BS EN 845-1:2013+A1:2016

Incorporating corrigendum September 2013

BSI Standards Publication

Specification for ancillary components for masonry

Part 1: Wall ties, tension straps, hangers and brackets

bsi.

National foreword

This British Standard is the UK implementation of EN 845-1:2013+A1:2016. It supersedes BS EN 845-1:2013 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by ▌A1〉 〈A1▐.

EN 845-1 specifies the characteristics and performance requirements for ties, joist hangers, straps and brackets available throughout the CEN member countries. It aims to do so in product performance terms, avoiding as far as possible prescriptive requirements and all the traditional designations of these products available throughout Europe.

EN 845-1 includes clauses covering initial type tests, factory production control, sampling for initial type testing and independent testing of consignments. These are similar in all masonry product specifications.

The UK National Annex NA attached to this standard provides an informative commentary on the use of BS EN 845-1 in the UK. Nothing in this annex should be construed as specifying requirements other than those contained in the normative parts of this European Standard.

If CE marking is performed, the procedures in Annex ZA will apply. The significance of the CE marking is that the product manufacturer claims compliance with the "harmonized" requirements given in the normative text of the product standard. These relate to the basic requirements for construction works as given in the Construction Products Regulation. Not all product characteristics need necessarily be given on the CE marking, but those product characteristics covered by regulations in force in each EU Member State, where the manufacturer intends that the product will be used, do need to be stated.

The UK participation in its preparation was entrusted by Technical Committee B/519, Masonry and associated testing, to Subcommittee B/519/3, Ancillary components.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Date	Text affected
30 September 2013	Correction to supersession details
30 September 2016	Implementation of CEN amendment A1:2016. National foreword and National Annex NA updated

EUROPEAN STANDARD

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EUROPÄISCHE NORM

EN 845-1:2013+A1

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English Version

Specification for ancillary components for masonry - Part 1: Wall ties, tension straps, hangers and brackets

Spécification pour composants accessoires de maçonnerie - Partie 1: Attaches, brides de fixation, étriers de support et consoles

Festlegungen für Ergänzungsbauteile für Mauerwerk - Teil 1: Maueranker, Zugbänder, Auflager und Konsolen

This European Standard was approved by CEN on 21 March 2013 and includes Amendment 1 approved by CEN on 23 April 2016.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN 845-1:2013+A1:2016) has been prepared by Technical Committee CEN/TC 125 “Masonry”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2017, and conflicting national standards shall be withdrawn at the latest by April 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1 approved by CEN on 2016-04-23.

This document supersedes ⟦A1⟩ EN 845-1:2013 ⟨A1⟧.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟦A1⟩ ⟨A1⟧.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

⟦A1⟩ *deleted text* ⟨A1⟧

EN 845, *Specification for ancillary components for masonry*, consists of the following parts:

— *Part 1: Wall ties, tension straps, hangers and brackets*

— *Part 2: Lintels*

— *Part 3: Bed joint reinforcement of steel meshwork*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies requirements for wall ties, tension straps, hangers and brackets for interconnecting masonry and for connecting masonry to other parts of works and buildings including walls, floors, beams, and columns. Where anchors or fasteners are supplied or specified as part of an ancillary component, the requirements including performance requirements apply to the complete product.

This European Standard is not applicable to:

a) anchors and fasteners other than as part of an ancillary component;

b) shelf angles;

c) wall starter plates for tying into existing walls;

d) products formed from materials other than:

   1) austenitic stainless steel (molybdenum chrome nickel alloys or chrome nickel alloys);

   2) austenitic ferritic stainless steel;

   3) ferritic stainless steel;

   4) copper;

   5) phosphor bronze;

   6) aluminium bronze;

   7) zinc-coated-steel with or without organic coating;

   8) polypropylene;

   9) polyamide (for expansion plugs only).

NOTE The resistance to fire performance of the products included herein cannot be assessed separately from the masonry element of which they are part and is therefore not covered under the scope of this part of this European Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 771 (all parts), *Specification for masonry units*

EN 846-2, *Methods of test for ancillary components for masonry — Part 2: Determination of bond strength of prefabricated bed joint reinforcement in mortar joints*

EN 846-3, *Methods of test for ancillary components for masonry — Part 3: Determination of shear load capacity of welds in prefabricated bed joint reinforcement*

EN 846-4, *Methods of test for ancillary components for masonry — Part 4: Determination of load capacity and load-deflection characteristics of straps*

EN 846-5, *Methods of test for ancillary components for masonry — Part 5: Determination of tensile and compressive load capacity and load displacement characteristics of wall ties (couplet test)*

EN 846-6, *Methods of test for ancillary components for masonry — Part 6: Determination of tensile and compressive load capacity and load displacement characteristics of wall ties (single end test)*

EN 846-7, *Methods of test for ancillary components for masonry — Part 7: Determination of shear load capacity and load displacement characteristics of shear ties and slip ties (couplet test for mortar joint connections)*

EN 846-8, *Methods of test for ancillary components for masonry — Part 8: Determination of load capacity and load-deflection characteristics of joist hangers*

EN 846-9, *Methods of test for ancillary components for masonry — Part 9: Determination of flexural resistance and shear resistance of lintels*

EN 846-10, *Methods of test for ancillary components for masonry — Part 10: Determination of load capacity and load deflection characteristics of brackets*

EN 846-11, *Methods of test for ancillary components for masonry — Part 11: Determination of dimensions and bow of lintels*

EN 846-13:2001, *Methods of test for ancillary components for masonry — Part 13: Determination of resistance to impact, abrasion and corrosion of organic coatings*

EN 846-14, *Methods of test for ancillary components for masonry — Part 14: Determination of the initial shear strength between the prefabricated part of a composite lintel and the masonry above it*

EN 998-2, *Specification for mortar for masonry — Part 2: Masonry mortar*

EN 10020, *Definitions and classification of grades of steel*

EN 10029, *Hot-rolled steel plates 3 mm thick or above — Tolerances on dimensions and shape*

EN 10088 (all parts), *Stainless steels*

EN 10143, *Continuously hot-dip coated steel sheet and strip — Tolerances on dimensions and shape*

EN 10244 (all parts), *Steel wire and wire products — Non-ferrous metallic coatings on steel wire*

EN 10245-1, *Steel wire and wire products — Organic coatings on steel wire — Part 1: General rules*

EN 10245-2, *Steel wire and wire products — Organic coatings on steel wire — Part 2: PVC finished wire*

EN 10245-3, *Steel wire and wire products — Organic coatings on steel wire — Part 3: PE coated wire*

EN 10346, *Continuously hot-dip coated steel flat products — Technical delivery conditions*

EN ISO 75 (all parts), *Plastics — Determination of temperature of deflection under load*

EN ISO 178, *Plastics — Determination of flexural properties (ISO 178)*

EN ISO 180:2000, *Plastics — Determination of Izod impact strength (ISO 180:2000)*

EN ISO 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST) (ISO 306)*

EN ISO 527 (all parts), *Plastics — Determination of tensile properties*

EN ISO 1133 (all parts), *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics*

EN ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods (ISO 1461)*

EN ISO 1463, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method (ISO 1463)*

EN ISO 2039-2, *Plastics — Determination of hardness — Part 2: Rockwell hardness (ISO 2039-2)*

ISO 427, *Wrought copper-tin alloys — Chemical composition and forms of wrought products*

ISO 428, *Wrought copper-aluminium alloys — Chemical composition and forms of wrought products*

ISO 431, *Copper refinery shapes*

ISO 1183 (all parts), *Plastics — Methods for determining the density of non-cellular plastics*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Dimensions and terms relating to wall ties are given in Figure 1.

3.1.1
asymmetrical tie
1) wall tie which is of a different physical design at either end over its embedment depth (or end fixing) and for which the centre section may be symmetrical or asymmetrical in detail

Note 1 to entry: Examples are given in Figure 2 a).

2) wall tie which is physically identical at either end over its embedment depth (or end fixing) but which is fixed in a different manner at each end is also defined as asymmetrical for the purposes of the test procedure

Note 2 to entry: Examples are given in Figure 2 b).

3.1.2
bracket
device attached to structural elements, comprising an individual support for two adjacent masonry units, which form part of a masonry wall

Note 1 to entry: Examples are given in Figure 3.

3.1.3
cavity wall tie
device for connecting a masonry leaf across a cavity to another masonry leaf or to a structural frame to resist tension and compression forces while allowing limited differential movement in the plane of the wall

Note 1 to entry: Examples are given in Figure 2 and Figure 4.

Note 2 to entry: Wall ties are further sub classified as asymmetrical or symmetrical and as horizontal, slope-tolerant or movement-tolerant. Examples are given in Figures 2, 4 and 5 respectively.

3.1.4
cavity width
distance between the cavity faces of the masonry leaves of a cavity wall, measured perpendicular to the plane of the wall

3.1.5
declared value
value for a product property, determined in accordance with this standard, that a manufacturer is confident of achieving bearing in mind the variability of the manufacturing process

3.1.6
minimum embedment length
minimum length to achieve the declared value of a wall tie, or hanger designed to be embedded in mortar

Note 1 to entry: The specification for the length to be built into the wall should be greater than the minimum used by the manufacturer for the declaration, so as to allow for tolerances in positioning on site (see Figure 1).

3.1.7
fixing
device (e.g. a nail, screw, screw/plug, anchor or bolt) used to connect ancillary components to masonry or to supporting structures to resist tension and shear forces

3.1.8
horizontal wall tie
cavity wall tie which is designed to be installed approximately horizontally and in the plane of the mortar joint across a cavity

Note 1 to entry: Examples are given in Figure 2 and Figure 4.

3.1.9
joist hanger (face fixing type)
device for supporting a joist, beam, truss or rafter on a masonry wall via fixing bolts or screws

Note 1 to entry: Examples are given in Figure 6.

3.1.10
joist hanger (joint fixing type)
device for supporting a joist, beam, truss or rafter on a masonry wall by direct loading via a flange which is embedded in a mortar joint

Note 1 to entry: Examples are given in Figure 7.

3.1.11
load capacity[1)]
individual value of the failure load, or load at an extreme displacement, given in the appropriate test method, whichever is the lesser

3.1.12
tensile/compressive/shear load capacity
mean of the load capacities of the number of wall ties tested in tension/compression/shear

3.1.13
vertical load capacity
mean of the load capacities of the number of joist hangers/brackets tested

3.1.14
movement-tolerant cavity wall tie
cavity wall tie which is designed to allow large in-plane differential movements of the walls, without generating large shear stresses, by the use of flexible body materials, free-running slot systems, articulated joints or other means

Note 1 to entry: Examples are given in Figure 8 and Figure 9.

3.1.15
profile height
maximum overall height (distance between the upper and lower surface at right angles to the length and width of the joint) of the embedded portion of a wall tie, strap or hanger

Note 1 to entry: See Figure 1.

3.1.16
shear tie
wall tie designed to transmit shear, tension and compression forces between two adjacent sections of masonry or between structural frames and masonry

Note 1 to entry: Shear ties are sub-classified as symmetrical or asymmetrical. (Examples are given in Figure 10.)

1) A convention has been adopted in this standard for terminology relating to the term 'load capacity'. It is also used in the EN 846 (all parts) test methods, which support EN 845. This term without a preceding qualifying adjective as shown in 3.1.11 denotes an individual value of 'load capacity', i.e. the result of one measurement on one specimen. Where the term is used with a preceding qualifying adjective, e.g. 'tensile load capacity' (see 3.1.12), this relates to the mean of the load capacities from a number of specimens tested.

3.1.17
slip tie (general purpose)
wall tie designed to transmit only shear forces between two adjacent sections of masonry or between masonry and structural frames while allowing in-plane movement

Note 1 to entry: Examples are given in Figure 11.

3.1.18
slope-tolerant tie
cavity wall tie designed to function satisfactorily with a significant slope from the horizontal

Note 1 to entry: Examples are given in Figure 5.

3.1.19
slot tie
wall tie whose end fixing (at one end) is by means of engaging a re-entrant key (e.g. dovetail) into a slot either embedded in a concrete wall or surface fixed to concrete, steel or masonry walls or frame elements, and which is free to slide in the slot either only during installation (for adjustment purposes) or both during installation and while in service (to allow differential movement)

Note 1 to entry: Examples are given in Figure 9.

3.1.20
symmetrical tie
wall tie which is physically identical at each end over its embedment length (or end fixing) and which is fixed in an identical manner at each end

Note 1 to entry: The centre section may be symmetrical or asymmetrical in detail.

Note 2 to entry: Examples are given in Figure 4.

3.1.21
tension strap
device for connecting masonry walls to other adjacent components such as floors and roofs and which resists tension forces

Note 1 to entry: Examples are given in Figure 12.

