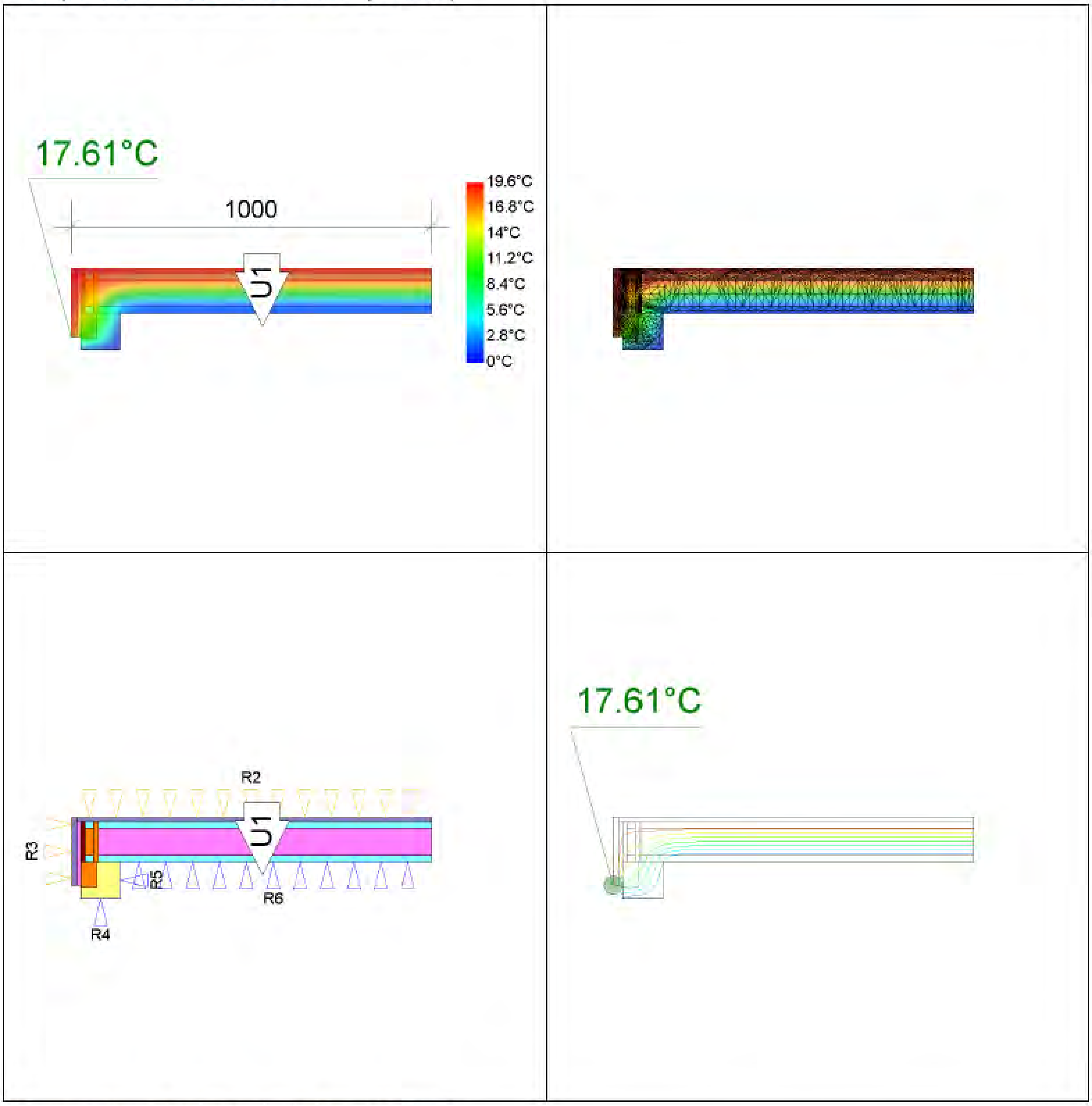
Window Jamb Frsi Report

Project:

Psi-Therm 2D

Date: 22.10.2020

Temperature factor calculation (f-value)



Temperature factor calculation (f-value)

Nr.	Name	Length	U-value	Correction factor
U1	U1	1.000 m	0.25 W/(m²K)	F_e (1.00)

$$f_{RSI} = 0.88 > 0.75$$

Conclusion

With regards to CRA at roof and eaves junctions: the sections through the junctions pass as condensation evaporates in summer months, consideration should be given to the following statement in output of calculations:

The risk of degradation of building materials and deterioration of thermal performance as a consequence of the calculated maximum amount of moisture shall be considered according to regulatory requirements and other guidance in product standards.

Consideration should be given to the likelihood of timber degrading within junction with the levels of condensation predicted. The suitability of not having a ventilated cavity immediately outside the timber, with regards Structure should also be considered.

Generally, when there isn't an independent layer of PIR above timbers members (i.e. a warm roof) there should be a ventilated cavity outside the timbers, confirmation should be sought re acceptability of the build-up approach against relevant timber construction guidance documents.

Calculations do not consider likelihood of vapour transmittance between foil face of plasterboard and steel inner face of eaves and ridge junction beams. CRA analysis is carried through section of junction components only. Utraframe should ensure that no vapour transmittance occurs beyond foil/steel interface.

12 ISO 9001:2015

12.1 Certificate number FM 23560 Expiry date 2021-04-10

bsi.

By Royal Charter

Certificate of Registration

QUALITY MANAGEMENT SYSTEM - ISO 9001:2015

This is to certify that:

Ultraframe Limited
Enterprise Works
Salthill Road
Clitheroe
BB7 1PE
United Kingdom

Holds Certificate Number: FM 23560

and operates a Quality Management System which complies with the requirements of ISO 9001:2015 for the following scope:

The design, manufacture and supply of domestic conservatory and extension roofing systems and associated products.

For and on behalf of BSI:

Andrew Launn, EMEA Systems Certification Director

Original Registration Date: 1993-03-17
Latest Revision Date: 2018-03-28

Effective Date: 2018-04-11
Expiry Date: 2021-04-10

Page: 1 of 1

UKAS MANAGEMENT SYSTEMS 003

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13. SCI Structural Evaluation

13.1 RT 1797 V3 Ultraframe roof System; analysis of test results and determination of member resistance.

13.2 RT 1828 V3 Wall Resistance

Ultraframe roof system: analysis of test results and determination of member resistance

Report to:	Ultraframe
Document:	RT 1797
Version:	03
Date:	March 2020

SCI (the Steel Construction Institute) has been a trusted, independent source of information and engineering expertise globally for over 30 years, and is one of the leading, independent providers of technical expertise and disseminator of best practice to the steel construction sector.

We support everyone involved in steel construction; from manufacturers, consulting and design engineers, architects, product developers to industry groups.

Version	Issue	Date	Purpose	Author	Reviewer	Approved
01		21/02/19	Interim report	DGB		
02		09/07/19	Updated, stiffness calculations added, eaves beam results added	DGB		
03		04/03/20	Typo corrected in Table 6	DGB		

EXECUTIVE SUMMARY

This report presents an analysis of the test results provided by Oxford Brooks University for Ultraframe roof panels of 2.0, 4.0 and 5.8 m spans, and for Eaves beams of 4.0 m span.

All tests demonstrate an ultimate resistance greater than the design loads likely to be applied in practice. Shear resistance was found not to be critical.

Roof beam resistance

The stiffness of an individual “beam” component of the roof panel (comprising back-to-back hardboard webs each with a steel flange) has been established from a consideration of the 4.0 m span and 5.8 m span tests.

The stiffness calculation has been carried out considering a limited range of load-deflection behaviour, such that the calculated stiffness is representative of the behaviour of a panel used in practice. The upper limit of the range of load-deflection results was taken as either (a) the maximum serviceability limit state load which might be applied to the span, or (b) the limiting serviceability limit state deflection, whichever gave the greater range.

The 2.0 m span results were not used to establish stiffness.

The stiffness of one “beam” alone, expressed in steel units is as follows:

Based on 4.0 m span tests: 2.59×10^6 mm^4.

Based on 5.8 m span tests: 2.94×10^6 mm^4.

The design bending resistance was calculated as 8.27 kNm.

Eaves beam resistance

The measured deflections in the horizontal direction (when the eaves beam is in service) were very small, but inconsistent. It is suggested that this is due to initial bedding in and possible friction in the test arrangement. The initial deformation behaviour was therefore ignored in the calculation of the stiffness.

The stiffness in the horizontal direction, expressed in steel units was 40.5×10^6 mm^4.

The design bending resistance was found to be 15.6 kNm.

Contents

1 Introduction

Following the SCI proposal PL 534 and Test Plan RT 1784, physical testing of Ultraframe panels and eaves beams has been completed by Oxford Brooks University (OBU).

Raw test data for the panel tests has been received by the SCI.

This report provides an analysis of the results to determine bending resistance and stiffness.

1.1 Panel tests

In accordance with RT 1784, three panel spans were tested; 2.0 m, 4.0 m and 5.8 m.

The 2.0 m spans were primarily to try and force a shear failure. Two types of 2.0 m span were tested – with and without a joint in the hardboard web.

The 4.0 and 5.8 m span tests were designed so that stiffness and ultimate bending resistance could be determined.

1.2 Panel arrangement

A typical test arrangement is shown in Figure 1.1.

Figure 1.1 Typical test arrangement

The panels consisted of three “beams”, comprising two “half” beams (with one hardboard web and one single “flange”) on the edges and two full beams within the panel. Beams were spaced at 300 mm centres.

The arrangement of beams internal to the panel and on the panel edge is shown in Figure 1.2

Figure 1.2 “beam” arrangement

The 4.0 m and 5.8 m span test panels were cycled three times to remove the permanent initial set, and then loaded to failure.

2 Analysis of results

The performance of the panels should be viewed in the context of applied loading and limiting deflection.

Imposed load for a roof should be taken from the UK NA to BS EN 1991-1-1, and is 0.6 kN/m^2

Ultraframe wish to consider the same product for other applications in domestic construction. Imposed load on a floor from the UK NA to BS EN 1991-1-1 is 1.5 kN/m^2.

For members with a brittle finish, the limiting deflection is span/360 under the unfactored imposed loads.

Generally in the following analyses, the design imposed load has been assumed to be 1.5 kN/m^2.

The loading calculations must be adjusted to reflect the spacing of the “beams” in use, which is 600 mm centres, rather than the 300 mm in the test arrangement.

2.1 Overview of results: 2.0 m span

No premature failure in shear was observed in the 2.0 m tests. Ultimate resistance was much higher than the loads typically applied in a roofing application.

Based on a load of 1.5 kN/m^2, the total serviceability limit state (SLS) load on a 1.8 m wide panel, 2.0 m span would be:

$1.5 \times 1.8 \times 2.0 = 5.4$ kN.

The ultimate limit state (ULS) load would be approximately:

$(1.35 \times 0.3 + 1.5 \times 1.5) \times 1.8 \times 2 = 9.6$ kN

A typical load-displacement curve is shown in Figure 2.1. Type 1 tests had a hardboard web without joints. The total load at failure of around 45 kN was similar for all the 2.0 m tests and is greatly in excess of the ULS design load.

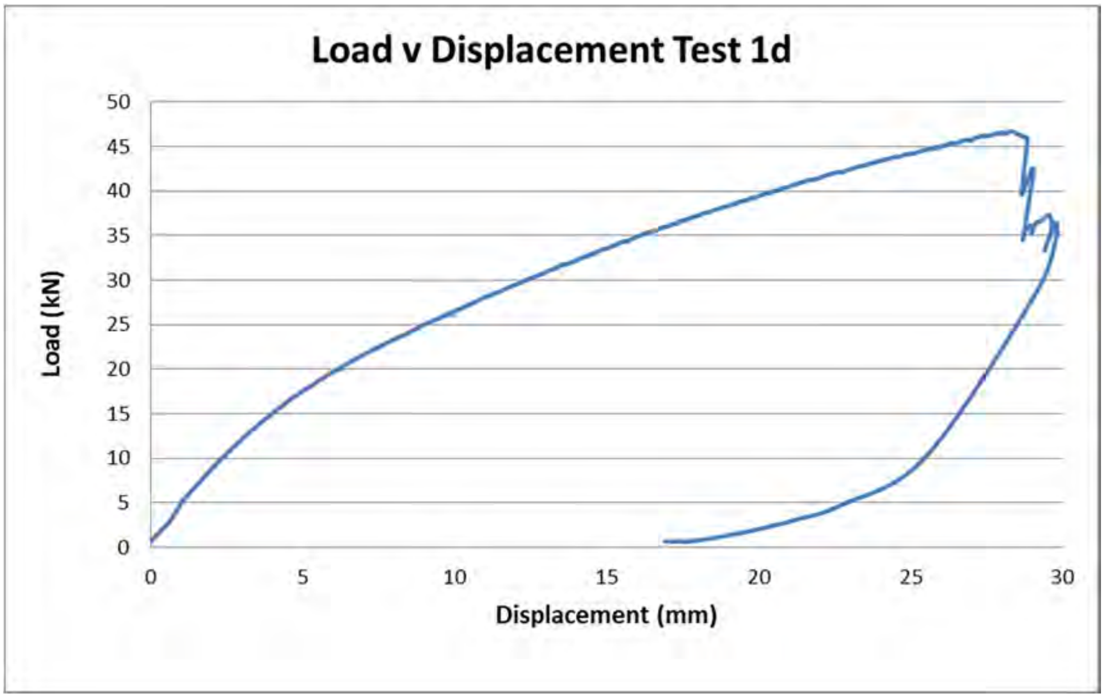


Figure 2.1 load-displacement test 1d

The 2 m tests were designed to identify any premature failure in shear; none was observed. The 2 m tests were not used to establish SLS performance.

2.1.1 Ultimate resistance

Because the ultimate resistances are so much higher than the ULS applied actions, only a simple average resistance and standard deviation are presented in Table 1.

Table 1 Ultimate resistances, 2.0 m span

Test	ULS Resistance (kN)
1a	42.6
1b	44.4
1c	43.9
1d	46.7
1e	45.2
1f	44.9
Average	44.6
Standard deviation	1.37

2.2 Overview of results: 4.0 m span

The total serviceability limit state (SLS) load on a 4 m span panel would be:

$1.5 \times 1.8 \times 4.0 = 10.8$ kN.

The ultimate limit state (ULS) load would be approximately:

$(1.35 \times 0.3 + 1.5 \times 1.5) \times 1.8 \times 4 = 19.1$ kN

Figure 2.2 shows a typical plot for load-displacement after the initial cycles. The ultimate resistance of around 55 kN was similar for all tests, and greatly in excess of the ULS design load.

2.2.1 Ultimate resistance

Because the ultimate resistances are so much higher than the ULS applied actions, only a simple average resistance and standard deviation are presented in Table 2.

Table 2 Ultimate resistances, 4.0 m span

Test	ULS Resistance (kN)
3a	55.3
3b	54.5
3c	53.8
3d	54.6
3e	56.6
3f	53.2
Average	54.7
Standard deviation	1.19

2.2.2 Serviceability performance

As can be seen in Figure 2.2, the load-displacement plot is curved, implying the displacement is not elastic when the ultimate resistance is reached. This could be observed in the tests, when permanent slip between the hardboard and flanges could clearly be seen, as shown in Figure 2.3.

To determine the stiffness, it is reasonable to consider only the interval governed by either total load or deflection.

As above, the total SLS load should not exceed 10.8 kN, but at this stage, the interval will be assumed to be 15 kN to establish the scope of the load-deflection plot.

The deflection limit is 4000/360 = 11.1 mm, but taken as 15 mm to establish the scope of the load-deflection plot.

From Figure 2.2, it may be observed that for 4.0 m spans, the limiting SLS load of 10.8 kN is the key criteria, being reached earlier in the loading cycle than the limiting deflection of 11.1 mm.

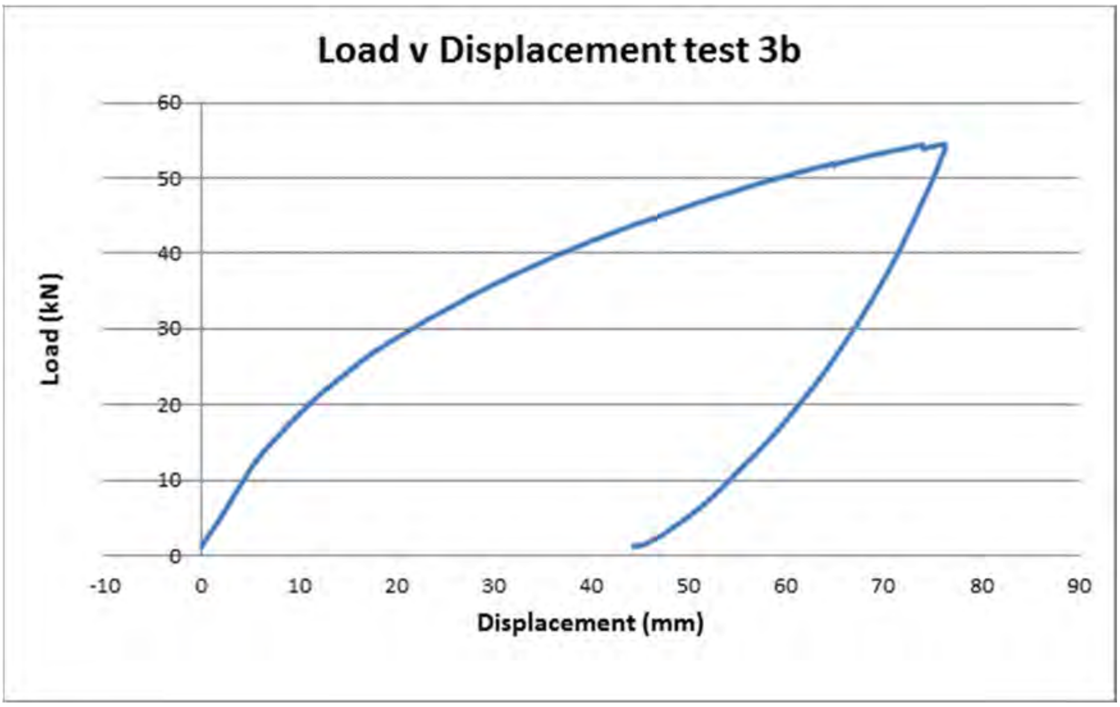


Figure 2.2 load-displacement test 3b

Figure 2.3 Permanent slip at ultimate load

Figure 2.4 shows the load displacement plot up to 15 kN total load. The form of the plot is quite linear, although some curvature is noted above about 12 kN

Figure 2.4 also shows the gradient of the plot, from which the stiffness may be calculated. Table 3 records the results from the six tests.

Table 3 Gradient from 4.0 m tests, to 15 kN maximum

Test	Gradient (kN/mm)
3a	1.97
3b	1.95
3c	1.92
3d	2.05
3e	1.99
3f	1.87

The average gradient is 1.96 kN/mm.

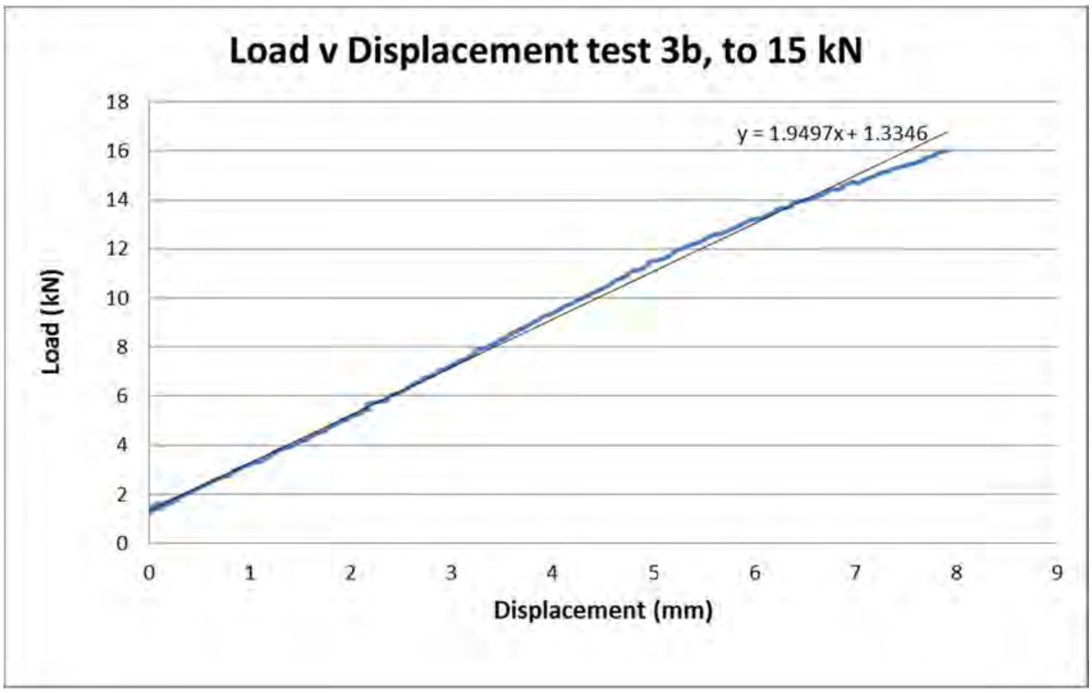


Figure 2.4 Test 3b, 15 kN maximum

2.2.3 Calculation of stiffness, 4 m span

Loading was applied in a way to mimic a UDL.

The midspan deflection under a UDL is given by:

$\delta = \frac{5WL^3}{384EI}$, noting that W in this expression is the total load.

Or, $EI = \frac{5L^3}{384}\frac{W}{\delta}$

Given $\frac{W}{\delta}$ = 1.96 then $EI = \frac{5\times4000^3}{384} \times 1.96 \times 10^3$ = 1.63 × 10^{12} Nmm^2

This is for three "beams", so for one beam, in steel units:

$I = \frac{1.63\times10^{12}}{3\times210000}$ = 2.59 × 10^6 mm^4

2.3 Overview of results: 5.8 m span

The total serviceability limit stale (SLS) load on a 5.8 m span panel would be:

1.5 × 1.8 × 5.8 = 15.7 kN.

The ultimate limit state (ULS) load would be approximately:

(1.35 × 0.3 + 1.5 × 1.5) × 1.8 × 5.8 = 27.7 kN

Figure 2.5 shows a typical plot for load-displacement after the initial cycles. The ultimate resistance of around 37 kN was similar for all tests, and greatly in excess of the design load.

2.3.1 Ultimate resistance

Because the ultimate resistances are significantly higher than the ULS applied actions, only a simple average resistance and standard deviation are presented in Table 4.

Table 4 Ultimate resistances, 5.8 m span

Test	ULS Resistance (kN)
4a	39.7
4b	38.3
4c	36.3
4d	39.0
4e	37.6
4f	38.9
Average	38.3
Standard deviation	1.21

2.3.2 Serviceability performance

As can be seen in Figure 2.5, the load-displacement plot is curved, implying the displacement is not elastic when the ultimate resistance is reached.

To determine the stiffness, it is reasonable to consider only the interval governed by either total load or deflection.

As above, the total load SLS should not exceed 15.7 kN, but at this stage, the interval will be assumed to be 25 kN

The deflection limit is 5800/360 = 16 mm, but taken as 20 mm to establish the scope of the load-deflection plot.

From Figure 2.5, it may be observed that for 5.8 m spans, the deflection limit of 16 mm is the key criteria, as this is reached in the loading cycle before the SLS load of 15.7 kN

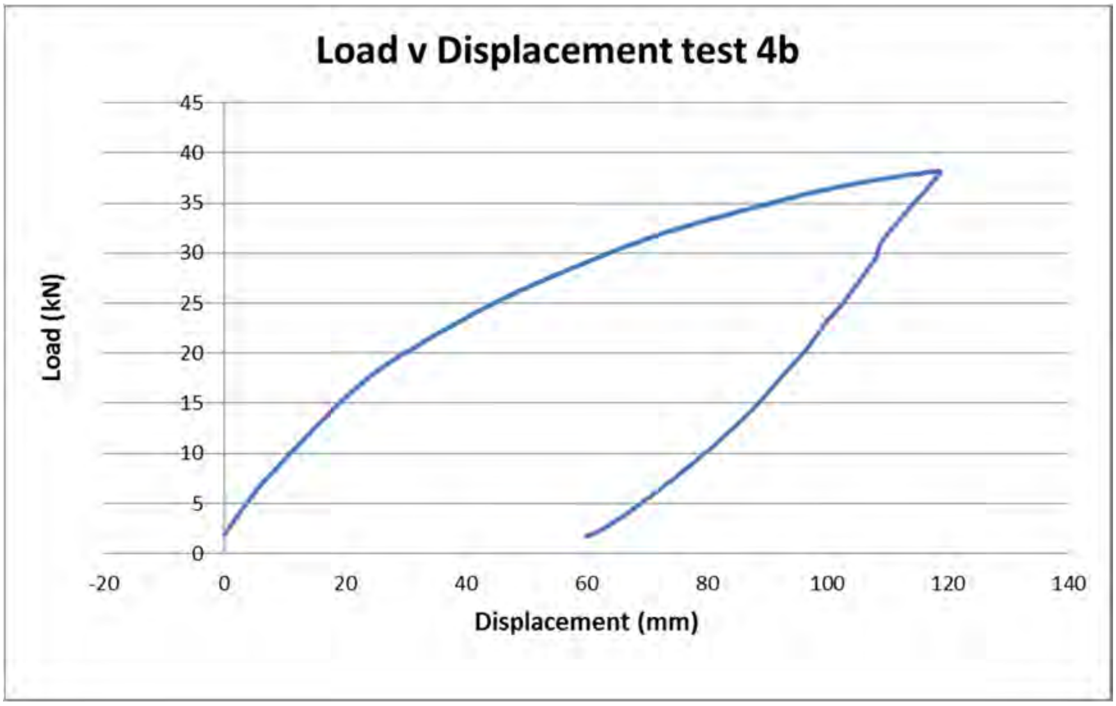


Figure 2.5 Test 4b load-deflection

Figure 2.6 shows the load displacement plot up to 15 kN total load. The form of the plot is quite linear, although some curvature is noted.

Figure 2.6 also shows the gradient of the plot, from which the stiffness may be calculated. Table 5 records the results from the six tests.

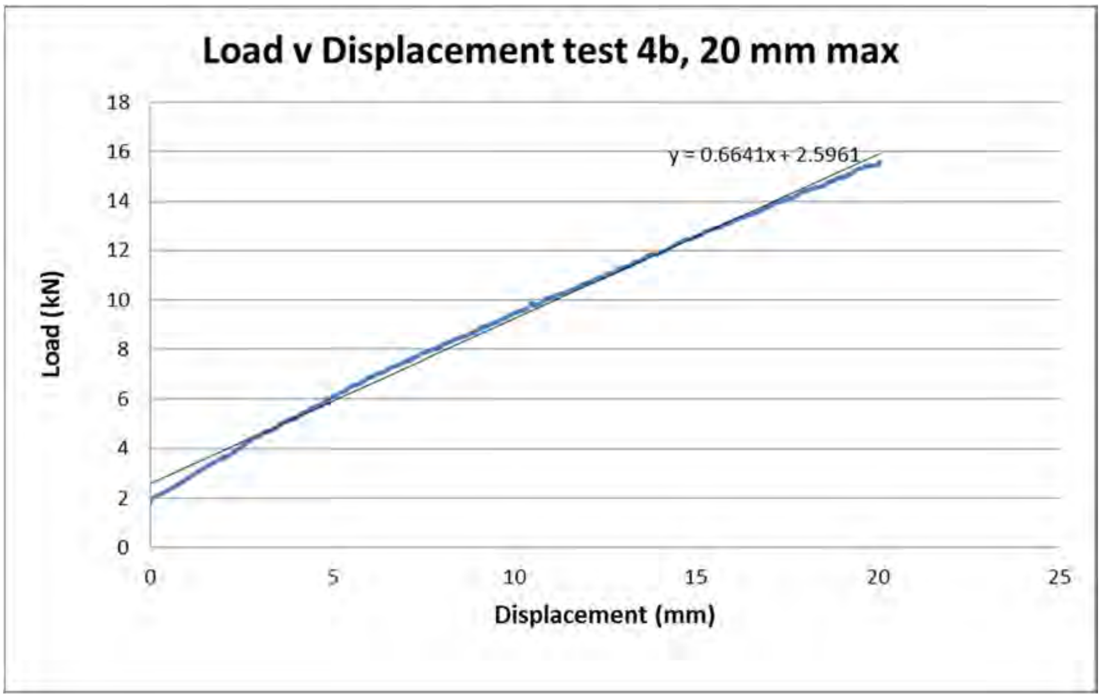


Figure 2.6 Test 4b, 20 mm maximum deflection

Table 5 Gradient from 5.8 m tests, to 20 mm maximum

Test	Gradient (kN/mm)
4a	0.71
4b	0.66
4c	0.78
4d	0.72
4e	0.76
4f	0.76

The average gradient is 0.73 kN/mm.

2.3.3 Calculation of stiffness, 5.8 m span

Loading was applied in a way to mimic a UDL.

The midspan deflection under a UDL is given by:

$\delta = \frac{5WL^3}{384EI}$, noting that W in this expression is the <u>total</u> load.

Or, $EI = \frac{5L^3}{384}\frac{W}{\delta}$

Given $\frac{W}{\delta}$ = 0.73 then $EI = \frac{5 \times 5800^3}{384} \times 0.73 \times 10^3$ = 1.86 × 10^{12} Nmm^2

This is for three “beams”, so for one beam, in steel units:

$I = \frac{1.86 \times 10^{12}}{3 \times 210000}$ = 2.94 × 10^6 mm^4

This should be compared with 2.59 × 10^6 mm^4 as calculated from the 4.0 m span tests.

2.4 Design bending resistance

BS EN 1990 provides recommendations on the procedure to calculate a design resistance in Annex D. As there is a reasonable mechanical model, based on prior teats in comparable situations, V_x is taken as “known” in Table D2.

For 5 tests, $k_{d,n}$ is 3.37 in Table D2.

The design resistance is taken as mean – $k_{d,n}$ × standard deviation

From the 4.0 m tests, presented in Table 2, the design load on the beam is given by:

54.7 – 3.33 × 1.19 = 50.7 kN

This is the design load of the test panel, comprising three “beams”, so the design load on a single 4.0 m span beam is 16.9 kN

From the 5.8 m tests, presented in Table 4, the design load on the beam is given by:

38.3 – 3.33 × 1.21 = 34.28 kN

This is the design load of the test panel, comprising three “beams”, so the design load of a single 5.8 m span beam is 11.4 kN

From the design loading, the design bending resistance may be calculated:

For the 4 m span, design bending resistance = 16.9 × 4 / 8 = 8.45 kNm

For the 5.8 m span, design bending resistance = 11.4 × 5.8 / 8 = 8.27 kNm

These resistances are remarkably similar. The calculated resistance of the “beam” may be taken as 8.27 kNm, which may be compared directly with the design bending moment.

2.5 Comparison of test results and calculated stiffness values

As noted in RT 1784, the inertia of the steel parts alone was computed to be 3.89 × 10^6 mm^4. This is about 40% larger than the results from the test, but assumes that the top and bottom ‘flanges’ are rigidly connected, which is not the case. There is some slip between the steel ‘flanges’ and between other components.

From earlier Ultraframe testing, the back-calculated inertia was in the order of 1.6 × 10^6 mm^4, which is only about 60% of the value computed from the OBU tests described in this report.

The first load cycle of the 5.8 m span beam is shown in Figure 2.7, where the gradient is 0.59.

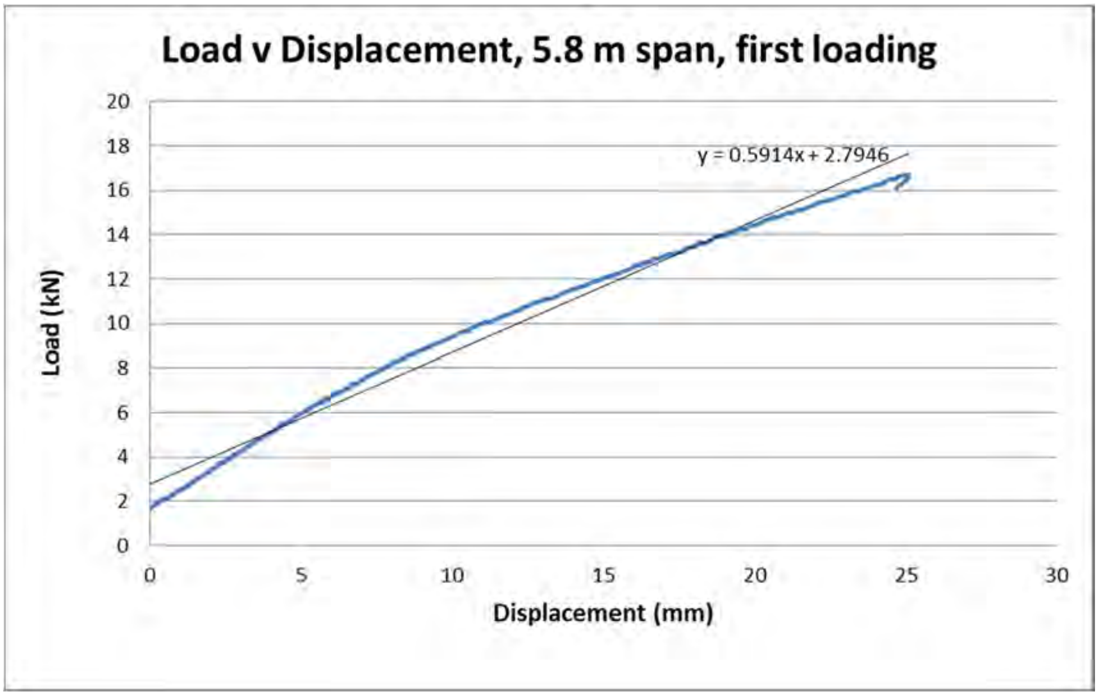


Figure 2.7 Test 4b, first load of cycle

Given $\frac{W}{\delta}$ = 0.59 then $EI = \frac{5 \times 5800^3}{384} \times 0.59 \times 10^3$ = 1.5 × 10^{12} Nmm^2

This is for three "beams", so for one beam, in steel units:

$I = \frac{1.5 \times 10^{12}}{3 \times 210000}$ = 2.38 × 10^6 mm^4

This is lower than in the Oxford Brooks "load to failure" tests, but not as low as Ultraframe's previous testing.

If a large deflection was used in the back calculation it is readily possible to determine a gradient of around 0.4 (as Figure 2.8), which leads to a stiffness of around 1.6 × 10^6 mm^4. This approach is not reasonable, as the deflection is much larger than would be allowed in practice.

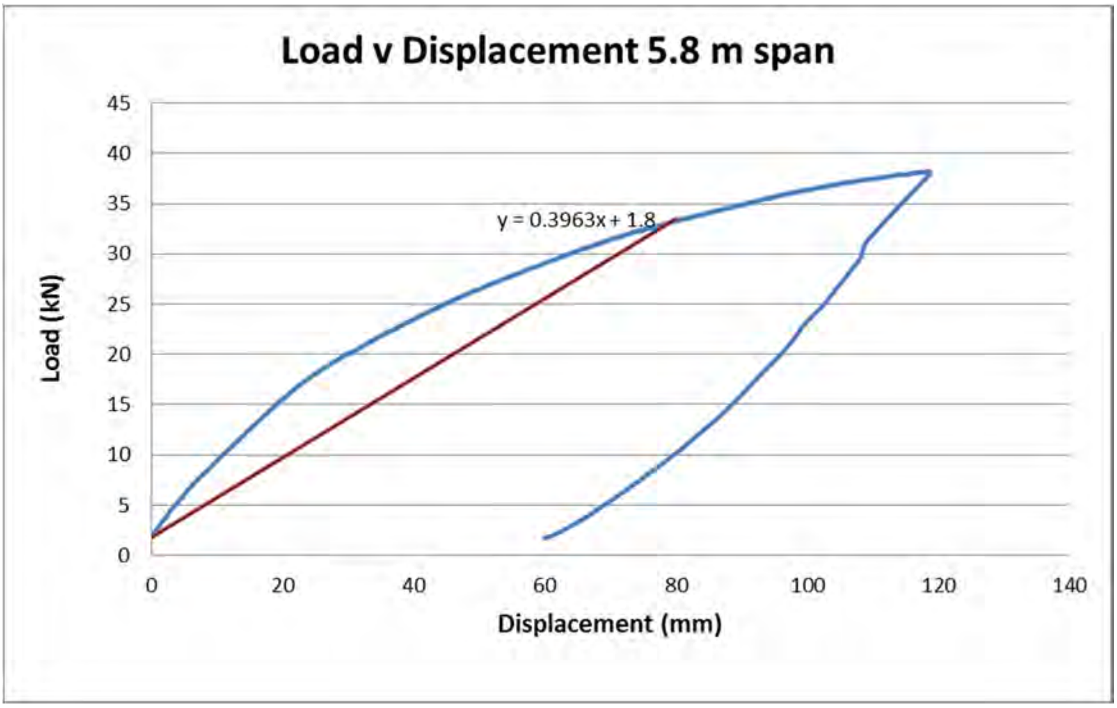


Figure 2.8 Test 4b, possible assessment of stiffness

3 Eaves beam testing

Initial eaves beam designs were tested in January 2019. The design of the eaves beams was revised and further samples tested in April 2019 at Oxford Brooks University.

The orientation of the eaves beam in service is shown in Figure 3.1. The orientation in the test arrangement is shown in Figure 3.2 and Figure 3.3.

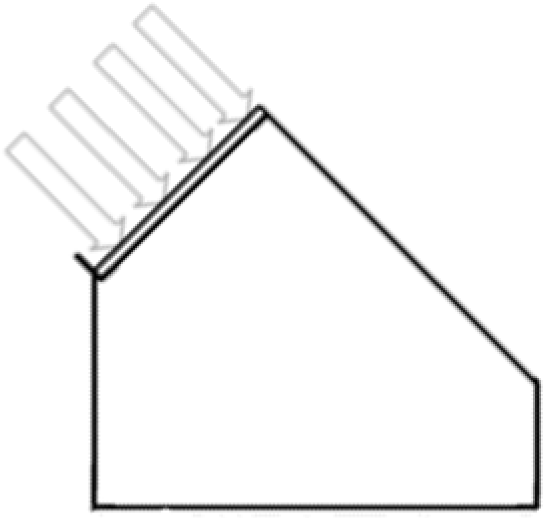


Figure 3.1 Eaves beam orientation in service

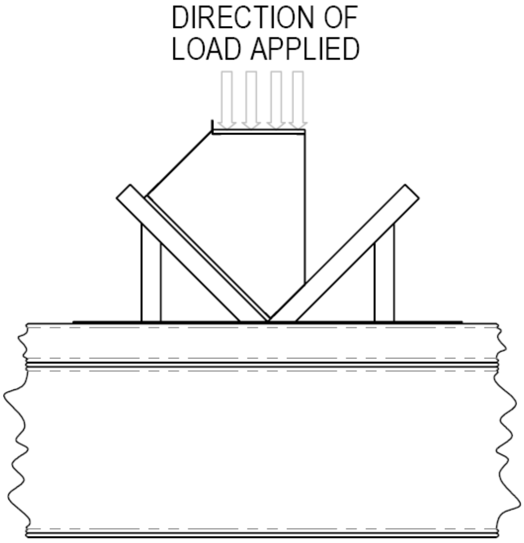


Figure 3.2 Eaves beam orientation in test arrangement

Figure 3.3 Test arrangement

Deflection measurements were taken in the vertical direction as tested (I.e. in line with the applied load, and in direction B (as shown in Figure 3.4), which is the horizontal direction when in service.

