

BS EN 846-9:2016



BSI Standards Publication

# Methods of test for ancillary components for masonry

Part 9: Determination of flexural resistance and shear resistance of lintels

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

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

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Published by BSI Standards Limited 2016

ISBN 978 0 580 87439 0

ICS 91.060.10; 91.080.30

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2016.

**Amendments/corrigenda issued since publication**

Date	Text affected
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EUROPEAN STANDARD

**EN 846-9**

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2016

ICS 91.060.10; 91.080.30

Supersedes EN 846-9:2000

English Version

## Methods of test for ancillary components for masonry - Part 9: Determination of flexural resistance and shear resistance of lintels

Méthodes d'essai des composants accessoires de  
maçonnerie - Partie 9: Détermination de la résistance à  
la flexion et de la résistance au cisaillement des  
linteaux

Prüfverfahren für Ergänzungsbauteile für Mauerwerk -  
Teil 9: Bestimmung der Biege- und  
Schubwiderstandsfähigkeit von Stürzen

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

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## European foreword

This document (EN 846-9:2016) 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of an identical text or by endorsement, at the latest by September 2016, and conflicting national standards shall be withdrawn at the latest by December 2017.

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 846-9:2000.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Provision has been made in this standard for the restraint of ‘L’ shape lintels against excessive torsion during testing.

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 methods for determining the flexural and shear resistances and load deflection characteristics of single span, single or composite lintels used for supporting uniformly distributed loads over openings in masonry construction.

## 2 Normative references

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

EN 845-2, *Specification for ancillary components for masonry — Part 2: Lintels*

## 3 Principle

Specimen lintels are simply supported and subjected to vertically applied loads in order to determine flexural strength, shear resistance and deflection.

## 4 Symbols

$B$	is the length of bearing, (mm)
$D_c$	is the total height of a composite lintel over both tension and compression elements, (mm)
$D_1$	is the overall depth of a single or combined lintel
$L_e$	is the effective length (or span), (mm)
$t$	is the thickness of supported wall, (mm)
$W$	is the applied load, (N)

## 5 Materials

### 5.1 Structural shell casing units

Structural shell casing units shall be in accordance with EN 845-2.

### 5.2 Composite lintels

Materials for the compressive elements of composite lintels shall be in accordance with manufacturer's specifications.

## 6 Apparatus

**6.1** Test rig capable of withstanding the applied loads without any distress or distortion that could affect the results of the test.

**6.2** Loading system accurate to within  $\pm 2\%$ .

Where the load is to be applied using weights this should be without shock, and each increment in load and the failure load shall be measured to an accuracy of  $\pm 2\%$ .

**6.3** Deflection monitoring equipment accurate to within  $\pm 2\%$ .

## 7 Sampling

The method of sampling shall be in accordance with EN 845-2. The minimum number of specimens shall be three for flexure and a further three for shear.

All relevant dimensions and thicknesses shall be measured.

## 8 Procedure

### 8.1 General

Test loads shall be obtained from EN 845-2.

### 8.2 Method of support

Simply support the lintel at each end on a firm base and with a minimum end bearing of 100 mm and in accordance with the manufacturer's specifications.

The lintel may be bedded on mortar to EN 998-2.

### 8.3 Conditioning of lintels finished *in situ*

Build the specimens on a flat horizontal surface. If fresh concrete or mortar is used, take appropriate steps to prevent the test specimen from drying out during the first 3 d after construction, e.g. by covering it with a polyethylene sheet and then leave it uncovered in a laboratory environment until tested.

### 8.4 Lateral restraint or composite action

The use of lateral restraint or of composite action arising from a masonry leaf or other infill masonry specified by the manufacturer shall be permitted if included in the design of the lintel.

When testing asymmetric lintels, for example those with an 'L' shaped across section, it may be necessary to use composite action and/or clamping the flange to the support in order to avoid excessive and unrealistic torsional effects during loading.

