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**SPACER KITS FOR BUILT-UP
METAL ROOF AND WALL
CLADDING**

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

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1 SCOPE OF THE EAD

1.1 Description of the Construction Product

A "kit" is a special form of "construction product" in the sense of the CPR. It consists of several "components" which are:

- placed on the market together with one common CE mark,
- assembled on site, and thus
- become an "assembled system" when installed in the construction works.

A kit component may itself, as a construction product in the sense of the CPR, bear the CE marking in its own right on the basis of a product hEN or ETA. Nevertheless, it may need to be assessed again as a component of the kit.

This EAD is applicable to a Spacer Kit for built-up metal roof and wall cladding for building envelopes, from now on termed "Spacer kit".

Various forms of Spacer Kits are available, but in all cases, their primary function is to hold the liner and outer sheets of the cladding system at a specified distance apart in order to create a void for the thermal insulation material. Spacer kits are generally manufactured from thin gauge metals (predominantly steel), but may also include non-metallic components such as insulation blocks and pads.

A typical spacer kit will include one or more of the following components:

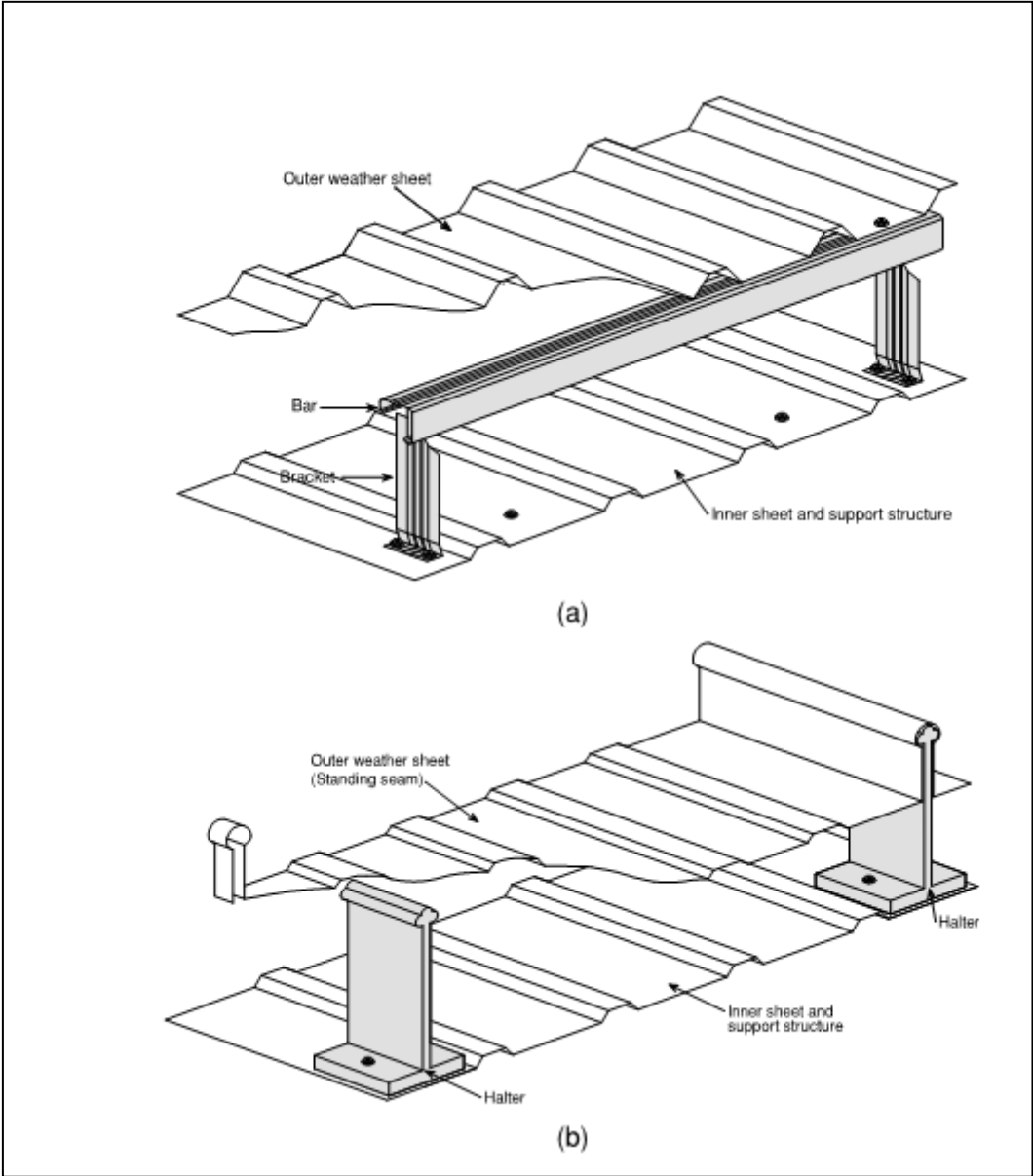
- light gauge metallic brackets
- bar
- halters
- sub-purlins
- fasteners
- non-metallic components such as plastic blocks, knuckles and pads.

Spacer kits can generally be categorised as either 'bar and bracket' or 'halter' systems, as shown in Figure 1, although other types also exist.

Spacer kits may be required to fulfil the following functions:

1. Connect the outer profiled cladding (weather) sheet to the supporting building structure underneath. The supporting building structure may comprise light gauge steel (purlins, rails, liner trays or decks), structural steelwork, timber framework or boards, or any other suitable structural building material. Spacer kits may also be used for over-cladding of an existing building.
2. Provide a predefined cavity depth between the outer cladding sheet and the inner liner, to accommodate the required thickness of thermal insulation. The cavity depth may also be required to accommodate other materials in addition to thermal insulation e.g. acoustic layers. The insulation thickness is specified to comply with the appropriate Building Regulations and client requirements for energy performance of the envelope, but it typically lies in the range 120 to 150 mm for walls and 180 to 200 mm for roofs. Note that these values are likely to increase in the future as Building Regulations are amended to improve the thermal performance of the building envelope.
3. Effectively transfer forces acting on the outer cladding sheet to the supporting building structure, without excessive deformation or instability. Forces typically include cladding self-weight, wind loading, imposed loads (including snow and access), construction loading and temperature induced forces, but may also include more substantial point loads from building envelope attachments such as solar panels or rain-screen.
4. Minimize thermal bridging to provide an effective thermal barrier between the outer sheet and the internal surface of the envelope.

Figure 1: Bar and Bracket (a) and Halter (b) Spacer Kits

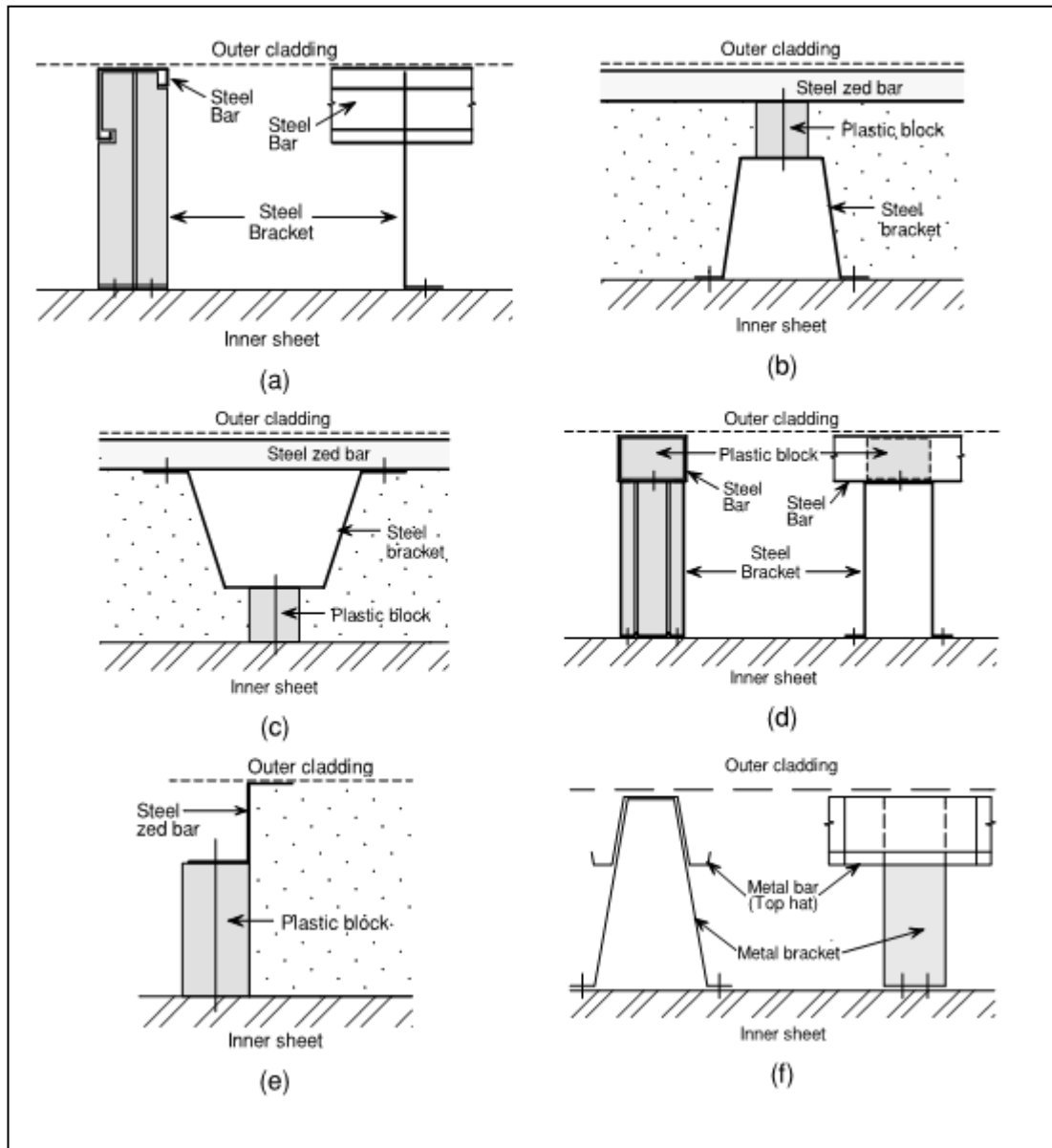


Note:

Spacer kits are not restricted to the types described in this EAD. Variations on the generic types shown in Figure 1, using different combinations of components, are available and others are likely to become available in the future.