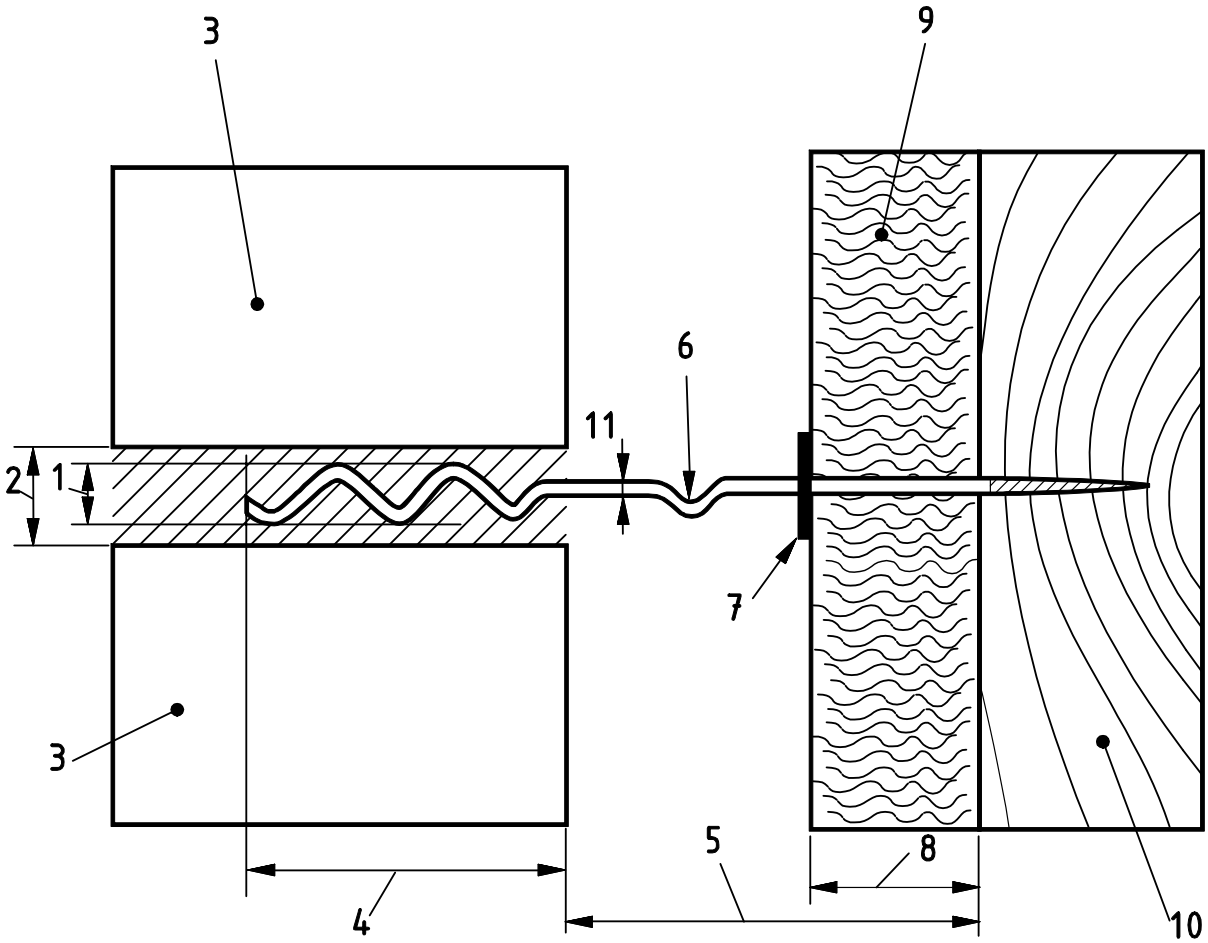
3.1.22
wall tie
device capable of transferring loads between masonry leaves or between masonry and other structures, in order to limit their relative movement in purely one or more planes, as required

Note 1 to entry: Examples are given in Figure 1, Figure 2, Figure 4, Figure 8 and Figure 10.

3.2 Symbols

L the overall perpendicular length of a bracket from the fixing surface to the extremity of the support flange, in mm

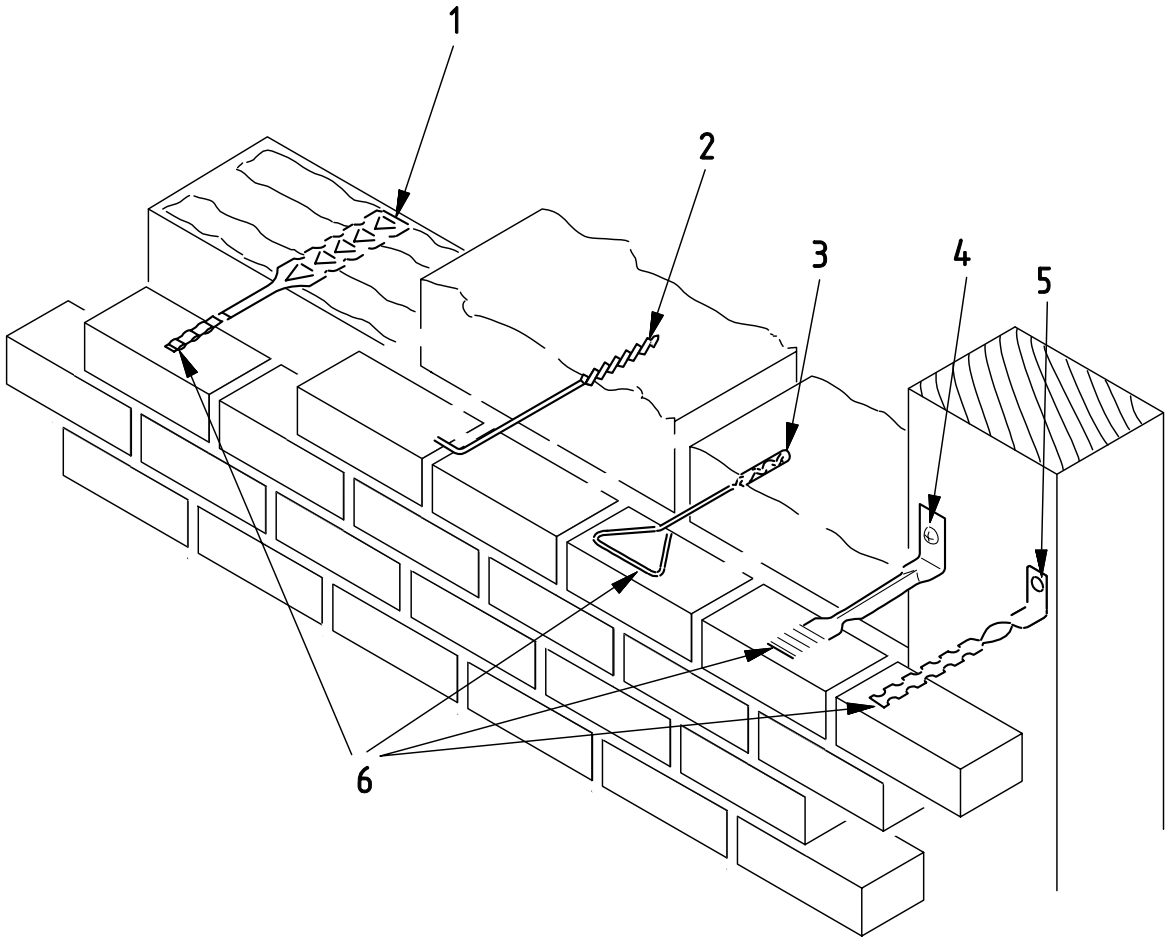
NOTE Examples are given in Figure 3.



Key

1 profile height	5 cavity width	9 insulation
2 mortar joint thickness	6 drip	10 inner leaf material, e.g. timber
3 units forming outer leaf	7 insulation retaining clip	11 diameter of wire or thickness of plate
4 embedment length	8 insulation width	

Figure 1 — Dimensions and terms relating to wall ties

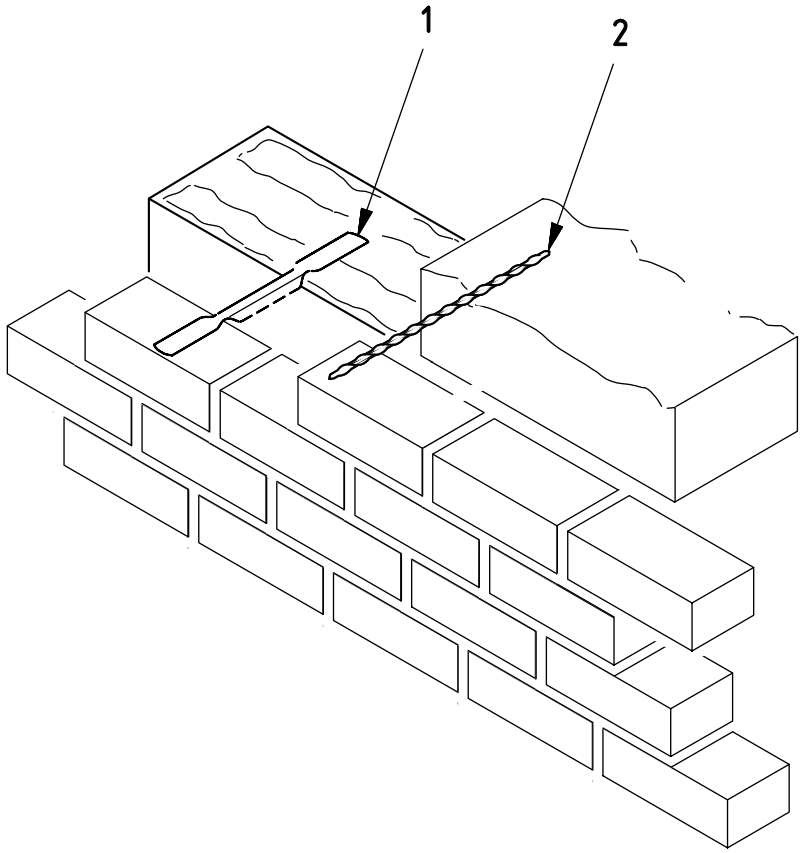


NOTE 1 For reasons of clarity, thermal insulation is not shown.

Key

1 thin layer mortar (far end)
2 screw fixing
3 resin anchor fixing
4 screwed to timber frame
5 nailed to timber frame
6 bedded in mortar (near end)

a) Examples of asymmetrical wall ties



NOTE 2 For reasons of clarity, thermal insulation is not shown.

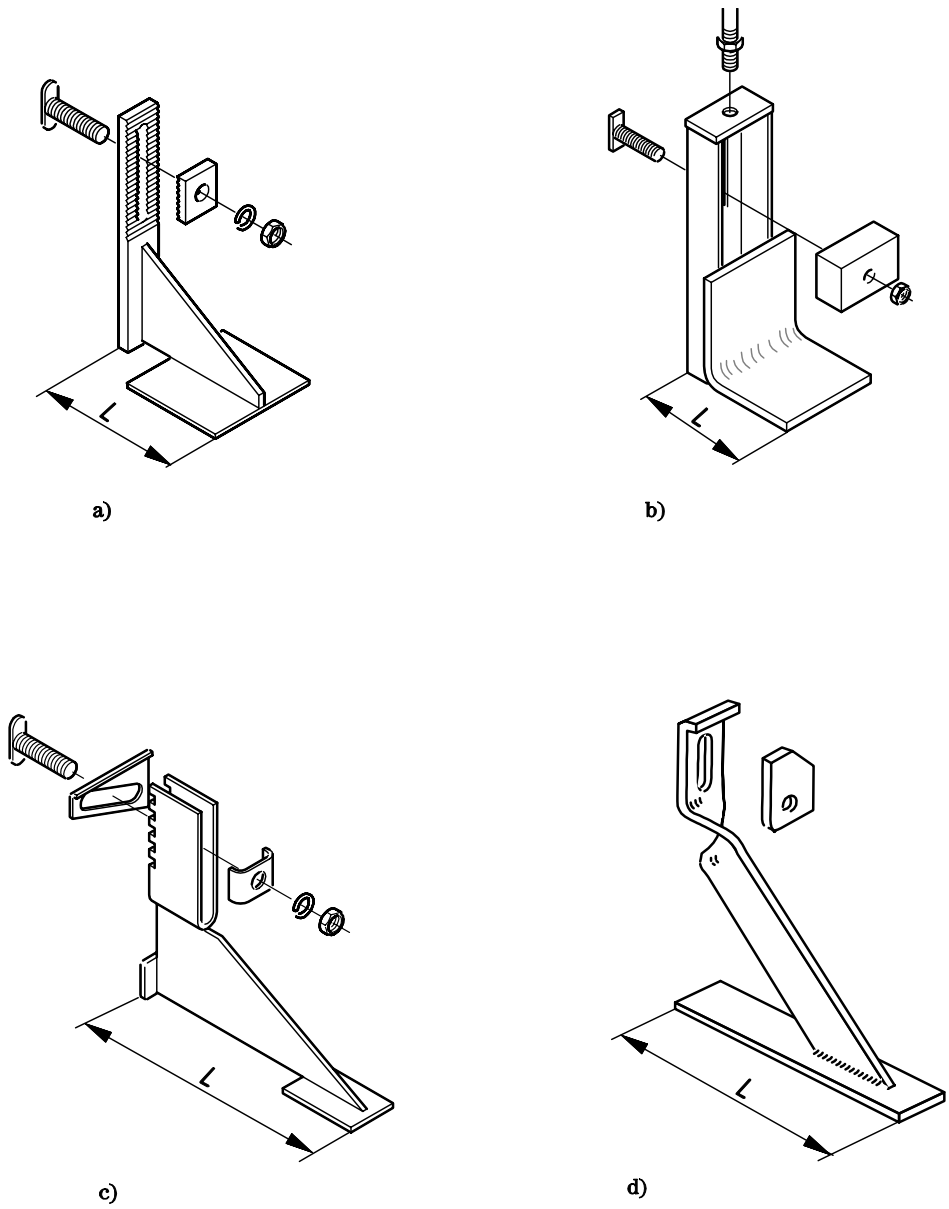
Key

1 deformed plate tie in masonry mortar (near end) and thin joint mortar (far end)

2 helical tie in masonry mortar (near end) and screwed into block (far end)

b) Examples of symmetrical wall ties used asymmetrically

Figure 2— Examples of wall ties



Key

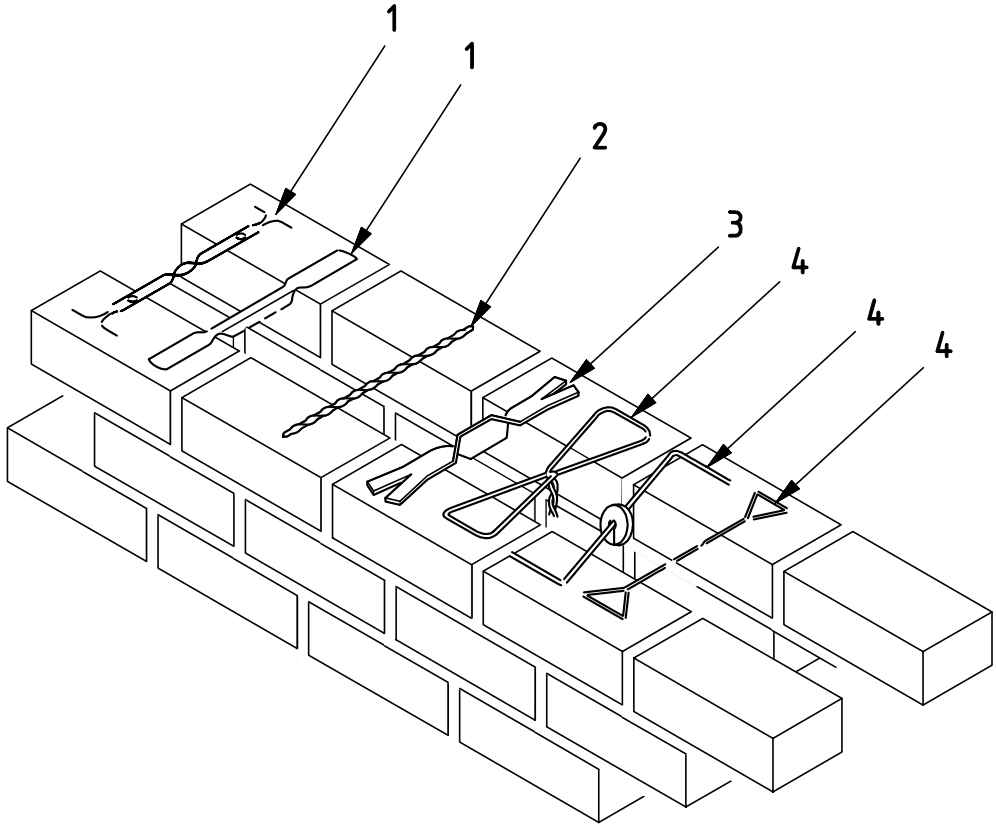
a) ribbed-plate adjuster type (and packing shim)

