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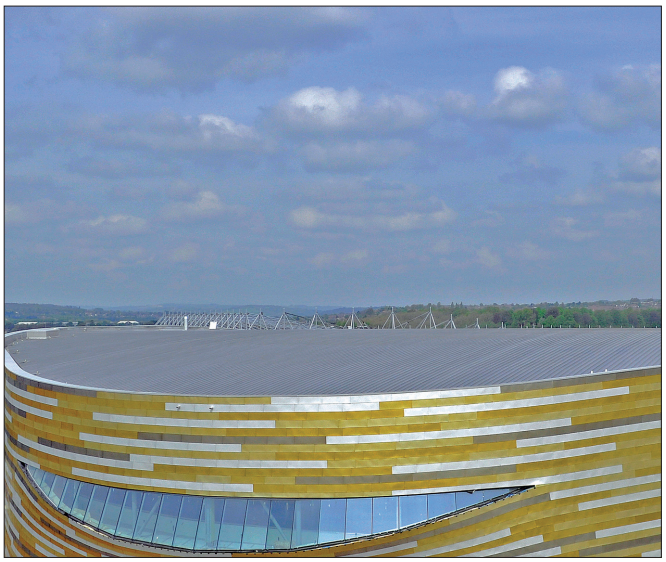
Agrément Certificate
13/5036
Product Sheet 1

BEMO STANDING SEAM ROOF SYSTEMS

BEMO N65/305, N65/333, N65/400 and N65/500 STANDING SEAM ROOF SYSTEMS

This Agrément Certificate Product Sheet(1) relates to BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam Roof Systems, comprising profiled aluminium alloy-coated, colour coil-coated or uncoated sheets and accessories for use as fully-finished structural roof systems with slopes from 1.5° to 60°, where access is available only for maintenance or repair.

(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 systems will remain structurally stable when installed in accordance with the provisions of this Certificate, and deflections will not be excessive under normal service conditions (see section 6).

Weathertightness — the systems will resist the passage of rain and wind-driven snow when installed in accordance with the provisions of this Certificate (see section 7).

Thermal performance — the systems can provide adequate insulation to contribute to the building meeting the requirements of the national Building Regulations (see section 8)

Condensation risk — the risk of condensation forming under normal service conditions is negligible (see section 9).

Performance in relation to fire — the roofing sheets have a notional AA designation as defined in the national Building Regulations (see section 10).

Durability — durability of the systems depends on the location, environment and coating finish used (see section 12).

The BBA has awarded this Certificate to the company named above for the systems described herein. These systems 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 Second issue: 9 March 2016

Originally certificated on 4 September 2013

Simon Wroe
Head of Approvals — Engineering

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.

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Regulations

In the opinion of the BBA, BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam Roof Systems, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):

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

Requirement:	**A1**	**Loading**
Comment:		The systems have sufficient strength and stiffness to sustain and transmit the design loads in accordance with section 6 of this Certificate.
Requirement:	**B2**	**Internal fire spread (linings)**
Requirement:	**B3(2)**	**Internal fire spread (structure)**
Comment:		The interior exposed surfaces of the systems have been assessed as having the surface classification given in section 10 of this Certificate.
Requirement:	**B4(2)**	**External fire spread**
Comment:		The external surface of the sheets has been assessed as having an AA designation as defined by BS 476-3 : 1958; therefore, constructions incorporating the systems are not subject to the limitations of a minimum distance from a boundary. See section 10 of this Certificate.
Requirement:	**C2(b)**	**Resistance to moisture**
Comment:		When subjected to the maximum design loads given in sections 6.1 to 6.4, the systems will resist the passage of moisture to the inside of the building. See section 9 of this Certificate.
Requirement:	**C2(c)**	**Resistance to moisture**
Comment:		The risks of harmful effects arising from interstitial and surface condensation will be minimal. See section 7 of this Certificate.
Requirement:	**F1**	**Means of ventilation**
Comment:		A roof construction incorporating one of the systems can be designed to satisfy this Requirement. See section 9 of this Certificate.
Requirement:	**L1(a)(i)**	**Conservation of fuel and power**
Comment:		The systems can contribute to meeting the requirements of this Regulation. See section 8 of this Certificate.
Regulation:	**7**	**Materials and workmanship**
Comment:		The systems are acceptable. See section 12 and the *Installation* part of this Certificate.
Regulation:	**26**	**CO_2 emission rates for new buildings**
Regulation:	**26A**	**Fabric energy efficiency rates for new dwellings (applicable to England only)**
Regulation:	**26A**	**Primary energy consumption rates for new buildings (applicable to Wales only)**
Regulation:	**26B**	**Fabric performance values for new dwellings (applicable to Wales only)**
Comment:		The systems can contribute to meeting the requirements of these Regulations. See section 8 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)(2)**	**Durability, workmanship and fitness of materials**
Comment:		The use of the systems satisfies the requirements of this Regulation. See sections 11 and 12 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards in relation to construction**
Standard:	1.1(a)(b)	Structure
Comment:		The systems have sufficient strength and stiffness to transfer the design load, with reference to clause 1.1.1[(1)]. See section 6 of this Certificate.
Standard:	2.5	Internal linings
Standard:	2.6	Spread to neighbouring buildings
Comment:		The exposed surfaces (seen from the inside of the building) of the systems have been assessed as having the surface rating class given in section 10 of this Certificate, with reference to clause 2.6.1[(1)(2)].
Standard:	2.8	Spread from neighbouring buildings
Comment:		The sheets have a low vulnerability classification, with reference to clause 2.8.1[(1)]. See section 10 of this Certificate.
Standard:	3.10	Precipitation
Comment:		When subjected to the maximum design load given in this Certificate, the systems will resist the passage of moisture to the inside of the building, with reference to clause 3.10.1[(1)]. See section 9 of this Certificate.
Standard:	3.15	Condensation
Comment:		The systems will have a minimal risk of surface condensation or of damage owing to interstitial condensation with reference to clauses 3.15.1[(1)] to 3.15.7[(1)]. See section 7 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The systems can contribute to satisfying, in full or part, clauses 6.1.2[(1)], 6.2.1[(1)], and 6.2.4[(1)]. See sections 8.1 to 8.4 of this Certificate. The system can also contribute to satisfying clauses 6.2.5[(1)] and 6.2.6[(1)]. See section 8 of this Certificate.

Standard:	7.1(a)	Statement of sustainability
Comment:		The systems can contribute to meeting the relevant Requirements of Regulation 9, Standards 1 to 6, and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. See section 8 of this Certificate.
Regulation:	12	Building standards applicable to conversions
Comment:		All comments given for the systems under Regulation 9, Standard 1 to 6, also apply to this Regulation with reference to clause 0.12.1[1][2] and Schedule 6[1][2].

(1) Technical Handbook (Domestic).
(2) Technical Handbook (Non-Domestic).

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

Regulation:	23	Fitness of materials and workmanship
Comment:		The systems are acceptable. See section 12 and the *Installation* part of this Certificate.
Regulation:	28	Resistance to moisture and weather
Comment:		When subjected to the maximum design loads given in section 6, the systems will resist the passage of moisture to the inside of the building. See section 9 of this Certificate.
Regulation:	29	Condensation
Comment:		The systems can be designed and constructed to meet the requirements of this Regulation. See section 7 of this Certificate.
Regulation:	30	Stability
Regulation:	31	Disproportionate collapse
Comment:		The systems have sufficient strength and stiffness to sustain and transmit the design load without excessive deflection or deformation. See section 6 of this Certificate.
Regulation:	34	Internal fire spread — Linings
Regulation:	35	Internal fire spread — Structure
Comment:		The interior exposed surfaces of the systems have been assessed as having the surface classification given in section 10 of this Certificate.
Regulation:	36	External fire spread
Comment:		The external surface of the sheets has been assessed as having a AA designation as defined by BS 476-3 : 1958; therefore, constructions incorporating the systems are not subject to the limitations of a minimum distance from a boundary. See section 10 of this Certificate.
Regulation:	39	Conservation measures
Comment:		The systems can meet the requirements of this Regulation. See section 8 of this Certificate.
Regulation:	40	Target carbon dioxide emission rate
Comment:		The systems can meet the requirements of this Regulation. See section 8 of this Certificate.

Construction (Design and Management) Regulations 2015

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, Principal Designer/CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See section: 3 *Delivery and handling* (3.1) of this Certificate.

Additional Information

NHBC Standards 2016

NHBC accepts the use of BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam Roof Systems, provided they are installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Part 7 *Roofs*.

