BRITISH STANDARD

BS EN
846-4:2002
Incorporating Amendment No.1

Methods of test for ancillary components for masonry —

Part 4: Determination of load capacity and load-deflection characteristics of straps

The European Standard EN 846-4:2001, with the incorporation of amendment A1:2004, has the status of a British Standard

ICS 91.100.99

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 846-4:2001, including amendment A1:2004.

EN 846-4 is a supporting standard to the forthcoming "harmonized" European product standard specifications on ancillary components for masonry, EN 845-1. These standards are the subject of transitional arrangements agreed under the Commission mandate. The Member States have agreed a nominal transition period for the co-existence of these standards and their corresponding national stanard(s). It is intended that this period will comprise a nominal nine month period during which any required changes to national regulations are to be made, followed by a further nominal twelve month period for the implementation of CE marking. At the end of this co-existence period, the national standard(s) will be withdrawn. In the UK there are no corresponding national standards to EN 846-4.

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

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 17 and a back cover.

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Amendments issued since publication

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English version

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

(includes amendment A1:2004)

Méthodes d'essai des composants accessoires de maçonnerie — Partie 4: Détermination de la résistance et de la rigidité des brides de fixation (inclut l'amendement A1:2004)

Prüfverfahren für Ergänzungsbauteile für Mauerwerk — Teil 4: Bestimmung der Festigkeit und Last-Verformungs- Eigenschaften von Bändern (enthält Änderung A1:2004)

This European Standard was approved by CEN on 13 October 2001.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Management Centre has the same status as the official versions.

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CEN

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉE EUROPÉEN DE NORMALISATION
EUROPAISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart 36, B - 1050 Brussels

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Foreword

This European Standard 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 May 2002, and conflicting national standards shall be withdrawn at the latest by March 2004.

This European Standard follows initial preparation by Working Group 4 "Test methods", taking into account the proposals submitted by Task Group 4 "Tests for ancillary components".

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Foreword to amendment A1

This document (EN 846-4:2001/A1:2004) 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 April 2005, and conflicting national standards shall be withdrawn at the latest by July 2006.

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

Introduction

Straps are used in buildings to provide horizontal and vertical restraint for floor and roof constructions against wind pressure and uplift forces.

1 Scope

This European Standard specifies methods for determining the load capacity and load-deflection characteristics of restraint straps fixed to timber joists, rafters and timber wall plates and masonry walls.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in by amendments or revision. For undated references the latest edition of the publication referred to applied (including amendments).

EN 336, *Structural timber – Coniferous and poplar – Sizes, permissible deviations.*

EN 338, *Structural timber - Strength classes.*

EN 845-1, *Specification for ancillary components for masonry - Part 1: Ties, tension straps, hangars and brackets.*

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

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

prEN 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

Straps are fixed to masonry walls, timber joists or rafters or to other floor/roof materials and loaded in a manner representative of their intended use.

4 Materials

4.1 Masonry units

4.1.1 Sampling

All of the masonry units for individual tests and for making the masonry specimens shall be taken from the same consignment.

4.1.2 Conditioning of the units

The conditioning of masonry units shall be as specified:

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

4.1.3 Testing

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

NOTE Where the strength of the masonry units will change with time, the compressive strength test should be carried out on the same day as the test.

4.2 Mortar

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

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

4.3 Timber

Timber sections shall be of coniferous timber as specified in accordance with strength class C16 of EN 338 and a moisture content of not greater than 18 % by mass.

