

Labelfaçade

7 Rue des Maraichers
Vaulx en Velin
Rhone
69120
France

Tel: 04 78 68 00 74 Fax: 09 58 64 92 68

e-mail: etude@labelfacade.fr

website: www.labelfacade.fr



Agrément Certificate

17/5424

Product Sheet 2

CLADDING SUPPORT SYSTEMS

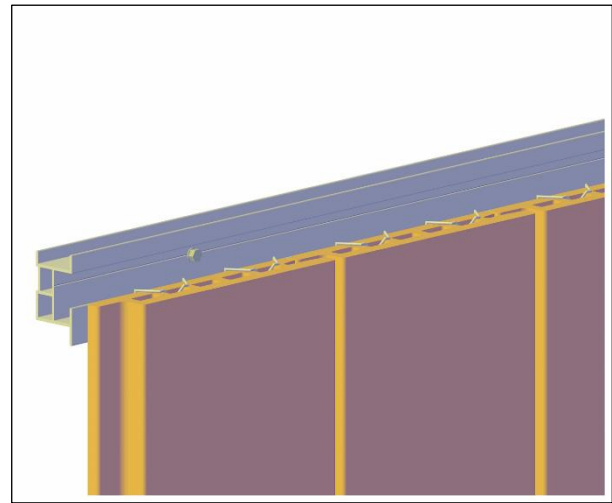
V-CLIP SYSTEM : HIGHER THAN 18 M

This Agrément Certificate Product Sheet⁽¹⁾ relates to the V-Clip System : Higher than 18 m, used to support terracotta and natural stone cladding panels on external masonry and concrete wall structures of new or existing buildings via a subframe.

(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 and stability — the system can be designed to support terracotta and natural stone panels and to transfer the design loads to the substrate wall structure safely (see section 6).

Behaviour in relation to fire — the V Clip aluminium rails and fixings system has an A1 reaction to fire classification to BS EN 13501-1 : 2007 (see section 7).

Drainage and ventilation — the amount of water entering the cavity depends on the cladding joint and/or gap between panels. Provided the provision of drainage and ventilation is made, the system will remove any water collecting in the cavity due to rain and condensation (see section 8).

Durability — when used in normal exposure conditions, the system can have a service life of at least 35 years (see section 10).



The BBA has awarded this Certificate to the company named above for the system described herein. This system 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

Paul Valentine
Technical Excellence Director

Claire Curtis-Thomas
Chief Executive

Date of First issue: 16 May 2018

Certificate amended on 22 January 2019 to include Regulation 7(2) for England and associated text.

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.*

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

British Board of Agrément

Bucknalls Lane
Watford
Herts WD25 9BA

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tel: 01923 665300
clientservices@bbacerts.co.uk
www.bbacerts.co.uk

Regulations

In the opinion of the BBA, the V-Clip system : Higher than 18 m, 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 system is acceptable for use as set out in sections 6.1 to 6.3 of this Certificate.
Requirement:	B4(1)	External fire spread
Comment:		The system is judged to satisfy the Class 0 requirements. See section 7.1 of this Certificate.
Requirement:	C2(b)(c)	Resistance to moisture
Comment:		When used in an external wall, the clips will not adversely affect the resistance of the wall to the passage of moisture. See Section 8 of this Certificate.
Regulation:	7	Materials and workmanship (Applicable in Wales only)
Regulation:	7(1)	Materials and workmanship (Applicable in England only)
Comment:		The system is acceptable. See section 10.1 and the <i>Installation</i> part of this Certificate.
Regulation:	7(2)	Materials and workmanship (Applicable in England only)
Comment:		The system is unrestricted by this Regulation. See sections 7.1 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)	Durability, workmanship and fitness of materials
Comment:		The system can contribute to a construction satisfying this Regulation. See section 10.1 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	1.1(a)(b)	Structure
Comment:		The system can be designed to adequately transfer the design loads from the cladding to the substrate wall structure, with reference to clause 1.1.1 ⁽¹⁾⁽²⁾ . See sections 6.1 to 6.3 of this Certificate.
Standard:	2.6	Spread to neighbouring buildings
Comment:		The system is unrestricted by this Standard with respect to clauses 2.6.4 ⁽¹⁾⁽²⁾ , 2.6.5 ⁽¹⁾ and 2.6.6 ⁽²⁾ . See section 7.1 of this Certificate.
Standard:	2.7	Spread on external walls
Comment:		The system is unrestricted by this Regulation. See section 7.1 of this Certificate.
Standard:	3.10	Precipitation
Comment:		The system is not watertight but will resist the passage of rainwater to the supporting structure, with reference to clauses 3.10.1 ⁽¹⁾⁽²⁾ to 3.10.3 ⁽¹⁾⁽²⁾ . See section 8 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The system 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.