### 8.5 Loading

#### 8.5.1 General requirements

Apply load continuously or in not less than six increments up to the maximum expected test load. Use any convenient loading rate, such that failure occurs at between 15 min and 30 min after commencing the test.

Load lintels designed for use in double leaf walls under the load ratios specified by the manufacturer.

#### 8.5.2 Flexural resistance

When testing flexural resistance, use a uniformly distributed load or alternatively, a series of point loads giving equivalent maximum shear and equivalent bending moment to that obtained from a uniformly distributed load.

Point loads should be applied through spreader plates of length between 50 mm and 200 mm. Suitable point loading arrangements are shown in Figures 1 and 2. Transversely across the section, the loads should be applied on the centre line of the position of the leaf or leaves as shown in Figures 1 and 2. The lintel should not be unduly stiffened by the loading arrangement.

### 8.5.3 Shear resistance

When testing shear resistance, use a shear load applied to the lintel at a distance from the edge of the support equal to the height of the lintel plus 75 mm (see Figures 1 and 2).

The load should be applied through a thick spreader plate of length between 50 mm and 200 mm.

### 8.5.4 Deflection monitoring

Monitor vertical and horizontal deflection at mid span. Vertical deflection shall be measured at the mid leaf position or in the case of double leaf walls, deflection shall be measured at the mid leaf position of both leaves, and the greater of the two readings shall be recorded.

The average vertical end deflection of the lintel (measured as closely as possible to the bearing) may be deducted from the vertical deflection at mid span.

Horizontal deflection shall be measured at the mid height of the lintel.

## 8.6 Test procedure for single, composite and combined lintels

### 8.6.1 Flexural resistance

- a) Measure all the dimensions of the specimen.
- b) Mount the lintel on the test apparatus and assemble the loading arrangement as in 8.5.2 and Figure 1 and Figure 2 (as appropriate).
- c) Apply load to the lintel continuously or in increments as described in 8.5.1.
- d) Monitor the deflection as described in 8.5.4 and plot the deflections after each increment of load to give a load deflection curve.
- e) Increase load until either (1) flexural failure occurs, or (2) the load at which further net mid-span deflection occurs without increase in load or (3) the load at which web buckling or shear failure occurs.
- f) Record the load reached in (e) as the failure load and the mode of failure as described by either e(1), e(2) or e(3) above. Record the failure load, to the nearest 10 N, and note any visible signs of distress in specimen, fixings or supporting member at all stages of the test.

### 8.6.2 Shear resistance

- a) Mount the lintel on test apparatus and assemble loading arrangements as in 8.5.3 and Figure 1 or 2 (as appropriate). The lintel length shall exceed 5 times its height.
- b) Apply load at the rate given in 8.5.1.
- c) Record the failure load, to the nearest 10 N, and note any visible signs of distress in specimen, fixings or supporting member at all stages of the test.

## 9 Expression of result

Record the failure load, to the nearest 10 N, and note any visible signs of distress in specimen, fixings or supporting member at all stages of the test.



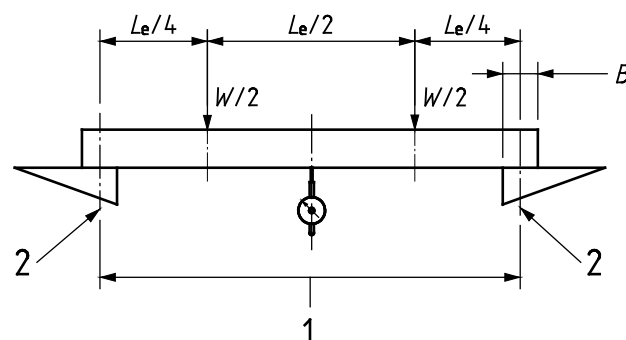
## 10 Evaluation of results

Calculate the mean failure load. The flexural resistance shall be taken as the mean failure load when following 8.6.1. The shear resistance shall be taken as the mean failure load when following 8.6.2.