1.1.1 Bar and Bracket Spacer Kits

Spacer kits comprising bars and brackets are most commonly made of light gauge galvanised steel. Various steel bracket cross sections are used for which L shapes, stools and hollow closed section brackets are common. Examples of commercially available bar and bracket spacer kits are shown in Figure 2.

Figure 2: Bar and Bracket Spacer Kits

A range of bracket heights is available, allowing the depth of the void between the liner and outer cladding sheet to be varied to suit the thickness of insulation. Bars are available in a variety of cross-sections but they are typically of a shape that allows interlocking of the bracket and bar in some form. Bars span between brackets, which are generally 1.0m apart, but this span may be reduced or increased depending on the structural support centres and the loading conditions. For example, longer spans are sometimes required for rooflights.

Where wall cladding is specified to have the outer weather sheet laid horizontally, the spacer kit has to be tied vertically, usually spanning between horizontal structural sheeting rails, which tend to be at centres greater than 1.0 m – typically 1.5 - 2.0 m.

Spacer kits specifically designed for this application are available, usually based on a bar and bracket system. An example is shown in Figure 2f. To provide a thermal break within the building envelope, a thermal or insulating pad (3-20 mm thick) may be included beneath the bracket. In other cases, the thermal break is provided at the bar to bracket connection.

A variation of the predominantly steel bar and bracket spacer kit is a kit based on the traditional zed spacer and ferrule system. Early ferrules tended to be 25 mm in diameter with a maximum height of 50 mm, limiting the overall spacer height (i.e. insulation thickness) to only 100 mm. As the insulation thickness increased, the ferrule was replaced by a more substantial plastic (polypropylene) block, typically 50 to 100mm in height. The plastic block may be used alone, or in combination with a steel bracket (positioned either below or above the steel bracket), and provides the necessary depth of

cavity between the outer weather sheet and the internal liner. It also provides a thermal break. See Figure 2 (c) and (e).

Although the most common bar and bracket kits are made of galvanised light gauge steel, these kits can be made from aluminium.

1.1.2 Halter Based Spacer Kits for Standing Seam Cladding

Halter spacer kits comprise individual brackets, known as 'halters', onto which the weather sheet is directly attached (i.e. they do not include bars). The halters are specifically used in conjunction with standing seam weather sheets, which are mechanically seamed over the top of the halter, as shown in Figure 1b. The base of the halter is fastened to the supporting structure or to a separate spacer kit or subpurlin. Three typical arrangements are shown in Figure 3.

The halters are typically manufactured either from aluminium alloy or from a reinforced plastic material. Metallic halters are generally placed on an insulating thermal pad to provide the necessary thermal break. This is not necessary for plastic halters as the thermal break is an integral part of the halter. In its simplest form, a halter based spacer kit comprises only halters (Figure 3a).

When used alone in this way, the maximum depth of the void is limited by the maximum height of the halter. This is typically 260 mm, corresponding to an insulation thickness of 200 mm (the remaining 60 mm is hidden under the standing seam, as shown in Figure 1b). A typical halter spacing is 400 mm.

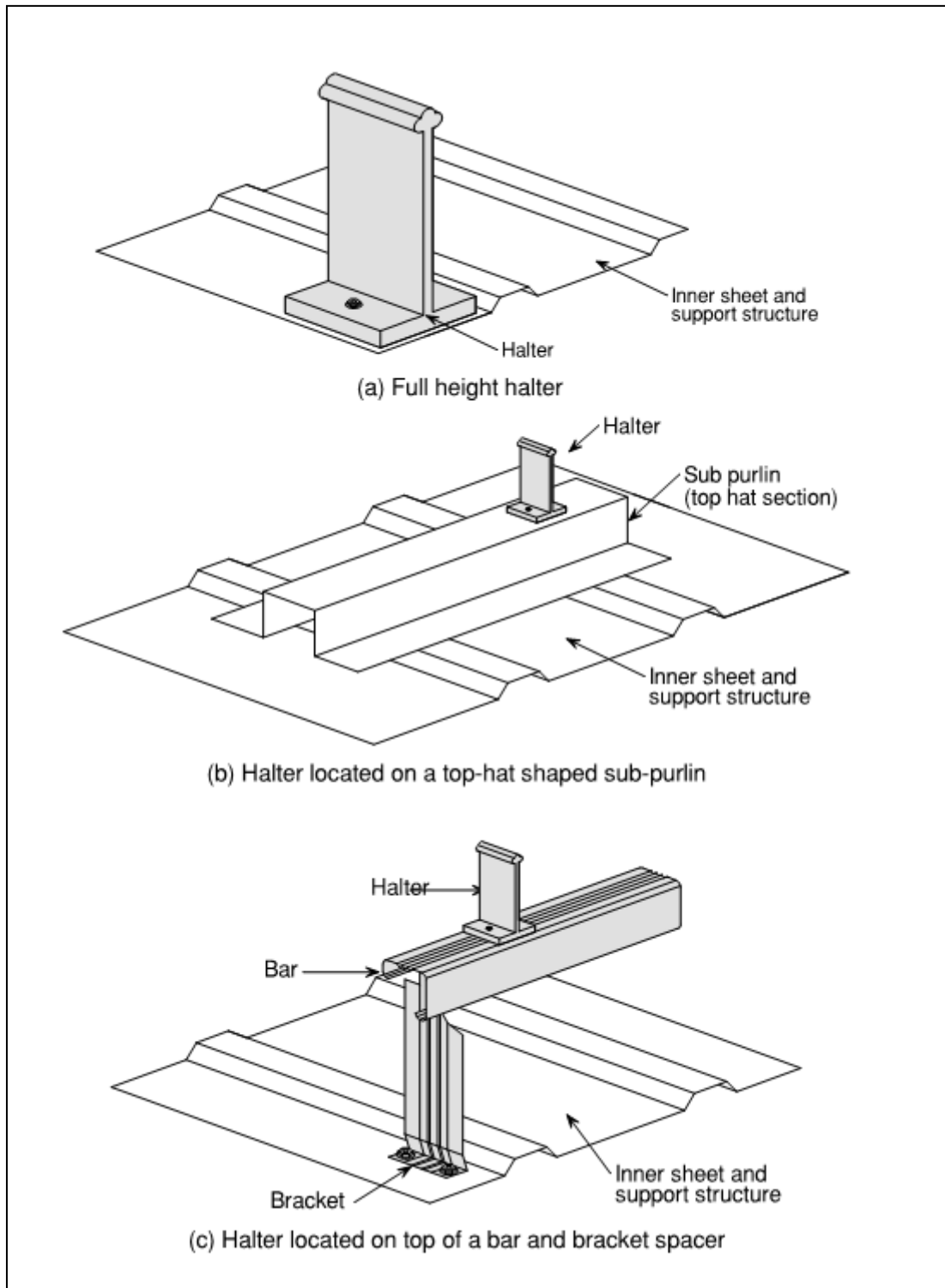
Where void depths greater than those achievable by the halter alone are required, additional spacer components will need to be included within the kit. These additional components are positioned beneath the halter, as shown in Figures 3b and 3c.

The arrangement depicted in Figure 3b comprises a light gauge steel or aluminium top hat section, commonly termed a sub-purlin. The flanges of the sub-purlin are fastened directly to the supporting structure if structural decking is used, or via 'saddles' if fixed into purlins. Top hat sub-purlins may also be used where there is a requirement for an additional acoustic layer. For the purposes of this EAD, the subpurlin is not considered to be part of the spacer kit.

The arrangement depicted in Figure 3c comprises a bar and bracket spacer kit supporting a halter. The bracket of the spacer kit is fastened directly to the supporting structure below, while the halter is fastened to the top surface of the bar.

For the purposes of this EAD, this arrangement is considered to be a combination of two separate spacer kits (the bar and bracket kit and the halter). It is envisaged that the two kits will be CE marked independently.

Various other halter-based hybrid spacer systems are available in addition to the examples shown in Figure 3.

Figure 3: Halter Based Spacer Systems**1.1.3 Other Forms of Spacer Kits**

In addition to the bar and bracket and halter systems described above, other forms of spacer system may be used, for example for deeper voids or for supporting heavier loads. These systems may fall within the scope of this EAD provided that they conform to the generic description and principles outlined above.

1.1.4 Ancillary Components

Spacer kits may include a number of ancillary components. These components do not need to be tested individually in order to CE mark the kit, but may be included in the tests of the kit itself.

