SLOVENSKI STANDARD
SIST EN 1351:2001

01-april-2001

Določevanje upogibne trdnosti avtoklaviranega celičastega betona

Determination of flexural strength of autoclaved aerated concrete

Bestimmung der Biegezugfestigkeit von dampfgehärtetem Porenbeton

Détermination de la résistance a la flexion du béton cellulaire autoclavé

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Ta slovenski standard je istoveten z: **EN 1351:1997**

SIST EN 1351:2001
https://standards.iteh.ai/catalog/standards/sist/11a7261e-c3d8-4b17-b535-5fcc0728283b/sist-en-1351-2001

ICS:

91.100.30	Beton in betonski izdelki	Concrete and concrete products

SIST EN 1351:2001 **en**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

SIST EN 1351:2001

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 1351:2001
https://standards.iteh.ai/catalog/standards/sist/11a7261e-c3d8-4b17-b535-5fcc0728283b/sist-en-1351-2001

SIST EN 1351:2001

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1351

January 1997

ICS 91.100.30

Descriptors: Concrete, autoclaved aerated concrete, flexural strength, testing.

English version

Determination of flexural strength of autoclaved aerated concrete

Détermination de la résistance à la flexion du béton cellulaire autoclavé

Bestimmung der Biegezugfestigkeit von dampfgehärtetem Porenbeton

This European Standard was approved by CEN on 1996-12-13.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

SIST EN 1351:2001

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

© 1997. CEN – All rights of exploitation in any form and by any means reserved worldwide for CEN national members.

Ref. No. EN 1351:1997 E

SIST EN 1351:2001

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 177 'Prefabricated reinforced components of autoclaved aerated concrete or lightweight aggregate concrete with open structure', the Secretariat of which is held by DIN.

In order to meet the performance requirements as laid down in the product standard for prefabricated components of autoclaved aerated concrete, a number of standardized test methods are necessary.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, and conflicting national standards withdrawn, by July 1997 at the latest.

In accordance with the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

1 Scope

This European Standard specifies a method of determining the flexural (tensile) strength of autoclaved aerated concrete (AAC) by means of prismatic specimens taken from prefabricated components [1]).

SIST EN 1351:2001
https://standards.iteh.ai/catalog/standards/sist/1a7261ec-c3d8-4b17-b535-5fcc0728283b/sist-en-1351-2001

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 678
Determination of the dry density of autoclaved aerated concrete

3 Principle

The flexural strength is determined by applying a uniform bending moment in the middle third of the span of a simply supported prismatic specimen by means of two-point loading. The maximum load sustained is recorded and the flexural strength calculated.

The method of centre-point loading may also be used and is specified in annex A.

The procedure using two-point loading shall be the reference test method.

NOTE: In general, the method of centre-point loading as described in annex A yields higher values of the flexural strength than the method of two-point loading.

4 Apparatus

The following apparatus shall be used:

a) Saw suitable for cutting reinforced AAC components.

b) Calipers, capable of reading the dimensions of the specimens to an accuracy of 0,1 mm.

c) Straightedge, with a length of approximately 300 mm, a 0,5 mm-feeler gauge, a 0,1 mm-feeler gauge, and a square, for checking the flatness and the squareness of specimens.

d) Balance, capable of determining the mass of the specimens to an accuracy of 0,1 %.

e) Testing machine, capable of applying a vertical compressive load at the required uniform rate without shock or interruption. The limit of error of the machine and the load indication shall be such that the ultimate load can be determined to an accuracy of ±2 %. The measuring range shall be such that the ultimate load is higher than one-tenth of the range used.

f) Loading device as shown in figure 1, for transmitting the load of the testing machine to the specimen.

The loading device shall consist of two supporting rollers and two loading rollers. The rollers shall be manufactured from steel and shall have a circular cross section with a diameter between 15 mm and 40 mm. They shall be at least 10 mm longer than the width of the specimen. The axes of all rollers shall be parallel to each other. Each roller, except one of the supporting rollers, shall be capable of rotating around its longitudinal axis

[1]) A European Standard for prefabricated reinforced components of autoclaved aerated concrete is in preparation.

SIST EN 1351:2001

and of being inclined in a plane normal to the longitudinal axis of the specimen. After correct centring in the testing machine, the axes of the hinges of the three inclinable rollers shall be situated on a vertical plane which shall not deviate by more than ±1 mm from the axis of the compressive force of the testing machine.

The middle axis between the loading rollers or the supporting rollers shall not deviate by more than ±1 mm from the axis of the testing machine (axis of the vertical compressive force).

