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Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of time to failure under sustained internal pressure

Systèmes de canalisations en plastiques — Tubes en plastiques thermodurcissables renforcés de verre (PRV) — Détermination du temps mis jusqu'à la défaillance sous une pression interne constante

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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).

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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 06, *Reinforced plastics pipes and fittings for all applications*.

This second edition cancels and replaces the first edition (ISO 7509:2000), which has been technically revised.

Introduction

This International Standard describes a method for determining the long-term resistance to internal pressure of glass-reinforced thermosetting plastics (GRP) pipes.

It is a method which uses the following conditions:

— water as the reference liquid inside the test piece;

— water or air, as the environment outside the test piece.

The method can be used for tests at different temperatures. It should be noted that, for a given temperature, the results obtained can differ depending on the end loading conditions and whether the external environment is water or air.

The method described in this International Standard differs from those in some other similar standards in the following details:

— the failure criteria and the detection of failure;

— the strain in the longitudinal and circumferential directions can be measured during the test;

— the test pressure is maintained constant.

This method can be used to obtain data to establish internal pressure versus time-to-failure relationships at different temperatures. The procedures for establishing the relationships are not within the scope of this International Standard. For such purposes, attention is drawn to ISO 10928.

Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of time to failure under sustained internal pressure

1 Scope

This International Standard specifies a method for determining the time-to-failure of glass-reinforced thermosetting plastics (GRP) pipes under internal hydrostatic pressure at a specified temperature. The external environment can be air or water.

NOTE For other internal or external environments, the referring standard is to specify any additional requirement.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 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.

3.1
failure
occurrence of bursting, leaking, or weeping

Note 1 to entry: See 9.1.

3.2
bursting
failure by rupture of the pipe wall with immediate loss of test liquid and drop of pressure

Note 1 to entry: See 9.1 and 9.2.1.

3.3
leaking
failure by visible loss of the pressurizing liquid through the pipe wall to an extent detectable visually and/or by a continuous drop in pressure

Note 1 to entry: See 9.1 and 9.2.1

3.4
weeping
failure by passage of the pressurizing liquid through the pipe wall to an extent detectable visually and/or electronically

Note 1 to entry: See 9.1 and 9.2.2.

4 Principle

A cut length of pipe at the required temperature is subjected to a specified internal hydrostatic pressure to cause a state of stress in the pipe wall, which depends upon the loading conditions (i.e. with or without the effects of end thrust being carried by the pipe wall). The results of tests at different end loading conditions will be different even for the same pipe. Water or air may be used as the environment outside of the test piece.

The test samples are held at the test pressure until failure occurs. Typically, the time to failure is longer at lower pressures (stresses).

In general, a series of tests are conducted over various failure times and the results obtained are analysed in accordance with ISO 10928 to establish a long term value. The number of tests required, the appropriate time intervals, and the time at which a value is established (time to failure) are given in the referring standard.

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

a) whether or not the test piece is to be loaded by the hydrostatic end thrust while under pressure (5.2);

b) free length, *L*, of the test piece (see 6.2);

c) number of test pieces (see 6.1);

d) test temperature and its tolerance (see 8.1);

e) if and what strain measurements are required (see 8.2);

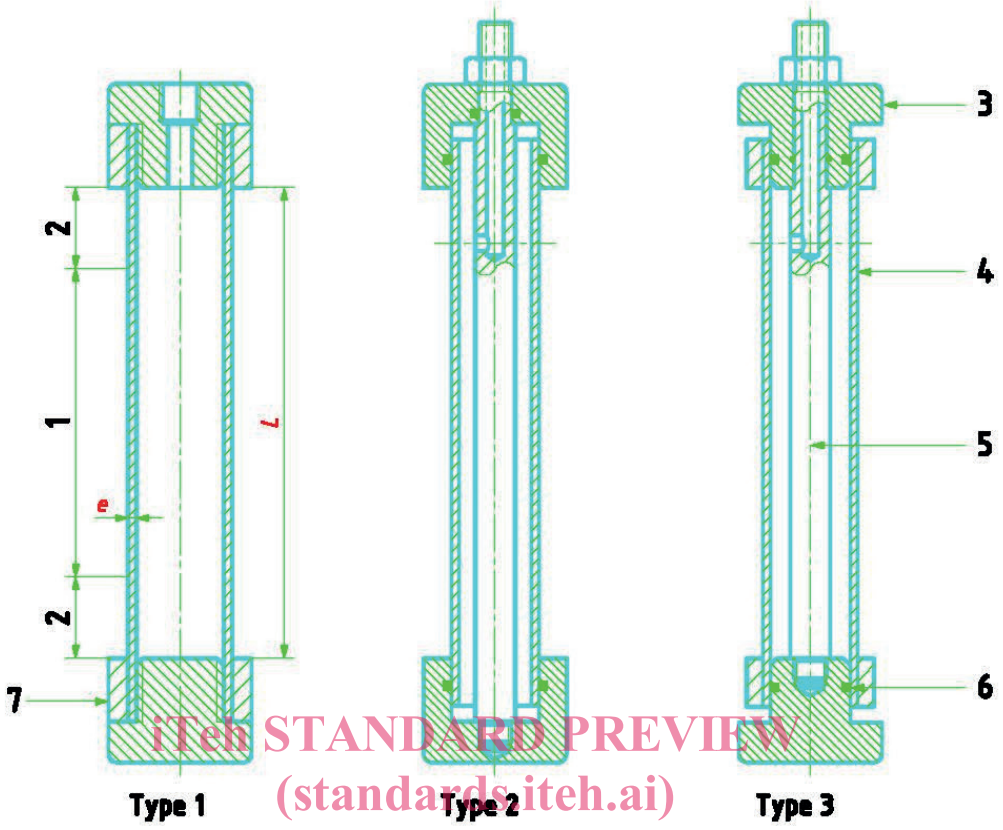
f) external environmental fluid, i.e. water or air (see 8.3) or other environment (see Note in Clause 1);

g) internal environmental fluid, if not water or a test liquid for the purposes of 5.7 and 9.2.2 (see Note in Clause 1).

5 Apparatus

5.1 Dimensional measurement devices, for determining length, diameter, and wall thickness with an accuracy of within ±1,0 %.

5.2 End sealing devices, for the test piece, capable of inducing the specified state of stress, i.e. with or without hydrostatic end thrust (see Figure 1). The end sealing concepts shown in Figure 1 are only typical and other configurations are possible.



Key

1 valid failure zone

2 end fixture influence zone, equal to $3{,}3\times([\mathrm{DN}]\times e)^{0{,}5}$

3 end cap

4 test specimen

5 tie rod to carry end thrust

6 elastomeric seal

7 end seal device

e wall thickness

L free length between end fixtures

Type 1 testing with end thrust

Type 2 testing without end thrust, external seals

Type 3 testing without end thrust, internal seals

Figure 1 — Typical arrangements for pressure testing of pipes

5.3 Test piece support(s), as necessary to minimize deformation of the test piece due to its own weight. Such support(s) shall not constrain the test piece circumferentially or longitudinally.

5.4 Container for water, if tested with water as the external environment (see 8.3), equipped so that the specified temperature can be maintained uniformly throughout the liquid.

NOTE This can require circulation.