Ancillary components may include:

- Components providing additional in-plane stability to the spacer kit, e.g. cleats and/or bracing.
- Additional metal sections, e.g. top hat sub-purlins, which provide a platform onto which the spacer kit may be attached. Sub-purlins are commonly used to provide a flat surface for the base of the bracket/block (or pad) and/or additional depth for thermal and acoustic insulation.
- Heavy duty metal brackets specifically for use during the construction process. These may be used to provide safe storage areas on the roof for packs of cladding sheets.
- Fasteners used within the spacer kit to provide connection between the components of the kit. (Fasteners connecting the cladding sheets to the kit and those used to connect the kit to the supporting structure or sub-purlin are not considered to be part of the spacer kit. In this case the fastener shall be specified according to the appropriate Eurocode for the material of the supporting structure (EN 1993-1-3 for light gauge steel purlins).)

The product is not covered by a harmonised European standard (hEN).

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the Intended Use(s) of the Construction Product

1.2.1 Intended Use(s)

Spacer kits are used within built-up insulated metal roof and wall cladding systems to provide a cavity of a specified depth. The cavity is occupied by thermal insulation material and may also accommodate acoustic insulation. The spacer kit provides for the mechanical fastening of the external weather sheet and the transfer of imposed loads (including wind and snow loads) to the supporting structure. Spacer kits may be used for new build applications and for refurbishment.

It is assumed that the local environment in the cavity will be non-corrosive for normal building applications, since the components of the spacer kit are protected from the external environment by the weather sheet and from the inner environment of the building by the liner. A vapour barrier may be included within the envelope if appropriate for the site conditions and building use.

The spacer kits are designed for use with mineral wool insulation only. Combustible insulation, such as expanded polystyrene (EPS), should not be used.

Verification of the weather and liner sheets, the fixings and any other components within the built-up cladding system, as well as verification of the supporting structure, including sub-purlins, is outside the scope of this EAD.

The spacer kits considered in this EAD are not intended for use in un-insulated roofs (cold roofs). The application(s) appropriate for each spacer kit product shall be described in detail in the ETA relating to that product.

1.2.2 Working Life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the Spacer Kit for Built-up Metal Roof and Wall Cladding for the intended use of 50 years when installed in the works provided that the Spacer Kit for Built-up Metal Roof and Wall Cladding is subject to appropriate installation. These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works².

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

1.3 Specific Terms used in this EAD

1.3.1 Building Envelope

A building envelope separates the interior and the exterior environments of a building. It serves as the outer shell to protect the indoor environment as well as to facilitate its climate control. The envelope includes the roof and the walls and may include soffits, fascias, parapets etc of the building

1.3.2 Built-up Metal Cladding

The term "Built-up metal cladding" refers to multi-layer site-assembled cladding systems. A double skin roof metal cladding system, for example, typically comprises an outer weather sheet, a spacer kit, insulation material and a liner. The weather sheet may either be through-fixed or of the standing seam or secret-fix type.

1.3.3 Bracket

A bracket as referred to in this EAD is the component of the spacer kit which forms the cavity of a predetermined height between the outer skin of the building envelope and the liner. A bracket is typically made of galvanised light gauge steel but could be made from an aluminium alloy.

1.3.4 Block

Thhh A block as referred to in this EAD comprises an insulating material (e.g. polypropylene) that provides a thermal barrier in order to minimize thermal bridging within a built-up cladding system. The height of the block varies but typically ranges between 50 and 120 mm. It can be used together with a metal bracket to provide the specified void depth.

1.3.5 Thermal Pad

A thermal pad as referred to in this EAD comprises an insulating material (e.g. neoprene, polyamide) usually located between the base of the bracket and the supporting structure in order to minimize thermal bridging at this interface. The thickness of the pad typically lies in the range of 3 mm to 20 mm.

1.3.6 Halter

A halter is a proprietary bracket (usually made from aluminium) that provides structural support to standing seam metal cladding whilst maintaining a cavity of a specified depth for the insulation material. The tip of the halter is shaped to allow the cladding to be mechanically seamed over it. This provides a mechanical connection between the sheet and halter without preventing thermal movement. Halters are usually supplied by the standing seam cladding manufacturers as part of their system.

1.3.7 Through Fixed Profiled Metal Cladding

The term through fixed profiled metal cladding refers to a type of cladding in which fasteners penetrate the sheets in order to attach them to the supporting structure or spacer kit. The sheets are profiled to give them structural strength and, in the case of weather sheets, to allow the run-off of rainwater. They may be used on walls and roofs, but are limited to circumstances in which external penetrations of the sheet by fasteners is acceptable. Profiled sheets may be used for the weather sheet and liner and are available in coated steel or aluminium.

² The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

1.3.8 Standing Seam Metal Cladding

Standing seam metal cladding comprises an outer weather sheet which is mechanically seamed over halters to provide a roof cladding system with no external penetrations. Aluminium profiled sheets are commonly used, although other metals such as coated steel, copper and stainless steel are also suitable. Standing seam systems are commonly used in conjunction with metal roof decking, which acts as the liner and supports the insulation.

1.3.9 Secret Fix Metal Cladding

Secret fix metal cladding comprises an outer weather sheet that is specially profiled to enable it to clip over the edge of the adjacent sheet, thereby concealing the fasteners. This type of cladding is used as an alternative to standing seam cladding for applications in which exposed fastener penetrations are unacceptable. Coated steel and aluminium profiles are both commonly used.

1.3.10 Cleat

A cleat is a structural metal component that attaches the purlin or cladding rail to the primary structural steelwork.

1.3.11 Roof

For the purposes of this EAD, a roof is defined as a building envelope element whose pitch relative to the horizontal lies between 0 degrees and 70 degrees

1.3.12 Wall

For the purposes of this EAD, a wall is defined as a building envelope element whose pitch relative to the horizontal is in excess of 70 degrees.

1.3.13 Structural Support System

For the purposes of this EAD, a structural support system is defined as the element of the building structure that provides support to the spacer system. It may include structural metal decking, liner trays, steel or timber purlins or the primary structural frame. For refurbishment applications (overcladding), the structural support system could be the underlying existing cladding system.

1.3.14 Sub-purlin

A sub-purlin is the name given to a metal component that is used to provide additional cavity depth between the liner and weather sheet. The sub-purlin provides a suitable flat fixing surface and a connection to the supporting structure. Commonly, the sub-purlin is a light gauge steel or aluminium top hat section. For the purposes of this EAD, the sub-purlin is not part of the spacer kit.

1.3.15 Fasteners

Fasteners are generally threaded metal components that are supplied as part of the spacer kit as a means of fixing two components within the kit. Fasteners may be of the self drilling type or of the self tapping type (which require a predrilled hole). They may be manufactured from carbon steel or stainless (austenitic) steel. Where the cavity comprises two separate spacer kits, e.g. a "short" halter on a bar and bracket spacer kit (Fig 3c), then the fasteners connecting the two kits are outside the scope of this EAD. Similarly, fasteners used to secure the kit to the structural support (including sub-purlins) or to secure the weather sheet to the spacer kit are not included.

1.3.16 Roof Light

A roof light is an optional element that may be supplied as part of the roof cladding to admit natural daylight into the building. Roof lights may be installed as part of a built-up cladding system, using spacer kits covered by this EAD. The roof lights themselves are outside the scope of the EAD.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of Spacer Kits for Built-up Metal Roof and Wall Cladding is assessed in relation to the essential characteristics.

Table 1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No.	Essential Characteristic	Assessment method	Type of expression of product performance (Value, Class, Criterion, etc.)
Basic Works Requirement 2: Safety in case of Fire			
2	Reaction to Fire*	2.2.2.1	Class
Basic Works Requirement 4: Safety and Accessibility in Use			
4	In-plane Stability of Spacer Kit**	2.2.4.1	Pass/Fail
5	Bracket Assembly Detachment (pullout) Resistance**	2.2.4.2	Pass/Fail
6	Bracket Assembly Compression Resistance**	2.2.4.3	Maximum bracket assembly height for specified 'vertical' compressive force
7	Bending Resistance of Bar**	2.2.4.4	Maximum span for specified concentrated force at mid span
8	Halter Detachment (pull-out) Resistance**	2.2.4.5	Pass/Fail
9	Halter Compression Resistance**	2.2.4.6	Maximum halter height for specified 'vertical' compressive force
other characteristics			
12	Durability Electrochemical Compatibility (Corrosion)	2.2.7.1	Declared Material Properties
* This characteristic also relates to Essential Requirements 2 of components.			
** This characteristic also relates to Essential Requirement 4 of components.			

2.2 Methods and criteria for the performance of the product in relation to essential characteristics of the product

The characteristics of the Components of the Assembled System and methods of verification and assessment criteria which are relevant for the Spacer Kits for the intended use referred to in 1.2 are given in Tables 2a to 2e.

Table 2a: Characteristics of the Bracket

No	Essential Characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of Fire			
2	Reaction to Fire*	2.3.1.1	Class
Basic Works Requirement 4: Safety and Accessibility in Use			
4	Bracket Assembly Detachment (pullout) Resistance**	2.3.1.2	Pass/Fail
5	Bracket Assembly Compression Resistance**	2.3.1.3	Maximum bracket assembly height for specified 'vertical' compressive force
other characteristics			
8	Durability Corrosion	2.3.1.4	Declared Material Properties
* This characteristic also relates to Essential Requirements 2 of the kit.			
** This characteristic also relates to Essential Requirement 4 of the kit.			