The centre distance between the supporting rollers (i.e. the span), l, shall be equal to $3h$, where h is the nominal height of the specimen (normally, 50 mm). The loading rollers shall be equally spaced between the supporting rollers as shown in figure 1.

All rollers shall be adjusted in their correct position, with all distances being set to an accuracy of ±0,5 mm.

g) Ventilated oven, capable of maintaining a temperature of (105 ± 5) °C (see NOTE).

NOTE: In addition, a ventilated oven capable of maintaining a temperature of 40 °C to 60 °C can be helpful for conditioning the specimens.

5 Test specimens

5.1 Sample

The sample for specimen preparation shall be taken in so as to be representative of the product to be investigated.

NOTE: The specimens may be prepared from prefabricated reinforced components. Alternatively, they may be taken from prefabricated unreinforced components of the same mould.

5.2 Shape and size of test specimens

The reference specimens shall be prisms cut from prefabricated components, with a height, h, of 50 mm, a width, b, of 50 mm and a length, L, of 200 mm.

Specimens of other sizes may be used, provided that the flexural strength determined on such specimens can be directly related to the flexural strength determined on prisms measuring 50 mm × 50 mm × 200 mm.

5.3 Number of test specimens

A test set shall comprise three specimens.

Whenever possible, one specimen shall be prepared from the upper third of the component, one from the middle and one from the lower third, in the direction of rise of the mass during manufacture (see figure 2).

The position of the specimens in the material relative to the rise of the mass shall be shown by the numbering, and the direction of rise shall be marked on the specimens.

5.4 Preparation of test specimens

The specimens shall be taken from the zone of the prefabricated component which is adjacent to the surface subject to maximum tension under service conditions (see figure 2). The longitudinal axis of the specimens shall be perpendicular to the direction of rise (see figure 2).

They shall be cut from the component not before two days after removal from the autoclave. They shall not contain any reinforcement within the span, l. The surfaces shall be plane and perpendicular to each other.

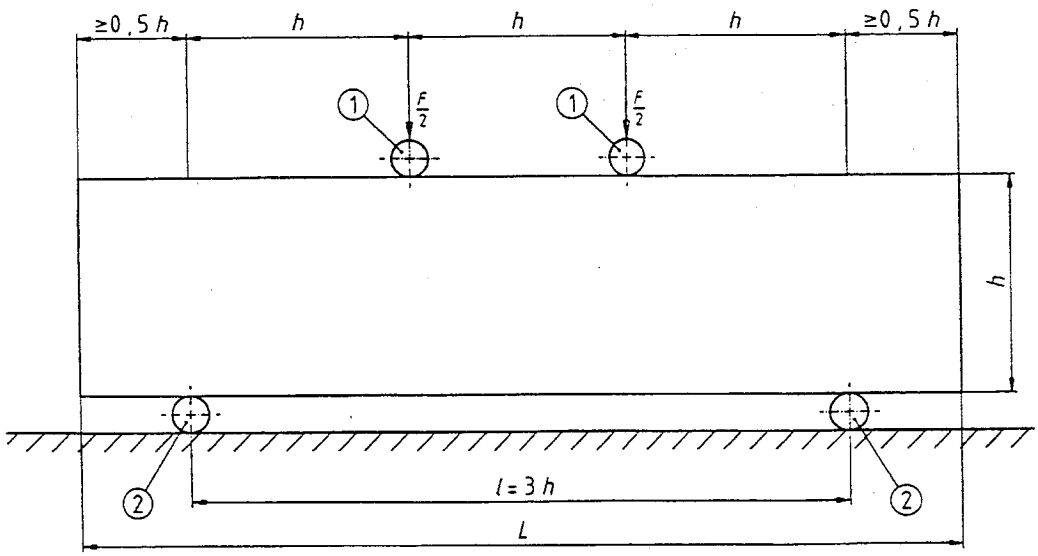
The flatness of the surfaces shall be checked along the two diagonals of each surface and along the lines where the loading forces and the support reactions will be applied, using a straightedge and, if necessary, feeler gauges. Deviations by more than 0,5 mm along the diagonals and by more than 0,1 mm along the lines where the loading forces and the support reactions will be applied shall be corrected by grinding.

The angle between adjacent faces of the specimens shall also be checked, using a square and, if necessary, a 0,5 mm-feeler gauge. Deviations from squareness by more than 0,5 mm per 50 mm (≈ 0,6°) shall be corrected by grinding.

