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Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test method to prove the structural design of fittings

Systèmes de canalisation en matières plastiques — Tubes et raccords plastiques thermodurcissables renforcés de verre (PRV) — Méthode d'essai pour prouver la conception structurelle des raccords

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Foreword

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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).

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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 6, *Reinforced plastics pipes and fittings for all applications*.

Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test method to prove the structural design of fittings

1 Scope

This International Standard specifies methods of test for fittings of any form, i.e. bends, branches, tapers, intended to be used in plastics piping systems for pressure and non-pressure drainage and sewerage or water supply made of glass-reinforced thermosetting plastics (GRP). This International Standard is applicable to fittings, in order to test their structural design, but is not applicable to connecting joint systems. It assumes that the fitting either is or is not intended to be subject to the effects of hydrostatic end thrust.

The tests detailed in 8.1 to 8.4 are applicable to fittings intended to be used in buried or non-buried applications.

These test procedures are applicable to fittings of all nominal sizes specified in the referring standard. The tests are for evaluating fittings intended for use in applications conveying liquids at temperatures specified in the referring standards.

The test procedures in this International Standard are damaging to the test piece which will not be suitable for reuse after these tests. The test procedure is applicable to type testing.

NOTE This International Standard is not intended to be used for the assessment of the performance of non-integrated joints as there are already international test methods for this purpose. See Bibliography.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
pressure
hydrostatic gauge pressure

3 Principle

A fitting is subjected to a specified internal pressure with or without end thrust. The procedure includes prolonged static tests at elevated pressures.

At the end of each of the tests, the test piece is inspected for signs of failure as defined in 8.2.

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

a) number of test pieces to be used (see 5.2);

b) if applicable, conditioning other than given in Clause 6;

c) test temperature and its permissible deviations (see Clause 7);

d) nominal pressure relevant to the fitting under test (see 5.1 and Clause 8);

e) if applicable, any criteria indicative of structural damage to the fitting [see Clause 8 and Clause 9 i)];

f) whether the fitting is or is not to be tested with end loads.

4 Apparatus

4.1 End sealing devices

4.1.1 General

End sealing devices shall be of a size and type appropriate to the fitting under test.

4.1.2 Capable of applying the end loads

If the fitting is to be tested with the end load [see Clause 3 f)], then the end sealing devices shall be anchored to transfer internal pressure end thrust to the fitting.

4.1.3 Not capable of applying the end loads

If the fitting is to be tested without the end load [see Clause 3 f)], then the end-sealing devices shall not be anchored to the fitting. Typically, the end caps for such applications rely on tie-rod(s) through the bore of the test piece or on an external structure to resist internal pressure end thrust.

4.2 Supports

4.2.1 End thrust supports

If required, the end thrust supports shall comprise part of the test rig and shall be capable of supporting the end thrust induced by the internal pressure but shall not otherwise support the fitting. Non-end thrust loaded fittings can be tested using appropriately designed reinforced concrete encasements. For branches, the branch pipe shall be designed to resist end-loading due to end thrust. The header pipe can be tested either with or without the end-load thrust.

NOTE If concrete encasements are used, their design and reinforcement are to be described in detail to ensure that the design of the thrust supports represents the actual conditions on site.

4.2.2 Straps and Cradles

If used, straps or cradles for use as supports shall be of sufficient width for the fitting components of the test piece and shall not have a detrimental effect on the test piece, e.g. shall not apply point loads.

4.3 Source of hydrostatic pressure

A source of hydrostatic pressure to meet the needs of the test.

4.4 Means to measure the gauge pressure

A means to measure the gauge pressure which has a calibrated accuracy within 1 % at the specified gauge pressure (see 8.3 and 8.4.)

