BS EN 846-5:2012

BSI Standards Publication

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)

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National foreword

This British Standard is the UK implementation of EN 846-5:2012. It supersedes BS EN 846-5:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/519/3, Ancillary components.

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

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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)

Méthodes d'essai des composants accessoires de maçonnerie - Partie 5: Détermination de la charge admissible à la traction et à la compression, et des caractéristiques effort-déformation des attaches murales

Prüfverfahren für Ergänzunsbauteile für Mauerwerk - Teil 5: Bestimmung der Zug- und Drucktragfähigkeit sowie der Steifigkeit von Mauerankern (steinpaar-Prüfung)

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Foreword

This document (EN 846-5:2012) 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of an identical text or by endorsement, at the latest February 2013, and conflicting national standards shall be withdrawn at the latest by February 2013.

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 supersedes EN 846-5:2000.

The principal changes in this document form the previous edition relate to the tie position, the number of ties to be tested, the location of the clamp during testing and the treatment of slope and movement tolerant ties. Ties are to now be placed at the minimum declared embedment length rather than a length calculated from the tie length and design cavity width. Ten ties are tested in tension and ten in compression. In the compression tests the ties are loaded over an extended cavity, or alternatively provision is made for evaluating the cavity section by calculation. Where ties are designed to tolerate either an induced slope or movement then prior to test they are cycled fifty times through the slope or movement for which they have been designed.

According to the CEN/CENELEC Internal Regulations, the national standards organisations 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 the couplet method for determining the tensile and compressive load capacity and load displacement characteristics of wall ties embedded in mortar joints. The test is intended for ties used for connecting together two leaves of masonry and for the mortar-bedded end of ties for connecting masonry leaves to other structures.

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 771-1, *Specification for masonry units — Part 1: Clay masonry units*

EN 771-2, *Specification for masonry units — Part 2: Calcium silicate masonry units*

EN 771-3, *Specification for masonry units — Part 3: Aggregate concrete masonry units (Dense and lightweight aggregates)*

EN 771-4, *Specification for masonry units — Part 4: Autoclaved aerated concrete masonry units*

EN 771-5, *Specification for masonry units — Part 5: Manufactured stone masonry units*

EN 771-6, *Specification for masonry units — Part 6: Natural stone masonry units*

EN 772-1, *Methods of test for masonry units — Part 1: Determination of compressive strength*

EN 772-10, *Methods of test for masonry units — Part 10: Determination of moisture content of calcium silicate and autoclaved aerated concrete units*

EN 845-1, *Specification for ancillary components for masonry — Part 1: Wall ties, tension straps, hangers and brackets*

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

EN 1015-3, *Methods of test for mortar for masonry — Part 3: Determination of consistence of fresh mortar (by flow table)*

EN 1015-7, *Methods of test for mortar for masonry — Part 7: Determination of air content of fresh mortar*

EN 1015-11, *Methods of test for mortar for masonry — Part 11: Determination of flexural and compressive strength of hardened mortar*

3 Principle

The tie is embedded in a mortar typical of the type for which the tie is specified between a pair (couplet) of masonry units. The tie is then subjected to tension or compression until failure occurs.

4 Materials

4.1 Masonry units

4.1.1 Sampling and conditioning

Masonry units shall be as specified in accordance with EN 771. All of the masonry units for individual tests or for making the couplet specimens shall be taken from the same consignment.

The conditioning of masonry units shall be as specified.

Record the method of conditioning the masonry units prior to laying. Measure the moisture content by mass of autoclaved aerated concrete and calcium silicate units in accordance with EN 772-10. Record the age of non-autoclaved concrete units at the time of testing the masonry specimens.

4.1.2 Testing

Determine the compressive strength of a sample of masonry units using the method given in EN 772-1. For non-autoclaved concrete units, determine the compressive strength at the time of testing the couplet specimens.

4.2 Mortar

The mortar, its mixing procedure and its flow value shall conform to the requirements of EN 998-2, unless otherwise specified and these shall be reported in the test report.

