BS EN 846-7:2012

BSI Standards Publication

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)

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National foreword

This British Standard is the UK implementation of EN 846-7:2012. It supersedes BS EN 846-7:2000 which is withdrawn.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 7: Determination of shear load capacity and load displacement characteristics of shear ties and slip ties (couplet test for mortar joint connections)

Méthodes d'essai des composants accessoires de maçonnerie - Partie 7: Détermination de la charge admissible au cisaillement et des caractéristiques effort-déformation des attaches résistant au cisaillement et des attaches de glissement (essai dans un joint de mortier entre deux éléments)

Prüfverfahren für Ergänzungsbauteile für Mauerwerk - Teil 7: Bestimmung der Schubtragfähigkeit und der Steifigkeit von Mauerverbindern (Steinpaar-Prüfung in Mörtelfugen)

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Foreword

This document (EN 846-7:2012) 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of an identical text or by endorsement, at the latest by February 2013, and conflicting national standards shall be withdrawn at the latest by February 2013.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 846-7:2000.

There are no major changes from the previous edition although the curing period for the different types of mortar has been clarified.

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 horizontal and vertical shear load resistance and load-deflection behaviour of shear ties and slip ties embedded in mortar joints. The test is intended for ties for connecting together two leaves of masonry forming a collar jointed wall or two walls at right angles. It also applies to ties used for connecting the edges of infill panel walls to frames which encircle them.

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: 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

One end of the tie is embedded in a mortar joint, typical of the type for which the tie is specified, between a pair (couplet) of typical masonry units. The tie is then clamped at its free end and subjected to shear against a reactive support for the couplet. Slip ties may be tested by the same method.

NOTE The method measures the capacity of the tie alone and does not measure the contribution to the total shear resistance given by two masonry faces separated by a vertical mortar joint. This value should be obtained by wallette tests if required.

4 Materials

4.1 Masonry units

4.1.1 Sampling and conditioning

Masonry units shall be as specified. All of the masonry units for individual tests or for making the couplet specimens shall be taken from the same consignment. Masonry units shall be in an air dried condition, unless otherwise specified.

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. Measure the moisture content by mass of AAC or Calcium silicate units in accordance with EN 772-10. For other types of units, record the method of conditioning prior to laying.

4.2 Mortar

The mortar, its mixing procedure and its flow value shall conform with 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 masons board to make mortar prism specimens, to determine the flow value in accordance with EN 1015-3 and 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 couplet specimens in accordance with EN 1015-11.

4.3 Ties

The method of sampling shall be in accordance with EN 845-1. The minimum number of specimens shall be 10 for each direction of test, but this number shall be doubled where both ends of asymmetrical ties are tested separately.

5 Apparatus

5.1 A means of applying and maintaining a constant compressive stress of 0,1 N/mm^2 ± 0,01 N/mm^2 on the couplet simulating the restraint within a masonry wall.

A possible device is shown in Figures 1 and 2.

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

Typical clamps are shown in Figures 1 and 2.

NOTE Clamping failures will invalidate the deformation measurement and therefore specially designed clamps or packing pieces may be needed for particular tie forms. The use of low melting point alloys to act as chucks is recommended for complex pressings. Some frame ties will require special clamps to deal with the nailing/screwing tab.

5.3 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 device shall apply a shear force to the specimen. The upper platen of the universal test machine shall be fitted with a rigidly connected pillar and clamp which is used to apply the load to the tie end as depicted in Figures 1 and 2. The couplet specimen within the pre-stressing clamp shall bear on the lower platen of the test machine and the support shall be extended through the main axis of the test

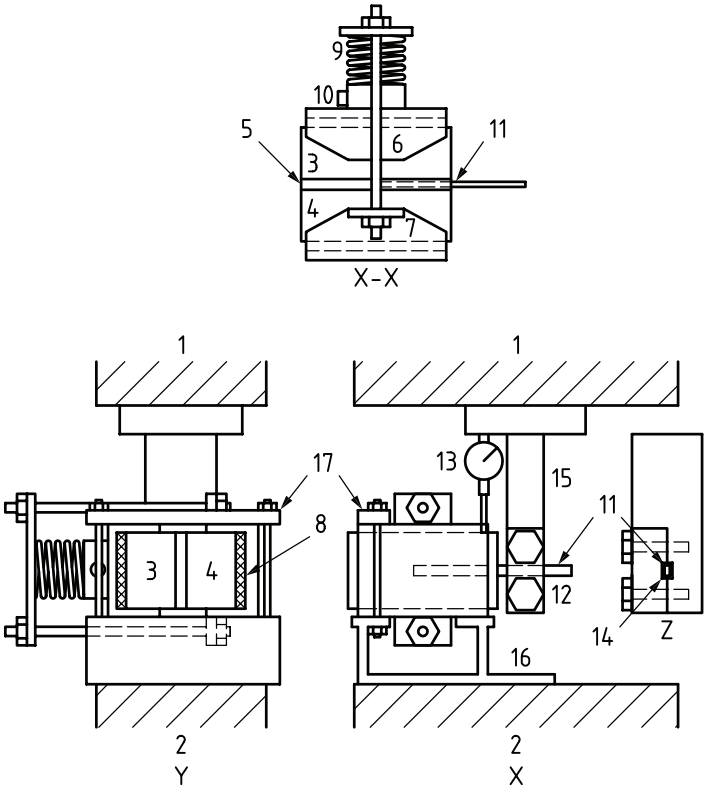
machine to prevent any rotation of the couplet assembly. This will necessitate a restraint clamp for the horizontal test arrangement (Figure 1). Figure 1 shows the assembly arranged for a horizontal shear test and Figure 2 for vertical shear.

5.4 A means of measuring displacement of the couplet in relation to the clamp using a dial gauge or electrical linear displacement transducer as shown in Figures 1 and 2.