Alternatively, if the surfaces in contact with the loading rollers or support rollers depart from a plane by not more than 0,5 mm, rubber or leather strips may be used as a load distributing intermediate layer between the rollers and the bearing surfaces, instead of grinding these areas.

The rubber or leather strips shall be of uniform thickness (approximately 5 mm), 25 mm in width, and extend over the full width of the specimen.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 1351:2001
https://standards.iteh.ai/catalog/standards/sist/11a7291e-c3d8-4017-b335-5b60728283b6/sist-en-1351-2001

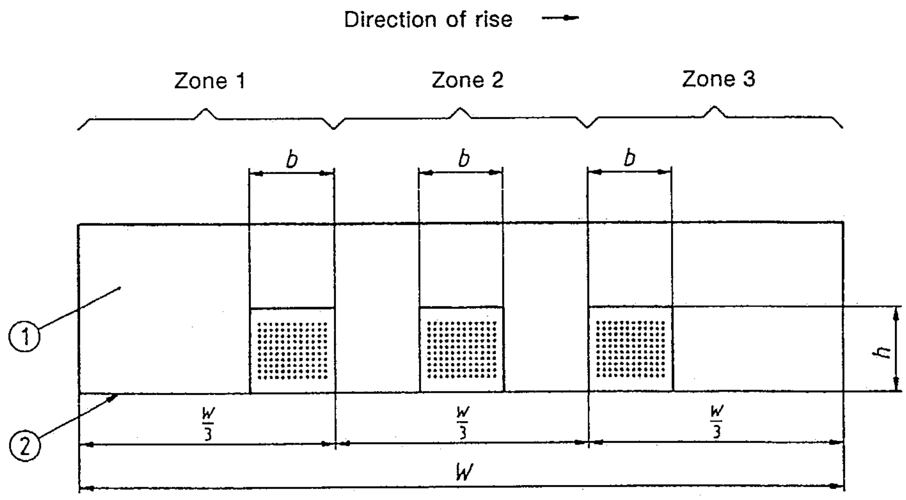


1 Loading rollers (capable of rotating and of being inclined independently of each other)

2 Supporting rollers (one fixed and the other capable of rotating and of being inclined)

Figure 1: Loading arrangement for two-point loading

SIST EN 1351:2001



1 Component

2 Surface in tension under service conditions

Figure 2: Sampling scheme

5.5 Examination of test specimens and determination of their dimensions and volume

The specimens shall be examined visually and any abnormalities shall be reported.

The dimensions of the specimens shall be measured to an accuracy of 0,1 mm, using calipers. Measurements may be taken before or after conditioning according to 5.6.

The width, b, and the height, h, shall be measured at both ends (b_1 and b_3, or h_1 and h_3) and at midspan (b_2 or h_2), each value being the mean value of a total of two individual measurements taken at two opposite longitudinal faces.

The total length, L, shall be measured along the middle axes of two opposite longitudinal faces.

The volume, V, of the individual specimens shall be calculated by multiplying the arithmetic mean value of length measurements by the geometric mean value of width measurements $(b_1 + 2b_2 + b_3)/4$ and the geometric mean value of height measurements $(h_1 + 2h_2 + h_3)/4$.

5.6 Conditioning of test specimens

Specimens shall be conditioned at a temperature not exceeding 60 °C until their moisture content is (6 ± 2) % by mass (see NOTE).

After reaching the specified moisture content, the specimens shall be conditioned, protected against moisture changes, for at least 24 h for ensuring moisture equilibrium and thermal equilibrium with the laboratory atmosphere at (20 ± 5) °C prior to the flexural test. Immediately before this test, the moist mass, m_{hum}, of the specimens shall be determined again, to an accuracy of 0,1 %.

The actual moisture content shall be determined after the test (see last paragraph of 6.2). Prior to the test, attainment of the specified moisture content may be estimated by comparing the moist density of the specimens with the dry density determined in accordance with EN 678 on companion specimens extracted from the same area of the same component.

NOTE: The expected moisture content of a specimen, $\mu_{m.exp}$, as a percentage by mass, may be calculated from equation (1):

$$\mu_{m.exp} = \frac{\varrho_{hum.t} - \varrho_{comp}}{\varrho_{comp}} \cdot 100 \qquad (1)$$

where

$\varrho_{hum.t}$ = m_{hum}/V is the moist density of the specimen, calculated by dividing its moist mass, m_{hum}, by its volume V determined according to 5.5, in kg/m³;

ϱ_{comp} is the dry density of the companion specimen determined according to EN 678, in kg/m³.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 1351:2001
https://standards.iteh.ai/catalog/standards/sist/11a7261c-c3d8-4b17-b535-5fa07728283b/sist-en-1351-2001

6 Procedure

6.1 Flexural test

All testing machine bearing surfaces shall be wiped clean and any loose material removed from the faces of the specimen that will be in contact with the rollers.