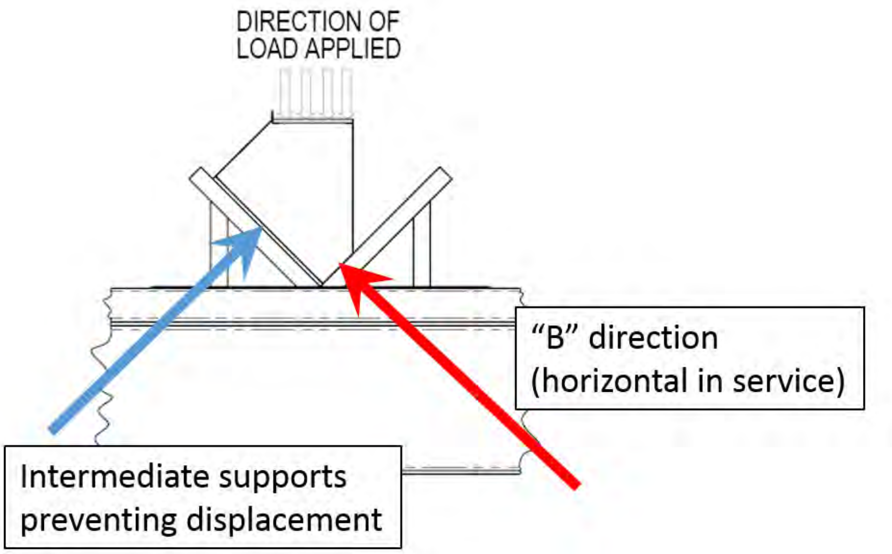


Figure 3.4 Orientation of deflection measurements

Three intermediate supports were provided in the rig to prevent movement in the vertical (when in service) direction, as shown in Figure 3.5. As shown in Figure 3.5, the span of the eaves beam was 4.0 m.

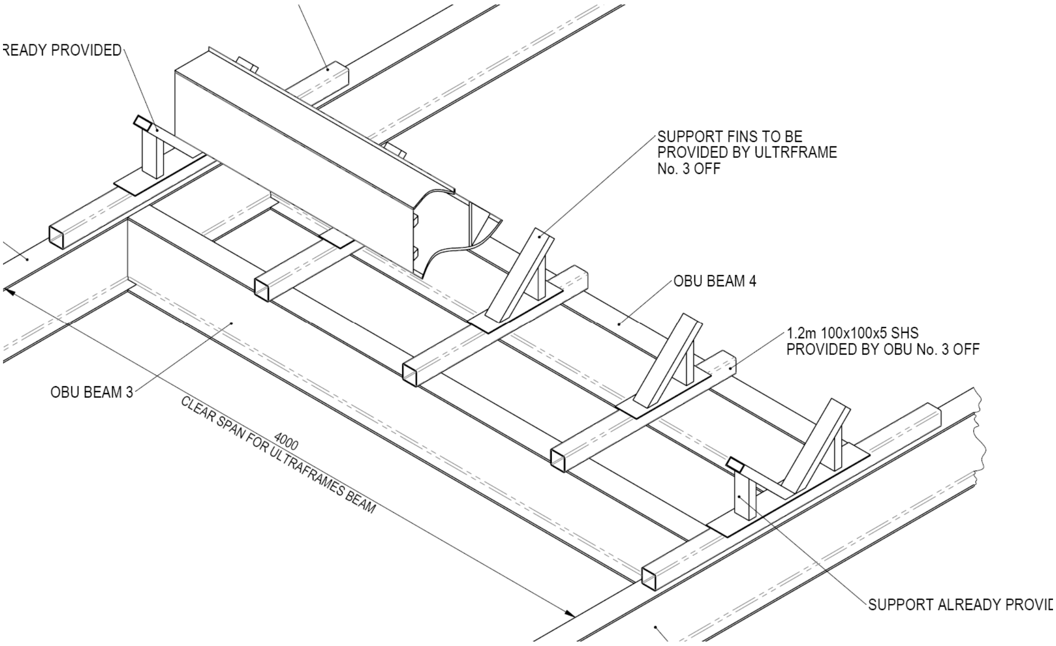


Figure 3.5 Intermediate supports

3.1 Loading

The ultimate load applied in line with the roof members (see Figure 3.2) is approximately 9.6 kN/m.

As the majority of the load is an imposed action (see the calculations in Section 2.3) the SLS load is approximately 55% of the ULS value.

Therefore, the SLS load is approximately 5.3 kN/m.

On a 4 m span, the total SLS load would be approximately 21.2 kN

3.2 Ultimate resistance

The maximum loads applied in the tests are shown in Table 6.

Table 6 Maximum test load

Test	Max load (kN)
1e	53.5
2c	58.5
3c	67.4
4c	60.9
5c	57.5
6c	61.4
Average	59.9
Standard deviation	4.65

Following the same procedure described in Section 2.2.1, the maximum design load on a 4 m eaves beam is given by:

59.9 – 3.33 × 4.65 = 44.0 kN

For the 4 m span, design bending resistance = 44.0 × 4 / 8 = 22.0 kNm. This is in line with the roof line. For a 45° eaves beam, it may be assumed that the lateral bending resistance is approximately $^{1}/_{\sqrt{2}} \times 22$ = 15.6 kNm.

3.3 Serviceability performance

The measured deflections are quite inconsistent. Typical examples of load-deflection plots (measured in the “B” direction) are shown in Figure 3.6 and Figure 3.7.

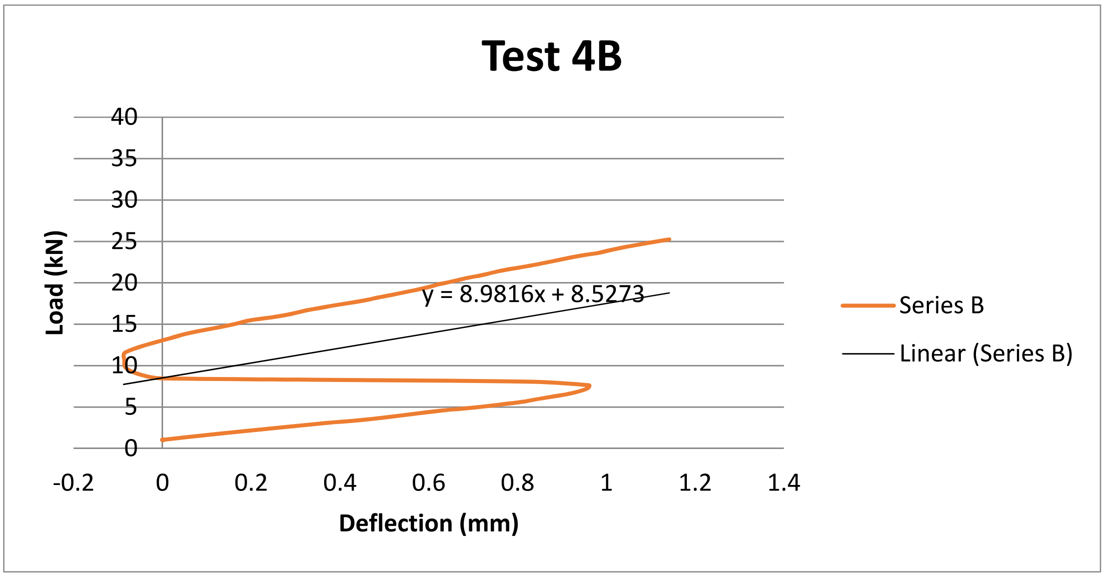


Figure 3.6 Test 4B – “B” direction

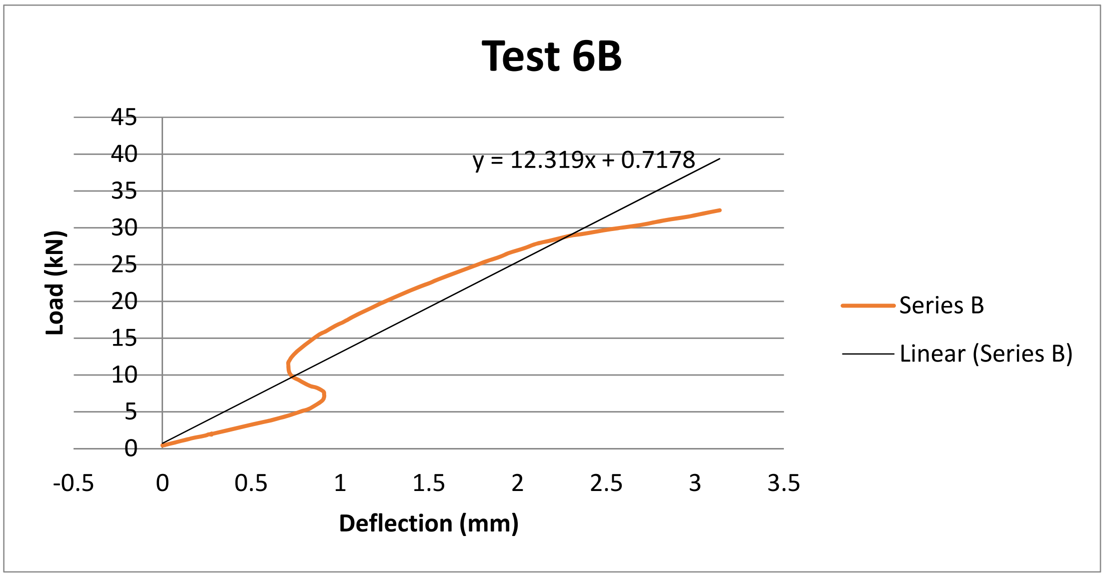


Figure 3.7 Test 6B – "B" direction

In contrast to the deflections measured in the "B" orientation, the deflections measured in line with the applied load were very consistent, as shown in Figure 3.8 and Figure 3.9.

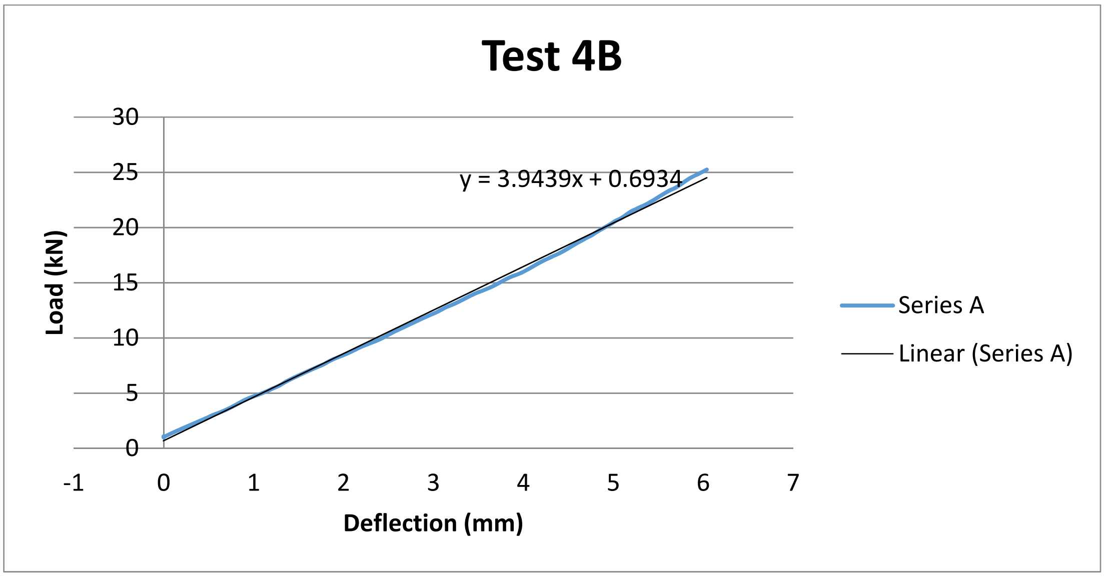


Figure 3.8 Test 4B – deflection in line with applied load

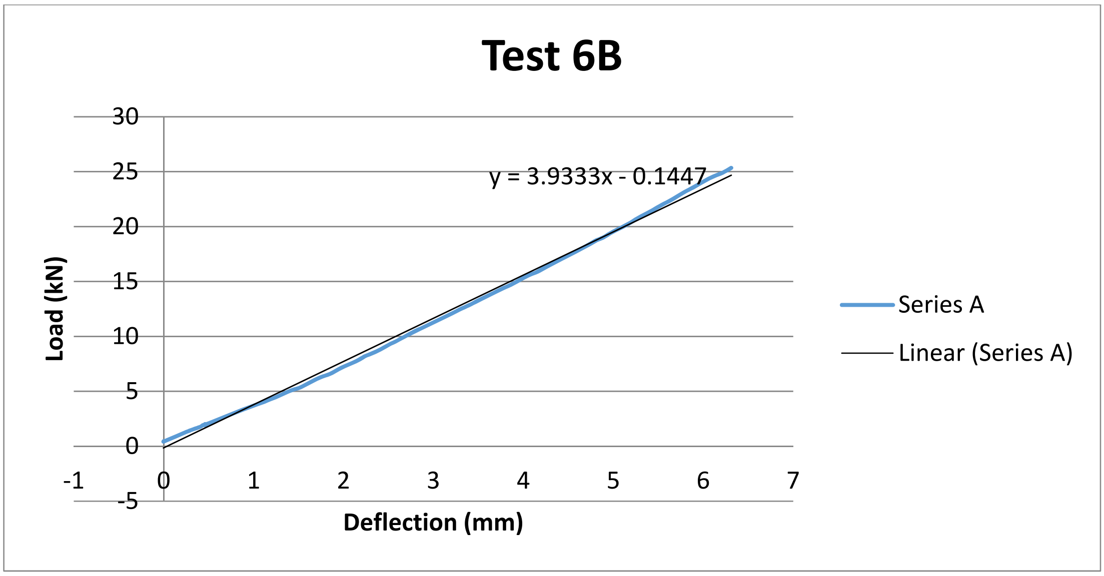


Figure 3.9 Test 6B – deflection in line with applied load

As can be seen from Figure 3.6 and Figure 3.7, the deflections are very small. The probable reason for the strange results is likely to be a combination of initial bedding in and friction between the eaves beam and the intermediate supports.

An attempt has been made to assess the load-deflection relationship subsequent to the initial movement, by neglecting the initial displacement data. Typical relationships are shown in Figure 3.10 and Figure 3.11.

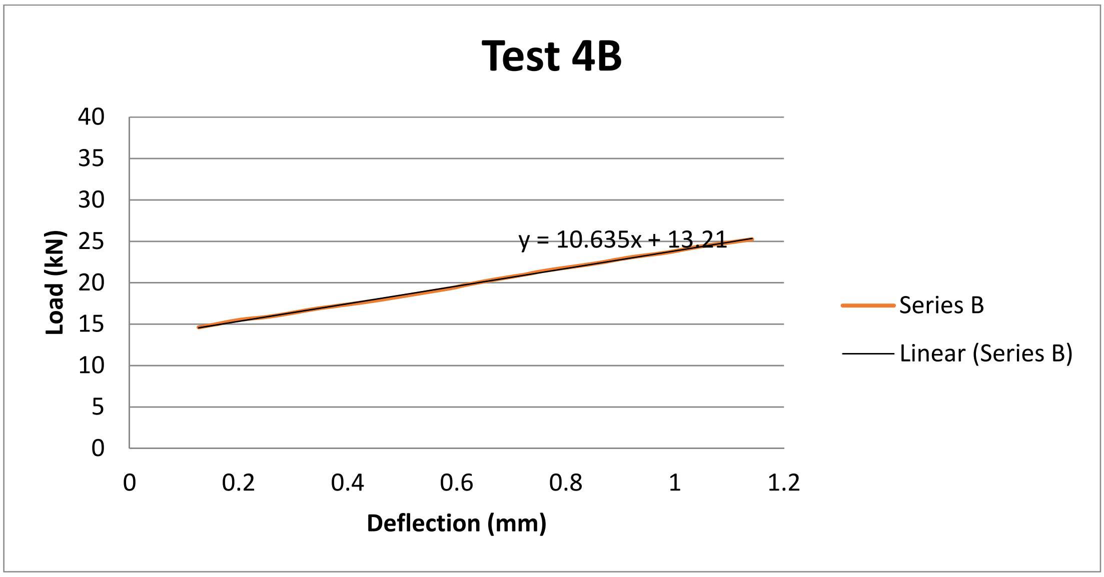


Figure 3.10 Test 4B – "B" direction, after initial movement

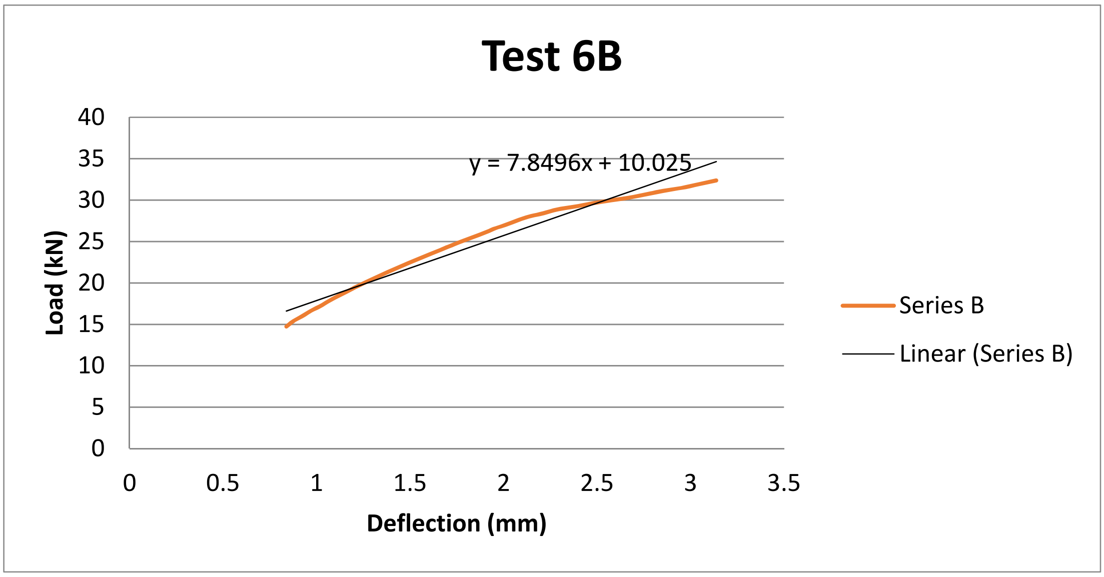


Figure 3.11 Test 6B – "B" direction, after initial movement

Following this procedure, the resulting slopes of the load-deflection plots are recorded in Table 7.

Table 7 Gradient from Eaves beam tests

Test	Gradient (kN/mm)
1c	9.01
2b	17
2c	15.5
3b	13
3c	11.1
4b	10.6
4c	7.2
5b	8.4
5c	10
6b	7.9
6c	7.3

The average slope is 10.2 kN/mm.

Given that for a UDL, $\delta = \frac{5WL^3}{384EI}$

then for the 4 m span tested:

$$EI = \frac{5WL^3}{384\delta} = \frac{5 \times 4000^3}{384} \times 10.2 \times 10^3 = 8.5 \times 10^{12}\ \mathrm{mm}^2$$

In steel units this is $8.5 \times 10^{12} / 210000$ = 40.5×10^6 mm^4

4 Typical example calculations

4.1 Example 1

Roof beam elements, spaces at 600 mm centres, 3.7 m span

Say permanent action = 0.5 kN/m^2

Say variable action = 0.6 kN/m^2

Say deflection limit is span/360 on unfactored variable actions.

Bending

Ultimate loading = 1.35 × 0.5 + 1.5 × 0.6 = 1.6 kN/m^2

load on one beam = 0.6 × 1.6 = 0.96 kN/m

Ultimate bending moment = 0.96 × 3.7^2/8 = 1.64 kNm

Resistance = 8.27 kNm, OK

Deflection

SLS load per beam = 0.6 × 0.6 = 0.36 kN/m

deflection = $\frac{5\times 0.36\times 3700^4}{384\times 210000\times 2.59\times 10^6}$= 1.6 mm

Allowable = 3700/360 = 10.3 mm, OK

4.2 Example 2

Determine the maximum variable load and maximum ultimate load that a 5.1 m span roof beam can carry. Asume beams at 600 mm centres.

Maximum deflection = 5100/360 = 14.2 mm

then $14.2 = \frac{5\times w\times 5100^4\times w}{384\times 210000\times 2.59\times 10^6}$

therefore *w* = 0.88 kN/m on the beam.

This is equivalent to a distributed load of 0.88/0.6 = 1.46 kN/m^2

Ultimate resistance = 8.27 kNm

then 8.27 = $W\times 5.1^2/8$

so *w* = 2.56 kN/m per beam

This is equivalent to a distributed load of 2.56/0.6 = 4.27 kN/m^2

This if the variable load was 1.46 kN/m^2

Then 1.35 × g_k + 1.5 × 1.46 = 4.27

g_k = 1.54 kN/m^2

4.3 Example 3

45° Eaves beam, 4m between horizontal ties. Supported on the wall, so no deflection limit in the vertical direction.

Although the load is applied in the line of the roof, the horizontal component must be calculated for defection calculations.

Bending

Assume 8 kN/m ultimate load in line with the roof.

The lateral component is 5.66 kN/m

Lateral bending moment = $5.66 \times 4^2/8$ = 11.32 kNm

Resistance = 15.6 kNm, OK

Deflection

Assume the SLS lateral load = 0.5 × 5.66 = 2.83 kN/m

$\delta = \frac{5 \times 2.83 \times 4000^4}{384 \times 8.5 \times 10^{12}}$ = 1.11 mm

Allowable = 4000/360 = 11.1 mm, OK

Ultraframe wall panel resistance

Report to:	Ultraframe
Document:	RT 1828
Version:	03
Date:	March 2020

SCI (the Steel Construction Institute) has been a trusted, independent source of information and engineering expertise globally for over 30 years, and is one of the leading, independent providers of technical expertise and disseminator of best practice to the steel construction sector.

We support everyone involved in steel construction; from manufacturers, consulting and design engineers, architects, product developers to industry groups.

Version	Date	Purpose	Author	Reviewer	Approved
01	01/20	Issue to Ultraframe	DGB		
02	01/20	Shear resistance calculations added	DGB		
03	03/20	Typo corrected in section 2	DGB		

EXECUTIVE SUMMARY

Wall panels 213 mm and 113 mm deep, manufactured by Ultraframe, have been tested at Oxford Brooks University to determine their ultimate axial resistance.

In addition, 113 mm panels were tested, so that the bending stiffness and moment resistance could be determined.

The axial resistance of the 113 mm wall panels, 3 m tall, was found to be 76.0 kN/m

The axial resistance of the 213 mm wall panels, 3 m tall, was found to be 103.2 kN/m

The second moment of area of each of the 113 mm 'beams' forming a panel, in steel units, was found to be 0.43×10^6 mm^4.

The ultimate resistance of each of the 113 mm 'beams' forming a panel was found to be 3.2 kNm.

It should be noted that the critical design check for the 113 mm deep panels in bending is deflection, not strength.

Although shear resistance is not critical, and no failure in shear was attained during the test programme, conservative design shear resistances for panel components have been determined.

The design shear resistance of a 213 mm deep 'beam' used in a panel, and of a 213 mm deep intermediate beam, may be taken as 20 kN

The design shear resistance of a 285 mm deep 'beam' used in a panel, and of a 285 mm deep intermediate beam, may be taken as 26 kN

Contents

1 INTRODUCTION

Prefabricated panels and other supporting components forming the Ultraframe system were previously tested in 2019. The results of the previous tests are covered in SCI Reports RT 1797 and RT 1826.

1.1 Wall panel test arrangements

To determine the compression resistance when used as wall components, panels were tested under axial load at Oxford Brooks University in January 2020. The general arrangement of the tests is shown in Figure 1.1.

Figure 1.1 General arrangement of wall panel tests

The panels were tested in the horizontal position. Axial load was applied to the central member only. The movement of the jack and the central vertical out-of-plane deflection was recorded.

In the first test, the panel was not restrained laterally. A small amount of lateral movement (in-plane) was observed. Because lateral movement is prevented in use (by battens and additional material such as cladding and plasterboard), lateral movement in subsequent test was prevented by the addition of brackets at the mid-point of the panel, as can be seen in Figure 1.2.

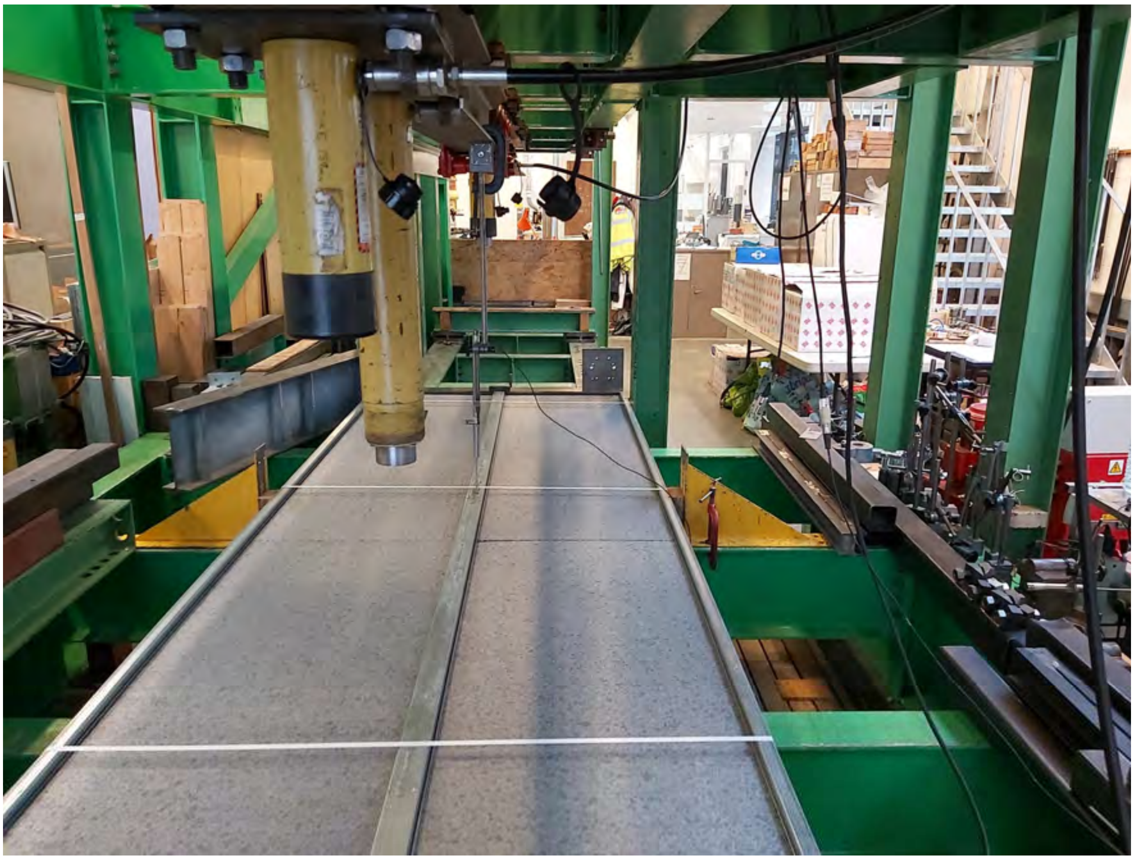


Figure 1.2 Test arrangement with lateral movement prevented

For the first three tests, an assessment of the initial imperfections out-of-plane was made by simply measuring the position of the two external members at midspan and the supports. Initial imperfections of up to 3 mm were observed. During the tests, it was clear that there was no correlation between the direction and magnitude of the measured initial imperfections and the deflection under load. Some panels changed direction of midspan deflection during loading, whilst others deflected in the opposite direction to the initial imperfections. Other than a check for gross manufacturing errors, the measurement of initial imperfections was discontinued.

1.2 Wall panel behaviour under load

Load was increased until the midspan vertical deflection started to increase rapidly with no increase in load.

As the panels deflected, the flange on the concave face experiences the highest compression. Local buckling of the cover strip on the concave side of the panel could be observed, as can be seen in Figure 1.3.

Figure 1.3 Local buckling of steel cover strip

Rapidly increasing deflections were generally associated with a substantial buckle in the ‘flange’, close to the end of the member. It is tentatively suggested that at this ‘end’ location there is no continuity, possibly combined with an uneven stress distribution local to the applied load, leading to the local buckle seen in Figure 1.4.

Figure 1.4 Buckling of steel 'flange' at end of member

A similar buckle at the end of the member can be seen in Figure 1.5. The ultimate behaviour is not overall buckling (which would be manifest by failure towards the mid span of the member), but by a local buckling (crushing) of a component.

The cross-sectional resistance of the section is approximately 120 kN. The failure load was approximately half this value, suggesting that local effects were significant.

Figure 1.5 Buckling of steel 'flange' at end of member

1.3 Axial resistance of wall panels

Six 113 mm deep wall panels were tested, and six 213 mm deep wall panels. As the panels differed only in depth and behaved in the same manner, the twelve test results are treated as one family when calculating the design resistance. As the axial resistance primarily depends on the steel in the 'flanges' and a mechanical model can be proposed, 'V_x known' is assumed when taking values of $k_{d,n}$ from Table D2 of BS EN 1990.

1.4 113 mm deep panels

A typical load – midspan deflection plot is shown in Figure 1.6

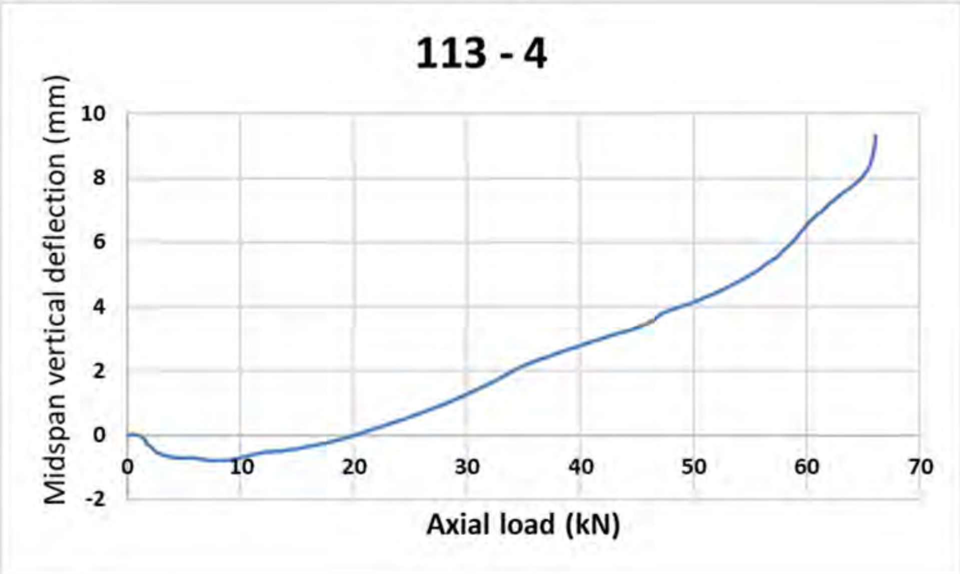


Figure 1.6 Typical load-midspan deflection for 113 mm panel

The maximum axial load for the six tests is reported in Table 1.1.

Table 1.1 113 mm wall panel tests

Test	Tested resistance (kN)
113-1	69.8
113-2	60.1
113-3	62.0
113-4	66.1
113-5	60.3
113-6	73.4

Samples of the steel used to manufacture the wall panels had been independently tested. Results were received from Ultraframe on 6 January 2020, and are recorded in Table 1.2. The test report refers to the 0.2% PS (proof stress) which is taken as equivalent to the yield strength if there is no well-defined yield point.

Table 1.2 Steel yield and ultimate tensile strengths

Test	Measured yield strength (N/mm²)	Measured ultimate strength (N/mm²)
4507GC	305	376
4508GC	309	380
4509GC	307	375
4510GC	304	374
4511GC	286	352
4512GC	300	366
Average	301.8	
Standard deviation	8.3	

From Table D1 of BS EN 1990, for six tests and 'V_x known', k_n = 1.77

The characteristic yield strength of the samples is therefore:

301.8 – 1.77 × 8.3 = 287.1 N/mm²

The minimum specified yield for the steel coil is 275 N/mm². The normalised resistances of the 113 mm wall panels are shown in Table 1.3, based on the tested values factored by 275/287.1

Table 1.3 113 mm wall panel tests

Test	Tested resistance (kN)	Normalised resistance (kN)
113-1	69.8	66.9
113-2	60.1	57.6
113-3	62.0	59.4
113-4	66.1	63.3
113-5	60.3	57.8
113-6	73.4	70.3
Average	-	62.5
Standard deviation	-	5.2

From Table D2 of BS EN 1990, $k_{d,n}$ = 3.23 (from 10 tests)

The design axial resistance is therefore:

62.5 – 3.23 × 5.2 = 45.6 kN

This is an axial resistance equivalent to 76.0 kN/m.

1.5 213 mm deep panels

A typical load – midspan deflection plot is shown in Figure 1.7. It should be noted that the direction of deflection was not the same in all tests, and in some tests changed direction during the load application.

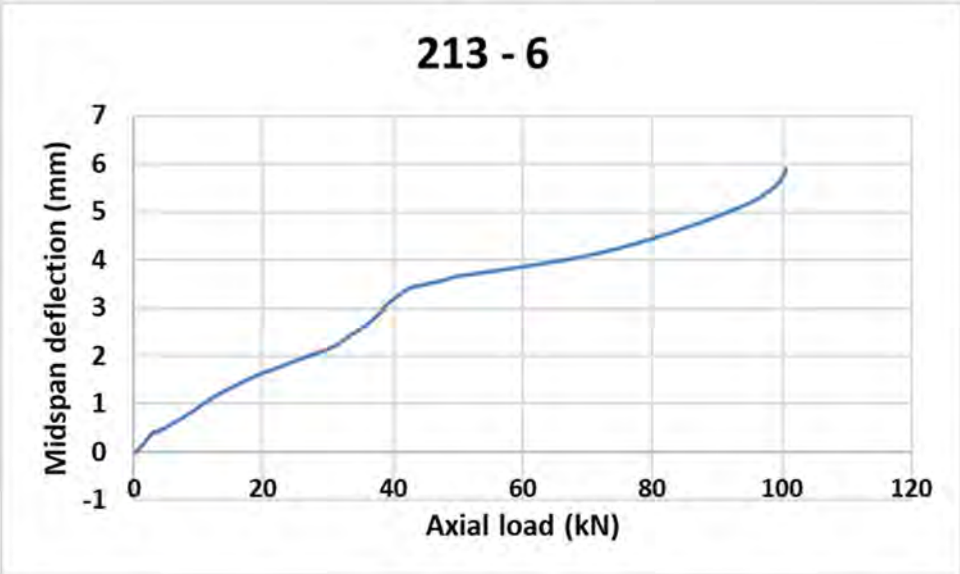


Figure 1.7 Typical load-midspan deflection for 213 mm panel

The behaviour of the 213 mm deep wall panels was the same as the 113 mm deep panels, with rapidly increasing mid span deflection after local buckling occurred at the ends of the member. Local buckling at the end of a 213 mm panel is shown in Figure 1.8.

Figure 1.8 Local buckling – 213 mm deep panel

The maximum axial load for the six tests is reported in Table 1.4.

Table 1.4 213 mm wall panel tests

Test	Tested resistance (kN)
213-1	85.5
213-2	82.2
213-3	86.9
213-4	91.1
213-5	102.3
213-6	100.6

As reported in Section 1.4, the characteristic yield strength of the steel used in the panels was determined as 287.1 N/mm^2.

The minimum specified yield for the steel coil is 275 N/mm^2. The normalised resistances of the 213 mm wall panels are shown in Table 1.5, based on the tested values factored by 275/287.1

Table 1.5 213 mm wall panel tests

Test	Tested resistance (kN)	Normalised resistance (kN)
213-1	85.5	81.9
213-2	82.2	78.7
213-3	86.9	83.2
213-4	91.1	87.3
213-5	102.3	98.0
213-6	100.6	96.4
Average	-	87.6
Standard deviation	-	7.9

From Table D2 of BS EN 1990, $k_{d,n}$ = 3.23 (from 10 tests)

The design axial resistance is therefore:

87.6 – 3.23 × 7.9 = 62.0 kN

This is an axial resistance equivalent to 103.2 kN/m.

1.6 Bending resistance and stiffness of 113 mm panels

Three 113 mm deep panels of 4.2 m span were tested to determine their bending resistance and stiffness. The panels comprised two internal ‘beams’ and two edge ‘beams’, making three structural ‘beams’ per panel.

The general arrangement is shown in Figure 1.9. Point loads were applied to model a uniformly distributed load.

Figure 1.9 General arrangement of 113 mm deep panel bending tests

Load was initially cycled to bed in the test samples, and then load increased until failure occurred. A typical load-deformation plot is shown in Figure 1.10.

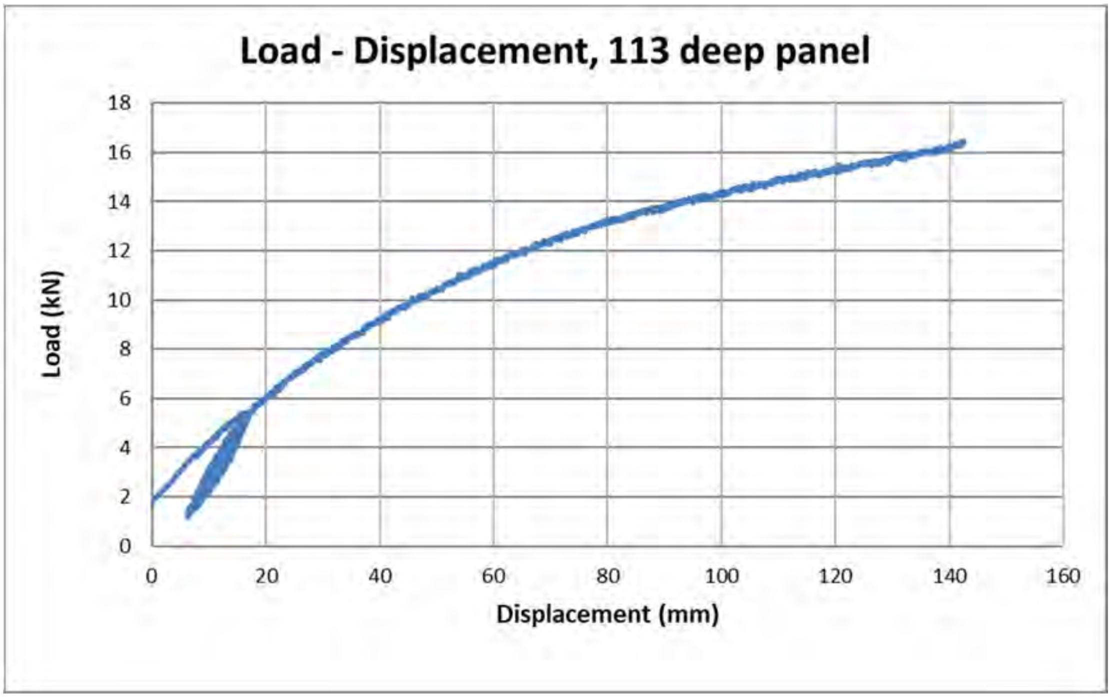


Figure 1.10 Typical load-deformation plot for 113 mm deep panel

The panel continued to deflect (past the range of the transducers) until it came into contact with the test rig, as can be seen in Figure 1.11. The panel had not failed, but would clearly be unserviceable at such a high deformation.

Figure 1.11 Deflection of 113 mm deep panel

1.6.1 Bending stiffness

The maximum permitted deflection of a panel is assumed to be L/200 or 21 mm.

The 113 mm deep panels are designed to span vertically, with lateral wind loads. Typical wind loads are (say) 1 kN/m^2. This equates to:

0.6 kN/m on a single ‘beam’, spaced at 600 mm centres;

2.5 kN total load on a single ‘beam’ of 4.2 m span;

7.6 kN total load on a panel comprising three ‘beams’.

The stiffness has therefore been calculated over a range up to 8 kN, which corresponds to a deflection of 30 mm.

