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Determination of the drying shrinkage of autoclaved aerated concrete

Bestimmung des Schwindens von dampfgehärtetem Porenbeton

Détermination du retrait de séchage du béton cellulaire autoclavé

Ta slovenski standard je istoveten z: EN 680:1993

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**Determination of the drying shrinkage of
autoclaved aerated concrete**Détermination du retrait de séchage du béton
cellulaire autoclavéBestimmung des Schwindens von dampfgehärtetem
Porenbeton**ITEH STANDARD PREVIEW**
(standards.iteh.ai)SIST EN 680:2001<https://standards.iteh.ai/catalog/standards/sist/976eb5a7-7e79-40d1-b20c-6541daae6d43/sist-en-680-2001>

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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.

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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 United Kingdom.

CENEuropean Committee for Standardization
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Foreword

This European Standard has been prepared by CEN/TC 177 "Prefabricated reinforced components of autoclaved aerated concrete or lightweight aggregate concrete with open structure".

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of an identical text or by endorsement, at the latest by June 1994, and conflicting national standards shall be withdrawn at the latest by June 1994.

The Standard was approved and in accordance with the CEN/CENELC Internal Regulations, 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, United Kingdom.

1 Scope

This European Standard specifies the procedure for the determination of the relative length change during drying (conventional drying shrinkage) of autoclaved aerated concrete.

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

EN 678 Determination of dry density of autoclaved aerated concrete.

3 Principle

Prismatic test specimens are cut from prefabricated components and, if necessary, moistened by underwater storage until their moisture content is at least 30 % by mass.

Subsequently, the test specimens are stored in air under specified conditions until a moisture content of ≤ 4 % by mass has been reached, and changes of length and mass are determined at appropriate intervals.

Finally, the test specimens are dried to constant mass at $(105 \pm 5)^\circ\text{C}$ in order to determine the dry density and to enable the calculation of the moisture content from the mass of the test specimen recorded at each measuring date.

A graph relative length change versus moisture content is plotted, and from the curve the conventional value of drying shrinkage, ϵ_{CS} , is determined as the relative length change between the two specified moisture contents 30 % by mass and 6 % by mass.

4 Apparatus

a) a saw with rotating carborundum or diamond blade or similar equipment for cutting test specimens;

b) a balance, capable of determining the mass of the test specimens to an accuracy of 0,1 %;

c) calipers, capable of reading the dimensions of the test specimens to an accuracy of 0,1 mm;

d) a temperature controlled room, capable of maintaining a temperature of $(20 \pm 2)^\circ\text{C}$ and a relative humidity of not less than 45 % for storing the test specimens during the drying period and for performing the measurement of length changes (see note 1);

e) a measuring apparatus (comparator) for measuring length changes of test specimens.

Any suitable measuring apparatus may be used provided the following requirements are met:

- The length changes shall be measured in the longitudinal axis of the test specimens.
- Positive contact shall be established with the gauge plugs attached in the centres of the end faces of the test specimens.
- The measurements shall be performed with an accuracy of $\Delta L/L_0 \leq 10^{-5}$ where L_0 is the initial length of the test specimen.
- The measuring apparatus shall have sufficient range to allow for small variations in the actual length of various test specimens.
- Means shall be provided for checking the measuring apparatus at each measuring date against an invariable standard reference.

f) gauge plugs, to be applied on the end faces of the test specimens, made of corrosion resistant metal and shaped in such a way that a reliable positive contact with the measuring apparatus used is ensured.

g) a ventilated drying oven, capable of maintaining a temperature of $(105 \pm 5)^\circ\text{C}$.

NOTE 1: The room according to d) needs not necessarily be humidity controlled. Alternatively, during the drying period, the test specimens may be stored in a container under the specified climatic conditions.

5 Test specimens

5.1 Sample

The sample for the preparation of the test specimens shall be taken in such a manner that it is representative of the product to be investigated.

NOTE 2: The test 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 the test specimens

The test specimens shall be prisms with a cross section of 40 mm x 40 mm and a length to suit the length of the measuring apparatus, but not less than 160 mm.

5.3 Number of test specimens

A test set shall consist of three test specimens.