Take representative samples of fresh mortar from the mason's board to make mortar prisms to determine the flow value in accordance with EN 1015-3, and to determine the air content in accordance with EN 1015-7. Use the prism specimens to determine the mean compressive strength at the time of testing of the masonry specimens in accordance with EN 1015-11.

4.3 Wall ties

The method of sampling shall be in accordance with EN 845-1. The minimum number of specimens shall be 20, but this number shall be doubled where both ends of asymmetrical ties are tested separately.

5 Apparatus

5.1 A simple support for the couplet specimen so that the reaction (e.g. hardwood bearer-see Figure 4) is no closer to the centre line of the tie than 75 mm.

The support system shall not apply any restraint against splitting of the specimen, apart from the friction generated at the reaction due to the applied load. A possible arrangement is shown in Figure 4 for tension and in Figure 4 for compression.

In cases where slope tolerant ties are required to be tested at their maximum design slope the load should be applied to the tie end via a rigid loading assembly and the support arrangement should allow the specimen to be offset from the machine axis by the specified offset distance.

5.2 A means of applying and maintaining a constant compressive stress of 0,1 N/mm^2 ± 0,01 N/mm^2 on the couplet.

A possible device is shown in Figure 2.

NOTE The device is optional where ultimate failure does not occur by splitting apart of the couplet.

5.3 A clamp for gripping the free end of the tie and applying a load.

Typical clamps are shown in Figure 3.

NOTE Movement of the specimen within the clamp will invalidate the deformation measurement and therefore specially designed clamps may be needed for particular tie forms. The use of low melting point alloys to act as chucks is recommended. Some frame ties will require special clamps.

5.4 A test machine capable of applying the load without distortion such that the maximum load reading occurs above 20 % of the full scale reading.

The load shall be measured using a load cell device having a digital or analogue readout with a maximum error of 2 % of the full scale reading. The system shall apply an axial force to the specimen. The system or universal test machine shall be fitted with a rigid connection between the clamp which is used to apply tension or compression loads and the machine cross-head or loading device, i.e. any pivot ball joint or universal joint connections to the load cells shall be locked.

5.5 A means of measuring displacement of the couplet in relation to the clamp using at least two symmetrically placed dial gauges or electrical linear displacement transducers as shown in Figure 1.

Displacement shall be measured to the nearest 0,01 mm.

Displacement shall not be measured by recording the cross-head travel of the test machine.

5.6 For polymer-based (plastics) products only, a controlled temperature and humidity chamber or room which may be a chamber which fits over the specimen.

6 Preparation and storage of test specimens

6.1 General

Ten couplet specimens each for compression and tensile testing shall be prepared with the ties embedded to the declared minimum embedment length. The number of specimens for each shall be doubled where both ends of asymmetrical ties are tested separately.

6.2 Preparation

Build the specimens on a flat horizontal surface, and lay the ties in the bed joints between two masonry units by normal bricklaying techniques, using a jig to ensure axial alignment of each tie. A typical jig is shown in Figure 4. Align the two stretcher faces to be used for reaction to give a plane surface. Strike off the mortar flush with the faces of the specimen.

General purpose and lightweight masonry mortar joints shall be between 8 mm and 15 mm thick. Thin layer mortar joints shall be between 1 mm and 3 mm thick.

Record the position of the ties in relation to any perforations, frogs or other depressions of the bed face of the units.

Deviations from axiallity of the tie in a couplet is liable to reduce its measured strength. This effect may be assessed by measuring the compressive strength of offset ties in a suitable test machine.

6.3 Length of embedment of ties in mortar beds

For symmetrical ties, physically identical at each end and designed or intended to be used in mortar at each end, the length of embedment shall be the declared minimum embedment length.

For asymmetrical ties either of a different physical design at each end or designed or used in different materials at each end, the length of embedment shall be the declared minimum embedment length for each end.

In each case, record the length of mortar beyond the embedment length.