A typical load-deflection plot for this range, after the initial load cycles have been completed, is shown in Figure 1.12

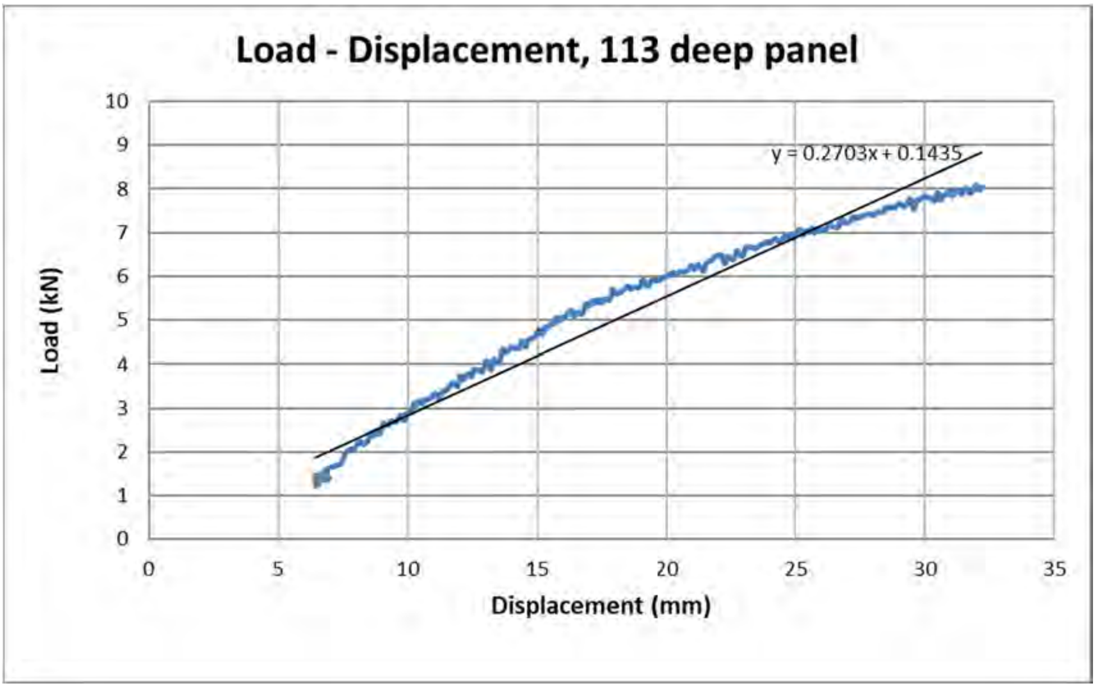


Figure 1.12 Deflection of 113 mm deep panel after initial loading, to 8 kN

Over this range, the gradient of the plot of the three tests is reported in Table 1.6

Table 1.6 Gradient from 113 mm panel tests

Test	Gradient (kN/mm)
115-B1	0.27
115-B2	0.26
115-B3	0.30

The average gradient is 0.28 kN/mm

The midspan deflection under a UDL is given by:

$\delta = \frac{5WL^3}{384EI}$, noting that W in this expression is the total load.

Or, $EI = \frac{5L^3}{384}\frac{W}{\delta}$

Given $\frac{W}{\delta}$ = 0.28 then $EI = \frac{5\times 4200^3}{384} \times 0.28 \times 10^3$ = 0.27 × 10^{12} Nmm^2

This is for three "beams", so for one beam, in steel units:

$I = \frac{0.27\times 10^{12}}{3\times 210000}$ = 0.43 × 10^6 mm^4

1.6.2 Bending resistance

The bending resistance of the 113 mm deep panels was not discovered under test. The resistance of the panels will clearly be dominated by a deformation limit.

The maximum loads recorded were 18.6 kN, 18.8 kN and 21 kN.

Taking the maximum load under test as 18 kN, the design load on a single 'beam' is 6 kN.

The design bending resistance = 6 × 4.2 / 8 = 3.2 kNm.

2 SHEAR RESISTANCE OF 213 mm AND 285 mm DEEP MEMBERS

Six tests of 213 mm deep members with a 2.0 m span were previously undertaken to try and induce a failure in shear. The tests are reported in SCI report RT 1797.

It was not possible to induce a failure in shear. The test loads reported in RT 1797 therefore represent a conservative resistance.

From the data recorded in Table 1 of RT 1797, the design load may be calculated in accordance with BS EN 1990, taking $k_{d,n}$ as 3.33 from Table D2, for "V_x known".

The design load is given by 44.6 – 3.33 × 1.37 = 40.0 kN

The design shear resistance is therefore 20.0 kN, as the shear is half the applied load.

The 213 mm deep beam used in a panel, and the 213 mm deep intermediate beam, both have two webs of the same thickness of hardboard, so the calculated resistance is appropriate for both members.

Although no 285 mm deep members were tested with the specific objective of inducing a shear failure, a conservative approach is to recognise that the shear area of a member is proportional to depth. The 285 mm members are deeper, but in all other respects identical.

By simple proportion, the design shear resistance of a 285 mm deep beam and a 285 mm deep intermediate beam with two webs of hardboard may be taken as 20 × 285/213 = 26 kN.

3 REFERENCES

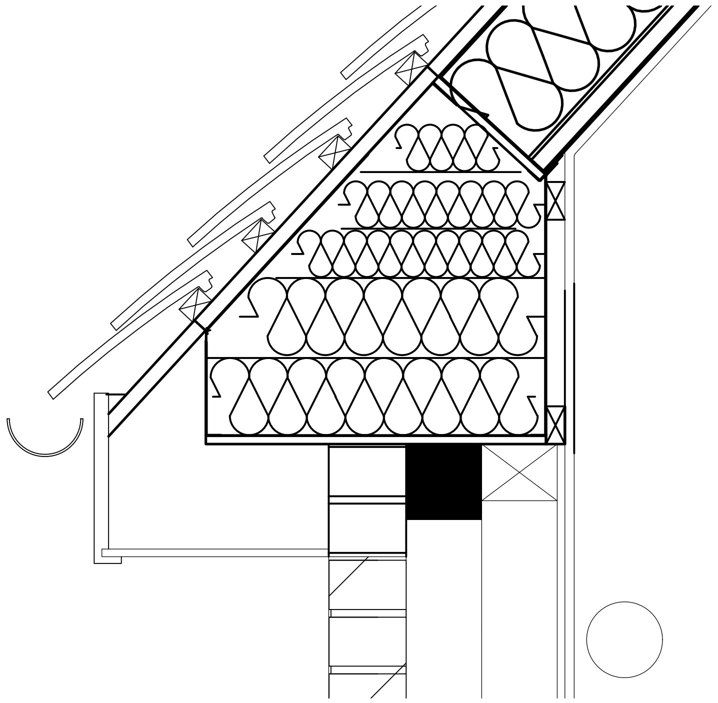
14. Typical Complete Roof details

14.1 Barratt Homes Hesketh

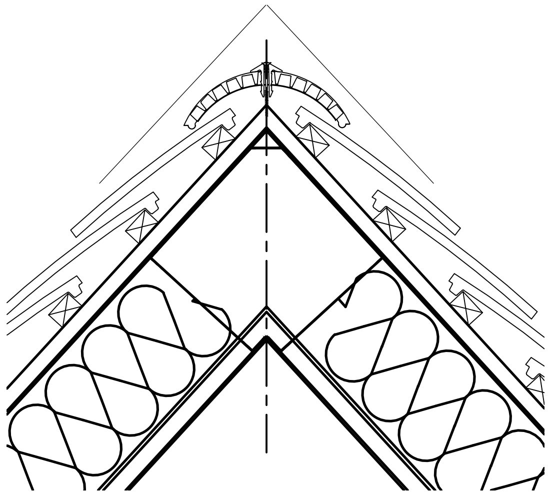
14.2 Barratt Homes Norbury

14.3 Barratt Homes Kingsville

1 .1



Eaves Detail
Scale 1:10



Ridge Detail
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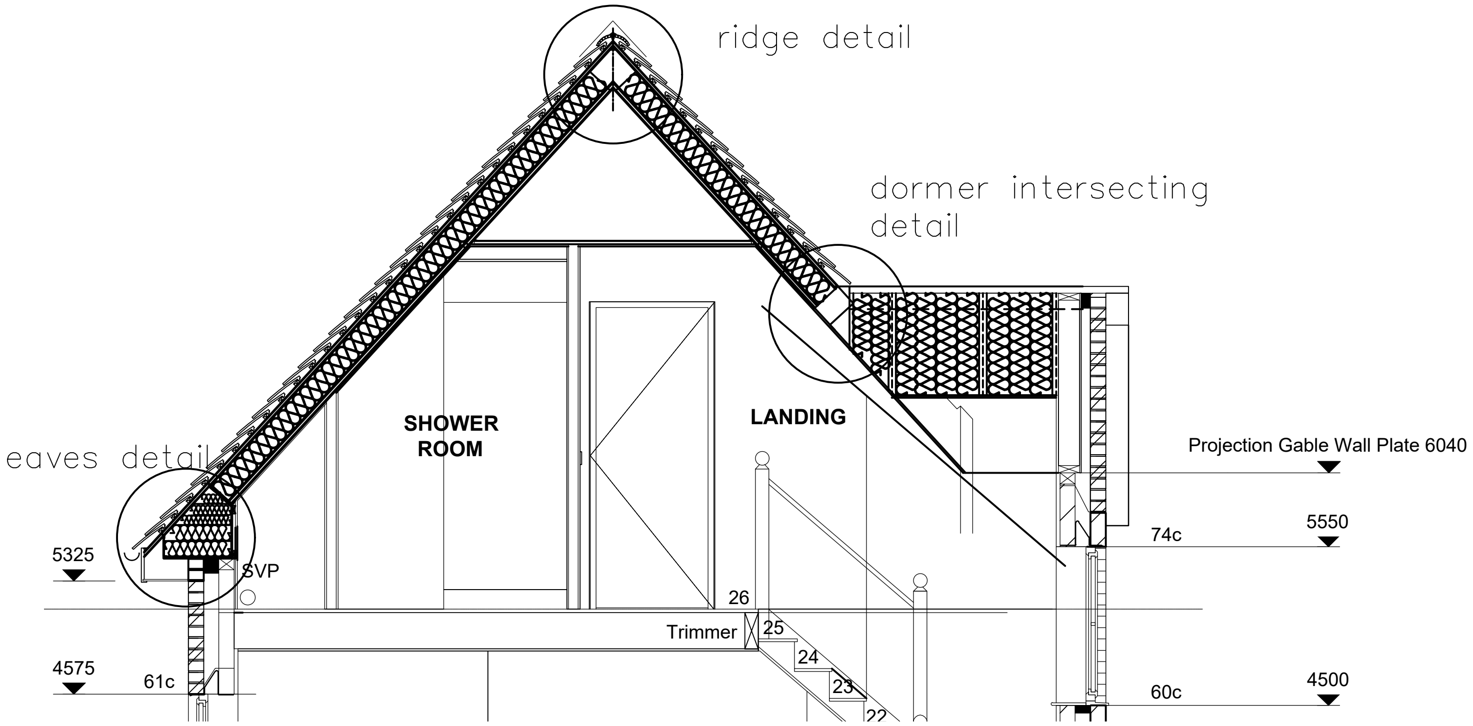
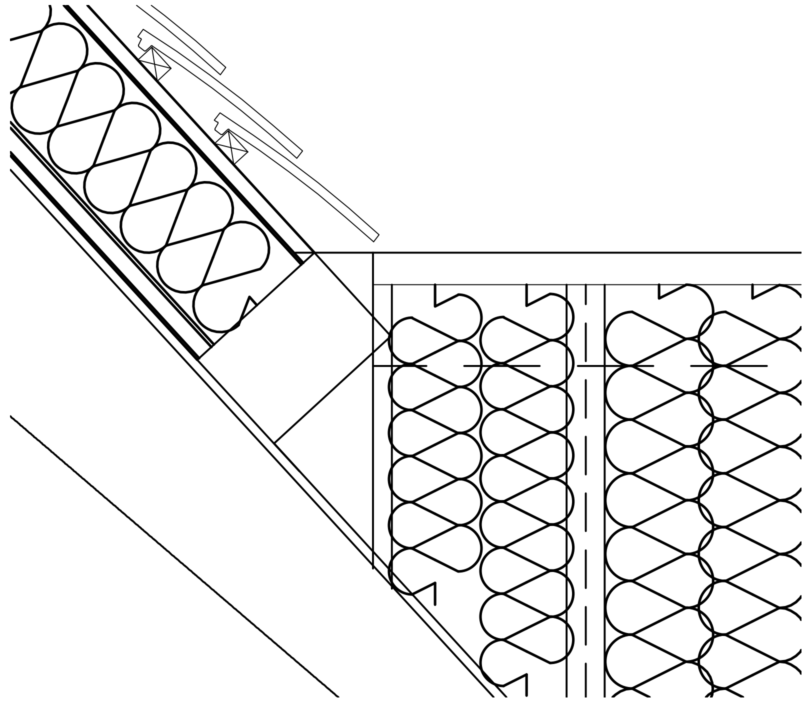
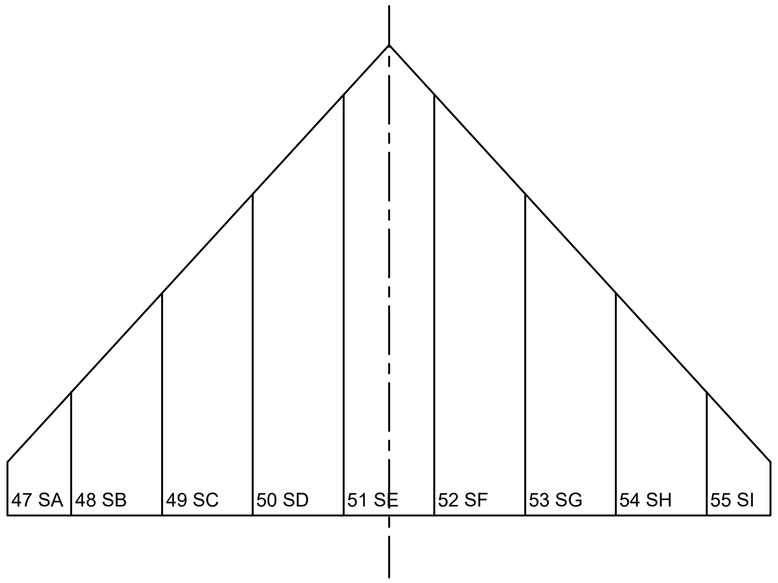


Section Detail
Scale 1:50



Intersecting Dormer Detail
Scale 1:10

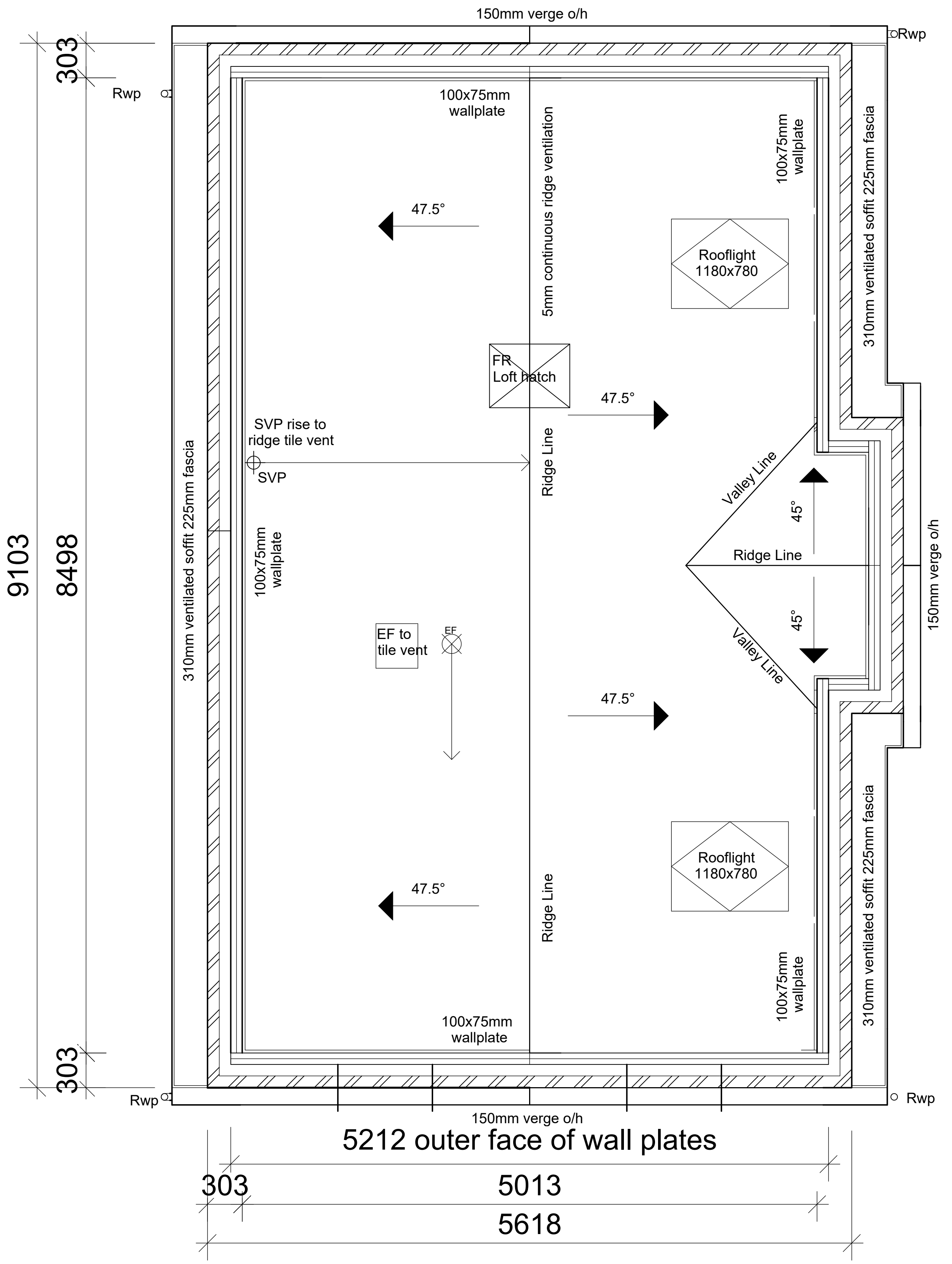


Spandrel Wall Panel Layout
Scale 1:50

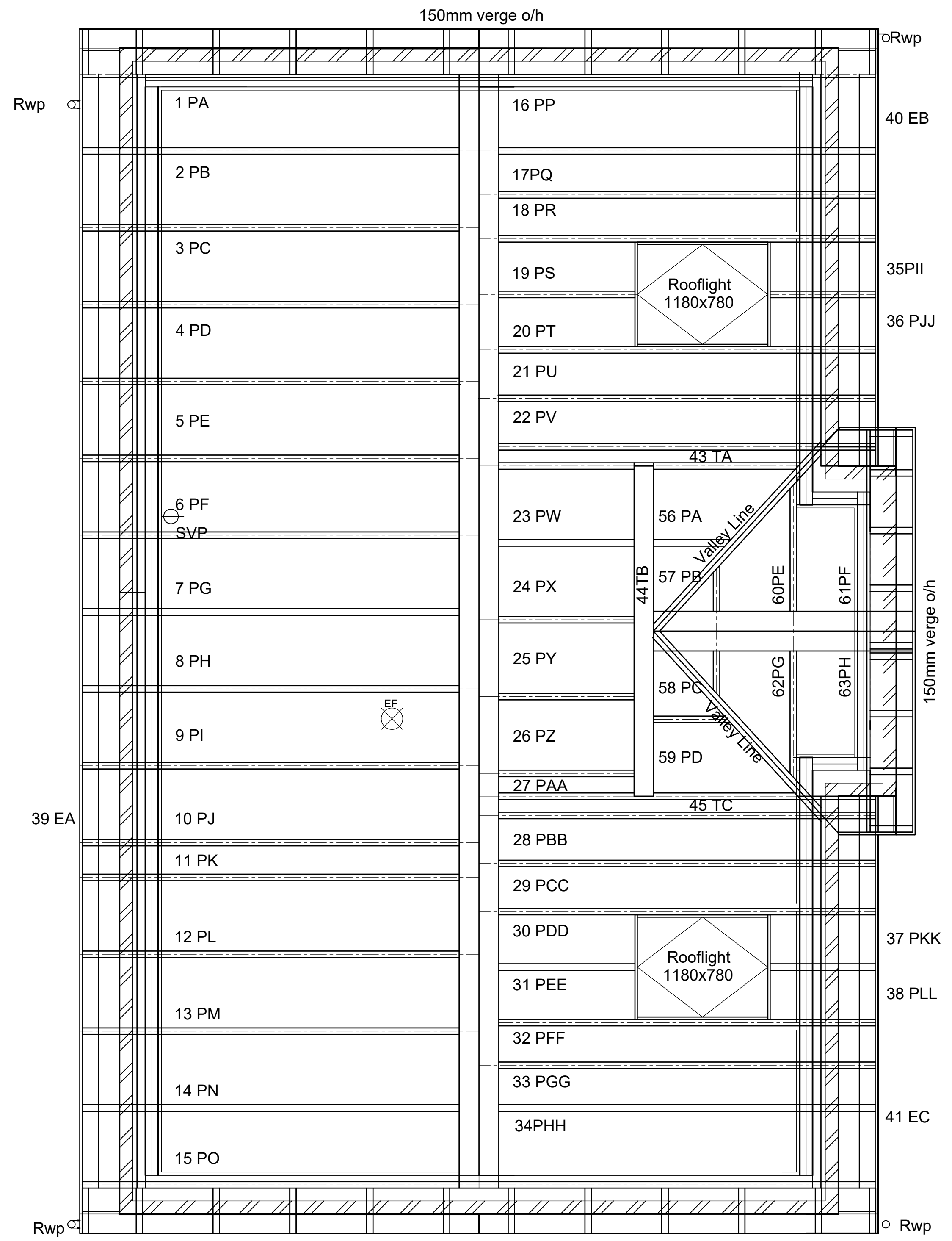
ultraframe

DRAWN BY: SAB
DATE CREATED: 28-03-19
SCALE: 1:20&1:50
STATUS: Prelimninary
DESCRIPTION: The Hesketh House Type (detached)
DRAWING No: HES-02
STOCK CODE:
REV:
MODEL NAME: / CONFIG. NAME:
SHEET 2 OF 4, SIZE A3
08/03/2019

1 .1



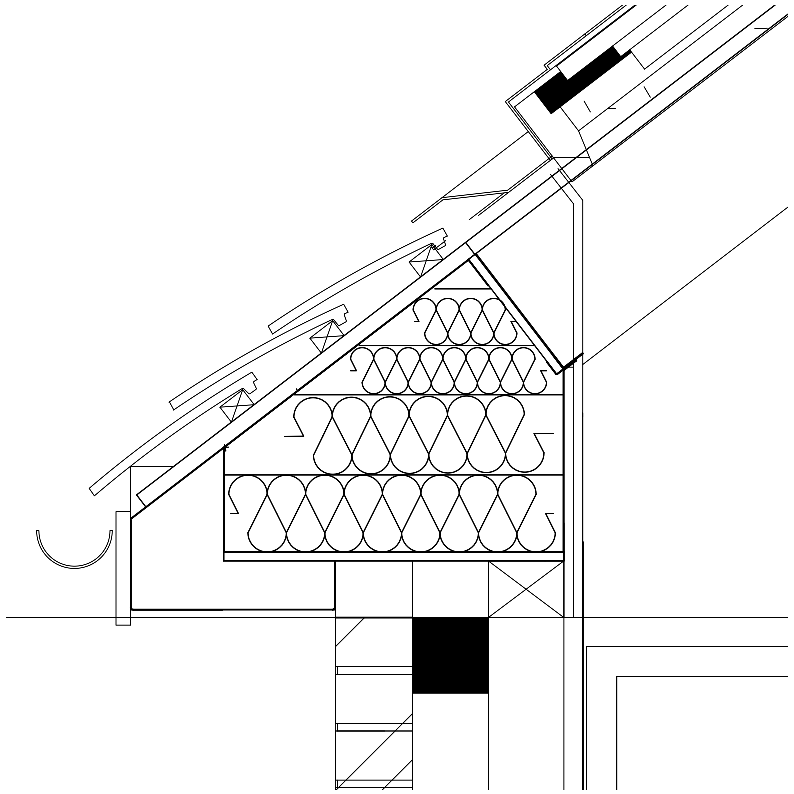
Roof Layout
Scale 1:50



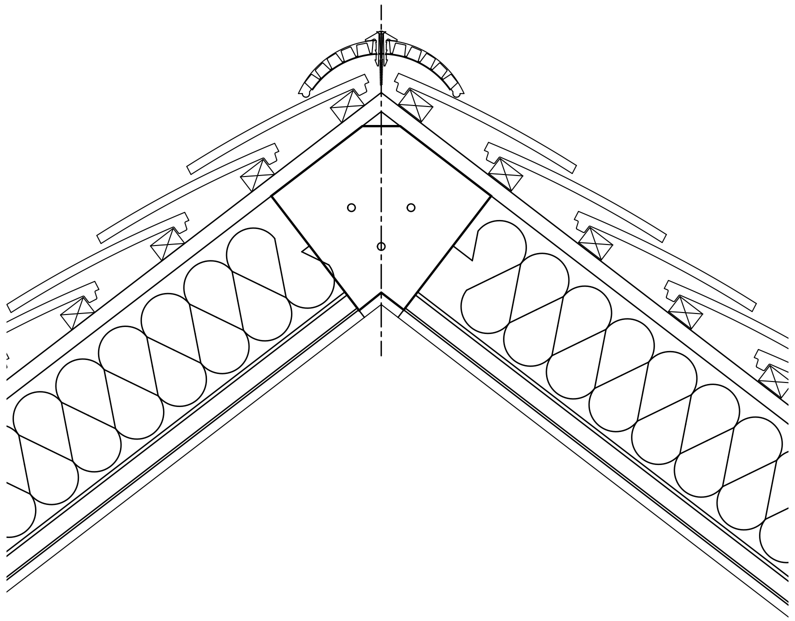
U 380 Panel Layout
Scale 1:50

DRAWN BY: SAB	DATE CREATED: 28-03-	
SCALE: 1:50	STATUS: Prelimi	
DESCRIPTION: The Hesketh House Type (Detached)	DRAWING No: HES-01	STOCK CODE:
MODEL NAME: / CONFIG. NAME:		SHEET 1 OF 2, SIZE

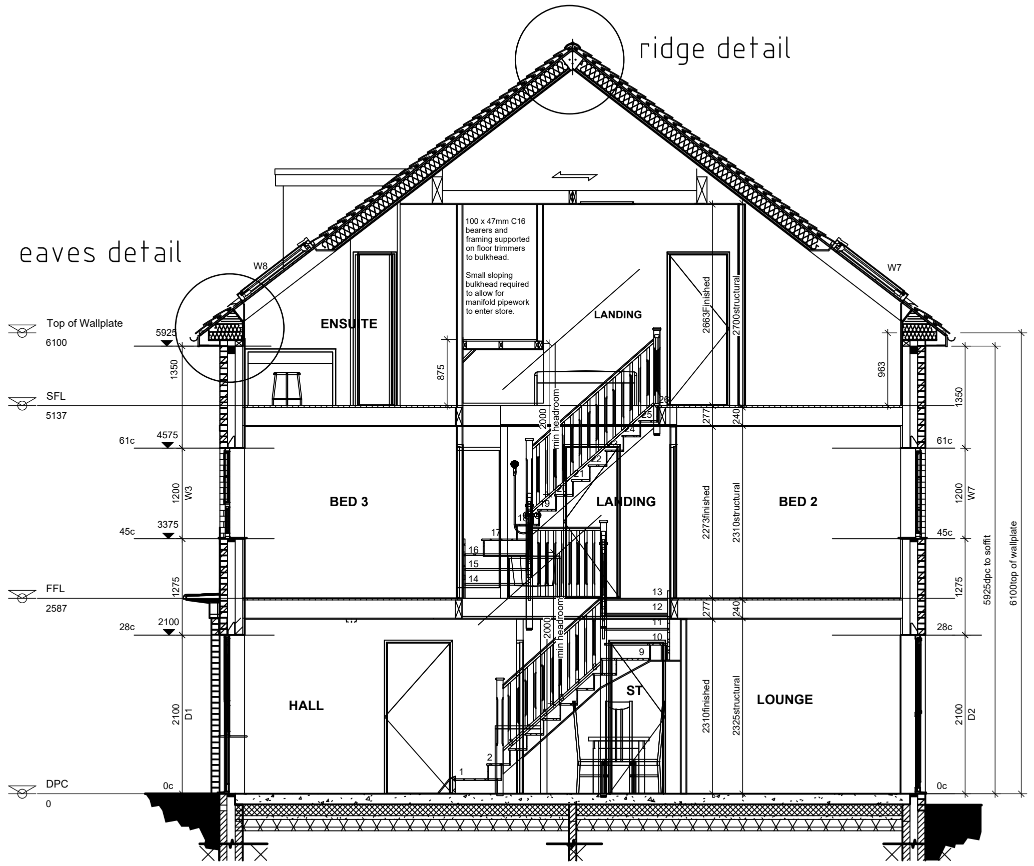
1 .2



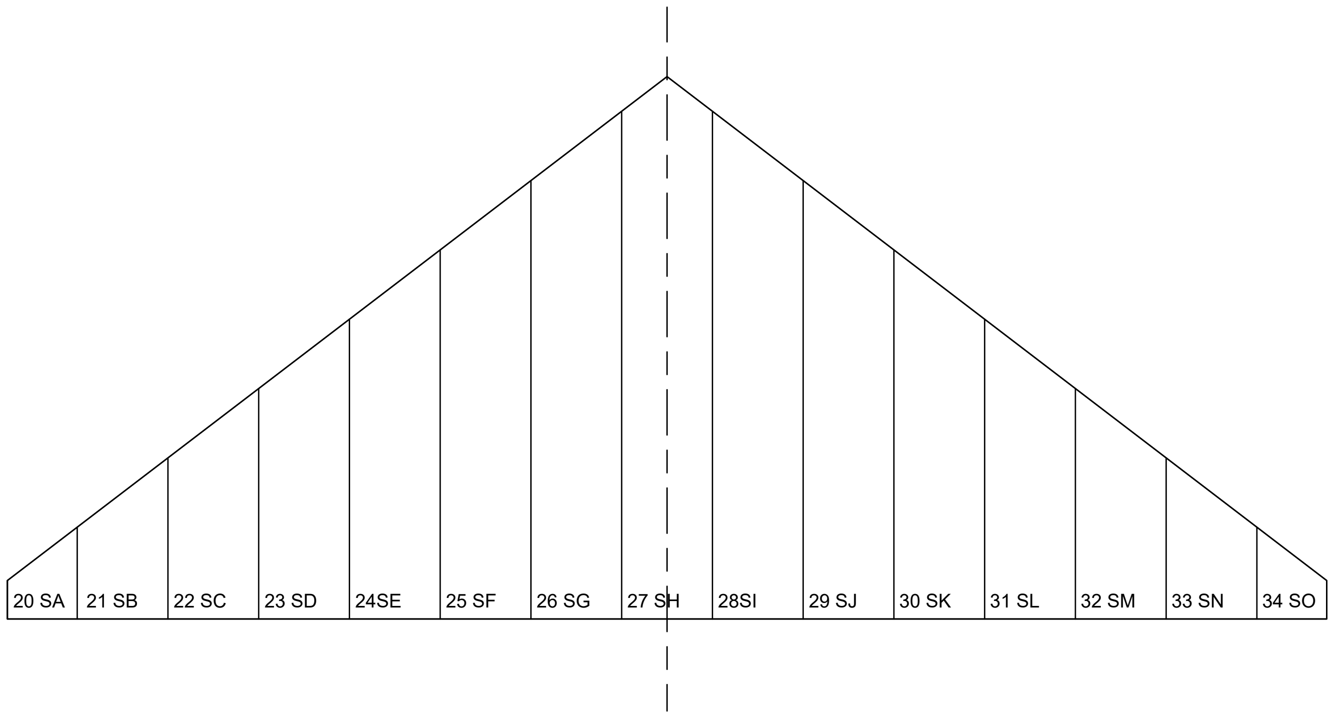
Eaves Detail
Scale 1:10



Ridge Detail
Scale 1:10



Roof Section Detail
Scale 1:100



Spandrel Wall Panel Detail
Scale 1:50

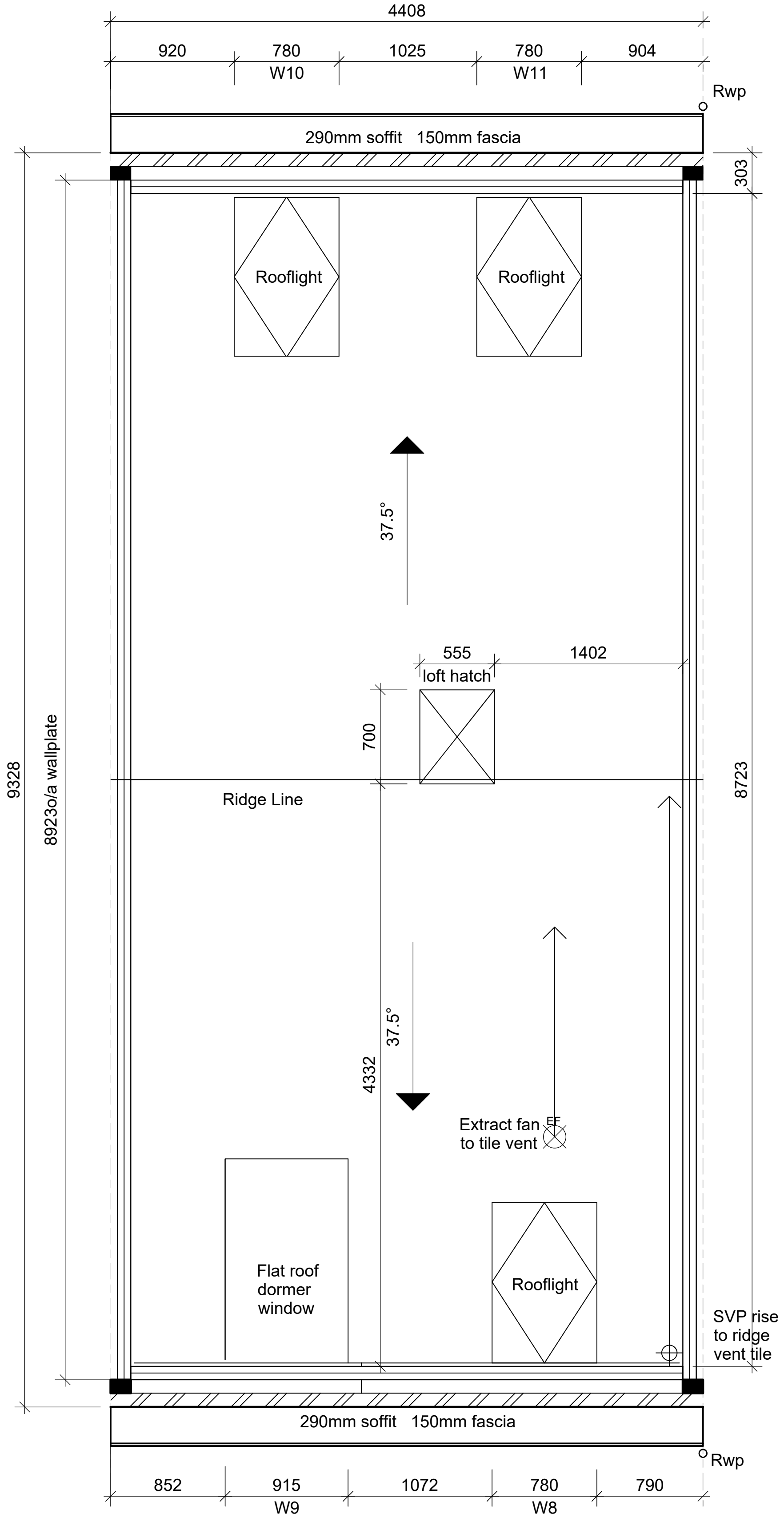
DRAWN BY: SAB	DATE CREATED: 28-03-19
SCALE: 1:100&1:50	STATUS: Prelimninary

DESCRIPTION: The Norbury House Type (Mid Terraced)

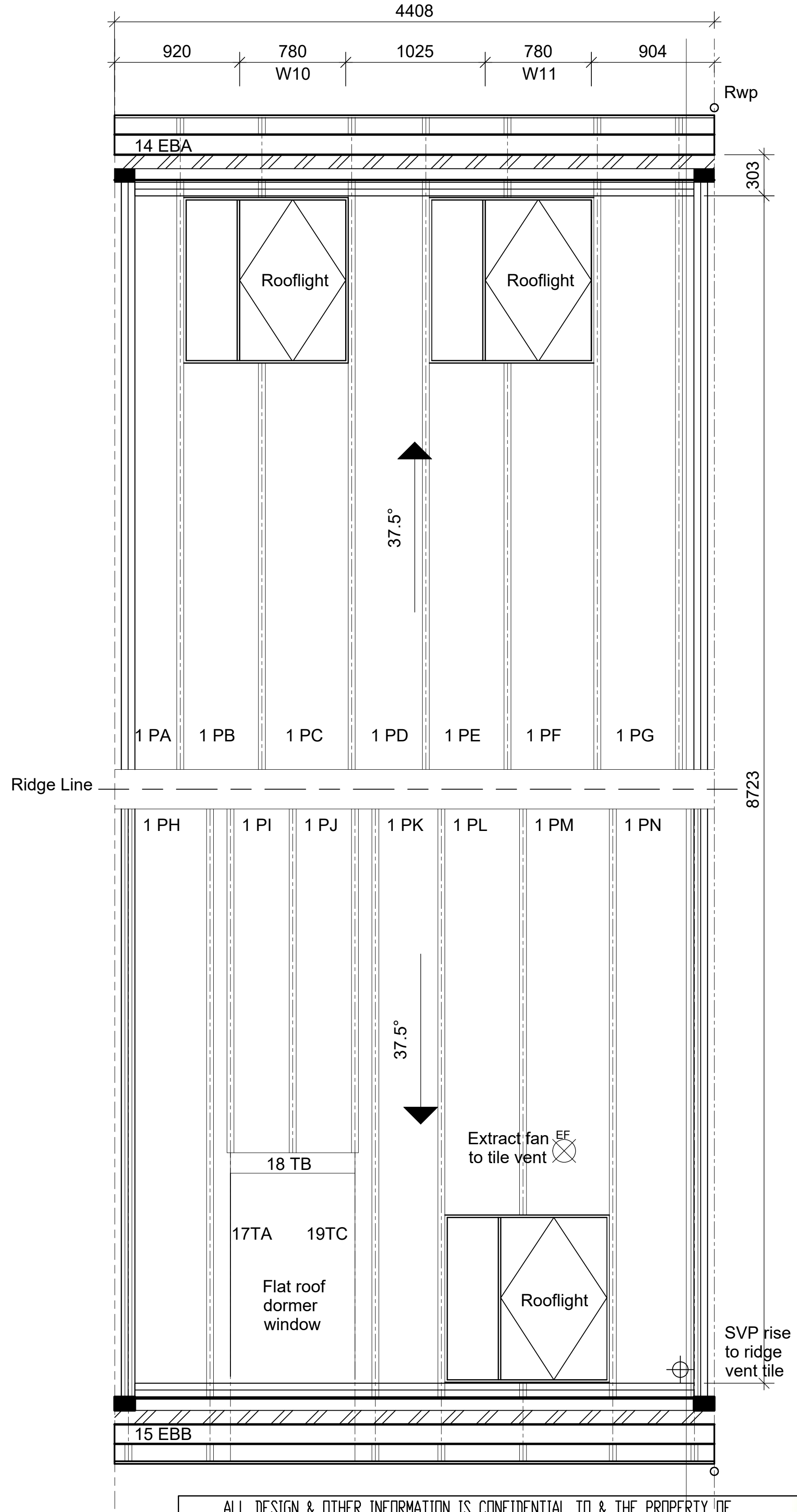
DRAWING No: NOR-02 | STOCK CODE: | REV:

MODEL NAME: / CONFIG. NAME: | SHEET 2 OF 2, SIZE A3 | 08/03/2019

1 .2



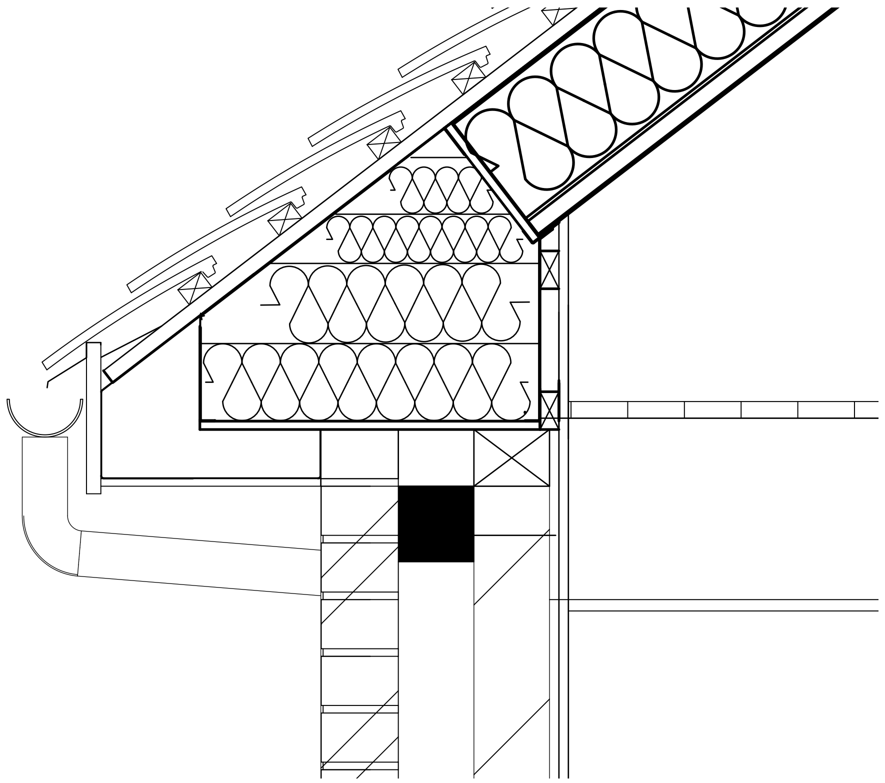
Roof Layout
Scale 1:50



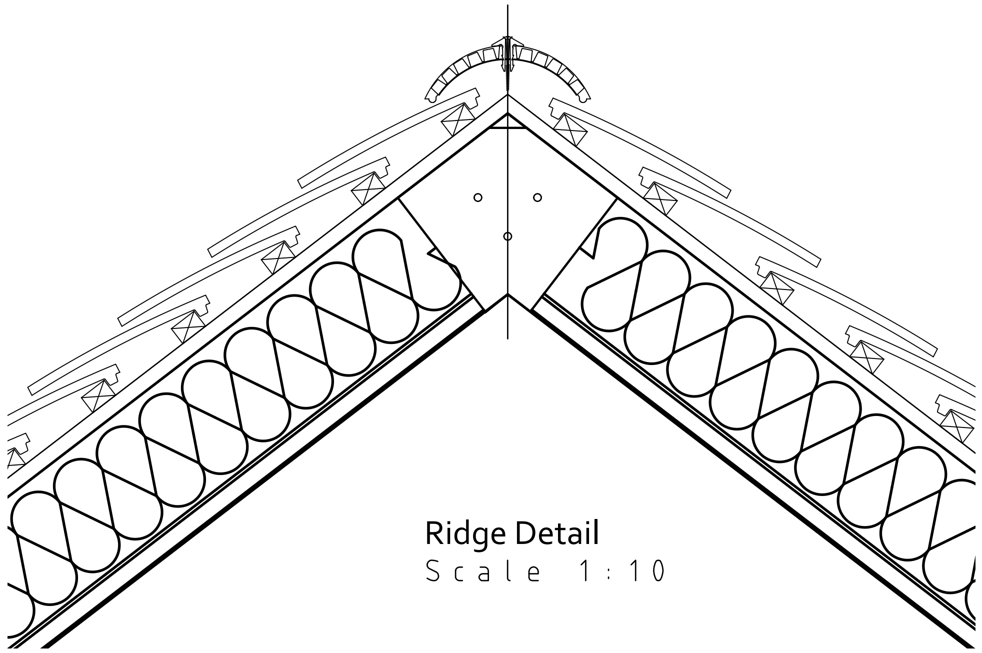
U380 Panel Layout
Scale 1:50

DESCRIPTION: The Norbury House Type (Mid Terraced)	DRAWN BY: SAB	DATE CREAT 28-03	
	SCALE: 1:100&1:50	STATUS: Prel	
	DRAWING No: NOR-01	STOCK CODE:	
MODEL NAME: / CONFIG. NAME:		SHEET 1 OF 2, SIZE	

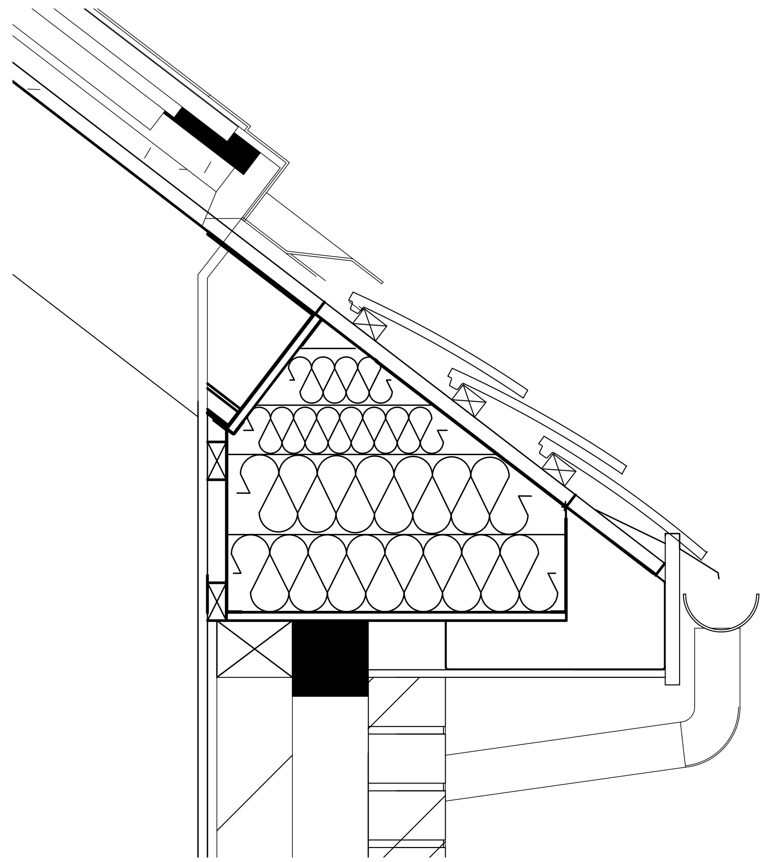
1 .3



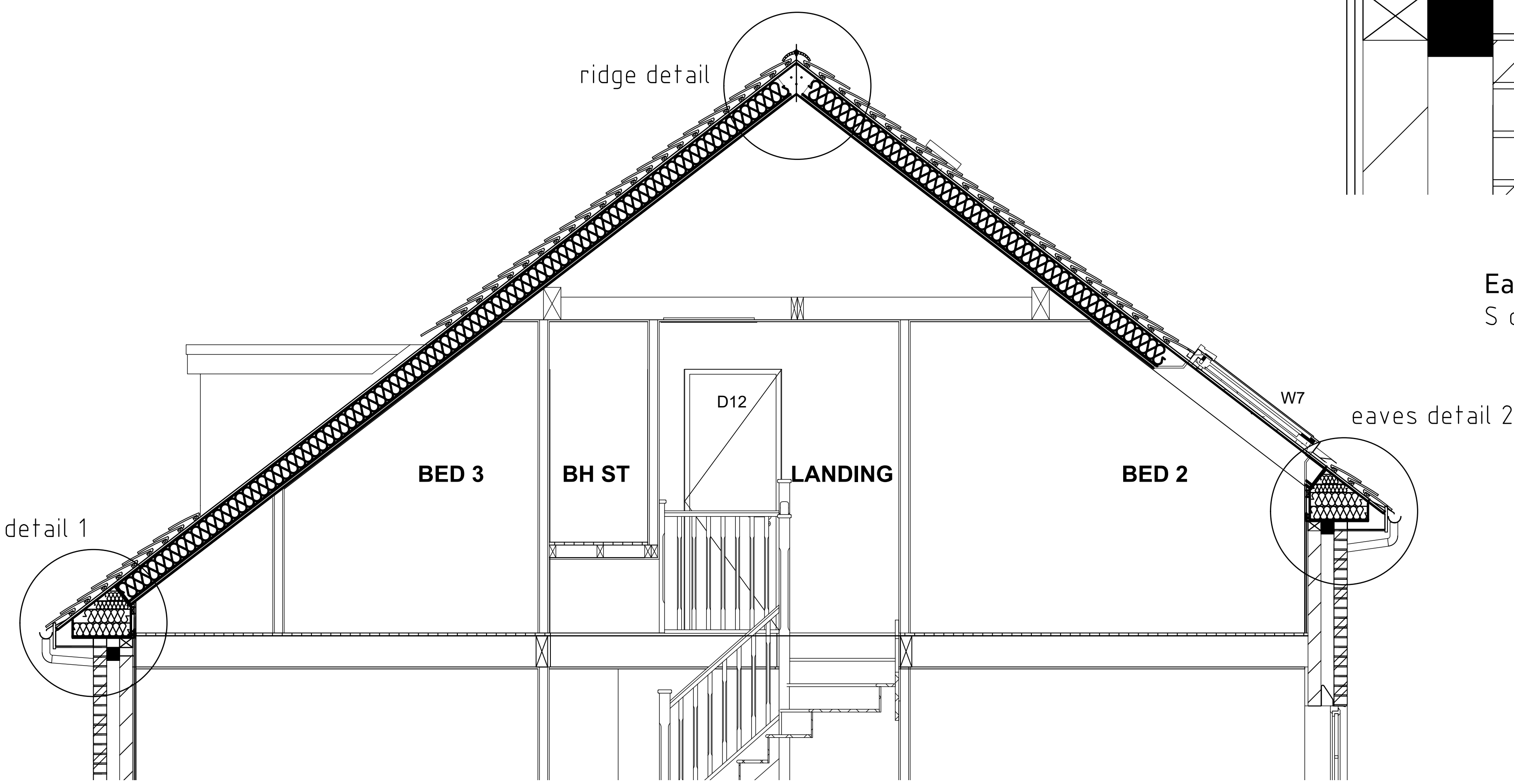
Eaves Detail 1
Scale 1:10



Ridge Detail
Scale 1:10



Eaves Detail 2
Scale 1:10



Section Detail
Scale 1:50

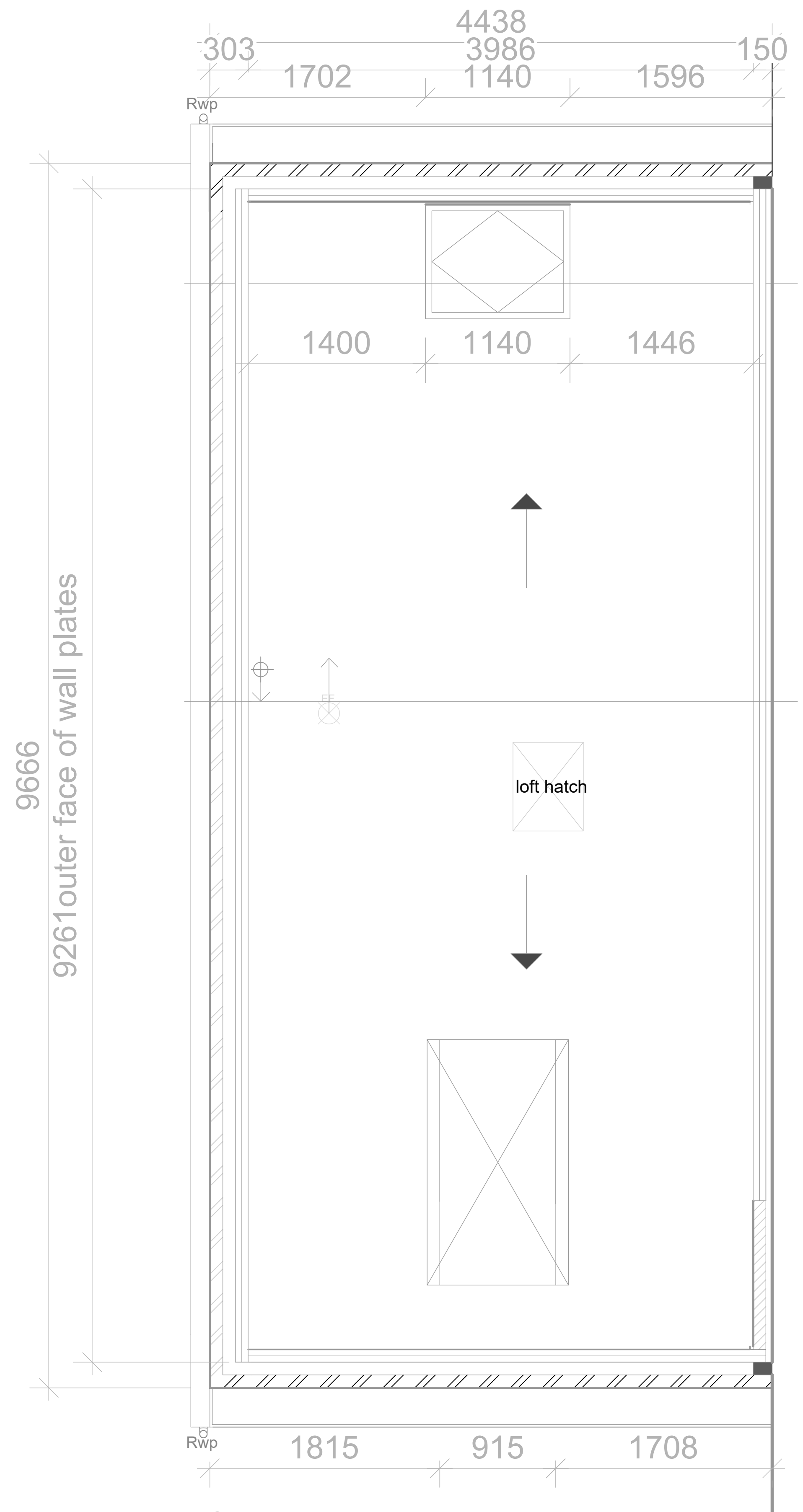
DRAWN BY: SAB	DATE CREATED: 28-03-19
SCALE: 1:10&1:50	STATUS: Prelimninary
DRAWING No: KIN-02	STOCK CODE:
REV:	

DESCRIPTION: The Kingsville House Type (semi detached))

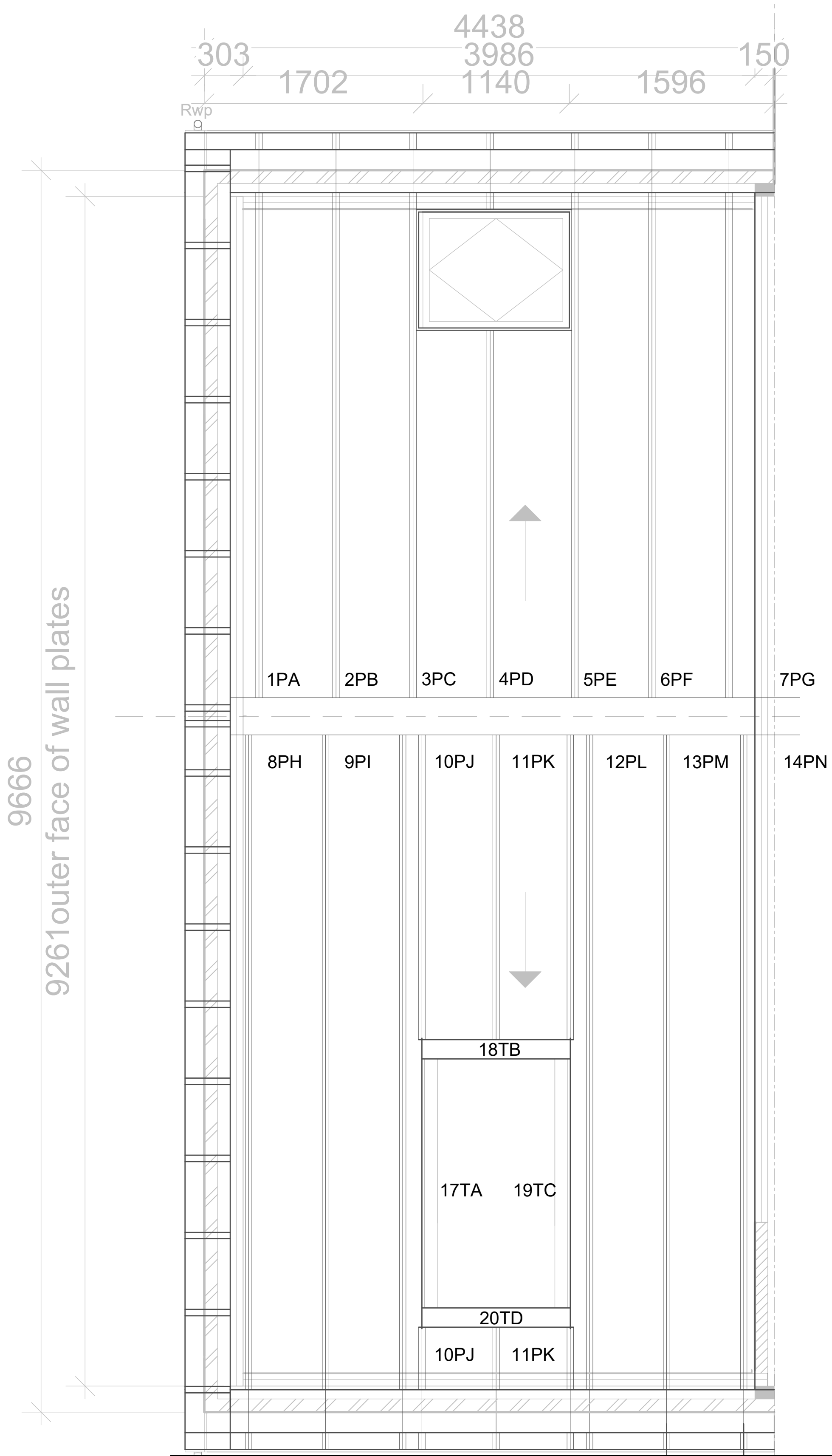
MODEL NAME: / CONFIG. NAME:

SHEET 2 OF 3, SIZE A3 08/03/2019

1 .3



Roof Layout
Scale 1:50



U380 Panel Layout
Scale 1:50

300

DRAWN BY: SAB
DATE CREATED: 28-03-19
SCALE: 1:50
STATUS: Prelimninary
DESCRIPTION: The Kingsville House Type (End Terraced)
DRAWING No: KIN-01
STOCK CODE:
REV:
MODEL NAME: / CONFIG. NAME:
SHEET 1 OF 3, SIZE A3
08/03/2019

15. RBA Acoustic Review

15.1 Assessment report

15.2 Indicative Test

Our Ref: 9670.LE01.1

16 March 2020

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Andrew Thompson
Ultraframe
Salthill Rd
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BB7 1PE

Dear Andrew

ULTRAPANEL - ROOM IN ROOF ACOUSTIC REVIEW

Please find to follow our acoustic review of the proposed room in roof system, as discussed previously.

1.0 INTRODUCTION

Ultraframe are developing a modular 'room in roof' system, with a view to being able to provide these to major housebuilders for use on large scale developments. It is understood that the roof and wall panels would typically be used in traditional cavity walled constructions, and in adjoining dwellings and so the system forming the party wall between residences will need to comply with the acoustic requirements detailed in Approved Document E to the Building Regulations.

Therefore, RBA Acoustics has been appointed to undertake a review of the proposed system and its interface detailing with regard to compliance with the relevant acoustic performance standards.

2.0 CRITERIA

2.1 Approved Document E

Approved Document E (2003 edition incorporating 2004, 2010 and 2015 amendments) to the Building Regulations details the requirements for levels of sound insulation within residential developments. These criteria are applicable to separating walls and floors between individual demises and also between demises and common parts. Therefore the sound insulation criteria to be achieved are as follows:

Separating Floors

Minimum airborne sound insulation of 45dB $D_{nT,w} + C_{tr}$. This is an on-site performance rating.

Maximum impact sound pressure level of 62dB $L'_{nT,w}$. This is an on-site performance rating.

Separating Walls

Minimum airborne sound insulation of 45dB $D_{nT,w} + C_{tr}$. This is an on-site performance rating.

In this instance, the room in roof system only forms separating walls between premises, and therefore the relevant criterion is the airborne sound insulation performance of 45dB $D_{nT,w} + C_{tr}$.

2.2 Enhanced Standard

In some instances, it may be that enhanced standards are required for specific projects. It is relatively common for housing developments to target a standard that is 5 dB better than the requirements of Approved Document E.

It is understood, based on discussions that the current target for the proposed system is to achieve a standard which is 5 dB better than the basic standards of Approved Document E, and as such the guidance in this document relates to achieving a standard of 50dB $D_{nT,w} + C_{tr}$.

3.0 PROPOSED DETAILS

The proposed partition build up, and head and base details are indicated on the following drawings:

- SD-01 dated 14/08/2019
- SD-04 dated 14/08/2019
- SD-05 dated 14/08/2019
- SD-16 dated 16/09/2019

These have been used as the basis of this review, and are indicated in Figure 1 at the end of this report.

4.0 WALL BUILD UPS

The wall build up for the room in roof system is indicated on the drawings as being the following:

- 2 layers of 15 mm Gyproc Fireline Board fixed to steel clip
- 113 mm Ultrapanel
- 100 mm cavity containing 100 mm mineral fibre insulation
- 113 mm Ultrapanel
- 2 layers of 15 mm Gyproc Fireline Board fixed to steel clip

It is understood that the two leaves of the partition are effectively independent.

This build up would be expected to be capable of meeting adopted target. This is dependent on good construction, and all junctions being appropriately detailed to control flanking sound transmission. Additionally, the two leaves of the partition should not be rigidly tied or strapped together.

5.0 INTERFACE DETAILS

5.1 Base Detail

The base detail as shown on drawing SD-04 is considered suitable acoustically. The cavity blockwork separating wall (by others, does not form part of this review) penetrates through the floor, which will control flanking sound transmission via the base. The interface between the plasterboard linings and the blockwork is appropriate acoustically, as is the detailing at the base of the Ultrapanels.

5.2 Head Detail

The head detail as shown on drawing SD-05 and the eaves detail as shown on drawing SD-01 are considered to be acceptable acoustically with respect to achieving proposed project requirements

The Ultrapanels which line the roof are broken at the partition line. In the head detail, the Fireline board penetrates through the Ultrapanels and meets the roof membrane/tiles (with a cavity barrier). In the eaves detail, the flanking sound transmission route is blocked by the solid timber end pieces.

It is critical to ensure that no plasterboard linings (or other lightweight elements) span past the end of the separating partition.

5.3 Recessed Fixtures and Fittings

The proposed detail indicates how sockets/switches will be recessed into the plasterboard lining and the detailing is considered acceptable acoustically. Where possible, back to back sockets should be avoided – they should be staggered by around 500 mm.

6.0 SUMMARY

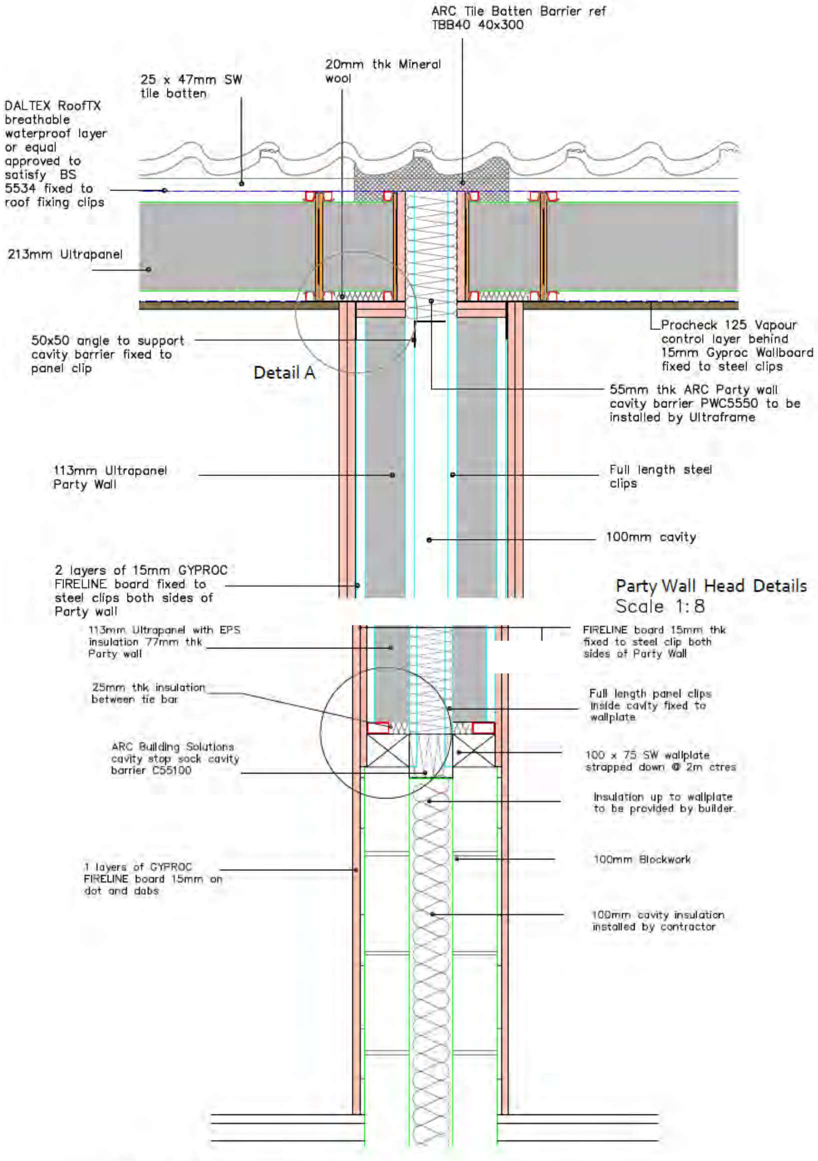
In summary, it is considered that the proposed system as it stands would meet the minimum requirements of Approved Document E, when constructed in accordance with the proposed details.

In order to achieve the proposed enhanced standard of 5 dB better than the requirements of Approved Document E, it is recommended that an additional layer of 15 mm standard plasterboard is included to the roof lining on each side of the Ultrapanel separating partition.

We trust the above is clear and of use, however, should you have any questions, please do not hesitate to contact the undersigned.

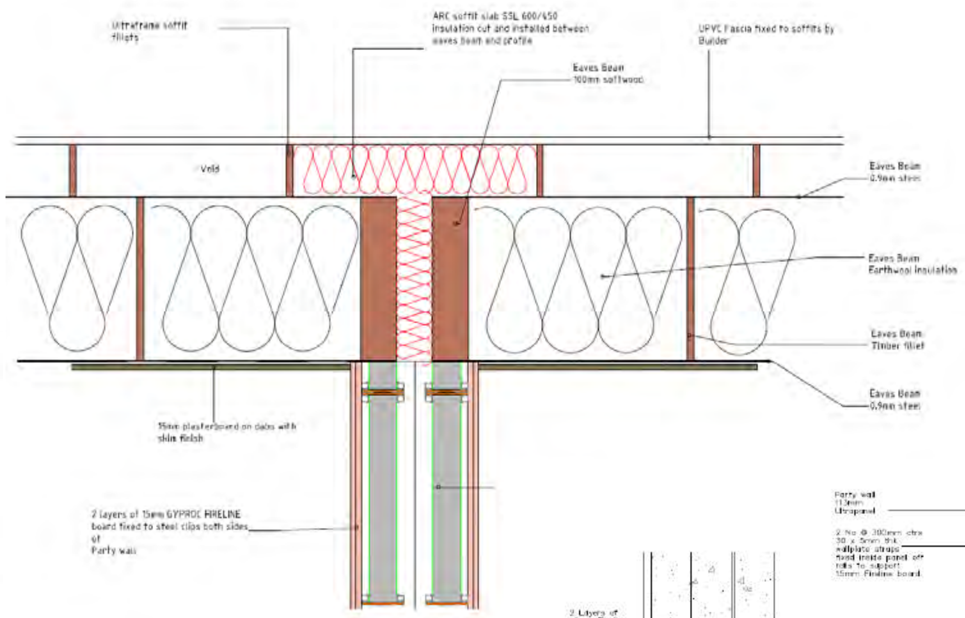
Yours sincerely,
For RBA Acoustics

Helen Sheldon

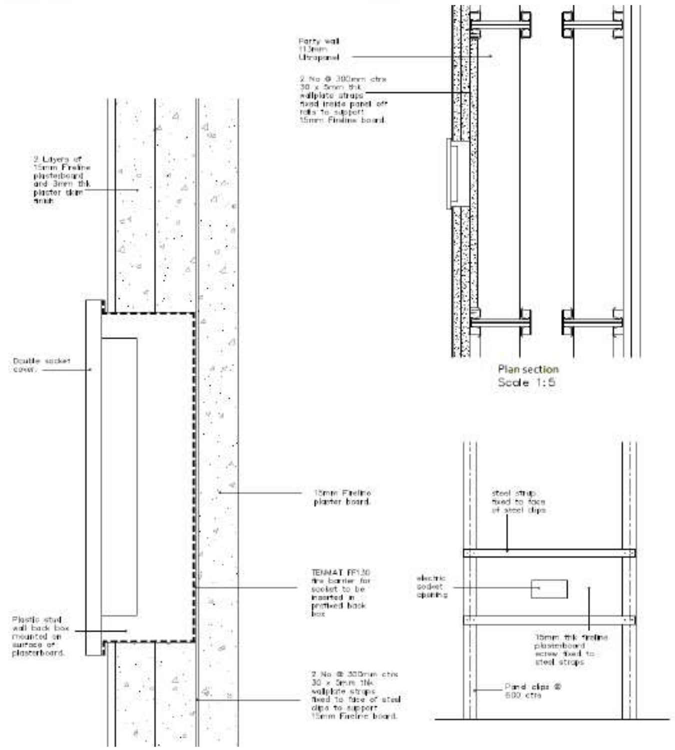


Party Wall Head Details
Scale 1:8

Party Wall Base Details
Scale 1:8



Top View of Eaves Beam



Plan section
Scale 1:5

Ultrapanel - Room in Roof
Proposed head, base, eaves, and socket details
Project 9670

Figure 1
16 March 2020
Not to Scale

ACOUSTIC TECHNICAL NOTE

Reference:	9670.ATN01.SIT.2
Revision:	1
To:	Mark Hanson & Andrew Thomson
Date:	15 December 2020
Project:	Ultraframe
Subject:	Sound Insulation Test Results

1.0 INTRODUCTION

Ultraframe are developing a modular 'room in roof' system, with a view to being able to provide these to major house builders for use on large scale developments.

Further to our acoustic reviews of the system as well as site visits, RBA have undertaken sound insulation testing of the partition formed as part of the system.

Testing has been undertaken within the Ultraframe factory where a mock-up prototype of the system has been constructed.

2.0 CRITERIA

We have previously outlined the criteria which the system desires to meet within our acoustic review report reference 9670.ATN01.IBF.0.06122019.HMS.

The purpose of this testing exercise has been to determine if the current prototype system can meet these requirements without the additional benefits of being tested within a complete constructed house.

3.0 WALL BUILD UPS

The wall build up for the room in roof system is indicated on the drawings as being the following:

- 2 layers of 15 mm Gyproc Fireline Board fixed to steel clip
- 113 mm Ultrapanel
- 100 mm cavity containing 100 mm mineral fibre insulation
- 113 mm Ultrapanel
- 2 layers of 15 mm Gyproc Fireline Board fixed to steel clip

It is understood that the two leaves of the partition are effectively independent.

It is worth noting that the source room is effectively a full installation of the proposed system, with window openings and external access blocked up with plasterboard, mineral wool, and boarding. The receiver room is effectively part of an installation, which has been enclosed using boarding for the purposes of the test.

4.0 ACOUSTIC TESTS

4.1 General

Acoustic testing of the separation wall structure at Ultraframe was undertaken on Monday 14th December 2020.

The site measurements and analyses were undertaken in general accordance with the following British Standards as required by Approved Document E of the Building Regulations:

Airborne Sound: BS EN ISO 140-4:1998 "Acoustics – Measurement of sound insulation in buildings and of building elements – Part 4: Field measurements of airborne sound insulation between rooms"

The results of the measurements have subsequently been analysed and presented in accordance with the following:

Airborne Sound: BS EN ISO 717-1:1997 "Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation"

All the procedures in Annex B of Approved Document E of the Building Regulations have been followed and carried out in full accordance with ISO 140-4 and/or ISO 140-7.

4.2 Instrumentation

The following equipment was used for the measurements:

<table>
<tr><th rowspan="2">Manufacturer</th><th rowspan="2">Model Type</th><th rowspan="2">Serial No.</th><th colspan="2">Calibration</th></tr>
<tr><th>Certificate No.</th><th>Valid Until</th></tr>
<tr><td>Norsonic Type 1 Sound Level Meter</td><td>Nor140</td><td>1406007</td><td rowspan="2">U35075</td><td rowspan="2">29 June 2022</td></tr>
<tr><td>Norsonic Pre Amplifier</td><td>1209</td><td>20043</td></tr>
<tr><td>Norsonic ½" Microphone</td><td>1225</td><td>208146</td><td>35074</td><td>29 June 2022</td></tr>
<tr><td>Norsonic Sound Calibrator</td><td>1251</td><td>34127</td><td>U35073</td><td>29 June 2022</td></tr>
<tr><td>Norsonic Type 1 Sound Level Meter</td><td>Nor140</td><td>1406407</td><td rowspan="2">U26539</td><td rowspan="2">20 September 2021</td></tr>
<tr><td>Norsonic Pre Amplifier</td><td>1209</td><td>20688</td></tr>
<tr><td>Norsonic ½" Microphone</td><td>1225</td><td>226839</td><td>26538</td><td>20 September 2021</td></tr>
<tr><td>Norsonic Sound Calibrator</td><td>1251</td><td>34482</td><td>U26537</td><td>20 September 2021</td></tr>
</table>

The equipment was calibrated prior to and on completion of the testing.

No significant calibration drifts were observed.

4.3 Airborne Sound Insulation Test Method

The airborne sound insulation test method used was undertaken in accordance with the *Test Procedure (airborne) 2* as detailed in the ANC Practice Guidance for sound insulation testing in dwellings (2018).

The airborne sound insulation performance of the structures was determined by generating a broadband, random diffuse sound field in the source room and measuring the spatially averaged 1/3 octave band sound pressure levels in both the source and receive areas. The receive room levels were corrected for background noise in accordance with the procedure detailed in BS EN ISO 140-4 and then subtracted from the source levels to determine the level difference, *D*, over the frequency range 100-3150 Hz. These 1/3 octave band values were then standardised to a reference of 0.5 seconds using the measured reverberation time of the receive room.

For each test two separate source positions were used and spatially averaged noise levels within both the source and receive room were measured by means of a moving microphone over a sample period of 30 seconds for each source position. A single background noise level was measured in the receive room using the same procedure.

Reverberant decays were also recorded in the receive room using the interrupted noise method, with the sound source at a single position, to determine the reverberation times, *T*, over the same frequency range. Six decays in total were recorded at three different positions within the receive room and subsequently averaged.

The 1/3 octave band results were then compared with a standard curve, using the method described in BS EN ISO 717-1: 1997 to determine the single-figure descriptor of airborne sound insulation, the Weighted Standardised Level Difference, $D_{nT,w}$, and the spectrum adaptation term, C_{tr}.

5.0 MEASUREMENTS AND RESULTS

Measurements were undertaken between two adjacent spaces either side of the partition:

Table 2 – Separating Wall Measurement Room Details (Airborne)

Test	Test Type	Source Room	Receive Room	Structure Tested
		Vol (m³)	Vol (m³)	
1	Airborne	99	98	Wall

The results of the airborne sound insulation measurement made are presented on the attached Figure 1.

For summary purposes the single figure $D_{nT,w}$ + C_{tr} value is given below:

Table 5 – Separating Wall Airborne Sound Insulation

Test	$D_{nT,w}$ + C_{tr} (dB)	Minimum Requirement (Approved Doc E)	Comment
1	45*	45	Pass

* Results at the limit of measurement, i.e. limited by high background noise levels on site. The actual performance of the structure may be greater than that measured and shown in the attached graph.

As above the tested partition has met the minimum requirements of Approved Document E.

6.0 DISCUSSION

6.1 Results

Analysis of the results shows that the performance of the tested partition reaches the minimum requirement of Approved Document E for new build homes. However, there is still a shortfall on the desired +5dB performance.

There are a number of areas of weakness that would not be expected to be an issue when installed on-site. These include:

- Lack of ceiling installed to receive room
- Plasterboard linings not installed to all external walls
- Flanking noise through doors and incomplete external walls
- Mock-up roof only tiled to one side

We would expect an uplift in performance when installed and complete on site, however it is not possible to give an exact figure on the level of performance increase.

6.2 Change to Wall Detail

It is understood that alternative solutions are also being considered. The first option would be changing the Ultrapanel which is currently formed of EPS insulation, to a dense rockwool batt.

In reality, the alternative rockwool batt is likely to offer better sound insulation and we would therefore expect this to improve the performance of the wall build-up.

The other alternative would be to include two layers of 15mm Fireline to the inner face of each leaf. The 100mm cavity previously fully filled with Earthwool will now become a 40mm cavity but still filled with 40mm Earthwool Loftroll.

Should these changes be progressed, we would not expect the acoustic performance to be reduced. In both cases, the acoustic performance would be expected to improve slightly.

7.0 CONCLUSION

RBA Acoustics have undertaken sound insulation testing of the separating wall structure at Ultraframe. As discussed, the current wall build up has met the minimum requirements of ADE in a factory mock-up.

Going forward we expect that the acoustic performance of the wall will improve under fully completed conditions. In addition to this a change to either of the alternative options are expected to marginally increase the acoustic separation provided by the partition.