5 Test pieces

5.1 Test arrangement

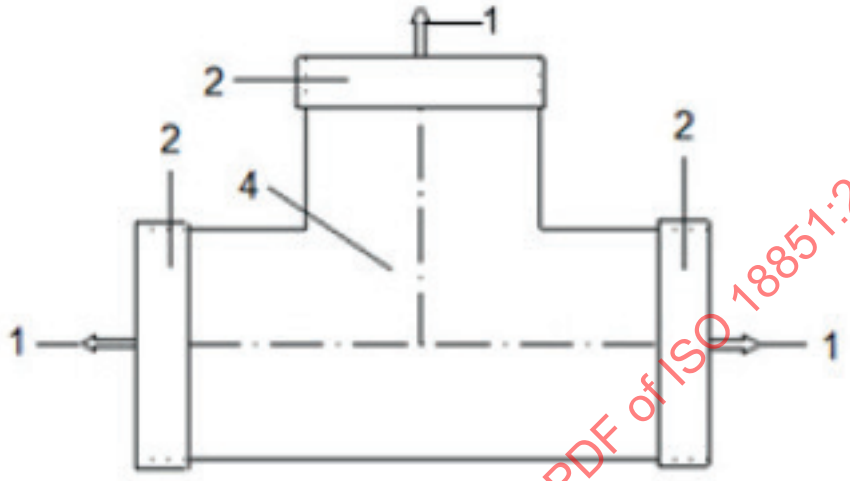
The test piece shall comprise a fitting of the correct size and pressure class, including appropriate end sealing devices.

For the tests detailed in 8.3 and 8.4, the arrangement shall be as shown in Figure 1.

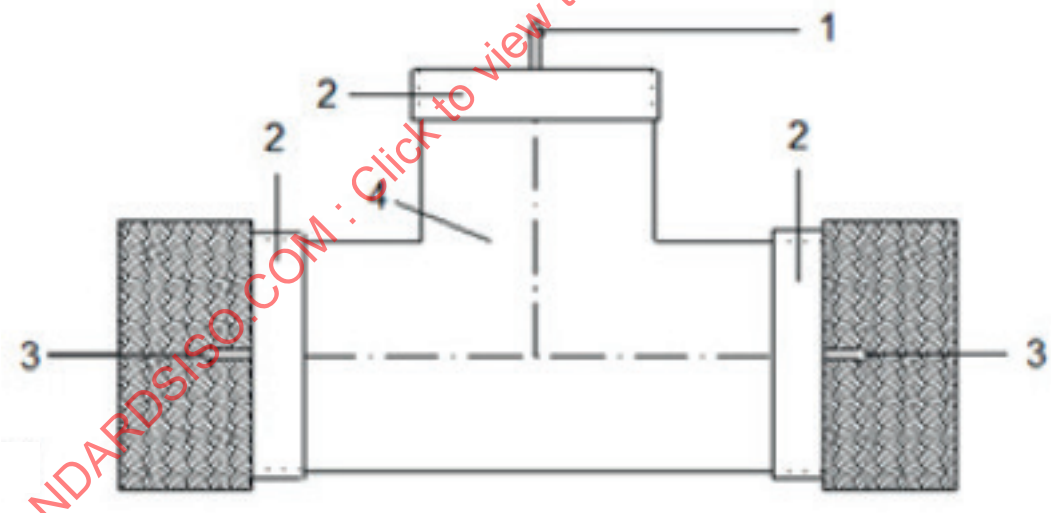
The test piece shall be assembled in accordance with the manufacturer's recommendations and the requirements of the referring standard.

5.2 Number of test pieces

Unless otherwise specified, the number of test pieces shall be one.



a) Arrangement with end loads



b) Arrangement without end loads

Key

1 thrust carried by test piece
2 end sealing device
3 thrust carried by test rig
4 fitting being tested

Figure 1 — Typical test arrangement for a branch for the tests detailed in 8.3 and 8.4

NOTE Figure 1 shows test arrangements for a branch. Any other type of fitting can be tested using the procedures mentioned in this International Standard.

