BSI Standards Publication

Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the long-term ultimate bending strain and the long-term ultimate relative ring deflection under wet conditions

bsi.

National foreword

This British Standard is the UK implementation of ISO 10471:2018.

The UK participation in its preparation was entrusted to Technical Committee PRI/88/2, Plastics piping for pressure applications.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2018.

Amendments/corrigenda issued since publication

Date	Text affected

INTERNATIONAL STANDARD

ISO
10471

Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the long-term ultimate bending strain and the long-term ultimate relative ring deflection under wet conditions

Tubes en plastiques thermodurcissables renforcés de verre (PRV) — Détermination de l'effort à la flexion ultime à long terme et réflexion annulaire relative ultime à long terme dans des conditions mouillées

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 on 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 the following URL: 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 10471:2003), which has been technically revised. It also incorporates the Amendment ISO 10471:2003/Amd1:2010.

The major changes to this edition include:

— reference to ISO 3126 for dimension measurement;

— clarification of accuracy statements;

— inclusion of calculation procedure for spring-line failures.

Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the long-term ultimate bending strain and the long-term ultimate relative ring deflection under wet conditions

1 Scope

This document specifies a method for determining by extrapolation the long-term ultimate ring bending strain and the calculation of the long-term ultimate relative ring deflection of glass-reinforced thermosetting plastics (GRP) pipes, under wet conditions.

Two methods of loading are given, one using plates the other beam bars.

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, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of initial specific 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:

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

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

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
mean diameter
d_m
diameter of the circle corresponding with the middle of the pipe wall cross-section and given by either of the following formulae:

$$d_m = d_i + e$$

$$d_\mathrm{m} = d_\mathrm{e} - e$$

where

d_i is the internal diameter, in metres (m);

d_e is the external diameter, in metres (m);

e is the wall thickness of the pipe, in metres (m).

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

3.3
vertical deflection
y
verticalchangeindiameterofapipeinahorizontalpositioninresponsetoa *vertical compressive force* ([3.1](#))

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

3.4
relative vertical deflection
y/d_m
ratio of the *vertical deflection*, y ([3.3](#)), to the *mean diameter* ([3.2](#)) of the pipe, d_m

3.5
ultimate vertical deflection under wet conditions
$y_\mathrm{u,\,wet}$
vertical deflection ([3.3](#)) of the pipe, y, when failure occurs under wet conditions (see [Clause 4](#))

Note 1 to entry: Ultimate vertical deflection under wet conditions is expressed in metres.

3.6
ultimate relative vertical deflection under wet conditions
$y_\mathrm{u,\,wet}/d_\mathrm{m}$
ratio of the *ultimate vertical deflection under wet conditions*, $y_\mathrm{u,\,wet}$ ([3.5](#)), to the *mean diameter* ([3.2](#)) of the pipe, d_m

3.7
long-term ultimate ring deflection under wet conditions
$y_\mathrm{u,\,wet,\,x}$
extrapolated value of the *ultimate vertical deflection under wet conditions* ([3.5](#)) of the pipe, $y_\mathrm{u,\,wet}$, when failure is expected to occur at a time, x, specified in the referring standard

Note 1 to entry: Long-term ultimate ring deflection under wet conditions is expressed in metres.

3.8
long-term ultimate relative ring deflection under wet conditions
$y_\mathrm{u,\,wet,\,x}/d_\mathrm{m}$
ratio of the long-term *ultimate ring deflection under wet conditions* ([3.7](#)) of the pipe, $y_\mathrm{u,\,wet,\,x}$, to the *mean diameter* ([3.2](#)) of the pipe, d_m

3.9
failure
loss of the structural integrity of a test piece as evidenced by the inability of the test piece to carry the load

3.10
time to failure
t_u
time elapsed until *failure* (3.9) occurs

Note 1 to entry: Time to failure is expressed in hours.