Regulation:	12	Building standards applicable to conversions
Comment:		All comments given for the system under Regulation 9, Standards 1 to 6 also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ .
		(1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



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

Regulation:	23	Fitness of materials and workmanship
Comment:		The system is acceptable. See section 10.1 and the <i>Installation</i> part of this Certificate.
Regulation:	28	Resistance to moisture and weather
Comment:		The system is not watertight but will resist the passage of rainwater to the supporting structure. See section 8 of this Certificate.
Regulation:	30	Stability
Comment:		The system can be designed to adequately transfer the design loads from the cladding to the substrate wall structure. See sections 6.1 to 6.3 of this Certificate.
Regulation:	36(a)	External fire spread
Comment:		The system is unrestricted by this Regulation. See section 7.1 of this Certificate.

Construction (Design and Management) Regulations 2015

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

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

See section: 3 *Delivery and site handling* (3.1 and 3.6) of this Certificate.

Technical Specification

1 Description

1.1 The V-Clip system : Higher than 18 m comprises V-Clip fasteners, horizontal rails, and mechanical fixings, and is used to support terracotta and natural stone cladding panels. The cladding panels are attached to the horizontal rails with the aid of V-Clip fasteners which hook into the panel and horizontal rails. The horizontal rails are mechanically fixed to the steel sub-frame (outside the scope of this Certificate). The specifications of the components are:

- V-Clip fastener (see Figure 1) — made from 1.8 mm diameter stainless steel wire of grade 1.4462 in accordance with EN 10088-2 : 2014. There are three different types of V-Clip fasteners depending on the thickness of the cladding panel that they need to support. The V-Clip fasteners are used with different designs of terracotta and natural stone cladding panels including solid panels with grooved top and bottom edges, as well as hollow core. The range of the V-Clip fasteners are given in Figure 2
- supporting horizontal rail — made from 2.0 mm thick extruded aluminium alloy EN-AW 6060 T5 or EN AW-6005 T5 in accordance with EN 755-9 : 2016. The horizontal rails support the cladding panels via the V-Clip fasteners. There are two types of horizontal rails depending on the width of the required horizontal joint between cladding panels (8 or 18 mm). The end rail is used where only one panel edge is supported. The range of the horizontal rails are given in Figure 3
- fixings — 6 mm diameter shaft, 50 mm long and 12 mm diameter head, self-drilling screw SX 3/20 made of stainless steel grade A2, 1.4301, manufactured to BS EN 10088-2 : 2014. The screws are fixed through the web of the horizontal rail into the supporting structure.

Figure 1 V-Clip fastener n°11

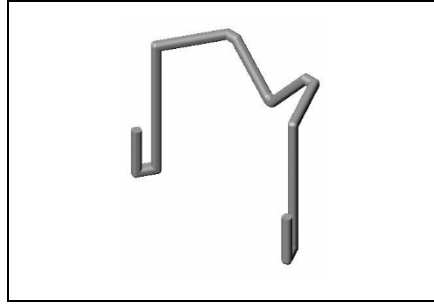
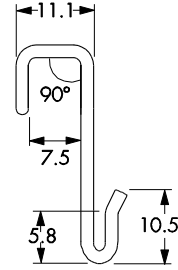
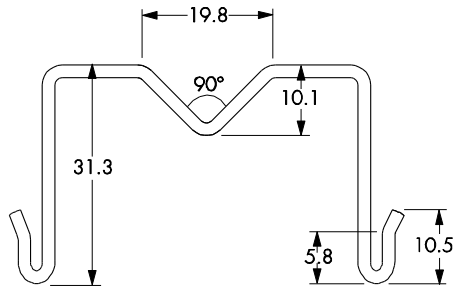
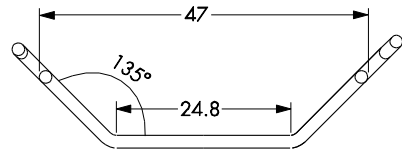
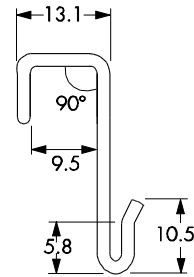
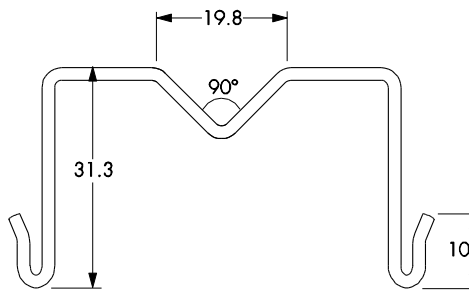
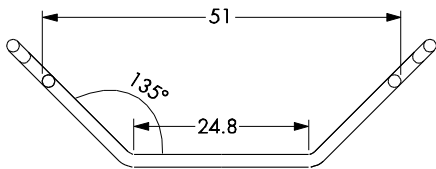


