BRITISH STANDARD

BS EN
1288-4:2000

Glass in building — Determination of the bending strength of glass —

Part 4: Testing of channel shaped glass

The European Standard EN 1288-4:2000 has the status of a British Standard

ICS 81.040.20

National foreword

This British Standard is the official English language version of EN 1288-4:2000.

The UK participation in its preparation was entrusted by Technical Committee B/520, Glass and glazing in building, to Subcommittee B/520/4, Properties and glazing methods, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible 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.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 9 and a back cover.

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English version

Glass in building - Determination of the bending strength of glass - Part 4: Testing of channel shaped glass

Verre dans la construction - Détermination de la résistance du verre à la flexion - Partie 4: Essais sur verre profilé

Glas im Bauwesen - Bestimmung der Biegefestigkeit von Glas - Teil 4: Prüfung von Profilbauglas

This European Standard was approved by CEN on 5 September 1999.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 129, Glass in building, the Secretariat of which is held by IBN.

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of an identical text or by endorsement, at the latest by December 2000, and conflicting national standards shall be withdrawn at the latest by December 2000.

CEN/TC 129/WG8, Mechanical Strength, prepared the draft, Glass in building - Determination of the bending strength of glass - Part 4: Testing of channel shaped glass.

There are four other parts to this standard:

- Part 1: Fundamentals of testing glass;
- Part 2: Coaxial double ring test on flat specimens with large test surface areas;
- Part 3: Test with specimen supported at two points (four point bending);
- Part 5: Coaxial double ring test on flat specimens with small test surface areas.

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.

1 Scope

This European Standard specifies a method for determining the bending strength (defined as the profile bending strength) of wired or unwired channel shaped glass for use in buildings.

The limitations of this standard are described in EN 1288-1.

EN 1288-1 should be read in conjunction with this standard.

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 it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 572-1 Glass in building - Basic soda lime silicate glass products - Part 1: Definitions and general physical and mechanical properties.

EN 572-7 Glass in building - Basic soda lime silicate glass products - Part 7: Wired or unwired channel shaped glass.

EN 1288-1 Glass in building - Determination of the bending strength of glass - Part 1: Fundamentals of testing glass.

ISO 48 Rubber, vulcanized or thermoplastic - Determination of hardness (hardness between 10 IRHD and 100 IRHD).

3 Definitions

For the purposes of this standard, the following definition applies.

3.1 profile bending strength: the quotient of the maximum bending moment and the section modulus of a channel shaped glass (EN 572-7)

NOTE: Due to sideways movement of the flanges of the channel shaped profile in the bending test, the specimens break almost exclusively at the transition from web to flange (i.e. not at the extreme edge of the flange or the face of the web). Consequently, the profile bending strength is not the glass strength, but rather a value representing the strength of the profile.

4 Symbols

B Width of web

F_{max} Maximum force

NOTE: Where the bending rollers are not firmly attached to the testing machine, but are laid on the specimen, the force resulting from their weight is added to the maximum measured force.

G Specimen's own weight

h_F Thickness of flange

h_W Thickness of web

H Height of flange

L_s Distance between supporting rollers
M_{bB} Maximum bending moment

P_{bB} Profile bending strength

Z Section modulus

Z_F Section modulus with flanges in tension

Z_W Section modulus with web in tension

5 Apparatus

5.1 Testing machine

The bending test shall be carried out using a suitable bending testing machine, which shall incorporate the following features.

a) The stressing of the specimen shall be capable of being applied from zero up to a maximum value in a manner which minimizes shock and is stepless.

b) The stressing device shall be capable of the specified rate of stressing.

c) The testing machine shall incorporate a load measuring device with a limit of error of ±2,0 % within the measuring range.

d) The supporting rollers and the bending rollers (see Figure 2) shall have a diameter of 50 mm and a length of not less than 550 mm. All the rollers shall be free to rotate.

5.2 Measuring instruments

The following measuring instruments are required:

- a measuring instrument enabling the web width, B, of the specimen to be measured to the nearest millimetre and the flange height, H, of the specimen to be measured to the nearest 0,5 mm;

- a measuring instrument allowing the thickness of the specimen flange, h_F, and web, h_W, to be measured to the nearest 0,1 mm.