b) screwed adjuster type (and packing shim)

c) toothed support and angled slot adjuster type

d) light duty cam washer adjuster type

Figure 3 — Examples of brackets

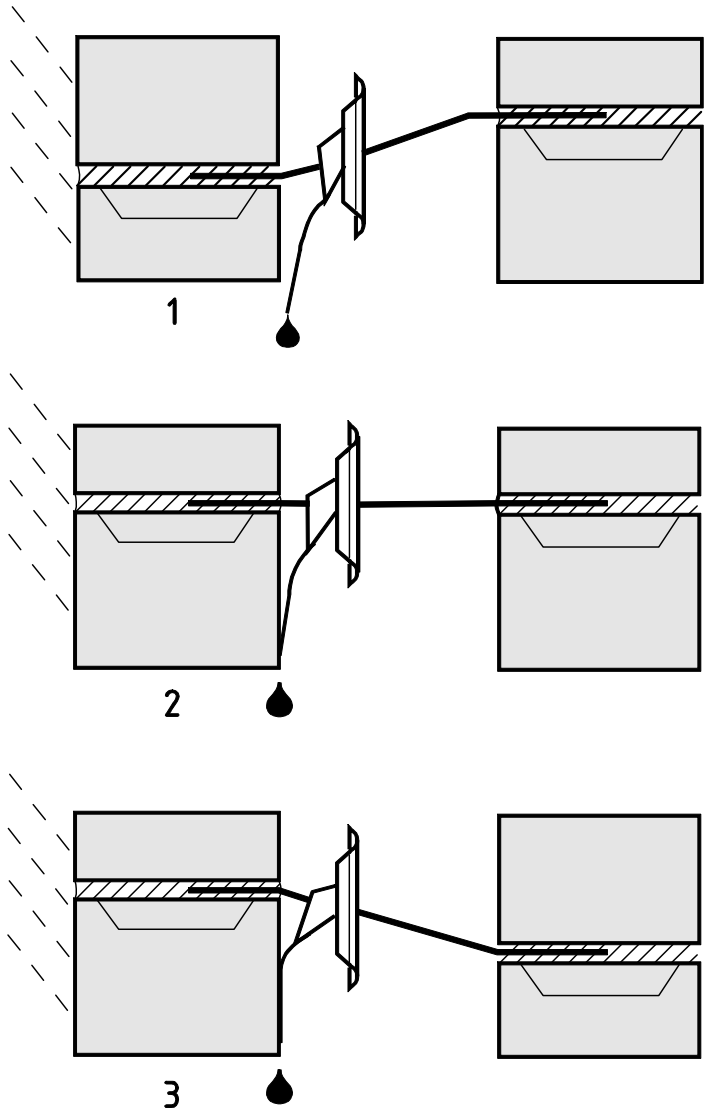


NOTE For reasons of clarity, thermal insulation is not shown.

Key

1 thin plate types
2 helical (spiral) types
3 thick plate types
4 wire types

Figure 4 — Examples of symmetrical wall ties



NOTE For reasons of clarity, thermal insulation is not shown.

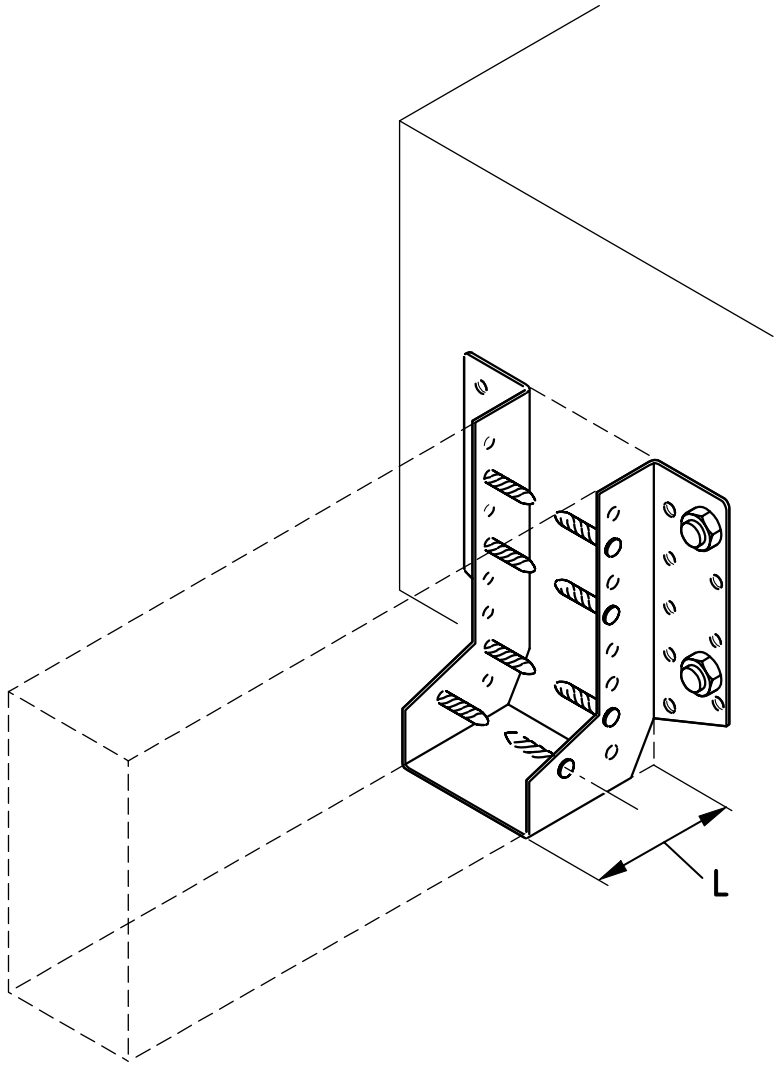
Key

1 installed with favourable slope

2 installed level

3 installed with unfavourable slope

Figure 5 — Examples of slope-tolerant cavity wall ties



Key

L clear length of joist hanger flange

Figure 6 — Example of joist hangers (face-fixing type)

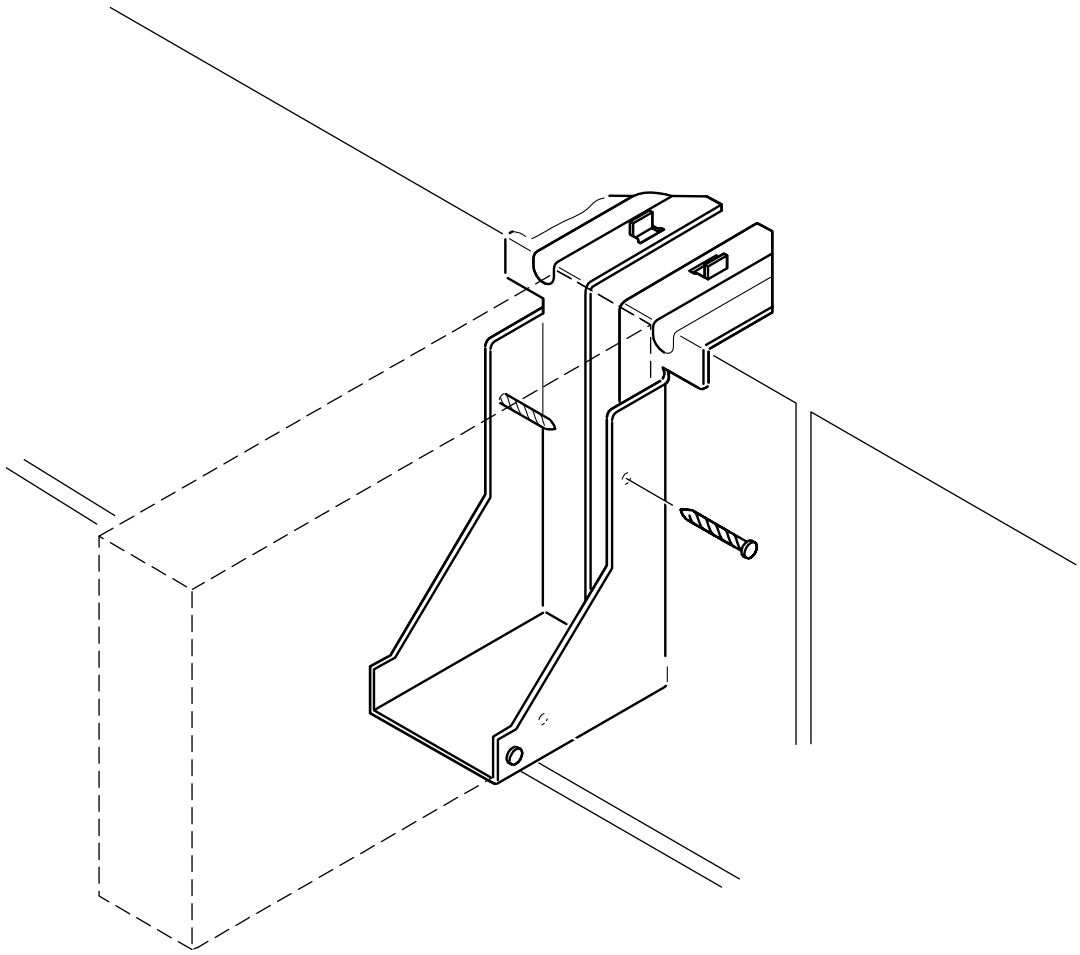
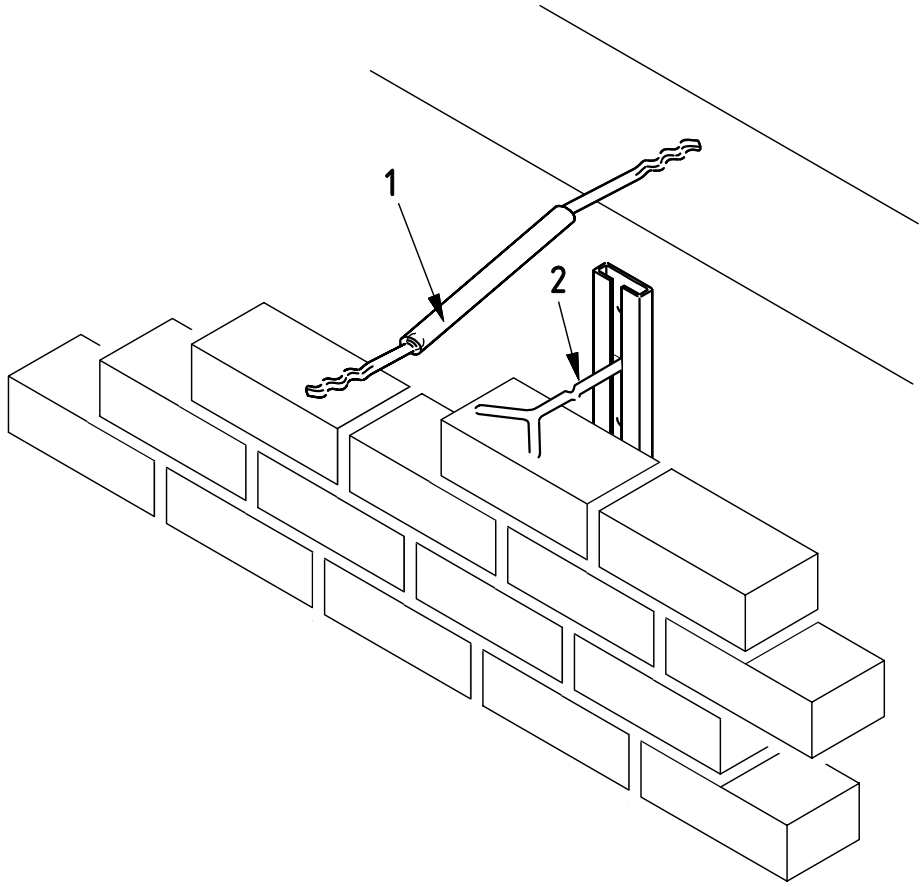


Figure 7 — Example of joist hanger (joint fixing type)



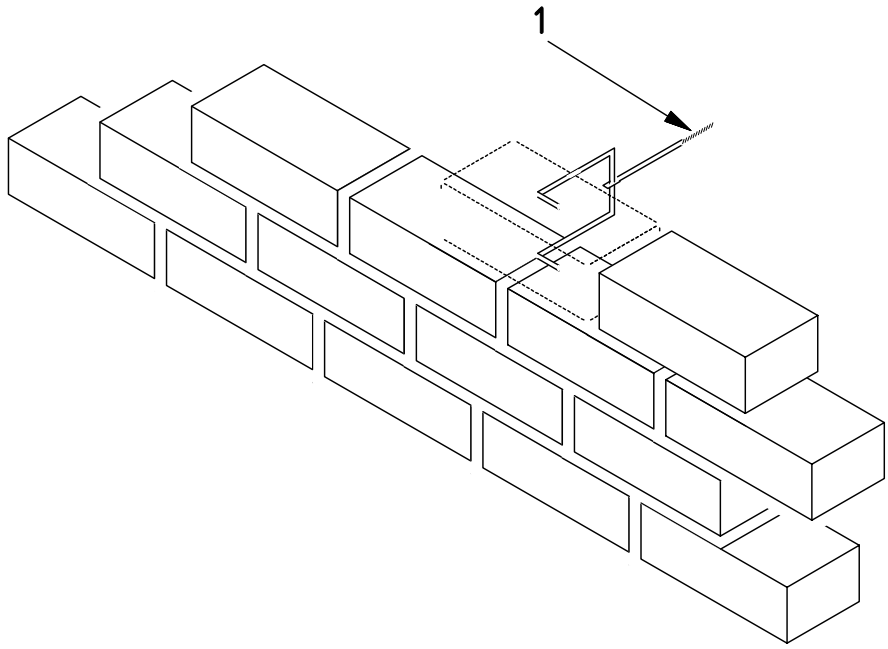
NOTE For reasons of clarity, thermal insulation is not shown.