Technical Specification

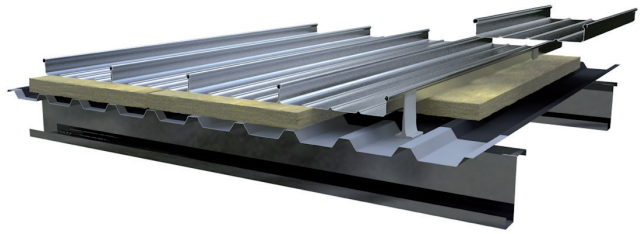
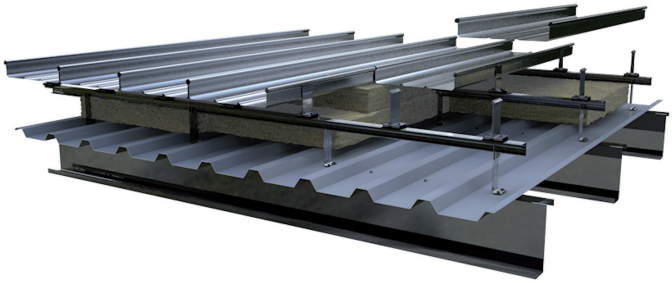
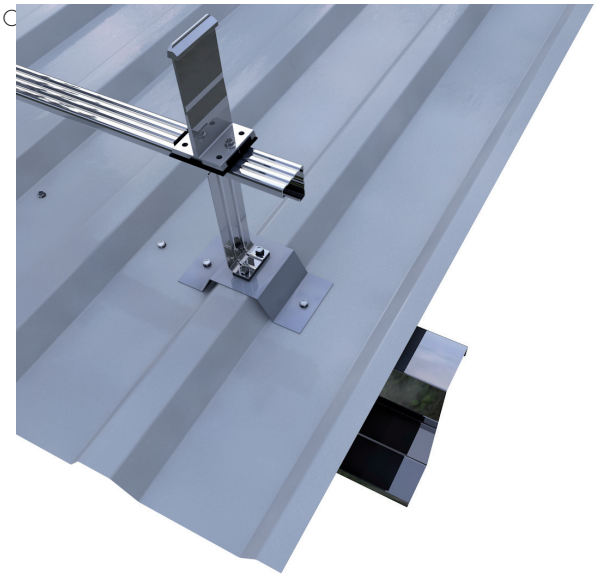
1 Description

1.1 BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam Roof Systems comprise a range of profiled aluminium alloy-coated, coil-coated or uncoated sheets and accessories:

- roof coverings of interlocking, profiled aluminium alloy sheets. The sheets are secured to the roof structure with hidden fixings, ensuring that there is no visible through-fixing of the roof sheet
- aluminium halters or GFK thermal halters and supporting sub-structure
- insulation
- liner panel
- vapour control barrier
- ancillary components.

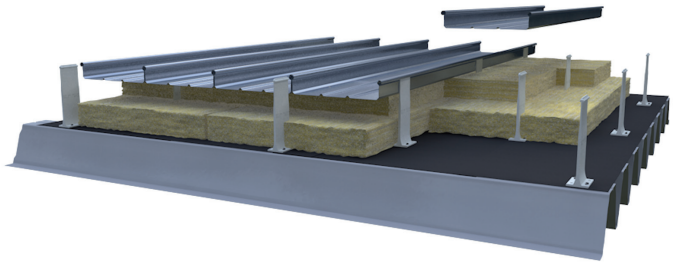
1.2 The BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam Roof Systems construction types covered in this Certificate are shown in Table 1.

Table 1 BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam Roof Systems

System make-up	Construction type/description
BEMO-GFK thermal halter (on purlins) 	BEMO N65 sheets are secured to BEMO-GFK thermal halters and fixed through the vapour control layer (VCL) and liner to the purlins. A 20 mm EPDM spacer may be clipped onto the base of the BEMO-GFK thermal halter if required. The insulation is placed between the VCL and the underside of the sheet
GFK thermal halter with optional Top Hat (on purlins) 	Optionally, to enable increased insulation thicknesses to be used, Top Hats may be fixed below the halter.
BEMO COMBI BAR & BRACKET (on purlins) 	BEMO N65 sheets are secured to aluminium halters on 5 or 15 mm thick thermal-break pads, and fixed to the BEMO COMBI BAR & BRACKETS which are attached through the VCL and liner to the purlins. Bracket heights vary from 100 to 200 mm, increasing in 10 mm increments. The insulation is placed between the VCL and the underside of the sheet.
C 	Optionally, to enable increased insulation thicknesses to be used, Top Hats may be fixed below the COMBI-BRACKET.

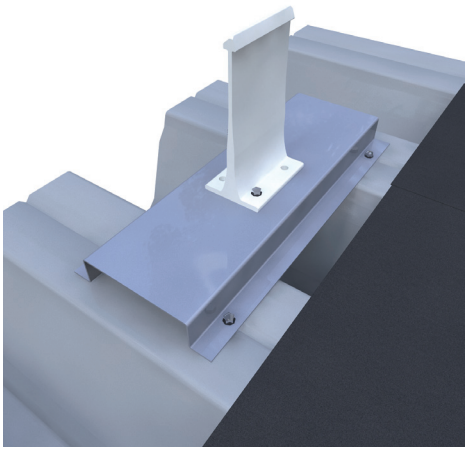
continued

BEMO-GFK thermal halter (on a structural deck)



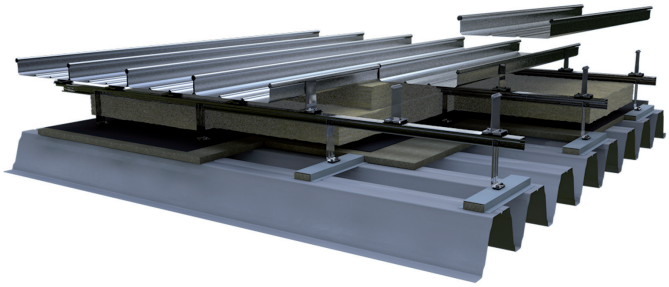
BEMO N65 sheets are secured to BEMO-GFK thermal halters, and fixed through the VCL to the structural deck. A 20 mm EPDM spacer may be clipped onto the base of the BEMO-GFK thermal halter if required

GFK thermal halter with optional Top Hat (on a structural deck)

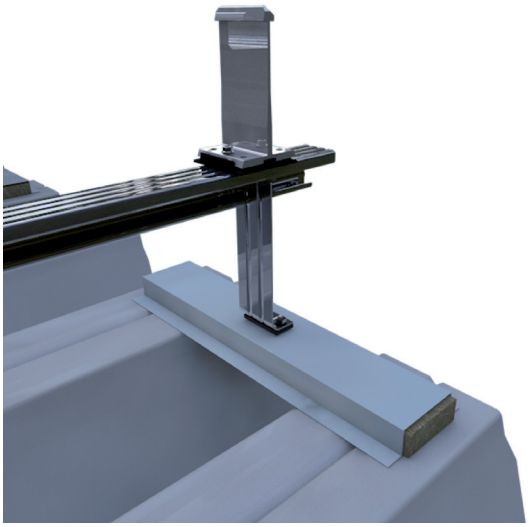


Optionally, to enable increased insulation thicknesses to be used, Top Hats may be fixed below the GFK thermal halter.

BEMO COMBI BAR & Bracket (on a structural deck)



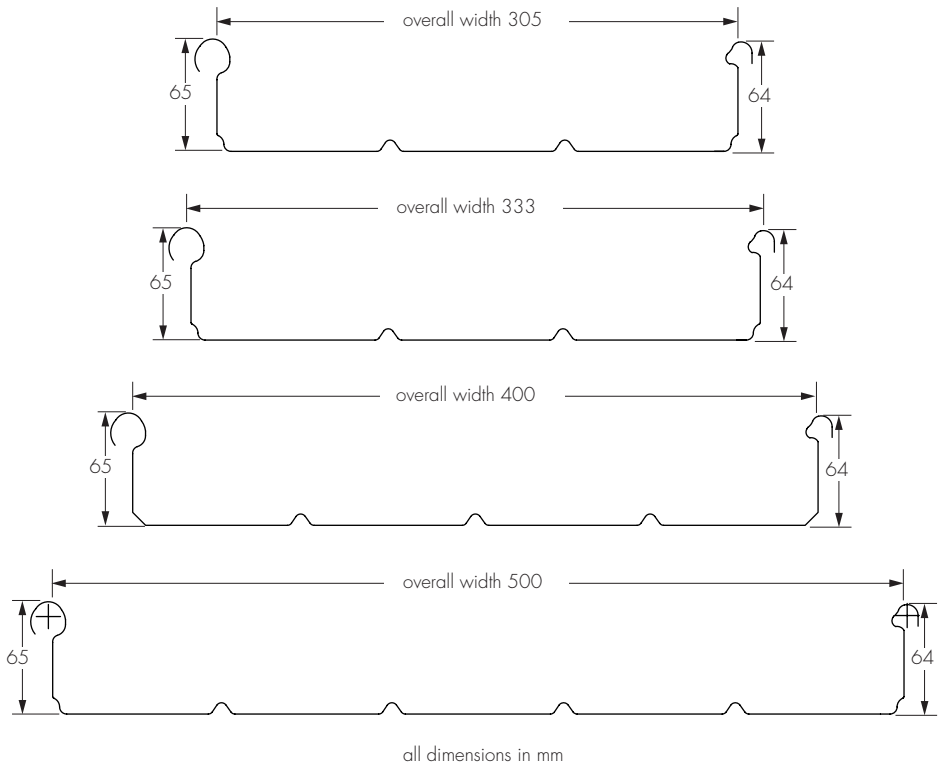
BEMO N65 sheets are secured to aluminium halters (height up to 220 mm) on 5 or 15 mm thick thermal-break pads, and fixed to BEMO COMBI BAR & BRACKETS, which are attached through the VCL and liner to the top hat, which is in turn fixed to the structural deck.