3.11
specific ring stiffness
S
physical characteristic of a pipe, that is a measure of the resistance to ring deflection per metre length under external load and is defined by the following formulae

$$S = \frac{E \times I}{d_m^3}$$

where

E is the apparent modulus of elasticity, in newtons per square metre, determined by testing in accordance with ISO 7685;

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.

$$I = \frac{e^3}{12}$$

where

e is the wall thickness of the pipe, in metres (m);

d_m is the mean diameter of the pipe, in metres (m) (see 3.2).

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

3.12
initial specific ring stiffness
S_0
value of *specific ring stiffness S* (3.11), determined by testing in accordance with ISO 7685

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

3.13
strain factor
D_g
dimensionless factor used to transform a deflection value into a strain value

4 Principle

Each of several cut lengths of pipe is supported horizontally and loaded throughout its length to compress it diametrically to achieve a desired level of strain. The force application surfaces are either bearing plates or beam bars.

The pipe is immersed in water at a given temperature for a period of time during which the force remains constant and the increasing vertical deflection is measured at intervals until failure (see 3.9) occurs. The relative vertical deflection at failure [ultimate relative vertical deflection, $y_{u,\,wet}/d_m$ (see 3.6)] is converted into a bending strain at failure (ultimate bending strain, $\varepsilon_{u,\,wet}$, in percent), either calculated using Formula (1) or determined from a strain-deflection calibration curve (see 10.3).

The strain may also be measured directly by the use of waterproofed strain gauges.

The following strain calculations assume that the neutral axis is at the pipe wall midpoint. For pipe wall constructions that produce an altered neutral axis position, it is necessary to evaluate results by substituting $2\bar{y}$ for the wall thickness e where $\bar{y}$ is the distance from the appropriate pipe surface to the neutral axis. The neutral axis position shall be determined using an appropriate method, e.g. calculation or use of strain gauge couples.

$$\varepsilon_{u,wet} = D_g \times \frac{e}{d_m} \times \frac{y_{u,wet}}{d_m} \times 100 \tag{1}$$

where for crown or invert failures:

D_g is calculated using Formula (2):

$$D_g = \frac{4{,}28}{\left(1 + \dfrac{y_{u,wet}}{2 \times d_m}\right)^2} \tag{2}$$

where for spring line failures:

D_g is calculated using Formula (3):

$$D_g = \frac{2{,}44}{\left(1 + \dfrac{y_{u,wet}}{2 \times d_m}\right)^2} \tag{3}$$

where

$y_{u,\,wet}$	is the ultimate vertical deflection under wet conditions, in metres (m);
d_m	is the mean diameter of the pipe (see 3.2), in metres (m);
e	is the mean wall thickness of the pipe at crown, invert or spring-lines as appropriate, in metres (m).

These values of ultimate bending strain and the applicable times, t_u (see 3.10), are used in the procedures described in ISO 10928 to determine the long-term ultimate bending strain under wet conditions, $\varepsilon_{u,\,wet,\,x}$.

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

a) the time, x, to which the values are to be extrapolated (see 3.7 and 3.8);

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

c) the length and number of test pieces (see Clauses 6 and 7);

d) the distribution of the times to failure (see 10.8);

e) the pH of the test water.

This standard test procedure is to determine and analyse the bending strains induced by the vertical deflections. This procedure accommodates sample to sample variation and results in a strain versus time expression applicable to a range of pipe classifications.

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 and immersed in water can be compressed vertically and maintained under a constant force for the duration of the test in accordance with 10.7.

Ensure that the applied force is not affected by buoyancy effects or friction.

For test pieces subjected to high forces, for which failure is expected to occur within 100 h, an automatic recording device can help in recording failure times and deflections accurately. Such devices are useful for all test samples.

5.2 Force application surfaces

5.2.1 General arrangement

The method allows the use of either bearing plates or beam bars for loading the test piece, subject to reporting the choice used. Either method may be used for measurements of relative vertical deflection up to 28 %. When it is expected that 28 % deflection is going to be exceeded then the procedure is limited to the use of at least one beam bar.

