INTERNATIONAL STANDARD

ISO 10466

Second edition
2021-04

Glass-reinforced thermosetting plastics (GRP) pipes — Test method to prove the resistance to initial ring deflection

Tubes en plastiques thermodurcissables renforcés de verre (PRV) — Méthode d'essai pour établir la résistance à la déflexion annulaire initiale

Reference number
ISO 10466:2021(E)

Contents

Page

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 second edition cancels and replaces the first edition (ISO 10466:1997), which has been technically revised.

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

— Clause 2, "Normative references", has been added;

— subclause 5.3, "Dimension-measuring instruments, capable of determining", has been amended;

— subclause 6.3, "Determination of dimensions", has been amended.

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 — Test method to prove the resistance to initial ring deflection

1 Scope

This document specifies a method for testing the ability of glass-reinforced thermosetting plastics (GRP) pipes to withstand specified levels of initial ring deflection without displaying surface damage and/or structural failure.

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*

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 http://www.electropedia.org/

3.1
vertical deflection
y
vertical change in diameter of a pipe in a horizontal position in response to a vertical compressive load

Note 1 to entry: It is expressed in metres.

3.2
relative vertical deflection
y/d_m
ratio of the *vertical deflection*, y, (3.1) to the *mean diameter*, d_m (3.3), of the pipe

3.3
mean diameter
d_m
diameter of the circle corresponding to the middle of the pipe wall cross-section and given, in metres (m), by either of the following formulae:

$$d_m = d_i + e$$

$$d_m = d_e - e$$

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.

3.4
visual evidence of structural failure
unless otherwise specified by the referring standard, a failure apparent in any of the following forms:

— interlaminar separation;

— tensile failure of the glass fibre reinforcement;

— buckling of the pipe wall;

— if applicable, separation of the thermoplastic liner from the structural wall.

3.5
strength-reduction evidence of structural failure
unless otherwise specified by the referring standard, a failure apparent in any of the following ways:

a) during the two-minute inspection period, there is an instantaneous drop in load in excess of 10 % of the maximum load applied;

b) when an instantaneous drop in load of up to 10 % has occurred and the test piece cannot sustain an increase in load equal to twice the reduction in load.

3.6
compressive load
F_1 or F_2
load applied to a pipe to cause a diametric deflection

Note 1 to entry: Compressive load is expressed in newtons.

4 Principle

A length of pipe supported horizontally is loaded throughout its length to compress it diametrically to two successive specified levels of vertical deflection (see Figure 2). The pipe is inspected at the first deflection level for visual evidence of surface damage and/or structural failure and at the second deflection level for visual evidence of structural failure (see 3.4). A performance test for structural integrity is also carried out, as a function of the resistance to loading.

NOTE It is assumed that the following test parameters are set by the standard making reference to this document:

a) the two pipe deflection limits (see 5.1 and 8.3);

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

c) the number of test pieces (see Clause 6);

d) the test temperature (see 8.1);

e) the surface(s) of the test piece to be inspected for surface damage (see 8.3);

f) the visual characteristics of surface damage and structural failure (see 8.3).

5 Apparatus

5.1 Compressive-loading machine

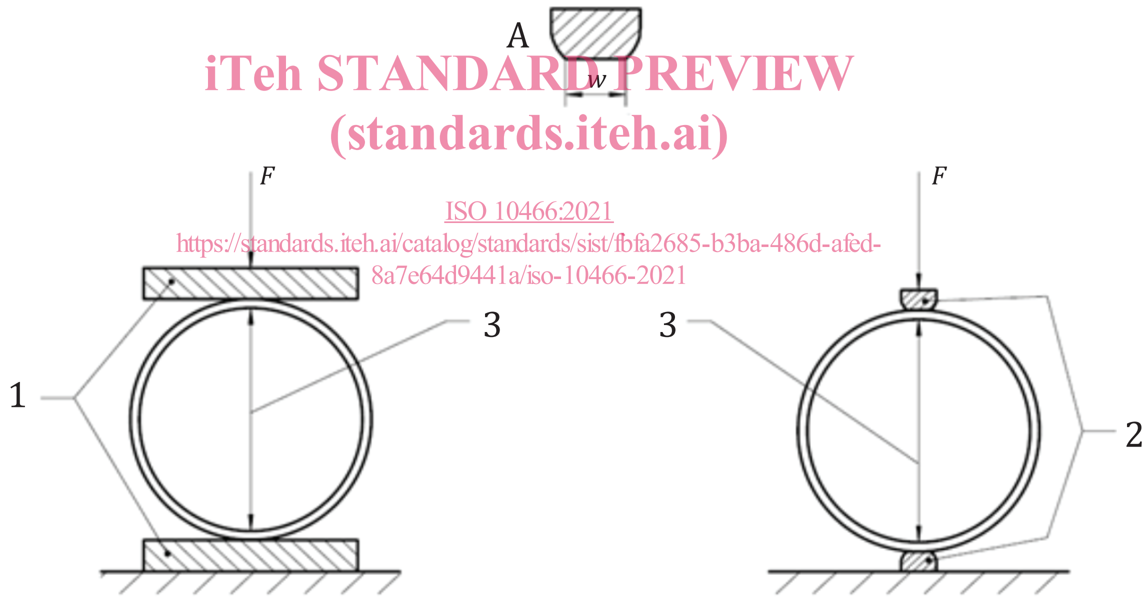
The machine comprises a system capable of applying, without shock, a compressive force, *F*, at a controlled rate through two parallel load application surfaces conforming to 5.2 so that a horizontally orientated pipe test piece conforming to Clause 6 can be compressed vertically. The machine shall be able to achieve and sustain the deflections or relative vertical deflections specified in the referring standard in accordance with the periods specified in 8.3.