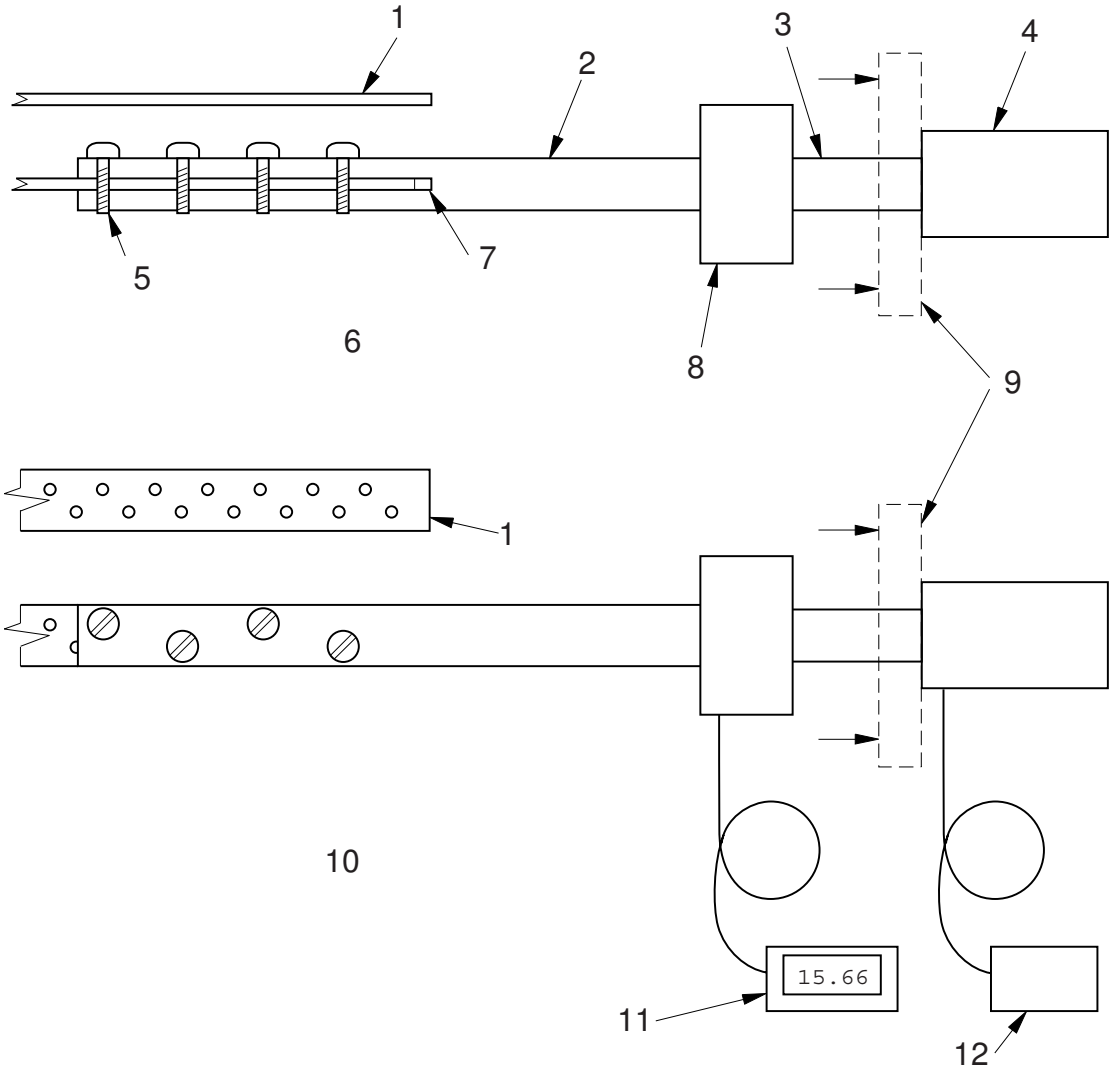
4.4 Fixings

Fixings shall be as specified by the manufacturer, in a clean dry uncontaminated state.

5 Apparatus

A device for clamping and applying axial tensile force to the strap. A typical arrangement is described below and is shown in Figure 1. The end of the strap to be loaded (1) is placed inside the strap connector (2) comprising a cylindrical steel bar, which has a slot (7) cut up its centre. Each connector or connector and associated packing pieces should be specially made to fit the strap to be tested: holes are drilled along its length with the same hole spacing and pattern as that of the strap. The strap is held in the connector by a number of bolts that pass through the strap and screw into the connector. The test load is applied axially to the strap through the bar. Alternatively a hydraulic clamp device may be suitable.