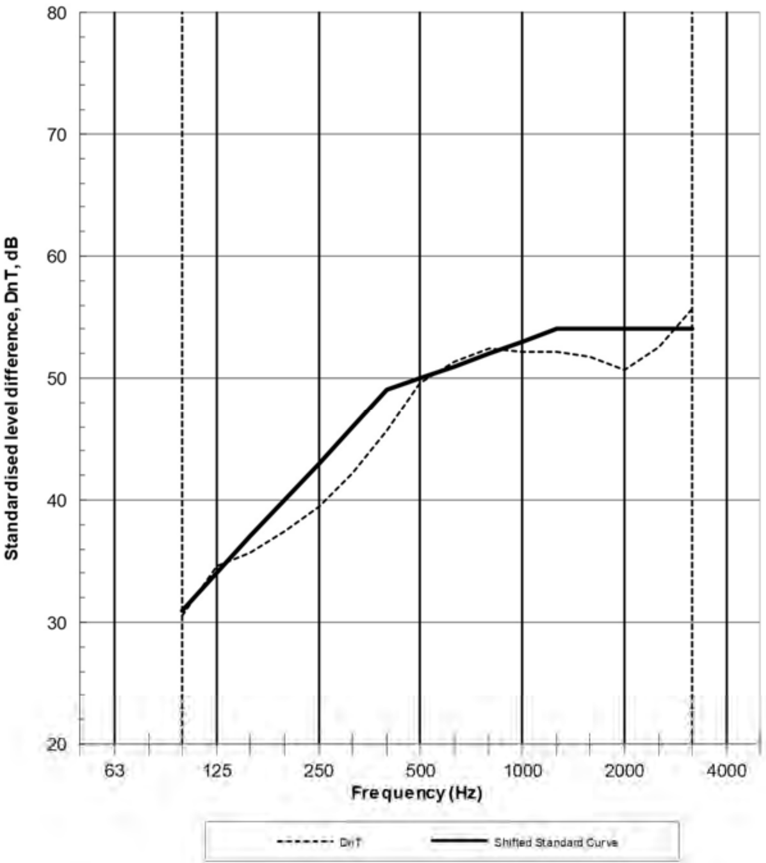
AIRBORNE SOUND INSUALTION TEST CERTIFICATE

Ultraframe
Source Room to Receive Room

Standardised Level Difference According to ISO 140-4
Field Measurement of Airborne Sound Insulation Between Rooms

Construction Under Test: **2 layers of 15 mm Gyproc Fireline Board fixed to steel clip; 113 mm Ultrapanel ; 100 mm cavity containing 100 mm EPS insulation; 113 mm Ultrapanel; 2 layers of 15 mm Gyproc Fireline Board fixed to steel clip**

Frequency f (Hz)	D_{nT} (dB)	
50		
63		
80		
100	30.5	
125	34.6	
160	35.7	
200	37.4	
250	39.5	
315	42.1	
400	45.6	
500	49.6	
630	51.4	
800	52.4	
1000	52.2	
1250	52.1	
1600	51.7	
2000	≥50.6	*
2500	≥52.5	*
3150	≥55.7	*
4000		
5000		



* Performance limited
by background noise level

Rating according to BS EN ISO 717-1: $D_{nT,w}$ $(C; C_{tr})$ = 50 (-2; -5) dB

Evaluation based on field measurement results obtained in one-third-octave bands by an engineering method

Test undertaken by:

Source Room Volume: 99 m^3

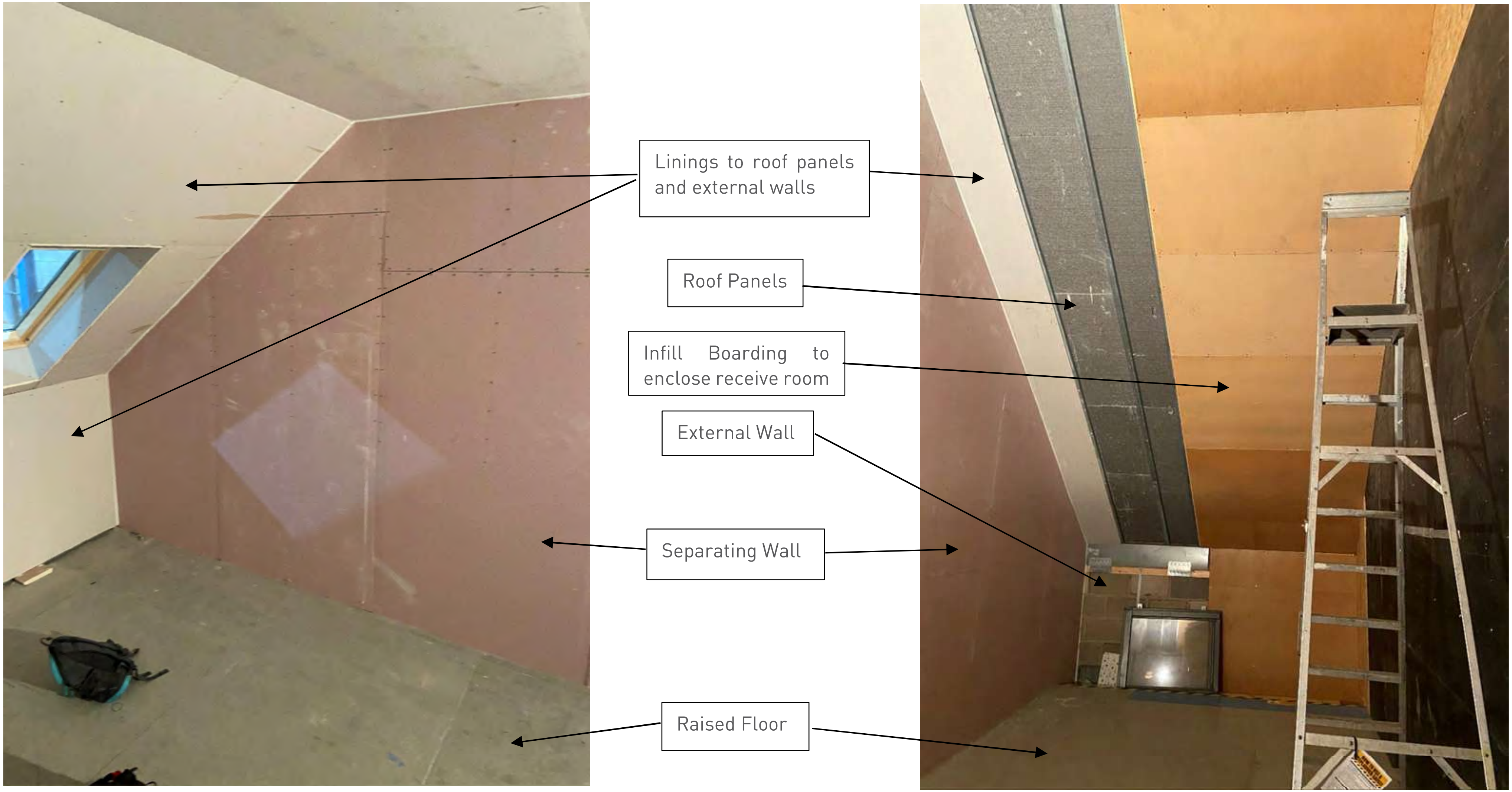
Receiving Room Volume: 98 m^3

Client: Ultraframe
Test Date: 14/12/2020
RBA Acoustics

Project 9670
Figure 1

SOURCE ROOM

RECEIVER ROOM



Ultraframe
Source and Receive Rooms
Project 9670

Figure 1
15 December 2020
Not to Scale

16. Siniat Multi purpose Panel

16.1 Declaration of Performance

16.2 BBA cover sheet

DECLARATION OF PERFORMANCE
Siniat MultiPurpose Panel

No. UKSI-0184-001

1. Unique identification code of the product-type:
Siniat MultiPurpose Panel

2. Intended use/s:
Internal use (ETAG 018-4 type Z_2); Internal use high humidity (ETAG 018-4 type Z_1); External semi-exposed use (ETAG 018-4 type Y)

3. Manufacturer:
Siniat, Etex Building Performance Limited, Marsh Lane, Easton-in-Gordano, Bristol, BS20 0NE, UK

4. Not applicable

5. System/s of AVCP: **System 1**

6a. Not applicable

6b. European Assessment Document: **ETAG 018-4**
European Technical Assessment: **ETA 17/0171** Technical Assessment Body: **UBAtc** Notified body: **1121**

7. Declared performance/s:

Essential Characteristics	Performance	Harmonised Technical Specification
BWR1 Mechanical resistance and stability:	Not applicable	ETAG 018-4:2004
BWR2 Safety in the case of fire:		
Reaction to fire	A1	
Resistance to fire	See ETA 17/0171 Annex 2	
BWR3 Hygiene, health and the environment:		
Water impermeability	Pass	
Release of dangerous substances	Declaration	
Release of formaldehyde	No formaldehyde containing components	
BWR4 Safety and accessibility in use:		
Flexural strength	MOR ≥ 4.5 MPa (95% confidence level)	
Dimensional stability	Dimensionally stable	
Resistance to impact and eccentric load	NPD	
BWR5 Protection against noise:		
Airborne sound insulation	NPD	
Sound absorption	NPD	
Impact sound insulation	NPD	
BR6 Energy economy and heat retention:		
Thermal conductivity	NPD	
Water vapour permeability	NPD	
Durability and serviceability:		
Resistance to deterioration caused by water:	Pass	
Resistance to soak/dry	Pass	
Resistance to freeze/thaw	Pass	
Resistance to heat/rain	NPD	
Basic durability assessment	Working life ≥ 25 years for uses Z_2, Z_1 and Y	

ETEX BUILDING PERFORMANCE LIMITED
Gordano House, Marsh Lane, Easton-in-Gordano, Bristol, BS20 0NE
Technical Services | T: +44 (0)800 145 6033 or +44 (0)1275 377 789
E: technical.siniat@etexbp.co.uk
www.siniat.co.uk

DECLARATION OF PERFORMANCE

Siniat MultiPurpose Panel

8. Appropriate Technical Documentation and/or Specific Technical Documentation: n/a

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Signed for and on behalf of Etex Building Performance Limited by:
Nigel Morrey, Technical Director
Bristol, UK, 01/06/2017

www.siniat.co.uk

ETEX BUILDING PERFORMANCE LIMITED
Gordano House, Marsh Lane, Easton-in-Gordano, Bristol, BS20 0NE
Technical Services | T: +44 (0)800 145 6033 or +44 (0)1275 377 789
E: technical.siniat@etexbp.co.uk
www.siniat.co.uk

Etex Building Performance Limited
Marsh Lane
Easton-in-Gardano
Bristol BS20 0NE

Tel: 01275 37773 Fax: 01275 37773
e-mail: technical.services@siniat.co.uk
website: www.siniat.co.uk

APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

Agrément Certificate
16/5371
Product Sheet 1

SINIAT BUILDING BOARDS

SINIAT MULTIPURPOSE PANELS

This Agrément Certificate Product Sheet(1) relates to Siniat Multipurpose Panels, fibre-reinforced, calcium silicate flat sheets for use as general-purpose building boards for internal and semi-exposed locations. The boards are non-combustible and can be used to provide up to 30 minutes' fire resistance, depending upon the application.

(1) Hereinafter referred to as 'Certificate'.

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

Strength — the products have sufficient strength to resist the loads likely to be encountered in service (see section 6).

Performance in relation to fire — the products are non-combustible as described in the relevant national Building Regulations and achieve the requirements for a Class 0 or 'low risk' surface, and are therefore unrestricted by the various Regulations (see section 11).

Durability — under normal internal environmental conditions or in semi-exposed locations the products will provide a service life in excess of 30 years (see section 16).

The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 26 April 2017

	John Albon – Head of Approvals Construction Products	Claire Curtis-Thomas Chief Executive

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 are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

British Board of Agrément
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Herts WD25 9BA

tel: 01923 665300
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clientservices@bba.star.co.uk
www.bbacerts.co.uk

17. Typical chimney fixing details

17.1 Masonry Solutions site guide

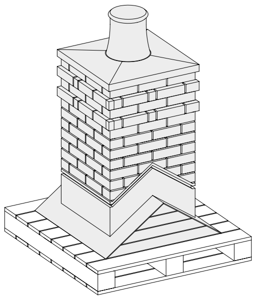
SITE GUIDE

CHIMNEYS

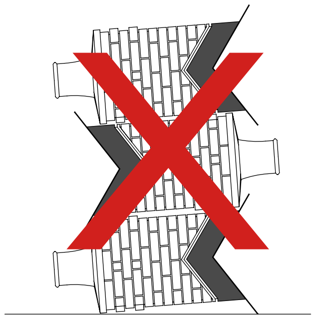
masonry solutions

GRP for the built environment

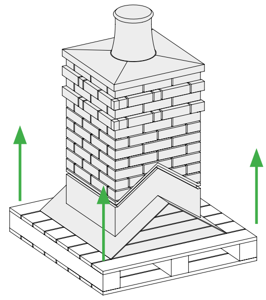
CHIMNEYS
STORAGE & HANDLING



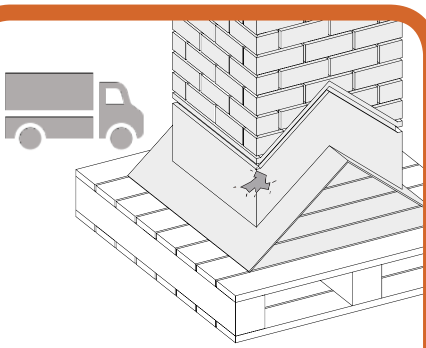
Products are delivered on a pallet and shrink wrapped



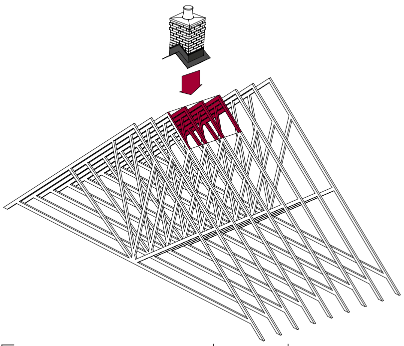
Do not stack products



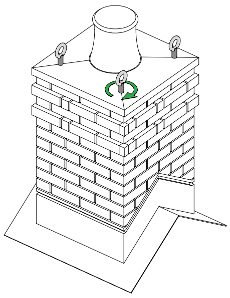
Lift and support products with an evenly distributed force



Report damage at point of delivery



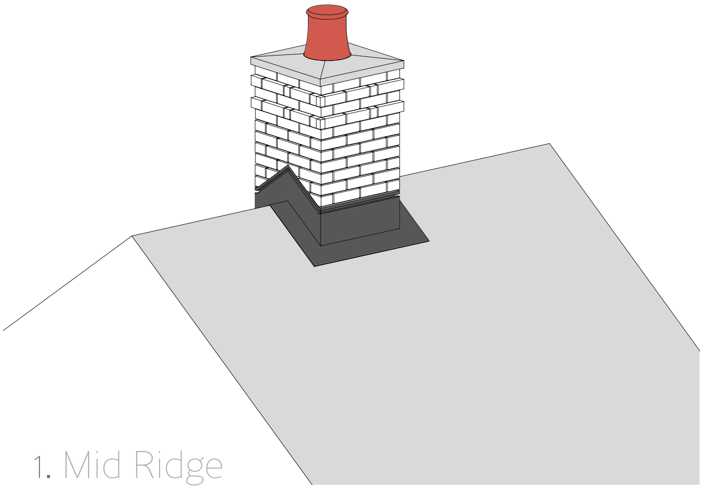
Ensure trusses have been designed to take chimney



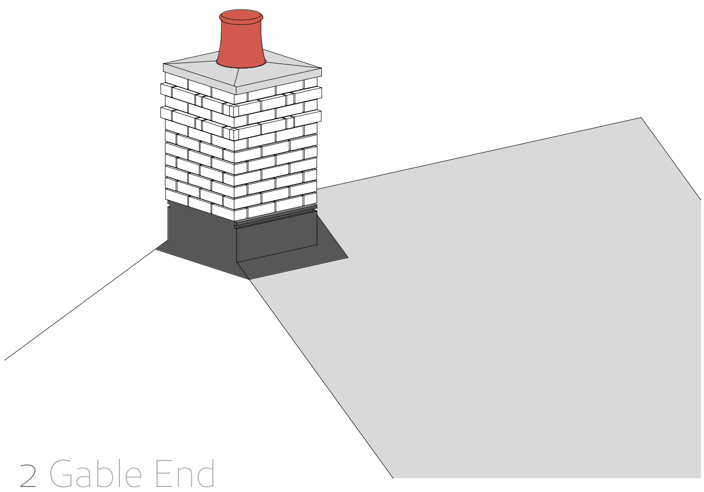
Ensure lifting eyes are secured tightly

CHIMNEYS

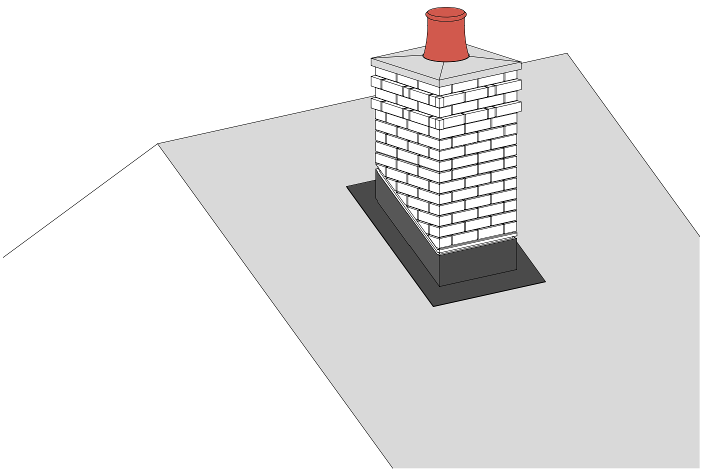
CHIMNEY LOCATIONS



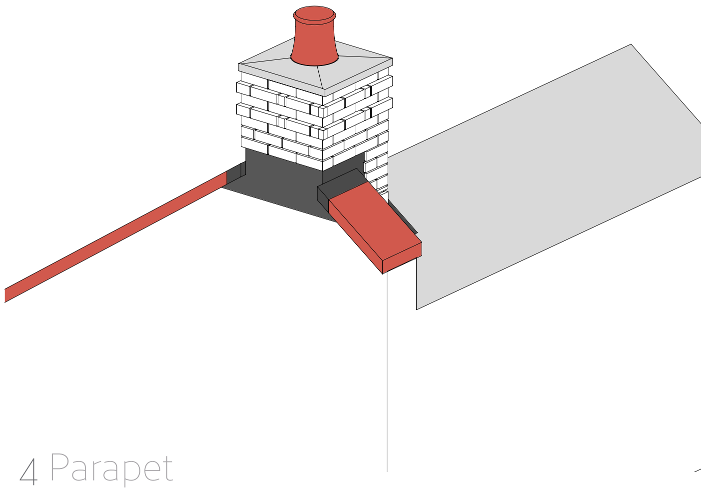
1. Mid Ridge



2 Gable End



3 Mono Pitch

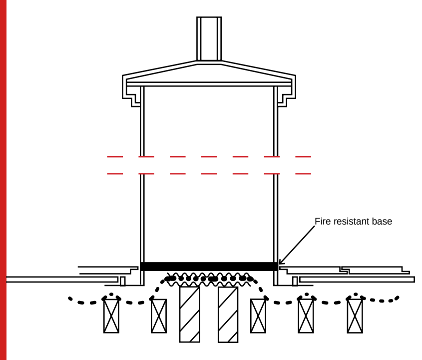


4 Parapet

NHBC GUIDANCE

Fire protection at the junction of a separating wall to a pitched roof is usually achieved by the provision of mineral quilt to fill any gaps between the wall, roof underlay and roof covering, across the full width of the wall. Where a dummy chimney sits over a party wall, it is essential that the fire protection is not compromised.

To prevent the spread of fire, the dummy chimney should be provided with a fire resistant base so as to achieve the required fire protection.
Any gaps between the base of the chimney and the top of the separating wall should be filled with a non-combustible material in a similar manner to the fire stopping provided between the party wall and roof covering.

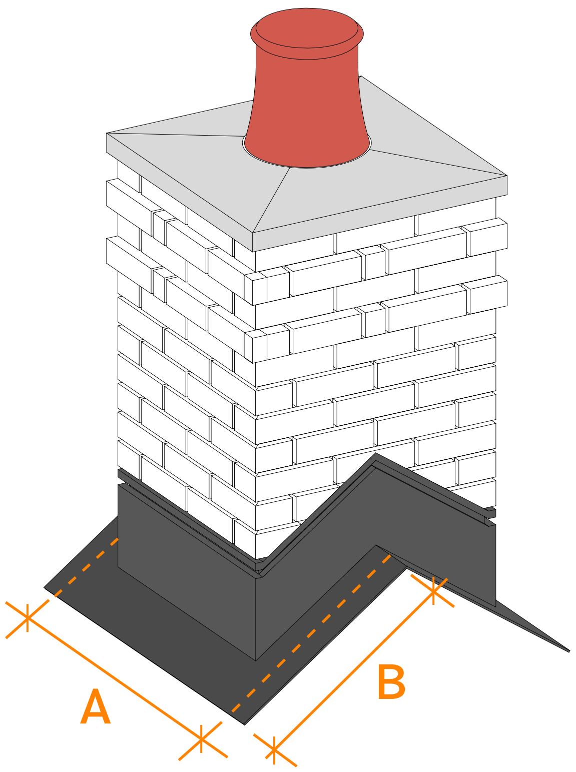


SECTION THROUGH PARTY WALL

FOR TECHNICAL ADVICE CALL
01827 250236

CHIMNEYS
PRE INSTALLATION

THE CHIMNEY MUST BE INSTALLED BY A COMPETENT INSTALLER.

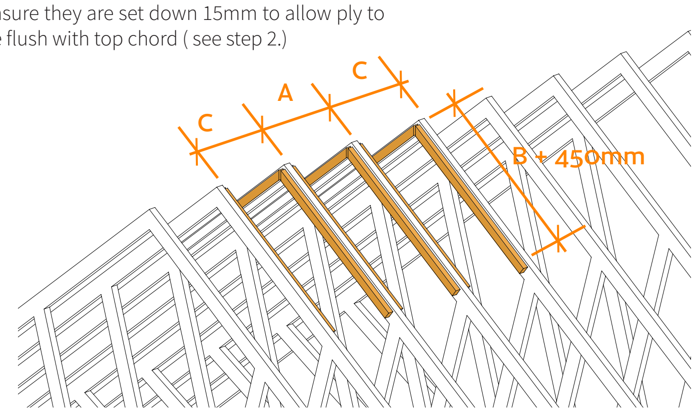


DIMENSIONS	DESCRIPTION
A	Width between centres of fixing channel
B	Length of Chimney Skirt
C	Extend to next truss ensuring minimum increase of Dimension A + 450mm

Masonry Solutions Chimneys are designed to suit various roof designs both apex and mono pitch and it is important that the roof trusses have been designed to take the load and position of the chimney at design stage, please check with the truss supplier before installing your chimney.

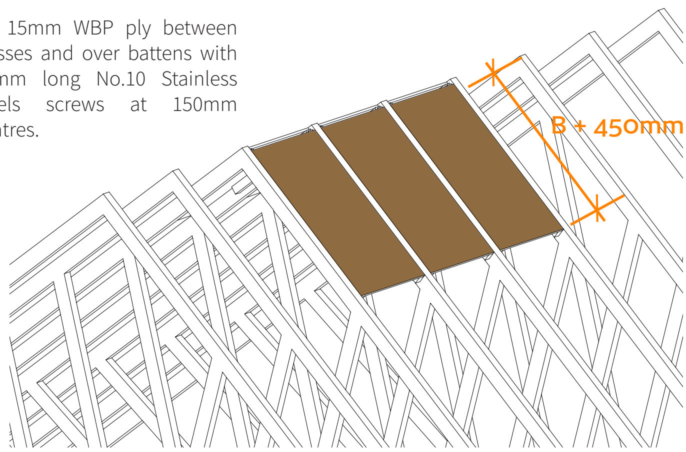
For mono pitch roof designs additional fixing assemblies might be required so please consult your project specific drawings.

Fix 50x38 support battens to internal face of trusses with 75mm nails at 150mm centres. Ensure they are set down 15mm to allow ply to be flush with top chord (see step 2.)



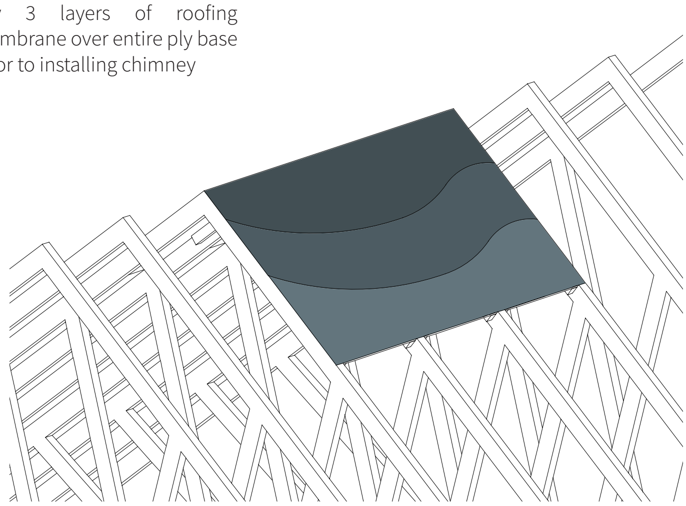
1 Install battens

Fix 15mm WBP ply between trusses and over battens with 38mm long No.10 Stainless steels screws at 150mm centres.



2 Install ply would sheathing

Lay 3 layers of roofing membrane over entire ply base prior to installing chimney



3 Lay roofing membrane

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01827 250236

CHIMNEYS
MID RIDGE CHIMNEY

PREPARATION

Brick slip chimneys should be pointed on the ground prior to installation as close to the plot as possible. The mortar used must include a waterproofing admixture and bucket handle profile should be achieved.

GRP BRICK EFFECT CHIMNEYS DO NOT NEED POINTING AS THIS EFFECT IS ACHIEVED IN THE FACTORY.

LIFTING

The chimneys come fixed to the pallet they are delivered on so remove any fixings prior to lifting. Remove the plastic plugs from the lifting threads and insert the lifting eyes supplied ensuring they are tightly fitted. Crane the chimney into position in accordance with the site agreed lift plan and under the supervision of a competent person.

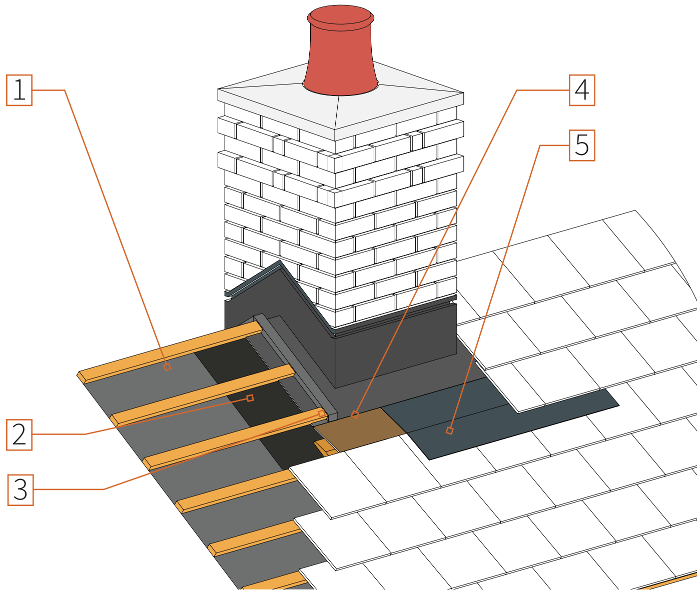
FIXING

When in position locate the centres of the trusses under the fixing plate and pre drill the fixing plate at 150mm centres. Screw directly into the trusses with the fixings and washers provided.

Once fixed , remove the loops and reinsert the plastic plugs applying a liberal amount of sealant around the plug to form a waterproof seal.

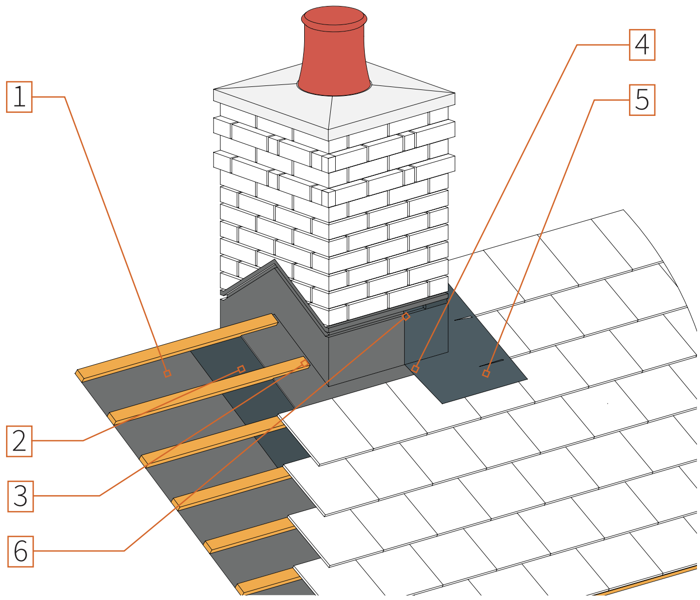
TILING - GRP BRICK EFFECT CHIMNEYS

Ensure roofing membrane (1) is dressed under the perimeter of the chimney underlay (2). Fix battens up to the vertical side of the weather bar (3) on the chimneys saddle, ensure any battens fixed through the saddle are screw fixed and not nailed to prevent cracking of the GRP saddle.
Fix ply lead support tray (4) under bottom flange of chimney. Ensure lead flashing would be supported continuously to first tile to prevent any ponding.
Ensure lead flashing is rolled back to provide clear working area and tile roof to correct specification leaving a 15mm gap to vertical sides of chimney. Dress lead over tiles (5) and ensure fully supported to prevent any ponding.



TILING - BRICK SLIP CHIMNEYS

Ensure roofing membrane (1) is dressed under the perimeter of the chimney underlay (2). Fix battens up to the vertical side of the chimney (3) over the chimneys saddle, ensure any battens fixed through the saddle are screw fixed and not nailed to prevent cracking of the GRP saddle.
To prevent any ponding ensure tiles are close to face of chimney, if coursing prevents this fit a lead support tray (4).
Tile roof to correct specification and zonal fixing method (5).
Apply 15mm bead of polyurethane sealant to entire flashing channel (6). Code 4 lead must then be dressed into full depth of channel and wedged into place prior to sealant curing.
Once lead is in position the remainder of the channel must have sealant applied to allow a flush finish with brick slips.



CHIMNEYS
MONO PITCH CHIMNEY

PREPARATION

Brick slip chimneys should be pointed on the ground prior to installation as close to the plot as possible. The mortar used must include a waterproofing admixture and bucket handle profile should be achieved.

The chimneys must be located as per the project engineers design and fully supported by the trusses. Mono pitch chimneys need to be supported over a timber/steel support platform (supplied and designed by others).

LIFTING

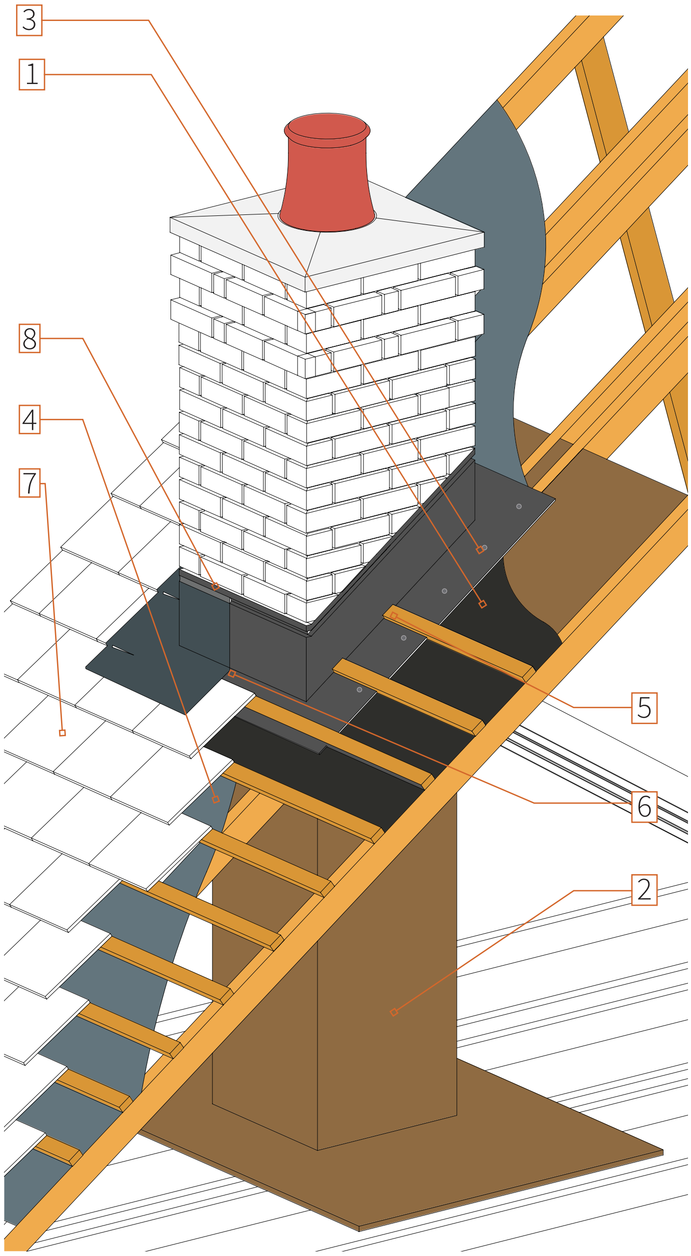
The chimneys come fixed to the pallet they are delivered on so remove any fixings prior to lifting. Remove the plastic plugs from the lifting threads and insert the lifting eyes supplied ensuring they are tightly fitted. Crane the chimney into position over the support platform in accordance with the site agreed lift plan and under the supervision of a competent person.

Prior to lifting ensure that three layers of membrane cover the lifting platform and extend 450mm past extent of chimney saddle(**1**).

FIXING

In general mono pitch chimneys require a support platform (**2**) to take and support the weight and load of the chimney so must be designed and fixed appropriately. IT IS THE RESPONSIBILITY OF THE PROJECT STRUCTURAL ENGINEER TO CONFIRM WHETHER THIS IS REQUIRED AND DESIGN ACCORDINGLY>

Once the chimney is in position locate the centres of the trusses below the fixing plate and pre drill the fixing plate at 150mm centres. Screw directly into the trusses with the fixings and washers provided (**3**).



TILING

Ensure roofing membrane (**4**) is dressed under the perimeter of the chimney underlay at base and sides and laps over it at the head (**1**). Fix battens up to the vertical side of the chimney (**5**) over the chimneys saddle, ensure any battens fixed through the saddle are screw fixed and not nailed to prevent cracking of the GRP saddle.
To prevent any ponding ensure tiles are close to face of chimney, if coursing prevents this fit a lead support tray (**6**).
Tile roof to correct specification and zonal fixing method (**7**).
Apply 15mm bead of polyurethane sealant to entire flashing channel (**8**). Code 4 lead must then be dressed into full depth of channel and wedged into place prior to sealant curing. Once lead is in position the remainder of the channel must have sealant applied to allow a flush finish with brick slips.

CHIMNEYS
GABLE END CHIMNEY

PREPARATION

Brick slip chimneys should be pointed on the ground prior to installation as close to the plot as possible. The mortar used must include a waterproofing admixture and bucket handle profile should be achieved.

Gable end chimneys must be located as per the project engineers design and fully supported by atleast 3 trusses. *Ensure the gable support straps are correctly fixed and aligned in accordance with the brick coursing.*

LIFTING

The chimneys come fixed to the pallet they are delivered on so remove any fixings prior to lifting. Remove the plastic plugs from the lifting threads and insert the lifting eyes supplied ensuring they are tightly fitted. Crane the chimney into position over the support platform in accordance with the site agreed lift plan and under the supervision of a competent person.

Prior to lifting ensure that three layers of membrane cover the lifting platform and extend 450mm past extent of chimney saddle.

FIXING

In general Gable End chimneys are supported by a minimum of 3 trusses with the gable end supported by building in the straps to the brick work and ensuring bricks finish flush with the u/s of the chimney frame.

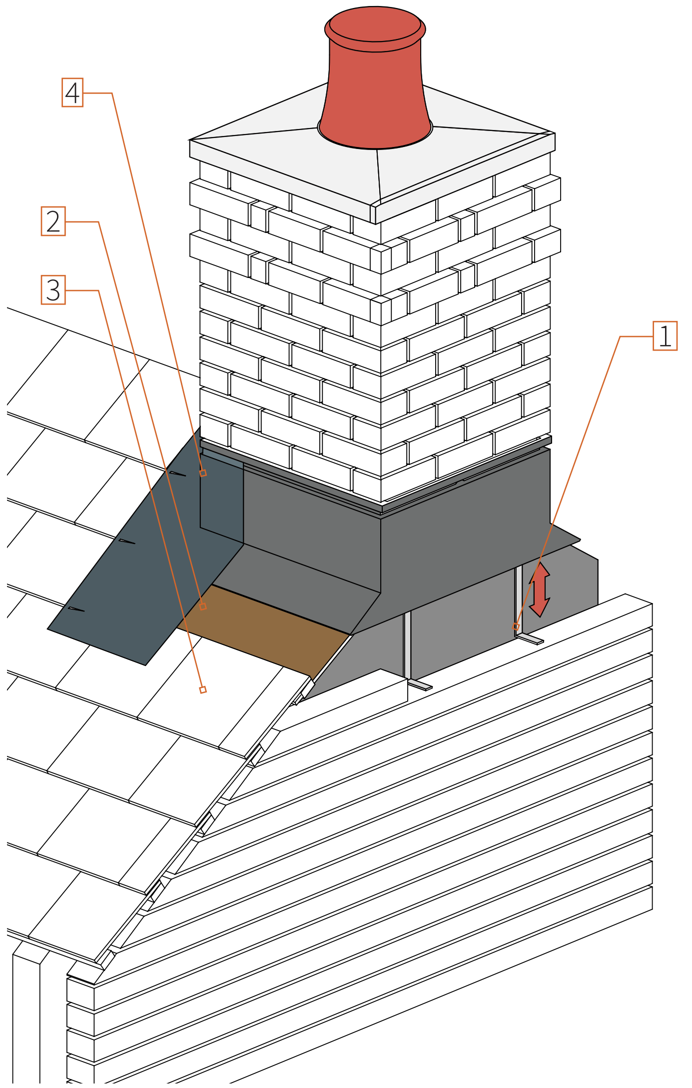
Once the chimney is in position locate the centres of the trusses below the fixing plate and pre drill the fixing plate at 150mm centres. Screw directly into the trusses with the fixings and washers provided.

Ensure the gable support straps are adjusted and fixed to suit the top coursing of the brick work and bedded in (1).

TILING

Ensure roofing membrane is dressed under the perimeter of the chimney underlay at base and sides. Fix battens up to the vertical side of the chimney over the chimneys saddle, ensure any battens fixed through the saddle are screw fixed and not nailed to prevent cracking of the GRP saddle.
To prevent any ponding ensure tiles are close to face of chimney, if coursing prevents this fit a lead support tray (2).
Tile roof to correct specification and zonal fixing method (3).
Apply 15mm bead of polyurethane sealant to entire flashing channel (4). Code 4 lead must then be dressed into full depth of channel and wedged into place prior to sealant curing. Once lead is in position the remainder of the channel must have sealant applied to allow a flush finish with brick slips.

Ensure the lead is dressed into the brickwork to provide a water tight seal at the gable interaction.



18. Installation Guide

18.1 Version 5   1/12/20

Ultrapanel®
Building Technologies

Standard details and installation manual

Ultrapanel® Roofing System Transforming 'Room In The Roof' Engineering

1/12/20_v5

Introduction

Ultrapanel
Building Technologies

Ultrapanel roofing system has been developed to create 'room in roof' constructions speedily and safely. Fabricated off site and then 'flat packed' ready for on site installation, it guarantees an engineered high quality install, ready to receive battens and tiles externally and plasterboard internally. Ultrapanel includes spandrel panels and party wall constructions (on appropriate house types)

This guide explains the responsibilities of the housebuilder and defines what Ultrapanel includes and how other trades work up to and around the roof/spandrel to create an effective 'room in roof' construction.

Contents

Health and safety

Site safety is paramount. The Construction (Design & Management) Regulations 2015 apply to the whole construction process, on all construction projects from concept through to completion. Compliance is required to ensure construction projects are carried out in a way that secures health and safety. The installation company shall be responsible for the safety of all of the fitting team, the customer and other trades.

The Ultrpanel Contracts Manager will carry out a written risk assessment and method statement (RAMS) to reduce risk on site and this should have been discussed with all stakeholders prior to starting.

Please use safe working platforms/ scaffolding and ladders that comply with BS EN 131. Always use equipment in line with manufacturers recommendations. Personal Protective Equipment – appropriate to the task, should be used all times.

The Ultrapanel roofing system comprises an insulated box beam, propped roof panels and ridge section with spandrel/party wall solutions. Further system options include preparation for GRP dormers, roof windows and valleys.

Site process

The Ultrapanel Contracts Manager Simon Tennant (pictured) or one of the team will;

- At the start of a new site, ensure the site manager and their team are fully conversant with the system prior to any installation on site
- Draft and gain agreement on RAMS
- Prior to installation of individual plots, liaise with the site manager that the wall plate is fitted within tolerance (see page 5), strapped in accordance with NHBC Standards and cavity stop socks have been fitted
- Ensures on the day of completion stage photos are taken to show cavity stop socks in the roof/party walls/Spandrels are fitted in accordance with agreed specification.