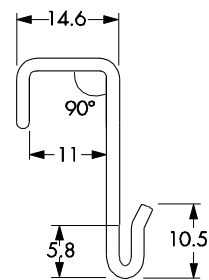
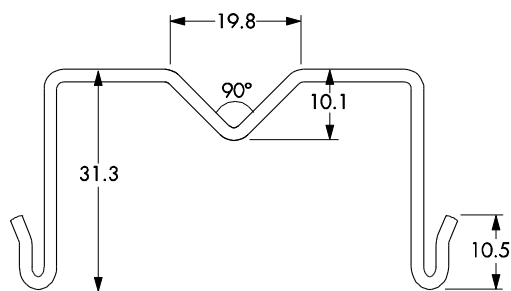
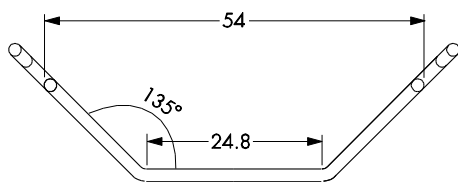
Figure 2 Range of V-Clip fasteners (all dimensions in mm)



V-clip No 9

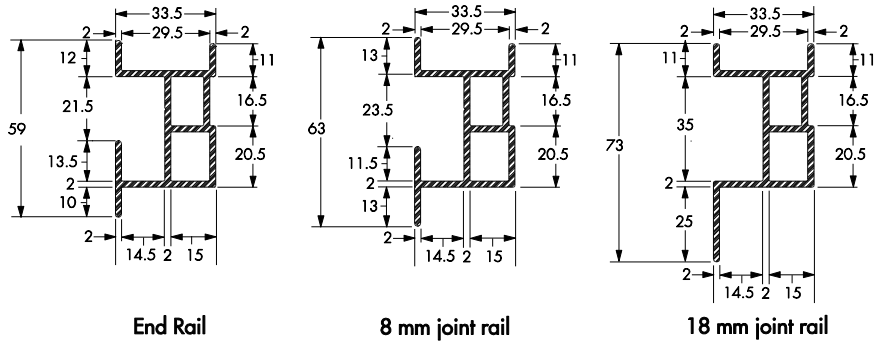


V-clip No 11



V-clip No 13

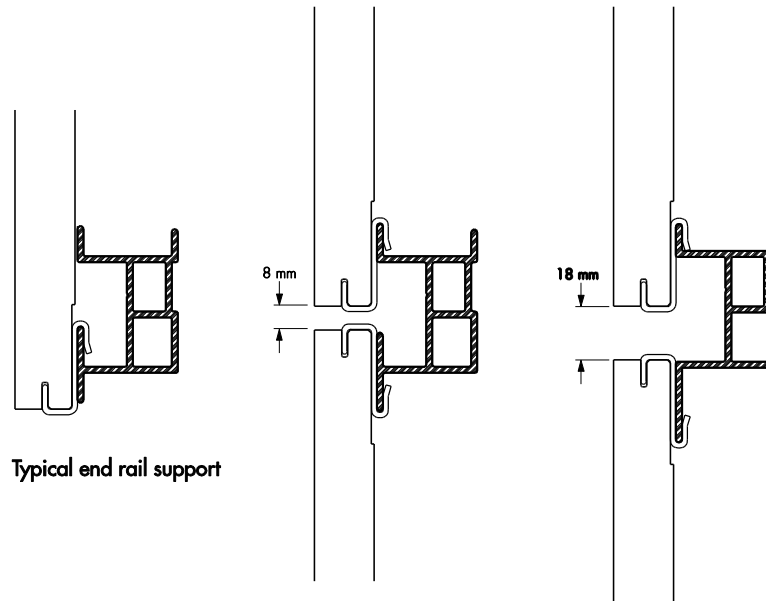
Figure 3 Range of horizontal rails



End Rail

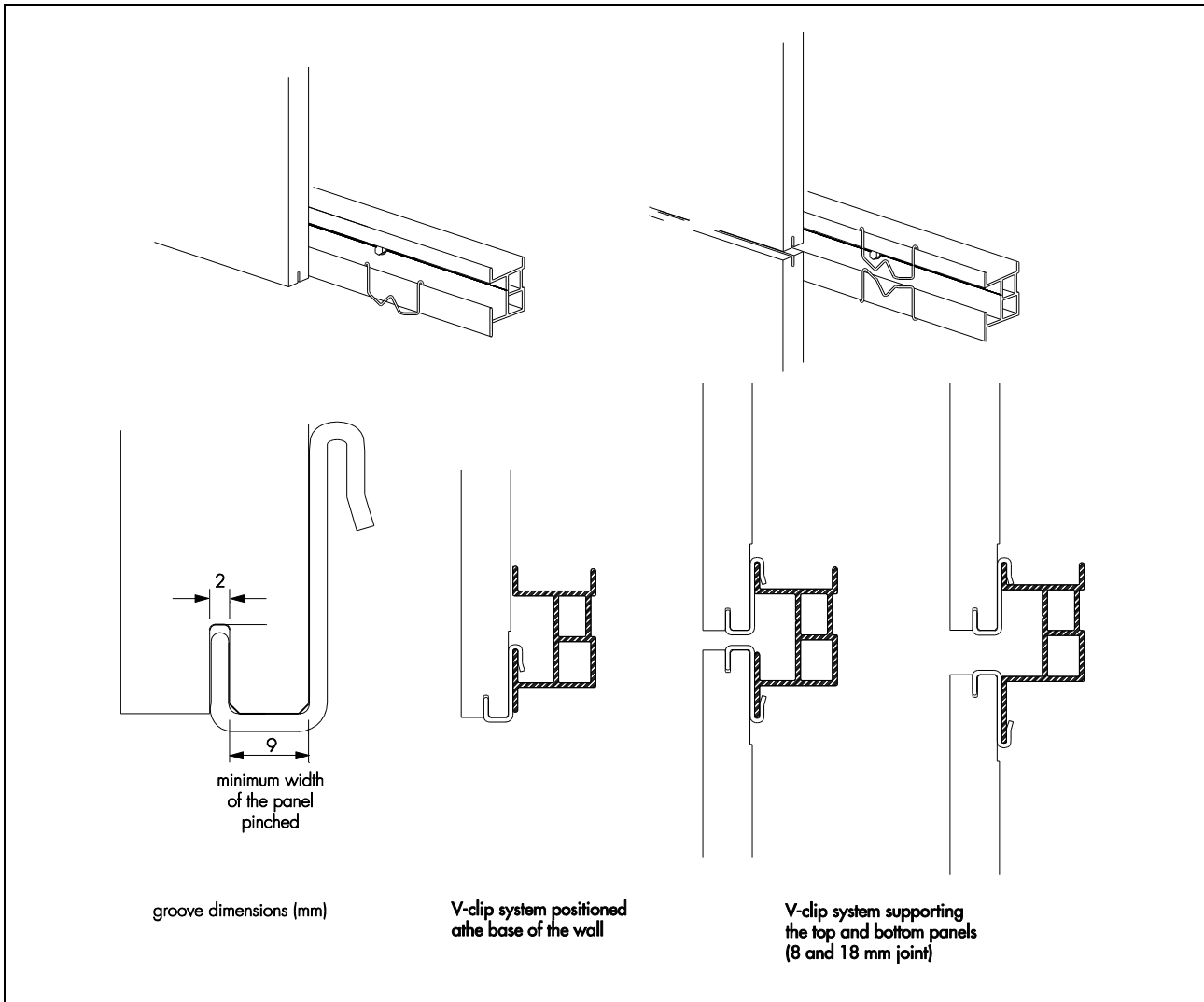
8 mm joint rail

18 mm joint rail



Typical end rail support

Figure 4 Typical arrangements of the V-Clip System with grooved panels



1.2 Ancillary items used with the system, but outside the scope of this Certificate, are:

- sub-frame system/substrate wall
- terracotta and natural stone cladding panels
- cavity barriers
- shims (for vertical panels joints).