6 Sample

6.1 Number of specimens

The number of specimens to be tested shall be determined depending on the confidence limits required, especially with regard to estimating the extremes of the strength distribution (see EN 1288-1 for a discussion of numbers of specimens).

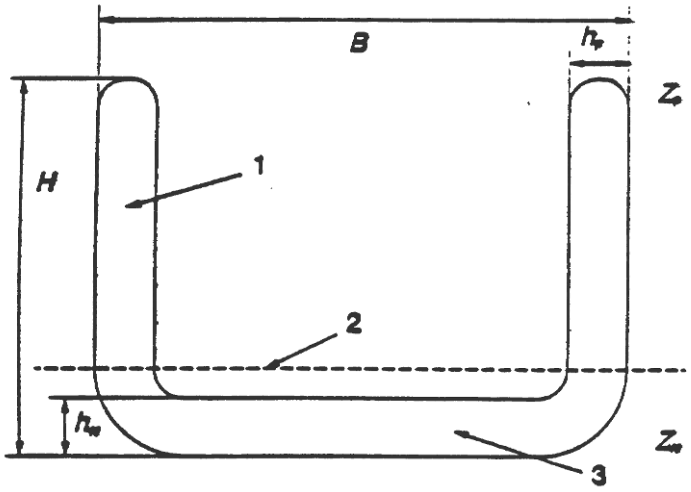
6.2 Specimen dimensions

The dimensions of the specimen web, B, flange height, H, the web thickness, h_W, the flange thickness, h_F, and the angle between the web and the flanges, shall be within the tolerances specified for the product to be tested (in accordance with EN 572-7).

The length of the specimens shall be 2 100 mm ± 5 mm.

6.3 Specimen condition

The specimens shall be stored in the testing environment (see 7.2) for at least 4 h before being tested.



1 Flange
2 Principal axis
3 Web

Figure 1: Cross-section of specimen

7 Procedure

7.1 Determination of dimensions of each specimen

The width of the web, B, the height of the flange, H, and the thickness of the flanges, h_F, shall be measured at the ends of the profiles and in the centre of the specimen. The web thickness, h_W, shall be measured only at the ends (see Figure 1 and Figure 2).