6.4 Storage

Take appropriate steps to prevent the test specimen from drying out during the first three days after construction, e.g. by covering with polyethylene sheets, and then leave uncovered in a laboratory environment until tested. Use a curing period of 7 days for thin layer mortars and 28 days for general purpose mortars.

7 Procedure

7.1 Setting specimen in test machine

At the end of the curing period:

a) Load the specimens into the test system or test machine such that the tie body is axial and aligned at the centre of the test machine where no movement tolerance or slope tolerance is specified for the particular tie system;

or

b) In cases where slope tolerant or movement tolerant ties are required to be tested offset one end of the specimen over a distance which gives the maximum slope or half the maximum movement specified by the manufacturer and repeat this in both directions fifty times. After this offset one end of the specimen from the centre of action of the test machine or test system by a distance which gives the maximum slope or half the maximum movement specified by the manufacturer.

When testing in tension the clamp may be applied to the tie at a distance from the couplet equal to the cavity width at which the tie is intended to be used. When testing in compression the clamp should be applied at a distance from the couplet equal to the cavity width at which the tie is intended to be used plus 15 mm. Alternatively where the resistance of the anchorage is to be determined separately from the section which bridges the cavity the clamp should be placed close to the face of the couplet. In the case of compression testing a gap of approximately 5 mm is required. The distance from the clamp to the face of the couplet should be measured and recorded.

7.2 Test environment

Carry out the tests at ambient laboratory temperature except where plastics ties or ties having plastics components resisting all or part of the load are tested when the temperature shall be 32,5 °C ± 2,5 °C.

7.3 Loading

Apply a load smoothly at the rates given in Table 1 up to a value not exceeding 200 N nor exceeding a maximum take-up of slack of 1 mm. After take up of slack the load shall be reduced to a nominal positive value, e.g. 10 N, and the deflection zeroed, before continuing the test procedure.

Reapply load smoothly at the rates given in Table 1, using the machine cross-head or hydraulic drive, either continuously, when both load and displacement are recorded continuously, or in increments,

where load and/or displacement are recorded manually. Record the complete load-displacement curve either continuously or in not less than 10 increments to a displacement not exceeding 5 mm. If recording is by a maximum readout device, record any specific maximum values. Failure shall be taken either as the peak load recorded or the load at a displacement of 5 mm whichever is the smaller and which shall be taken as the load capacity. Record the mode of failure.

Table 1 — Maximum loading rates and increments

Anticipated minimum failure load Newtons (N)	**Maximum rate of load increase** N/min
500	200
2 000	800
5 000	2 000

8 Expression of results

Calculate the mean load capacity both in tension and compression as the arithmetic mean of the individual load capacities, to the nearest 10 N.

Report the mean load capacity and identify the lowest individual value of load capacity in both tension and compression.

9 Test report

The test report shall include the following information:

a) the number, title and date of issue of this European standard;

b) the name of the test laboratory;

c) a description of the type of wall tie to EN 845-1, including material and leading dimensions;

d) a description of the type of masonry unit used in couplets to the relevant part of EN 771, the position of tie in relation to any perforations, frogs or depressions of the bed-joint of the units and the length of mortar beyond the embedment length;

e) a description of the mortar to include details of the mixing procedure, flow value, air content and compressive strength, preferably consisting of the appropriate test reports or extracts from these reports;

f) the curing conditions and period for the specimens;

g) the embedment length of the tie in the specimen;

h) the distance from the clamp to the face of the couplet in mm;

