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Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods to prove the design of locked socket-and-spigot joints, including double-socket joints, with elastomeric seals

Tubes et raccords en plastiques thermodurcissables renforcés de verre (PRV) — Méthodes d'essai pour confirmer la conception des assemblages mâle-femelle verrouillés, y compris ceux à double emboîture avec joints d'étanchéité en élastomère

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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 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 7432:2002), which has been technically revised.

This edition includes the following significant changes compared to the previous edition:

— changed Scope to mention that the test procedure is a destructive test;

— terms and definitions clause added to this document;

— changed testing sequences from mandatory to recommended;

— changed wording from “misalignment” to “deformation”;

— modified test sequence for the proof of the design (Clause 9);

— changes in Table 1 with modified testing sequences for the proof of the design of joints;

— modification of bending test sequence.

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.

Introduction

In a pipework system, pipes and fittings of different nominal pressures and nominal stiffnesses may be used.

A joint may be made between pipes and/or fittings and should be designed such that its performance is equal to or better than the requirements for the pipeline, but not necessarily for the components being joined.

The requirements for the assembly of the joint are not included in this document, but they should be in accordance with the manufacturer's recommendations.

The material-dependent parameters and/or performance requirements are stated in the referring standard.

Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods to prove the design of locked socket-and-spigot joints, including double-socket joints, with elastomeric seals

1 Scope

This document specifies methods of test for joints with a locked socket and spigot, including double-socket joints, and with elastomeric seals, for buried and above ground glass-reinforced thermosetting plastics (GRP) piping systems. It covers methods of test for leaktightness and resistance to damage of the joint only, when subjected to specified combinations of angular movement, compression (deformation) perpendicular to the pipe axis and internal pressure. It assumes that the joint will be exposed to the effects of hydrostatic end thrust.

This document is applicable to joints for either pressure or non-pressure applications. The tests are suitable for the evaluation of joints intended for applications in which the liquids are conveyed at temperatures specified in the referring standards.

The joints tested in accordance with this document are subjected to conditions which measure their ability to function and thereby prove the design of the joint, especially for type test purposes. The joint is only qualified according to the test sequences and configurations detailed in this document.

With the exception of the bending test (see 9.5), the test procedures are applicable to joints for pipes and fittings of all nominal sizes. If not otherwise agreed between the manufacturer and the customer, the bending test detailed in 9.5 is applicable to joints with pipes and fittings up to and including DN 600.

The test procedures in this document are damaging to the test piece, which will not be suitable for reuse after these tests. The test procedure is intended to be applied for type testing purposes.

This document is applicable only to the joint and specifies methods of test to prove its design.

2 Normative references

There are no normative references in this document.

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 http://www.iso.org/obp

3.1
pressure
hydrostatic gauge pressure

Note 1 to entry: Expressed in bar.

3.2
bending
bending in the pipe and coupling configuration as a result of a vertical force on the coupling

3.3
deformation
pipe deformation in the coupling as a result of a vertical force on the pipe and a supported coupling causing a step between the two pipe spigots at the loading position

4 Principle

A test piece comprising two pieces of pipe jointed together, by incorporation of a socket or inclusion of a double-socket coupler, is subjected to specified load conditions, including combinations of bending and deformation. In each specified combination the test piece is subjected to a series of test pressures for specified periods of time, including an internal sub-atmospheric test pressure. This also simulates an external positive pressure.

In addition, a test at elevated positive static pressure is conducted to prove the structural design of the coupling (see Table 1 and 9.6).

In the tests detailed in 9.5 the joint is subjected to a bending load of such a magnitude that the axial tensile stress in the pipe is equal to that developed from a pressure of 0,5 times PN [see Formula (1)].

$$\sigma_b = 0{,}5\frac{0{,}1[\mathrm{PN}]\times(d_i + e)}{4e} \tag{1}$$

In addition, the joint is then pressure tested at 1,5 times PN, which then results in a total axial stress (bending plus pressure), σ_{ax}, equivalent to 2 times PN, i.e.:

$$\sigma_{ax} = \frac{0{,}1[\mathrm{PN}]\times d_i}{2e} \tag{2}$$

When under pressure, the joint is monitored for leakage. After each test condition (see Table 1) the joint is inspected for signs of damage.

NOTE 1 The only reason for testing the joint for resistance to negative pressure is to ensure adequate safety against infiltration of pollutants through the joint into the fluid carried in the piping system. Under the test conditions used, pipes with low stiffness can require support to prevent buckling.

NOTE 2 If not otherwise specified, the ISO product standards ISO 10639, ISO 10467 and ISO 25780 specify the following test parameter. It is assumed these test parameters are also set by other applicable product standards. If this is not the case the parameters detailed in this document and in ISO 10639, ISO 10467 as well as ISO 25780 can be used as default values.