To discuss any aspect of the site process then please contact Simon Tennant, Ultrapanel Contracts Manager
07765 252928 | simon.tennant@Ultraframe.co.uk

Ultrapanel
Building Technologies

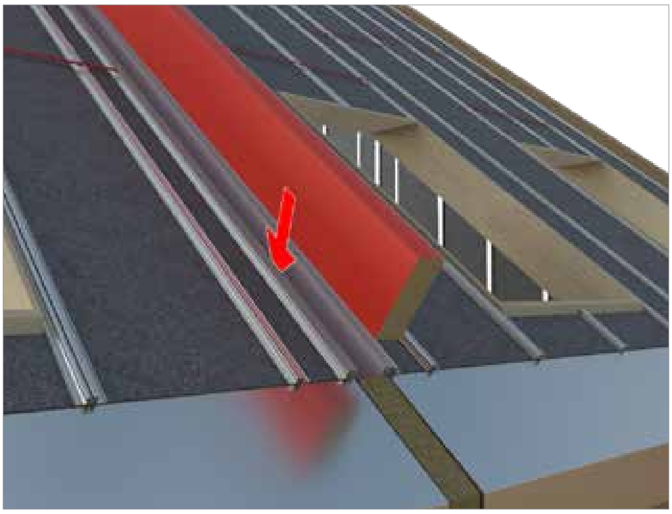
Eaves Beam / spandrel / roof interface - External

Eaves Beam / spandrel / roof interface - Internal

Ridge / gable / ladder interface

Spandrel - external

Spandrel - bracing / lateral support



Party wall firestop

Ultrapanel
Building Technologies

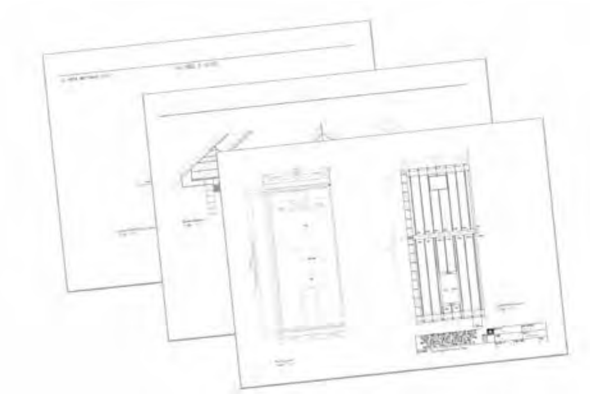
Assemblies overview
(eaves beams shown at floor level)

Eaves Beam / soffit

Roof / spandrel / ridge interface

Document checklist

Accompanying each roof – as well as this guide – are layout plans showing the position of all beams/panels and wall sections. All Ultrapanel items are clearly labelled and keyed to the location plan.

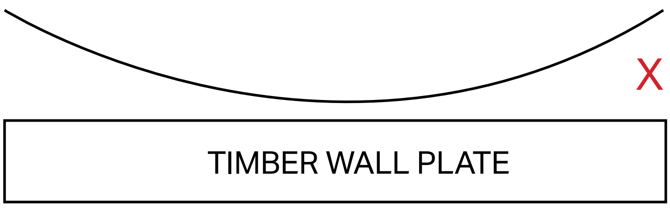


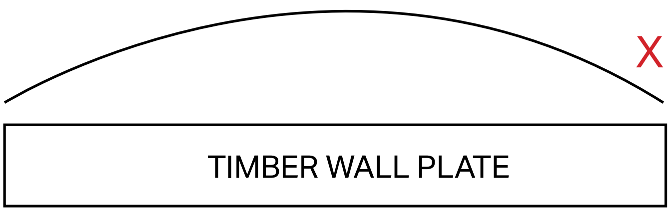
Pre-install checks/good practice

- When positioning the beams check the dimensions match the critical dimensions supplied with the roof. Levelling and packing the beams is **critical** to a successful install.
- Always use the fixings/sealants/ancillaries provided or specified to ensure the strength/water tightness of the roof and to ensure NHBC warranty is valid.
- Do not cut the panel strapping until all roof and spandrel panels are fully installed. (but before steel clips added)
- Safely dispose of all packaging. Ultrapanel timber pallets will be collected and returned.

Tolerances

- Ultrapanel is an engineered solution and is designed to be constructed on a substructure constructed by the housebuilder to a pre determined/pre-agreed specification. Every care must be taken by the housebuilder to ensure dimensional accuracy corresponds with their own working drawings throughout the build process.
- The substructure must be set out accurately using a laser level, steel tape or equivalent.
- Lengths of all walls should be within +/- 20mm
- Diagonals should be equal to ensure squareness of building, acceptable differences - +/- 20mm
- Ensure the walls supporting the wall plate are levelled to +/- 5mm





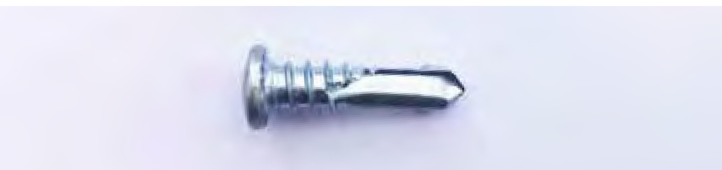
Please use the fixings supplied when installing Ultrapanel
to ensure a secure and correct installation.

There are two primary fixings used to install Ultrapanel. Both fixings are collated and featured a square head design to enhance drivability.

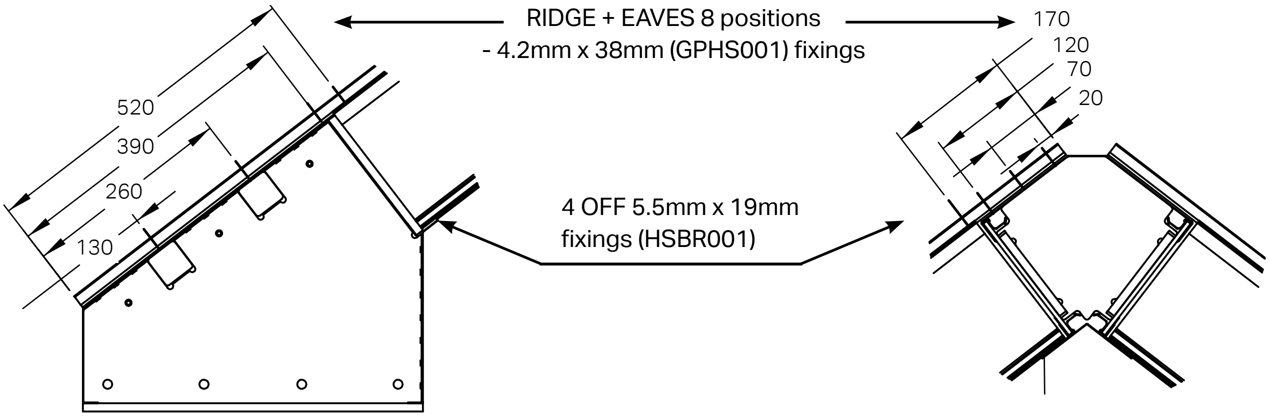
HSSCOO1 Timber tile batten to steel clip – for the roofer 4.8mm x 44 philips head.

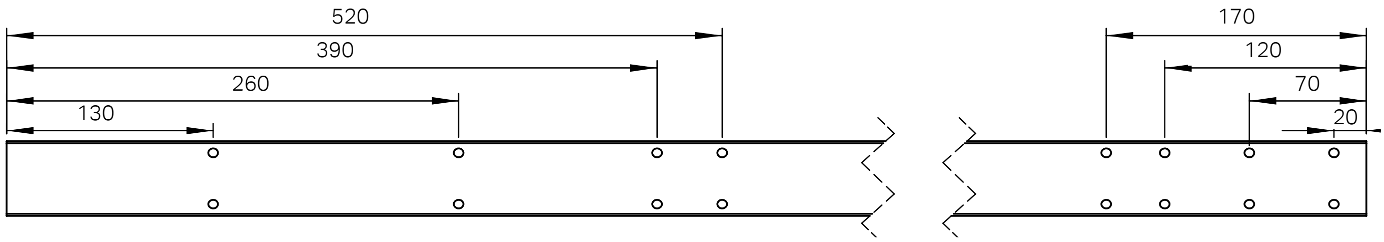
Primary fixings

GPHS001 4.2mm x 38mm square drive fixing for external use e.g. clip fixings, soffit, gable ladder.



HSBROO1 5.5mm x 19mm Reduced wafer head square drive fixing for internal use e.g. clip fixing.





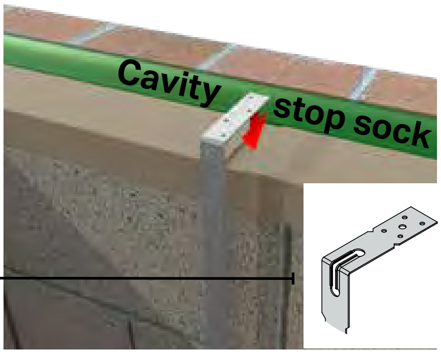
EAVES END OF STEEL CLIP - EXTERNAL

RIDGE END OF STEEL CLIP - EXTERNAL

THE RIDGE AND EAVES BEAM WILL HAVE LABELS TO INDICATE LOCATIONS. EACH FIXINGS POSITIONS MUST BE FILLED WITH THE APPROPRIATE FIXING SUPPLIED.

Housebuilder preparation [recommended]

It is the housebuilders responsibility to bed/line/level 100 x 75mm wall plate on 10mm mortar bed and ensure the relevant cavity stop sock is fitted (shown in image 1 in green).

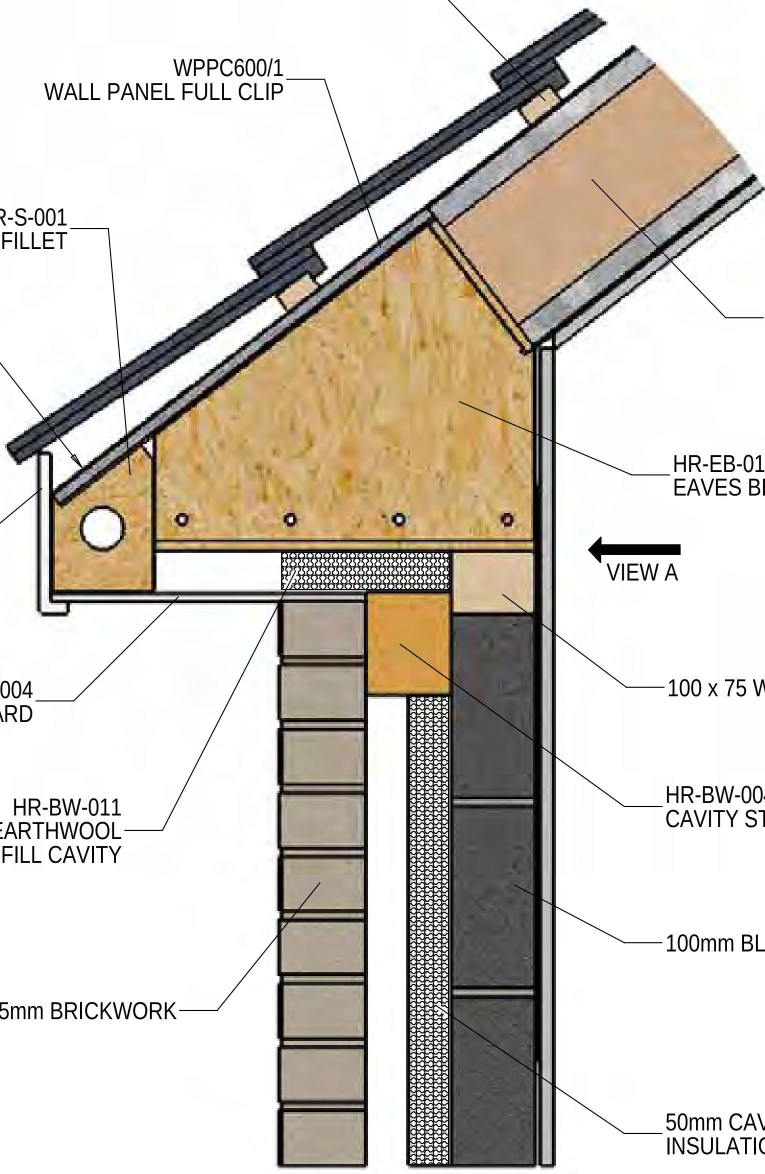


1. If a 'traditional' restraint strap (30x2.5mm) is used it MAY require the wall plate to be 'rebated' so the straps sit flush with top of timber wall plate

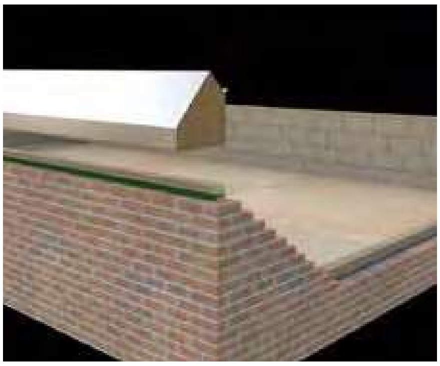
2. Traditional strap when rebated

3. This is what will be expected when Ultrapanel eaves beam is fitted - straps to NHBC standards

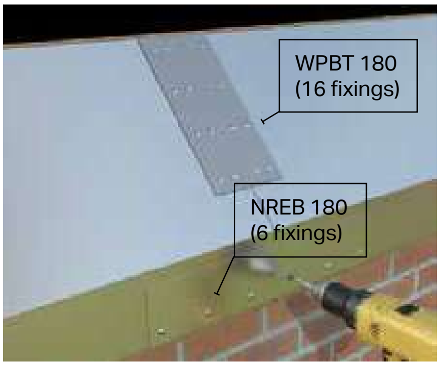
If a strap with an engineered bend is used and so is 1.2mm thick, Ultrapanel eaves beam can comfortably 'ride over' so no need to rebate.



Eaves beam
(wall plate on gable at different level)



1. Lift box eaves beam onto the dwarf wall



2. When over 7 metres, eaves beams are supplied in 2 lengths (or multiple lengths suited to the design) – use plates and 4.2 x 38mm in positions indicated above screws

3. Take the two lengths of 2mm thick x 150mm steel tie plate and join together using the 4 x M10 x 25mm stainless steel nuts and bolts

4. Support and offer up the assembled steel tie plate.

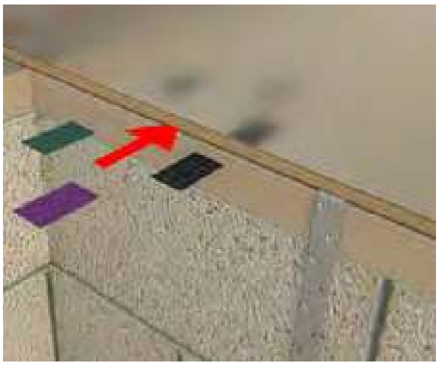
5. Secure each end of the tie plates with 3 x M10 x 25mm steel bolts and 2 x M10 coach bolts.

6. Offer up the 50 x 50 x 0.9mm steel angle onto the wall plate

If your dwelling features party walls see illustration bottom left and page 16

7. Measuring from the cavity side of the wall plate set the back edge of the angle plate inboard by 63mm. Screw down at 300mm centres using 4.2mm x 38mm screws (or 3.1 x 45 ARS nail)

8. Now check beams are level and plumb – check dimensions against set out drawings



9. Where appropriate use packers supplied (varying thickness)

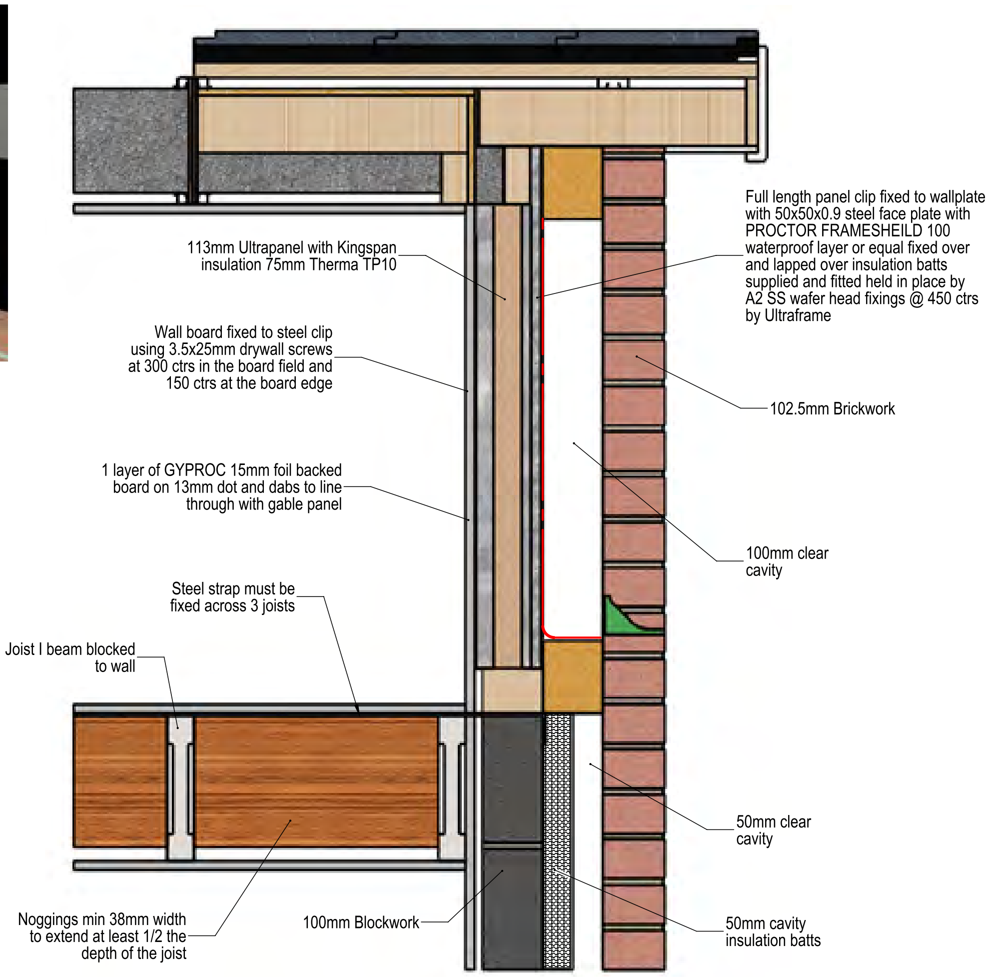
Party wall

Position steel tray on wall plate 6mm overhang into room side - then attach with two fixings every 600mm. Ensure CSS100 cavity stop sock is already fitted by the housebuilder. Fit the steel box tie beam following steps A -D on page 10.

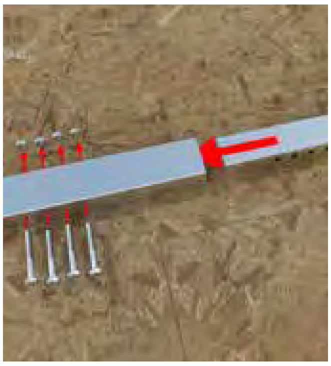
Eaves beam

11. Fasten plate with the fixings supplied to both timber wall plate and box beam. Eight 4.2 x 38mm screws 4 into steel of the beam and 4 into timber wall plate (or use 3.1mm x 45mm ARS nails), where the beam does not align with the blockwork:-

- *up to 10mm allow plate to bend*
- *more than 10mm packing behind the plate required*



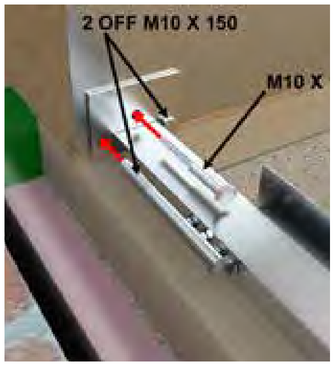
Tie bar when all eaves beams at floor level



A. Now slide the steel spigot onto the 50 x 25mm box tie. Bolt together using the M6 bolts and washers/nuts.

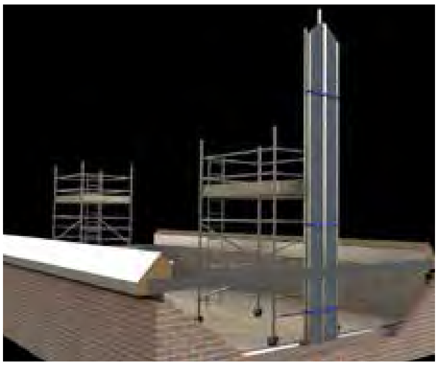
B. The 50 x 25mm box tie is supplied in two lengths. Using the 500mm long sleeve channel provided, line up the pre-drilled holes and add M6 bolts and washers/nuts – 4 each side of the butt joint.

C. With a co-worker lift the entire tie beam assembly into place, line up the holes in the eaves beam with the spigots and fasten using the M10 bolts, nuts and washers provided.



D. Use one x 100mm M10 bolt in the single uppermost hole and use two 150mm M10 bolts in the lower two holes. Inside the eaves beam are captivated barrel nuts to receive the bolts.

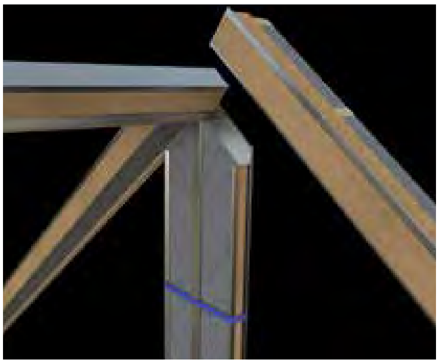
Ridge / Roof gable panel



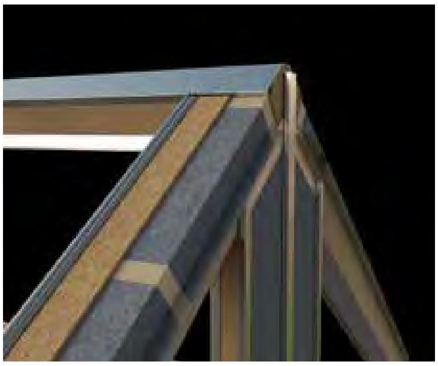
1. Lift the central spandrel panel assembly into place on the wall plate at floor level. Use raked timber to support the vertical panel. Complete this at both ends of the ridge

2. Lift ridge into position and rest it on the vertical panel shelf

3. Now use fixing GPHS001 4.2 x 38mm and put two through the steel clip and into the timber end of the ridge. Additionally put one fixing down through the ridge shelf and into the steel angle of the spandrel support.



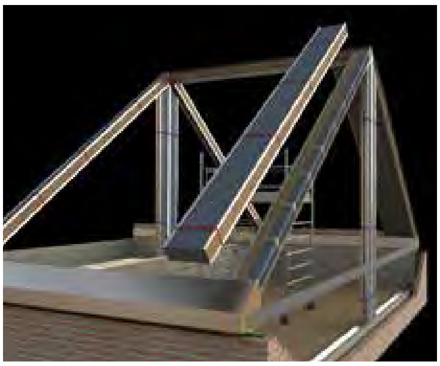
4. Now its time to add the narrow roof panel/ ladder starter panels – fit as pairs. Always check the location plan for the correct positioning of panels



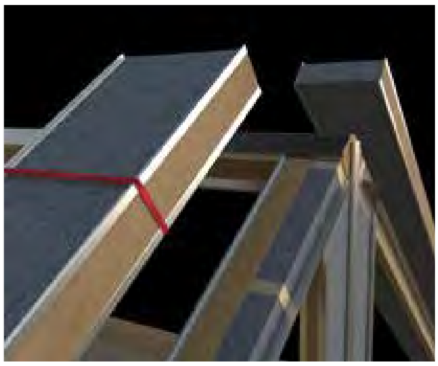
5. This is the first roof panel/ladder starter in position

6. Temporary fix the narrow roof panels through the steel shelf at the eaves

7. Temporary fix the narrow roof panels through the steel shelf at the ridge

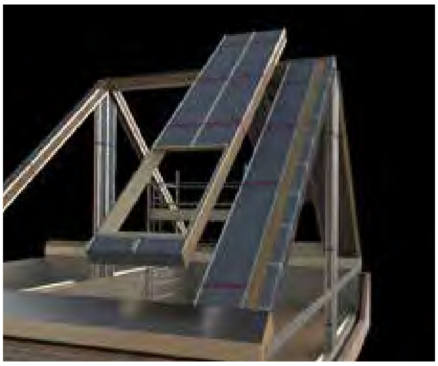


8. Now add the next roof panels, again referencing the location plan

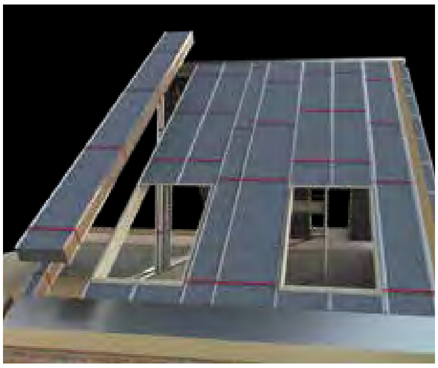


9. Always 'match up' panels wherever possible at each side of the ridge

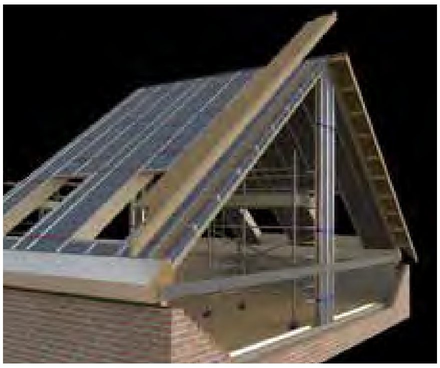
Roof panels



10. Continue to fit panels according to the location plan – here it shows a panel with a roof window prep



11. Continue until the last panel is fitted



12. Add the second part of the gable ladder – if a detached dwelling repeat at both gable positions

13. Now cut all red straps and dispose of them safely

14. Clips line up with front edge of beam – use a block when knocking clips onto the roof panels

15. To complete the gable ladder, screw through the overlapping OSB using GPHS001 4.2 x 38mm into the structural timbers beneath (the positions of the timber bearers is marked to indicate positions) – two fixings into every timber

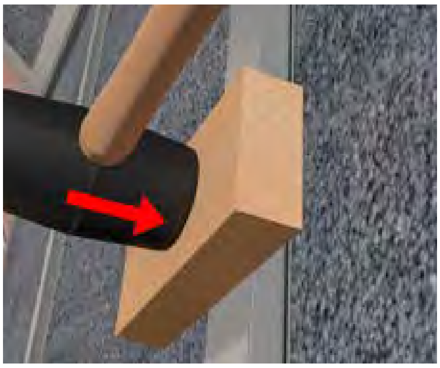
16. Now its time to fasten the external steel clips. External clips are fixed using 4.2 x 38mm GPHS001, eight fixings into the eaves and eight into the ridge

17. Clips line up with the end of the eaves beam – use a dead blow hammer and a timber block and tap the clips into final position

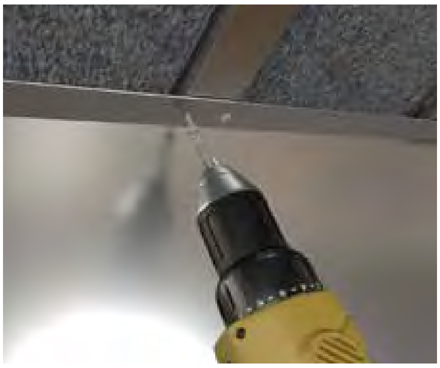
18. Fasten the clips , two into the roof panel and six into the box eaves beam use 4.2mm x 38mm GPHS001

19. Fasten the clips, two into the roof panel and six into the ridge body using 4.8mm x 38mm screws GPHS001

21. Moving inside to fit the steel clips to the underside of the panels. The inner clips are supplied in two pieces – a short length to be used at the eaves and a longer length for the ridge end. At the eaves end, 'spear' the short steel clip onto the roof panel rails, then drive/tap the short clip fully down into the eaves shelf



20. Adding the clips with a timber block to help drive into position

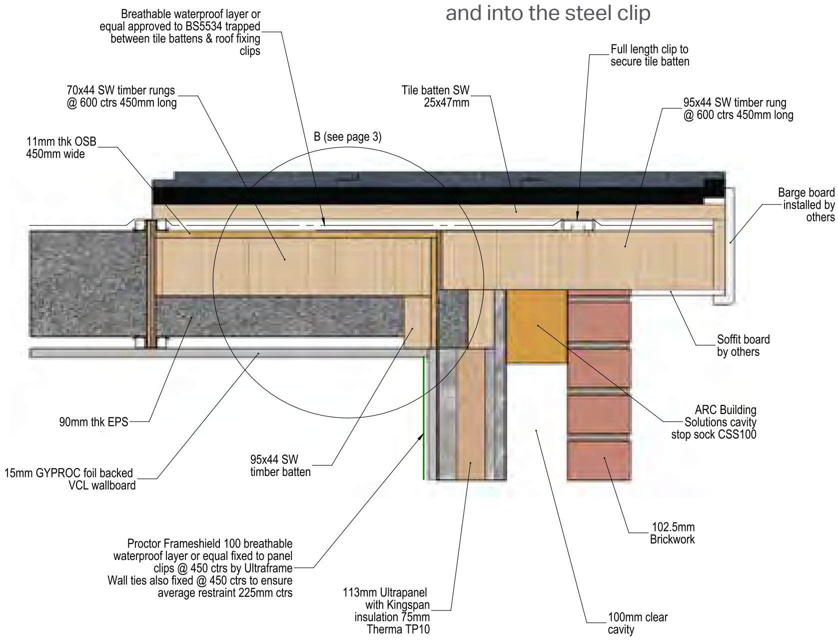


22. Using four 5.5 mm x 19 mm screws HSBR001 fasten through the shelf and into the short length of steel clip

23. Now fasten the end of the short clip where it will abut the longer clip. Use two 4.2mm x 38mm screws GPHS001

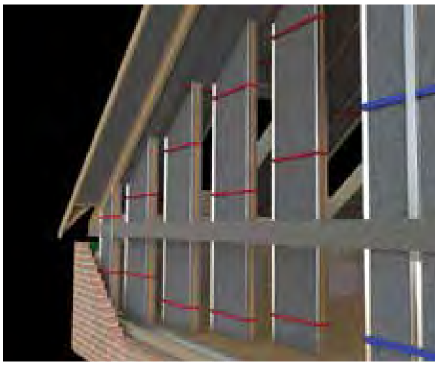
24. At the ridge spear' the long steel clip onto the roof panel rails, then drive/ tap the clip fully into the shelf before knocking the long clip fully onto the rails along its entire length. Then at the ridge end use four 5.5 mm x 19 mm screws HSBR001 to fasten through the shelf and into the steel clip

25. Now fasten the end of the long clip where it abuts the already fixed short clip. Use two 4.2mm x 38mm screw GPHS001

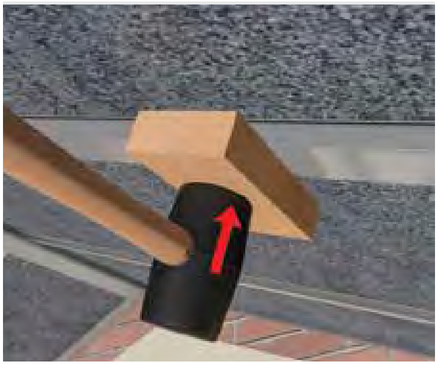


SPANDREL HEAD DETAIL

Gable/spandrel wall



1. Now fit spandrel panels starting in the corner and working towards the middle. When the spandrel panel is lifted into position the vertical rail clip should sit inside the steel angle (floor side) and the vertical clip to external wall should finish on the wall plate.



2. External clips knock on and fit behind the angle on the timber wall plate

3. Externally, the 110mm wide steel plate is fastened through into the vertical steel clip (2) and timber wallplate (2) use 4.2 x 38mm GPHS001

4. Add internal spandrel clips

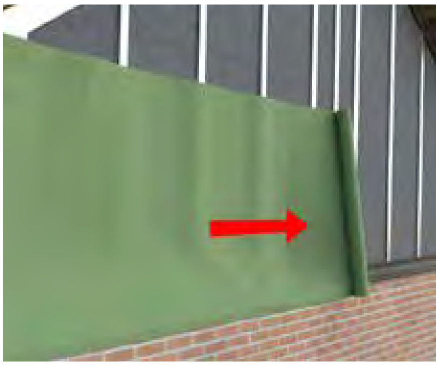
5. Internally fasten through the 'L' shaped steel angle into each clip - 2 4.2 x 38mm GPHS001

6. Externally, fit the 140mm wide steel plate and fasten through into the vertical steel clips - 2 screws 4.2 x 38mm GPHS001

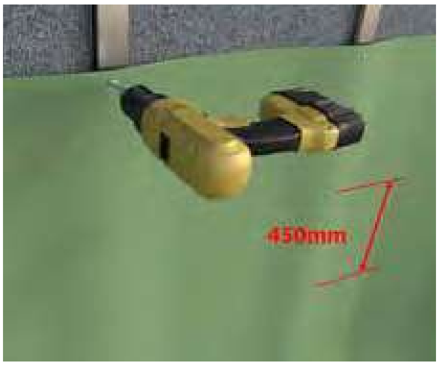
7. Finally offer up 180 x 75mm steel angle internally, 170mm leg fits against small gable ladder panel (roof) - use the 4.2 x 38mm GPHS001 @ 300mm centres through the plate into steel clips

8. The 75mm leg of the 180 x 75 steel angle is tight against vertical spandrel clips - use 2 screws 4.2 x 38mm GPHS001 into clips vertically and on the roof panel.

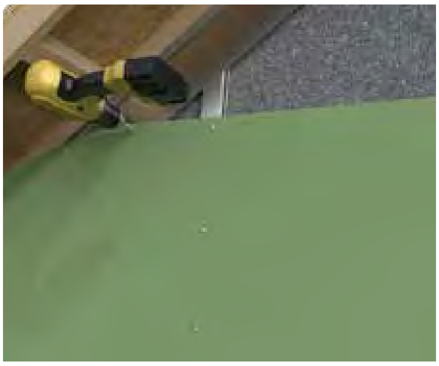
9. Use a roll of 250mm wide DPC and attach to the 110mm steel strip that runs along the bottom of the clips and wall plate. Use wafer head 19mm stainless steel screws to fix DPC to steel strip



10. Unroll the membrane and stretch across the full width of the spandrel and lap the membrane fully onto the DPC at 150mm centres. If a lap is required vertically, make this over a clip and with a 150mm lap.

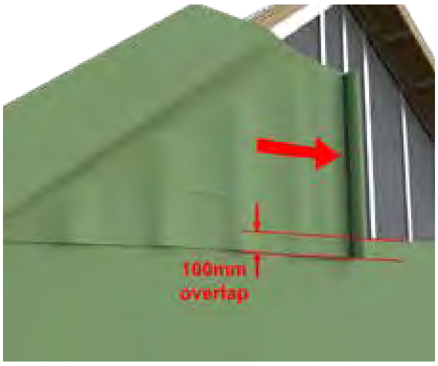


11. Fix the membrane into each vertical steel clip at 450mm centres. Fix membrane into steel strip at base of wall at 150mm centres

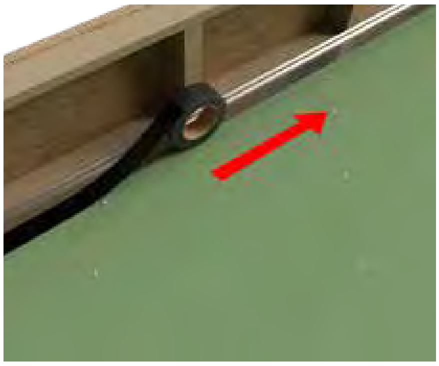


12. Secure into rake of roof by fastening as before into the steel angle at 150mm centres

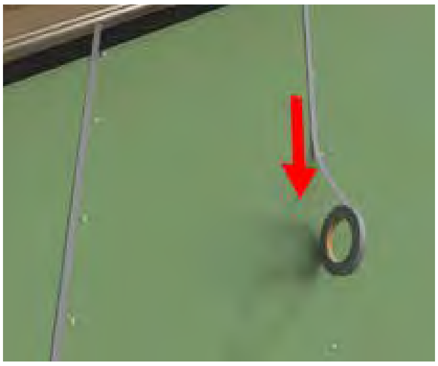
13. Ensure the end of the eaves beam is dressed with membrane, do not tape the membrane at the bottom of the eaves beam to allow moisture migration



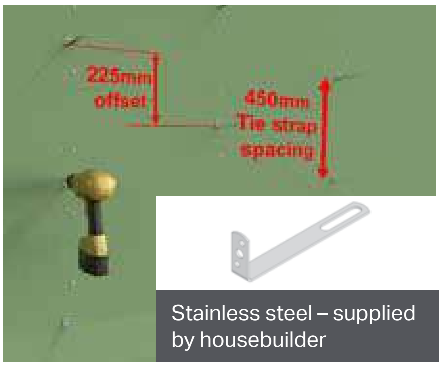
14. Offer up a second layer of membrane- ensure a 100mm horizontal lap. Cut into rake of roof



15. With the membrane cut into the steel angle that runs up the gable ladder then fasten at 150 centres and tape the cut joint



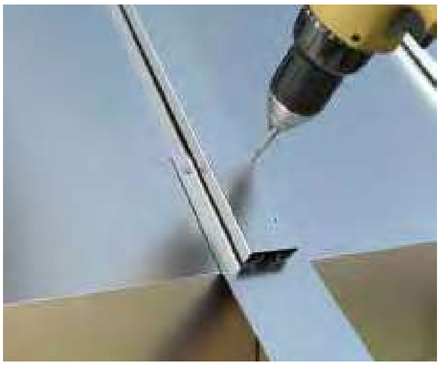
16. Fit high tack marker tape along line of vertical steel panel clips – to ensure follow on bricklayer trade can identify where to screw fix angled brick ties



Fit angled brick ties to gable wall at every taped position at 450mm centres, staggered – use 2 x wafer head 19mm stainless steel screws supplied – this task is by the housebuilder - see p29

Add soffit assemblies

1. Add the soffit assemblies



2. Two fixings through the clip and two each side of the soffit where it overlaps onto the roof - 4.2 x 38mm GPHS001

3. Add a fixing each side into the underside of the beam - use 4.2 x 38mm screw GPHS001

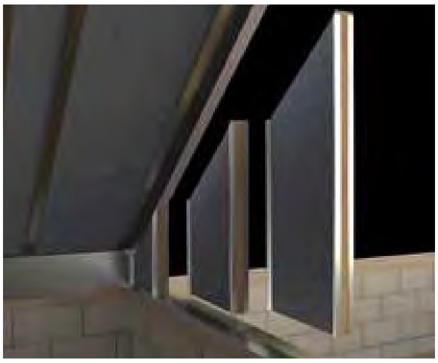
Party wall - Leaf 1

A party wall consists of two ‘leaves’ - this page relates to leaf 1 whilst pages 17 relates to leaf 2 (which has subtle differences in installation sequence.

1. Attach steel tray to wall plate - use two fixings every 600mm. Ensure CSS100 cavity stop sock is already fitted by the housebuilder. Fit the steel box tie beam following steps A-D on page 10

2. Lift into position a length of the 250x 75mm steel L shape with two layers of Fireline plasterbaord attached - fix to the roof panel clip

3. Insert narrow strips of insulation board alongside the tie beam to prevent any cold bridging

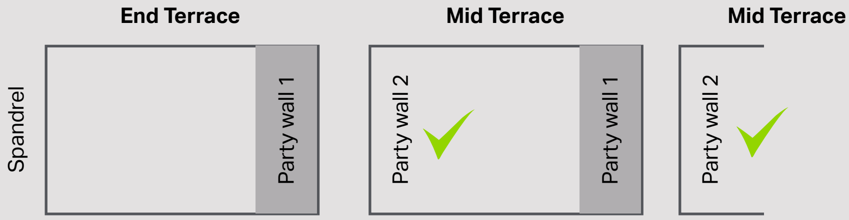


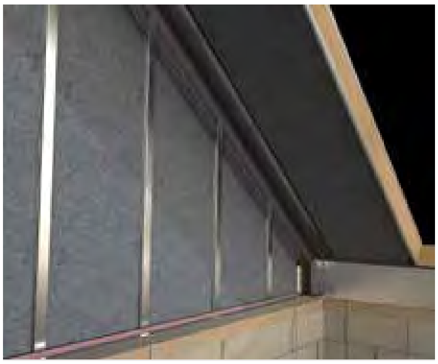
4. Starting at one side of party wall, place into position the smallest panel and work across towards the already fitted vertical centre panel

5. Now fit the two layers of 15mm Fireline plasterboard

6. Fasten the steel angle up the rake of the roof - fasten to vertical clips and roof panel clips

A party wall consists of two 'leaves' - this page relates to leaf 2 whilst pages 16 relates to leaf 1 which has subtle differences in installation sequence.