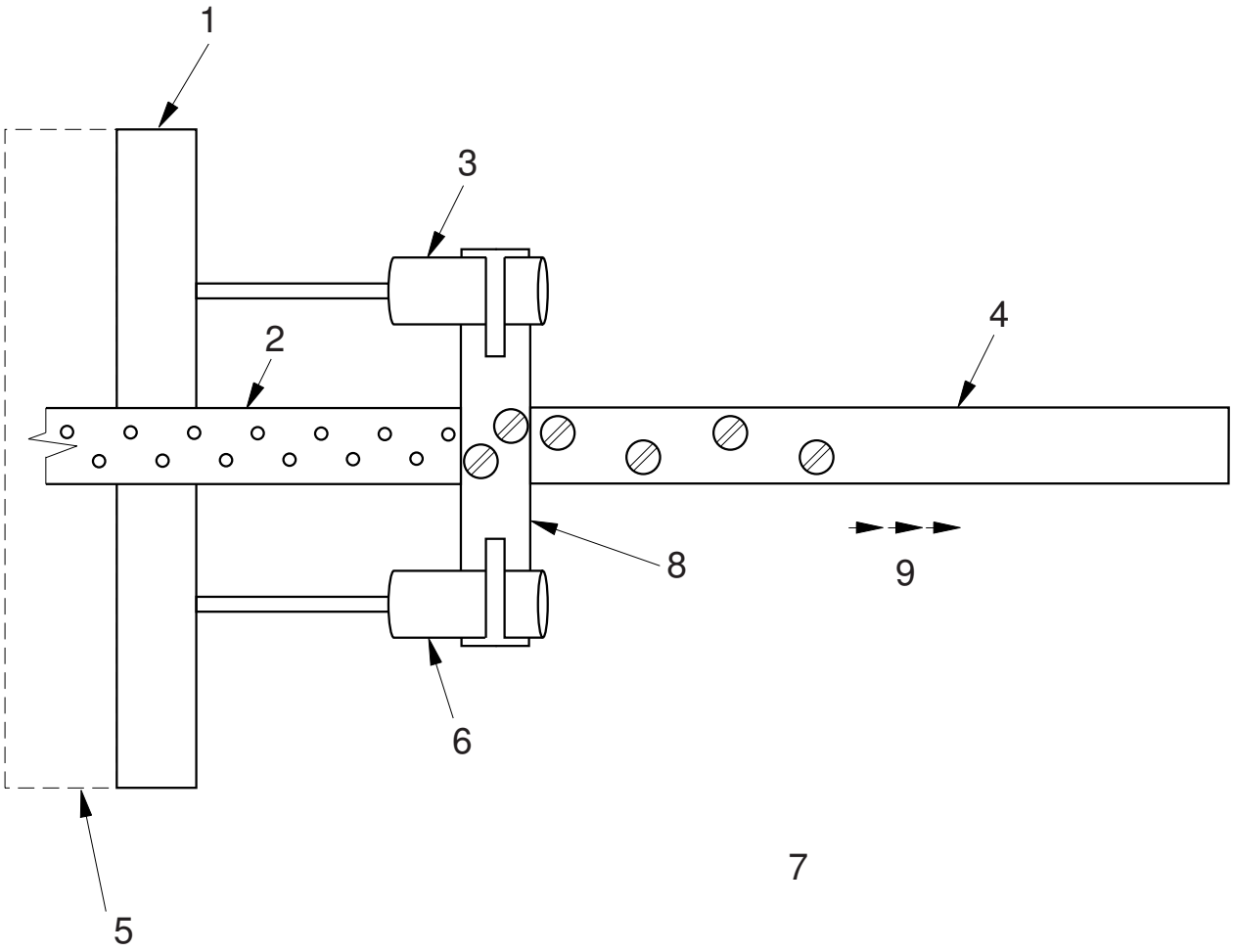
Load is applied to the strap by means of a hydraulic ram or screw (4), which reacts against a reaction frame (9), and is connected via a load cell (8) to the strap connector. The load measuring system (11) shall comprise a load cell device having a digital or analogue readout with a resolution of 2 % of the full scale reading or better. A typical arrangement for measuring movement of the strap is shown in Figure 2.



Key

1 Strap
2 Strap connector
3 Piston
4 Hydraulic cylinder
5 Fixing screw
6 ELEVATION
7 Specially made slot
8 Load cell
9 Reaction frame
10 PLAN
11 Voltmeter or recording device
12 Hydraulic pump

Figure 1 - Device for clamping and applying axial force to the strap



Key

1 Load spreader
2 Strap
3 Transducer
4 Strap connector
5 Specimen
6 Transducer
7 PLAN
8 Transducer mounting plate
9 Tension force