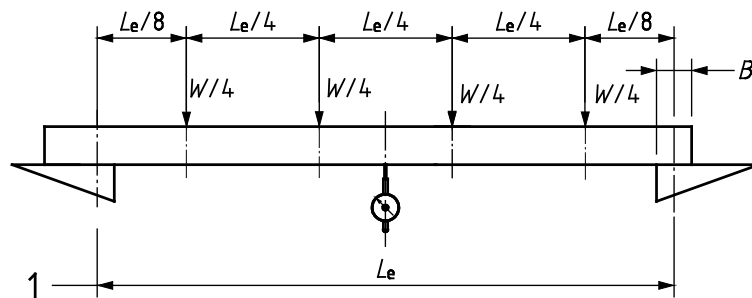
## 11 Test report

The test report shall include the following information:

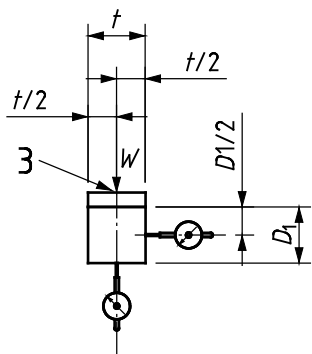
- a) The number, title and date of issue of this European Standard.
- b) The name of the test laboratory.
- c) Material specification and dimensions of lintel specimen.
- d) Details of any lateral restraint or composite action employed.
- e) Dimensions of end bearings with a description of any bedding mortar.
- f) Loading arrangement and positions at which deflection was measured.
- g) For composite lintels, the dimensions of the masonry and a description of the masonry units and the mortar to the appropriate standards as specified under EN 845-2.
- h) Load ratios used (where relevant).
- i) For the flexural resistance test, the individual values of (1) the failure load to the nearest 100 N (2) the load deflection curve (3) a description, drawing or photograph of the mode of failure.
- j) The flexural resistance.
- k) For the shear resistance test, the individual values of (1) the failure load to the nearest 100 N (2) the load deflection curve (3) a description, drawing or photograph of the mode of failure.
- l) The shear resistance.