Key

1 universal-jointed type

2 sliding tee-in-slot type

a) Examples of movement-tolerant cavity wall ties

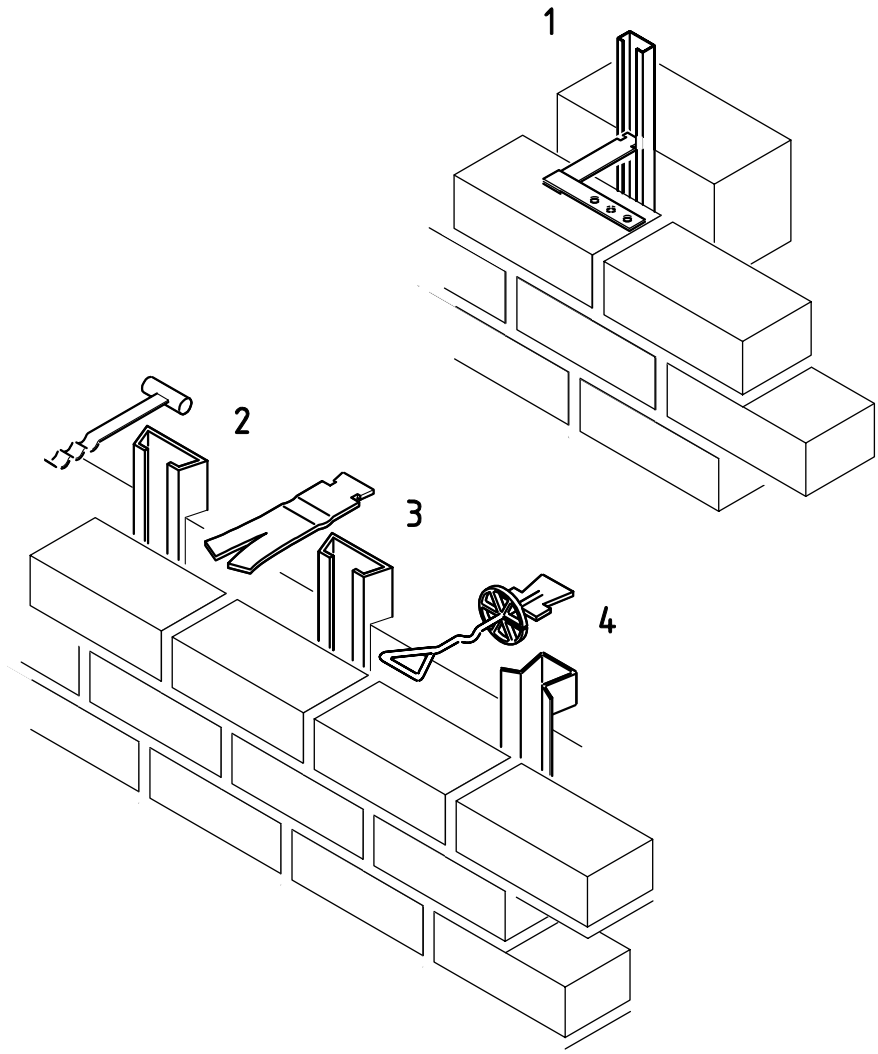


Key

1 rod with eye which can slide up or down

b) Example of movement-tolerant cavity wall tie having rod and eye that can be fixed to inner leaf of the wall

Figure 8 — Examples of movement-tolerant cavity wall ties



NOTE For reasons of clarity, thermal insulation is not shown.

Key

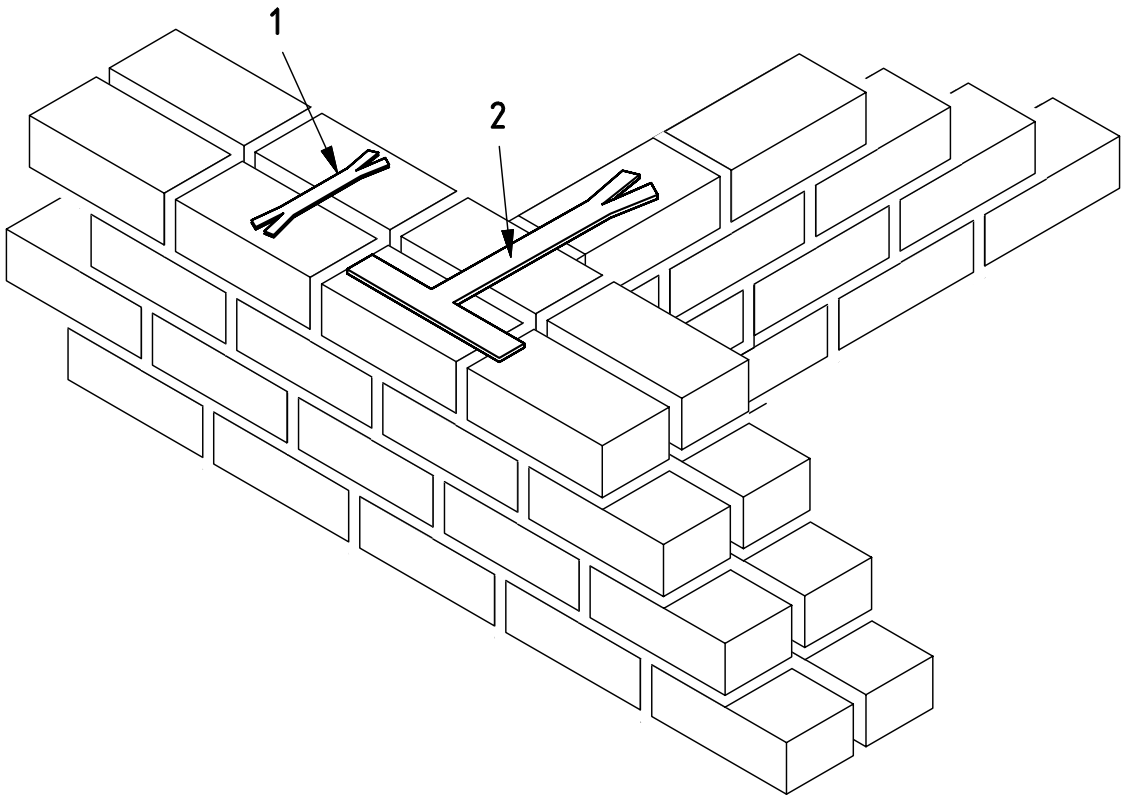
1 face-mounted key slot

2 sliding tee-in-slot type

3 key slot

4 dovetail slot

Figure 9 — Examples of slot ties



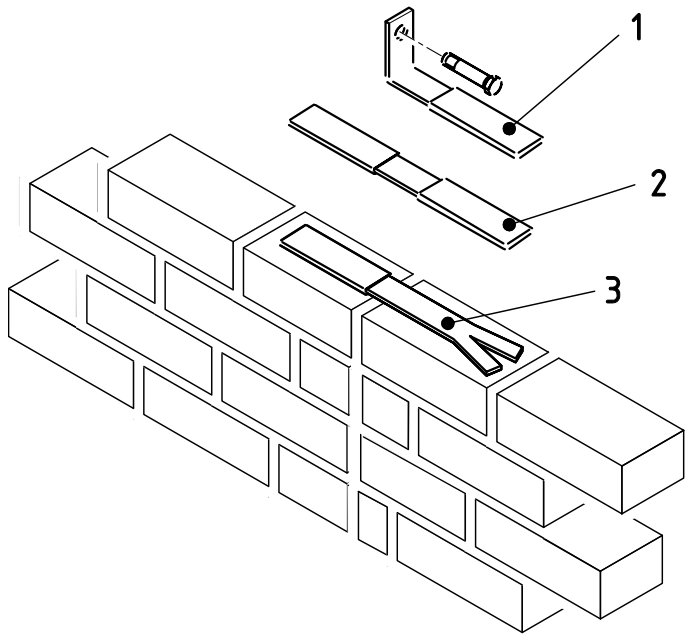
NOTE For reasons of clarity, thermal insulation is not shown.

Key

1 symmetrical split-ended anchor type

2 asymmetrical tee type

Figure 10 — Examples of shear ties



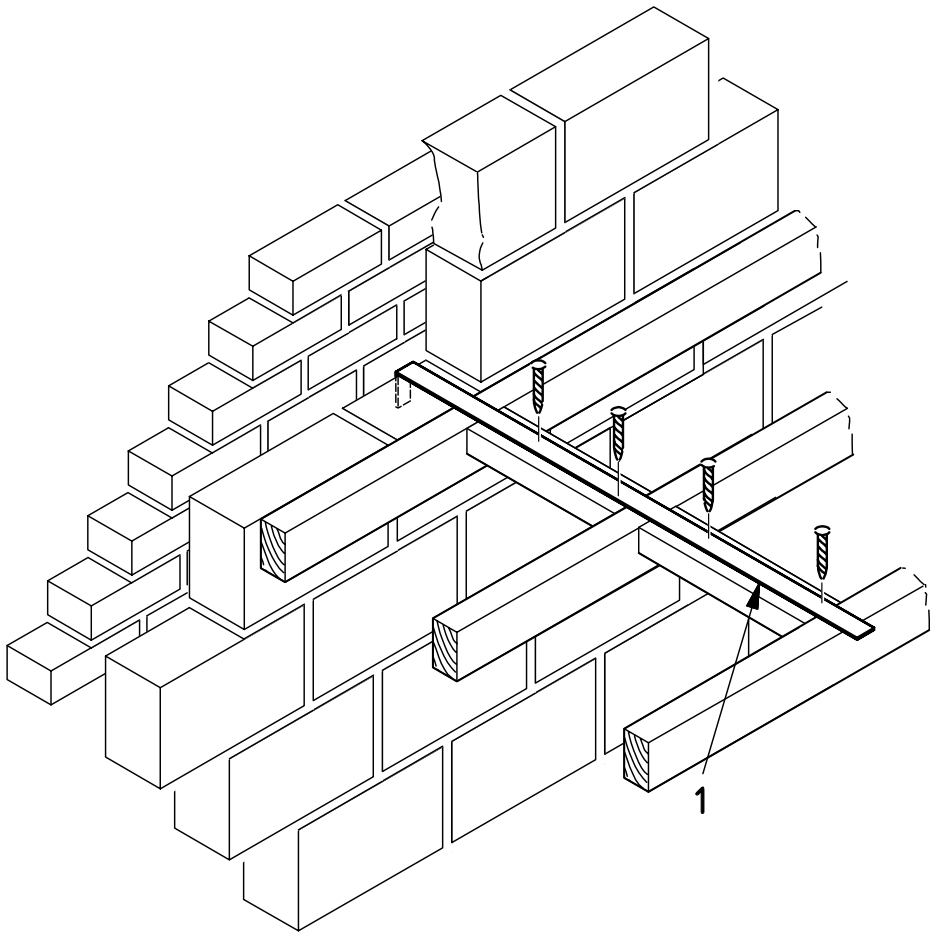
Key

1 asymmetrical fixing/slip-case type

2 symmetrical slip-case type

3 asymmetrical split-ended/slip-case type

Figure 11 — Examples of slip ties (general purpose type)



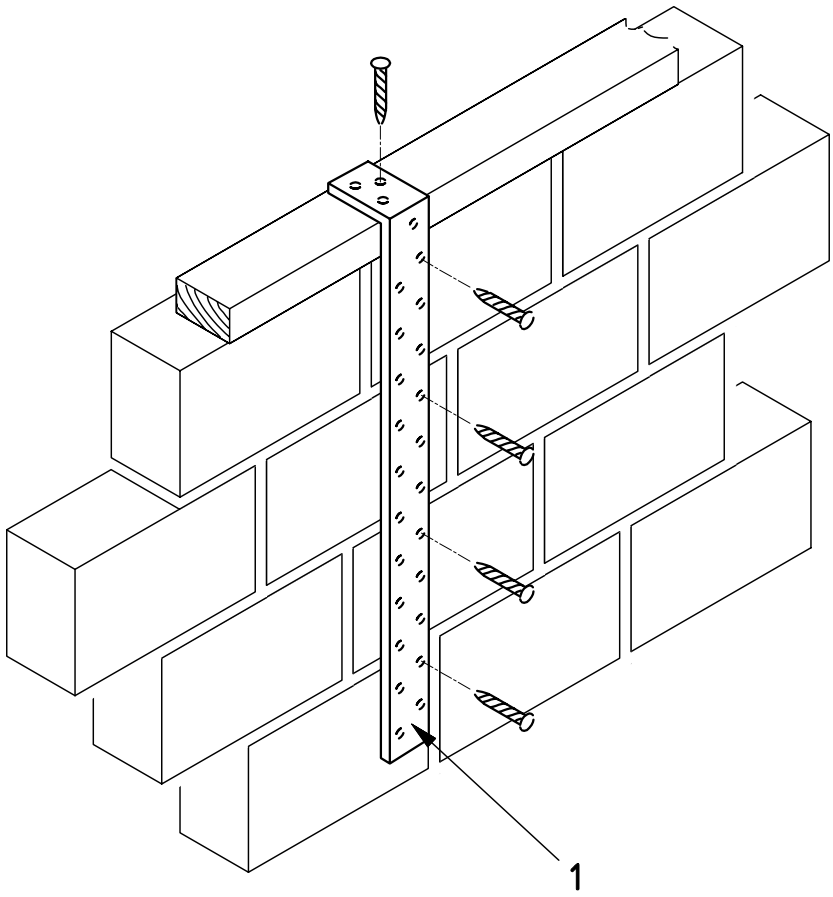
NOTE For reasons of clarity, thermal insulation is not shown.