Bracket heights vary from 100 to 200 mm increasing in 10 mm increments.

1.3 BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam roof sheets and tapers are cold-formed from stucco-embossed aluminium to BS EN 573-3 : 2009, AW3004 H27 or AW3005 H27, or BBA-approved polyester, polyvinylidene difluoride (PVDF) or abrasion resistant surface (ARS) colour coil-coated aluminium to BS EN 573-3 : 2009, AW3105 H25 (BBA Certificate 93/2922 PS1, PS2 and PS3) to the profiles shown in Figure 1.

Figure 1 BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam sheets

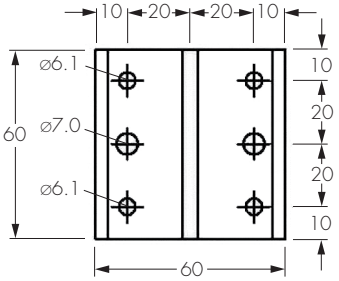


1.4 The sheets are available in thicknesses of 0.9, 1.0 or 1.2 mm, and in lengths of up to 27 m for transportation to site, or in greater lengths if the profile is formed on the construction site. Curved and tapered sheets are also available (see Figure 2). Panels are available in lengths to suit project requirements and have a minimum width of 100 mm. The panels are available with or without ribs, and a capillary groove is integrated into each.

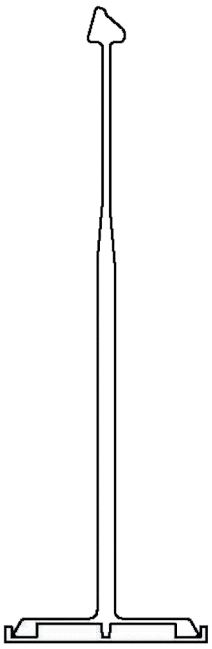
Figure 2 BEMO typical tapered panels

1.5 Standard BEMO aluminium halters (see Figure 3) are manufactured from extruded aluminium alloy to BS EN 755-1: 2008. They are used in conjunction with thermal-break pads manufactured from grey, high-density polyethylene (HDPE), 5 mm or 15 mm thick, which are attached to the base of the halter. The halters are available in heights of 80 mm, 100 mm, 120 mm, 140 mm, 160 mm, 180 mm, 200 mm and 220 mm.

Figure 3 Aluminium halter and thermal break pad



support base

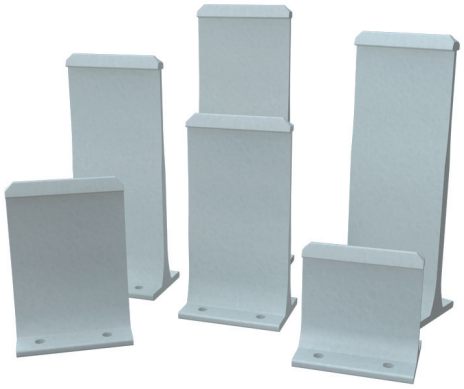


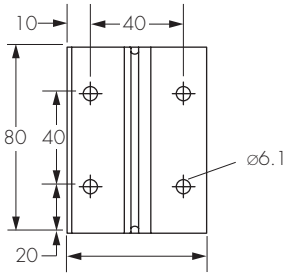
support base with barrier pad

all dimensions in mm

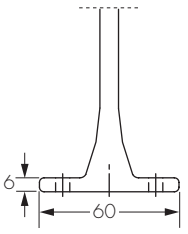
1.6 BEMO-GFK thermal halters (see Figure 4) are produced from a glassfibre-reinforced polymer and are available in heights of 85 mm, 125 mm, 165 mm, 205 mm, 225 mm and 245 mm.

Figure 4 BEMO-GFK thermal halter





support base



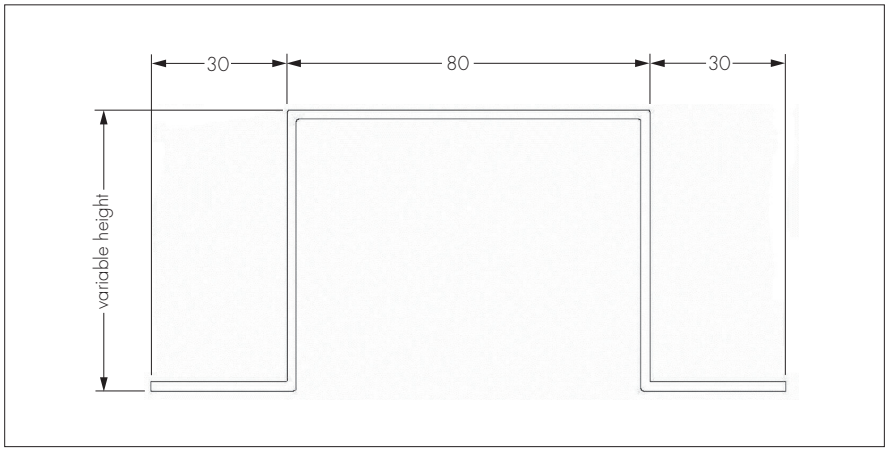
GFK Halter 205/80

all dimensions in mm

1.7 Spacer pads, 20 mm thick and manufactured from EPDM, may be clipped to the base of the BEMO-GFK thermal halter depending on the roof design.

1.8 Top Hat sections (see Figure 5) are manufactured from aluminium (grade EN AW 1050A H14, minimum thickness of 2.0 mm) or from galvanized steel (grade S280, minimum thickness 1.6 mm) with zinc or iron-zinc coating.

Figure 5 Section through Top Hat



1.9 Fixings for use with the system are detailed in Table 2.

Table 2 Details of fixings

Application	Halter	Fastener specification	Number of fixings
Halter to steel purlins or top hat	GFK	6.0 mm diameter austenitic stainless steel grade 304 or higher, self-tapping, self-drilling fasteners complete with stainless steel or aluminium/EPDM bonded washers	2 or 4
Halter to BEMO COMBI-BAR	Aluminium	6.3 mm diameter austenitic stainless steel grade 304 or higher, self-tapping, self-drilling fasteners complete with stainless steel or aluminium/EPDM bonded washers	2 or 4
BEMO COMBI-BRACKET to top hat	N/A	6.3 mm diameter austenitic stainless steel grade 304 or higher, self-tapping, self-drilling fasteners complete with stainless steel or aluminium/EPDM bonded washers	2
Top hat to steel purlins or structural deck	N/A	6.3 mm diameter austenitic stainless steel grade 304 or higher, self-tapping, self-drilling fasteners complete with stainless steel or aluminium/EPDM bonded washers	4
Halter to structural decking	GFK	6.0 mm diameter austenitic stainless steel grade 304 or higher, self-tapping, self-drilling fasteners complete with stainless steel or aluminium/EPDM bonded washers	2 or 4
Halter to timber purlins	GFK	for timber purlins (minimum width 75 mm) — 6.0 mm diameter austenitic stainless steel (AISI Grade 304 or higher), self-tapping fasteners complete with 16 mm diameter stainless steel or aluminium/ EPDM bonded washers. The fixing length is dependent upon the pull-out strength required and grade of timber used.	4

(1) See section 4.6.

1.10 The BEMO COMBI BAR & BRACKET system comprises:

- BEMO COMBI-BARS manufactured from high tensile 1.25 mm galvanized steel to BS EN 10346 : 2015, Grade S390GD+Z275. The bars are supplied in standard lengths of 1 m, 2 m and 3 m, and have a spigot on one end to facilitate connection and form a continuous bar
- BEMO COMBI-BRACKETS manufactured from 1.6 mm high tensile galvanized steel to BS EN 10346 : 2015, Grade S390GD+Z275, and incorporate stiffening ribs and vapour seal pads. The brackets range in height from 100 mm to 200 mm, in 10 mm increments.

The BEMO COMBI-BRACKETS are positioned at a maximum spacing of 1000 mm along the BEMO COMBI-BAR.

Insulation

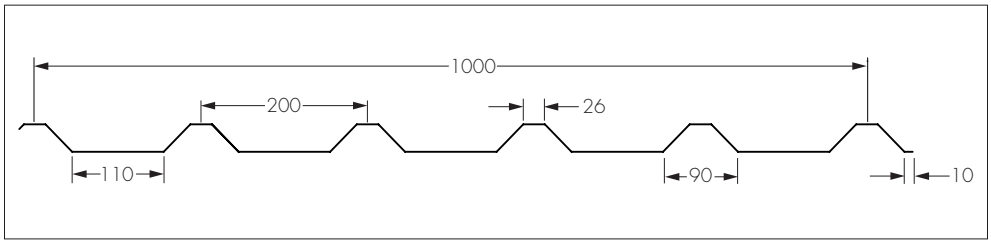
1.11 BEMO-THERM is a lightweight, non-combustible glass mineral wool insulation in accordance with BS EN 13162 : 2012, with declared thermal conductivity (λ_D) values of 0.040, 0.037, 0.035 or 0.032 $W \cdot m^{-1} \cdot K^{-1}$. A variety of thicknesses is available.