2 Manufacture

2.1 The rails are manufactured from extruded sections of aluminium alloy.

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

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

2.3 The management system of the manufacturer has been assessed and registered as meeting the requirements of ISO 9001 : 2008 by AFNOR (Certificate No 1990/1484.16).

3 Delivery and site handling

3.1 The V-Clip fasteners are supplied in boxes weighing 10.5 kg which are banded on pallets. Each pallet carries 12 boxes (of 800 x 600 mm), each carrying 3500 V-Clip fasteners. Each box incorporates a label bearing identification and quantity of the product, batch number and date of production.

3.2 The aluminium rails are shipped in 3.0 or 3.6 m lengths, banded on pallets. Every pallet carries a label bearing identification of the product including the length, number of rails, production date and batch code.

3.3 Packs of rails should be stacked horizontally, on sufficient bearers to prevent distortion, to a maximum height of one metre. Other components should be stored safely until ready for use.

3.4 All pallets should be stored on a dry, flat and level surface, suitably protected from the weather.

3.5 The system components should be handled with care. Damaged items should be discarded.

3.6 Protective clothing should be worn, as required, and all Health and Safety regulations observed. Care should be exercised when handling long lengths of rail, especially at height.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the V-Clip System : Higher than 18 m.

Design Considerations

4 Use

4.1 The V-Clip System : Higher than 18 m, when installed in accordance with this Certificate, is satisfactory for use as a cladding support system to attach terracotta and natural stone panels directly to a masonry or concrete substrate wall or through a steel sub-frame on external masonry or concrete walls of new or existing buildings.

4.2 The V-Clips are for use in supporting grooved, non-grooved and voided terracotta and natural stone panels.

4.3 The spacing between the horizontal rails must not exceed 1500 mm centres. The distance between the vertical supports of the sub-frame must not exceed 600 mm.

4.4 The substrate wall to which the system and the subframe are to be fixed must be weathertight. The sub-frame must be structurally sound and designed in accordance with the all relevant Standards.

4.5 It is important for designers, planners, contractors and/or installers to ensure that the system (as per section 1.1) has adequate structural capacity to support cladding panels in accordance with the design and installation requirements of the cladding panel supplier.

4.6 It must be ensured that all V-Clip fasteners are flush with the surface of the tile.

4.7 Vertical and horizontal joints should be provided in the substrate wall. These movements joints should be carried through the face of the cladding. The V-Clip system rail and the cladding must not straddle the joints.

5 Practicability of installation

The system is designed to be installed by cladding contractors approved by the Certificate holder.

6 Strength and stability

Wind loading



6.1 The substrate wall to which the cladding and the system are to be fixed via the sub frame should be designed and constructed in accordance with the requirements of the relevant UK Building Regulations and British Standards.

6.2 Design wind actions on the wall should be calculated in accordance with BS EN 1991-1-4 : 2005 and its UK National Annex. Due consideration should be given to the higher pressure coefficients applicable to corners of the building as recommended in this Standard. In accordance with BS EN 1990 : 2002 and its UK National Annex, it is recommended that a partial load factor of 1.5 is used to determine the ultimate wind load to be resisted by the system.

6.3 Assessment of structural performance of the system for individual buildings must be carried out by a suitably qualified and experienced individual to confirm that:

- the sub-frame to which the rails are fixed has adequate strength to resist additional loads applied as a result of installing the cladding system
- the system, associated fixings and layout provide adequate resistance to wind actions and self-weight of the chosen cladding
- for rails attached to the sub-frame, the design pull-out strength of fixings should be determined by applying appropriate safety factors to the characteristic pull-out value calculated from test data in accordance with BS 5427 : 2016
- for rails attached to the substrate wall via the substrate, an appropriate number of site-specific pull-out tests must be conducted on the substrate wall to determine the minimum pull-out resistance to failure of the fixings. The characteristic pull-out resistance should be determined in accordance with the guidance given in EOTA TR055 : 2016, using 50% of the mean value of the five smallest measured values at the ultimate load
- thermal expansion effects of the system should be taken into consideration in the design, detailing and installation
- utilisation ratio between horizontal and vertical loads for the clips and the horizontal rails:

$$\frac{F_h}{R_h} + \frac{F_v}{R_v} \leq 1.0$$

where:

F_h and F_v are the applied horizontal and vertical design loads respectively
 R_h and R_v are the horizontal and vertical design resistances respectively.