Whenever possible, one test 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 1).

The position of the test specimens in the material, relative to the rise of the mass, shall be shown by the numbering.

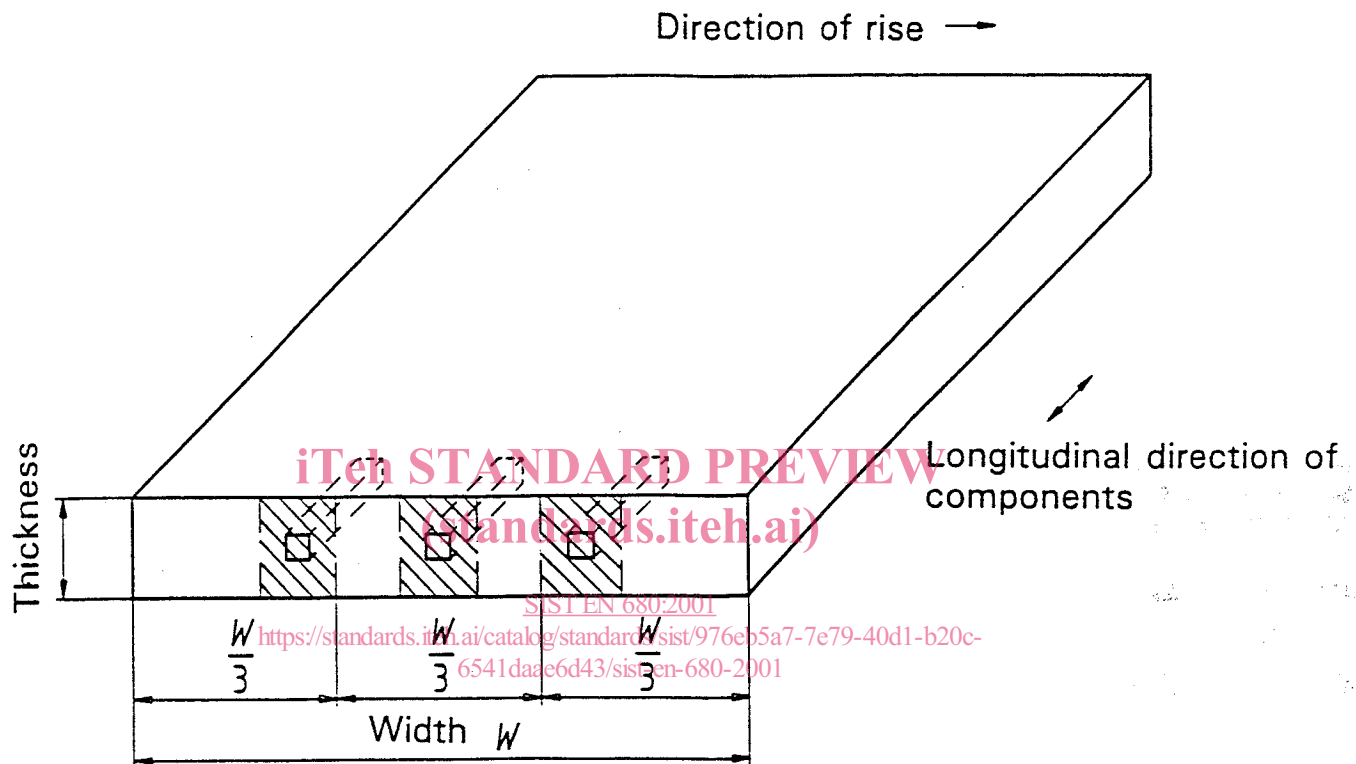


Figure 1: Sampling scheme

5.4 Preparation of test specimens

The test specimens shall be cut by means of a rotating carborundum blade or similar equipment. They shall not contain any reinforcement. All surfaces shall be plane and clean. The longitudinal axis of the test specimens shall be perpendicular to the direction of rise and preferably in longitudinal direction of the components. The gauge plugs shall be firmly attached to the end faces of the test specimens using an adhesive such that the adhesive does not influence the measured length changes.