NOTE 3 It is assumed that the following test parameters are set by the standard making reference to this document:

— the nominal size of the components to be connected by the joint (see 6.1);

— the pressure class of the components (see 6.1);

— the total effective length, L, of the test piece (see 6.1);

— the number of test pieces (see 6.2);

— if applicable, the conditioning to be applied (see Clause 7);

— the test temperature (see Clause 8);

— the sequence of testing, if appropriate (see 9.1);

— the test configuration (see Table 1);

— the deformation and bending forces F_1 and F_2 (see 9.3, 9.4, 9.5, and 9.6);

— the permissible change in negative pressure (see 9.2.3).

5 Apparatus

5.1 End-sealing devices

The end sealing devices shall be of sizes and type appropriate to the components under test. The end-sealing devices shall be securely fixed to the pipes to transmit the end thrust loads to the pipes.

5.2 Supports

5.2.1 **Straps or cradles**, for use as follows:

a) a **support R** (item 6 in Figure 2) positioned at least 500 mm from the spigot end of the pipe at the point of balance to provide support during testing with deformation (see 9.3 and 9.4);

b) a **strap or cradle** (100 ± 5) mm wide (item 7 in Figure 2) supporting at least a 120° arc of the socket, as required for deformation testing (see 9.3 and 9.4);

c) a **strap or cradle** (100 ± 5) mm wide supporting an arc up to 180° of the pipe barrel, positioned adjacent to the end of the joint being tested (item 5 in Figure 2) and through which the force F_1 necessary for deformation testing (see 9.3 and 9.4) can be applied;

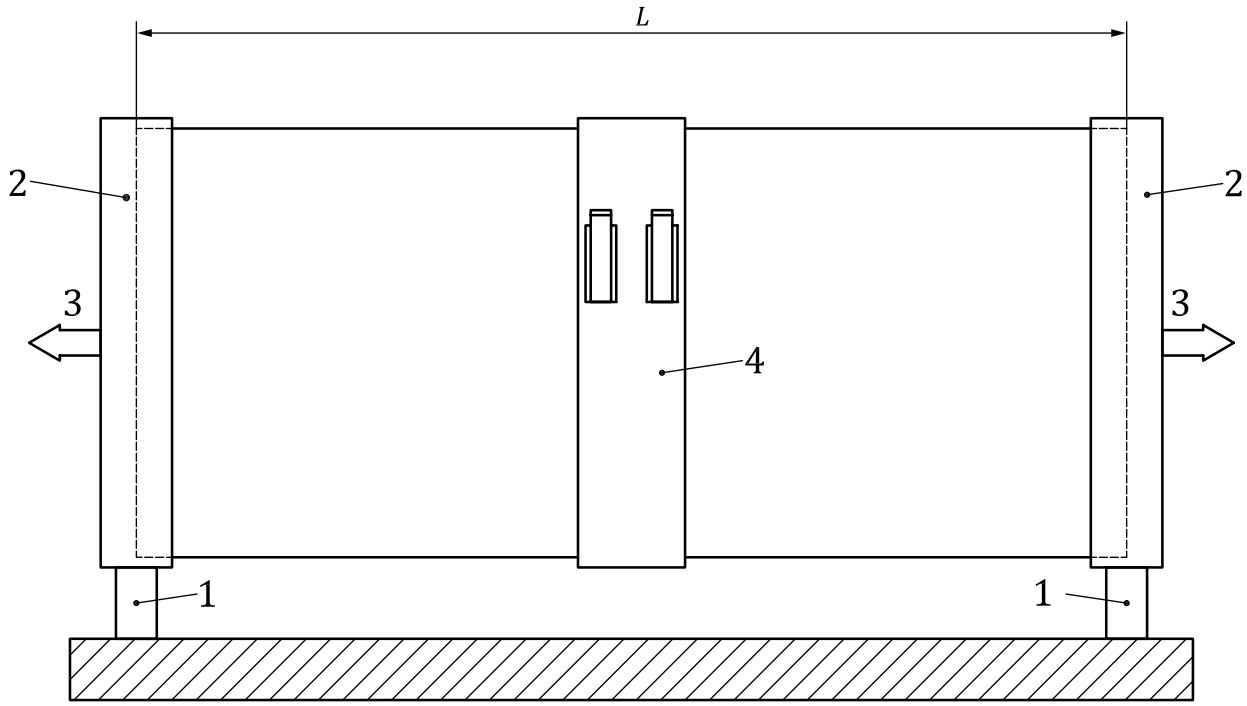
d) a **strap or cradle** (100 ± 5) mm wide supporting an arc up to 180° of the pipe barrel, positioned in the middle of the joint being tested (item 5 in Figure 3) and through which the force F_2 necessary for the bending test (see 9.5) can be applied;

e) **supports** of sufficient width to carry the pipe components of the test piece (item 3 in Figure 2) and designed in such a way that they allow deformation to occur.

The straps or cradles shall not have a detrimental effect on the test piece, e.g. by applying point loads.

5.2.2 Special supports

Special supports shall be used if necessary to prevent buckling of the pipe barrel during deformation (see 9.3 and 9.4) or negative pressure (9.2) testing. Such supports shall be positioned in such a way that they do not affect the force F_1 applied to the joint or the joint's response to such a load.