6.4 The substrate wall must resist any racking loads with no contribution from the cladding and fixing system. The supporting structure must be capable of resisting all wind actions.

6.5 The number of V-Clip fasteners will be dependent on the wind loading and weight of the terracotta and natural stone cladding panels to be supported, and is determined by design on a project specific basis by a suitably qualified and experienced individual, taking into account the horizontal and vertical resistances of the system, as per Table 1.

6.6 When tested for dynamic wind load resistance, the system comprising 600 mm wide x 1500 mm long ($48 \text{ kg}\cdot\text{m}^{-2}$) x 30 mm thick double-skin terracotta tiles, supported with 6 V-Clip fasteners (No. 11) at each end (top and bottom) and attached to the horizontal rails which are fixed to steel sub-frame spaced at 600 mm centres, using 6 x 50 mm stainless steel SX 3/20 screws, achieved an ultimate failure load of $3.28 \text{ kN}\cdot\text{m}^{-2}$. This must be divided by the partial factor of 2.0 to derive the design resistance of the system of $1.64 \text{ kN}\cdot\text{m}^{-2}$.

6.7 The design of the V-Clip fasteners, rails and associated connections should be such as to satisfy the requirements of BS EN 1993-1-1 : 2005, using the mechanical properties of the aluminium grade adopted. Horizontal mid-span deflections of the horizontal rail should be limited to $L/200$ (L is the length between the vertical supports of horizontal rail) and at the end of cantilever deflections limited to $L/150$ (L is the effective length of rail cantilever) or 4 mm whichever is less. Vertical mid-span deflections of the horizontal rail should be limited to $L/200$ and at the end of cantilever deflections limited to $L/150$ or 1.3 mm whichever is less.

6.8 The design resistances of the V-Clip fasteners are given in Table 1.

Table 1 Design resistances of the V-Clip fasteners

V-Clip type	Minimum width of panel pinched (mm) (see Figure 5)	Design resistance (N)	
		Horizontal load ⁽¹⁾	Vertical load ⁽²⁾
		with grooved/hollow core terracotta or natural stone panel	
N°9	8.5	80	80
N°11	9.9		
N°13	12.3		

(1) Use of the above resistances produces a partial safety factor on clip strength of 4.

(2) Use of the above design resistances produces a partial safety factor on clip strength of 5. The vertical load of the tile is carried by the clips on the bottom edge of each tile.

6.9 In general, horizontal rails should be attached using one fixed fixing at the subframe support nearest mid-point and allowed to expand toward the ends using slotted holes (flexible or sliding point). To allow for thermal expansion, a minimum gap between adjacent horizontal rails should be provided based on a coefficient of thermal expansion for aluminium as $23 \times 10^{-6} \text{ C}^{-1}$.

6.10 The design of the system and installation must be checked by a suitably qualified and experienced individual.

6.11 Any insulation behind the cladding should be suitably fixed to the supporting wall and provide adequate resistance to negative wind pressure and the self-weight of the panels. Insulation should be, at least, of semi-rigid type (eg boards or batts).

7 Behaviour in relation to fire



7.1 The V-Clip fasteners, aluminium rails, and associated rail-to-bracket fixings are non-combustible and, therefore, can be classified as Class A1 in accordance with the national Building Regulations and are not subject to any restriction on building height or proximity to boundaries. See also section 7.2.

7.2 For resistance to fire, the performance of a wall incorporating the cladding system can only be determined by tests, or assessment, from a suitably accredited laboratory and is not covered by this Certificate.

7.3 Designers should refer to the relevant national Building Regulations and guidance for detailed conditions of use, particularly in respect of requirements for substrate fire performance, cavity barriers and combustibility limitations for other materials and components used in the overall wall construction, for example, thermal insulation.

