SLOVENSKI STANDARD
SIST EN 17151:2019

01-oktober-2019

Cevni sistemi iz polimernih materialov, ki delujejo po težnostnem principu in so položeni v zemljo, za transport in shranjevanje vode, ki ni namenjena pitju - Preskusna metoda za ugotavljanje dolgotrajne tlačne odpornosti zabojev

Plastics piping systems for non-pressure underground conveyance and storage of non-potable water - Test method for determination of long-term compression strength of boxes

Kunststoff-Rohrleitungssysteme für die drucklose unterirdische Entwässerung für Nicht-Trinkwasser - Prüfverfahren zur Bestimmung der Langzeitdruckfestigkeit von Versickerungsblöcken

Systèmes de canalisations en plastique pour le transport et le stockage souterrains sans pression de l'eau non potable - Méthode d'essai pour la détermination de la résistance à la compression à long terme des structures alvéolaires ultra-légères

Ta slovenski standard je istoveten z: **EN 17151:2019**

ICS:

23.040.03	Cevovodi za zunanje sisteme transporta vode in njihovi deli	Pipeline and its parts for external water conveyance systems

SIST EN 17151:2019 **en,fr,de**

EUROPEAN STANDARD
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English Version

Plastics piping systems for non-pressure underground conveyance and storage of non-potable water - Test method for determination of long-term compression strength of boxes

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This European Standard was approved by CEN on 19 October 2018.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 17151:2019) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by February 2020, and conflicting national standards shall be withdrawn at the latest by February 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This standard is intended to reflect the current state of knowledge of determining and predicting the long-term lifetime of products mentioned in the scope while maintaining reasonable testing times for producers and developers of these systems.

The products covered by this standard are part of storm water management systems.

CEN TC 155 is aware that these products are used in modular systems and that the long term compression strength determined by this standard applies to a single box and might not reflect the maximum allowable loads on an installed system.

Linearity is assumed to extrapolate the (log) load versus log time curve from the results of the creep rupture tests. The test described in Annex A is intended to demonstrate linearity over the extrapolated lifetime by testing at elevated temperatures.

This test is given as an informative annex due to limited practical experience and lack of reliability analyses. CEN TC 155 wants to encourage stakeholders to perform these tests before the next revision.

NOTE Linear behaviour of the boxes can be assumed when the difference in the slope between creep tests performed at 20 °C and at 70 °C as described in Annex A is small and therefore there has been no deviation from linear behaviour.

The test method follows the principles of ISO 9080 [1] and applies them to the testing of boxes.

CEN TC 155 is aware that including a not failed data point at 4 380 h in the calculation of LCL would bias the outcome in the lower 95 % confidence level (*LCL*) for the stress leading to a failure at 50 years.

1 Scope

This document specifies a test method for determining the long-term compression strength for a specified period on boxes made of thermoplastics materials for non-pressure underground conveyance and storage of non-potable water.

The document is applicable for boxes which maintain their linear behaviour over the specified period.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions (ISO 3126)*

EN ISO 7500-1:2018, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system (ISO 7500-1:2018)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
box
thermoplastic cuboid shaped element, with or without sidewalls, used to create a modular storage system

3.2
integral component
load bearing component contributing to the overall strength of the box

3.3
initial height, length, width
h_i, l_i, b_i
respectively height (test direction), length and width of the sample before testing, in mm

3.4
initial height after pre-load
h_0
height of the sample after applying a pre-load, but before the load is further increased and recorded, in mm

3.5
long-term compression strength
95 % lower confidence limit of the applied stress for which the sample would survive 50y without creep rupture, in kN/m^2

3.6
linear behaviour
products that exhibit linear behaviour are defined as those that exhibit a linear relationship of stress versus log-time or log-stress versus log-time to creep rupture throughout the recorded and extrapolated lifetime

3.7
test duration periods (TDP1, TDP2)
specifies the duration of a series of creep rupture tests failing in a specific period of time

4 Symbols and units

For the purposes of this document, the following symbols and units apply.

		Units
h_i	initial height	mm
l_i	initial length	mm
b_i	initial width	mm
h_0	initial height after pre-load	mm
σ_{fl}	failure stress, long-term	kN/m²
σ_{fs}	failure stress, short-term	kN/m²
σ_{max}	short-term compression strength	kN/m²
σ_r	long-term compression strength	kN/m²
t_0	time when the test load is applied	s
t_{fl}	failure time, short-term	s
t_{fs}	failure time, long-term	s
a, b	constants for fitting a straight line	-
y, x	variables for fitting a straight line	-
t	time	s
σ	applied stress	kN/m²
T_h	elevated test temperature	°C
y_i, x_i	data pair for fitting a straight line number i	-
t_i, σ_i	data pair of time and stress number i	-
N	number of data pairs	-
$u(a), u(b)$	the standard uncertainties in the fit intercept, u(a), the fit gradient, u(b)	-

5 Test method

Creep rupture tests are performed at different load levels and the time until rupture is measured. The load levels are selected to distribute the ruptures evenly over log-time.

The creep rupture tests are carried out by testing a series of samples placed between two stiff plates with different constant compression loads applied. Deflection is recorded against time. The different times taken for creep rupture to occur are used to plot a trend line which, when extrapolated, can be used to predict the stress at which creep rupture will occur at a specific time in the future.

The uncertainty of the extrapolated value is determined to enable the definition of a lower limit at a specified confidence level.

NOTE Creep rupture tests give information on a change of strain at failure with time to rupture.

6 Apparatus

6.1 Compression testing apparatus, which shall be capable of applying a constant load via stiff plates. The load may be applied either directly or indirectly, e.g. by use of a lever arm arrangement. The load shall be applied perpendicular (90° ± 1°) on the bottom plate.

If the force is applied by a force multiplication device, the resultant load applied to the sample shall be validated using an appropriate load cell that has been calibrated according to EN ISO 7500-1:2018 class 2.

6.2 A pair of parallel plates.

Where the compression load can be applied to the test sample, the plates shall be flat, smooth and clean and shall not deform during the test to an extent that would affect the results. The out of plane deformation of the plates shall be less than 1,0 mm for the loads applied. The upper plate shall be fixed (plate type 1) or shall have the capability to rotate around one or both horizontal axes (plate type 2). If a test sample has integral protrusions, it is allowed to use an additional loose flat plate with recesses as a load distribution layer to secure acceptable contact between the surface of the test sample and the plate of the testing machine or remove the integral protrusions.

The length and the width of each plate shall be greater than the length and width of the test sample.

6.3 Timer, which shall be capable of continuously measuring and recording the testing time with an accuracy of 1 min.

6.4 Dimensional measuring devices, which shall be compliant with EN ISO 3126, and capable of determining the test piece dimensions with an accuracy of 1 mm.

6.5 Displacement measuring devices, which shall be capable of continuously measuring and recording the distance between the two plates of the compression machine with an accuracy of 0,1 mm.

6.6 Weighing devices, which shall be capable of measuring the weight of the test sample, with an accuracy better than 0,1 % of the sample weight. They shall be capable of measuring the weight of the plate(s) and the dead load, if applicable, with an accuracy better than 0,5 % of the weight of the plates.

6.7 Load measuring device, which shall be capable of continuously measuring and recording the magnitude of the compression load being applied onto the sample with an accuracy according to EN ISO 7500-1:2018 class 2 or better.

Where dead loads are used that do not change their weight throughout the period of the test, no continuous measuring and recording is required. The dead load shall be weighed before and after the test.