Test specimens may be prepared from samples which have previously been used for other tests, provided that they are cut at least 150 mm from an area where visible damage or changes to the normal structure and appearance have occurred.

NOTE 3: It is useful to know the mass of the gauge plugs and their fixation (adhesive).

5.5 Measurement of test specimens and determination of their volume

The dimensions of the test specimens shall be measured to an accuracy of 0,1 mm, using calipers.

Width and thickness shall be measured - between the longitudinal middle axes of opposite longitudinal surfaces - near both ends and in the middle of the length.

The length L_0 shall be measured along the longitudinal middle axes of two opposite longitudinal surfaces.

The volume V of test specimen shall be calculated by multiplying the mean values of thickness, width, and length measurements.

5.6 Conditioning of test specimens

After preparation, the test specimens shall be conditioned, if necessary by underwater storage, in order to ensure that their moisture content exceeds 30 % by mass (see note 4). The previous determination of the dry density according to EN 678 on companion specimens taken from the same areas of the same samples can be helpful for the estimation of the moisture content (see note 5).

After reaching the required moisture content the test specimens shall be sealed in plastic foil or similar material, in order to prevent loss of moisture, and stored at $(20 \pm 2)^\circ\text{C}$ for at least 24 h prior to the test in order to achieve sufficiently uniform moisture distribution.

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The actual moisture content shall be determined at the end of the test in accordance with 7.2.

NOTE 4: Instead of wetting the test specimens, it is preferable to cut them from newly-produced components where the "natural" moisture content normally exceeds 30 % by mass.

NOTE 5: In this case the expected moisture content $\mu_{m,exp.}$, in % by mass, of a test specimen may be calculated as

$$\mu_{m,exp.} = \frac{\rho_{m,t} - \rho_{comp}}{\rho_{comp}} \times 100$$

where:

$\rho_{m,t}$ = m_m/V is the moist density of the test specimen, calculated by dividing its moist mass m_m by its volume V which is determined from the dimensions measured according to 5.5, in kilograms per cubic metre;

ρ_{comp} is the dry density of the companion specimen determined according to EN 678 (see also 5.5, 6.2, and 7.4 of this European Standard), in kilograms per cubic metre.

6 Testing procedure

6.1 Exposure to air at $(20 \pm 2)^\circ\text{C}$ and $\geq 45\%$ relative humidity and measurement of length changes and variations of mass

In order to avoid faulty readings due to the presence of dirt, the gauge plugs shall be wiped carefully before each measurement.

After removal of the sealing material the first reading of the gauge length and the first measurement of the mass, m_0 , of the test specimens conditioned according to 5.6 shall be made.

Subsequently, the test specimens shall be gradually dried by storing in air at $(20 \pm 2)^\circ\text{C}$ and a relative humidity not below 45 %. During this period they shall be placed on a grid with enough clear space around each other, enabling free circulation of air around test specimens.

At least five readings of the gauge length and accompanying measurements of the mass of the test specimens shall be executed at suitable time intervals until the expected moisture content (see Note 5) is less than 4 % by mass.

6.2 Drying of test specimens at $(105 \pm 5)^\circ\text{C}$

The test specimens shall be placed in a ventilated drying oven at $(105 \pm 5)^\circ\text{C}$ until constant mass is attained. Immediately after removal from the drying oven the mass of the individual test specimens shall be determined. The mass of the test specimens is considered constant if after 24 h of further drying it has not changed by more than 0,2 %. At constant mass, the gauge plugs shall be detached, and the mass of the individual test specimens shall again be determined.

7 Test results

7.1 Calculation of relative length change

For each gauge length reading, L_i , the relative length change, ϵ_{si} , in millimetres per metre, is calculated as follows:

$$\epsilon_{si} = \frac{\Delta L}{L_0} \times 1\,000$$

where:

ΔL is the variation in gauge length according to 6.1 (first measurement minus measurement at date i), in millimetres;

L_0 is the initial length (mean value of the two length measurements according to 5.5) of the test specimen between the gauge plugs, in millimetres.

The relative length change of each individual test specimen and the mean value at each measuring date shall be expressed to the nearest 0,01 mm/m.