SLOVENSKI STANDARD
SIST EN 1355:2001

01-april-2001

Določevanje deformacij avtoklaviranega celičastega betona ali betona iz lahkega agregata z odprto strukturo zaradi lezenja pri tlačni obremenitvi

Determination of creep strains under compression of autoclaved aerated concrete or lightweight aggregate concrete with open structure

Bestimmung der Kriechverformungen unter Druckbeanspruchung von dampfgehärtetem Porenbeton und von haufwerksporigem Leichtbeton

Détermination du fluage en compression du béton cellulaire autoclavé et du béton de granulats légers a structure ouverte

Ta slovenski standard je istoveten z: **EN 1355:1996**

ICS:

91.100.30	Beton in betonski izdelki	Concrete and concrete products

SIST EN 1355:2001 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1355

December 1996

ICS 91.100.30

Descriptors: concrete, cellular concrete, aggregates, mechanical tests, compression tests, creep tests, determination, creep strength

English version

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This European Standard was approved by CEN on 1996-11-30. 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.

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 United Kingdom.

CEN

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

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Contents

Foreword

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

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 1997, and conflicting national standards shall be withdrawn at the latest by June 1997.

In order to meet the performance requirements as laid down in the product standards for prefabricated components of autoclaved aerated concrete and of lightweight aggregate concrete with open structure, a number of standardized test methods are necessary.

According to 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.

1 Scope

This European Standard specifies a method of determining the longitudinal long-term strains (creep strains) of test specimens taken from prefabricated components of autoclaved aerated concrete (AAC)[1)] or lightweight aggregate concrete with open structure (LAC) according to prEN 1520 due to a constant compression stress sustained over a long period of time.

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 dry density of autoclaved aerated concrete
EN 679	Determination of compressive strength of autoclaved aerated concrete
EN 992	Determination of dry density of lightweight aggregate concrete with open structure
EN 1354	Determination of compressive strength of lightweight aggregate concrete with open structure.
prEN 1520	Prefabricated components of lightweight aggregate concrete with open structure

3 Principle

Creep strains are determined on test specimens taken from prefabricated components.

The creep strain at a given age t ($\epsilon_{cc,t}$) is defined as the total strain under compression at that age ($\epsilon_{cc,tot,t}$), less the instantaneous strain under the same stress occurring during the application of the load ($\epsilon_{ci,t0}$), less the strains due to shrinkage from the time of loading to the considered age ($\epsilon_{cs,t}$).

The strains due to shrinkage are determined on unloaded control specimens identical to those used in the creep test which are taken from the same component and stored under the same conditions.

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1) A European Standard for "Prefabricated reinforced components of autoclaved aerated concrete" is in preparation at CEN.

4 Apparatus

a) any saw suitable for cutting reinforced AAC or LAC components;

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

c) a straight-edge, feeler gauges (0,1 mm for AAC, 0,5 mm for LAC, and 1,0 mm for both) and a square;

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

e) (only in the case of LAC) equalizing layers of soft fibreboard with a thickness of (12 ± 2) mm and a density of (250 to 400) kg/m^3 to be inserted between the loadbearing surfaces of the test specimens and the platens of the compression testing machine (not required in the case of levelling the loadbearing surfaces by grinding or capping);

f) a loading frame capable of applying and maintaining the required compressive load on the test specimen(s) for the required period of time (in general at least one year), despite any length change of the test specimen(s) (see note 1).

The header plates of the loading frame shall have sufficient stiffness, and their bearing surface shall not depart from a plane by more than 0,1 mm per 100 mm. In any loading frame several test specimens may be stacked for simultaneous loading.

Means shall be provided for measuring the load to the nearest 3 % of the total applied load. This may be a permanently installed pressure gauge or a hydraulic jack or load cell inserted temporarily in the frame when the load is applied or adjusted.

When a hydraulic load-maintaining element is used, several frames may be loaded simultaneously through a central hydraulic pressure-regulating unit.

When springs are used, care shall be taken to provide a spherical seated head, or a ball joint and end plates rigid enough to ensure uniform loading of the test specimens.

g) a measuring device for the determination of the longitudinal length changes (strains) of the test specimens. The apparatus may be portable or attached (see note 2).

If a portable apparatus is used, gauge points shall be attached to the test specimen in a positive manner which is normally done by glueing with rapid hardening glue.

The gauge length shall be not less than 100 mm. The gauge points shall be provided accurately on the longitudinal axes of the four longitudinal surfaces of the prismatic test specimens, and they shall be attached equidistant from the ends, the distance from the adjacent end being not less than 50 mm.

The device shall be capable of measuring strains to the nearest 10×10^{-6} (0,01 mm/m) for at least one year without change in calibration;

h) a room, capable of maintaining a temperature of (20 ± 2) °C and a relative humidity of (60 ± 5) %.

j) a ventilated drying oven capable of maintaining a temperature of (105 ± 5)°C (see note 3).

NOTE 1: A usual frame consists of header plates bearing on the ends of the loaded test specimens, a load maintaining element, that may be either a spring or a hydraulic capsule or ram, connected with a cylinder of high pressure nitrogen and a hydraulic pressure regulating unit, and threaded rods to take the reactions of the loaded system.

NOTE 2: Systems in which the varying length changes or strains are compared with a constant-length standard bar are considered most reliable.

NOTE 3: In addition a ventilated drying oven capable of maintaining a temperature of (40 to 60)°C can be helpful for conditioning of test specimens.