The surfaces shall be provided by a pair of bearing plates, in accordance with 5.2.2, or a pair of beam bars, in accordance with 5.2.3, or a combination of one such plate and one such bar. However, if the applied force is expected to cause a relative deflection in excess of 28 %, at least one of the surfaces shall be a beam bar. The surface's major axes shall be perpendicular to and centred on the direction of application of force F by the compressive loading machine, as shown in Figure 1. The surfaces to be in contact with the test piece shall be flat, smooth, clean and parallel.

5.2.2 Plates

The plate(s) shall have a width of at least 100 mm and a length at least equal to the length of the test piece (see Clause 6). They shall be sufficiently stiff so that they do not visibly bend or otherwise deform during the test.

5.2.3 Beam bars

Each beam bar shall be sufficiently stiff that it does not visibly bend or otherwise deform during the test. Each beam bar shall have a length at least equal to the length of the test piece (see Clause 6) and a flat face (see Figure 1) without sharp edges. The width of the flat face shall be 15 mm to 55 mm.

The beam bars shall be constructed and supported so that no other surface of the beam bar structure comes into contact with the test piece during the test.

5.3 Water container

A container large enough is required to accommodate submerged test pieces in accordance with Clause 6 while they are subject to the compressive force in accordance with 10.6 and containing test water maintained at the specified temperature (see Clause 4).

The water level shall be maintained sufficiently constant to avoid any significant effect on the value of the vertical force applied to the test piece.

5.4 Measuring devices

The requirements for the measuring devices are as follows:

a) The devices used to measure dimensions (length, diameter, wall thickness) as specified in Clause 8 shall have a calibrated accuracy of within ±1 % of the dimension being measured.

b) The devices used to measure deflection of the test piece in the vertical direction during the test shall have a calibrated accuracy of within ±1 % of the initial deflection value.

c) The devices used to measure load shall have a calibrated accuracy of ±1 % of the value applied.

When selecting the device to measure the change in diameter of the test piece, consideration should be given to the potentially corrosive environment in which the device is to be used.

a) Plate loading   b) Beam bar loading
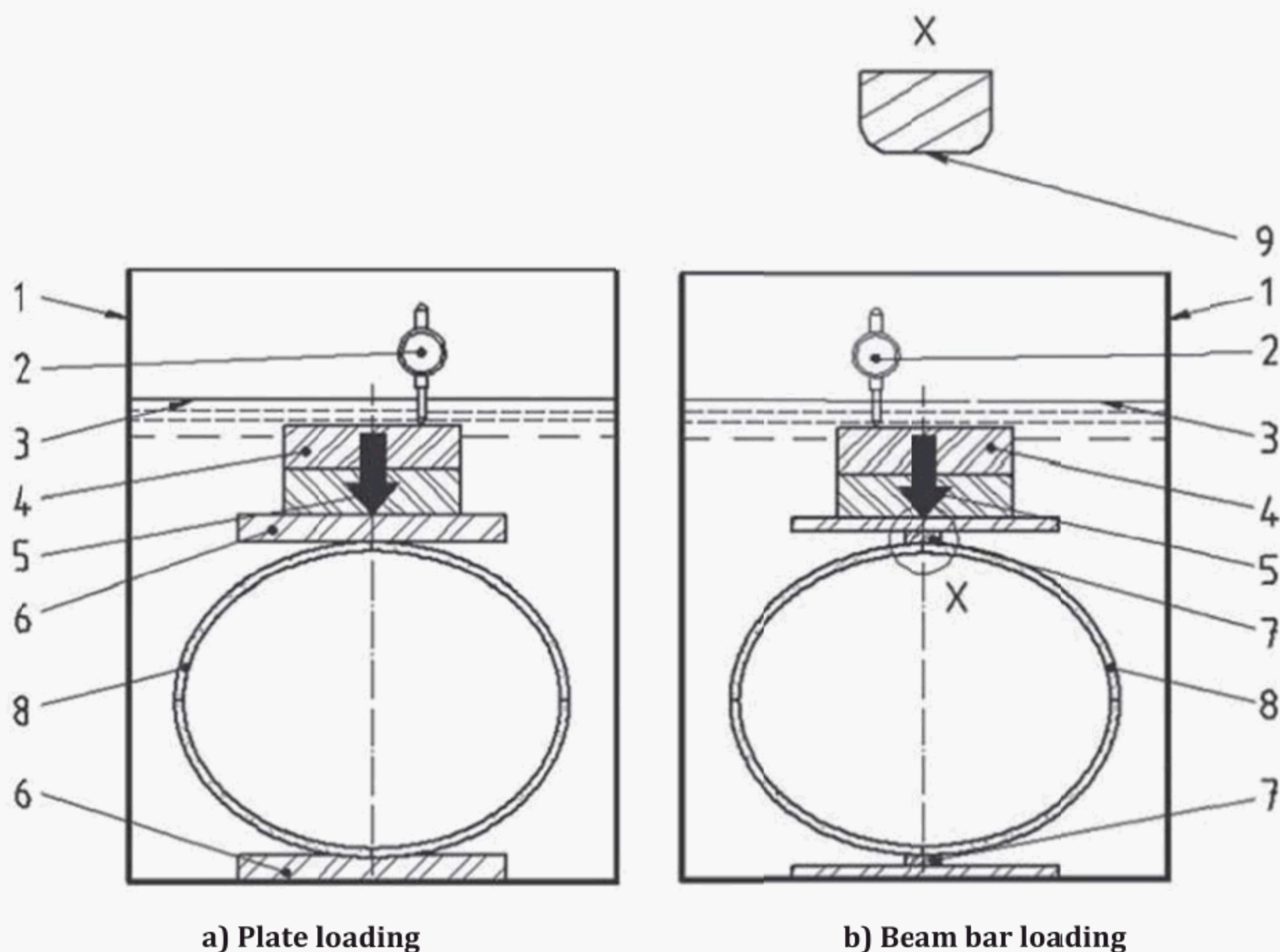
Key