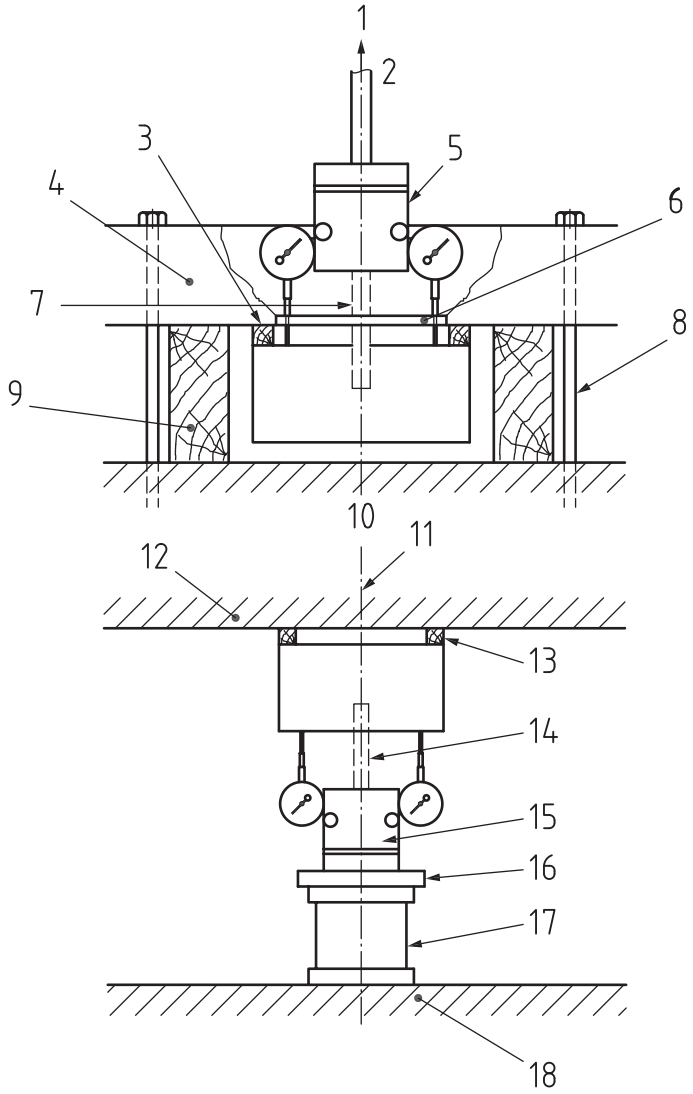
i) the value of applied precompression load, if applicable, to the nearest 0,01 N/mm^2;

j) the load displacement curves or the load displacement data and the mode of failure for each individual specimen;

k) the load capacity, to the nearest 10 N, for each individual specimen tested over the design cavity width in both tension and compression;

l) the mean and lowest single value of load capacity, to the nearest 10 N, from these 10 results in both tension and compression;

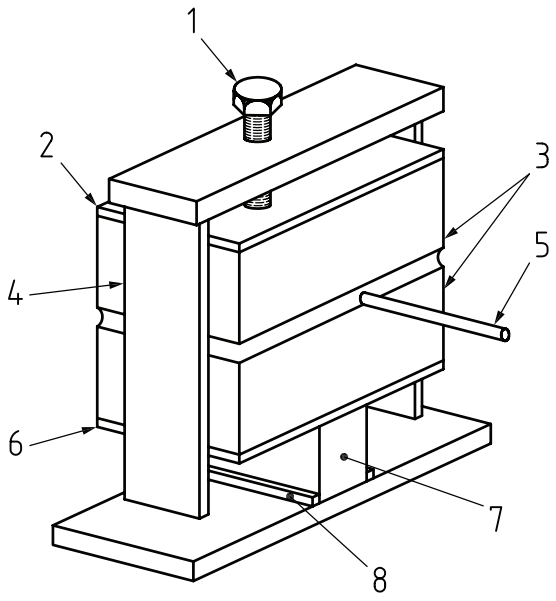
m) remarks, if any.