8 Drainage and ventilation



8.1 The system, when incorporated in a back-ventilated and drained cavity rainscreen cladding system, will not have an adverse effect on the removal of water from the cavity by drainage and ventilation.

8.2 For the effective removal of moisture from the cavity, a minimum ventilation area of 5000 mm² per linear metre must be provided at the building base point and at the roof edge. The ventilation openings should be suitably protected or baffled to prevent the ingress of birds, vermin or rain and ventilation pathways must not be allowed to become blocked.

8.3 The minimum cavity width created by the support systems between the back of the specified cladding panels and the supporting wall must be a minimum of 38 and 50 mm for cladding panels with baffled or labyrinth joints and open joints respectively, in accordance with the requirements of the *NHBC Standard* 2018, Chapter 6.9.

8.4 It must be ensured that a drainage mechanism/detail is incorporated in the bottom flange of the rail to prevent build up of any water.

9 Maintenance

9.1 The system itself does not require special maintenance. However, period inspections should be carried out to ensure that rainware is complete and in good order, and that the cladding panels are in place and secure.

9.2 Panels can be replaced independently. The V-Clip fasteners starting from the top, are untightened using appropriate pliers allowing for the panel to be lifted and slid off the wall carefully. The replacement panel is then inserted, starting from the bottom side, clips are then released to hook the panel in place.

10 Durability



10.1 The system, when used as described in this Certificate, can be expected to have a service life of at least 35 years in normal UK conditions.

10.2 The aluminium may corrode when in direct contact with wet cement based material.

11 Reuse and recyclability

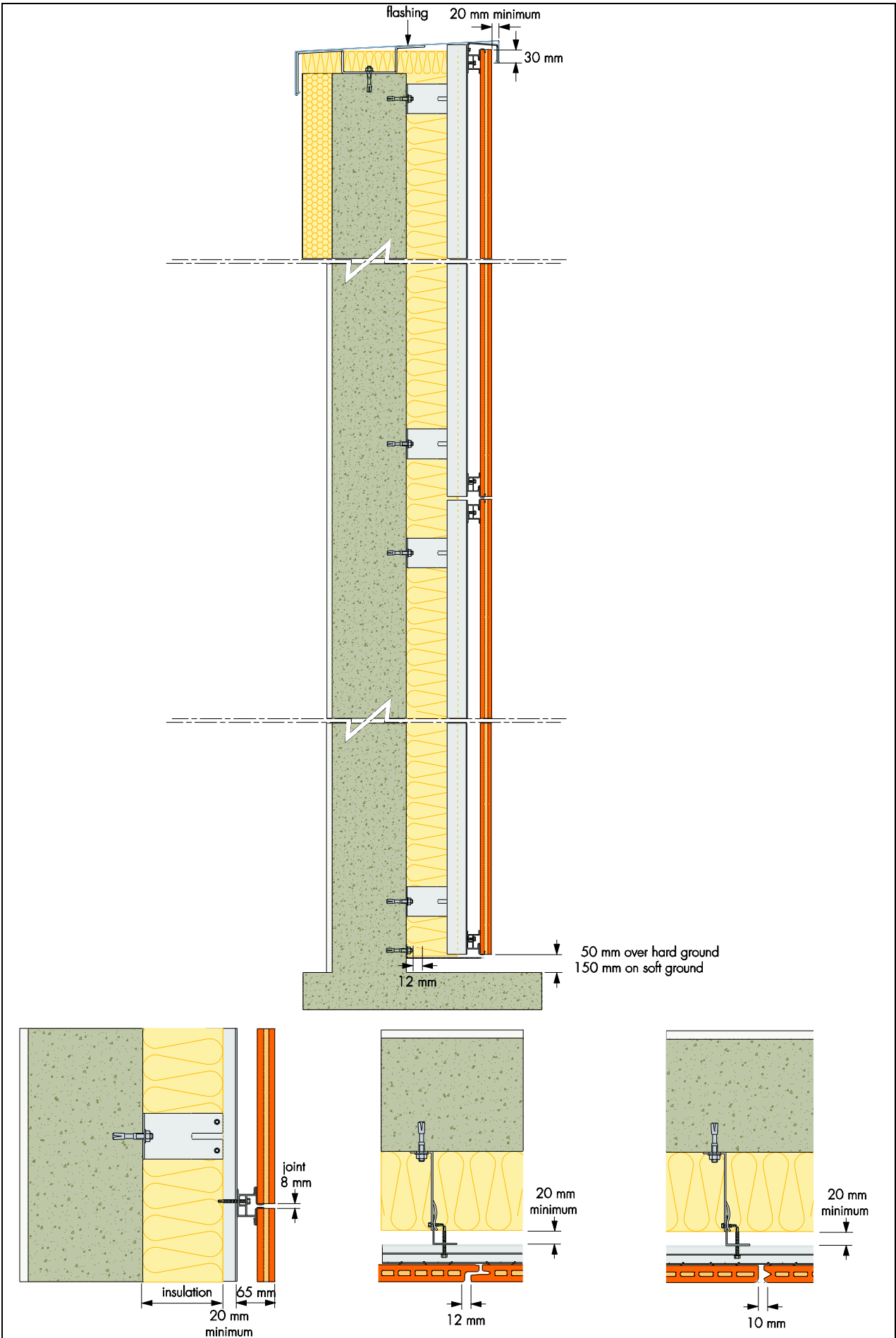
The stainless steel, aluminium and polypropylene components of the system can be readily recycled.