5.2 Load application surfaces

5.2.1 General arrangement

The surfaces shall be provided by a pair of plates (see 5.2.2), or a pair of beam bars (see 5.2.3), or a combination of one such plate and one such bar, with their major axes perpendicular to and centred on the direction of application of the load *F* by the compressive-loading machine, as shown in Figure 1. The surfaces in contact with the test piece shall be flat, smooth, clean and parallel.

Plates and beam bars shall have a length at least equal to that of the test piece (see Clause 6) and a thickness such that visible deformation does not occur during the test.



Key

1 plate
2 beam bar
3 deflection measurement taken at mid-length of test piece
F compressive load
A detail of beam bar
w width of the flat surface

Figure 1 — Schematic diagram of the test arrangement

5.2.2 Plates

The plate(s) shall have a width of at least 100 mm.

5.2.3 Beam bars

Each beam bar shall have rounded edges, a flat face (see Figure 1) without sharp edges and a width dependent upon the pipe as follows:

a) for pipes with a nominal size not greater than DN 300, the width shall be (20 ± 2) mm;

b) for pipes of nominal sizes greater than DN 300, the width shall be (50 ± 5) mm.

The beam bars shall be designed and supported such that no other surface of the beam bar structure shall come into contact with the test piece during the test.

5.3 Dimension-measuring instruments

The instruments shall be capable of determining:

a) the dimensions (length, diameter, and wall thickness) of the test pieces. The devices shall be calibrated to an accuracy of within ±1,0 %;

b) the change in diameter of the test piece in the vertical direction. The device shall be calibrated to an accuracy of within ±1,0 %.

NOTE The maximum value of the change to be measured depends upon the vertical deflection or the relative vertical deflection specified in the referring standard.

5.4 Temperature-measuring instrument

If applicable, the instrument shall be capable of verifying conformity to the test temperature (see 8.1).

6 Test pieces

6.1 Preparation

Each test piece shall be a complete ring cut from the pipe to be tested. The length of the test piece shall be as specified in the referring standard, with permissible deviations of ±5 %.

The cut ends shall be smooth and perpendicular to the axis of the pipe.

Six straight lines, to serve as reference lines, shall be drawn on the inside or the outside along the length of the test piece at 60° intervals around its circumference.

6.2 Number

The number of test pieces shall be as specified in the referring standard.

6.3 Determination of dimensions

6.3.1 Wall thickness

Using one of the methods specified in ISO 3126, measure the wall thickness of the test piece at each end of each reference line.

Calculate the average wall thickness e, in metres, of the measured values.

6.3.2 Mean diameter

Using one of the methods specified in ISO 3126, measure either of the following:

a) the internal diameter, d_i, of the test piece between each pair of diametrically opposed reference lines at their mid-length, e.g. by means of a pair of calipers;

b) the external diameter, d_e, of the test piece at the mid-points of the reference lines, e.g. by means of circumferential-wrap steel tape.

Calculate the mean diameter, d_m, of the test piece using the values obtained for the wall thickness and either the internal or the external diameter (see 3.3).

7 Conditioning

Unless otherwise specified by the referring standard, store the test pieces for at least 0,5 h at the test temperature (see 8.1) prior to testing.

In cases of dispute, condition the test pieces for 24 h at (23 ± 5) °C before testing, or subject them to a mutually agreed conditioning schedule.

8 Procedure

8.1 Test temperature

Conduct the following procedure at the temperature specified in the referring standard.

8.2 Choice of load application surfaces and positioning of the test piece

If one of the required relative deflection limits (for surface damage or for structural failure) is in excess of 28 %, use beam bars. Otherwise use either plates and/or beam bars (see 5.2).

Place the test piece in contact with the upper and lower plate or beam bar (see 5.2.1), with one of the pairs of diametrically opposed reference lines vertically aligned. Ensure that the contact between the test piece and each plate or beam bar is as uniform as possible and that the plates and/or beam bars are not tilted laterally.

8.3 Application of load and measurement of deflection

8.3.1 Compress the test piece at a constant rate so that the first minimum initial vertical deflection or minimum initial relative vertical deflection specified in the referring standard is reached to an accuracy of ±2,0 % of the specified deflection value in (2 ± 0,5) min and record the corresponding load F_1 (see Figure 2).