Figure 2 - Deflection measuring arrangement

6 Test specimens

6.1 Sampling

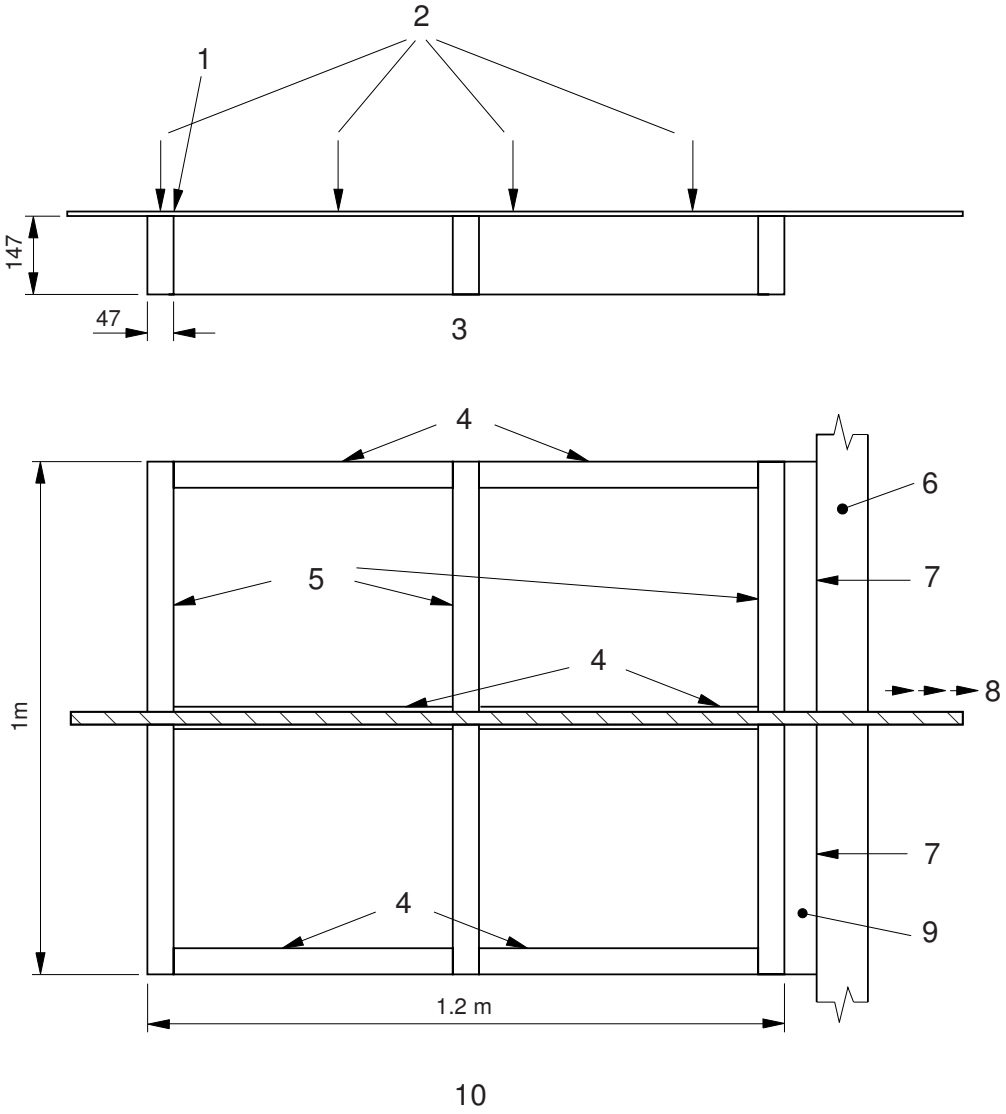
Five specimens of straps shall be sampled for each test format in accordance with EN 845-1. Sufficient specimens shall be set aside for determining compliance with specifications of materials.

Prior to building in or fixing the straps, all relevant dimensions and thickness shall be measured and recorded.

6.2 Horizontal restraint strap : Timber specimen

A panel approximately 1 m x 1,2 m is fabricated consisting of three timber ceiling joists of 47 mm x 147 mm timber in accordance with EN 336. with spacing noggins between them made with the same timber, nailed together as shown in Figure 3. The strap shall be connected to this element in accordance with the manufacturer's instructions. The specimen shall be restrained from rotation.