1. This is what you will see in starting party wall 2. Roof completed and supported on central vertical panel. Fix angle up the rake of the roof and steel tray to wall plate - as step 1 to 4 page 16

2. Add mineral wool to fully fill the cavity

2. Lift into position a length of the 250x 75mm steel L shape with two layers of Fireline plasterbaord attached - fix to the roof panel clip

4. Assemble the first 3 panels – attach clips internally and externally

5. Starting at one side of party wall 2, place into position the smallest panel and work across towards the middle. At the roof intersection panels push against a steel angle

6. Assemble the next group of panels and insert

7. Now add steel angle up the rake of the roof - fasten through into vertical panel clips and roof panel

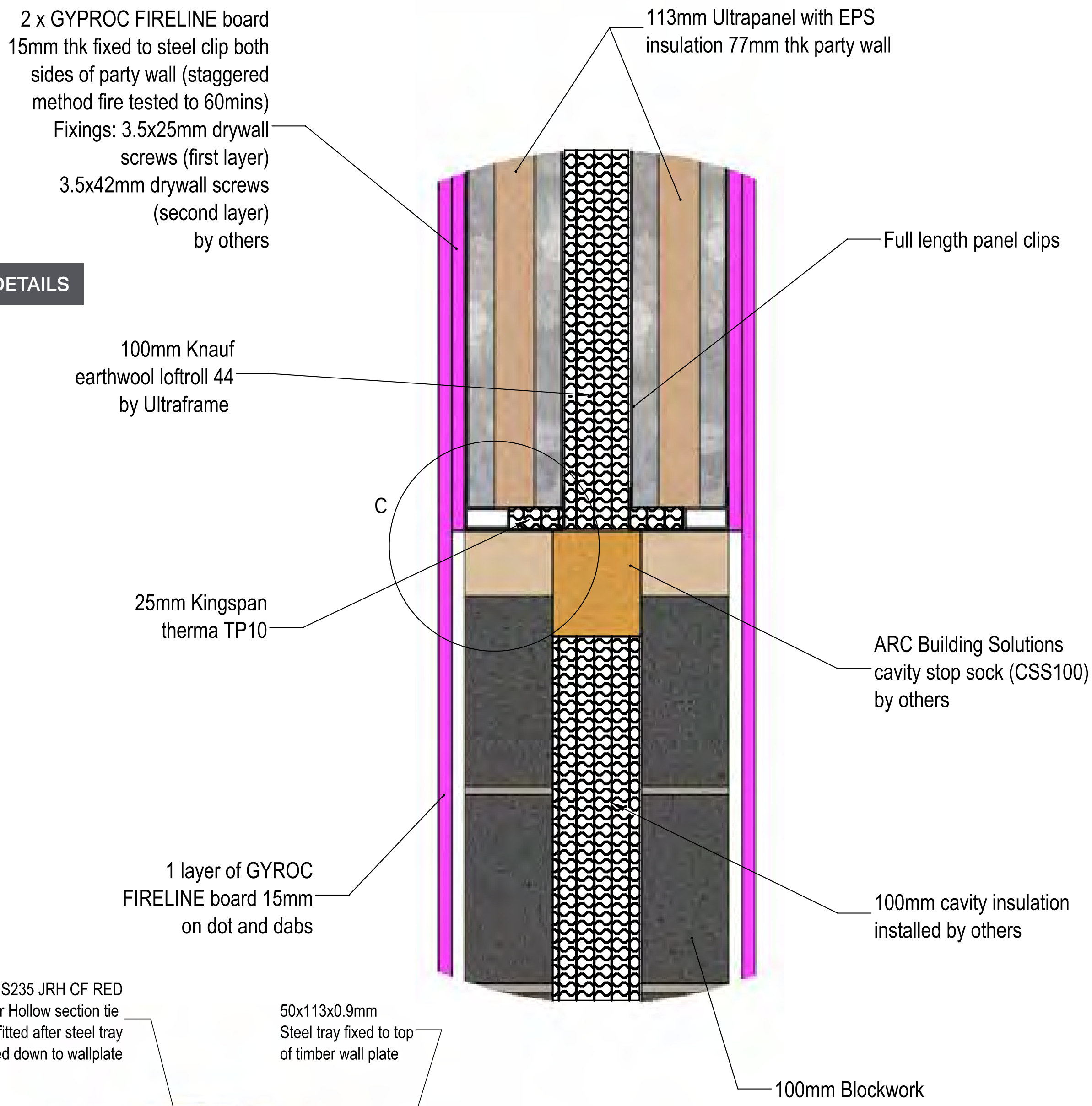
8. Fasten the clips through the 50mm angle upstand at wall plate

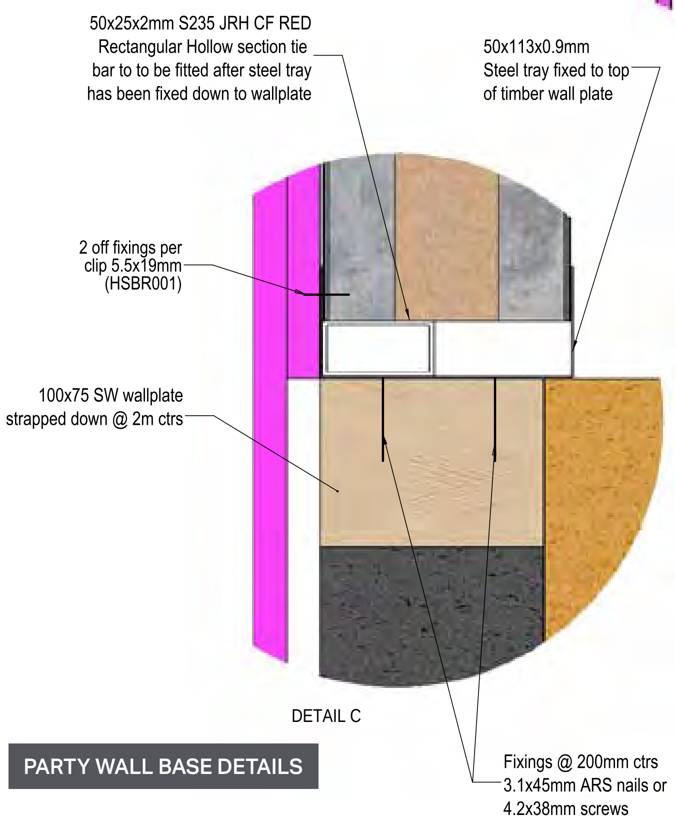
9. On the roof insert the cavity sock

10. Shape to fit cavity closure, mineral wood in between eaves beams

Party wall-base

BASE FIXINGS DETAILS

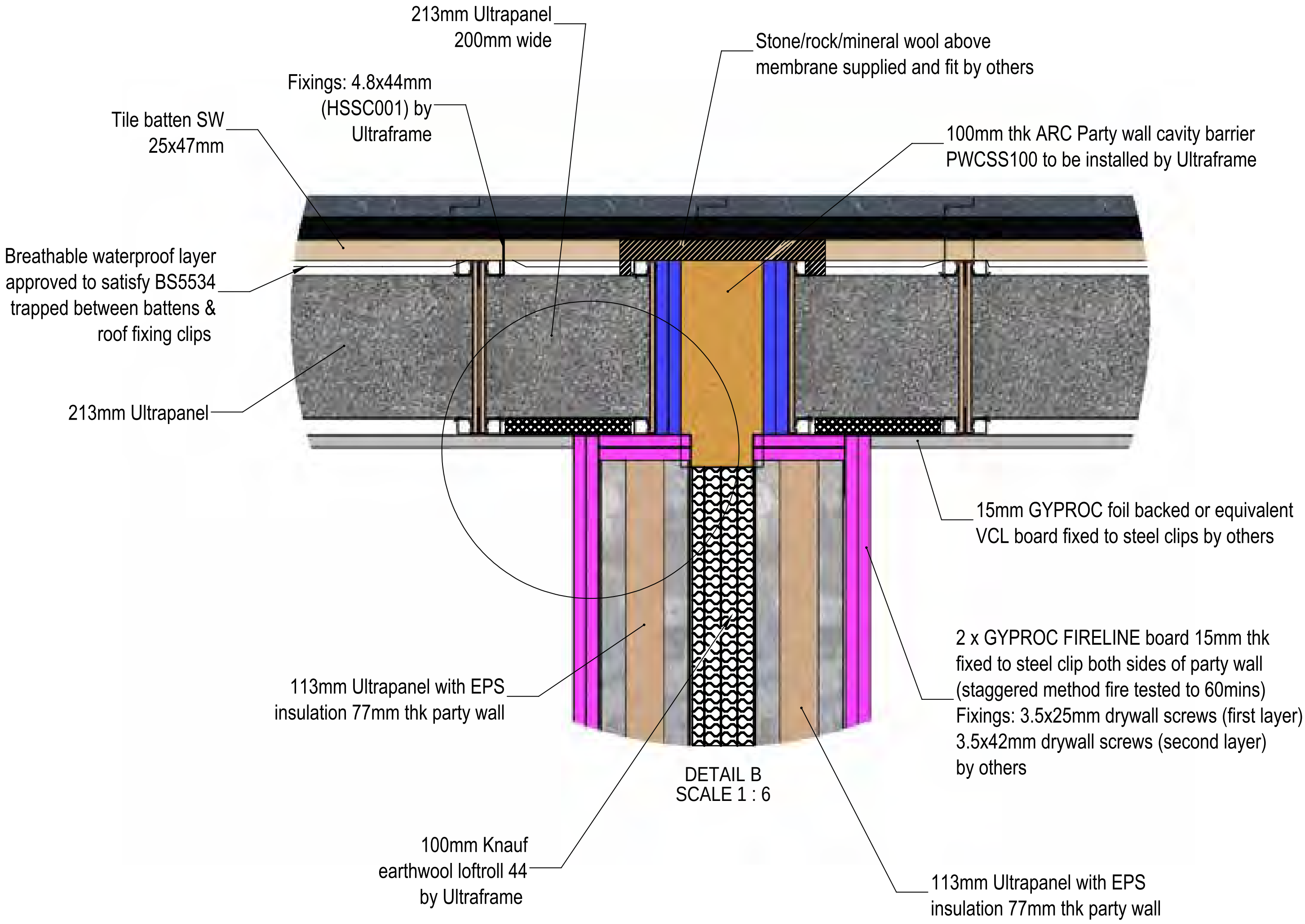


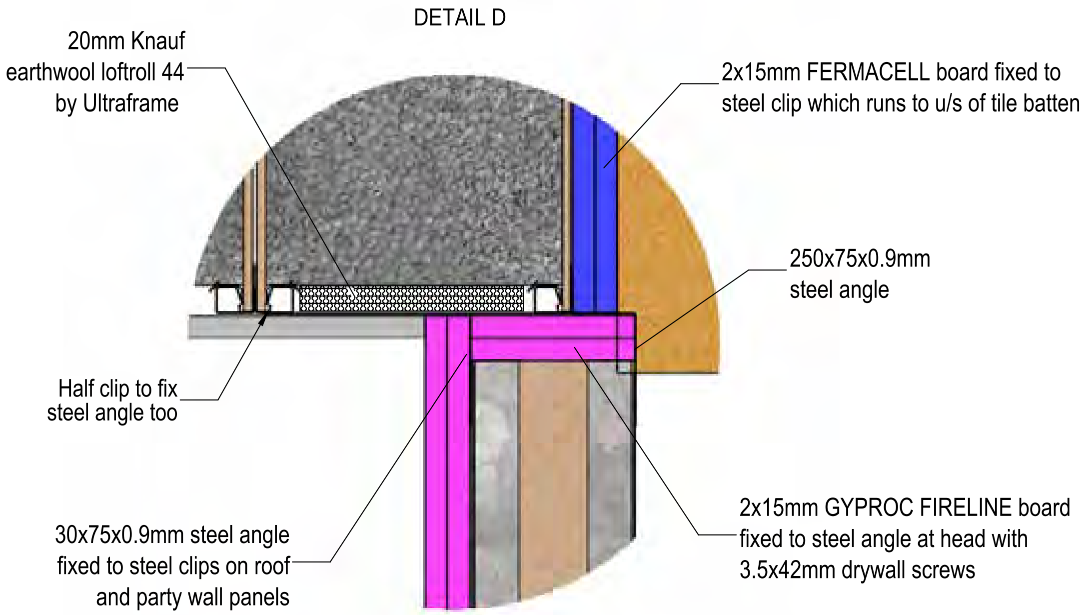


DETAIL C

PARTY WALL BASE DETAILS

Party wall-head

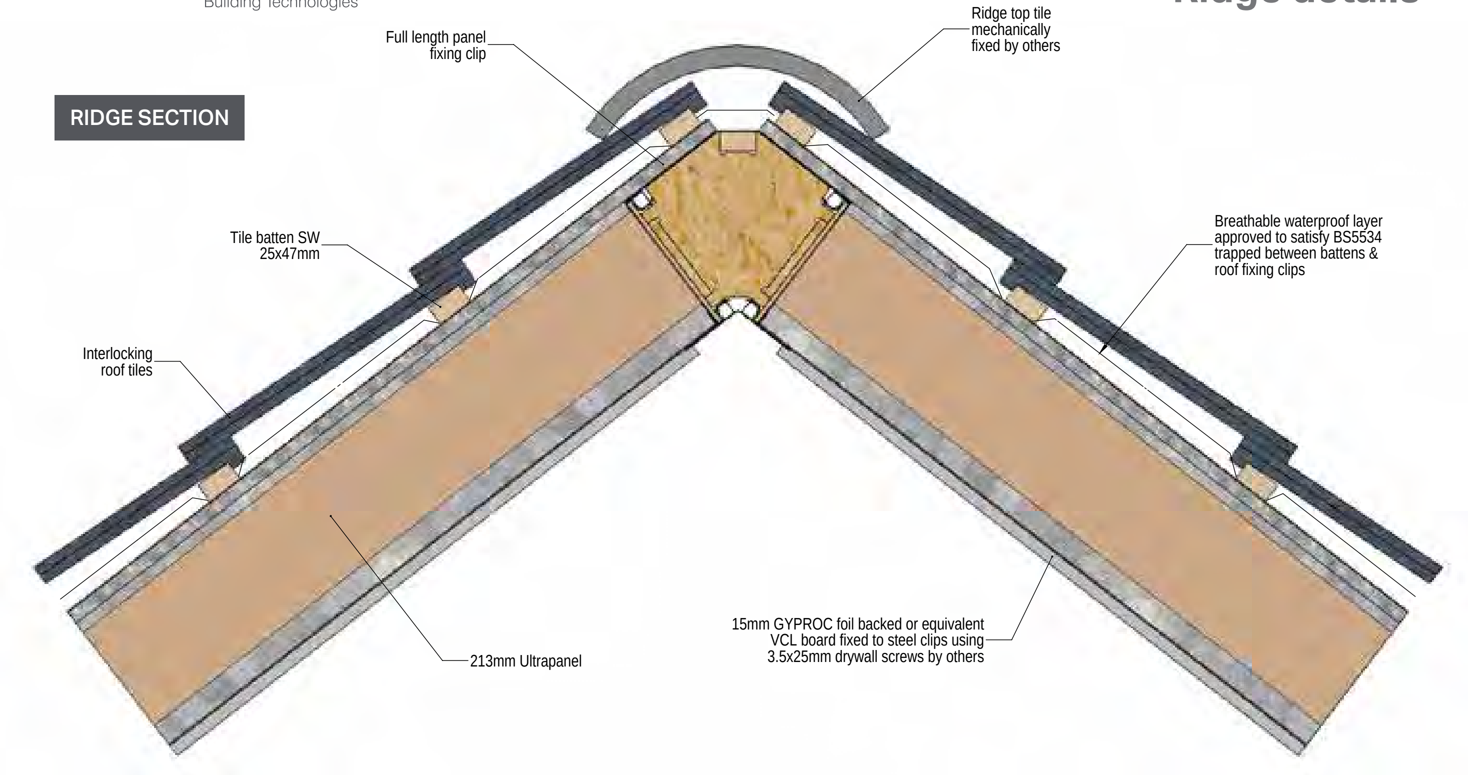




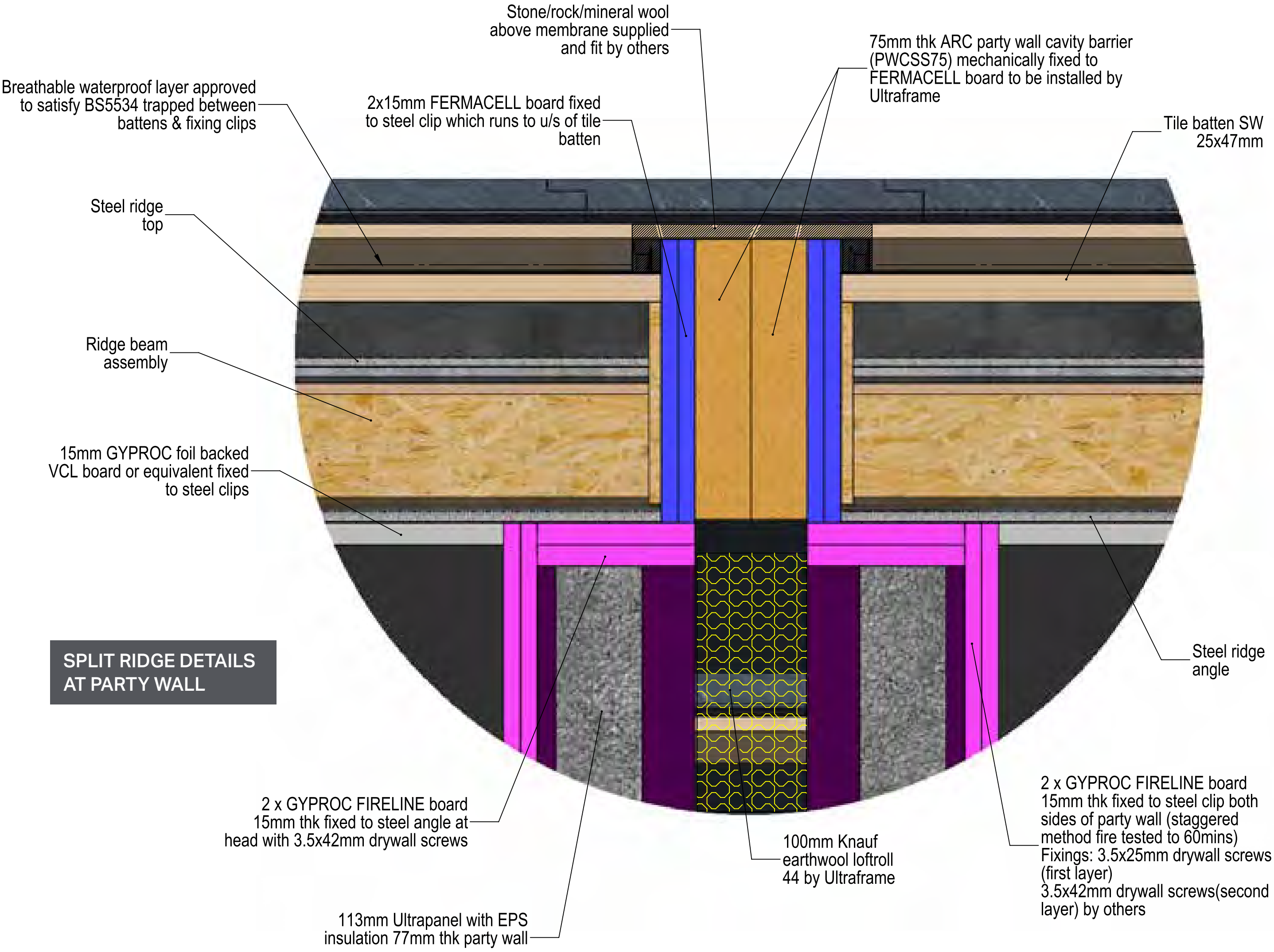
PARTY WALL HEAD DETAIL

Ridge details

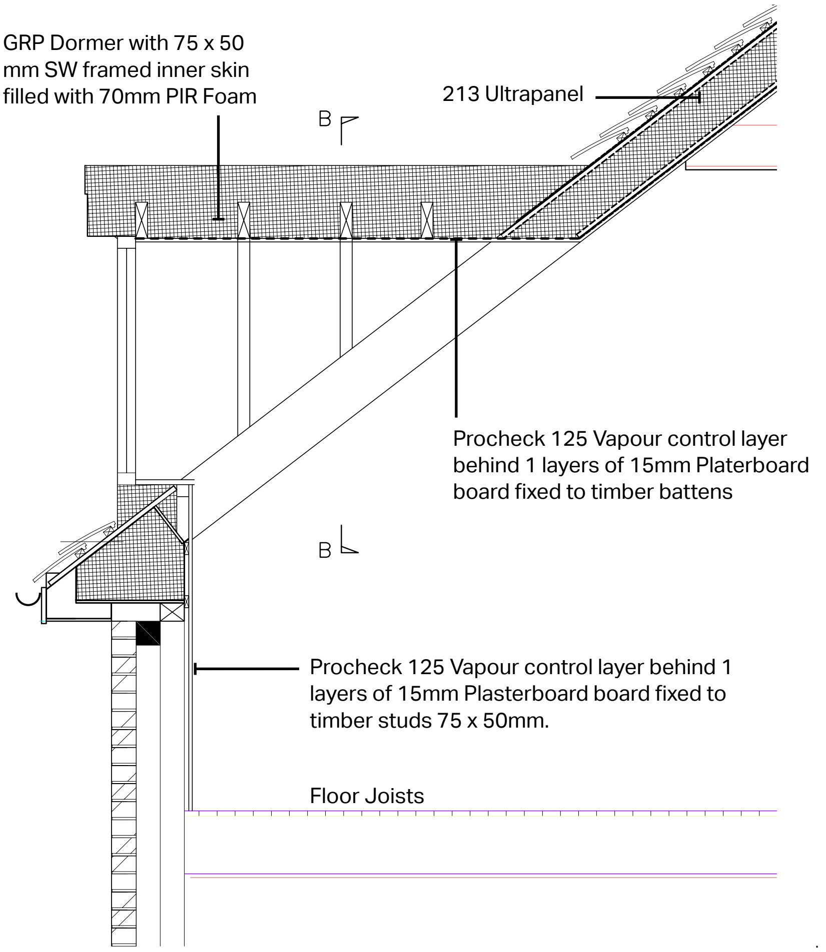
RIDGE SECTION



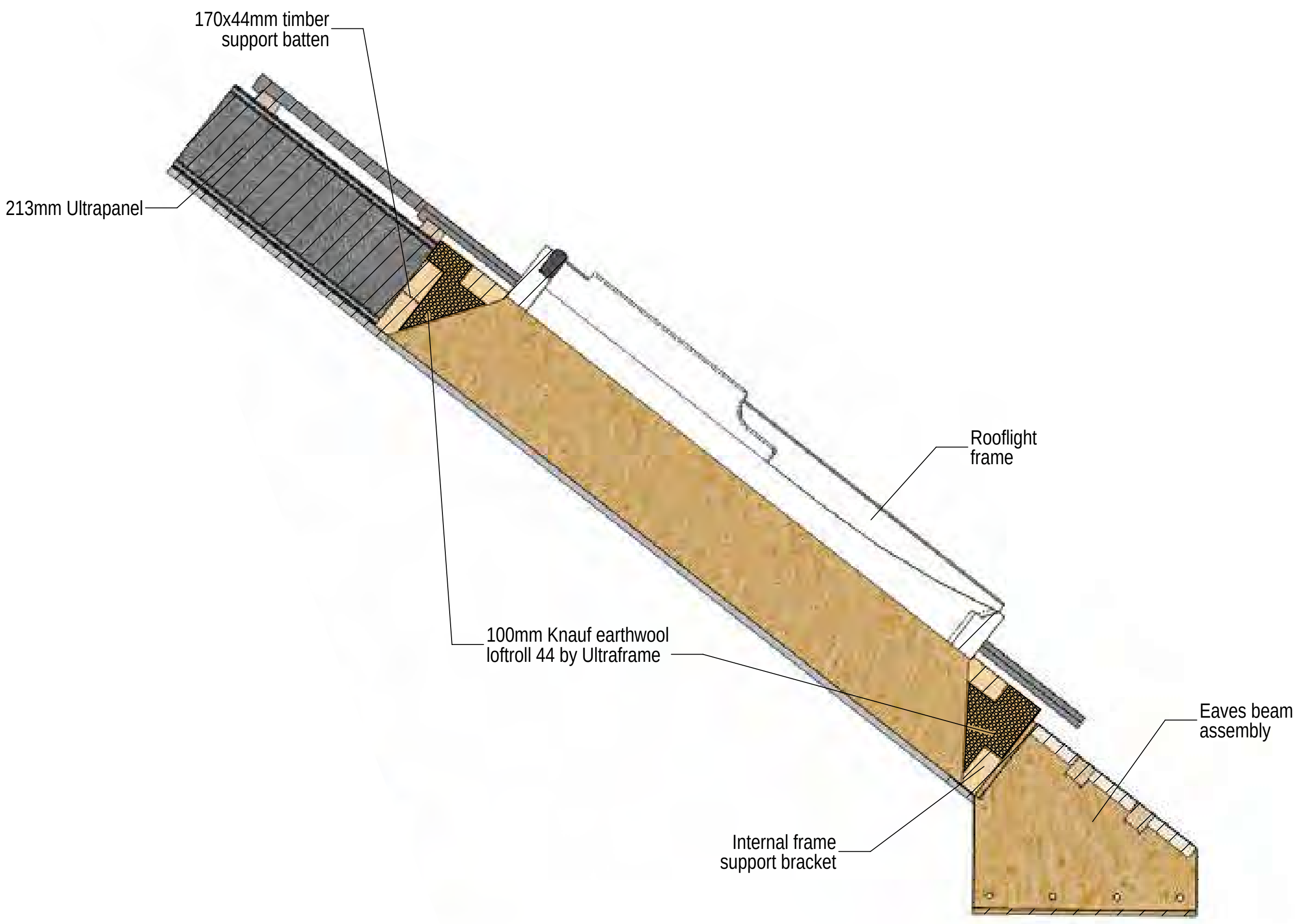
SPLIT RIDGE DETAILS AT PARTY WALL

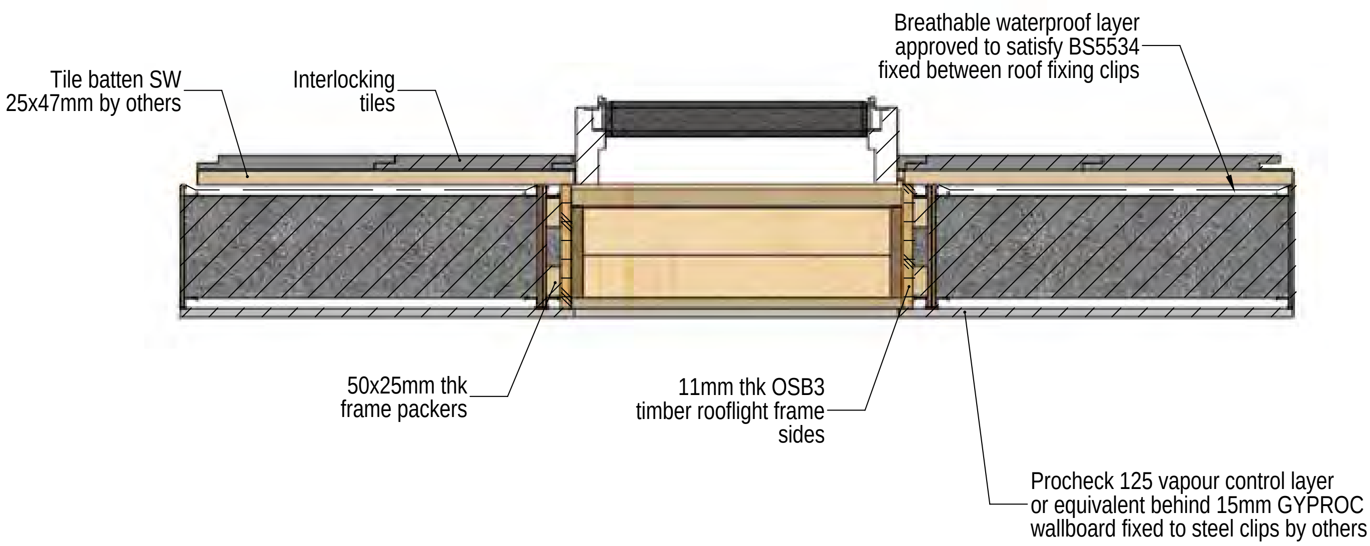


Appendix 1 - GRP Dormer



TYPICAL VELUX JAMB SECTION





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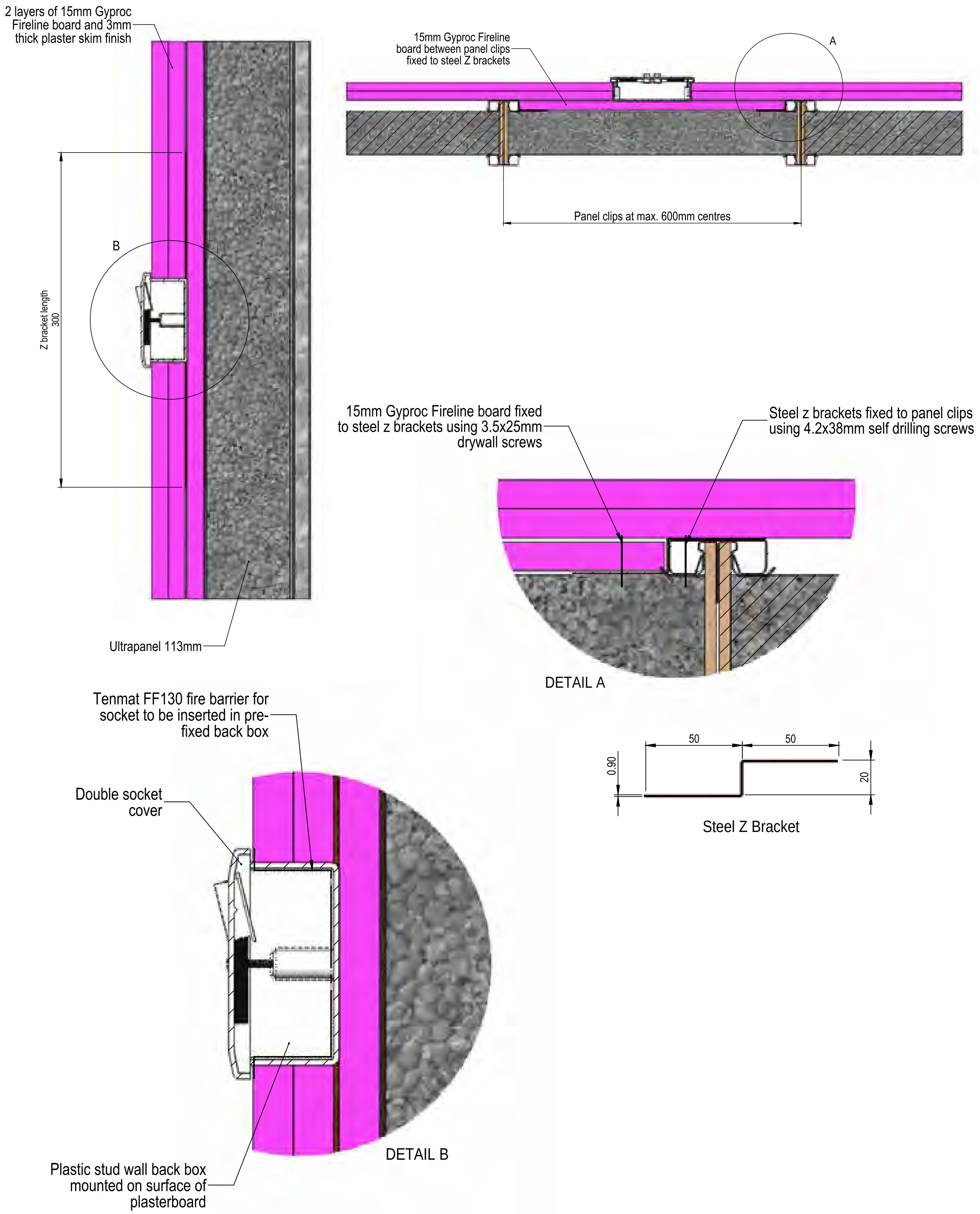
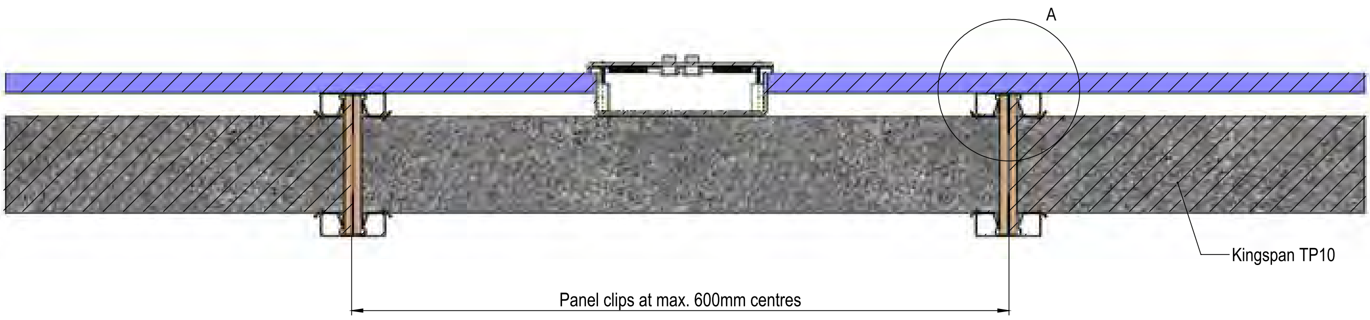
Appendix 3 - Electrical outlets - party wall

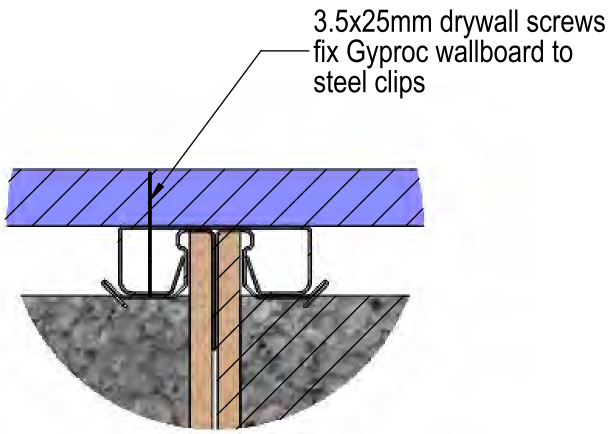


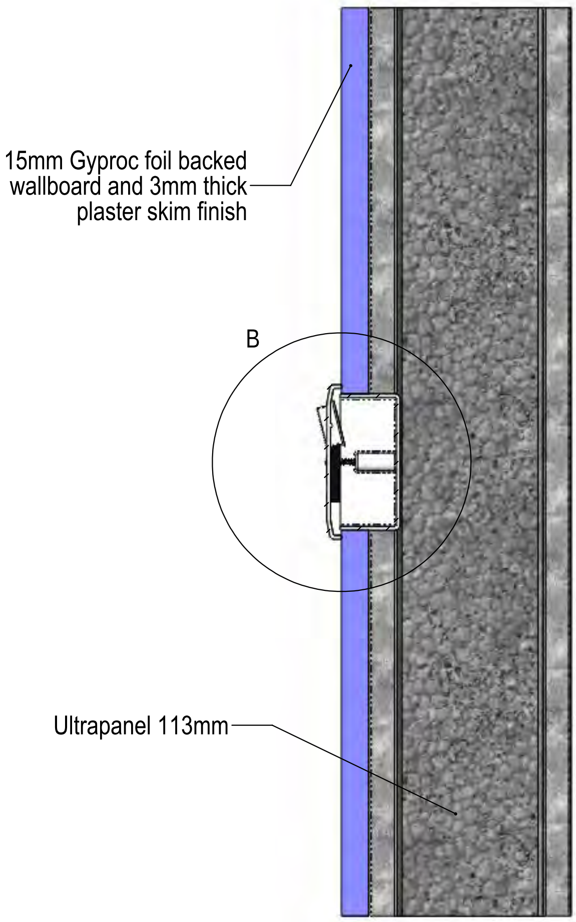
STEEL Z BRACKET

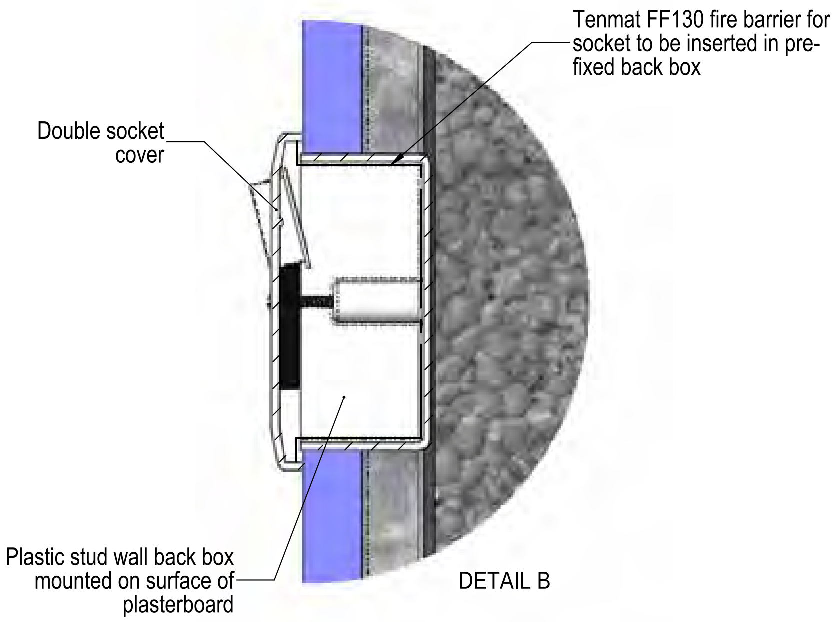
FRONT VIEW

Appendix 3 - Electrical outlets - gable spandrel









FRONT VIEW

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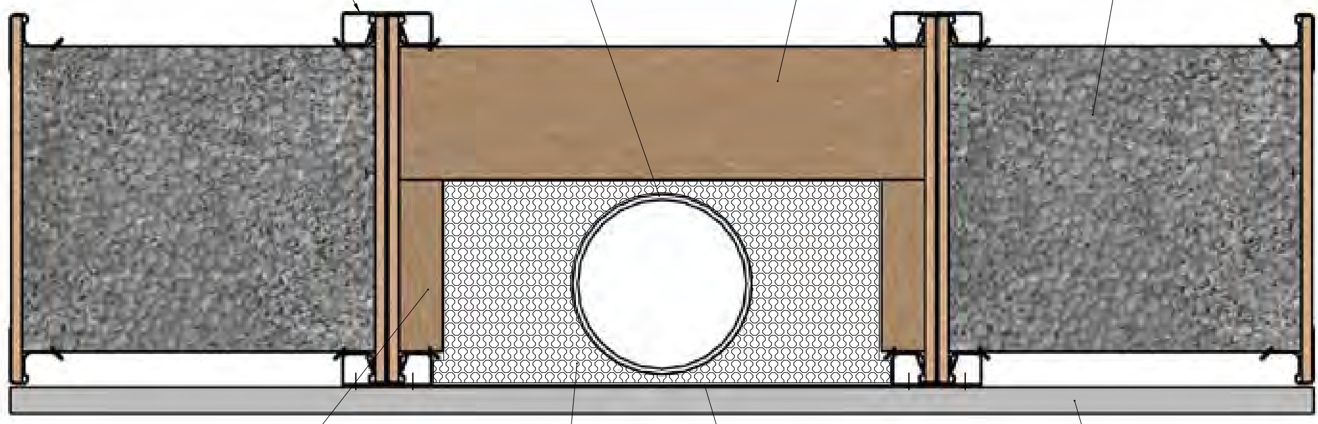
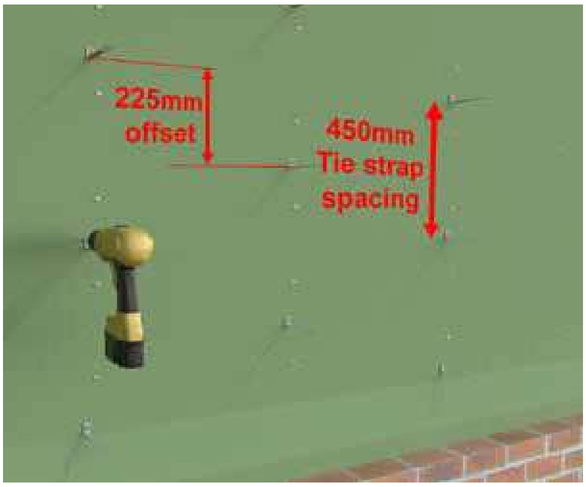
Appendix 4 - Vent pipe



Appendix 5 - Spandrel attaching brickwork ties



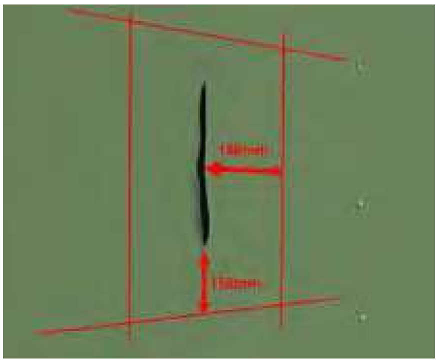
Fit angled brick ties to gable wall at every taped position at 450mm centres, staggered – use 2 x wafer head 19mm stainless steel screws supplied – this task is by the housebuilder

Stainless steel brick ties – supplied by housebuilder

NB. Stainless steel fixings supplied and left with site manager

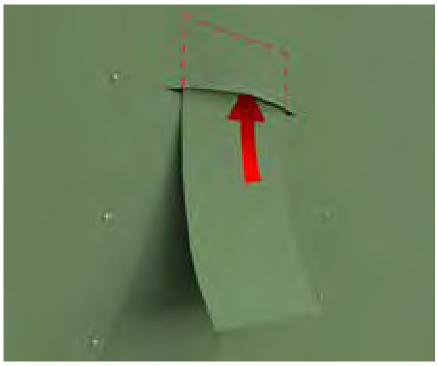
Section 1

Appendix 5 - Repairing gable/spandrel membrane

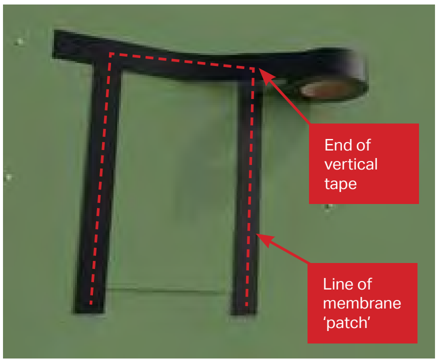


1. Should there be a tear in the gable/ spandrel membrane follow these steps. Cut a new piece of membrane to the sizes shown, allowing an additional 150mm at the top end to fit into the slit being cut in step 2

2. Using a sharp safety blade or scissors, slice a neat vertical cut into the membrane above the tear.

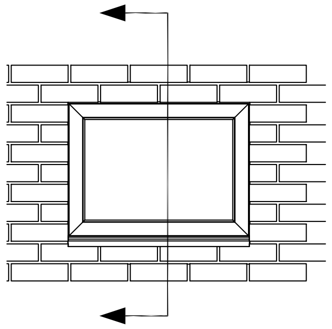


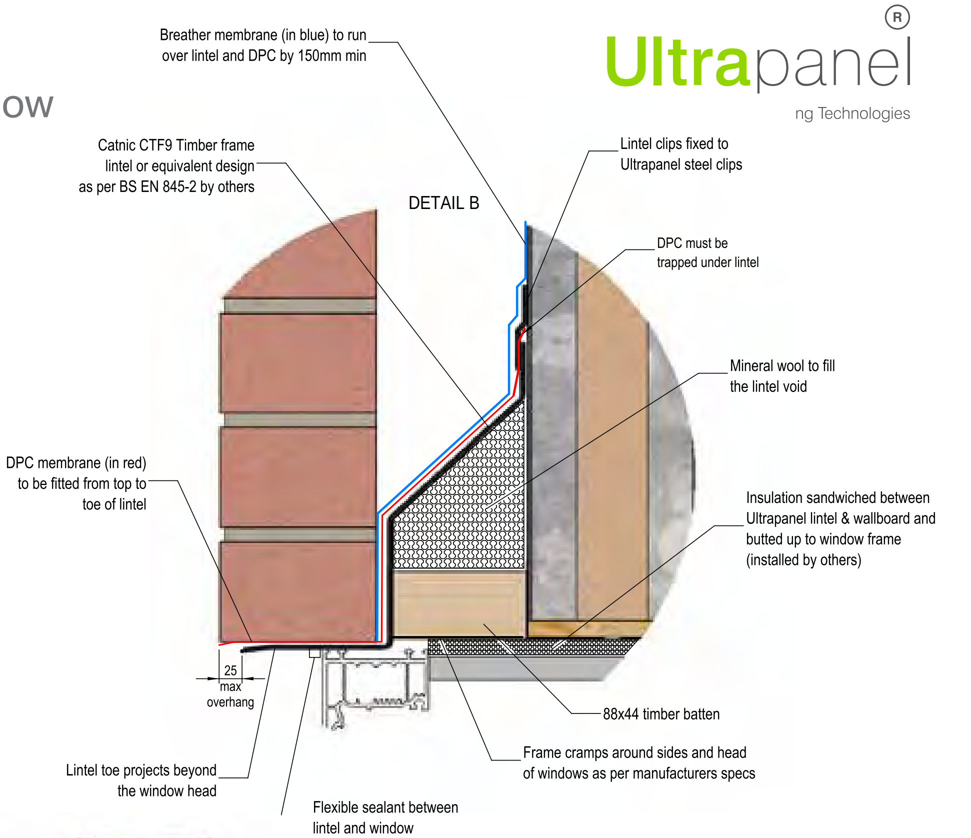
3. Now take your pre-cut 'patch' of membrane and slide into the neatly cut slot – patch must be slid in 150mm.