8.3.2 Maintain this deflection for (2 ± 0,25) min while inspecting the test piece without magnification for surface damage [see items e) and f) in the NOTE to Clause 4].

Record any observations of surface damage together with the corresponding deflection.

8.3.3 Increase the deflection, using either a constant rate of compression or loading chosen so that the second minimum initial vertical deflection or minimum initial relative vertical deflection is reached to an accuracy of within ±2,0 % of the specified deflection value in (2 ± 0,5) min and record the corresponding load F_2.

8.3.4 Maintain this deflection for (2 ± 0,25) min while continuously monitoring and recording the load applied (see Figure 2) and continuously inspecting the test piece for structural failure [see item f) in the

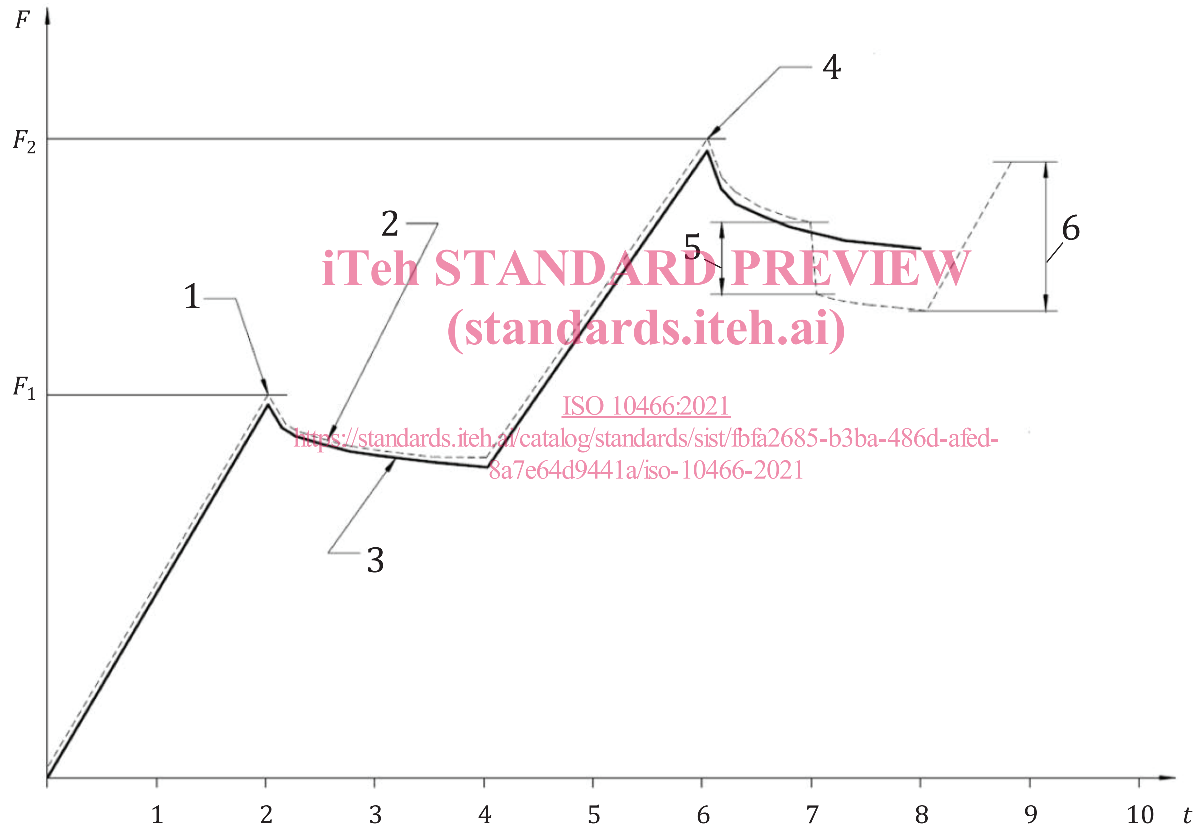
NOTE to Clause 4] in accordance with the visual evidence of structural failure (see 3.4) the strength-reduction evidence of structural failure (see 3.5) unless otherwise specified.

8.3.5 If no instantaneous drop in load is detected during the inspection period, record that no failure has occurred and unload the test piece. If strength-reduction evidenced by an instantaneous drop in load of not more than 10 % of F_2 is detected during the inspection period, determine the size of the drop and increase the load at the end of the inspection period by twice this value (maximum 20 % of F_2).

If the test piece withstands the increased load, record that no failure has occurred and unload the test piece.

If the test piece does not withstand the increased load, record that failure has occurred and unload the test piece.

If the instantaneous drop in load is more than 10 % of F_2 during the inspection period, record that failure has occurred and unload the test piece.



Key

F	load	3	normal case
t	time, in min	4	second relative deflection limit
1	first relative deflection limit	5	maximum load drop: $0{,}1 \cdot F_2$
2	exceptional case	6	minimum load increase: twice the load drop

Figure 2 — Schematic diagram of load versus time

9 Test report

The test report shall include the following information:

a) a reference to this document (i.e. ISO 10466:2021) and to the referring standard;