Table 2b: Characteristics of the Bar and Methods of Verification and Assessment

No	Essential Characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of Fire			
2	Reaction to Fire*	2.3.2.1	Class
Basic Works Requirement 4: Safety and Accessibility in Use			
4	Bending Resistance of Bar **	2.3.2.2	Maximum span for specified concentrated force at mid span
other characteristics			
7	Durability Corrosion	2.3.2.3	Declared Material Properties
* This characteristic also relates to Essential Requirements 2 of the kit.			
** This characteristic also relates to Essential Requirement 4 of the kit.			

Table 2c: Characteristics of the Block and Methods of Verification and Assessment

No	Essential Characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of Fire			
2	Reaction to Fire*	2.3.3.1	Class
Basic Works Requirement 4: Safety and Accessibility in Use			
4	Block (in bracket assembly) Detachment Resistance (pull-out)*	2.3.3.2	Pass/fail
5	Block (in bracket assembly) Compression Resistance**	2.3.3.3	Maximum bracket assembly height for specified 'vertical' compressive force
other characteristics			
8	Durability Corrosion	2.3.3.4	Declared Material Properties
* This characteristic also relates to Essential Requirements 2 of the kit.			
** This characteristic also relates to Essential Requirement 4 of the kit.			

Table 2d: Characteristics of the Fasteners and Methods of Verification and Assessment

No	Essential Characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of Fire			
2	Reaction to Fire*	2.3.4.1	Class
Basic Works Requirement 4: Safety and Accessibility in Use			
4	Fastener (in bracket assembly) Detachment Resistance (pull-out)**	2.3.4.2	Pass/fail
5	Fastener (in bracket assembly) Compression Resistance (if appropriate)**	2.3.4.3	Pass/fail
other characteristics			
8	Durability Corrosion	2.3.4.4	Declared Material Properties
* This characteristic also relates to Essential Requirements 2 of the kit.			
** This characteristic also relates to Essential Requirement 4 of the kit.			

Table 2e: Characteristics of the Halter and Methods of Verification and Assessment

No	Essential Characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of Fire			
2	Reaction to Fire*	2.3.5.1	Classification in accordance with EN 13501-1
Basic Works Requirement 4: Safety and Accessibility in Use			
4	Halter Detachment Resistance (pull out)**	2.3.5.2	Pass/fail
5	Halter Compression Resistance**	2.3.5.3	Pass/fail
other characteristics			
8	Durability Corrosion	2.3.5.4	Declared Material Properties
* This characteristic also relates to Essential Requirements 2 of the kit.			
** This characteristic also relates to Essential Requirement 4 of the kit.			

2.3 Methods and Criteria for assessing the Performance of the Product in Relation to Essential Characteristics of the Product

2.3.1 Safety in Case of Fire

2.3.1.1 Reaction to Fire

Reaction to fire of the spacer kit is verified from the reaction to fire of its components.

The component shall be tested in order to be classified in accordance with Commission Delegated Regulation (EU) No 2016/364 and EN 13501-1.

Metallic kit components (light gauge galvanised carbon steel, aluminium/aluminium alloys and stainless steel) are considered to satisfy the requirements for performance Class A1 of the characteristic reaction to fire, in accordance with the provisions of EC Decision 96/603/EC (as amended) without the need for testing on the basis of its listing in that decision.

Non-metallic components of the spacer kit (e.g. plastic (polypropylene) blocks, EPDM/neoprene, polyamide pads) are generally small in size and insignificant in respect to the spread of fire. Furthermore, these components are usually positioned at least 1.0 m apart within a layer of inert mineral wool insulation material.

For non-metallic components of the spacer kit (e.g. plastic (polypropylene) blocks, EPDM/neoprene, polyamide pads), if the provisions given in EOTA technical report TR021 "Reaction to fire requirements for small components" are met, a component's contribution to fire spread will be deemed to be sufficiently small and testing can be omitted. If the provisions are not met, the reaction to fire performance will have to be examined.

The spacer kits are designed for use with mineral wool insulation only. Combustible insulation, such as expanded polystyrene (EPS), should not be used. There is no need to consider the fire resistance performance of spacer kits, since they are non-structural in the context of this EAD.

The product shall be classified according to Commission Delegated Regulation (EU) No 2016/364.

2.3.2 Safety and Accessibility in Use

2.3.2.1 In-plane Stability of the Spacer Kit

The stability of the spacer kit shall be verified in accordance with the method given in Annex B.

The appraisal is based on the outcome of tests (see Annex A). The test(s) will determine the adequacy of in-plane stability based on the non-collapse of the spacer kit under a vertical load of 1.2 kN¹ (or other prescribed load) and the corresponding notional horizontal force.

2.3.2.2 Bracket Assembly Detachment (pull-out) Resistance

The bracket assembly detachment (pull-out) resistance shall be verified according to the method(s) indicated in Annex B.

The appraisal is based on the outcome of tests (see Annex B). The test(s) will confirm that the bracket assembly does not fail when resisting a pull-out force of at least 3 kN.

This load magnitude ensures that the bracket assembly has a minimum level of resistance to wind suction based on a typical bracket spacing of 1.0m.

(Manufacturers should provide safe load tables stating the maximum allowable wind suction force per m² for various bracket spacing's. These load tables are outside the scope of this EAD)

2.3.2.3 Bracket Assembly Compression Resistance

The bracket assembly compression resistance shall be verified according to the test method(s) indicated in Annex C.

The appraisal is based on the outcome of tests (see Annex C). The test(s) will determine the maximum height of the bracket assembly that can resist a compressive force of at least 1.2¹ kN (or other prescribed load) without failure.

2.3.2.4 Bar Bending Resistance

The bending resistance of the bar shall be verified according to the method(s) indicated in Annex D.

The appraisal is based either on the outcome of tests or on calculations to EN 1993-1-3 (see Annex D). The test(s) or calculations will determine the maximum span of the bar that can resist a vertical concentrated force of at least 1.2 kN¹ (or the prescribed load) applied at the mid span.

2.3.2.5 Halter Detachment (pull-out) Resistance

The halter detachment (pull-out) resistance shall be verified according to the method(s) indicated in Annex E.

The appraisal is based on the outcome of tests (see Annex E). The test(s) will confirm that the halter does not fail when resisting a pull-out force of at least 1.5 kN. This load magnitude ensures that the halter has a minimum level of resistance to wind suction based on a typical halter spacing of 0.5m. (Manufacturers should provide safe load tables stating the maximum allowable wind suction force per m² for various halter spacings. These load tables are outside the scope of this EAD)

2.3.2.6 Halter Compression Resistance

The halter compression resistance shall be verified according to the test method(s) indicated in Annex F.

The appraisal is based on the outcome of tests (see Annex F). The test(s) will determine the maximum height of the halter that can resist a compressive force of at least 1.2 kN¹ (or other prescribed load) without failure.

2.3.3 Durability

2.3.3.1 Electrochemical Compatibility between Kit Components (Corrosion)

The Technical Assessment Body shall assess the electrochemical compatibility between kit components.

If necessary, the performance deterioration caused by electrochemical corrosion should be stated.

The Technical Assessment Body will establish if any deterioration will affect the proper functioning of the kit under the serviceability loads.

2.4 Methods and Criteria for Assessing the Performance of the Components of the Assembled System in relation to Essential Characteristics

2.4.1 Bracket

2.4.1.1 Reaction to Fire

See 2.2.2

2.4.1.2 Bracket Assembly Detachment Resistance (Pull-out)

The bracket assembly detachment (pull-out) resistance shall be verified according to the method(s) indicated in Annex B.

The appraisal is based on the outcome of tests (see Annex B). The test(s) will confirm that the bracket assembly does not fail when resisting a pull-out force of at least 3 kN.

2.4.1.3 Bracket Assembly Compression Resistance

The bracket assembly compression resistance shall be verified according to the test method(s) indicated in Annex C.

The appraisal is based on the outcome of tests (see Annex B). The test(s) will determine the maximum height of the bracket assembly that can resist a compressive force of at least 1.2 kN¹ (or other prescribed load) without failure.

2.4.1.4 Corrosion

The corrosion protection of the brackets shall be stated in terms of declared material properties according to the appropriate EN standard (e.g. thickness of zinc coating for steel sections).

No independent appraisal is required provided that the material used for the manufacture of the bracket conforms to the appropriate Product Standard.

2.4.2 Bar

2.4.2.1 Reaction to Fire

See 2.2.2

2.4.2.2 Bending Resistance of Bar

The bending resistance of the bar shall be verified according to the method(s) indicated in Annex D.

The appraisal is based either on the outcome of tests or on calculations to EN 1993-1-3 (see Annex D). The test(s) or calculations will determine the maximum span of the bar that can resist a vertical concentrated force of at least 1.2 kN (or other prescribed load) applied at the mid span.

Note:

The recommended magnitude of the concentrated downward vertical load used for the compression and bending resistance tests is 1.2 kN, in keeping with the load used for sheeting tests according to EN 14782. This is a minimum level of load to which the components must be tested.

Alternatively, manufacturers may specify a higher test load (up to 1.5 kN) to suit the concentrated load specified in EN 1991-1-1 (the value is stated in the National Annex, so may vary between nations).

2.4.2.3 Corrosion

The corrosion protection of the bar, if relevant, shall be stated in terms of declared material properties according to the appropriate EN standard (e.g. thickness of zinc coating for steel sections).

No independent appraisal is required provided that the material used for the manufacture of the bracket conforms to the appropriate Product Standard.