Key

1 cranked end strap used horizontally to tie floor to wall

a) Example of horizontal tension strap

Figure 12 — Examples of tension straps *(continued)*

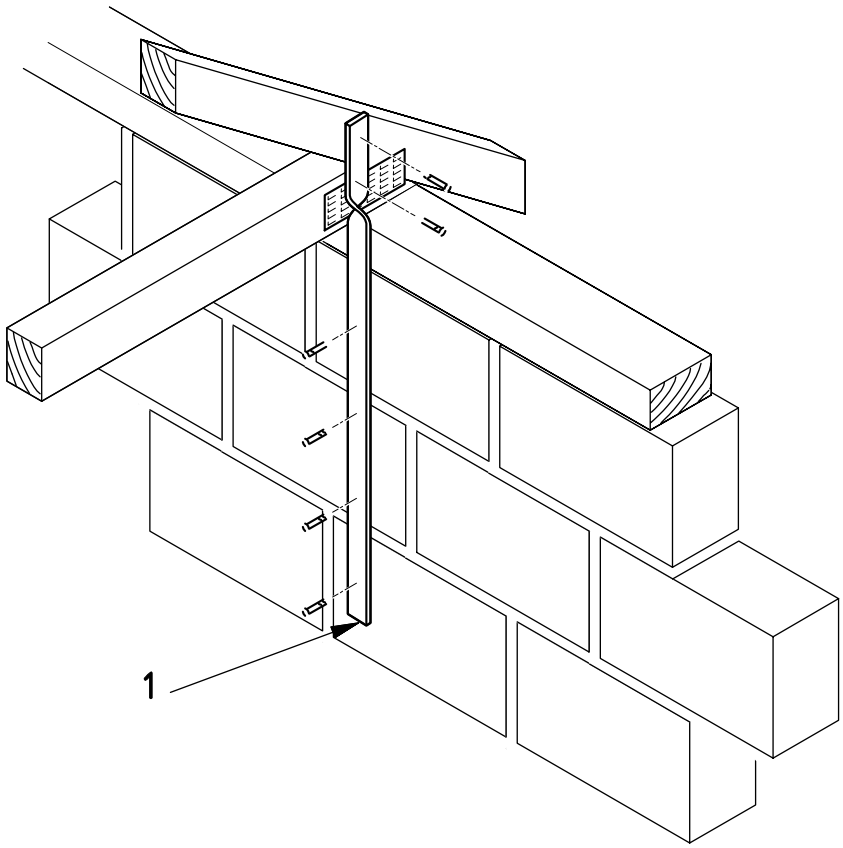


Key

1 cranked end strap used vertically to hold roof down

b) Example of holding down tension strap (wall plate)

Figure 12 — Examples of tension straps *(continued)*



Key

1 roof hold -down to wall strap

c) Example of holding down tension strap (truss)

Figure 12 — Examples of tension straps *(concluded)*

4 Materials

4.1 General

Materials for the manufacture of components covered by this standard shall be selected from Annex A and the material/coating reference shall be declared. The materials within a product, including those for any fixings, shall be compatible and stainless steel shall not be in contact with other types of steel.

The combinations of masonry units, mortars and fixings (where appropriate), for which the relevant declared values of product performance characteristics are valid, shall be declared.

4.2 Fixings and materials not supplied by the manufacturer

Unless otherwise chosen by the manufacturer, the products shall be tested using masonry units conforming to EN 771 (all parts) with a normalised compressive strength of not greater than 5 N/mm^2 and general purpose mortar conforming to EN 998-2 with a compressive strength not greater than 1,5 N/mm^2.

Where the fixings are not supplied as part of the product, fixings in accordance with a European Standard or European Technical Approval shall be specified. The materials for such fixings shall be compatible with that of the component.

5 Requirements

5.1 General

The requirements and properties specified in this standard shall be defined in terms of the test methods and procedures referred to in this European Standard.

NOTE The conformity criteria given in 5.2 to 5.7 inclusive relate to initial type tests (see 8.2) and when relevant consignment testing 〖A1〗 *deleted text* 〖/A1〗.

For production evaluation, conformity criteria in the factory production control documentation shall be defined.

5.2 Dimensions and limit deviations

5.2.1 Method of measurement and accuracy

Dimensions shall be measured using a calibrated device capable of achieving an error limit of ± 1 %.

5.2.2 Length, applicable cavity width, embedment and fixings (number, size and location)

5.2.2.1 Wall ties

The minimum embedment length of wall ties shall be 30 mm. Ties should be so designed that there will be 20 mm minimum of mortar beyond the tie in its plane, to prevent compression forces pushing the tie through the wall.

The overall length of wall ties shall be declared. When sampled in accordance with Clause 8 and measured, the overall length of wall ties shall be within ± 2,5 % of the declared value.

For cavity wall ties, the range of cavity widths over which the declared values of product performance characteristics are valid shall be declared.

For each end of a wall tie, as appropriate, the minimum embedment length forming the basis for the declared load capacity, or details and instructions for fixing shall be declared.

The requirements of this standard may be applied to some component parts of more complex tying systems.

5.2.2.2 Tension straps

The overall dimensions of each length of a strap together with details of the number, size and location of fixings as appropriate shall be declared. When sampled in accordance with Clause 8 and measured, dimensions shall be within ± 5 % or 3 mm of the declared values whichever is the lesser.

5.2.2.3 Joist hangers

The minimum declared embedment length of joist hangers (joint fixing type) shall be at least 50 mm. The clear length of the joist flange (all types) shall be at least 75 mm.

The following dimensions shall be declared. When sampled in accordance with Clause 8 and measured these dimensions shall be within ± 5 % or 3 mm of the declared values whichever is the lesser:

— the clear length of the masonry flange;

— the clear length of the joist flange;

— the perpendicular distance between the bearing surface of the masonry flange and the bearing surface of the joist flange (joint fixing type only);

— the width of the joist for which the hanger is intended.

5.2.2.4 Brackets

The overall perpendicular length, *L* (see Figure 3), from the fixing surface to the extremity of the support flange shall be declared. When sampled in accordance with Clause 8 and measured, *L* shall be within ± 5 % or ± 3 mm of the declared value, whichever is the lesser.

5.2.3 Thickness or diameter

5.2.3.1 Wall ties, tension straps and joist hangers

The minimum thickness of mortar joint for which the component is suitable shall be declared. This declared thickness shall be not less than the thickness of the joint as used in the tests carried out in accordance with EN 846 (all parts).

5.2.3.2 Brackets

The minimum thickness of the material shall be declared. When sampled in accordance with Clause 8 and measured, the minimum thickness shall be equal to or greater than the declared value.

The permissible deviations on thickness for continuously hot-dip metal coated steel sheet and strip shall be in accordance with EN 10143 and for hot rolled steel plates 3 mm thick and above shall be in accordance with EN 10029.

5.2.4 Other information

5.2.4.1 General

Any other information, including the number, size and location of fixings, which affect the structural performance of a product or which co-ordinate with other components shall be declared. When sampled in accordance with Clause 8 and measured, these dimensions shall be within ± 5 % of the declared values.

5.2.4.2 Movement-tolerant cavity wall ties

For movement-tolerant cavity wall ties, the maximum permissible range of movement shall be declared.

5.2.4.3 Slope-tolerant cavity wall ties

For slope-tolerant ties, the maximum and minimum permissible slopes shall be declared.

5.3 Mechanical strength

5.3.1 Wall ties and associated fixings

5.3.1.1 General

Wall ties shall be designated as either symmetrical or asymmetrical and either horizontal, slope-tolerant or movement-tolerant. The mechanical performance of slope-tolerant and movement-tolerant ties at all points of their ranges of slope or movement shall be equal to or greater than the declared values.

Where cavity wall ties are declared to be movement-tolerant and/or slope-tolerant, their mechanical strength shall be determined for the maximum condition of movement and/or maximum slope.

NOTE The term 'load capacity' relates to test values for individual specimens whereas the terms 'compressive load capacity', 'shear load capacity' and 'vertical load capacity' relate to the mean of the test values for a sample.

The declared load capacity of a wall tie shall be taken as the lowest of the load capacities of parts of the tie, determined separately, if required, for example load capacity of one or both anchorages, tensile or compressive strength of the bridging part of the tie or of subdivisions of the bridging part. The load capacity of a tie may have more than one declared value, if the tie is specified to be used in more than one type of masonry.

The load capacity shall be declared from the results of tests, using test methods specified in this standard, or their interpretation.

Calculation models may be used to interpret and extend the results obtained from testing. The calculation models should be based on a mechanical approach and appropriate material properties. Historic test data may be used to demonstrate the validity of the calculation model.

The failure mode of the masonry and/or the component and/or the structure to which the component is fixed shall be declared as anchorage/fixing failure, material failure of the component or masonry failure, for each declared load capacity.

The ultimate demonstration of conformity of the product with this standard shall be by testing, in accordance with the methods in EN 846-5, EN 846-6 or EN 846-7, samples selected in accordance with Clause 8; the load bearing capacity obtained from tests shall be greater than the declared value.

5.3.1.2 Cavity wall ties

5.3.1.2.1 Tensile load capacity

The tensile load capacity of the wall ties shall be declared. When sampled in accordance with Clause 8 and tested by the method of EN 846-5 or EN 846-6 as appropriate, using the declared minimum embedment length, the tensile load capacity shall be equal to or greater than the declared value and additionally no load capacity of any individual specimen in tension shall be less than 70 % of the declared value. For asymmetrical ties, where the ends are tested separately, the tensile load capacity shall be that of the weaker end. If anchorage is dealt with separately EN 846-5 or EN 846-6 as appropriate shall be used with the clamp placed close to the surface of the masonry part in which the wall tie is anchored.

5.3.1.2.2 Compressive load capacity

The compressive load capacity of the wall ties shall be declared. When sampled in accordance with Clause 8 and tested by the method of EN 846-5 or EN 846-6 as appropriate, using the declared minimum embedment length, the compressive load capacity shall be equal to or greater than the declared value and additionally no load capacity of any individual specimen in compression shall be less than 70 % of the declared value. For asymmetrical ties, where the ends are tested separately, the load capacity of any individual specimen in compression shall be that of the weaker end. If anchorage is dealt with separately, EN 846-5 or EN 846-6 as appropriate shall be used with the clamp placed close to the surface of the masonry part in which the wall tie is anchored.

5.3.1.2.3 Displacement under load

The mean displacement of a sample of wall ties at one third of the declared value of their tensile load capacity or compressive load capacity shall be declared.

When sampled in accordance with Clause 8 and tested in accordance with EN 846-5 or EN 846-6, as appropriate, the mean displacement at one third of the declared tensile or compressive load capacity shall be equal or less than the declared value.

5.3.1.3 Shear ties

5.3.1.3.1 Tensile load capacity

The tensile load capacity of the wall ties shall be declared. When sampled in accordance with Clause 8 and tested by the method of EN 846-5 or EN 846-6 as appropriate, using the declared minimum embedment length, the tensile load capacity shall be equal to or greater than the declared value and additionally no load capacity of any individual specimen in tension shall be less than 70 % of the declared value. For asymmetrical ties, where the ends are tested separately, the tensile load capacity shall be that of the weaker end. If anchorage is dealt with separately EN 846-5 or EN 846-6 as appropriate shall be used with the clamp placed close to the surface of the masonry part in which the wall tie is anchored.

5.3.1.3.2 Compressive load capacity

The compressive load capacity of the wall ties shall be declared. When sampled in accordance with Clause 8 and tested by the method of EN 846-5 or EN 846-6 as appropriate, using the declared minimum embedment length, the compressive load capacity shall be equal to or greater than the declared value and additionally no load capacity of any individual specimen in compression shall be less than 70 % of the declared value. For asymmetrical ties, where the ends are tested separately, the load capacity of any individual specimen in compression shall be that of the weaker end. If anchorage is dealt with separately, EN 846-5 or EN 846-6 as appropriate shall be used with the clamp placed close to the surface of the masonry part in which the wall tie is anchored.

5.3.1.3.3 Shear load capacity

Shear ties shall be designated as either symmetrical or asymmetrical.

The shear load capacity of the shear ties shall be declared. When sampled in accordance with Clause 8 and tested by the method of EN 846-7, the shear load capacity shall be equal to or greater than the declared value for either the horizontal or the vertical direction or for both directions. Additionally no load capacity of a specimen under shear shall be less than 70 % of the declared value.

5.3.1.3.4 Displacement under load

When measured in accordance with EN 846-5, EN 846-6 or EN 846-7 as appropriate, the mean displacement of a sample of wall ties at one third of the declared value of their tensile load capacity, compressive load or shear load capacity shall be declared.

5.3.1.4 Slip ties (general purpose)

5.3.1.4.1 General

Slip ties shall be designated as either symmetrical or asymmetrical.

5.3.1.4.2 Shear load capacity

The shear load capacity of the slip ties shall be declared. When sampled in accordance with Clause 8 and tested by the method of EN 846-7, the shear load capacity shall be equal to or greater than the declared value for either the horizontal or the vertical direction or for both directions. Additionally no load capacity of any individual specimen under shear shall be less than 70 % of the declared value.

5.3.1.4.3 Displacement under load

When measured in accordance with EN 846-7, the mean displacement of a sample of wall ties at one third of the declared value of their shear load capacity shall be declared.

5.3.2 Joist hangers

5.3.2.1 General

The declared load capacity of a joist hanger shall be taken as the lowest of the load capacities of parts of the hanger, determined separately, if required, for example load capacity of the anchorage, load capacity of the supporting part or of subdivisions of the supporting part. The load capacity of a hanger may have more than one declared value, if the hanger is specified to be used in more than one type of masonry.

The load capacity shall be declared from the results of tests, using test methods specified in this standard, or their interpretation.

Calculation models may be used to interpret and extend the results obtained from testing. The calculation models should be based on a mechanical approach and appropriate material properties. Historic test data may be used to demonstrate the validity of the calculation model.

The failure mode of the masonry and/or the component shall be declared as a fixing/anchorage failure or as material failure of the component.

The ultimate demonstration of conformity of the product with this standard shall be by testing, in accordance with the methods in EN 846-8, samples selected in accordance with Clause 8; the load-bearing capacity obtained from tests shall be greater than the declared value.

5.3.2.2 Vertical load capacity

The vertical load capacity of the joist hangers shall be declared. When sampled in accordance with Clause 8 and tested by the method of EN 846-8, using the declared minimum embedment length, the vertical load capacity shall be equal to or greater than the declared value. Additionally, no load capacity of any individual specimen shall be less than 90 % of the declared value.

When required, the vertical load bearing capacity shall be declared additionally as a characteristic duty.

When it is required to declare a characteristic value in addition to declaring the vertical load capacity according to EN 846-8 as a mean of the test results, the characteristic value should be taken as 0,9 of the mean value.

5.3.2.3 Deflection under load

When measured in accordance with EN 846-8, the mean deflection of a sample of joist hangers at one third of the declared value of their vertical load capacity shall be declared.

5.3.3 Brackets

5.3.3.1 General

The declared load capacity of a bracket shall be taken as the lowest of the load capacities of parts of the bracket, determined separately, if required, for example load capacity of the anchorage, load capacity of the supporting part or of subdivisions of the supporting part. The load capacity of a bracket may have more than one declared value if the bracket is specified to be used in more than one type of masonry.

The load capacity shall be declared from the results of tests, using test methods specified in this standard, or their interpretation.

Calculation models may be used to interpret and extend the results obtained from testing. The calculation models should be based on a mechanical approach and appropriate material properties. Historic test data may be used to demonstrate the validity of the calculation model.

The failure mode of the masonry and/or the component shall be declared as a fixing/anchorage failure or as material failure of the component.

The ultimate demonstration of conformity of the product with this standard shall be by testing, in accordance with the methods in EN 846-10, samples selected in accordance with Clause 8; the load bearing capacity obtained from tests shall be greater than the declared value.

