INTERNATIONAL STANDARD

ISO 1288-4

First edition
2016-02-15

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

Reference number
ISO 1288-4:2016(E)

© ISO 2016

COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

© ISO 2016 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 160, *Glass in building*, Subcommittee SC 2, *Use considerations*.

ISO 1288 consists of the following parts, under the general title *Glass in building — Determination of the bending strength of glass*:

— *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 4: Testing of channel shaped glass*

— *Part 5: Coaxial double ring test on flat specimens with small test surface areas*

© ISO 2016 – All rights reserved

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

Part 4:
Testing of channel shaped glass

1 Scope

This part of ISO 1288 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 part of ISO 1288 are described in ISO 1288-1.

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.

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

ISO 1288-1, *Glass in building — Determination of the bending strength of glass — Part 1: Fundamentals of testing glass*

NOTE ISO TC 160 SC1 is still not certain as to whether there is a need for a standard on the product "Wired or unwired channel shaped glass".

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
profile bending strength
quotient of the maximum bending moment and the section modulus of a channel shaped glass

Note 1 to entry: 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.

© ISO 2016 – All rights reserved

4 Symbols

B	width of web	m
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.	N
G	specimen's own weight	N
h_F	thickness of flange	m
h_W	thickness of web	m
H	height of flange	m
L_s	distance between supporting rollers	m
M_{bB}	maximum bending moment	Nm
P_{bB}	profile bending strength	Pa
Z	section modulus	m^3
Z_F	section modulus with flanges in tension	m^3
Z_W	section modulus with web in tension	m^3

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.

e) The air bags (see Figure 2) shall have an overall dimension of 310 mm × 1 020 mm × 200 mm and shall have a safe working pressure not less than 100 kPa. The air bags shall be pressurized to 70 kPa for channel shaped glass with a nominal width up to 300 mm and 50 kPa for channel shaped glass with a nominal width over 300 mm.

f) The spreader plates (see Figure 2) shall have dimensions of 300 mm × 1 000 mm and be sufficiently robust to adequately transmit the force into the air bags.

© ISO 2016 – All rights reserved

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 1 mm 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 ISO 1288-1 for a discussion of numbers of specimens).

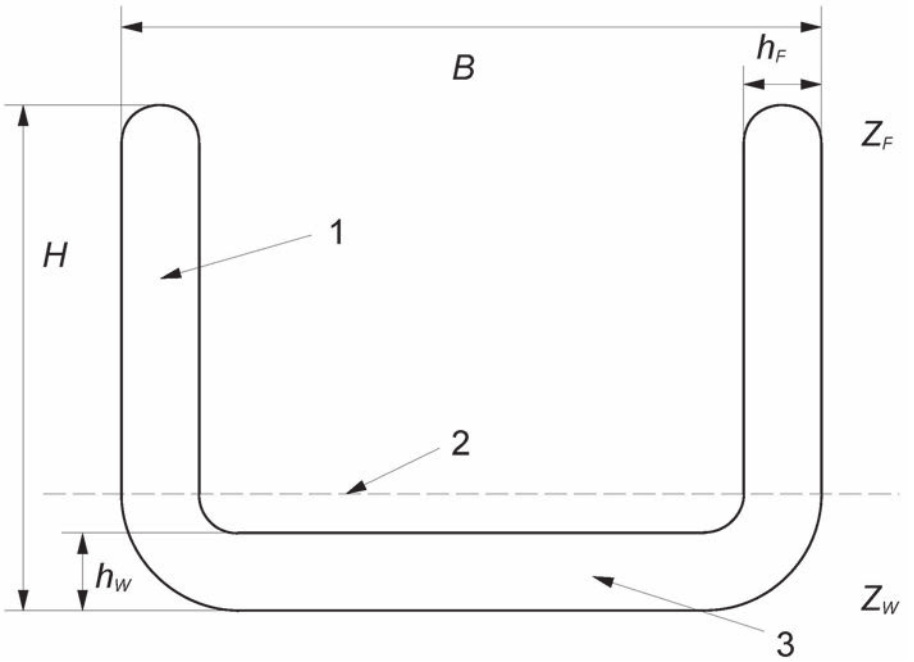
6.2 Specimen dimensions

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.

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.