2.4.3 Block

2.4.3.1 Reaction to Fire

See 2.2.2

2.4.3.2 Block (in Bracket Assembly) Detachment Resistance (Pull-out)

The block detachment (pull-out) resistance shall be verified according to the method(s) indicated in Annex B.

The appraisal is based on the outcome of tests (see Annex B). The test(s) will confirm that the block of the bracket assembly does not fail when resisting a pull-out force of at least 3kN.

2.4.3.3 Block (in Bracket Assembly) Compression Resistance

The block compression resistance shall be verified according to the test method(s) indicated in Annex C.

The appraisal is based on the outcome of tests (see Annex C). The test(s) will determine the maximum height of the bracket assembly that can resist a compressive force of at least 1.2 kN (or other prescribed load) without failure.

2.4.3.4 Corrosion

The corrosion protection of the block, if relevant, shall be stated in terms of declared material properties according to the appropriate EN standard (e.g. thickness of zinc coating for steel sections).

No independent appraisal is required provided that the material used for the manufacture of the bracket conforms to the appropriate Product Standard.

2.4.4 Fasteners

2.4.4.1 Reaction to Fire

See 2.2.2

2.4.4.2 Fastener (in Bracket Assembly) Detachment Resistance (Pull Out)

The performance of fasteners depends on the context in which they are used. Therefore, the fasteners of the spacer kit are verified as part of the bracket assembly and not in isolation. The detachment (pull-out) resistance of the bracket assembly shall be verified according to the method(s) indicated in Annex B.

The appraisal is based on the outcome of tests (see Annex B). The test(s) will confirm that the fasteners of the bracket assembly can resist a vertical pull-out force (applied in a direction parallel to the bracket) of at least 3 kN without failure. (The term 'pullout' refers to the removal of the bracket from the supporting structure. The fasteners themselves may be loaded in tension or shear, depending on the arrangement of the bracket assembly)

2.4.4.3 Fastener (in Bracket Assembly) Compression Resistance

The performance of fasteners depends on the context in which they are used. Therefore, the fasteners of the spacer kit are verified as part of the bracket assembly and not in isolation. The compression resistance of the bracket assembly shall be verified according to the method(s) indicated in Annex C.

The appraisal is based on the outcome of tests (see Annex C). The test(s) will determine the maximum height of the bracket assembly that can resist a compressive force of at least 1.2 kN¹ (or other prescribed load) without failure.

2.4.4.4 Corrosion

The corrosion protection of the fasteners, if relevant, shall be stated in terms of declared material properties according to the appropriate EN standard.

No independent appraisal is required provided that the fasteners are supplied in accordance with the appropriate Product Standard.

2.4.5 Halters**2.4.5.1 Reaction to Fire**

See 2.2.2

2.4.5.2 Halter Detachment Resistance (Pull Out)

The halter detachment (pull-out) resistance shall be verified according to the method(s) indicated in Annex E.

The appraisal is based on the outcome of tests (see Annex E). The test(s) shall confirm that the halter can resist a pull-out force of at least 1.5 kN without failure.

2.4.5.3 Halter Compression Resistance

The halter compression resistance shall be verified according to the test method(s) indicated in Annex F.

The appraisal is based on the outcome of tests (see Annex F). The test(s) will determine the maximum height of halter that can resist a compressive force of at least 1.2 kN¹ (or other prescribed load) without failure.

2.4.5.4 Corrosion

The corrosion protection of the Halter, if relevant, shall be stated in terms of declared material properties according to the appropriate EN standard.

No independent appraisal is required provided that the materials used for the manufacture of the halter conform to the appropriate Product Standards for the materials. Halters are often made from a combination of aluminium and plastic, in which case corrosion need not be considered.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of Assessment and Verification of Constancy of Performance to be applied

For the products covered by this EAD the applicable European Legal Act is: Decision 1998/214/EC, amended by 2001/596/EC,

The System is: **2+**

In addition, with regard to reaction to fire for products covered by this EAD the applicable European Legal Act is: Decision 1998/214/EC, amended by 2001/596/EC

The systems are given in Table 3:

Table 3: Choice of the System of Attestation and Verification of Constancy of Performance applicable to Spacer Kits with respect to Reaction to Fire

Product(s)	Intended Use(s)	Level(s) or Class(es) Reaction to Fire	AVCP System(s)
Structural metallic sections/profiles (As per table 2a)	For uses subject to regulations on reaction to fire	A1*, A2*, B*, C*	1
		A1**, A2**, B**, C**, D, E,	3
		(A1 to E) ***, F	4
<p>* Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material)</p> <p>** Products/materials not covered by footnote (*)</p> <p>*** Products/materials that do not require to be tested for reaction to fire (eg. Products/materials of class A1 according to Decision 1996/603/EC, as amended)</p>			

3.2 Tasks of the Manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 4.

Table 4: Control plan for the Manufacturer; Cornerstones

No.	Subject/type of Control (product, raw/constituent material, component - indicating characteristic concerned)	Test or Control Method (refer to 2.2 or 3.4)	Criteria, if Any	Minimum Number of Samples	Minimum Frequency of Control
Factory Production Control (FPC)					
Incoming Material					
1	Carbon steel, stainless steel and aluminium/ aluminium alloy.	Check of inspection certificates according to EN 10204.	Certificates	-	Each delivery
2	All Materials	Inspection prior to discharge of delivery ticket and/or label on the package showing compliance with the order.	Conformity with the order.	-	Each Delivery
3	All Components	Inspection prior to discharge of delivery ticket and/or label on the package showing compliance with the order.	Conformity with the order.	-	Each Delivery
Finished Products					
4	Bars Brackets Blocks Fasteners Halters	- Type - Form - Mechanical properties - Dimensions - Tolerances	Conformity with ETA specification or product standard	-	Each Delivery
5	Ancillary Components e.g. Thermal Pads	- Type - Form - Dimensions - Tolerances	Conformity with ETA specification or product standard.	-	Each Delivery
Initial Type Testing					
6	All characteristics in section 2.2 (unless Table 4 regarding reaction to fire is applicable).	See section 2.2	See section 2.2	According to test methods.	-

3.3 Tasks of the Notified Body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for ... [*product*] are laid down in Table 5.

Table 5: Control Plan for the Notified Body; Cornerstones

No	Subject/type of control (<i>product, raw/constituent material, component - indicating characteristic concerned</i>)	Test or control method (<i>refer to 2.2 or 3.4</i>)	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial Type Testing of the Kit (<i>for systems 1+ and 1 only</i>)					
1.	Testing	Testing and / or Classification in Accordance with EN13501-1	See section 2.3.2	According to test methods.	-
Initial inspection of the manufacturing plant and of factory production control (<i>for systems 1+, 1 and 2+ only</i>)					
2.	Inspection of Factory and Factory Production Control as Described in the Control Plan.	Control of devices, results and documentation of FPC	As per Control Plan	-	-
Continuous surveillance, assessment and evaluation of factory production control (<i>for systems 1+, 1 and 2+ only</i>)					
3.	Inspection of Factory and Factory Production Control as described in the Control Plan.	Control of devices, results and documentation of FPC	As per Control Plan	-	Twice a year and when relevant changes are made

4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment, is of relevance.

EN 10204	Metallic products. Types of inspection documents.
EN 14782	Self-supporting metal sheet for roofing, external cladding and internal lining – Product specification and requirements
EN 13501-1	Fire classification of construction products and building elements. Part 1: Classification using test data from reaction to fire tests.
EN 1990	Eurocodes. Basis of structural design.
EN 1991	Eurocode 1: Actions on structures
EN 1993	Eurocode 3. Design of steel structures
EN 1993-1-1	Eurocode 3. Design of steels structures. Part 1-1: General rules and rules for buildings.
EN 1993-1-3	Eurocode 3. Design of steel structures. General rules. Supplementary rules for cold-formed members and sheeting
EN 1999	Eurocode 9: Design of aluminium structures
EN 1999-1-1	Eurocode 9. Design of aluminium structures. Part 1-1: General rules and rules for buildings.
EN 10346	Continuously hot-dip coated steel flat products. Technical delivery conditions
EN ISO 898-1	Mechanical properties of fasteners made of carbon steel and alloy steel. Bolts, screws and studs with specified property Classes. Coarse thread and fine pitch thread
EN ISO 10666	Drilling screws with tapping screw thread. Mechanical and functional properties (ISO 10666:1999).
EN ISO 15480	Hexagon washer head drilling screws with tapping screw thread. (ISO 15480:1999).
EN ISO 35061-1	Mechanical properties of corrosion resistant stainless steel fasteners. Part 1: Bolts, screws and studs. (ISO 3506-1:1998).
EN ISO 35064-4	Mechanical properties of corrosion resistant stainless steel fasteners. Part 4: Tapping screws (ISO 3506-4:2009).
EN 10088-1	Stainless steels. Part 1: List of stainless steels.
EN 10088-2	Stainless steels. Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes.
EN 10088-3	Stainless steels. Part 3: Technical delivery conditions for semifinished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes.
EN 12020-1	Aluminium and aluminium alloys. Extruded precision profiles in alloys EN AW-6060 and EN AW-6063. Part 1: Technical conditions for inspection and delivery.
EN 12020-2	Aluminium and aluminium alloys. Extruded precision profiles in alloys EN AW-6060 and EN AW-6063. Part 2: Tolerances on dimensions and form.
EN 755-1	Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Part 1: Technical conditions for inspection and delivery.
EN 755-2	Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Part 2:
EN 755-9	Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Part 9: Profiles, tolerances on dimensions and form.
EN 15088	Aluminium and aluminium alloys. Structural products for construction works.