1.12 BEMO-SLAB insulation is a 30 mm or 50 mm thick, non-combustible, semi-rigid, high-density rock fibre acoustic and thermal insulation in accordance with BS EN 13162 : 2012, with declared thermal conductivity (λ_D) values of 0.035 or 0.037 $W \cdot m^{-1} \cdot K^{-1}$.

Liner

1.13 The liner is CE-marked by the manufacturer to BS EN 14782 : 2006. The profile is shown in Figure 6 and is designated as R1000 Super Six - 32/1000 x 0.7 mm thick coated steel. Both sides are coated with polyester, one to a thickness of 25 microns and the other to a thickness of 10 microns.

Figure 6 Liner profile



Vapour control layer (VCL)

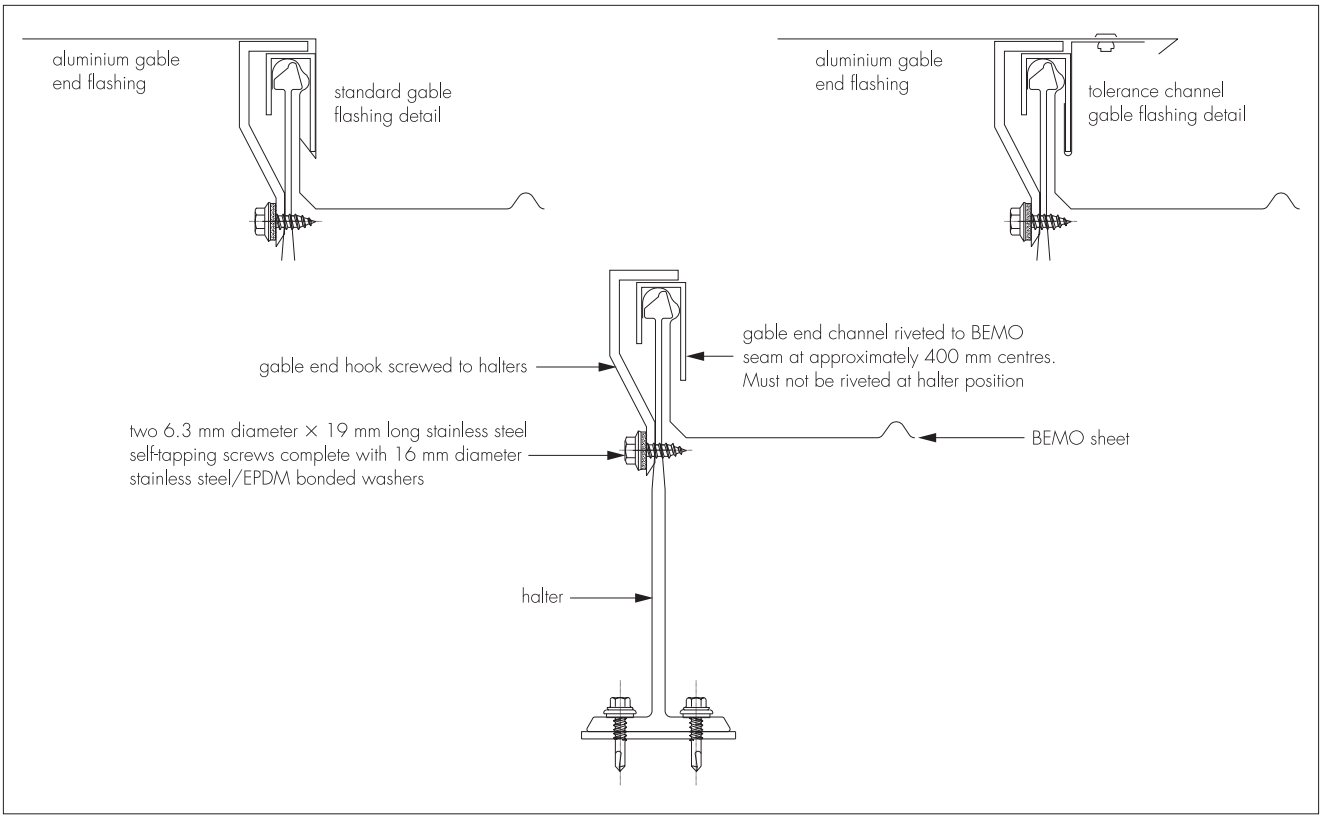
1.14 VCL's used with the system include:

- BEMO-CLEAR — reinforced polyethylene with 533 MN·s·g^{-1} vapour resistance
- BEMO-FOIL — aluminium foil encapsulated reinforced polyethylene with 44600 MN·s·g^{-1} vapour resistance.

1.15 Ancillary items used with the system (see Figure 7) are:

- gable end hooks — extruded aluminium alloy to the same specification as the halters. The 60 mm long component is secured to the gable end halter by two 6.3 mm diameter austenitic stainless steel (AISI Grade 304), self-tapping, self-drilling fasteners complete with stainless steel or aluminium/EPDM bonded washers
- gable end channel — extruded aluminium alloy supplied in 3000 mm lengths, fixed to the end seam of the profile using 4.8 mm diameter aluminium blind sealed rivets with stainless steel mandrels at 400 mm centres.

Figure 7 Gable end hook and channel



1.16 Other accessories used with the system, but outside the scope of this Certificate, include:

- gutters
- eaves and ridge closure pieces
- flashings — made to the same material finish as the BEMO Standing Seam sheets and fastened generally with aluminium rivets with stainless steel mandrels, used in such places as the verge, ridge and eaves
- trims
- filler blocks
- openings — such as vents, PVC or GRP rooflights.
- walkways.

2 Manufacture

2.1 The sheets are cold-formed at the factory or at the construction site.

2.2 Other components are bought in to the Certificate holder's specifications.

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

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

3 Delivery and site handling

3.1 BEMO Standing Seam sheets of the required length can be roll-formed at the construction site or delivered to site on pallets, each carrying the BBA logo incorporating the number of this Certificate. Sheets are packed three wide and are positioned in pairs, one inside the other. The packs are banded together with wooden pallets, which ensure that the pack has sufficient strength and the sheets cannot bend or become damaged. The sheets should not project more than 1 metre from the end of the pallet.

3.2 When pallets are lifted, the braces or ropes must have edge protection. If the sheets are not required immediately, the pallets should be stored on firm, level ground, preferably under cover in dry, dust-free conditions with adequate ventilation. Pallets must not be stacked.

3.3 The components of the system should be adequately protected and handled, and stored in accordance with the Certificate holder's recommendations to avoid damage before or during installation.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam Roof Systems.

Design Considerations

4 General

4.1 BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam Roof Systems are satisfactory for use on steel or timber substructures as fully-finished structural roof systems with slopes from 1.5° to 60° where access is available for maintenance and repair only.

4.2 The systems comprise standing seam profiles which form the outer skin of the roof, attached either by halters only or by halters secured to a support system and fixed to the structural frame, which can be either purlins (minimum bearing width 60 mm) with a liner sheet, or structural decking(1).

(1) The purlins and structural deck are not covered by the Certificate.

4.3 If architectural features, through fittings or rooflights are required on the roof, special care and attention is necessary in common with all metal roofs to ensure that these features have been correctly detailed and fitted. Openings to such details are outside the scope of this Certificate.

4.4 To cope with thermal expansion of the aluminium, the roof sheets are fixed at one location, normally at the ridge, so that the remainder of the sheet is free to slide over the supporting halters. Details of the most suitable location for the fixed section are provided by the Certificate holder's Technical Department. Typical fixed point details are shown in Figures 8 and 9 (see also section 6.4).

4.5 Fixed point detail can only be created using aluminium halters. On systems using GFK thermal halters, aluminium halters must be provided at the fixed points. Where necessary, either top hats or spacers are used to ensure that all halter heads are the same distance above the deck.

Figure 8 Two fixed point option

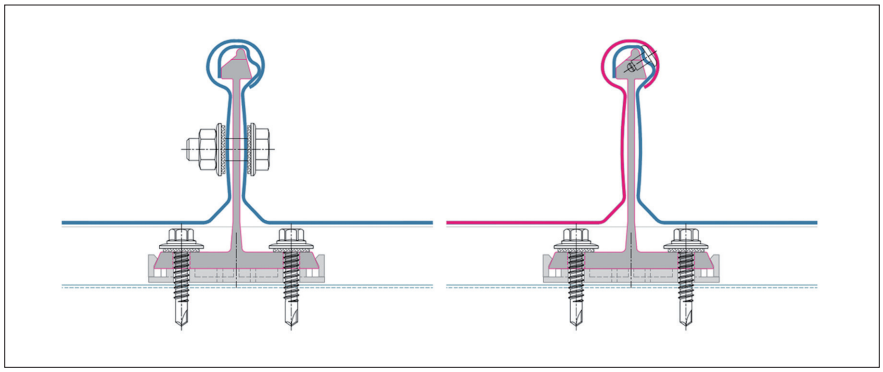
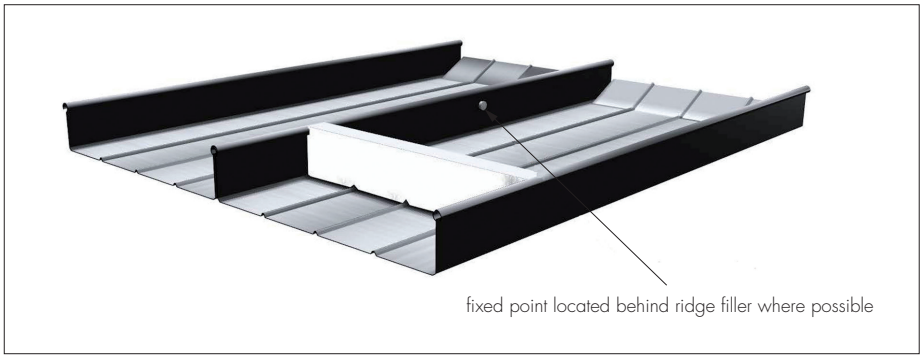


Figure 9 Typical fixed point detail



4.6 Project-specific calculations are available from the Certificate holder's Technical Department to confirm the number of fixings for local wind uplift zones.