The loading device shall be correctly centred in the testing machine (cf. clause 4 f)).

The specimen shall be placed on the support rollers of the loading device in the testing machine, correctly centred and aligned perpendicular to the rollers. The longitudinal axis shall not deviate by more than ±1 mm from the (theoretical) plane of the hinges of the inclinable rollers (see 4 f)).

If possible, the specimen shall be supported on that face corresponding to the face of the component subject to the maximum tensile stresses under service conditions (see figure 2).

The load shall not be applied before all loading and supporting rollers are resting evenly against the specimen.

Subsequently, the load may be applied rapidly, but without shock, until about 50 % of the anticipated breaking load have been reached. Then, the load shall be increased continuously until rupture occurs, at a uniform rate which constantly increases the stress in the extreme fibres at approximately 0,02 N/mm² per second, when calculated in accordance with clause 7 (see NOTE).

When using a manually controlled testing machine, any tendency for the selected rate of loading to decrease, as specimen failure is approached, shall be corrected by appropriate adjustment of the controls.

When using an automatically controlled testing machine, the rate of loading shall be periodically checked to ensure that the rate is constant and at the required level.

The maximum load indicated shall be recorded.

NOTE: The required loading rate of the testing machine, R, in N/s, for specimens with square cross

SIST EN 1351:2001

section under two-point loading according to figure 1 is given by the equation (2):

$$R = \frac{s h^2}{3} \qquad (2)$$

where

s is the specified stress rate (normally, $s = 0{,}02$), in N/mm² · s;

h is the nominal height of the specimen, in mm.

For reference specimens with a nominal square section of 50 mm × 50 mm and a span, l, of 150 mm, the specified stress rate is achieved by increasing the load by approximately 20 N/s.

6.2 Examination and measurement of test specimens after the test

The fractured specimen shall be examined, and the appearance of the AAC and type of fracture shall be recorded if these are unusual.

Height, h_{fr}, and width, b_{fr}, of the cross section at the location of fracture shall be expressed to the nearest 0,1 mm, each value being the mean value of a total of two individual measurements taken at two opposite longitudinal faces. Subsequently, the specimens shall be dried at (105 ± 5) °C in order to check the actual moisture content of the AAC and to determine the dry density on the basis of EN 678.

7 Test results

The flexural strength of the specimen, f_{cf}, in N/mm², shall be calculated from equation (3) (see NOTE):

$$f_{cf} = \frac{F l}{b_{fr} h_{fr}^2} \qquad (3)$$

where

F is the maximum load (see NOTE), in N;

l is the span, in mm;

b_{fr} and h_{fr} are the cross-sectional dimensions of the specimen at the point of fracture, in mm (see figure 1).

The flexural strength of each individual specimen and the mean value shall be expressed to the nearest 0,01 N/mm².

The dry density of the AAC, ϱ, in kg/m³, shall be calculated from equation (4):

$$\varrho = \frac{m_d}{V} \qquad (4)$$

where

m_d is the dry mass of the broken specimen according to 6.2, in kg;

V is the volume of the specimen according to 5.5, in m³.

The dry density of each individual specimen and the mean value shall be expressed to the nearest 10 kg/m³.

The moisture content of the AAC, μ_m, as a percentage by mass, shall be calculated from equation (5):

$$\mu_m = 100 \frac{m_{hum} - m_d}{m_d} \qquad (5)$$

where

m_{hum} is the mass of the specimen in the moist state according to 5.6, in kg;

m_d is the dry mass of the broken specimen according to 6.2, in kg.

The moisture content of each individual specimen and the mean value shall be expressed to the nearest 0,1 %.

NOTE: The mass of the specimen is not included. Depending on the testing machine and the loading device used, the mass of the latter or parts thereof is not always included in the indicated maximum load. It may be necessary, therefore, to take this into account when calculating the flexural strength.

8 Test report

The test report shall include the following:

a) identification of the product;

b) date of manufacture or other code;

c) place and date of testing, testing institute and person responsible for testing;

d) number and date of issue of this European Standard;

e) dimensions (actual or checked nominal) and relative position of the specimens with regard to the direction of rise;

f) method of loading (two-point loading or centre-point loading);

g) flexural strength of each individual specimen, and mean value;

h) dry density of each individual specimen, and mean value;

j) moisture content of each individual specimen, and mean value;

k) observations on the appearance of the specimens before and after the flexural test, appearance of the fracture surface, location of fracture outside the loading rollers;

l) any deviations from the standard method of testing;

m) a declaration that testing has been carried out in accordance with this European Standard, except as detailed in clause 8 l).