1	water container	6	bearing plate
2	deflection-measuring device	7	beam bar
3	water level	8	test piece
4	dead-weights	9	flat face
5	direction of compressive force, F		

Figure 1 — Typical test arrangements

6   Test piece

The test piece shall be a complete pipe ring. The length, L, in metres, of the test piece shall be as specified in the referring standard, subject to permissible deviations of ±5 %. If not specified in the referring standard, the length of the test piece shall be (300 ± 15) mm.

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

Four straight lines shall be drawn on either the inside or the outside along the length of the test piece at 90° to each other, to serve as reference lines.

7 Number of test pieces

Unless otherwise specified in the referring standard, at least 18 test pieces shall be used to obtain the distribution of failure times specified in the referring standard (see the numbered list in Clause 4).

8 Determination of the dimensions of the test piece

8.1 Length

Measure the length of each test piece along each reference line in accordance with ISO 3126. Trim or replace, as applicable, the test piece if it does not conform.

Calculate the mean length, L, in metres, of each test piece from the six measured values.

8.2 Wall thickness

Measure in accordance with ISO 3126 the wall thickness of each test piece at four equally spaced locations on each reference line.

For each reference line, calculate the mean wall thickness, e, in metres, of the four measured values.

Calculate the sample mean wall thickness using all thickness values.

8.3 Mean diameter

Measure in accordance with ISO 3126 either the internal or external diameter (see 3.2).

Using either Formula (1) or Formula (2), calculate the mean diameter, d_m (see 3.2), of the test piece using the value obtained for the sample mean wall thickness, e, in 8.2.

9 Conditioning

If applicable, condition the test pieces in accordance with the referring standard.

10 Procedure

10.1 For each test piece conduct the following procedure at the temperature specified in the referring standard (see Clause 4).

10.2 To assess the uniformity of the test pieces, determine and record in accordance with the constant load procedures in ISO 7685 the initial specific ring stiffness, S_0, of each test piece. The measured value of S_0 at the pair of reference lines (see Clause 6) may also be used to estimate the force required to compress the test piece to the necessary deflection to achieve a time to failure that, together with those produced from other test pieces, conforms to the distribution of times to failure specified in the referring standard.