Key

1 flange
2 principal axis
3 web

Figure 1 — Cross section of specimen

© ISO 2016 – All rights reserved

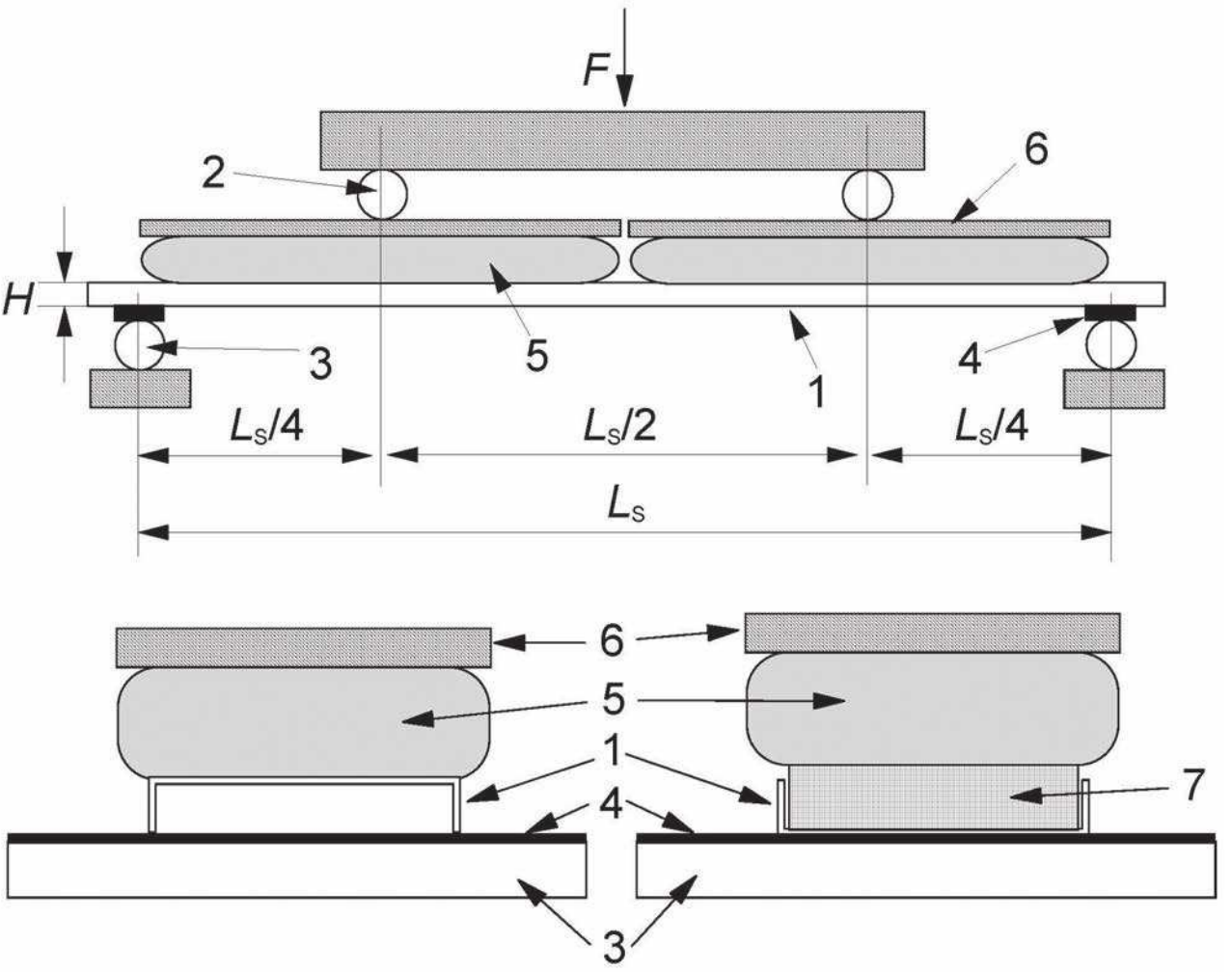
7 Procedure

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.



Key

1	specimen	5	air bag
2	bending roller	6	spreader plate
3	supporting roller	7	foam slab
4	rubber pad	L_S	2 000 mm ± 4 mm

Figure 2 — Arrangement of specimen in testing machine

Rubber strips, 6 mm thick and of hardness of not less than (40 ± 10) IRHD, (in accordance with ISO 48), shall be placed between the specimen and the supporting rollers.

© ISO 2016 – All rights reserved

When testing with the web in tension, a foam slab (expanded polystyrene or similar), not less than 1 000 mm in length and of width 10 mm less than the internal space between the flanges, shall be placed under the air bag to prevent it from applying the load directly to the flanges.

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) MPa/s until failure occurs. The maximum force, F_{max}, shall be measured and the time taken to reach this force shall be recorded.

8 Evaluation

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

$$P_{bB} = \left(F_{max} + G\right)\frac{L_S}{8Z} \quad (1)$$

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:

a) a reference to this part of ISO 1288, i.e. ISO 1288-4;

b) 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;

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

d) number of specimens;

e) 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 MPa to the nearest 1 MPa;

   6) time to breakage in seconds, to the nearest 1 s.

   No average for the measured results shall be given;

f) the number of specimens not broken in accordance with Clause 8;

© ISO 2016 – All rights reserved

g) any deviation from this part of ISO 1288 which may have affected the results.

© ISO 2016 – All rights reserved

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

Dimensions in millimetres

Width of web	Height of flange	Glass thickness	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

© ISO 2016 – All rights reserved

Bibliography

[1] ISO 16293-1, *Glass in building — Basic soda lime silicate glass products — Part 1: Definitions and general physical and mechanical properties*

© ISO 2016 – All rights reserved

ICS 81.040.20

Price based on 8 pages

© ISO 2016 – All rights reserved