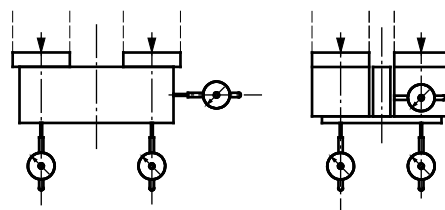
a) Loading by two point loads



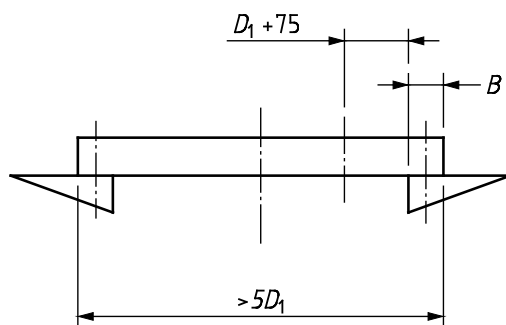
**b) Loading by four point loads**



**c) Transverse load position**



**d) Transverse load position**

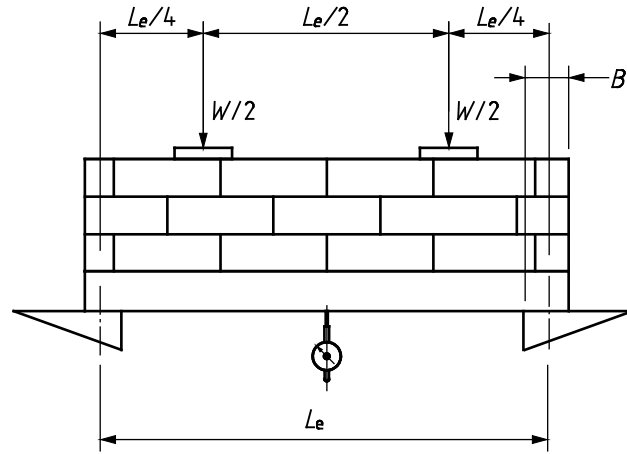


**e) Test arrangement for shear at end support**

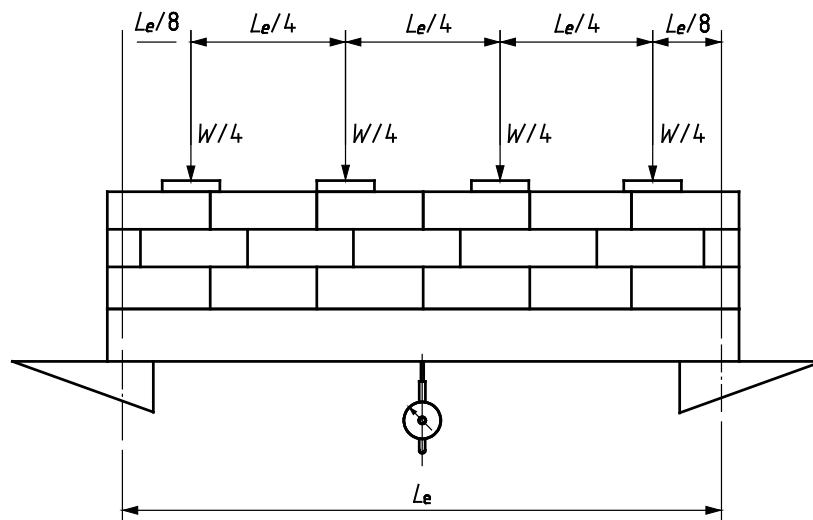
**Key**

- 1 effective length  $L_e$
- 2 centre line of bearing
- 3 load applied through centre line of wall leaf

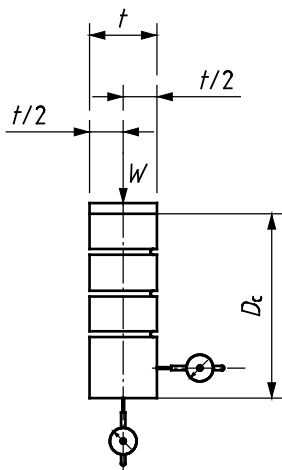
**Figure 1 — Examples of loading arrangements for single and combined lintels**



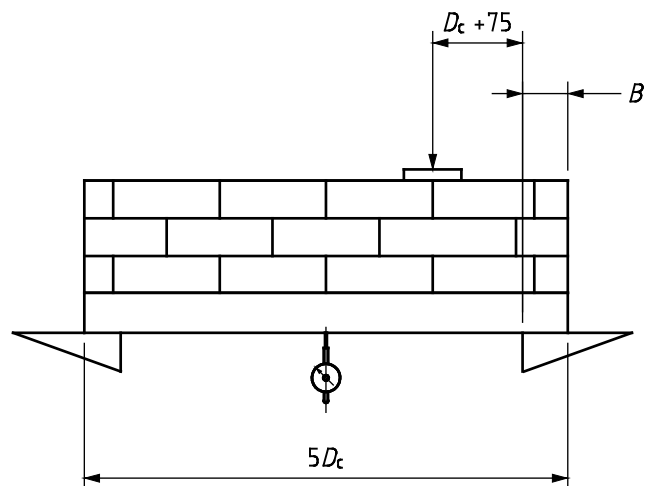
a) Loading by two point loads



b) Loading by four point loads



c) Transverse load position



d) Test arrangement for shear at end support

Figure 2 — Examples of loading arrangements for composite lintels

## Bibliography

- [1] EN 772-1, *Methods of test for masonry units — Part 1: Determination of compressive strength*
- [2] EN 998-2, *Specification for mortar for masonry — Part 2: Masonry mortar*
- [3] EN 1015-11, *Methods of test for mortar for masonry — Part 11: Determination of flexural and compressive strength of hardened mortar*



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## BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