4.7 Mill or stucco-finished uncoated aluminium sheets must not come into contact with the materials listed below. Where problems of incompatibility are likely to occur, barriers (eg paint, bimetallic separation tapes or pads, appropriate to the materials and environment) should be incorporated:

in any conditions

- ungalvanized mild steel
- brass
- copper and its alloys
- timber treated with fire retardants
- mortar
- alkali-bearing materials

in damp conditions

- timber preserved with copper or fluoride compounds
- other metals (ie bimetallic contact)

in coastal environments

- lead
- stainless steel

in industrial environments

- lead.

4.8 Under normal exposure conditions, aluminium sheets do not need coating for corrosion resistance but, if desired, can be painted using conventional techniques for the materials.

4.9 If the building has an exposed eaves detail, and is in an aggressive environment, or if there are corrosive conditions inside it, the specification of the reverse side coating should be discussed with the Certificate holder.

5 Practicability of installation

The systems should only be installed by installers who have been trained and approved by the Certificate holder.

6 Structural performance

6.1 Systems incorporating the BEMO GFK thermal halters have adequate strength and stiffness to sustain the specified loads (see Tables 3 and 4). The designer must ensure that the specified roof construction can resist the positive and negative design loads.

Table 3 Maximum span for constructions using GFK halters (downward load) (kN·m^{-2})

Component	Thickness (mm)	Span (m)				
		1.00	1.25	1.50	1.75	2.00
BEMO N65/305	0.9	4.80	3.80	3.15	2.70	2.10
	1.0	5.45	4.35	3.60	3.05	2.50
	1.2	6.90	5.50	4.55	3.55	2.75
BEMO N65/333	0.9	4.40	3.40	2.90	2.50	2.00
	1.0	4.90	3.90	3.30	2.80	2.40
	1.2	6.30	5.00	4.20	3.50	2.70
BEMO N65/400	0.9	3.65	2.90	2.40	2.05	1.80
	1.0	4.10	3.30	2.75	2.35	2.05
	1.2	5.25	4.20	3.45	2.95	2.60
BEMO N65/500	0.9	2.90	2.30	1.90	1.65	1.40
	1.0	3.30	2.60	2.15	1.85	1.55
	1.2	4.20	3.35	2.75	2.35	2.05

Table 4 Maximum span for GFK halters (wind uplift) (kN·m^{-2})

Component	Thickness (mm)	Span (m)				
		1.00	1.25	1.50	1.75	2.00
BEMO N65/305	0.9	–2.40	–1.90	–1.60	–1.35	–1.20
	1.0	–2.90	–2.30	–1.90	–1.65	–1.45
	1.2	–2.90	–2.30	–1.90	–1.65	–1.45
BEMO N65/333	0.9	–2.20	–1.70	–1.40	–1.20	–1.10
	1.0	–2.70	–2.10	–1.70	–1.50	–1.30
	1.2	–2.60	–2.10	–1.70	–1.50	–1.30
BEMO N65/400	0.9	–1.80	–1.45	–1.20	–1.00	–0.90
	1.0	–2.20	–1.75	–1.45	–1.25	–1.10
	1.2	–2.20	–1.75	–1.45	–1.25	–1.10
BEMO N65/500	0.9	–1.45	–1.15	–0.95	–0.80	–0.70
	1.0	–1.75	–1.40	–1.15	–1.00	–0.85
	1.2	–1.75	–1.40	–1.15	–1.00	–0.85

Notes for Tables 3 and 4:

- Data relates to multiple span applications
- Figures include ultimate load factor of 1.6 for snow and 1.4 for wind
- Deflection is limited to span/90 for uplift and span 200 for downward load
- A factor of safety of 2.0 is incorporated for attachment failure
- Four fixings are used to secure each halter.

6.2 The resistance of systems incorporating the BEMO COMBI BAR & BRACKET with aluminium halters is limited by the resistance of the connections when subjected to uplift loads, and by the support brackets when subject to downward loads (see Tables 5 and 6). The designer must ensure that the specified roof construction can resist the positive and negative design loads.

Table 5 Maximum downward load[1][2][3] (all sheet thicknesses)

COMBI-BAR spacing (m)	Maximum design load (kN·m^{-2}) all sheet widths
1.00	2.20
1.25	1.98
1.50	1.55
1.80	1.07

(1) Data relates to multi span situations and is limited by the strength of the COMBI-BRACKETS (factor of safety of 2 applied).

(2) COMBI-BRACKETS at a maximum of 1000 mm spacing along the COMBI-BARS.

(3) Four fasteners per halter.

Table 6 Maximum uplift load[1][2] (kN·m^{-2}) (all sheet thicknesses)

COMBI-BAR spacing (m)	Sheet width (mm)			
	305	333	400	500
1.00	4.97	4.55	3.79	3.03
1.25	3.43	3.14	2.61	2.09
1.50	3.33	3.05	2.54	2.03
1.80	2.15	1.97	1.64	1.31

(1) Data relates to multi-span applications limited by the halter connection resistance (factor of safety of 2 applied).
(2) COMBI-BRACKET at a maximum of 1000 mm spacing along the COMBI-BARS.

6.3 When evaluating the design loads, the wind loads must be calculated in accordance with the recommendations of BS EN 1994-1-4 : 2005 and its UK National Annex, and the imposed snow loads must be checked in accordance with the recommendations of BS EN 1991-1-1 : 2002 and its UK National Annex.

6.4 The systems are designed to expand and contract about a fixed point on each sheet. Fixed points are designed to suit each particular project and are specified by the Certificate holder's Technical Department. Fixed ends using 5 mm rivets have capacities of 0.5 kN for single rivets and 0.7 kN for double rivets. A capacity of 1.5 kN is achieved using a 6 mm bolt through the halter at the fixed end.

6.5 The Certificate holder will provide Static Calculations and design the fixed point requirement. For COMBI BAR & BRACKET systems, the Certificate holder's Technical Department should be consulted as thermal movement may result in excessive COMBI-BRACKET rotation. This is dependent on the length of the sheet and the amount of movement expected; in certain instances taller COMBI-BRACKETS may not be suitable.

6.6 The sheets are capable of withstanding impacts associated with normal handling, installation and service conditions.

7 Weathertightness

7.1 When installed in accordance with the Certificate holder's instructions and the *Installation* part of this Certificate, the systems are weathertight when used on roofs with finished slopes from 1.5° to 60° and within exposure conditions related to the maximum design wind pressures.

7.2 The weathertightness of the systems will not be affected by normal service deflection.

8 Thermal performance

8.1 The thermal performance of each building incorporating the roof system must be evaluated in accordance with the relevant national Building Regulations, and is the responsibility of the overall designer of the building.

8.2 Indicative thermal transmittance values (U values) have been determined in accordance with BS EN ISO 10211 : 2007 for typical specific roof constructions and are shown in Table 7.

Table 7 Indicative thermal transmittance values

Construction type	Description	Insulation conductivity λ (W.m^{-1}.K^{-1})	U value (W·m^{-2}·K^{-1})
BEMO GFK thermal halter (on purlins)	500 mm aluminium panel on 245 mm BEMO GFK thermal halters; 20 mm GRP spacer and 30 mm top hat fixed through VCL and liner to the purlins; 1500 mm purlin centres; 200 mm BEMO-THERM insulation.	0.032 0.040	0.15 0.18
BEMO COMBI BAR & BRACKET (on purlins)	500 mm aluminium panel on 180 mm aluminium halters; 15 mm thick thermal-break pads fixed to the BEMO COMBI BAR & BRACKET through the VCL and liner to the purlins; 1500 mm purlin centres; 1000 mm spacing between COMBI-BRACKETS; 310 mm BEMO-THERM insulation.	0.032 0.040	0.11 0.14
BEMO GFK thermal halter (on a structural deck)	500 mm aluminium panel on 245 mm BEMO GFK thermal halters; 20 mm GRP spacer pads fixed through VCL and liner to structural decking; 200 mm BEMO-THERM insulation.	0.032 0.040	0.14 0.18
BEMO COMBI BAR & BRACKET (on a structural deck)	500 mm aluminium panel on aluminium halter; 15 mm thick thermal-break pads fixed to the BEMO COMBI BAR & BRACKET; attached through the VCL and liner to the top hat and fixed to the structural deck; 310 mm BEMO-THERM insulation and 30 mm BEMO-SLAB acoustic insulation.	0.032 0.040	0.11 0.13

Notes:
- Thermal conductivity (λ_D) value of insulation taken as:
  – 0.032 or 0.040 W·m^{-1}·K^{-1} for BEMO-THERM mineral wool quilt, other thermal conductivities are available
  – 0.035 W·m^{-1}·K^{-1} for BEMO-SLAB semi rigid mineral wool board
- U values have been calculated assuming the following:
  – halters are spaced at 1500 mm along the standing seam
  – COMBI-BRACKETS are at 1000 mm along the COMBI-BAR (perpendicular to the span)
- U values for roof constructions that are different to those precisely described in the table should be determined by a suitably-qualified person in accordance with BS EN ISO 10211 : 2007.