5 Test specimens

5.1 Sample

The sample for the preparation of the test specimens (usually at least one prefabricated component) shall be taken in such a manner that it is representative of the product to be investigated.

5.2 Shape and size of test specimens

The reference test specimens shall be prisms with a square cross-section of 100 mm x 100 mm and a height of 300 mm.

Test specimens of other sizes or shape may be used, provided that the correlation to the results of tests on the above reference test specimens is established.

5.3 Number of test specimens

At least two test specimens for determination of creep (creep specimens) and two control specimens for determination of shrinkage shall be prepared from the central part of the component (see figure 1).

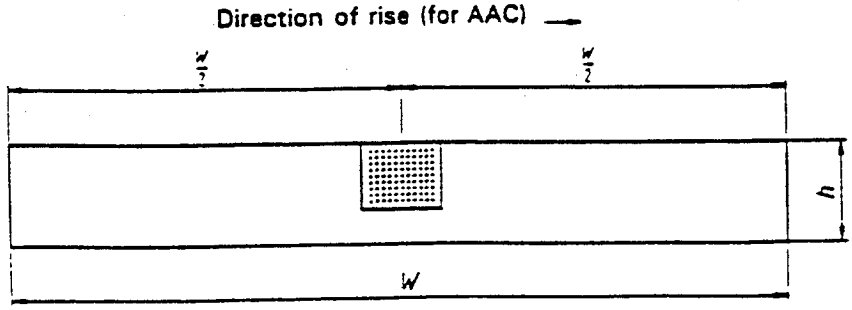

Figure 1: Sampling scheme

5.4 Preparation of test specimens

The specimens shall be cut not less than 2 d after autoclaving or casting, respectively. The dust or the slurry of the process shall be removed.

They shall be taken in such a way that their longitudinal axis is

- in the case of AAC: perpendicular to the rise of the mass during the manufacture;

- in the case of LAC: in the plane of the compression force acting in the component when used in the structure.

The specimens shall contain no reinforcing bars within the gauge length. (If unavoidable, bars which are perpendicular to the longitudinal axis may be accepted in exceptional cases. This shall be mentioned in the test report.)

The loadbearing surfaces of the creep specimens shall be plane, parallel to each other and perpendicular to the longitudinal surfaces of the specimens.

Planeness of loadbearing surfaces shall be checked across the two diagonals using a straight-edge and, if necessary, a feeler gauge. Deviations exceeding 0,2 mm shall be adjusted by cutting and/or grinding or by capping. In the case of LAC, deviations up to 0,5 mm may be tolerated, provided that equalizing layers of soft fibreboard according to 4 e) are used. Deviations from planeness of the other surfaces shall not exceed 1 mm.

The angle between the loadbearing surfaces and the adjacent longitudinal surfaces of the creep specimens shall not deviate from a right angle by more than 1 mm per 100 mm. This shall be checked along both orthogonal middle axes of the loadbearing surfaces by means of a square and a 1 mm-feeler gauge or similar instrument. Larger deviations shall be corrected by cutting or grinding.

5.5 Measurement of test specimens

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

Length and width of the cross-sectional area, A_c, shall be measured at mid height at two opposite longitudinal sides. The cross-sectional area shall be calculated using the mean values of the results of the measurements.

The height of the specimens shall be measured in the middle of two opposite longitudinal sides.

The volume V of the specimen shall be calculated by multiplying A_c by the mean value of the results of the height measurements.

5.6 Conditioning of specimens

The test specimens shall be conditioned at a temperature not exceeding 60 °C until their mass related moisture content is (6 ± 2) %. This may be estimated by comparing their moist density with the dry density determined in accordance with EN 678 for AAC or with EN 992 for LAC, respectively, on companion specimens extracted from the same area of the same component (see note).

After reaching the specified moisture content, the test specimens shall be stored, protected against moisture changes, for at least 72 h prior to the test at (20 ± 2) °C for ensuring uniform moisture distribution within the test specimen and thermal equilibrium with the temperature in the laboratory. During the creep test the test specimens shall be exposed to the sourrounding air with a temperature of (20 ± 2) °C and a relative humidity of (60 ± 5) %.

Conditions other than the above reference conditions may be chosen if required. This shall be indicated in the test report.

The actual moisture content of the specimens at the beginning and at the end of the creep test and the dry density shall be determined. For this purpose the specimens shall be weighed prior to the creep test - before applying of any devices for measurement of deformations - and after completion of the creep test - after removal of gauge plugs etc. Finally, they shall be dried to constant mass at (105 ± 5) °C (see clause 7). If the removal of the adhesive fixed gauge plugs is likely to remove concrete, the initial mass of the test specimen with and without gauge plugs shall be taken, and the appropriate correction shall be made in the calculations.

NOTE: The expected moisture content of a test specimen may be calculated according to equation (1):

$$\mu_{m,exp} = \frac{\rho_{hum,t} - \rho_{comp}}{\rho_{comp}} \times 100 \qquad \ldots(1)$$

where:

$\mu_{m,exp}$ is the expected mass related moisture content, in per cent;

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

ρ_{comp} is the dry density of companion specimens determined according to EN 678 (for AAC) or EN 992 (for LAC), in kilograms per cubic metre.

6 Creep test

6.1 Age at loading and duration of sustained load

In the case of AAC the age at loading is optional.

In the case of LAC the creep specimens shall be loaded at an age of 28 d, if not specified otherwise.