5.3.3.2 Vertical load capacity

The vertical load capacity in normal loading format shall be declared. When sampled in accordance with Clause 8 and tested by the method of EN 846-10, the vertical load capacity in normal loading format shall be equal to or greater than the declared value. Additionally no load capacity of any individual specimen shall be less than 90 % of the declared value.

When required, the vertical load bearing capacity shall be declared additionally as a characteristic value.

When it is required to declare a characteristic value in addition to declaring the vertical load capacity according to EN 846-10 as a mean of the test results, the characteristic value should be taken as 0,9 of the mean value.

5.3.3.3 Deflection under load

When measured in accordance with EN 846-10, the mean deflection of a sample of brackets at one third of the declared value of their vertical load capacity shall be declared.

NOTE When tested, the deflection of the bracket is measured at (10 ± 0,5) mm from the free edge and the value obtained will, therefore, be much greater than the deflection of masonry supported by the product type.

5.3.4 Tension straps

5.3.4.1 General

The declared load capacity of a tension strap shall be taken as the lowest of the load capacities of parts of the strap, determined separately, if required, for example load capacity of the anchorage, load capacity of the restraining part or of subdivisions of the restraining part. The load capacity of a strap may have more than one declared value, if the strap is specified to be used in more than one type of masonry.

The load capacity shall be declared from the results of tests, using test methods specified in this standard, or their interpretation.

Calculation models may be used to interpret and extend the results obtained from testing. The calculation models should be based on a mechanical approach and appropriate material properties. Historic test data may be used to demonstrate the validity of the calculation model.

The failure mode of the masonry and/or the component and/or the structures to which the component is fixed shall be declared as a fixing/anchorage failure or as material failure of the component.

The ultimate demonstration of conformity of the product with this standard shall be by testing, in accordance with the methods in EN 846-4, samples selected in accordance with Clause 8; the load bearing capacity obtained from tests shall be greater than the declared value.

NOTE A vertical pre-compression of 0,4 N/mm^2 is applied to the top of masonry specimens when tested in accordance with EN 846-4. In masonry where vertical characteristic loading results in a pre-compression less than 0,4 N/mm^2, the design values for the capacity of straps used in structural calculations will need to take this into account on the basis of experience of the mode of failure and use.

5.3.4.2 Tensile load capacity

The tensile load capacity shall be declared. When sampled in accordance with Clause 8 and tested by the method of EN 846-4, the tensile load capacity shall be equal to or greater than the declared value. Additionally no load capacity of any individual specimen shall be less than 90 % of the declared value. For asymmetrical straps, where the ends are tested separately, the tensile load capacity shall be that of the weaker end.

When required the tensile load bearing capacity shall be declared additionally as a characteristic value.

When it is required to declare a characteristic value in addition to declaring the tensile load capacity according to EN 846-4 as a mean of the test results, the characteristic value should be taken as 0,9 of the mean value.

5.3.4.3 Displacement under load

When measured in accordance with EN 846-4, the mean displacement of a sample of tension straps at one third of the declared value of their tensile load capacity shall be declared.

5.4 Resistance to water crossing a cavity

It shall be declared whether wall ties are resistant to water crossing a cavity.

NOTE Resistance to water crossing a cavity can be achieved by design of the central section (e.g. by the use of a shaped section of the wall tie (“drip”), a clip-on device or by the wall tie sloping downwards from inner to outer leaf).

The range of difference in level from the outer to the inner leaf over which slope tolerant ties may be used, shall be declared.

5.5 Safety during installation

The product design shall minimise the danger to persons handling the product through either:

a) the avoidance of sharp edges and pointed ends, or

b) use of suitable protective equipment supplied with the product or specified on the product label (e.g. gloves and/or eye protectors).

5.6 Durability

The materials for the manufacture of the products and their corrosion protection systems shall be selected in accordance with the requirements of 4.1 and 4.2.

NOTE The durability of performance characteristics against corrosion is dependent on both the condition of exposure of the masonry and the material/coating specification. This European Standard follows the state of the art by giving material/coating specifications for use with EN 1996-2 or regulatory requirements.

Some combinations of metals can lead to corrosion and such combinations should be avoided.

5.7 Dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonised test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: *http://ec.europa.eu/enterprise/construction/cpd-ds/*.

6 Description and designation

The information to be supplied, indicated by a tick (✓), shall be as given in Table 1.

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Table 1 — Information to be provided

Information reference number	Information to be supplied [a]	Cavity wall ties	Shear ties	Slip ties	Tension straps	Joist hangers	Brackets
1	Material/coating specification in accordance with Table A.1 and steel grade relevant to product type.	✓	✓	✓	✓	✓	✓
2	Dimensions in accordance with 5.2 in mm	✓	✓	✓	✓	✓	✓
3	Declared minimum embedment length in mm	✓	✓	✓	–	✓	

Information reference number	Information to be supplied [a]	Cavity wall ties	Shear ties	Slip ties	Tension straps	Joist hangers	Brackets
4	Declared value of tensile load capacity in N and failure mode	✓	✓	–	✓	–	–
5	Declared value of compressive load capacityin N and failure mode	✓	✓	–	–	–	–
6	Declared value of shear load capacity and failure mode in N	–	✓	✓	–	–	–
7	Declared value of vertical load capacity in N and failure mode	–	–	–	–	✓	✓
8	Declared mean displacement/deflection in mm	✓	✓	✓	✓	✓	✓
9	Whether the component is symmetrical or asymmetrical	✓	✓	✓	✓	–	–
10	Whether the component is slope-tolerant , and if it is, the range of difference in level from the outer leaf down to the inner leaf, over which it may be used in mm	✓	–	–	–	–	–
11	Whether the component is movement tolerant together with the maximum permissible movement range in mm	✓		–	–	–	–
12	Whether a component is intended to be resistant to water crossing the cavity	✓					
13	Specification for use, including limiting requirements on compressive strength and types of masonry units and mortars, the type, size, number and location of any fixings and any particular assembly or installation instructions	✓	✓	✓	✓	✓	✓
14	Product identity (see Clause 7 c))	✓	✓	✓	✓	✓	✓
15	Minimum mortar joint thickness in mm for which the component is suitable (where relevant)	✓	✓	✓	✓	✓	–
16	The specification of any fixing devices not provided by the manufacturer and not packaged with the product	✓	✓	✓	✓	✓	✓

[a] Additional information may include sound attenuation, thermal characteristics and instructions regarding safety during installation.

✓ To be provided

– Not required

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7 Marking

The following information shall be clearly and indelibly marked on the product or on its packaging, delivery note, invoice or in the accompanying documentation, supplied with the product:

a) the number and date of issue of this European Standard ▌A1⟩ EN 845-1:2013+A1:2016 ⟨A1▐;

b) the name or identifying mark and registered address of the manufacturer, or the manufacturer's authorised representative;

c) unique reference number, name or code which will identify the product type and relate it to its description and designation.

▌A1⟩

8 Assessment and verification of constancy of performance – AVCP

8.1 General

The compliance of wall ties, tension straps, hangers and brackets with the requirements of this standard and with the performances declared by the manufacturer in the DoP shall be demonstrated by:

— determination of the product type;

— factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

NOTE The assignment of tasks to the notified body(ies) and the manufacturer is shown in Table ZA.2.

8.2 Type testing

8.2.1 General

All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions for declaring them without performing tests. (e.g. use of previously existing data, and conventionally accepted performance).

Assessment previously performed in accordance with the provisions of this standard, may be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP system on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

NOTE Same AVCP system means testing by an independent third party, under the responsibility of a notified product certification body

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for that same characteristic for all products within that same family

In addition, the determination of the product type shall be performed for all characteristics included in the standard for which the manufacturer declares the performance:

— at the beginning of the production of a new or modified wall tie, tension strap, hanger and bracket (unless a member of the same product range), or

— at the beginning of a new or modified method of production (where this may affect the stated properties);

or

— they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the wall tie, tension strap, hanger and bracket design, in the raw material or in the supplier of the components, or in the method of production (subject to the definition of a family), which would affect significantly one or more of the characteristics.

Where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of assessment methods of other product standards, these characteristics need not be re-assessed. The specifications of these components shall be documented.

Products bearing regulatory marking in accordance with appropriate harmonized European specifications may be presumed to have the performances declared in the DoP, although this does not replace the responsibility on the wall tie, tension strap, hanger and bracket manufacturer to ensure that the wall tie, tension strap, hanger and bracket as a whole is correctly manufactured and its component products have the declared performance values.

8.2.2 Test samples, testing and compliance criteria

The minimum sample size for a single test shall be as given in Table 2 and shall be drawn at random. For initial type testing, the batch from which the sample is drawn shall be of a size of at least 100 times the number of specimens taken. Pre-production samples may be used for initial type tests where it is possible to demonstrate that the characteristics of performance are representative of products from the full production process.

Table 2 — Sampling - Number of specimens

Product [a]	**Minimum number per single test**
Wall ties designed to link two leaves of a cavity wall or cladding to a frame	10 [a,b]
Shear ties	10 [b]
Slip ties	10 [b]
Joist hangers	5
Brackets	5
Tension-straps	5 per end
[a] For testing organic coatings, see sampling requirements of EN 846-13. [b] These quantities will be doubled where both ends of asymmetrical wall ties are tested separately.	

In the event of the need to check the compliance of a lot or consignment of a product supplied to site or installed, a sample shall be taken at random from the lot or consignment and tested. The sample sizes shall be not less than those given in Table 2.

8.2.3 Test reports

The results of the determination of the product type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the wall tie, tension strap, hanger and bracket to which they relate.

8.2.4 Shared other party results

NOTE The sharing of other party results is in principle applicable to all systems of assessment and evaluation of constancy of performance.

A manufacturer may use the results of the product type determination obtained by someone else (e.g. by another manufacturer, as a common service to manufacturers, or by a product developer), to justify his own declaration of performance regarding a product that is manufactured according to the same design (e.g. dimensions) and with raw materials, constituents and manufacturing methods of the same kind, provided that:

— the results are known to be valid for products with the same essential characteristics relevant for the product performance;

— in addition to any information essential for confirming that the product has such same performances related to specific essential characteristics, the other party who has carried out the determination of the product type concerned or has had it carried out, has expressly accepted to transmit to the manufacturer the results and the test report to be used for the latter's product type determination, as well as information regarding production facilities and the production control process that can be taken into account for FPC;

— the manufacturer using other party results accepts to remain responsible for the product having the declared performances and he also:

— ensures that the product has the same characteristics relevant for performance as the one that has been subjected to the determination of the product type, and that there are no significant differences with regard to production facilities and the production control process compared to that used for the product that was subjected to the determination of the product type; and

— keeps available a copy of the determination of the product type report that also contains the information needed for verifying that the product is manufactured according to the same design and with raw materials, constituents and manufacturing methods of the same kind.

8.3 Factory production control (FPC)

8.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the essential characteristics.

The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures.

This factory production control system documentation shall ensure a common understanding of the evaluation of the constancy of performance and enable the achievement of the required product performances and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performances of the essential characteristics.

In case the manufacturer has used shared product type results, the FPC shall also include the appropriate documentation as foreseen in 8.2.4.

8.3.2 Requirements

8.3.2.1 General

The manufacturer is responsible for organizing the effective implementation of the FPC system in line with the content of this product standard. Tasks and responsibilities in the production control organization shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product constancy, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-constancies from occurring, actions in case of non-constancies and to identify and register product constancy problems.

Personnel performing work affecting the constancy of performance of the product shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory the manufacturer may delegate the action to a person having the necessary authority to:

— identify procedures to demonstrate constancy of performance of the product at appropriate stages;

— identify and record any instance of non-constancy;

— identify procedures to correct instances of non-constancy.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control. The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process. The FPC system should achieve an appropriate level of confidence in the constancy of performance of the product. This involves:

— the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made;

— the effective implementation of these procedures and instructions;

— the recording of these operations and their results;

— the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-constancy of performance.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European Standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labeled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass the above responsibilities on to a subcontractor.

NOTE Manufacturers having an FPC system, which complies with EN ISO 9001 and which addresses the provisions of the present European Standard are considered as satisfying the FPC requirements of the Regulation (EU) No 305/2011.

8.3.2.2 Equipment

8.3.2.2.1 Testing

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

8.3.2.2.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer's written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

8.3.2.3 Raw materials and components

As appropriate, the manufacturer shall define the acceptance criteria of raw materials and the procedures operated to ensure that these are met.

8.3.2.4 Controls during manufacturing process

The manufacturer shall plan and carry out production under controlled conditions.

8.3.2.5 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics he declares are maintained. The characteristics, and the means of control, are:

1) material properties (organic coating impact, abrasion and corrosion resistance only) (see Table A.2)

2) dimensions and permissible deviations in accordance with 5.2 shall be measured

3) tensile load capacity shall be subject to the tests indicated in 5.3.1.2, 5.3.1.3 and 5.3.4.2, see Annex B;

4) compressive load capacity shall be subject to the tests indicated in 5.3.1.2 and 5.3.1.3, see Annex B;

5) shear load capacity shall be subject to the tests indicated in 5.3.1.3 and 5.3.1.4, see Annex B;

6) vertical load capacity according to product type shall be subject to the tests indicated in 5.3.2 and 5.3.3, see Annex B.

Displacement/Deflection (as appropriate) at one third of the declared value of mean load capacity shall be subject to the tests indicated in 5.3.1.2, 5.3.1.3, 5.3.1.4, 5.3.2.3, 5.3.3.3 and 5.3.4.3, see Annex B.

Alternative methods of test to the methods referenced in this European Standard may be adopted except for the initial type test and in cases of dispute, provided that these alternative methods satisfy the following:

— a relationship can be shown to exist between the results from the referenced test and those from the alternative test; and

— the information on which the relationship is based is available.

8.3.2.6 Non-complying products

The manufacturer shall have written procedures which specify how non-complying products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures.

Where the product fails to satisfy the acceptance criteria, the provisions for non-complying products shall apply, the necessary corrective action(s) shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this European Standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

8.3.2.7 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence.

8.3.2.8 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

8.3.3 Product specific requirements

The FPC system shall address this European Standard and ensure that the products placed on the market comply with the declaration of performance.

The FPC system shall include a product specific FPC, which identifies procedures to demonstrate compliance of the product at appropriate stages, i.e.:

a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down in the FPC test plan;

and/or

b) the verifications and tests to be carried out on finished products according to a frequency laid down in the FPC test plan.

If the manufacturer uses only finished products, the operations under b) shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

If the manufacturer carries out parts of the production himself, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production that are carried out by the manufacturer, the more operations under b) may be replaced by operations under a).

In any case the operation shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

The operations under a) refer to the intermediate states of the product as on manufacturing machines and their adjustment, and measuring equipment etc. These controls and tests and their frequency shall be chosen based on product type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters etc.