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

Displacement shall be measured between the tie end clamp and the unit forming one half of the couplet. Displacement shall not be measured by recording the cross-head travel of the test machine.

5.5 For polymer-based (plastic) fixing components only, a controlled temperature and humidity chamber or room which may be a chamber which fits over the specimen.

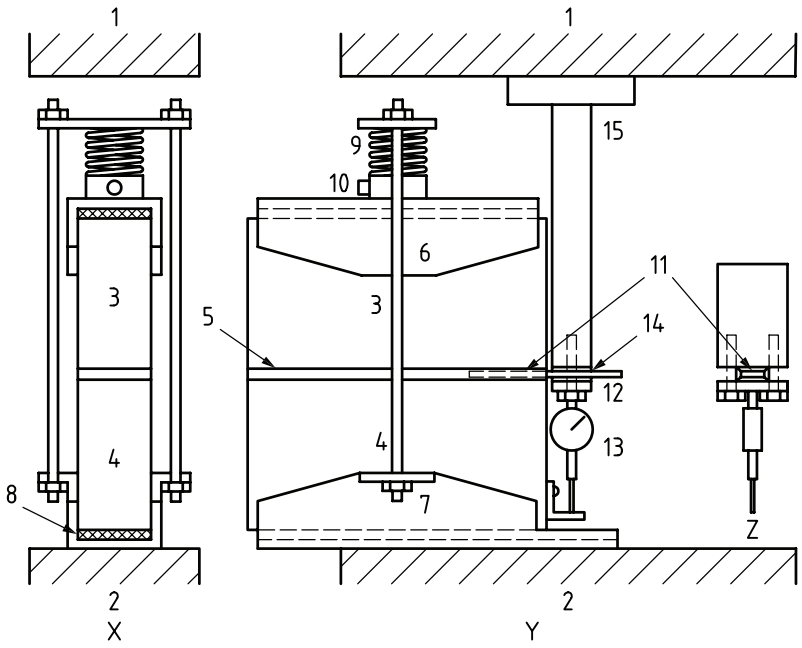


(X) Side elevation of couplet in test machine
(Y) End elevation of couplet in test machine
(Z) End elevation of clamping device
(XX) Side elevation of couplet

Key

1	Test machine upper platen	10	Load cell
2	Test machine lower platen	11	Tie
3	Upper unit	12	Tie clamp
4	Lower unit	13	Deflection gauge
5	Mortar joint	14	Packing around tie in clamp
6	Upper couplet clamp	15	Loading pillar
7	Lower couplet clamp	16	Specimen support device
8	Packing material	17	Anti-rotation restraint clamp
9	Load spring		

Figure 1 — Typical apparatus for testing horizontal shear resistance of ties (shown for brick-sized couplets)



(X) Side elevation of couplet in test machine (Y) End elevation of couplet in test machine
(Z) End elevation of clamping device

Key

1	Test machine upper platen	9	Load spring
2	Test machine lower platen	10	Load cell
3	Upper unit	11	Tie
4	Lower unit	12	Tie clamp
5	Mortar joint	13	Deflection gauge
6	Upper couplet clamp	14	packing around tie in clamp device
7	Lower couplet clamp	15	loading pillar
8	Packing material		

Figure 2 — Typical apparatus for testing vertical shear resistance of ties (shown for block-sized couplets)

6 Preparation and storage of test specimens

6.1 General

Ten ties each shall be tested in either horizontal or vertical shear as required by EN 845-1. In the case of asymmetric ties where both ends are intended to be bedded into masonry for each type of tie and ten ties shall be tested in either horizontal shear or vertical shear as required by EN 845-1.

6.2 Preparation

Build the specimens on a flat horizontal surface, and lay the tie or pairs of ties in the bed joints between two masonry units by normal bricklaying techniques, using a jig to ensure axial alignment of each tie. The tie shall be embedded to the intended design depth either directly in the mortar (shear tie) or in a sleeve if provided (slip tie). Align the two stretcher faces 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.

Two ties may be laid in large masonry units but if a splitting failure occurs in the first test, the specimen shall be discarded. Only one tie shall be laid in couplets less than 250 mm in length.

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

6.3 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. Store specimens incorporating plastic fixing components at 32,5 ± 2,5 °C immediately prior to the test. Use a curing period of 7 days for thin layer mortar and 28 days for general purpose mortar.

7 Procedure

7.1 Setting specimen in test machine

At the end of the curing period load the specimens into the test system or test machine such that the couplet and precompression assembly lies flat on the bottom platen of the test machine with the tie protruding. The clamping post should be attached rigidly to the top platen of the machine such that it is centred and axial and the tie should then be clamped into the clamping post. There shall be a gap of 10 mm between the face of the couplet and the clamping post. This can be set with a rule or by use of a 10 mm thick piece of stiff foam.

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.

NOTE This additional procedure should not be necessary for slip ties employing a thin polymer sleeve but will be essential for ties attached to units or other materials using polymer plugs and screws.

7.3 Loading

Apply a precompression of 0,1 N/mm^2 ± 0,01 N/mm^2. Apply shear 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 10 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 10 mm whichever is the smaller. Record the load and 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 shear load capacity as the arithmetic mean of the individual failure loads, to the nearest 10 N.

Report the mean shear load capacity and identify the lowest individual value of shear load capacity.

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 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 and the position of tie in relation to any perforations of the bed-joint of the units;

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 embedment length of the tie in the specimen;

g) the curing conditions and period for the specimens;

h) the orientation of the applied shear load (either horizontal or vertical shear);

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

j) the failure load, to the nearest 10 N for each individual specimen;

k) the shear load capacity and lowest individual value of load capacity, to the nearest 10 N;

l) remarks, if any.

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