8.3 The systems can contribute to maintaining continuity of thermal insulation at junctions between elements and openings. For Accredited Construction Details, the corresponding psi values in Table 3 of BRE Information Paper IP 1/06 may be used in carbon emission calculations in Scotland and Northern Ireland. Detailed guidance for other junctions and on limiting heat loss by air infiltration can be found in:

England and Wales – Approved Documents to Part L and, for new thermal elements to existing buildings, Accredited Construction Details (version 1.0) (for new-build, see also SAP 2012, Appendix K, and the *iSBEM User Manual*)

Scotland – Accredited Construction Details (Scotland)

Northern Ireland – Accredited Construction Details (version 1.0).

9 Condensation risk

9.1 In common with all metal roof construction, there is a risk of condensation which can arise either as interstitial condensation within the roof construction or as surface condensation at thermal bridges.

9.2 The VCL detail must be undamaged and continuous over ridges and hips, and sealed at penetrations and abutments.

9.3 Guidance on the evaluation and control of internal atmospheric conditions is given in BS 5250 : 2011, BS 5720 : 1979 and BS 5925 : 1991. Calculations to determine the risk of condensation should be to BS EN ISO 10211 : 2007 and BS EN ISO 13788 : 2012, and BRE Information Paper IP 1/06 should be used to establish relevant temperature factors.

9.4 In applications with a high vapour load (eg swimming pools) the use of BEMO-FOIL VCL is recommended; however, calculations should be conducted to confirm suitability.

10 Performance in relation to fire

BEMO N65 sheets have a notional AA designation as defined by BS 476-3 : 1958, provided that the blanket insulation installed is non-combustible.

11 Maintenance

11.1 The systems should be inspected regularly (at least once a year) for damage to the roof sheets or their coatings and for any build up of dirt and debris. Damage must be repaired and accumulated dirt and debris removed.

11.2 In industrial and coastal environments it may be necessary to clean the installation periodically by hosing with water and a neutral detergent to restore its appearance and to remove corrosive deposits. It may be necessary to clean soffits in any environment.

11.3 Maintenance painting may be necessary to restore the appearance of coated sheets or to extend their design life, and should be considered at the intervals given in Table 8. The Certificate holder can recommend a suitable system for maintenance painting. In addition, specific requirements apply to mill- or stucco-finished uncoated aluminium (see section 12.2).

Table 8 Service life of coating

Sheet material	Minimum service life (years)[1]	
	Rural or suburban environment	Industrial or coastal environment
Polyester-coated aluminium alloy	15[2]	10[2]
PVDF-coated aluminium alloy	20[2]	15[2]
ARS-coated aluminium alloy	20[2]	15

(1) Minimum service life is that to when first maintenance painting is required.
(2) Full details of coated materials are given in Certificate Number 93/2922.

11.4 Damaged sheets can be removed and replaced. The Certificate holder should be contacted for details.

12 Durability

12.1 The durability of the sheets will depend upon the material or coating, the immediate environment, the aspect faced and their use (see sections 4.7 to 4.9).

12.2 The stucco-embossed aluminium sheet will have a minimum service life of 40 years in rural and suburban areas and a minimum 25 years in more aggressive areas, eg severe industrial or coastal environments.

12.3 Colour changes of the coatings in general will be slight and uniform on any one elevation. More pronounced changes with colours of vermilion, golden yellow and silver metallic may occur.

13 Reuse and recyclability

The metal components of the systems are fully recyclable.

Installation

14 General

Systems where halters are fixed directly to purlins or the structural deck

14.1 Installation of BEMO N65/305, N65/333, N65/400 and N65/500 Standing Seam Roof Systems must be carried out by experienced roofing contractors trained and approved by the Certificate holder.

14.2 The liner sheets, VCL and filler blocks should be laid in accordance with the manufacturer's instructions.

14.3 Once the liner installation is complete, the halter and thermal barrier pads are fixed through the underlining sheets. After careful positioning, both in line and level, according to the layout plan, the halters are fixed using the appropriate screws.

14.4 BEMO-THERM or BEMO-SLAB are placed and eased over the halters.

14.5 The roofing sheets are placed and the joints folded using either the BEMO seaming tool or the BEMO powered seaming machine (supplied by the Certificate holder).

14.6 Each section must be seamed as soon as it has been laid. In this way, the full load-carrying capacity and security against strong winds are assured for the system. Normal assembly is from verge flashing to verge flashing.

14.7 On completion of the installation of the sheets, the ancillary components forming the various ridge, perimeter and eaves fittings are fixed.