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 1351:2001
https://standards.iteh.ai/catalog/standards/sist/11a726fe-e3d8-4b17-b535-5fcc0728283b/sist-en-1351-2001

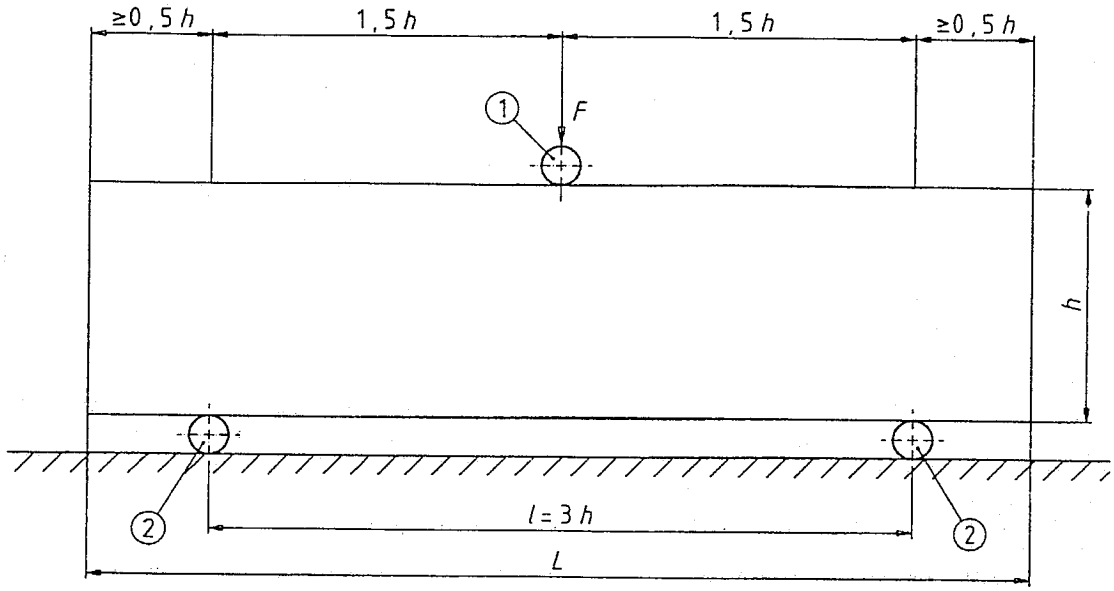
SIST EN 1351:2001

Annex A (normative)

Determination of flexural strength using the method of centre-point loading

If the method of centre-point loading is used (see NOTE in clause 3), the test procedure differs from the procedure with two-point loading as specified in this European Standard in the following respects:

The loading arrangement shall conform to that shown in figure A.1.



1 Loading roller at mid-span (capable of rotating and of being inclined)

2 Supporting rollers (one fixed and the other capable of rotating and of being inclined)

Figure A.1: Loading arrangement for centre-point loading

(With respect to the diameter of the rollers and other details, see clause 4 f).)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

The load shall be applied in accordance with 6.1, except that the loading rate, R, in N/s, is to be determined in accordance with equation (A.1).

SIST EN 1351:2001
https://standards.iteh.ai/catalog/standards/sist/11a7261e-c3d8-4b17-b535-5fcc0728283b/sist-en-1351-2001

$$R = \frac{s\,h^2}{9} \qquad \text{(A.1)}$$

where

s is the specified stress rate (normally, 0,02 N/mm²), in N/mm² · s;

h is the nominal height of the specimen, in mm.

For the reference specimens with nominal square section 50 mm × 50 mm and a span, l, of 150 mm, the specified stress rate is achieved by increasing the rate of loading by about 10 N/s.

The flexural strength of the specimen, f_{cf}, in N/mm², shall be calculated from equation (A.2):

$$f_{cf} = \frac{1{,}5\,F\,l}{b_{fr}\,h_{fr}^2} \qquad \text{(A.2)}$$

where

F is the maximum load (see NOTE to clause 7), in N;

l is the span (centre distance between the supporting rollers, see figure A.1), in mm;

b_{fr} and h_{fr} are the cross-sectional dimensions of the specimen at the point of fracture, in mm (see figure A.1).

In the test report it shall be expressly stated that the centre-point loading method has been used.