SLOVENSKI STANDARD
oSIST prEN ISO 10468:2022

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Cevi iz duromernih materialov, okrepljenih s steklenimi vlakni (GRP) - Določanje leznih lastnosti obroča v vlažnih in suhih pogojih (ISO/DIS 10468:2022)

Glass-reinforced thermosetting plastics (GRP) pipes - Determination of the ring creep properties under wet or dry conditions (ISO/DIS 10468:2022)

Rohre aus glasfaserverstärkten duroplastischen Kunststoffen (GFK) – Ermittlung der Ringkriecheigenschaften unter feuchten oder trockenen Bedingungen (ISO/DIS 10468:2022)

Tubes en plastiques thermodurcissables renforcés de verre (PRV) - Détermination des propriétés de fluage annulaires en conditions humides ou sèches (ISO/DIS 10468:2022)

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Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the ring creep properties under wet or dry conditions

Tubes en plastiques thermodurcissables renforcés de verre (PRV) — Détermination des propriétés de fluage annulaires en conditions humides ou sèches

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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).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 6, *Reinforced plastics pipes and fittings for all applications*.

This third edition cancels and replaces the second edition (ISO 10468:2018), which has been technically revised.

The main changes compared to the previous edition are as follows:

— deletion of Introduction, as the information was only valid for the previous version;

— for each test piece plot of measured deflection versus time and/or the stiffness versus time;

— initial ring stiffness according to ISO 7585 can be measured by constant load or constant deflection.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the ring creep properties under wet or dry conditions

1 Scope

This document specifies methods for determining the ring creep properties for glass-reinforced thermosetting plastics (GRP) pipes. Properties include the creep factor and the long-term creep stiffness. Testing is performed under either wet (total immersion in water) or dry conditions.

Dry creep testing is typically performed for the assessment and control of raw material consistency. Wet creep testing is typically undertaken to determine the long-term creep performance in simulated use conditions.

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.

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

ISO 7685, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of initial ring stiffness*

ISO 10928, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Methods for regression analysis and their use*

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:

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

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

3.1
vertical compressive force
F
vertical force, applied to a horizontal pipe to cause a vertical deflection

Note 1 to entry: Vertical compressive force is expressed in newtons.

3.2
ring stiffness
S
measure of the resistance of a pipe to ring deflection, per metre of length, under external load as defined by Formula (1):

$$S = \frac{E \times I}{d_{\mathrm{m}}^{3}} \qquad (1)$$

where

E is the apparent modulus of elasticity as determined in a ring stiffness test, in newtons per square metre;

I is the second moment of area in the longitudinal direction per metre length, in metres to the fourth power per metre (m^4/m), i.e.

$$I = \frac{e^3}{12} \quad (2)$$

where

e is the wall thickness of the pipe, in metres;

d_m is the *mean diameter* (3.3) of the pipe, in metres.

Note 1 to entry: ring stiffness is expressed in newtons per square meter.

3.3
mean diameter
d_m
diameter, of the circle corresponding with the middle of the pipe wall cross-section and given by either Formula (3) or (4)

$$d_m = d_i + e \quad (3)$$

$$d_m = d_e - e \quad (4)$$

where

d_i is the internal diameter, in metres;

d_e is the external diameter, in metres;

e is the wall thickness of the pipe, in metres.

Note 1 to entry: Mean diameter is expressed in metres.

3.4
initialring stiffness
S_0
value of S determined by testing in accordance with ISO 7685

Note 1 to entry: Initial ring stiffness is expressed in newtons per square metre.

3.5
long-term ring creep stiffness at position 1
$S_{x,1}$
value of S at a reference position, position 1 (see 10.2), at x years, obtained by extrapolation of long-term stiffness measurements at a constant force (see 3.2 and 10.2)

Note 1 to entry: Long-term ring creep stiffness at position 1 is expressed in newtons per square metre.