ANNEX A: TEST METHOD TO DETERMINE THE IN-PLANE SWAY STABILITY OF THE SPECER KIT

This test measures the in-plane sway stability of a 'bar and bracket' spacer kit when subjected to vertical loading. This test is not applicable for the Halter based spacer kit.

The test shall be carried out on a 'bar and bracket' based spacer kit deemed appropriate by the manufacturer, and fixed according to the manufacturer's installation instructions. For the purposes of this test, the term 'bracket assembly' refers to bracket assembly comprising either metal brackets only or to metal brackets with plastic blocks/EPDM pads.

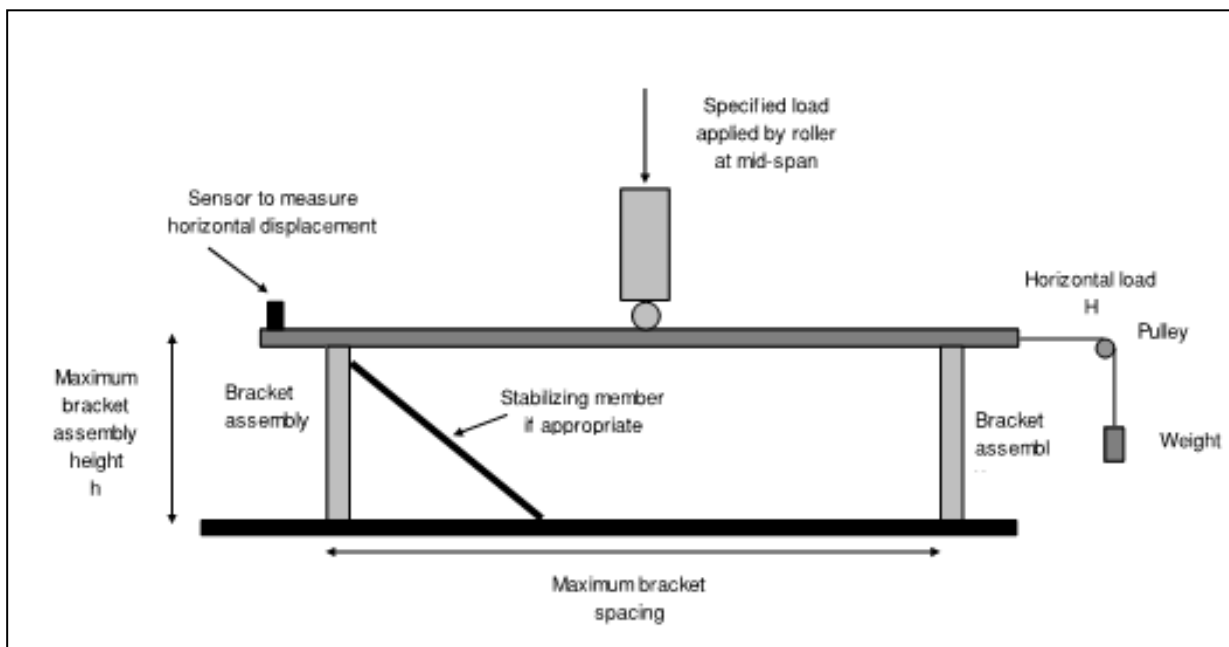
In service the bar and bracket spacer kit shall be adequately restrained against in-plane sway by the outer weather sheet. During construction of the building envelope, however, the spacer kit is less stable as there is no external stabilizing influence from the weather sheet. A measure of the in-plane stability resistance of the skeletal 'bar and bracket' spacer kit (including its own stabilizing frame, where appropriate) is therefore required.

A.1 Preparation of the Test Specimen

The test specimen is mounted in a test rig as shown in Figure A1. The test specimen comprises one bay of the spacer kit, which includes a length of bar and two bracket assemblies. The bracket assembly should be the deepest in the manufacturer's range, in order to represent the most onerous condition for the spacer kit in terms of its in-plane stability. The bracket height and spacing to be used in the tests may be determined from previous experience or by pre-testing.

The bar is connected to the brackets as it would be in service (following the manufacturer's installation instructions). The length of bar is selected so that it spans across the two brackets with sufficient overhang at each end. Each bracket is securely fastened at its base to a support structure. The base should be bolted or clamped in position to form a 'rigid' connection to the support. This will prevent failure from occurring at the base.

Figure A1: In-plane Stability Test of the bar and Bracket Spacer Kit



Where appropriate, and specific to a particular spacer kit, stabilizing components (e.g. stronger bracket or diagonal bracing) shall be included to provide appropriate stability for the spacer arrangement. The inclusion of such a component, often referred to as a 'sway bracket', should be in line with the manufacturer's recommendations. Only one such member should be provided per test specimen, with a standard bracket at the other end.

A.2 Test Procedure

The test specimen is first loaded horizontally at bar height with the prescribed notional horizontal force. This force may be applied through a weight and pulley arrangement, as shown in Figure A1, or by another suitable means. It is maintained constant throughout the test. The notional horizontal force is applied to prescribe a horizontal displacement to the spacer kit to simulate an appropriate 'out of vertical tolerance'.

A vertical force is gradually applied at bar mid-span at a mean rate of 150 ± 50 N/s up to the prescribed magnitude (at least 1.2 kN). When the prescribed vertical load has been reached, the load is maintained for a period not less than three minutes and the test specimen is observed to see if collapse occurs.

As the bracket assemblies can have differing horizontal stiffness depending on the direction of application of the in-plane notional horizontal force (0° or 180° directions), a pre test can be undertaken to determine the force direction which produces the worst case scenario. The above test procedure is repeated for at least 3 specimens such that a non-collapse 'pass' status is obtained from 3 consecutive tests (see acceptance criteria below).

A.3 Notional Horizontal Force

The magnitude of the notional horizontal force depends upon the stabilizing arrangement for the spacer kit.

If the spacer kit is designed to provide sufficient in-plane stability without the need for an additional stabilizing component (e.g. strengthened bracket or bracing), the magnitude of the notional horizontal load shall be 0.5 % of the vertical load acting on one single bay of the spacer kit, e.g. 0.005×1.2 kN = 6 N when the prescribed vertical load is 1.2 kN. This is a relatively small force, which may best be applied by a weight and pulley system (weight equal to approximately 650 grams for this example).

For spacer kits that require one or more sway brackets (i.e. stabilizing components) to provide the appropriate in-plane stability, the notional horizontal force selected to act on the test specimen will depend on the recommended interval between these brackets or similar stabilizing components. This interval should be clearly stated in the installation instructions provided by the manufacturer.

In general, the notional horizontal force will be equal to $0.005 \times n \times V$, where 'n' is the number of spans that each sway bracket is designed to stabilize and 'V' is the prescribed vertical test load. In this context, 'span' refers to the span of the bar between brackets. Thus, if a spacer kit is designed to have a bracing member attached to every 10th bracket and the prescribed test load is 1.2 kN, the appropriate notional horizontal force for the in-plane stability test will be 60 N.

Note:

The recommended vertical test load is 1.2 kN, but a higher value may be used to suit the concentrated force requirement in the National Annex to EN 1991-1-1.

A.4 Acceptance Criteria Statement

The spacer kit is deemed to have passed the in-plane stability test if it is able to support the combined horizontal and vertical loading without collapse for 3 consecutive tests. It shall be declared that the spacer kit, in its unclad state and with the declared maximum bracket height, does not suffer global collapse through in-plane instability, as determined by this test method. In addition, where applicable, if an additional stabilizing component is included in the spacer kit, its frequency of use shall also be stated.

ANNEX B: TEST METHOD TO DETERMINE THE DETACHMENT RESISTANCE OF THE BRACKET ASSEMBLY

The aim of this test is to determine the ability of the bracket assembly to resist a tensile (pull-out) force, representing wind suction on the cladding. The test measures the resistance of the bracket assembly as a whole, including the bracket itself, spacer block (if applicable) and the connections between components. Test configurations for two common forms of spacer kit are shown in Figure B1.

The test specimen comprises a length of bar (sufficient to accommodate the hook), the bracket, spacer block (if present) and fasteners, together referred to as the bracket assembly. The load is applied to the bar as close as possible to the centreline of the bracket assembly. The force is transmitted through all components of the assembly ensuring a realistic mode of failure, determined by the weakest link in the assembly. The bracket assembly is fixed to a solid base using a connection that is sufficiently strong to withstand the applied force. This connection, together with the position of the hook on the bar, ensures that failure occurs within the bracket assembly, and not in the bar or base.

B.1 Test Procedure

A tensile force of magnitude 3.0 kN is applied to the assembly by a hook attached to the short length of bar. The force is applied gradually to the test specimen at a mean rate of 150 ± 50 N/s and is measured to an accuracy of ± 25 N. Once a force of at least 3.0 kN has been reached, it is maintained for a period not less than three minutes and the test specimen observed for bracket assembly failure. If no failure occurs in the bracket assembly, it is deemed to have passed. The test is repeated at least twice (i.e. 3 tests in total) in order to achieve 3 consecutive passes.

B.2 Acceptance Criteria

It shall be declared that the designated bracket assembly will support, without collapse, a concentrated pull-out (tensile) force of at least 3.0 kN determined in accordance with this test method.