Dimensions in millimetres



Key

1 Anti-rotation reaction
2 Typical strap fixing nail or screw positions
3 SIDE ELEVATION
4 Noggin
5 Ceiling joist
6 Reaction frame
7 Reaction
8 Tension force
9 Packing piece
10 PLAN

Figure 3 - Timber specimen for horizontal restraint strap

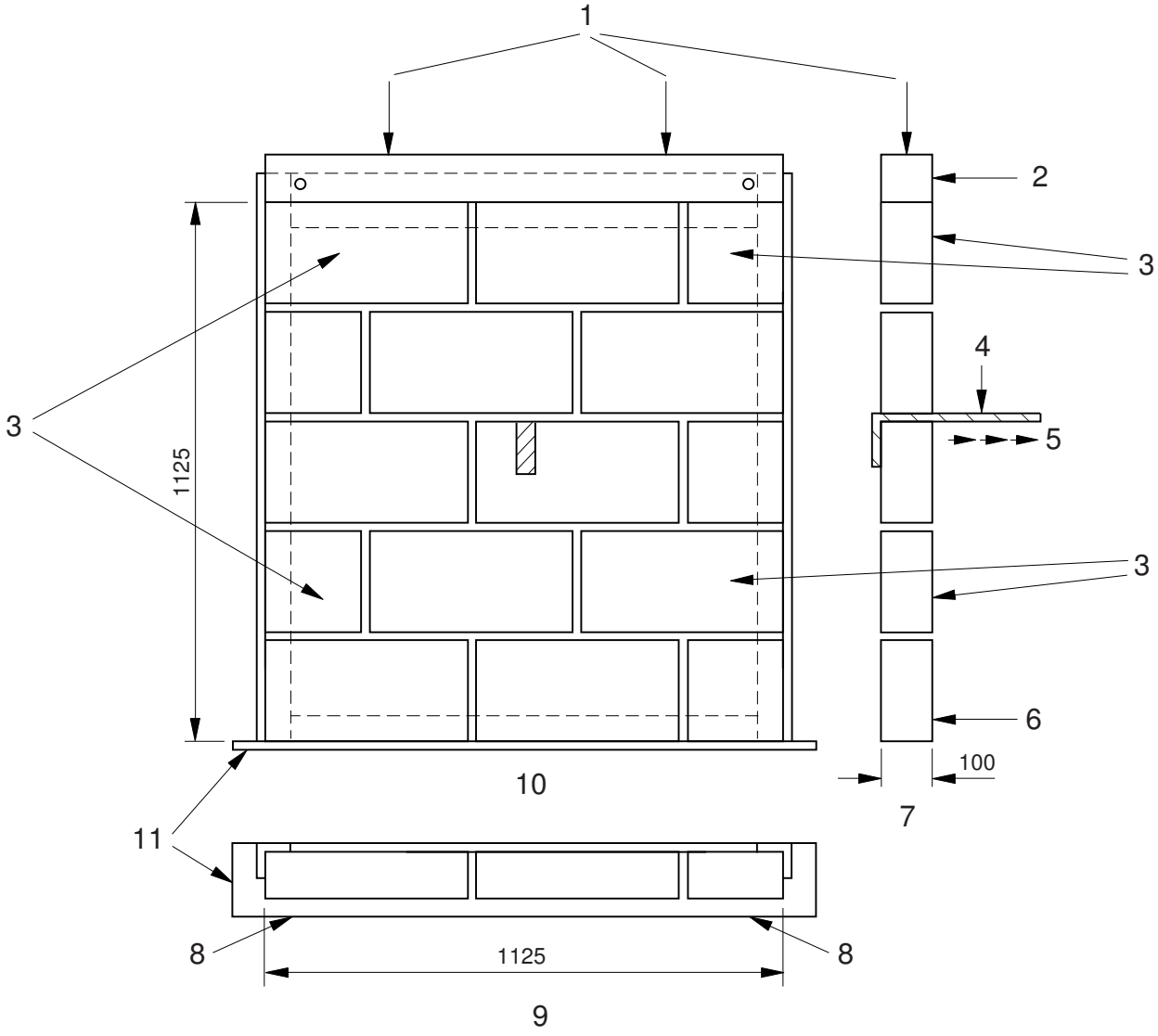
6.3 Horizontal restraint strap : Masonry specimens

Build the walls on a flat horizontal surface. Build the strap into the centre of the wall or otherwise fix in accordance with manufacturers instructions. A typical specimen is shown in Figure 4.

Strike off the mortar flush with the faces of the specimen. Normal 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.

Take appropriate steps to prevent the test specimen from drying out during the first 3 days after construction (e.g. by covering the polythene sheets) and then leave uncovered in a laboratory environment until tested. Unless otherwise specified, leave to cure for a least 28 days before testing.