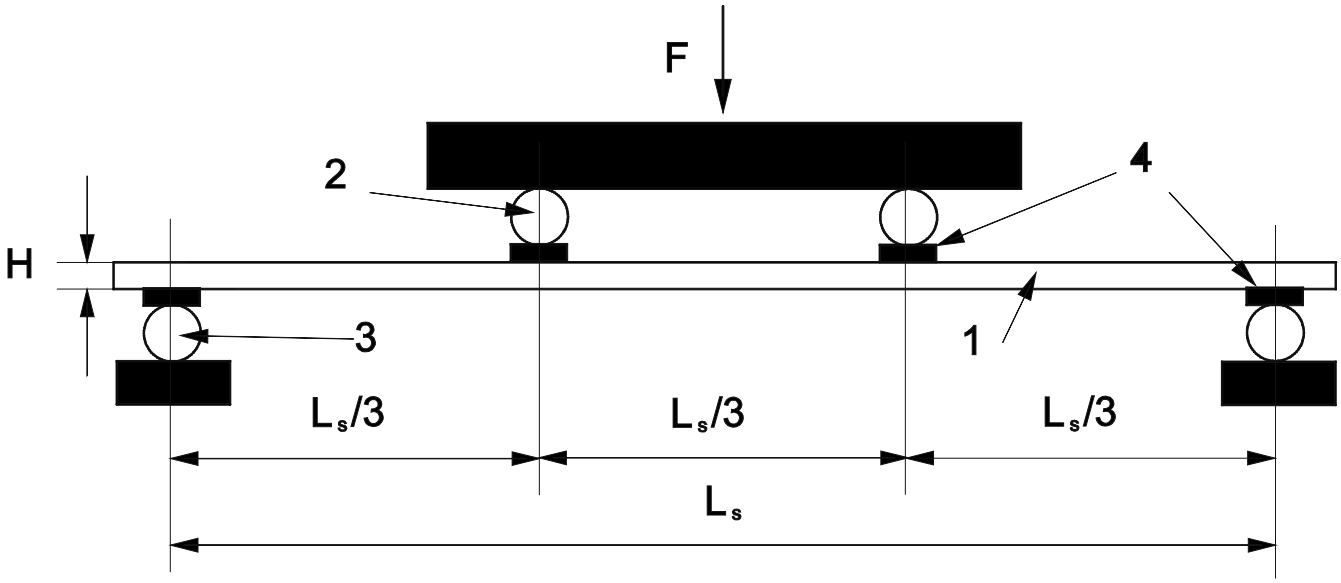
7.2 Bending test

The specimens shall be mounted as shown in Figure 2.

Rubber strips, 5 mm thick and of hardness of (40 ± 10) IRHD, (in accordance with ISO 48), shall be placed between the specimen and the bending and supporting rollers.

The bending test shall be carried out at (23 ± 5) °C with the relative humidity between 40 % and 70 %. During the test, the temperature shall be kept constant to 1 °C, in order to avoid development of thermal stresses.

The specimen shall be bent with a uniformly increasing bending stress at a rate of (2 ± 0,4) $N/mm^2 \cdot s$ until failure occurs. The maximum force, F_{max}, shall be measured and the time taken to reach this force shall be recorded.



1 Specimen
2 Bending roller
3 Supporting roller
4 Rubber pad
L_s = 2 000 mm ± 4 mm

Figure 2: Arrangement of specimen in testing machine

8 Evaluation

For evaluation purposes, only those specimens shall be considered in which the origin of fracture lies between the bending rollers.

The profile bending strength, P_{bB}, shall be calculated in accordance with equation (1):

$$P_{bB} = \frac{\frac{F_{max} L_s}{6} + \frac{G L_s}{8}}{Z}$$

The appropriate value of section modulus, Z, used for the calculation depends on whether the flange is in tension (Z_F) or the web is in tension (Z_W).

The bending strength shall be calculated with the section modulus and weight for the nominal dimensions of the profile provided that the permissible dimensional tolerances for the profile are not exceeded. Values for G, Z_F and Z_W are given in annex A for a non-exhaustive list of commonly available channel profiles. Where the permissible dimensional tolerances are exceeded, the section modulus and weight shall be calculated separately for each specimen.

9 Test report

The test report shall include the following information with reference to this standard:

a) Description of the profile, either by trade name or by specifying the nominal dimensions of web width, flange height, web thickness and flange thickness;

In the case of channels with wire, include a description of the wire;

b) The angle of deviation from a right angle, if the apparent deviation of the flange from a right angle is visually apparent;

c) Number of specimens;

d) For each specimen:

1) Measured thicknesses of flanges, and web to the nearest 0,1 mm;

2) Measured web width to the nearest 1 mm and flange height to the nearest 0,5 mm;

3) Whether tested with flange or web in tension;

4) Section modulus and weight used for calculation;

5) Profile strength, P_{bB}, in N/mm^2 to the nearest 1 N/mm2;

6) Time to breakage in seconds, to the nearest 1 s;

No average for the measured results shall be given;

e) The number of specimens not broken in accordance with clause 8;

f) Any deviation from this standard which may have affected the results.

Annex A (informative)

Properties of channel shaped glass

Table A.1 gives values of the self-weight and section modulus for some of the more commonly available channel shaped glass products.

Table A.1: Values of G, Z_F and Z_W for a non-exhaustive selection of commonly available channel sections

Width of web mm	Height of flange mm	Glass thickness mm	G N	Z_F mm^3	Z_W mm^3
232	41	6	89	5 210	22 670
232	60	7	117	13 000	47 910
262	41	6	98	5 260	24 570
262	60	7	127	13 150	52 420
270	40	6	100	5 020	23 920
331	41	6	119	5 370	28 490
331	60	7	151	13 430	62 070
498	41	6	169	5 540	36 030
748	41	6	245	5 700	43 300

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