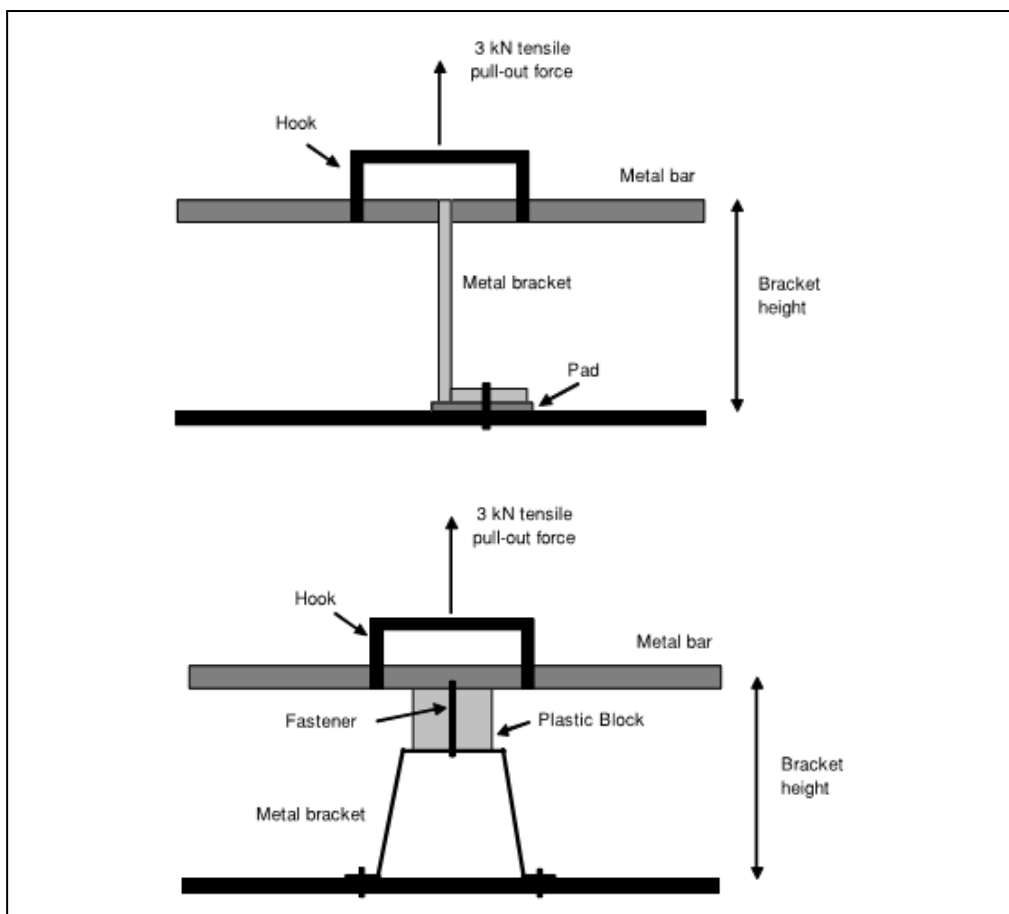


Figure B1: Bracket Detachment Test

ANNEX C: TEST METHOD TO DETERMINE THE RESISTANCE OF THE BRACKET ASSEMBLY TO A VERTICAL COMPRESSION FORCE

The aim of this test is to determine the ability of the bracket assembly to resist a compressive force at a specified height. The test measures the resistance of the bracket assembly as a whole, including the bracket itself, spacer block (if applicable) and the connections between components. Test configurations for two common forms of spacer kit are shown in Figure C1.

The test specimen comprises a short length of bar (250-300 mm long), the bracket, spacer block (if present) and fasteners, together referred to as the bracket assembly. The bracket assembly is fixed to a solid base using an appropriate connection. A vertical compressive load is applied directly over the bar by means of a bolted assembly connected to the bar.

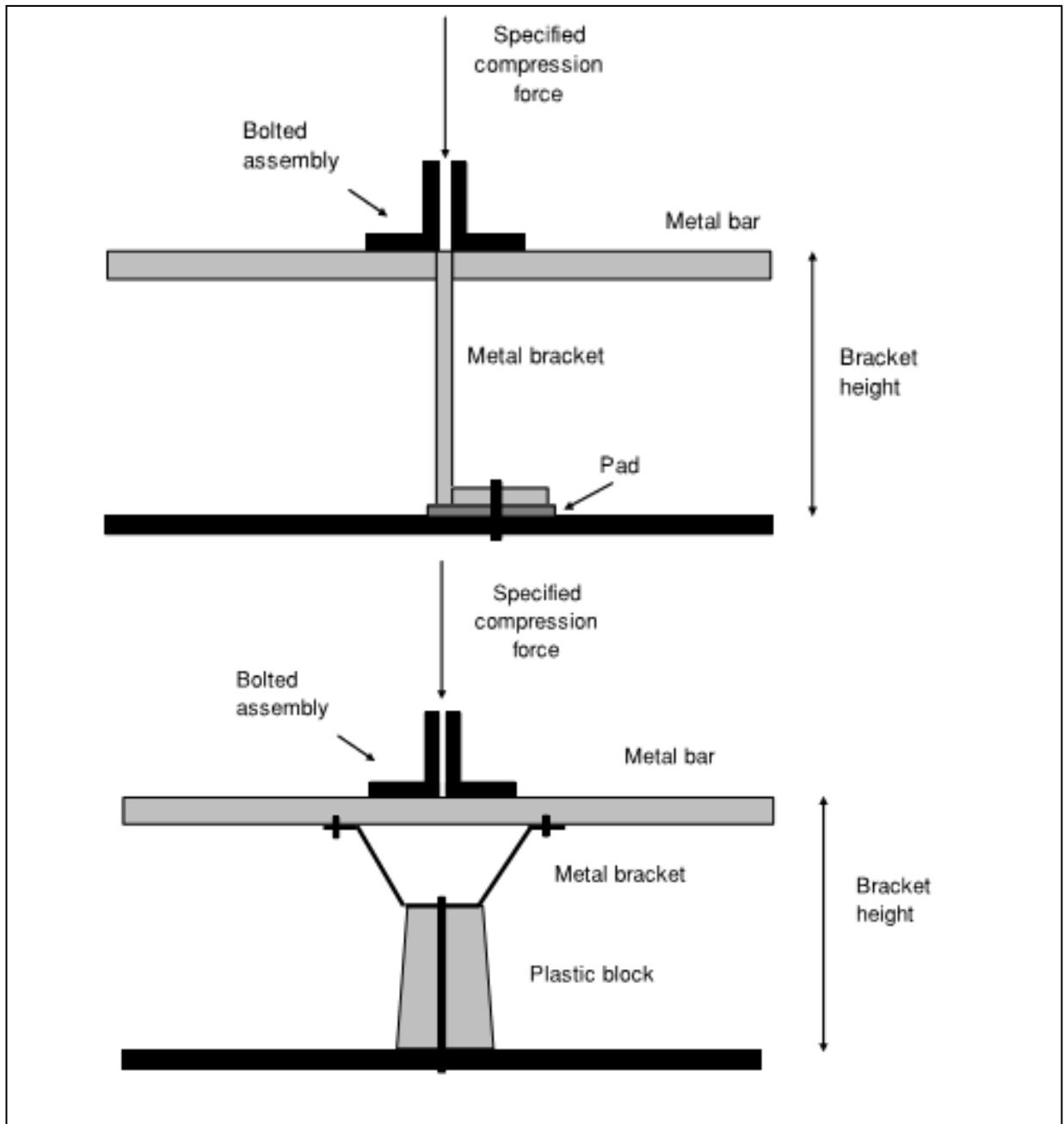


Figure C1: Bracket Compression Test

C.1 Test Procedure

A compressive force of at least 1.2 kN is applied to the bracket assembly (a higher value may be specified to suit the concentrated force requirement in the National Annex to EN 1991-1-1). The force is applied gradually to the test specimen at a mean rate of 150 ± 50 N/s and is measured to an accuracy of ± 25 N. For each increment of load, the corresponding vertical displacement of the top of the bracket assembly is noted. Once the specified force has been reached, it is maintained for a period not less than three minutes and the test specimen is observed for bracket assembly failure. If no failure has occurred in the bracket assembly, the bracket is deemed to have passed the test. The test is repeated at least twice (i.e. 3 tests in total) in order to achieve 3 consecutive passes.

If the bracket assembly fails to resist the concentrated compressive force, the manufacturer must retest using a smaller bracket assembly height.

C.2 Acceptance Criteria

It shall be proven that the designated bracket assembly will support without collapse or failure a concentrated compressive force of at least 1.2 kN (or other specified value) at the stated maximum bracket assembly height, determined in accordance with this test method.

ANNEX D: METHOD TO DETERMINE THE RESISTANCE OF THE BAR IN BENDING WHEN SUBJECTED TO VERTICAL LOADING

The bending resistance of the bar when subjected to a vertical (downward) concentrated force at mid span can be determined either by testing or by calculation.

D.1 Determination of the Bending Resistance of the Bar by Testing

The aim of this test is to determine the capacity of the bar in bending when subjected to a concentrated vertical force acting at mid span. More precisely, the aim is to determine the safe maximum span of the bar under a concentrated load equivalent to a person or stack of materials placed at mid span. The recommended magnitude of the test load is 1.2 kN, but a higher value may be specified to suit the concentrated force requirement in the National Annex to EN 1991-1-1. The span to be tested may be determined from previous experience or by pre-testing.