14.8 Typical construction details are shown in Figures 10 to 15.

Figure 10 Typical verge detail with GFK thermal halters

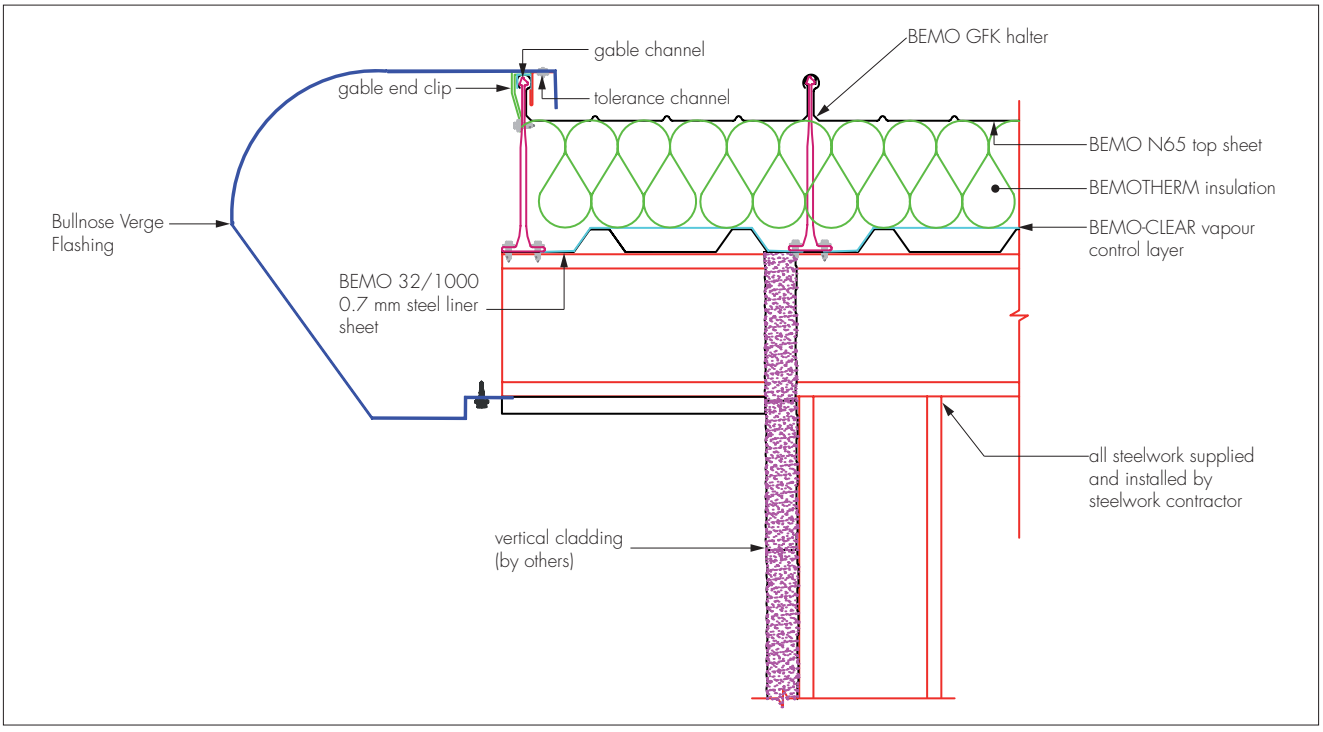


Figure 11 Typical verge detail with BEMO COMBI BAR & BRACKET

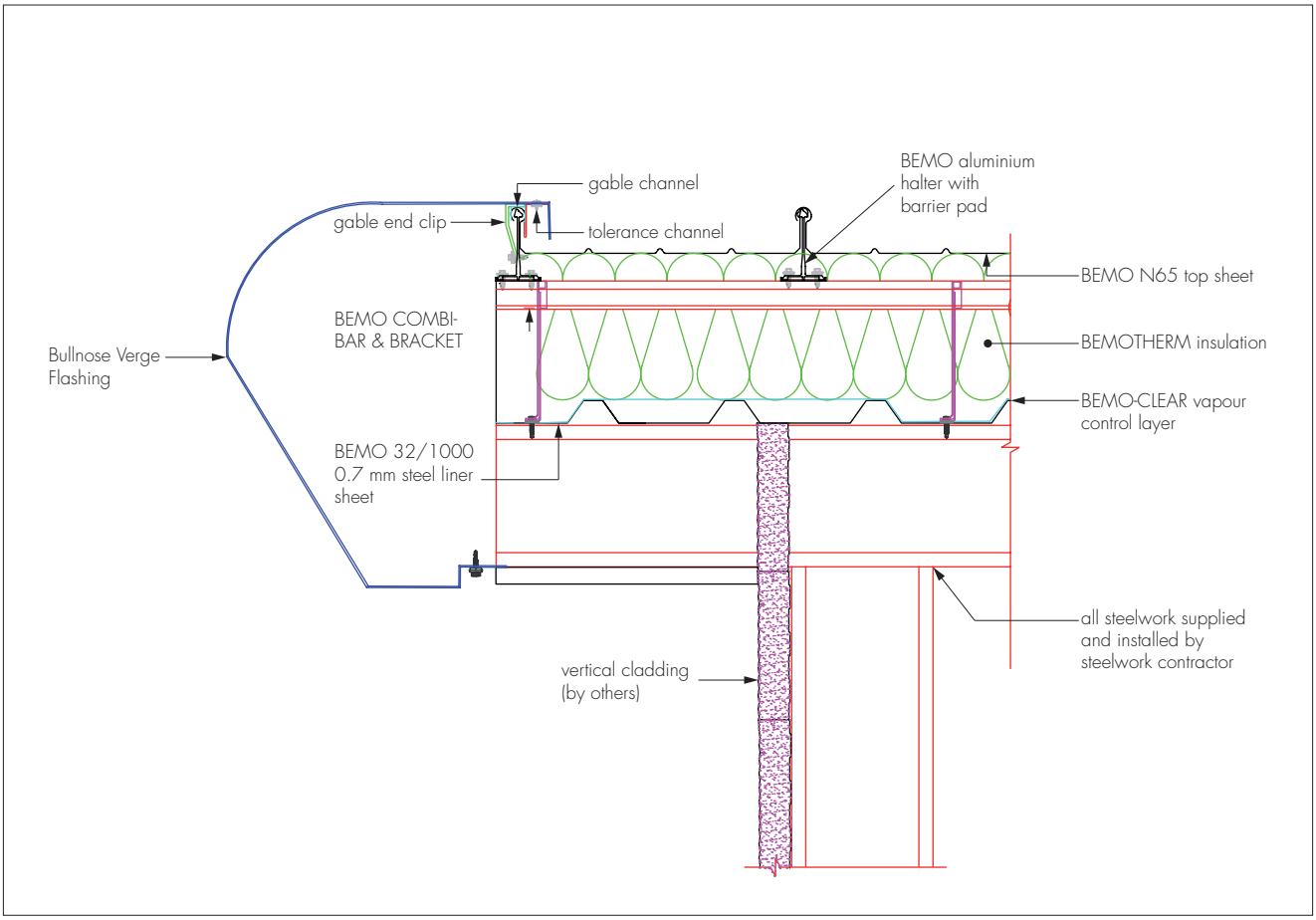


Figure 12 Typical ridge detail with GFK thermal halters

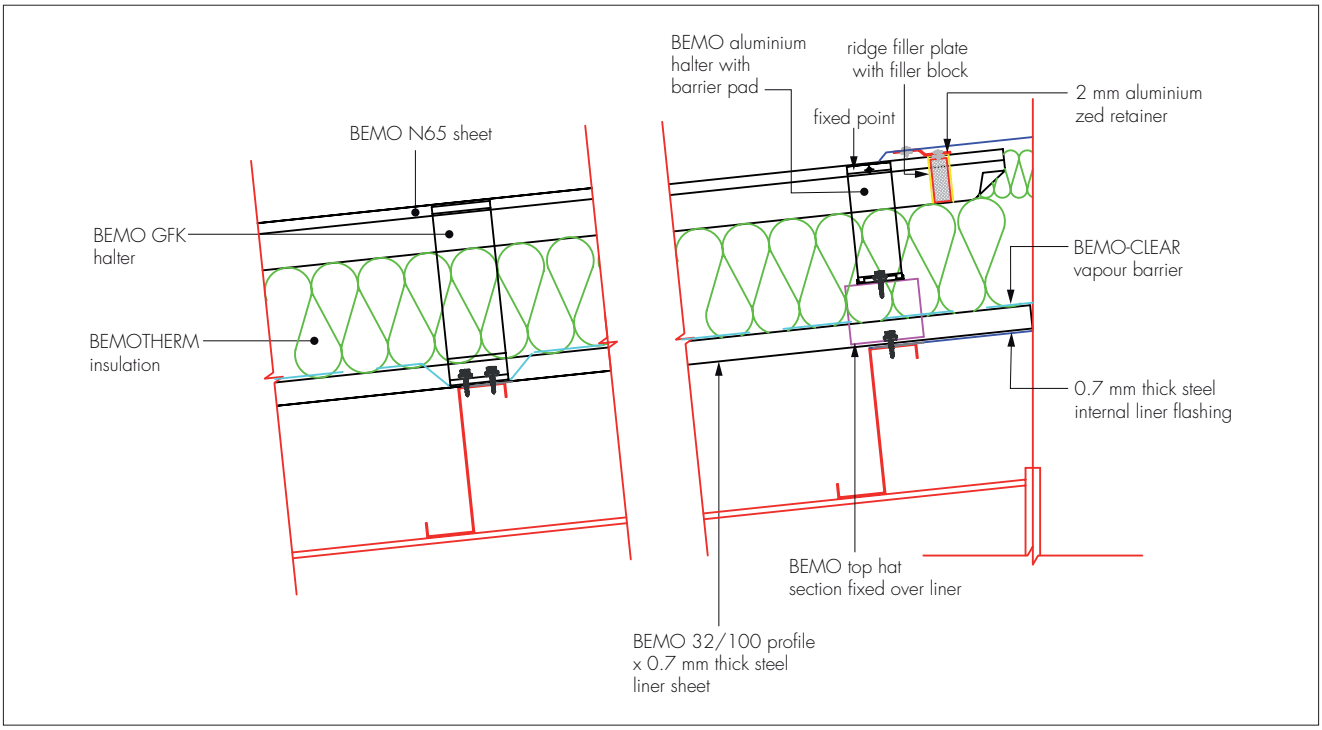


Figure 13 Typical ridge detail with BEMO COMBI BAR & BRACKET

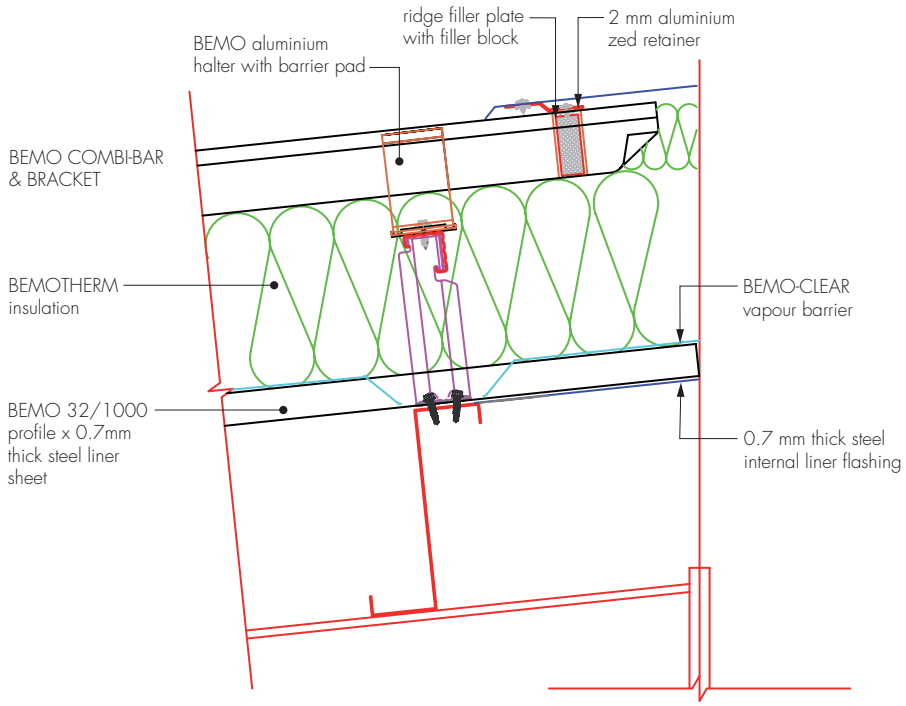


Figure 14 Typical eaves detail with GFK thermal halters

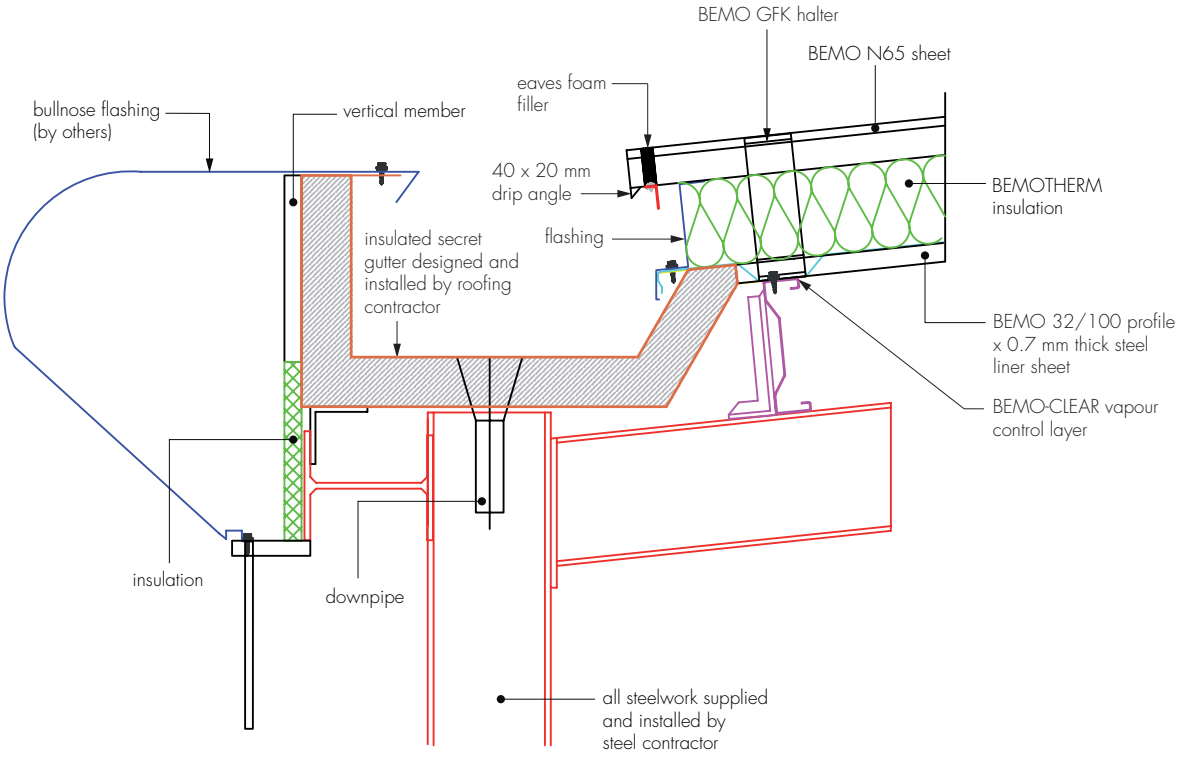
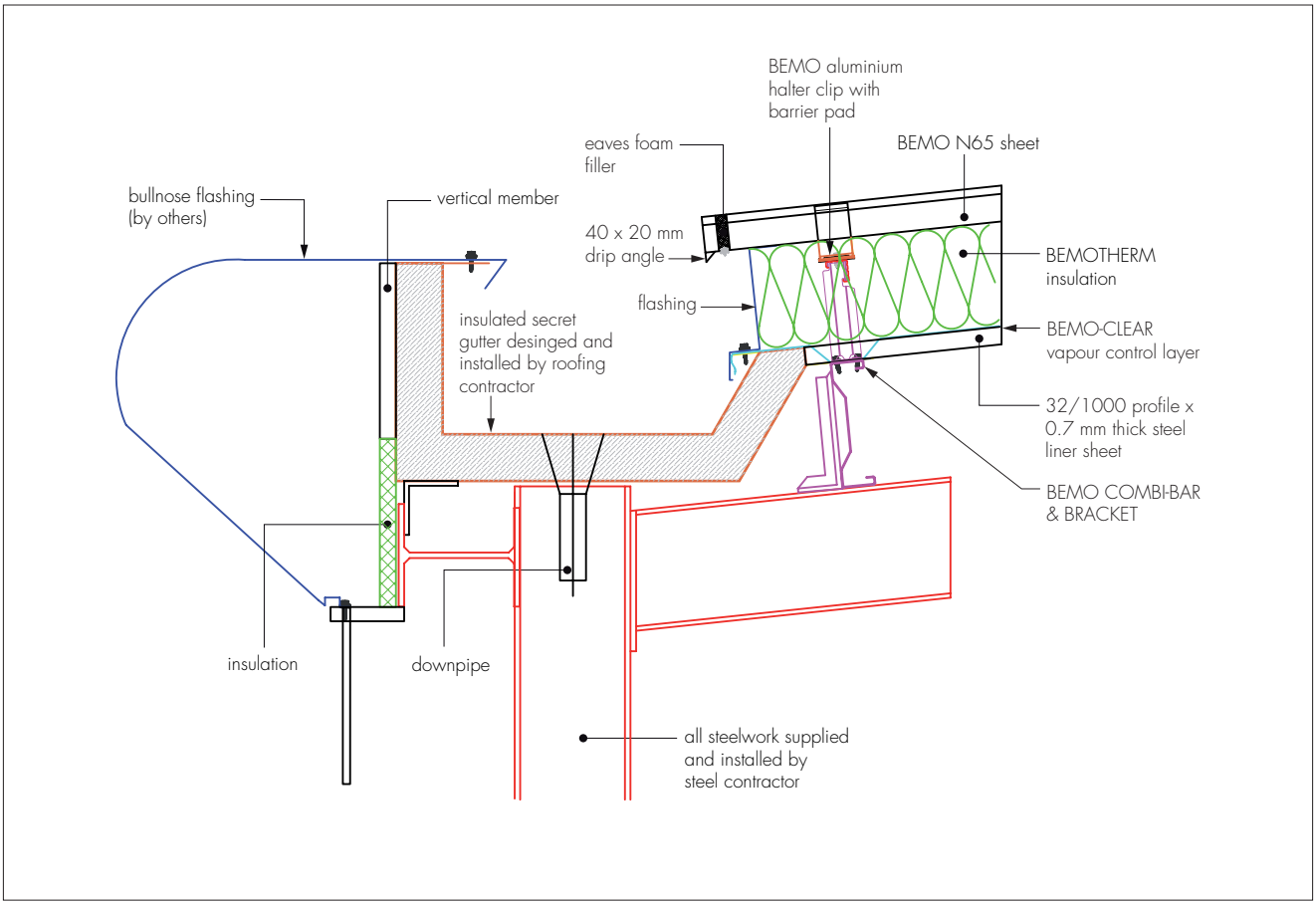


Figure 15 Typical eaves detail with BEMO COMBI BAR & BRACKET



Technical Investigations

15 Tests

Tests were carried out on the systems and the results assessed to determine:

- resistance to dead and imposed snow loading
- resistance to wind loading
- resistance to impact
- behaviour of fixings and profile under static and cyclic loading
- behaviour under concentrated loads.

16 Investigations

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

16.2 An assessment was made of:

- fire resistance
- practicability of installation of cut sheets and site-rolled sheets
- weathertightness of fixed cladding and details.

16.3 Existing information relating to durability of the systems, performance in fire and compatibility of materials in contact was assessed.

16.4 Site visits were made to assess the practicability of installation.

Bibliography

BS 476-3 : 1958 *Fire tests on building materials and structures — External fire exposure roof test*

BS 5250 : 2011 *Code of practice for control of condensation in buildings*

BS 5720 : 1979 *Code of practice for mechanical ventilation and air conditioning in buildings*

BS 5925 : 1991 *Code of practice for ventilation principles and designing for natural ventilation*

BS EN 573-3 : 2009 *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Chemical composition and form of products*

