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Thermoplastics pipes — Determination of creep ratio

Tubes en matières thermoplastiques — Détermination du taux de fluage

[Revision of second edition (ISO 9967:2007)]

ICS 23.040.20

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO-lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five-month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 9967 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 5, *General properties of pipes, fittings and valves of plastic materials and their accessories - Test methods and basic specifications*.

This fourth edition cancels and replaces the second edition (ISO 9967:2007), which has been technically revised.

Introduction

Experience shows that when a pipe is installed in the soil in accordance with an appropriate code of practice its increase in deflection virtually stops after a short period. Depending on the soil and installation conditions this period will vary but normally not exceed two years.

Therefore, the two-year creep ratio as determined in accordance with this International Standard is intended for use when long-term static calculations are carried out.

The theory of creep in thermoplastics materials is briefly explained in Annex A.

For experiments, the test can be carried out based on other ages of the test pieces, other test temperatures and/or other test durations.

Thermoplastics pipes — Determination of creep ratio

1 Scope

This International Standard specifies a method for determining the creep ratio of thermoplastics pipes having a circular cross-section.

2 Normative references

The following referenced documents are indispensable for the application 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*

3 Symbols

		Unit
d_n	nominal diameter of pipe	mm
d_i	inside diameter of test piece of pipe	mm
F	loading force	kN
F_0	pre-load force	N
p	pitch	mm
L	length of test piece	mm
y_0	measured initial deflection	mm
Y_t	calculated deflection at time t	mm
Y_2	extrapolated two-year deflection	mm
δ	vertical deflection used to determine the loading force	mm
B	theoretical deflection, at $t = 1$ h	mm
M	gradient coefficient	
N	number of points on the deflection curve used for the linear regression	
R	correlation coefficient	
t	time	h
x	log(t)	
y	measured total deflection	mm
γ	creep ratio	
S	stiffness	kN/m^2
E	modulus of elasticity of the material	kN/m^2
I	the moment of inertia	m^3
D	mean diameter of the test ring	m

4 Principle

A cut length of pipe is placed between two parallel flat horizontal plates and a constant compressive force is applied for 1 008 h (42 days).

The deflection of the pipe is recorded at specified intervals so as to prepare a plot of pipe deflection against time. The linearity of the data is analysed and the creep ratio is calculated as the ratio between the two years' extrapolated deflection value and the measured 6 min (0,1 h) deflection.

NOTE It is assumed that the test temperature, as appropriate (see 8.1), is set by the referring standard.

5 Apparatus

5.1 Compressive loading machine, capable of applying via plates (5.2) and maintaining to within 1 % both the applicable pre-load force, F_0 (see 8.4), and the necessary loading force, F (see 8.5), on the pipe.

The force may be applied either directly or indirectly, e.g. by use of a lever arm arrangement.

5.2 Two plates, through which the compressive force can be applied to the test piece. The plates shall be flat, smooth and clean and shall not deform during the test to an extent that would affect the results.

The length of each plate shall be at least equal to the length of the test piece. The width of each plate shall be not less than the maximum width of the contact surface with the test piece while under load plus 25 mm.

5.3 Dimensional measuring devices, capable of determining:

— individual values for the length of a test piece (see 6.2) to within 1 mm;

— the inside diameter of a test piece to within 0,1 mm or 0,2 % d_i, whichever is the greater;

— the change in inside diameter of a test piece in the direction of loading with an accuracy of 0,1 mm or 0,1 % of the deflection, whichever is the greater.

The change in inside diameter may be measured inside the pipe or be determined from the movement of the upper plate. In case of dispute the inside diameter shall be used as reference.

An example of a device for measuring the inside diameter of corrugated pipes is shown in Figure 1.

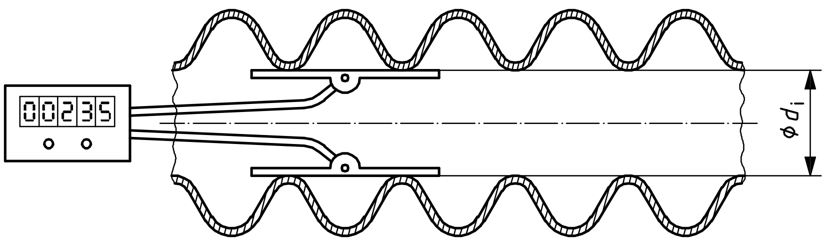

Figure 1 — Example of device for measuring the inside diameter of a corrugated pipe

5.4 Timer, capable of determining the first 6 min with an accuracy to within 1 s and the remaining times to within 0,1 % (see 8.5 and 8.6).

6 Test pieces

6.1 Marking and number of test pieces

The pipe of which the creep ratio is to be determined shall be marked on its outside with a line along one generatrix for its full length. Three test pieces, A, B and C respectively, shall be taken from this marked pipe such that the ends of the test pieces are perpendicular to the pipe axis and their lengths conform to 6.2.

6.2 Length of test pieces

6.2.1 The length of each test piece shall be determined by calculating the arithmetic average of three to six measurements of length equally spaced around the perimeter of the pipe as given in Table 1. The length of each test piece shall conform to 6.2.2, 6.2.3, 6.2.4 or 6.2.5, as applicable.

Each of the three to six length measurements shall be determined to within 1 mm.

For each individual test piece, the smallest of the three to six measurements shall not be less than 0,9 times the largest length measurement.

Table 1 — Number of length measurements

Nominal diameter, dn, of pipe mm	Number of length measurements
d_n • 200	3
200 < d_n < 500	4
d_n • 500	6

6.2.2 For pipes that have a nominal diameter, d_n, less than or equal to 1 500 mm, the average length of the test pieces shall be (300 ± 10) mm.

6.2.3 For pipes that have a nominal diameter, d_n, larger than 1 500 mm, the average length of the test pieces in millimetres shall be at least $0,2d_n$.

6.2.4 Structured wall pipes with perpendicular ribs, corrugations or other regular structures shall be cut such that each test piece contains a whole number of ribs, corrugations or other structures. The cuts shall be made at the mid-point between the ribs, corrugations or other structures.

The length of the test pieces shall be the minimum whole number of ribs, corrugations or other structures resulting in a length of 290 mm or greater, or $0,2d_n$ or greater for pipes larger than 1 500 mm (see Figure 2).