3.6
calculated long-term ring creep stiffness
$S_{x,creep}$
calculated value of S at x years obtained using Formula (5):

$$S_{x,creep} = S_0 \times \alpha_{x,creep} \quad (5)$$

where

x is the elapsed time, in years (or hours), specified in the referring standard;

$\alpha_{x,\text{creep}}$ is the *creep factor* (3.7);

S_0 is the initial ring stiffness, in newtons per square metre.

Note 1 to entry: Calculated long-term ring creep stiffness is expressed in newtons per square metre.

3.7
creep factor
$\alpha_{x,\text{creep}}$
ratio of the long-term ring creep stiffness to the initial ring stiffness, both at a reference position, position 1 (see 10.2), and given by Formula (6):

$$\alpha_{x,\text{creep}} = \frac{S_{x,1,\text{creep}}}{S_{0,1}} \tag{6}$$

where

$S_{0,1}$ is the ring stiffness at position 1, in newtons per square metre at 0,1 h;

$S_{x,1,\text{creep}}$ is the long-term ring creep stiffness at position 1 at time x, in newtons per square metre.

3.8
vertical deflection
y
vertical change in diameter of a pipe in a horizontal position, in response to a *vertical compressive force* (3.1)

Note 1 to entry: Vertical deflection is expressed in metres.

3.9
long-term vertical deflection
$y_{x,1}$
value of the vertical deflection y, at the reference position, position 1 (see 10.2), at x years

Note 1 to entry: Long-term vertical deflection is expressed in metres.

3.10
deflection coefficient
f
dimensionless factor which takes into account general second-order theory as applied to deflection and is given by Formula (7):

$$f = \left[1\ 860 + \left(2\ 500 \times y_1 / d_\text{m}\right)\right] \times 10^{-5} \tag{7}$$

where

y_1 is the long-term vertical deflection at position 1, in metres;

d_m is the *mean diameter* (3.3) of the pipe, in metres.

3.11
calculated strain

$\varepsilon_{calc,1}$

strain on the inner surface at the crown and invert of a pipe at the reference position, position 1, given in percent by Formula (8):

$$\varepsilon_{calc,1} = \frac{4{,}28 \times \dfrac{e}{d_m} \times \dfrac{y_1}{d_m} \times 100}{\left(1 + \dfrac{y_1}{2 \times d_m}\right)^2} \tag{8}$$

where

y_1 is the vertical deflection at position 1, in metres;

d_m is the *mean diameter* (3.3) of the pipe, in metres;

e is the wall thickness of the pipe, in metres.

4 Principle

A cut length of pipe supported horizontally is loaded throughout its length to compress it diametrically to a prescribed level of strain calculated using Formula (8). The force application surfaces are either bearing plates or beam bars.

The pipe is subjected to a force which remains constant and the vertical deflection is measured at intervals. The long-term ring creep stiffness is estimated by extrapolation. For wet creep determinations the pipe is immersed in water at a given temperature.

The creep factor is then determined from the long-term ring creep stiffness and the ring stiffness of the same test piece at 0,1 h. The declared creep factor is the average of the results from two test pieces.

It is assumed that values for the following test parameters will be set by the referring standard:

a) the time to which the values are to be extrapolated (see 3.6 and 11.1);

b) the test temperature (see 5.3 and 10.1);

c) the length of the test piece (see Clause 6);

d) if applicable, the conditioning parameters, i.e. temperature, humidity and duration (see Clause 9);

e) the time limits for maintaining the test piece under load (see 10.6);

f) the level of strain at which the test is to be conducted;

g) Whether the testing is to be conducted in wet or dry conditions.

5 Apparatus

5.1 Compressive loading machine

The machine shall comprise a system capable of applying a force, without shock, through two parallel force application surfaces in accordance with 5.2 so that a horizontally orientated test piece of pipe in accordance with Clause 6, immersed in water if applicable, can be compressed vertically and maintained under a constant force for the duration of the test in accordance with 10.6.

Equipment shall be capable of determining the force applied to within ±1 % of the value to be applied.