D.1.2 Test Specimen and Setup

Two alternative versions of the test setup are shown in Figure D.1. In both versions, a single spanning length of bar is positioned between two supports at the desired span with the prescribed concentrated load applied by a jack to the mid span. In the first arrangement, support to the bar is provided by a pair of bracket assemblies. The bracket assembly is fastened at the base using a bolted connection to form a 'rigid base to the assembly' connection which prevents failure occurring at the base of the bracket at the connection to test rig.

This arrangement is preferred because the metal bar cross section is typically an unsymmetrical open section, which if tested alone, will usually be awkward to support at its ends and will rotate when loaded vertically, thereby requiring provision for additional end and side support.

Where the bar has a closed symmetrical cross section (e.g. a square or rectangular hollow section) and is symmetrical about its minor axis, the test specimen to be tested can comprise, a bar only, where in this case the bar is supported directly onto a knife edge and roller support. See figure below.

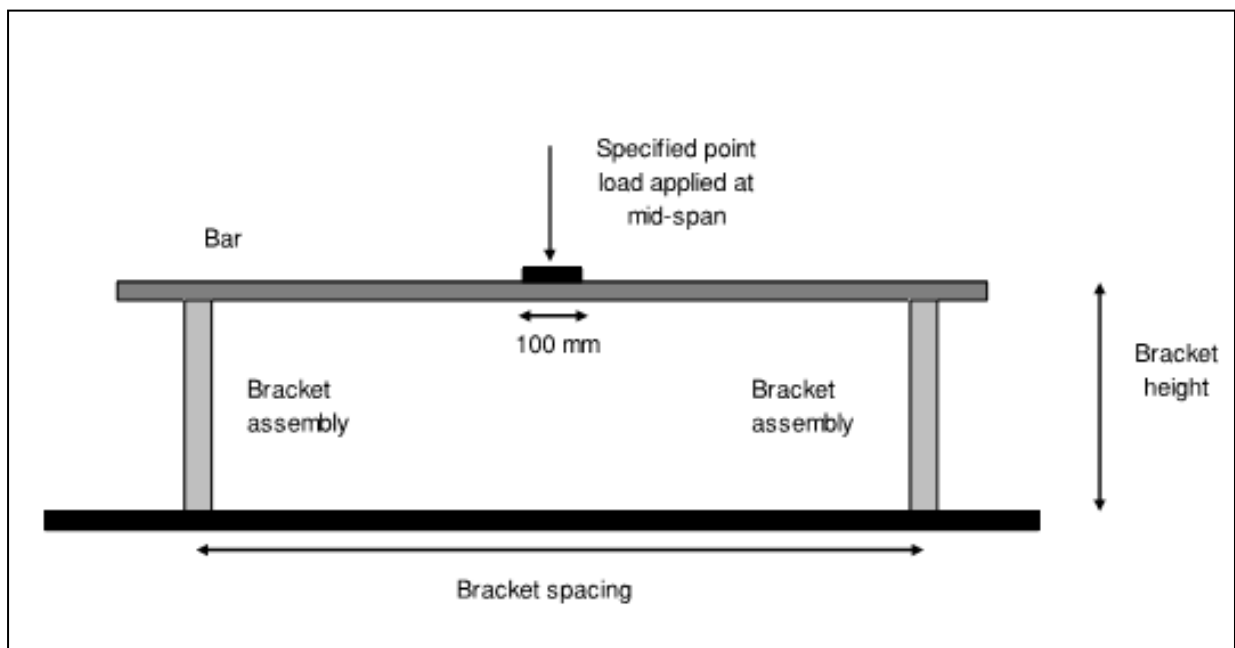


Figure D.1: Bar Bending Test

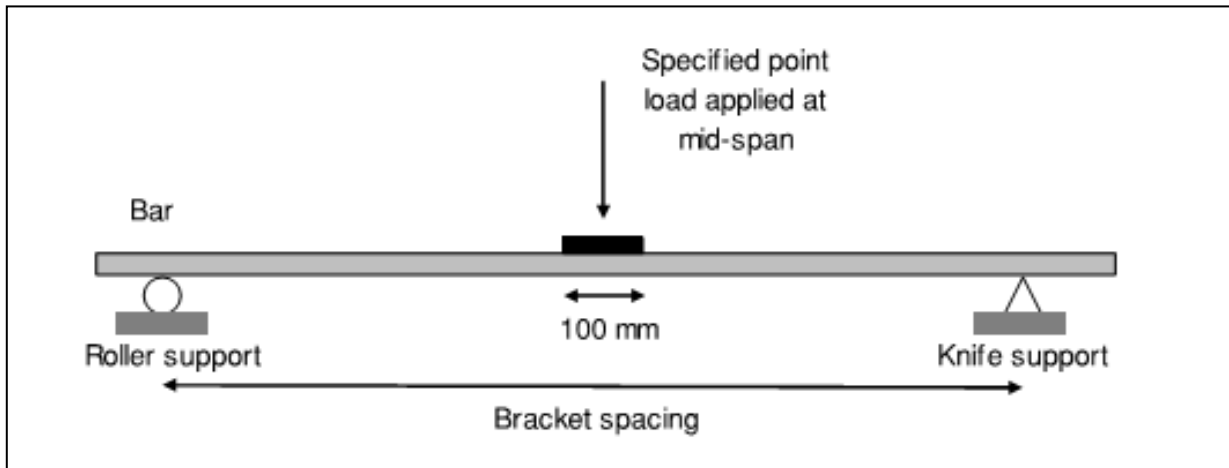


Figure D.1: Bar Bending Test

D.2 Test Procedure

A concentrated vertical force is applied to the mid span of the bar as shown in Figure D.1. The magnitude of the force is gradually increased at a mean rate of 150 ± 50 N/s until the specified test load has been reached (at least 1.2 kN). At this point, the load is maintained for a period of not less than three minutes. During the loading phase of the test, the corresponding vertical displacement at bar mid-span should be noted. The force shall be measured to an accuracy of ± 25 N.

The applied force shall be removed and all observations recorded.

If it is observed that the bar has visually collapsed, a fail outcome for the test will be recorded.

If a visual collapse has not occurred a plot of vertical load versus vertical deflection shall be analysed to determine that failure of the bar has not occurred. A pass outcome will be deemed to have occurred if the force-deflection curve does not show that the bar's maximum resistance has been reached (increasing load showing increasing deflection).

If a 'pass' test outcome is achieved, the test shall be repeated at least three times using similar test specimens. Testing will be deemed to be completed when three consecutive 'pass' outcomes are recorded.

Where the bar fails to resist the concentrated compressive force, the manufacturer should retest as appropriate.

D.3 Acceptance Criteria

It shall be proven that the designated bar will support without collapse or failure, a concentrated vertical force applied at bar mid span of at least 1.2 kN (or other specified value) at the stated maximum span determined in accordance with this test method.

D.4 Determination of the Bending Resistance of the Bar by Calculation

The adequacy of the metal bar in bending when subjected to a concentrated force at mid-span may alternatively be verified and assessed by performing structural calculations. The calculations shall be in accordance with the relevant EN Eurocodes (e.g. EN1993, EN 1999 etc.).

ANNEX E: DETACHMENT (PULL-OUT) RESISTANCE OF HALTER

The aim of this test is to determine the ability of the halter to resist a tensile (pull-out) force, representing wind suction on the cladding. To model the pull-out of the halter from the standing seam, the test specimen comprises a halter which is clipped firmly in place to the standing seam sheeting. The pull-out loading is applied to the standing seam sheeting in the vicinity of the halter such that the correct force transfer between the standing seam sheeting and the halter is achieved. The halter is fixed to a solid base using a connection that is sufficiently strong to withstand the applied force. This connection ensures that failure occurs within the halter, and not in the base.

E.1 Test Procedure

A tensile force of magnitude 1.5 kN is applied to the test assembly by suitable means. This force is applied to the test specimen at a rate of 5mm/min until a value of load equal to 1.5 kN is achieved. Once a force of at least 1.5 kN has been reached, it is maintained for a period not less than three minutes and the test specimen observed for halter failure or pull-out of the halter from the sheeting. If no failure occurs in the bracket assembly, it is deemed to have passed. The test is repeated at least twice (i.e. 3 tests in total) in order to achieve 3 consecutive passes.

E.2 Acceptance Criteria

It shall be proven that the designated halter, will support without collapse, a concentrated pull-out force of at least 1.5 kN at the stated maximum halter height determined in accordance with this test method.

ANNEX F: RESISTANCE OF HALTER UNDER COMPRESSION LOADING

The aim of this test is to determine the ability of the halter to resist a concentrated vertical compression force. The test specimen comprises a halter which is clipped firmly in place to the standing seam sheeting. The compressive loading is applied to the standing seam sheeting directly over the halter. The halter is fixed to a solid base using a connection that is sufficiently strong to withstand the applied force. This connection ensures that failure occurs within the halter, and not in the base.

F.1 Test Procedure

A compressive force of at least 1.2 kN is applied to the test assembly by suitable means (a higher value may be specified to suit the concentrated force requirement in the National Annex to EN 1991-1-1). This force is applied to the test specimen at a rate of 5mm/min until the prescribed value is achieved. Once this force has been reached, it is maintained for a period not less than three minutes and the test specimen observed for halter failure. If no failure occurs in the halter, it is deemed to have passed. The test is repeated at least twice (i.e. 3 tests in total) in order to achieve 3 consecutive passes. Care must be taken to prevent failure of the sheeting in the vicinity of the halter.

F.2 Acceptance Criteria

It shall be declared that the designated halter will support without collapse a concentrated compressive force of at least 1.2 kN (or other specified value) at the declared maximum halter height determined in accordance with this test method.