Dimensions in millimetres



Key

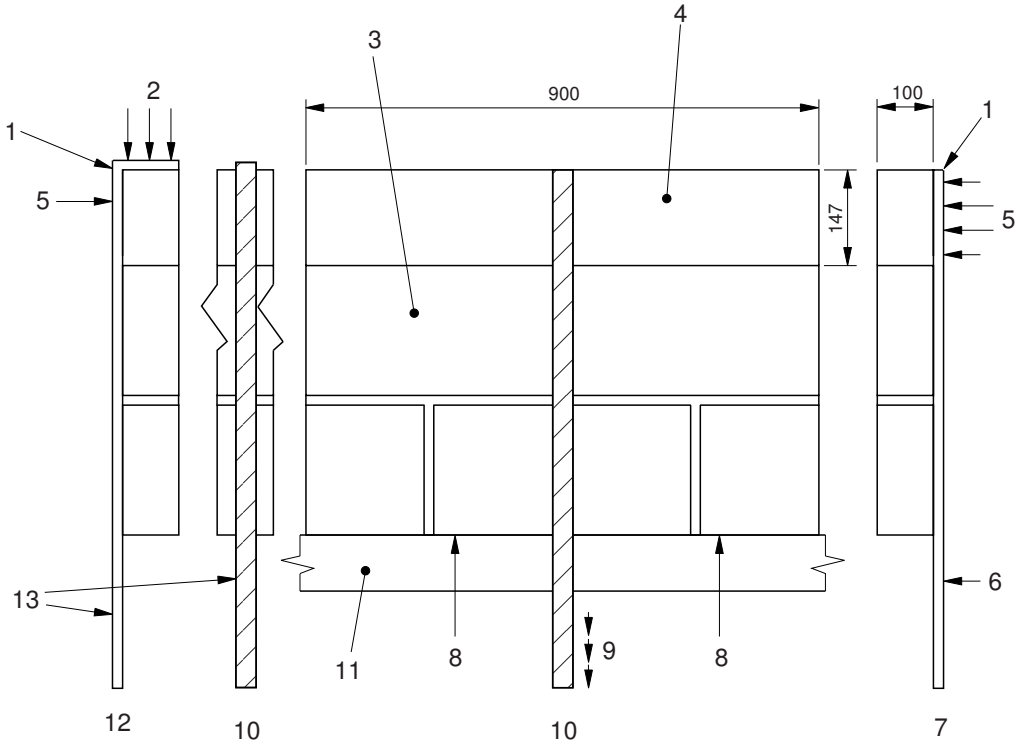
1 Simulated dead load
2 Load spreader
3 Reaction points
4 Strap
5 Tension loading force
6 Wall
7 END ELEVATION
8 Reaction point
9 PLAN
10 ELEVATION
11 Frame

Figure 4 - Typical block wall specimen with built-in strap installed

6.4 Vertical restraint strap : Timber wall plate or truss specimen

The specimen consists of a panel of masonry and a wallplate as shown in Figure 5. Mount the fixings into the side of the wall plate as detailed in Figure 5 a, or into the top and sides of a plate as shown in Figure 5 b in accordance with the manufacturers specifications.

Dimensions in millimetres



Key

1 Anti-rotation reaction
2 Fixing nail or screw positions
3 Masonry wall
4 Wall plate
5 Fixing nail or screw position
6 Side-fixed plain strap
7 END ELEVATION
8 Reaction
9 Tension loading force
10 SIDE ELEVATION
11 Reaction frame
12 END ELEVATION
13 Alternative side and top-fixed strap

Figure 5 - Vertical hold-down strap specimen

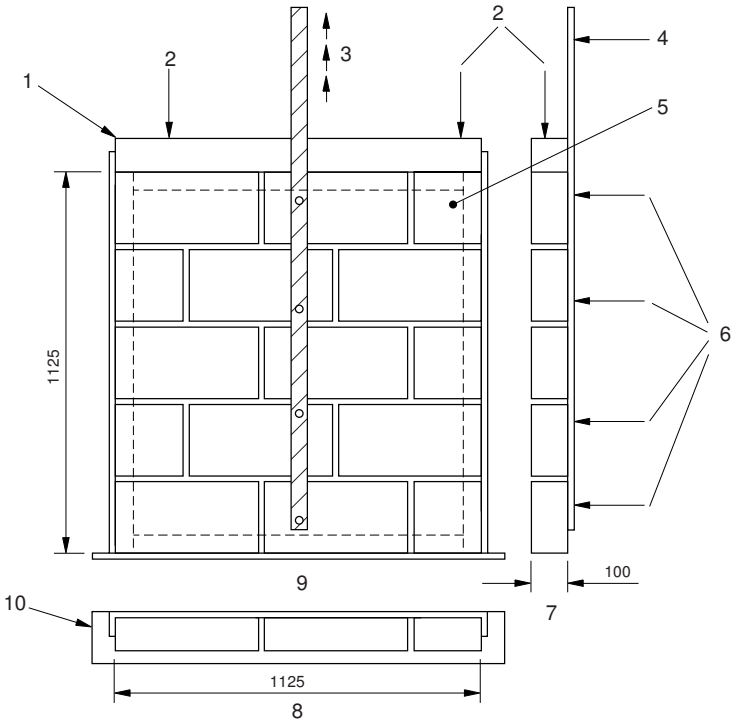
6.5 Vertical restraint strap : Masonry specimen