BS EN 755-1 : 2008 *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Technical conditions for inspection and delivery*

BS EN 1991-1-1 : 2002 *Eurocode 1: Actions on structures — General actions — Densities, self-weight, imposed loads for buildings*
NA to BS EN 1991-1-1 : 2002 UK National Annex to *Eurocode 1: Actions on structures — General actions — Densities, self-weight, imposed loads for buildings*

BS EN 1994-1-4 : 2005 + A1 : 2014 *Eurocode 4: Design of composite steel and concrete structures — General rules — Structural fire design*
NA to BS EN 1994-1-4 : 2005 UK National Annex to *Eurocode 4: Design of composite steel and concrete structures — General rules — Structural fire design*

BS EN 10346 : 2015 *Continuously hot-dip coated steel flat products for cold forming — Technical delivery conditions*

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

BS EN ISO 10211 : 2007 *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations*

BS EN ISO 13788 : 2012 *Hygrothermal performance of building components and building elements — Internal surface temperature to avoid critical surface humidity and interstitial condensation — Calculation methods*

BS EN 14782 : 2006 *Self-supporting metal sheet for roofing, external cladding and internal lining — Product specification and requirements*

SAP 2012 *The Government's Standard Assessment Procedure for Energy Rating of Dwellings 2012*

BRE Information Paper IP 1/06 *Assessing the effects of thermal bridging at junctions and around openings*

17 Conditions

17.1 This Certificate:

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

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

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

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

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

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

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

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

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