10.3 Deflections in excess of 28 % of the diameter may cause local flattening of the pipe and lead to erratic test results. For deflections approaching 28 %, improved accuracy is obtained by use of strain gauges to establish, for each pipe product, a calibration scale of deflection versus measured strain. This calibration technique is useful at all deflection levels. If such a calibration procedure is established then it shall be used to determine the strains for all test pieces in the test series.

10.4 Place a test piece in the apparatus in contact with the upper and lower plate or beam bar with the pair of diametrically opposed reference lines vertically aligned. However, if the applied force is expected to result in relative deflections that can be in excess of 28 %, use at least one beam bar. Ensure that the

contact between the test piece and each bearing plate or beam bar is as uniform as possible and the plates and/or beam bars are not tilted laterally. Place the apparatus in the water container.

10.5   Fill the container with water so that the test piece is fully immersed.

10.6   When the test piece is fully immersed in the water and taking account, as necessary, of the weight of the upper plate or beam bar, and of any spacer, apply the vertical compressive force, F, so that the corresponding vertical deflection is reached within 3 min and record the actual force applied and deflection achieved.

10.7   While maintaining the force applied in 10.6, measure and record at predetermined intervals of time the elapsed time and the deflection of the test piece, using either suitable manual devices or automatic recording equipment. When failure (see 3.9) occurs, the time to failure, t_u, and the deflection at failure, y_u, wet, shall be taken as:

a)   either the elapsed time and its associated deflection recorded on the automatic device (the preferred, recommended and most accurate method);

b)   or the last recorded readings, prior to failure occurring, of deflection and its associated time.

NOTE Table A.1 gives values of equal lg (time in h) increments which can be useful to the operator.

10.8   Continue the procedure detailed in 10.2 to 10.7 inclusive until at least 18 test pieces have failed with the distribution of times to failure specified in the referring specification. However, if 16 test pieces have failed and two others have been on test for more than 10 000 h without failing, then these two test pieces may be included in the data at their current elapsed time and deflection if it provides sufficient data for extrapolation and the distribution of failure times required by the referring standard will be satisfied.

10.9   Convert the relative vertical deflection at failure [ultimate relative vertical deflection, $y_{u, wet}/d_m$ (see 3.6)] determined in accordance with 10.7 and 10.8 into a bending strain at failure (ultimate bending strain), $\varepsilon_{u, wet}$, in percent, using Formulae (1) and (2) or (3) as appropriate or as determined by deflection-strain calibration.

11 Calculation

11.1 Extrapolation of the strain data to obtain the x-year value, $\varepsilon_{x, wet}$

Determine lg (time to failure in h), t_u (see 3.10), and lg (bending strain at failure in percent) from the series of calculated bending strains at failure and their associated times obtained in accordance with 10.9.

From this data, determine, in accordance with ISO 10928, the formula of the strain regression line. Using this formula, calculate the extrapolated long-term ultimate bending strain under wet conditions at x years, lg ($\varepsilon_{u, wet, x}$) and then the long-term ultimate bending strain, $\varepsilon_{u, wet, x}$, in percent.

If required by the referring standard, use the data obtained in accordance with 10.9 and plot lg (bending strain at failure) as a function of lg (time in h), i.e. the strain regression line.

NOTE The failure deflections (instead of strains) and times to failure can also be extrapolated using the procedures of ISO 10928 to determine a long-term relative ring deflection. However, the extrapolation of strains is felt to be a more accurate approach.

11.2 Calculation of the long-term ultimate relative ring deflection under wet conditions, $y_{u, wet, x}/d_m$

Where it is required to express the long-term ultimate relative ring deflection under wet conditions in percent, $y_{u, wet, x}/d_m$ (see 3.8), convert the long-term ultimate bending strain, $\varepsilon_{u, wet, x}$, determined in 11.1 to a deflection, in percent.