Build the walls on a flat horizontal surface. Fix a strap to the wall in accordance with manufacturers instructions. A typical specimen is shown in Figure 6.

Strike off the mortar flush with the faces of the specimen. Normal 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.

Take appropriate steps to prevent the test specimen from drying out during the first 3 days after construction (e.g. by covering the polythene sheets) and then leave uncovered in a laboratory environment until tested. Unless otherwise specified, leave to cure for a least 28 days before testing.

Dimensions in millimetres



Key

1 Load spreader
2 Reaction
3 Tension loading force
4 Strap
5 Masonry wall
6 Fixing position
7 END ELEVATION
8 PLAN
9 SIDE ELEVATION
10 Frame

Figure 6 - Typical block wall specimen with vertical hold-down strap fixed

7 Procedure

7.1 Horizontal and vertical restraint strap : Timber specimen

Attach the strap to the connector. Attach the deflection gauges to the strap and apply restraint to the end of the frame to prevent it from rotating under load.

Apply a preload to the test specimen of 5% of the estimated ultimate load and hold for a period of 1 min.

Remove the load and proceed as follows:-

Load the strap until either the strap breaks or the fixings fail or a deflection of 10 mm is reached. record the load which shall be taken to be the failure load of the strap as fixed. Record the mode of failure.

7.2 Horizontal restraint strap : Masonry specimen

Unless otherwise specified, apply a vertical precompression of 0.4 N/mm^2 to the top of the masonry specimen. A regulating layer of e.g. plywood or mortar capping shall be used between the loading platen and the masonry specimen.

Attach the strap to the loading rig and adjust the reaction points so that the strap is loaded axially. The reaction points should be set at approximately the same spacing as cavity wall ties for straps intended for installation into cavity walls since this defines the area free to deflect subject to a suction load force.

Apply a preload to the test specimen of 5 % of the estimated ultimate load and hold for a period of 1 min.

Remove the load and proceed as follows:-

Apply a load gradually and continuously at such a rate that the ultimate failure load is reached in approximately 3 min. Record the both the load and the deflection continuously. Increase the load at the appropriate rate until failure occurs, defined as either the peak load for a deflection of less than 10 mm or the load at the limiting deflection of 10 mm. The load and corresponding deflection shall be taken to be the failure load and deflection.

Record the failure load and the mode of failure.

7.3 Vertical restraint strap : Masonry specimen

Apply the load to the strap following the loading sequence in 7.2 including the specimen precompression and preloading.

7.4 Expression of results

Report the failure load of each specimen, to the nearest 10 N. Report the load-deflection curve for each specimen.

7.5 Evaluation of results

Calculate the load capacity as the mean of the failure loads and the load-deflection curve which is the mean load plotted against the mean deflection for all the specimens.

8 Test report

The test report shall include the following information:-

a) The number, title and date of issue of this European Standard;

b) Name of test laboratory;

c) The description of the straps to the relevant European Standard EN 845-1 and of the manufacturer's fixing instructions;

d) A description of the masonry units, mortar used, by reference to the relevant European Standards including their compressive strengths of the masonry units and mortar;

e) A description of the timber used, by reference to the relevant European Standards;

f) The relevant dimensions of the straps;

g) The date of load testing the specimens;

h) A load - deflection curve for each individual specimen in the test together with a note of the precompression applied;

i) Individual values of the failure load, to the nearest 10 N together with a note of the precompression applied;

j) The modes of failure of each specimen;

k) The load capacity and the load-deflection curve together with a note of the precompression applied.

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