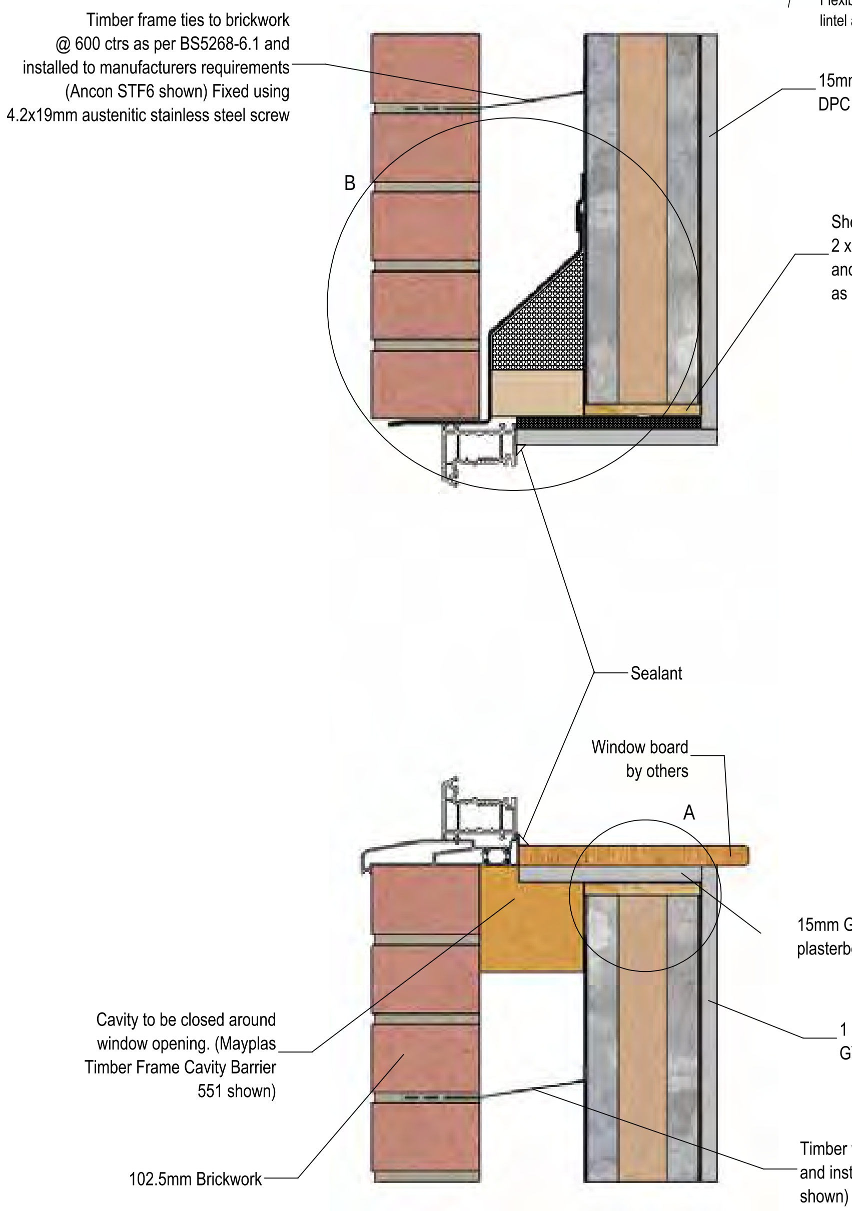


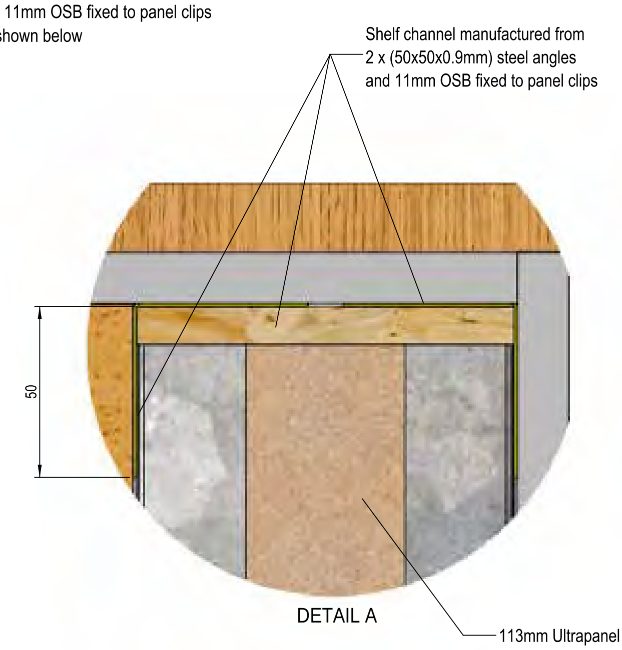
4. Using Reinforced Membrane Tape, apply as shown over the patch – horizontal tape must be applied over the two ends of the vertical tape and offer 25mm of cover to the end of the vertical tape.

Appendix 6 - Gable window vertical cross section'

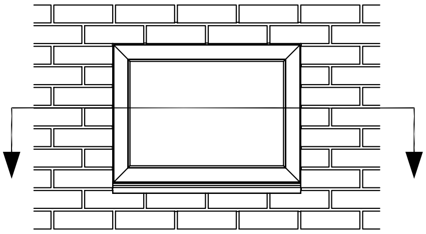


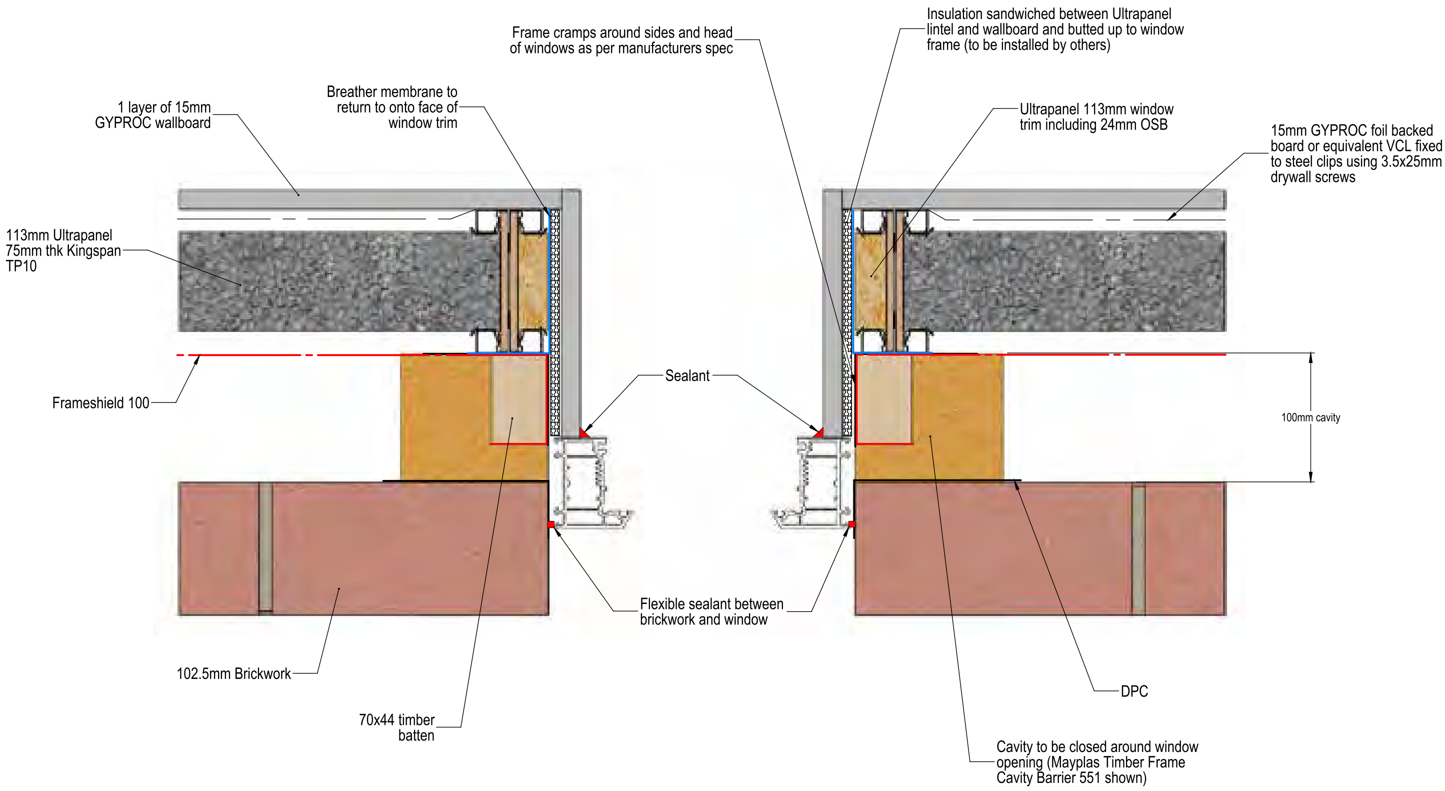






Appendix 6 - Gable window horizontal cross section'





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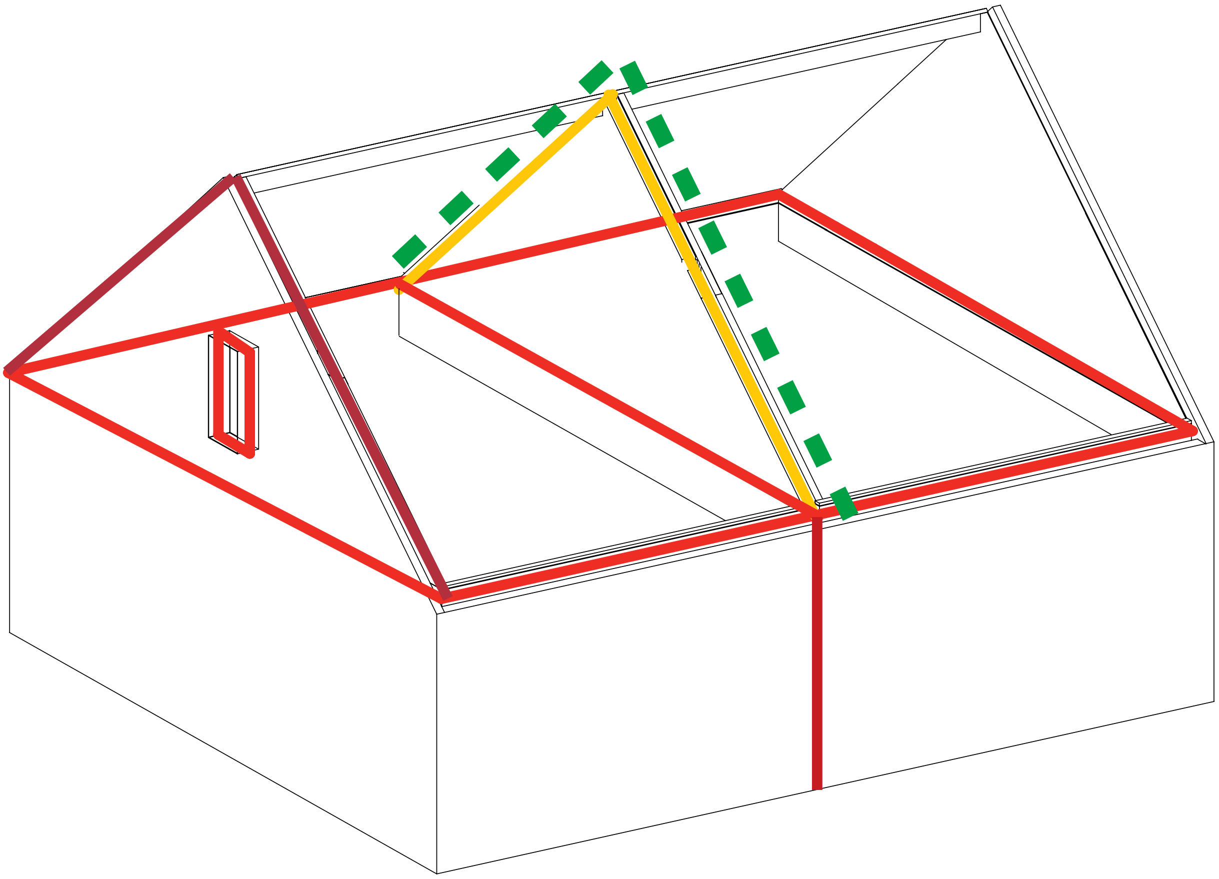
Appendix 7 - Cavity stop socks

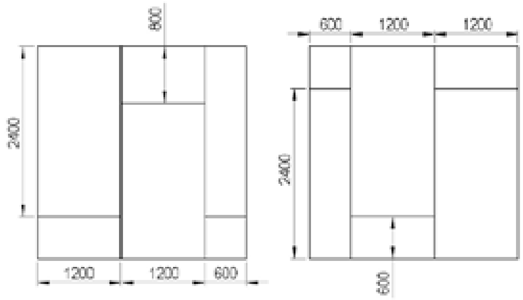


Yellow line	60 minute fire resistant Cavity stop sock installed with the roof
Red line	Polythene sleeved cavity barrier installed by housebuilder.
Green dashed line	Mineral wool fire stopping installed by roof tiler.

Roof installation team to photograph all cavity stop socks in position and at completion submit photos to site manager and contracts manager

Party wall - 60 minute fire rating

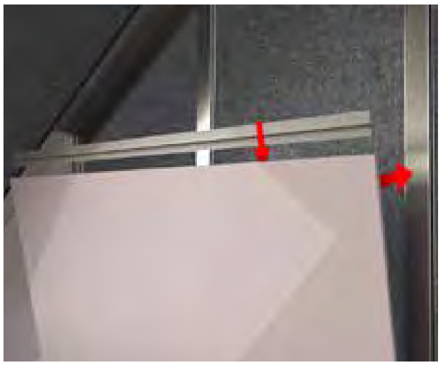
The party wall features two layers of 15mm Gyproc Square Edge (SE) Fireline boards, all vertical and horizontal joints MUST be staggered. Horizontal joints on both layers are fastened into the Gypframe GFT2400 Fixing T and steel structure and back pointed with Dowsil 400 Firestop fire rated intumescent acrylic sealant. All steps on Apendix 8 - Drylining are completed by the housebuilder team.



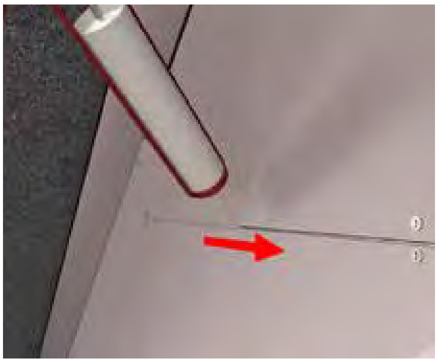
Typical arrangement of the two layers of 15mm Gyproc SE Fireline board with all joints staggered

1. Cut and offer up the first piece/sheet of 15mm Gyproc Fireline board – this first layer terminates at the top of the timber wall plate (see cross sectional drawing on page 18)

2. Now fasten the first piece/sheet into the steel clips/structure – use 3.5mm x 25mm drywall screws. 300mm spacing on the board edges and field of the board.



3. . When a board has a horizontal joint, cut the Gypframe GFT2400 Fixing T to the same length as the board – use the 3.5mm x 25mm drywall screw at 150mm centres into the Gypframe Fixing T and steel structure.



4. Now back point the horizontal joint of the first layer of Gyproc Fireline board with with Dowsil 400 Firestop fire rated intumescent acrylic sealant.

Second layer of 15mm Fireline board terminates at the wall plate and only one layer is fitted below wallplate - see p18

5. Now start to plan the arrangement of the second layer of 15mm Gyproc Fireline board , ensuring all vertical and horizontal joints are staggered. Use 3.5mm x 42mm drywall screws at 300mm spacings on the edges and field of the board - where the board is fastened horizontally into the Gypframe GFT2400 Fixing T , use the 3.5mm x 25mm drywall screws at 150mm centres. Back point horizontal joints with the Dowsil 400.

6. Gypframe GFT2400 and Dowsil 400 Firestop sealant

Gable/spandrel wall - 30 minute fire rating

The gable/spandrel wall uses one layer of 15mm Gyproc Taper Edge (TE) wall board.
Follow steps 2-3-4 above. Fill taper edge joint with Gypsum Easifiller/tape - see image alongside. Below wall plate level, Gyproc wallboard fitted on 'dabs' as per usual site practice.

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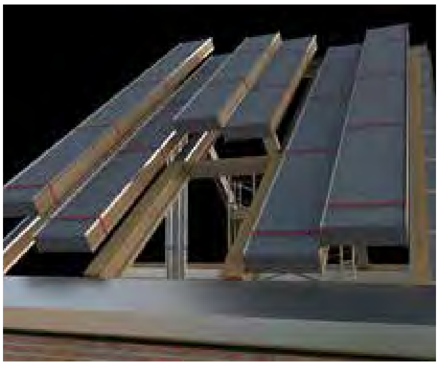
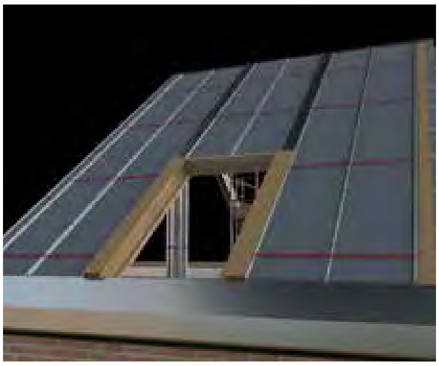
Appendix 9 - Intermediate roof beams
(for larger openings eg Dormers)

1. Using the roof location plan, set out the two intermediate beams and lower into position. At the eaves beam end , fasten up through the steel shelf on the eaves beam and into the steel flange of the intermediate roof beams.

2. Now complete the remainder of the Dormer support - a timber batten each side, sat in the flange and then the timber bearer and steel angle that supports the roof panels above. Finally, lay the OSB onto the top surface of the beams and fasten into position

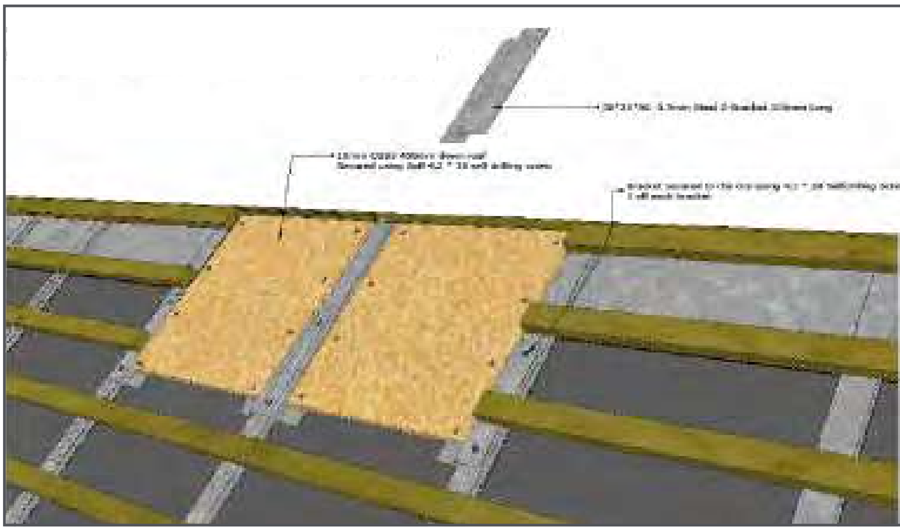


3. Now add the two smaller panels above the Dormer and the balance of the roof panels- this is per the earlier pages.



4. Intermediate roof beams in position ready to accept Dormer – supplied and fitted by other trades.

Appendix 10- GRP Chimney



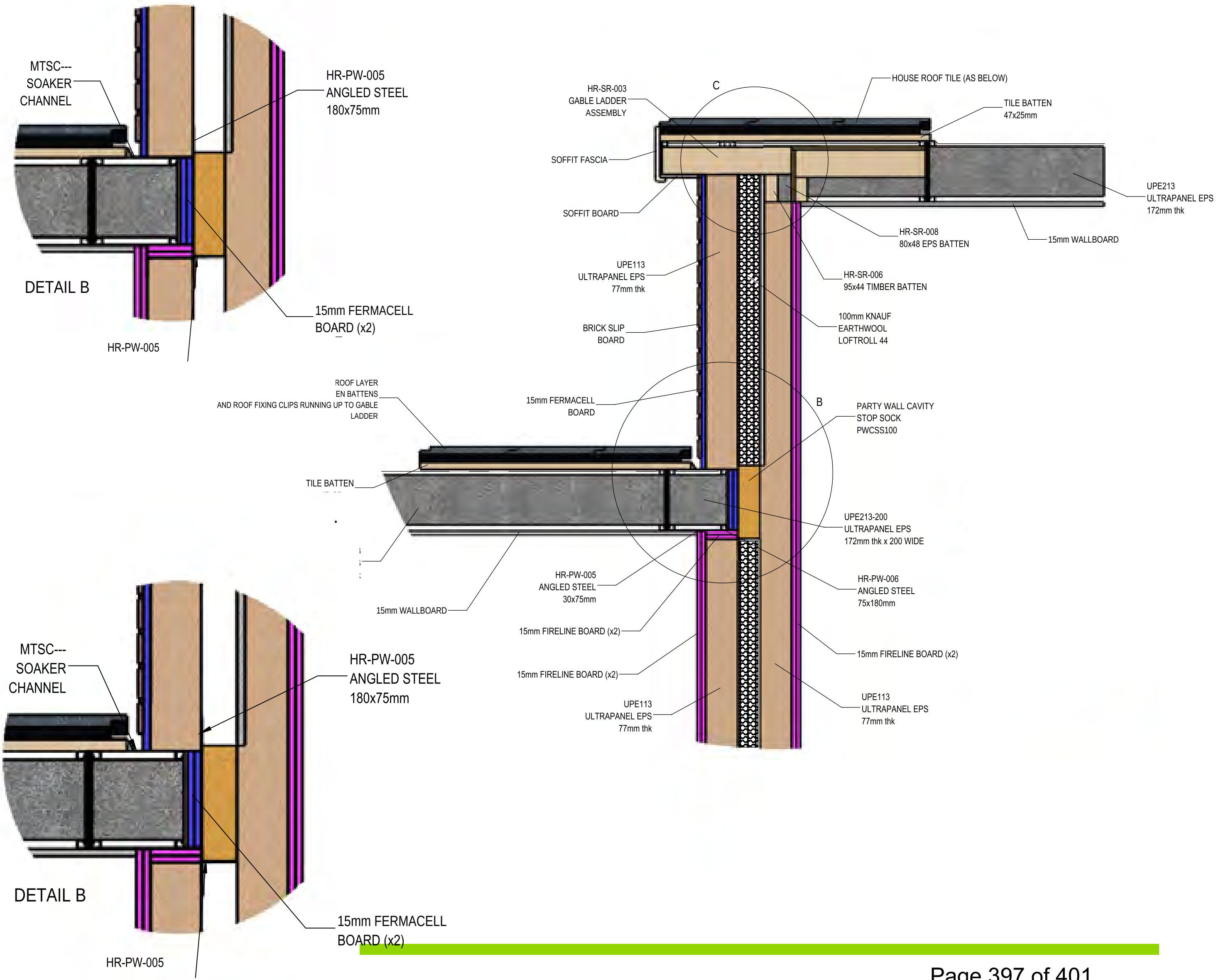
The weight of the GRP chimney must be taken account of at design stage. Each bracket is 50x20x50 steel, 300mm long attached using 3x4.2x38mm GPHS001 screws - two brackets used over central steel clip. Insert 18mm OSB and fix down in positions shown using same screws

Appendix 11 - fixing roof tile batterns

HSSCOO1 Timber tile batten to steel clip - 4.8mm x 44mm Philips head

Ensure each batten as it passes over the steel clip is fastened with a minimum of one HSSC001 screw. When battens are joined over a steel clip, one screw per batten (... so 2 into the steel clip)

Appendix 12 - Party wall – stepped roof arrangements



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19. Typical GRP Dormer Installation Details

19.1 Masonry Solutions Dormer installation Guide

Instructions

Installation
Guide.

GRP Dormer Fitting Details

Secret Gutter Dormer
Traditional Trussed Roof

Information

Storage

All Dormers should be stored flat on the protective ski's (timbers) on a level surface until ready to use.

Protective ski's must remain in place until just before installation.

Care must be taken when removing packaging.

Handling

Special care must also be taken when moving and unloading dormers on-site.

A forklift is required to unload the dormers on delivery.

Once fitted on the roof, they should not be walked on or used to store any material on top.

Fixings

Our products do not come with fixings unless otherwise stated. If you would like us to provide you with a quote for fixings please contact our Estimating department:

estimating@masonrysolutions.co.uk
Call: 01827 250236 (ask for Estimating).

Technical

For any other questions about the installation of our product or if any further information is required please contact our Technical department

technical@masonrysolutions.co.uk
Call: 01827 250236 (ask for Technical).

Issue: FG/DSG/P/001 – MS/12/16

General Enquiries:
Email: enquiries@masonrysolutions.co.uk
Call: 01827 250236

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- GRP & Brickslip Chimneys
- GRP Dormers & Canopies
- GRP Architectural Features
- Brick Arches & Panels

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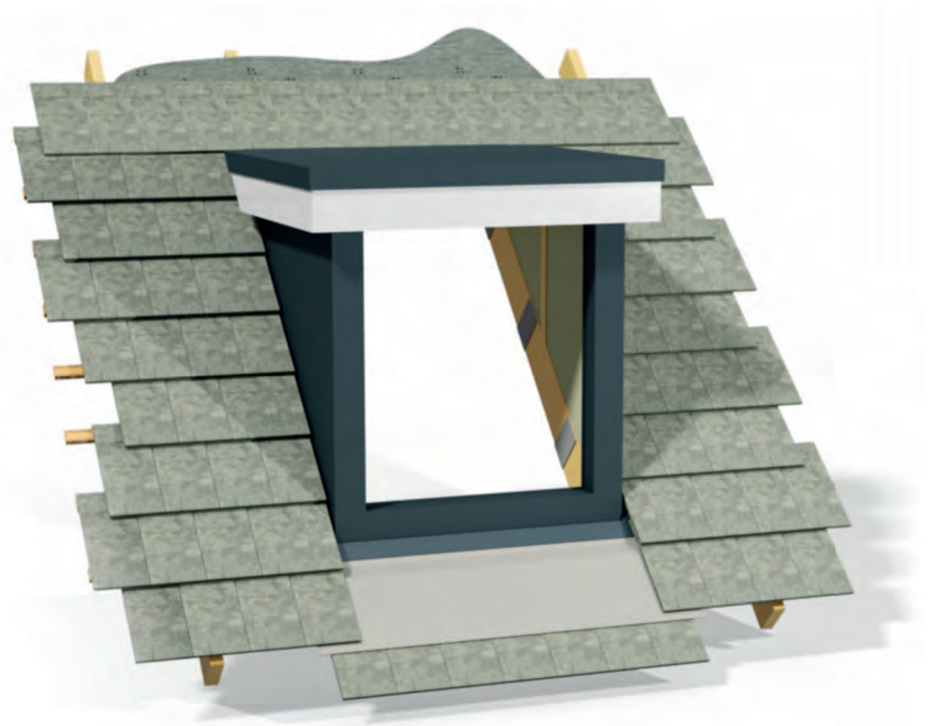


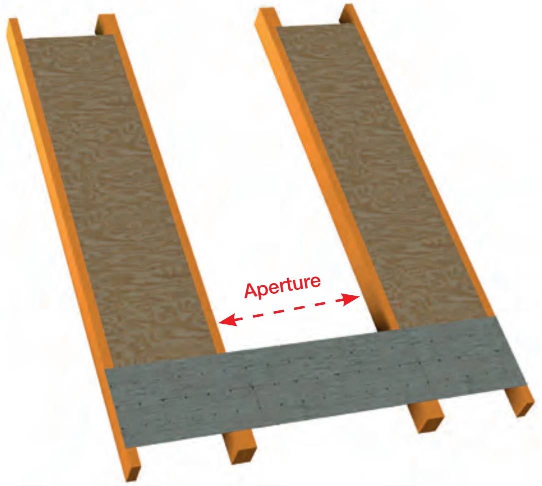
GRP Dormer Fitting Details

Secret Gutter Dormer
Traditional Trussed Roof

Stages 01 / 02

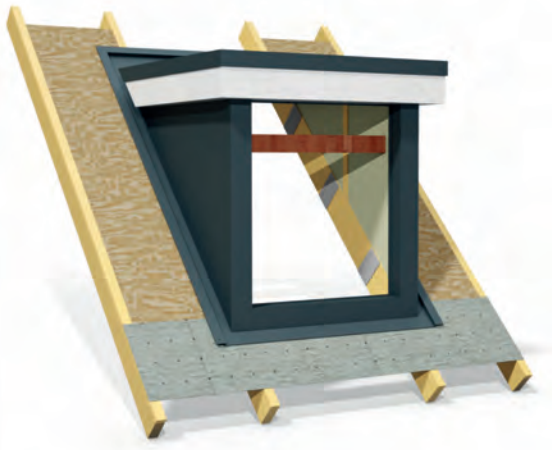
01.
Roof Preparation

- Check the aperture is the same width as the truss span indicated on the Dormer approval drawing.
- Insert 18mm Plywood Lay board between rafters.
- Extra Roofing membrane loose fixed across opening.



02.
Dormer Fitting

- Using a crane with a sling or a manitou lift the Dormer into place using the sacrificial lifting beams.
- Remove the protective timber ski's before the Dormer is installed.
- Before the Dormer is fixed into position using the nail plates, remove the sacrificial lifting beams and ensure the Dormer is sitting squarely on the roof.
- Fix the Dormer into position using Nail plates or similar approved (using a minimum of three per side).



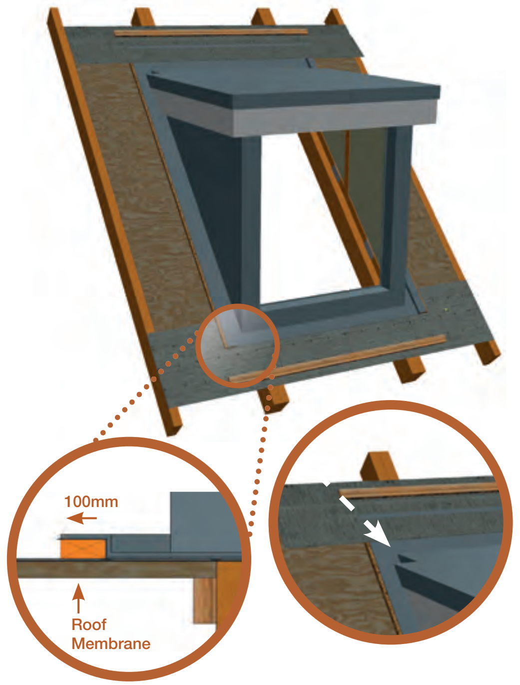
Stages 03 / 04

03.
Felting

- Install the roofing membrane as per traditional methods for the main body of the roof, ensuring a minimum 100mm over run on the cut membrane, into the upstand of the secret gutter.
- Install a rear additional piece of membrane over the up-stand at the rear of the Dormer.
- As shown below, return the roofing membrane under the secret gutter and also return on the upper flange. This prevents water from tracking underneath the Dormer.

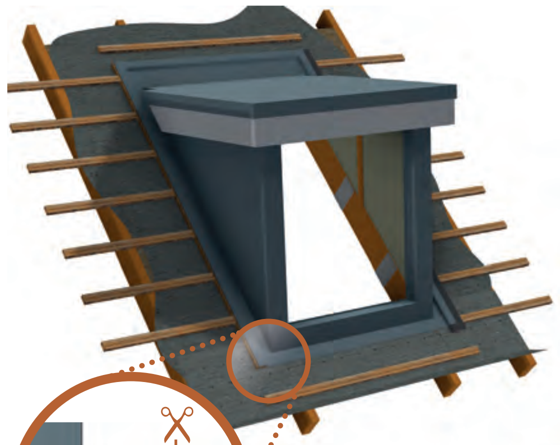
Notes

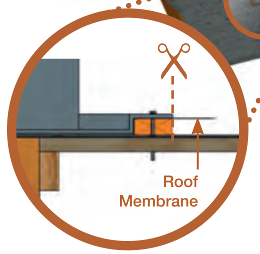
Fix 38 x 25mm batten through the GRP flange into the lay board. This needs to be installed all the way around the flange, and fixed every 300mm with 35mm round head stainless steel screws.



04.
Tile Laths

- Run tile laths - butt tile laths up to batten previously installed under the secret gutter on top of the roofing membrane.
- Ensure the excess roofing membrane is then returned up the batten end and back along the batten, underneath of the secret gutter.
- Trim the excess roofing membrane back to the flat flange of the secret gutter.





Notes

Do not nail through GRP

Stages 05 / 06

05.
Lead Flashing

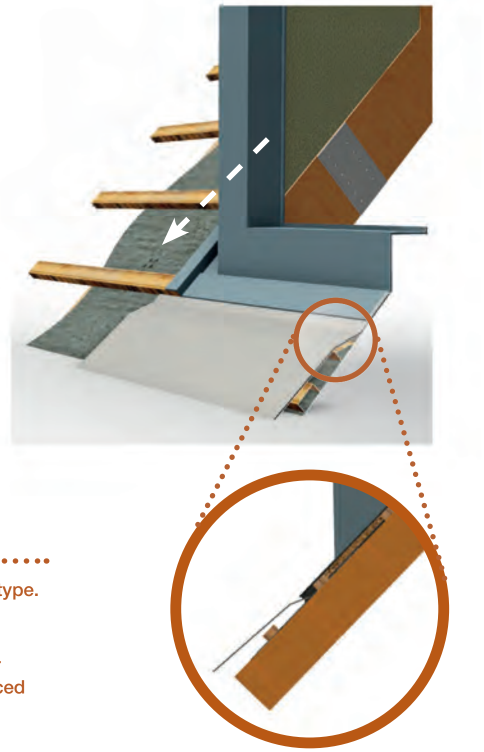
- Install a timber kick fillet at the front of the Dormer.
- Dress the lead under the Dormer to a min of 75mm.
- Once tiled, dress lead over the first tile ensuring a continuous fall and no sumping. (the tile is designed to avoid this).
- Extend the lead work beyond the side flanges by at least 300mm.
- Fit Lead dressing in accordance with LSA guidelines.

Notes

The distance of the kick fillet may vary depending on tile type.

If the Dormer has a lead pocket, dress the lead into this.

If not, a 4mm ply sheet can be installed under the Dormer flange before installing the plates. This can then be replaced by leadwork at a later stage. (Refer to above)



06.
Tiling

- Tiles should be installed in line with the manufactures recommendations into the Dormer cheek, leaving a Max gap of 15mm.
- Tile clips may be required depending on tile type.
- Expanding foam strips may be required depending on the tile profile. If required, install on the top horizontal flange of the secret gutter and trim around the tile clips.