The manufacturer shall establish and maintain records that provide evidence that the production has been sampled and tested. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available for at least three years.

8.3.4 Procedure for modifications

If modifications are made to the product, production process or FPC system that could affect any of the product characteristics declared according to this standard, then all the characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product type, as described in Clause 6.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report. 〈A1

Annex A
(normative)

Materials and protective coatings

Materials for ancillary components and the appropriate protective coatings shall be selected from Table A.1, Table A.2 and/or Table A.3.

Table A.1 — Materials and corrosion protection systems

Material	Specifications for material [a]	Coating specification			Organic coating Thickness µm	Material/coating reference [e]
		Mass per side [b] g/m²	Mass per two sides [c] g/m²	Thickness [d] µm		
Austenitic stainless steel (molybdenum chrome nickel alloys)	EN 10088 (all parts)	–	–	–	–	1 [i]
Plastic used for the body of wall ties	Polypropylene in accordance with Table A.3	–	–	–	–	2
Austenitic stainless steel (chrome nickel alloys)	EN 10088 (all parts)	–	–	–	–	3 [i]
Ferritic stainless steel	EN 10088 (all parts)	–	–	–	–	4 [i]
Phosphor bronze	ISO 427:— CuSn4.CuSn5.CuSn7	–	–	–	–	5
Aluminium bronze	ISO 428:— CuAl7	–	–	–	–	6
Copper	ISO 431:— Cu-ETP, Cu-FRTP, Cu-OF, Cu-DHP	–	–	–	–	7
Zinc coated steel wire	EN 10244 (all parts) zinc coating	940	–	–	–	8
Zinc coated steel component	EN ISO 1461 zinc coated steel	940	–	130 [g]	–	9
Zinc coated steel component	EN ISO 1461 zinc coated steel	710	–	100 [g]	–	10
Zinc coated steel component	EN ISO 1461 zinc coated steel	460	–	65 [g]	–	11
Zinc coated steel component	EN ISO 1461 zinc coated steel	395		55 [g]		11A
Zinc coated steel strip or sheet with organic coating over all outer surfaces of finished component	EN 10346 zinc pre-coating, organic coating Type 1	–	600	42 [d]	25	12.1
Zinc coated steel strip or sheet with organic coating over all outer surfaces of finished component	EN 10346 zinc pre-coating, organic coating Type 2	–	600	42 [d]	[f]	12.2
Zinc coated steel wire	EN 10020 with EN 10244 (all parts) zinc coating	265 [h]	–	–	–	13
Zinc coated steel strip or sheet with all cut edges organic coated	EN 10346 zinc pre-coating, organic coating Type 1	–	600	42 [d]	25	14

Table A.1 — Materials and corrosion protection systems *(continued)*

Material	Specifications for material [a]	Coating specification			Organic coating Thickness µm	Material/coating reference [e]
		Mass per side [b] g/m²	Mass per two sides [c] g/m²	Thickness [d] µm		
Zinc pre-coated steel strip or sheet	EN 10346 zinc pre-coating	–	600	42 [d]	–	15
Zinc coated steel strip or sheet with organic coating over all outer surfaces of finished component	EN 10346 zinc pre-coating, organic coating Type 1	–	275	20 [d]	25	16.1
Zinc coated steel strip or sheet with organic coating over all outer surfaces of finished component	EN 10346 zinc pre-coating, organic coating Type 2	–	275	20 [d]	–	16.2
Zinc pre-coated steel strip with zinc coated edges	EN 10336 zinc pre-coating	–	275	20 [d]	–	17
Zinc coated steel wire with organic coating over all surfaces of finished component	EN 10244 (all parts) zinc coating and EN 10245 organic coating : – Part 1 – Part 2 - Class 2a or 2b – or Part 3 – Class 3	60 [h]	–	–	min. 80 mean 100	18
Zinc coated steel wire	EN 10020 with EN 10244 (all parts) zinc coating	105 [h]	–	–	–	19
Zinc coated steel wire	EN 10020 with EN 10244 (all parts) zinc coating	60 [h]	–	–	–	20
Zinc pre-coated steel sheet	EN 10346: zinc coated steel	–	275	20 [d]	–	21
Zinc coated steel wire with bonded epoxy coating over all surface of finished component	EN 10020 with EN 10244 (all parts) zinc coating and bonded epoxy coating according to EN 10245-1 — General Principles	60 [h]	–	–	min. 80 mean 100	22
Austenitic-ferritic stainless steel	EN 10088 (all parts)	–	–	–	–	23 [i]

[a] Except where specified an appropriate grade of steel conforming to EN 10020 for zinc-coated products may be chosen.

[b] Coating weight is of zinc and is given for one side for wire and post fabrication coatings.

[c] Coating weight is of zinc and given for two sides for pre-galvanized sheet products. The mean one side figure will be 50 % of the two side figure but not necessarily evenly distributed.

[d] Coating thickness refers to the average thickness of metallic protective coating on any uncut surface of a product or any surface of a post-fabrication galvanized product.

[e] This number is given to allow unambiguous materials specification and gives no indication of relative performance or quality.

[f] Organic coating Type 2 is specified by performance testing and not by thickness.

[g] Local minimum thickness.

[h] On round wire before any subsequent processing.

[i] Treatment of stainless steels after fabrication is necessary in relation to welds, etc. in order to maintain corrosion resistance of the steel.

Table A.2 — Organic over-coatings for galvanised metal products

Coating	Description
Type 1	Bituminous solvent paint of minimum 25 µm dry film thickness or a 'One pack', adherent, chemically resistant paint of minimum 25 µm film thickness when measured in accordance with EN ISO 1463.
Type 2	A system which meets the requirements given in 6.2 a) or 6.2 b) and 7.2 a) or 7.2 b) of EN 846-13:2001 for impact, abrasion and corrosion resistance.

Table A.3 — Specification for polypropylene[a] for use in wall ties and polyamide[b] for expansion plugs

Property		Test method	Required value	
			Polypropylene	Polyamide plugs
Melt flow rate (MFR) 230 C/2, 16 kg	g/10 min	EN ISO 1133	2 ± 0,5	–
Density	kg/m^3	ISO 1183 (all parts)	905 ± 10	1 130 ± 110
Tensile yield	MPa	EN ISO 527 (all parts)	23 ± 2	70 ± 10
Flexural elastic modulus	MPa	EN ISO 178	1 000 ± 100	2 000 ± 200
Rockwell hardness	(R scale)	EN ISO 2039-2	-75 ± 5	
Izod notched impact strength at temperatures of:		EN ISO 180:2000 (1A)		
+23°C [c]	kJ/m^2		(no break) 50 ± 5	50 ± 5
0°C	kJ/m^2		-13 ± 1,3	–
-20°C	kJ/m^2		-9 ± 0,9	–
-40°C	kJ/m^2		6 ± 0,6	–
Heat distortion temperature under loads of:		EN ISO 75 (all parts)		
455 kN/m^2 (HDT B)	°C		80 ± 5	190 ± 20
1 820 kN/m^2 (HDT A)	°C		50 ± 5	85 ± 15
Softening temperature (VST/A/50)	°C	EN ISO 306	148 ± 5	220 ± 20

The properties of plastics depend on many factors, such as temperature and length of time over which stress is applied. Therefore most of the values shown in this table should not be used for design purposes because they are only for the prescribed test conditions.

Plastics should not be specified for any situations where the products are either exposed to light or subjected to long term stress.

[a] Polypropylene should be a heavy duty block co-polymer grade falling within this specification in respect of the mechanical and heat distortion properties.

[b] Polyamide should be a 'polyamide 6' and these figures are as-moulded values. Polyamide absorbs some moisture in service and this will alter these values significantly.

[c] No complete break (failure energy quoted).

Annex B
(informative)

Guidance on FPC frequencies

Table B.1 — Checking of finished products

Subject	Purpose of checking	Reference method	Frequency of checking by the manufacturer for a product group
Material properties	Conformity with the declared material/coating specification	In accordance with Table A.1	— for each change of raw material or — as given in the FPC documentation
Organic coating - Type 2	Conformity with the requirements given in Table A.2 of A1 EN 845-1:2013+A1:2016 A1	EN 846-13	— for each change of raw material or — as given in the FPC documentation
Dimensions in accordance with 5.2	Conformity with the declared dimensions and the permissible dimensional deviations determined by EN 845-1	EN ISO/IEC 17 025 laboratory standards	— 1 product specimen/500 products or — as given in the FPC documentation
Tensile load capacity and displacement of ties (see 5.3.1.2.1 and 5.3.1.3.1)	Conformity with the declared value in accordance with EN 845-1	EN 846-5 or EN 846-6	— not required if the material properties and dimensions are maintained (see above) unless the product has critical details which cannot be measured, in which case 1 product per 10 000 should be tested, or — as given in the FPC documentation
Compressive load capacity and displacement of ties (see 5.3.1.2.2 and 5.3.1.3.2)	Conformity with the declared value in accordance with EN 845-1	EN 846-5 or EN 846-6	— not required if the material properties and dimensions are maintained (see above) unless the product has critical details which cannot be measured, in which case 1 product per 10 000 should be tested, or — as given in the FPC documentation
Shear load capacity and displacement of ties (see 5.3.1.3.3 and 5.3.1.4.2)	Conformity with the declared value in accordance with EN 845-1	EN 846-7	— not required if the material properties and dimensions are maintained (see above) unless the product has critical details which cannot be measured, in which case 1 product per 10 000 should be tested, or — as given in the FPC documentation
Tensile load capacity and displacement of tension straps (see 5.3.4.2 and 5.3.4.3)	Conformity with the declared value in accordance with EN 845-1	EN 846-4	— not required if the material properties and dimensions are maintained (see above) unless the product has critical details which cannot be measured, in which case 1 product per 10 000 should be tested, or

			— as given in the FPC documentation
Vertical load capacity and deflection of joist hangers (see 5.3.2.2 and 5.3.2.3)	Conformity with the declared value in accordance with EN 845-1	EN 846-8	— not required if the material properties and dimensions are maintained (see above) unless the product has critical details which cannot be measured, in which case 1 product per 10 000 should be tested, or — as given in the FPC documentation
Vertical load capacity and deflection of brackets (see 5.3.3.2 and 5.3.3.3)	Conformity with the declared value in accordance with EN 845-1	EN 846-10	— not required if the material properties and dimensions are maintained (see above) unless the product has critical details which cannot be measured, in which case 1 product per 10 000 should be tested, or — as given in the FPC documentation
The manufacturer does not have to declare a value against every property and some may be on the basis of, for example, a specification referenced in this standard. When the declared value is derived by using standards referenced in EN 845-1, no testing is required. The FPC tests listed in this table should be carried out in accordance with subclause 8.1. Testing of finished product specimens can be replaced by inspections and measurements, when the manufacturer can assure dependence between measurements/inspections and declared load capacity. If the declared load capacity of the product is dependent on the manufacturing process, i.e. quality of welding or tolerances of dimensions, testing can be replaced by an inspection scheme covering welding and measurements of critical dimensions.			

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Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Regulation

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under a mandate M/116, as amended, *"Masonry and related products*" given to CEN by the European Commission and the European Free Trade Association.

When this European Standard is cited in the Official Journal of the European Union (OJEU), under Regulation (EU) No 305/2011, it shall be possible to use it as a basis for the establishment of the Declaration of Performance (DoP) and the CE marking, from the date of the beginning of the co-existence period as specified in the OJEU.

Regulation (EU) No 305/2011, as amended, contains provisions for the DoP and the CE marking.

Table ZA.1.1 — Relevant clauses for cavity wall ties and intended use

Product:	**Cavity wall ties**		
Intended use:	**In masonry walls and partitions as covered by the scope of this standard (for connecting two leaves in a cavity wall or one leaf to a frame structure)**		
Essential characteristics	**Clauses of this European Standard related to essential characteristics**	**Classes and/or threshold levels**	**Notes**
Compressive strength	5.3.1.2.2 Compressive load capacity	None	Compressive load capacity in N, for ties with: [a] - overall length in mm - cavity width, range in mm - minimum embedment length in mm (for one or both ends as relevant) - minimum mortar joint thickness in mm - minimum masonry unit strength and mortar strength when relevant - requirements for fixing devices and for strength/characteristics of the base material when relevant (if mechanically fixed) - maximum and minimum permissible slope in mm when relevant - maximum permissible range of movement in mm when relevant - reference to installation instructions when needed Failure mode
Tensile strength	5.3.1.2.1 .	None	Tensile load capacity in N, for ties with notes described above concerning compression strength [a] Failure mode
Buckling or bending stiffness	5.3.1.2.3	None	Displacement in mm [a, b]
Water shedding capability	5.4 Resistance to water crossing the cavity	None	Resistant or not resistant
Durability of performance characteristics (against corrosion)	5.6 Durability		Material/coating reference [c] and steel grade when relevant to product type
Dangerous substances	5.7	None	

[a] The mechanical strength of the products is dependent on their dimensions, minimum embedment as relevant and fixings.

[b.] Displacement control for the product type is addressed through a declared displacement at one third of the declared value of the mean load capacity.

[c] Durability of performance characteristics against corrosion is dependent on both the condition of exposure of the masonry and the material/coating specification. The harmonised standard follows the state of the art by giving material/coating specifications for use with EN 1996-2 or regulatory requirements.

Table ZA.1.2 — Relevant clauses for shear ties and intended use

Product:	**Shear ties**		
Intended use:	**In masonry walls and partitions as covered by the scope of this standard (for connecting two adjacent masonry leaves together, for connecting masonry walls which need to interact to produce composite action and for connecting masonry walls to frame structures)**		
Essential Characteristics	**Requirement clauses of this European Standard**	**Classes and/or threshold levels**	**Notes**
Compressive strength	5.3.1.3.2	None	Compressive load capacity in N, for ties with: [a] - overall length in mm - minimum embedment length in mm (for one or both ends as relevant) - minimum mortar joint thickness in mm - minimum masonry unit strength and mortar strength when relevant - requirements for fixing devices and for strength/characteristics of the base material when relevant (if mechanically fixed) - reference to installation instructions when needed Failure mode
Tensile strength	5.3.1.3.1	None	Tensile load capacity in N for ties with notes described above concerning compression strength [a] Failure mode
Buckling or bending stiffness	5.3.1.3.4	None	Displacement in mm [a, b]
Shear strength	5.3.1.3.3	None	Shear load capacity in N for ties with notes described above concerning compression strength [a, b] Failure mode
Water shedding capability	Not relevant	None	
Durability of performance	5.6 Durability		Material/coating reference [c] and steel grade when relevant to product type

characteristics (against corrosion)			
Dangerous substances	5.7	None	

[a] The mechanical strength of the products is dependent on their dimensions, minimum embedment as relevant and fixings.