6 Conditioning

Unless otherwise specified in the referring standard, following assembly and filling, the filled test piece shall be conditioned by storing at the test temperature (see Clause 7) for at least 24 h prior to testing until the required temperature is reached (medium and test sample).

NOTE Conditioning time is a function of pipe specimen wall thickness, water volume, temperature differential, the film heat transfer coefficient, and whether the elevated temperature environment is applied to one or both sides of the specimen.

7 Test temperature

Conduct the following procedure in Clause 8 at the temperature specified in the referring standard.

8 Procedure

8.1 Tests to be performed

Subject the test piece (see Clause 4) to the tests in 8.3 and 8.4 and summarized in Table 1. Fittings intended to carry end thrust shall be tested in this condition. Fittings not intended to carry end thrust shall be tested with the end sealing devices not restrained to the fitting but with the end load carried by independent supports. The pressure gauge shall measure the hydrostatic pressure applied at the top of the fitting.

NOTE Each reference to hydrostatic pressure specifies a positive internal pressure, relative to atmospheric pressure, expressed as multiples of the nominal pressure (PN) that is relevant to the fitting under test.

If a test is interrupted, record the details in the test report and resume after reconditioning (until the required temperature is reached of the medium and test sample). Failure of the testing apparatus (see Clause 4) shall not constitute failure of the test piece, but if the test conditions are invalidated thereby, continue the particular test after replacing the failed component.

8.2 Test Failure Criteria

Failure is the occurrence of bursting, leaking, or weeping.

8.2.1 Bursting

Failure by rupture of the test sample resulting in the immediate loss of test liquid and drop of pressure.

8.2.2 Leaking

Visible failure by loss of the pressurising liquid through the test sample.

8.2.3 Weeping

Failure by loss of the pressurising liquid through the test sample to an extent detectable visually.

NOTE For tests performed at elevated temperature in enclosed conditioning rooms, visual detection might not be practical. Therefore, alternative methods might be used to detect weeping such as electronic detection, colouring of the test liquid, etc.

8.3 Initial leakage

8.3.1 Fill the test piece with water and vent to remove any air.

8.3.2 Apply the internal pressure of 1,5 times the nominal pressure of the fitting, expressed in bar[1)] and maintain it above or equal to that pressure for 15 min (see Table 1).

8.3.3 Inspect the fitting for signs of leakage. If leakage is not present, proceed. Otherwise, stop the test and record the observations.

8.4 Resistance to internal pressure

8.4.1 Perform following procedure:

Steadily increase the pressure to 2,5 times the nominal pressure of the fitting, expressed in bars, and maintain it above or equal to that pressure for 100 h (see Table 1). During this procedure, the fitting shall not show any kind of failure described in 8.2.

8.4.2 Reduce the pressure to atmospheric and empty the test piece.

8.4.3 Inspect the test piece and record any signs of failure of the fitting.

Table 1 — Summary of test requirements

Property to be tested	Test to be performed	Test pressure	Duration	Clause number
Initial leakage	initial pressure	1,5 times PN	15 min	8.3 and Figure 1
Resistance to internal pressure	maintained pressure	2,5 times PN	100 h	8.4 and Figure 1
NOTE Nominal pressure (PN) is an alphanumeric designation of pressure related to the resistance of a component of a piping system to internal pressure.				

9 Test report

The test report shall include the following information:

a) a reference to this International Standard, i.e. ISO 18851:2014, and to the referring standard;

b) whether the fitting was tested with or without end thrust;

c) full identification of the fitting tested;

d) nominal pressure class (PN) of the fitting;

e) temperature range during the test;

f) using clause numbers in this International Standard describe the tests to which the fitting was subjected;

g) internal pressures, in bars, and test duration;

h) any observations of the failure of the fitting during each test;

i) any observations on the condition of the fitting during and after each test;

j) the details of interruptions, if any, to the test sequence;

k) any factors which might have influenced the results, such as any incidents or any operating details not specified in this International Standard;

1) 1 bar = 10^5 N/m^2 = 0,1 MPa.