Installation

12 General

12.1 The system must be installed in accordance with the Certificate holder's recommendations, the requirements of this Certificate and the specifications laid down by a suitably qualified and experienced individual. Typical applications are shown in Figure 5.

Figure 5 Typical V-Clip System application fixed to the sub-frame system



12.2 The Certificate holder's approved installers can provide technical assistance at the design stage and at the start of the installation.

13 Procedure

13.1 To reduce waste, appropriate planning of the system's layout should be made prior to the start of the installation. This layout will take into account the nominal dimensions of the panels and their dimensional tolerance as well as the 8 mm horizontal joint between ends of adjacent rails.

13.2 Installation is carried out sequentially, from bottom to top, following subsequent horizontal rows. The bottom rails are placed at the substrate façade's base. Special care is required to adjust the rail horizontally. The rails must be kept in the same plane, within ± 1 mm of each other (parallel plane tolerance).

13.3 The V-Clip fasteners are positioned on the cladding panels prior to fitting them onto the rails. The first and last clip on each panel must be placed between 30 and 50 mm from the panel edge.

13.4 The panels with the V-Clip fasteners are then fitted to the intended wall starting from the bottom rail. An alternative method is to pre-position the V-Clip fastener on the bottom of the rail, ready for the panels to be attached. To ensure that panels are correctly maintained vertically, a special tool for this purpose can be provided by the Certificate holder.

13.5 The top rails are placed into position (while the top of the panel below the rail is restrained), with the back hook of the V-Clip fasteners already placed at the top of the cladding panels inserted into the bottom flange of the rail. A 10 or 20 mm shim is placed on the vertical edge of the installed panel prior to placing the adjacent one in order to maintain a uniform joint width. The shim must not enter the horizontal joint between panels. It must be ensured that all clips are holding the tiles tightly.

Technical Investigations

14 Investigations

14.1 An investigation was made of the system's test data relating to:

- wind loading of a cladding system as described in 6.6
- vertical and horizontal load capacity of clip fasteners as described in Table 1.

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

Bibliography

BS 5427 : 2016 *Code of practice for the use of profiled sheet for roof and wall cladding on buildings*

BS EN 1990 : 2002 + A1 : 2005 *Eurocode — Basis of structural design*

NA to BS EN 1990 : 2002 + A1 : 2005 *Eurocode — Basis of structural design*

BS EN 1991-1-4 : 2005 + A1 : 2010 *Eurocode 1 — Actions on structures — General actions*

NA to BS EN 1991-1-4 : 2005 + A1 : 2010 *Eurocode 1 — Actions on structures — General actions*

BS EN 1993-1-1 : 2005 + A1 : 2014 *Eurocode 3 — Design of steel structures — General rules and rules for buildings*

EN 755-9 : 2016 *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Profiles, tolerances on dimensions and form*

EN 10088-2 : 2014 *Stainless steels — Technical delivery conditions for sheet/plate and strip corrosion resisting steels for general purposes*

EOTA TR055 : 2016 *Design of fastenings based on EAD 330232-00-0601*

ISO 9001 : 2008 *Quality management systems — Requirements*

15 Conditions

15.1 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.

15.2 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.

15.3 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.

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

15.5 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.

15.6 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.