Key

1	To upper crosshead	10	Machine crosshead
2	Central axis	11	Central axis of test machine
3	Hardwood bearer	12	Upper crosshead
4	300 mm × 90 mm channel	13	Hardwood bearer
5	Clamp	14	Tie
6	Hole (165 mm×100 mm) cut in channel	15	Clamp
7	Tie	16	Baseplate for clamp
8	Tie rod	17	Load cell
9	Hardwood spacer	18	Lower crosshead

Figure 1 — Examples of test arrangements in universal test machines (upper detail shows tension test arrangement, lower shows compression test arrangement)

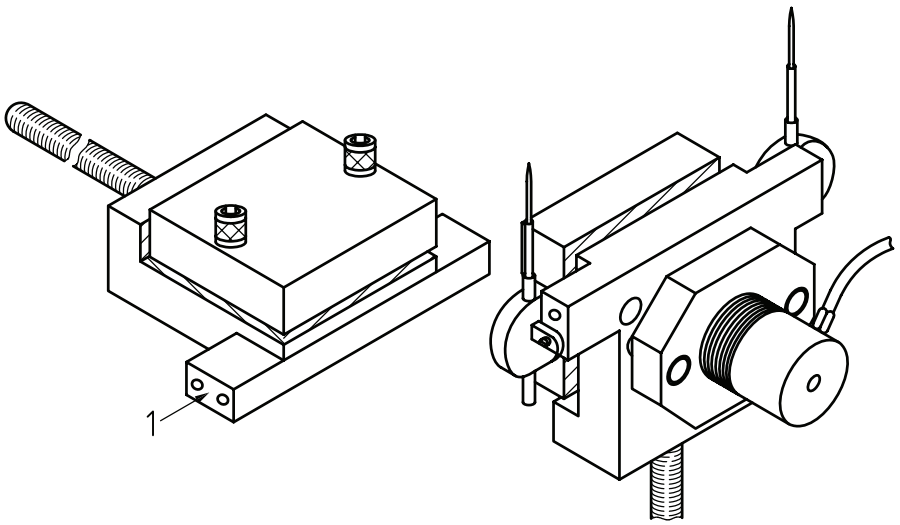


Key

1	Bolt	5	Wall tie
2	Steel plate	6	Steel plate
3	Couplet	7	Hydraulic load cell
4	Steel frame	8	Locating cup on frame for load cell

NOTE The couplet is assembled in the clamp between two steel plates and a compressive force is applied by tightening the bolt on the top plate of the clamp. The compression is indicated on the gauge of the hydraulic load cell. The clamps and load cell remain in position during tensile or compression testing of the tie and the compressive force exerted on the couplet can be adjusted whenever necessary by simply screwing the bolt in or out as required. Constant compression to any specified level can be readily achieved on the couplet by this means.

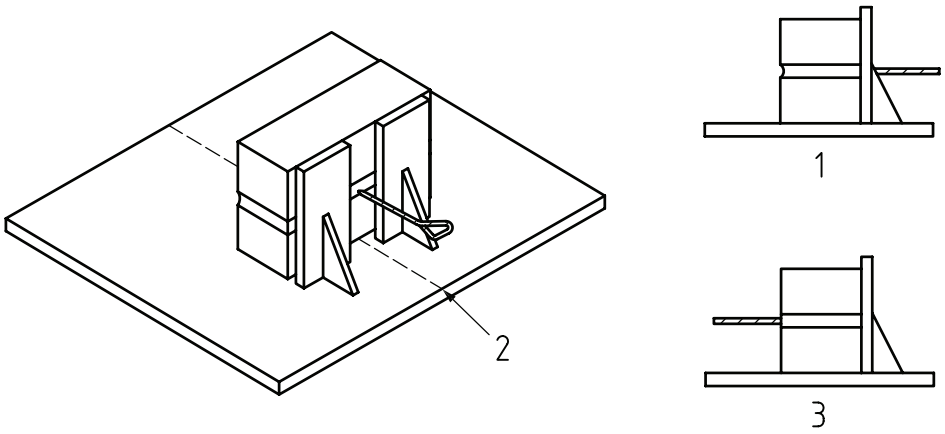
Figure 2 — Example of method for applying compressive load to specimens



Key

1 Mounting for dial gauge or transducer

Figure 3 — Examples of clamps for load tests



Key

1 Tension specimen
2 Guideline
3 Compression specimen

Figure 4 — Example of jig for building couplet specimens

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