[b] Displacement control for the product type is addressed through a declared displacement at one third of the declared value of the mean load capacity.

[c] Durability of performance characteristics against corrosion is dependent on both the condition of exposure of the masonry and the material/coating specification. The harmonised standard follows the state of the art by giving material/coating specifications for use with EN 1996-2 or regulatory requirements.

Table ZA.1.3 — Relevant clauses for slip ties and intended use

Product:	**Slip ties**		
Intended use:	**In masonry walls and partitions as covered by the scope of this standard (for connecting two adjacent walls or for connecting masonry cladding to frame structures while allowing in-plane movement)**		
Essential Characteristics	**Requirement clauses of this European Standard**	**Classes and/or threshold levels**	**Notes**
Shear strength and stiffness	Slip ties (general purpose) 5.3.1.4.2 Shear load capacity 5.3.1.4.3 Displacement under load	None	Shear load capacity in N, for ties with: [a, b] - overall length in mm - cavity width, range in mm - minimum embedment length in mm (for one or both ends as relevant) - minimum mortar joint thickness in mm - minimum masonry unit strength and mortar strength when relevant - requirements for fixing devices and for strength/characteristics of the base material when relevant (if mechanically fixed) - maximum permissible range of movement in mm when relevant - reference to installation instructions when needed Failure mode
Durability of	5.6 Durability		Material/coating reference [c]

performance characteristics (against corrosion)			and steel grade when relevant to product type
Dangerous substances	5.7	None	

[a] The mechanical strength of the products is dependent on their dimensions, minimum embedment as relevant and fixings.

[b.] Displacement control for the product type is addressed through a declared displacement at one third of the declared value of the mean load capacity.

[c] Durability of performance characteristics against corrosion is dependent on both the condition of exposure of the masonry and the material/coating specification. The harmonised standard follows the state of the art by giving material/coating specifications for use with EN 1996-2 or regulatory requirements.

Table ZA.1.4 — Relevant clauses for tension straps and intended

Product:	**Tension straps**		
Intended use:	**In masonry walls and partitions as covered by the scope of this standard (for connecting masonry walls to adjacent components such as floors and roofs)**		
Essential Characteristics	**Requirement clauses of this European Standard**	**Classes and/or threshold levels**	**Notes**
Tensile strength	5.3.4.2 Tension straps – tensile load capacity	None	Tensile load capacity as a mean value and if required as a characteristic value in N, for straps with: [a] - overall dimensions of each strap length in mm - minimum built-in length in mortar joint in mm when relevant - minimum mortar joint thickness in mm when relevant - precompression corresponding to declared tensile load capacity for horizontal straps - minimum masonry unit strength and mortar strength when relevant - requirements for fixings/ anchorage and for strength/characteristics of the base materials when relevant (if mechanically fixed) - reference to installation instructions when needed Failure mode
Displacement under load	5.3.4.3 tension straps – displacement under load	None	Displacement in mm [a, b]

Durability of performance characteristics (against corrosion)	5.6 Durability		Material/coating reference [c] and steel grade when relevant to product type
Dangerous substances	5.7	None	

[a] The mechanical strength of the products is dependent on their dimensions, minimum built-in length/anchorage and fixings..

[b] Displacement control for the product type is addressed through a declared displacement at one third of the declared value of the mean load capacity.

[c] Durability of performance characteristics against corrosion is dependent on both the condition of exposure of the masonry and the material/coating specification. The harmonised standard follows the state of the art by giving material/coating specifications for use with EN 1996-2 or regulatory requirements.

Table ZA.1.5 — Relevant clauses for joist hangers and intended use

Product:	**Joist hangers**		
Intended use:	**In masonry walls and partitions as covered by the scope of this standard (for supporting joists, beams or rafters on a masonry wall).**		
Essential Characteristics	**Requirement clauses of this European Standards**	**Classes and/or threshold levels**	**Notes**
Load bearing capacity	5.3.2.2 Joist hangers – Vertical load capacity	None	Load bearing capacity as mean value and if required as a characteristic value in N, for hangers with: [a] - applicable joist width - clear length of masonry flange and joist flange when relevant - distance between masonry flange and bearing surface of joist flange when relevant - minimum embedment length in mortar joint or bearing length in mm when relevant - clear length of joist flange in mm - minimum mortar joint thickness in mm when relevant - minimum masonry unit strength and mortar strength when relevant - requirements for fixings/anchorage and for strength/characteristics of the base materials when relevant (if mechanically fixed)

			- reference to installation instructions when needed Failure mode
Deflection under load	5.3.2.3 Joist hangers deflection under load	None	Deflection in mm [a, b]
Durability of performance characteristics (against corrosion)	5.6 Durability		Material/coating reference [c] and steel grade when relevant to product type
Dangerous substances	5.7	None	

[a] The mechanical strength of the products is dependent on their dimensions, minimum embedment length/anchorage and fixings.

[b] Deflection control for the product type is addressed through a declared deflection at one third of the declared value of the mean load capacity.

[c] Durability of performance characteristics against corrosion is dependent on both the condition of exposure of the masonry and the material/coating specification. The harmonised standard follows the state of the art by giving material/coating specifications for use with EN 1996-2 or regulatory requirements.

Table ZA.1.6 — Relevant clauses for brackets and intended use

Product:	**Brackets**		
Intended use:	**In masonry walls and partitions as covered by the scope of this standard (for attaching to a structural member for the support of two masonry units)**		
Essential Characteristics	**Requirement clauses of this European Standards**	**Regulatory class(es)**	**Notes**
Load bearing capacity	5.3.3.2 Brackets – Vertical load capacity	None	Load bearing capacity as a mean value and if required as a characteristic value in N, for brackets with: [a] - overall length bracket from fixing surface to support flange extremity in mm - minimum thickness of material comprising bracket in mm - minimum masonry unit strength and mortar strength when relevant - requirements for fixings/anchorage and for strength/characteristics of the base materials when relevant (if mechanically fixed) - reference to installation instructions when needed Failure mode
Deflection under load	5.3.3.3 Brackets – Deflection under load	None	Deflection in mm [a, b]
Durability of performance	5.6 Durability		Material/coating reference [c] and steel grade when relevant

characteristics (against corrosion)			to product type
Dangerous substances	5.7	None	

[a] The mechanical strength of the products is dependent on their dimensions, anchorage method and fixings.

[b] Deflection control for the product type is addressed through a declared displacement at one third of the declared value of the mean load capacity.

[c] Durability of performance characteristics against corrosion is dependent on both the condition of exposure of the masonry and the material/coating specification. The harmonised standard follows the state of the art by giving material/coating specifications to suit.

ZA.2 System of Assessment and Verification of Constancy of Performance (AVCP)

The AVCP system(s) of wall ties, tension straps, hangers and brackets indicated in Table(s) ZA.1 can be found in the EC legal act(s) adopted by the EC: Directive 89/106/EEC (CPD) Annex III.2.(ii), Second possibility.

Micro-enterprises are allowed to treat products under AVCP system 3 covered by this standard in accordance with AVCP system 4, applying this simplified procedure with its conditions, as foreseen in Article 37 of Regulation (EU) No.305/2011.

ZA.3 Assignment of AVCP tasks

The AVCP of wall ties, tension straps, hangers and brackets as provided in Table(s) ZA.1 is defined in Table(s) ZA.2 resulting from application of the clauses of this or other European Standards indicated therein. The content of the tasks assigned to the notified body shall be limited to those essential characteristics, if any, as provided for in Annex III of the relevant standardization request and to those that the manufacturer intends to declare.

Taking into account the AVCP systems defined for the products and the intended uses the following tasks are to be undertaken by the manufacturer and the notified body respectively for the assessment and verification of the constancy of performance of the product.

Table ZA.2.1 — Assignment of AVCP tasks for wall ties (cavity wall ties, shear ties and slip ties)

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1.1 to Table ZA.1.3	8.3 and Annex B
Tasks for a notified laboratory	The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product.	Compressive strength (for cavity wall and shear ties) - (see 5.3.1.2 and 5.3.1.3) Tensile strength (for cavity wall and shear ties) - (see 5.3.1.2 and 5.3.1.3) Buckling or bending stiffness (for cavity wall ties) - (see 5.3.1.2) Shear strength or stiffness (for shear ties) - (see 5.3.1.3) Shear strength or stiffness (for slip ties) - (see 5.3.1.4 and 5.3.1.5)	8.2

Table ZA.2.2 — Assignment of evaluation of AVCP tasks for tension straps

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1.4	8.3 and Annex B
Tasks for a notified laboratory	The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product.	Tensile strength (see 5.3.4.2) Displacement under load (see 5.3.4.3)	8.2

Table ZA.2.3 — Assignment of evaluation of AVCP tasks for joist hangers

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1.5	8.3 and Annex B
Tasks for a notified laboratory	The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product.	Load bearing capacity (see 5.3.2.2) Deflection under load (see 5.3.2.3)	8.2

Table ZA.2.4 — Assignment of evaluation of AVCP tasks for brackets

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.6 relevant for the intended use which are declared	8.3 and Annex B
Tasks for a notified laboratory	The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product.	Load bearing capacity (see 5.3.3.2) Deflection under load (see 5.3.3.3)	8.2

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Bibliography

[1] EN 1996-2, *Eurocode 6 — Design of masonry structures — Part 2: Design considerations, selection of materials and execution of masonry.*

[2] EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025)*

National Annex NA

(informative)

Additional information for the use of EN 845-1 in the UK

NA.1 General

Guidance on the use of wall ties, tension straps, hangers and brackets is given in, but not limited to, EN 1996-1-1, EN 1996-2, and PD 6697.

Designs, which specify wall ties, tension straps, hangers and brackets in accordance with EN 845-1, should state the required performance characteristics.

NA.2 Scope

EN 845-1 covers wall ties, tension straps, hangers and brackets made from specified materials that can provide adequate mechanical performance and durability.

NA.3 Fixings for ancillary components (see BS EN 845-1, 4.2)

EN 845-1 requires fixings to be either supplied with the component or specified by the manufacturer. The declared performance of the ancillary components is dependent on the use of the required fixings in the declared combination of masonry units, mortar and fixings.

NA.4 Dimensions and limit deviations (see BS EN 845-1, 5.2)

NA.4.1 General

EN 845-1 specifies the dimensions to be declared and the corresponding limit deviations.

NA.4.2 Minimum embedment length of wall ties

For wall ties that are intended to be embedded in mortar joints, EN 845-1 requires the minimum embedment length to be declared. The minimum embedment length is used in tests to determine the mechanical performance of the ties.

The actual embedment length used in a construction will need to be no less than the declared minimum embedment length. A minimum embedment length of 50 mm has been standard practice in UK execution works, but it is currently the practice for ties to be supplied with a minimum embedment length of 62.5mm and this should be taken into account in design specifications.

When selecting the overall length of ties, the minimum embedment length will need to be considered.

NA.5 Mechanical strength (see BS EN 845-1, 5.3)

NA.5.1 General

EN 845-1 requires the load capacity of the products covered to be declared in terms of compression, tension and shear, as appropriate to their function.

A mean value of the load capacity has to be declared, but a characteristic value may also be declared as 0.9 times the mean value. Where wall ties act together, the design strength may be obtained by dividing the declared mean value of load capacity by the appropriate material partial safety factor, γ_M. Values of γ_M will be found in the NA to EN 1996-1-1.

EN 845-1 requires that the displacement under load at one third of the declared value of load capacity shall be declared. Where a lower displacement value than that declared is required, a product with a load capacity greater than that required for strength alone will need to be chosen.

NA.5.2 Wall ties

Wall ties in the UK are classified by end use for convenience of selection and application. Such classification enables ties, meeting a combination of performance criteria, to be referenced more easily in design guidance, design specifications and execution instructions. The type references and qualifying criteria for the end use classification of wall ties will be found in PD 6697. The type references were developed for ties where the declared displacement at one third of the declared load capacity was not more than 1mm.

NA.5.3 Tension straps

To provide an equivalent performance to the prescriptive 30 mm × 5 mm lateral restraint straps, commonly used in the UK, tension straps should have a declared tensile load capacity of no less than 8 kN and a displacement of no more than 2mm.

NA.5.4 Joist hangers

EN 845-1 requires mechanical performance to be declared in terms of the vertical load capacity that can be carried at failure based on tests, and additionally the deflection under load is to be declared. Joist hangers used in the UK in accordance with Code of Practice Guidance should exhibit a mean deflection under load not exceeding 2mm. Conventionally, in UK practice, safe working loads have been specified for joist hangers for building into masonry walls and other forms of wall construction of mainly domestic dwellings and these can be derived by dividing the mean value of the declared vertical load capacity by an effective global safety factor (this effective global safety factor includes both load and material strength components). If the declared vertical load capacity has been calculated based upon the 2mm deflection limit, the safe working load is obtained by dividing the declared vertical load capacity by the global safety factor of 1.75. If it has been calculated based upon the failure load the safe working load is obtained by dividing the mean declared vertical load capacity by the global safety factor of 2. The minimum declared values of vertical load capacity for joist hangers for use in residential construction to support solid timber joists of certain sizes are given in Table NA.1.

Table NA.1 — Minimum declared values of vertical load capacity for joist hangers for use in residential construction to support solid timber joists of certain sizes

Joist width mm	Joist depth mm	Minimum declared value of vertical load capacity kN
38	175	2.8
38	225	3.7
50	175	3.2
50	225	4.1
63	150	2.9
63	225	4.4
75	150	3.1
75	225	4.7

NA.6 Resistance to water crossing a cavity (see BS EN 845-1, 5.4)

EN 845-1 requires a declaration to be made as to whether or not cavity wall ties are “resistant” or “not resistant” to water crossing the cavity.

NA.7 Durability (see BS EN 845-1, 5.6)

EN 845-1, Annex A requires a material/coating reference to be declared from a list of materials and corrosion protection systems.

Guidance on the choice of materials and corrosion protection systems, which closely match those used in current UK practice, will be found in PD 6697. Other design and execution guidance can also be found in EN 1996-2.

NA.8 Resistance to fire

Wall ties, tension straps, hangers and brackets can form a part of fire-resisting masonry elements, but do not themselves necessarily form fire-resisting components. EN 845-1 does not require any declaration in respect of the resistance to fire of the individual ancillary products. Unless constructions have been tested, ancillary components and fixings, which contain materials that readily soften or are easily combustible at elevated temperatures, will need to be avoided in fire-resisting elements.

NA.9 Assessment of load on wall ties, tension straps, hangers and brackets

Loads acting on a component should be assessed in accordance with the structural design codes.

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