12 Test report

The test report shall include the following information:

a)   a reference to this document, i.e. ISO 10471 and the referring standard;

b)   full identification of the pipe tested;

c)   the number of test pieces;

d)   the dimensions of each test piece;

e)   the positions in the pipe from which the test pieces were obtained;

f)   the initial specific ring stiffness, S_0, of the test pieces (see 10.2);

g)   if applicable, details of any conditioning (see Clause 9);

h)   for each test piece, whether the cut ends were sealed (see Clause 6);

i)   equipment details, including whether beam bars and/or plates were used and, if beam bars were used, the width of the flat face;

j)   the temperature and pH of the test water (see 5.3 and 10.1);

k)   if required by the referring standard, the plot of ultimate bending strain versus time (see 11.1);

l)   the calculated long-term ultimate bending strain under wet conditions, $\varepsilon_{u, wet, x}$;

m)   if required, the calculated long-term ultimate relative ring deflection under wet conditions, $y_{u, wet, x}/d_m$ (see 11.2);

n)   a description of the test pieces after testing;

o)   any factors which may have affected the results, such as any incidents or any operating details not specified in this document;

p)   for each test piece, the dates and duration of the test period, in hours;

q)   for each test piece, the load applied and the initial strain;

r)   for each test piece, the deflection and strain at failure, and the location of the failure;

s)   if applicable, any strain-deflection calibration curves.

Annex A
(informative)

Equal increments of lg (time in h)

Table A.1 presents intervals of time, in minutes, hours or days, which correspond to successive equal increments of 0,1 in lg (time in h). This information is provided for assistance in scheduling measurements of the deflection of the test pieces.

Table A.1 — Times comprising equal increments of lg (time in h)

lg (time in h)	Time			lg (time in h)	Time		
	min	h	days		min	h	days
0,0	60	1	0,042	2,5	18 974	316	13,18
0,1	76	1,3	0,052	2,6	23 886	398	16,59
0,2	95	1,6	0,066	2,7	30 071	501	20,88
0,3	120	2,0	0,083	2,8	37 857	631	26,29
0,4	151	2,5	0,105	2,9	47 660	794	33,10
0,5	190	3,2	0,132	3,0	60 000	1 000	41,7
0,6	239	4,0	0,166	3,1	75 536	1 259	52,5
0,7	301	5,0	0,209	3,2	95 094	1 585	66,0
0,8	379	6,3	0,263	3,3	119 716	1 995	83,1
0,9	477	7,9	0,331	3,4	150 713	2 512	104,7
1,0	600	10	0,42	3,5	189 737	3 162	131,8
1,1	755	13	0,52	3,6	238 864	3 981	165,9
1,2	951	16	0,66	3,7	300 712	5 012	208,8
1,3	1 197	20	0,83	3,8	378 574	6 310	262,9
1,4	1 507	25	1,05	3,9	476 597	7 943	331,0
1,5	1 897	32	1,32	4,0	600 000	10 000	416,7
1,6	2 389	40	1,66	4,1	755 355	12 589	524,6
1,7	3 007	50	2,09	4,2	950 936	15 849	660,4
1,8	3 786	63	2,63	4,3	1 197 157	19 953	831,4
1,9	4 766	79	3,31	4,4	1 507 132	25 119	1 046,6
2,0	6 000	100	4,17	4,5	1 897 367	31 623	1 317,6
2,1	7 554	126	5,25	4,6	2 388 643	39 811	1 658,8
2,2	9 509	158	6,60	4,7	3 007 123	50 119	2 088,3
2,3	11 972	200	8,31	4,8	3 785 744	63 096	2 629,0
2,4	15 071	251	10,47	4,9	4 765 969	79 433	3 309,7

This page deliberately left blank

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit, or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

Storing and using standards

Standards purchased in soft copy format:

- A British Standard purchased in soft copy format is licensed to a sole named user for personal or internal company use only.

- The standard may be stored on more than 1 device provided that it is accessible by the sole named user only and that only 1 copy is accessed at any one time.

- A single paper copy may be printed for personal or internal company use only.

- Standards purchased in hard copy format:

- A British Standard purchased in hard copy format is for personal or internal company use only.

- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than 1 copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright & Licensing team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email subscriptions@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Useful Contacts

Customer Services
Tel: +44 345 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 345 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.