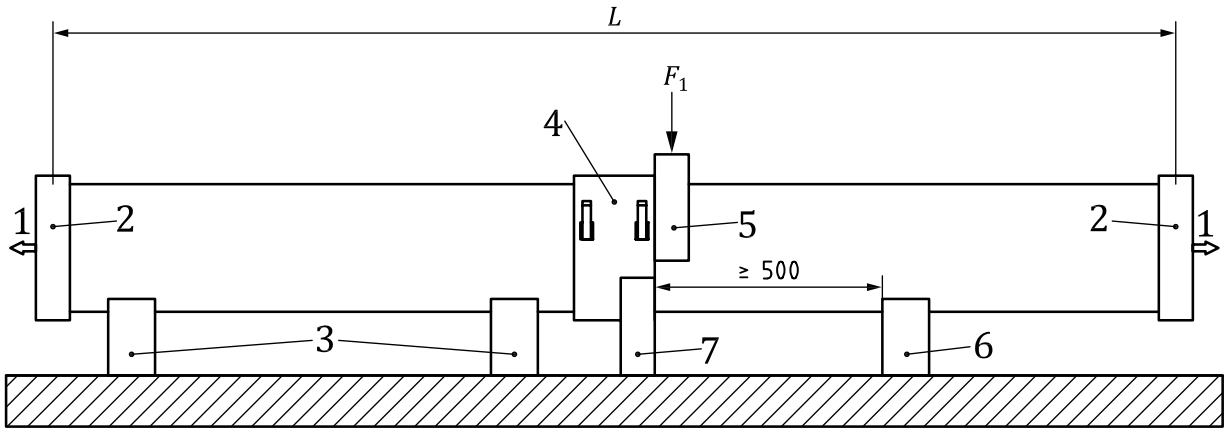


Key

1 support (if required)
2 end-sealing device fixed to test piece
3 thrust transmitted to test piece (will be negative in leaktightness test specified in 9.2)
4 test joint
L total effective length

NOTE The arrangement can be used either horizontally (as shown) or vertically.

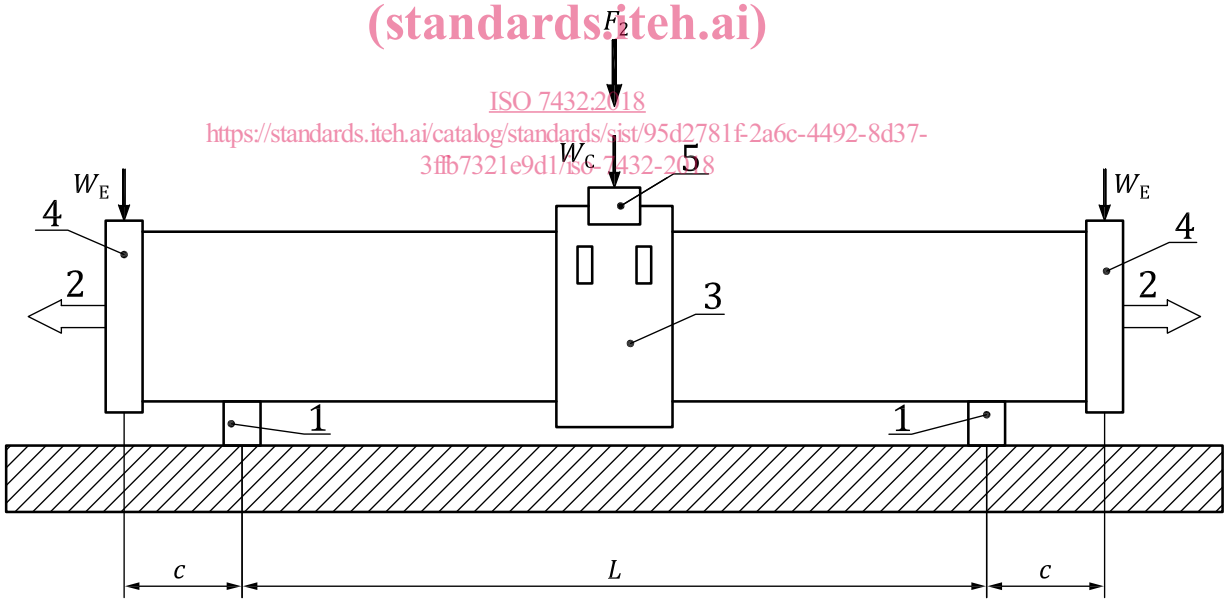
Figure 1 — Test arrangement for the tests detailed in 9.2 and 9.6



Key

1 thrust transmitted to test piece
2 end-sealing device fixed to test piece
3 support [see item e) in 5.2.1]
4 test joint
F_1 force to be applied
L total effective length
5 strap or cradle [see item c) in 5.2.1]
6 support R [see item a) in 5.2.1]
7 strap or cradle [see item b) in 5.2.1]

Figure 2 — Test arrangement for tests detailed in 9.3 and 9.4



Key

1 support
2 thrust transmitted to the test piece
3 test joint
F_2 bending force to be applied
L distance between the centre of the supports
c distance between the centre of the support and the centre of the end sealing device
4 end sealing device
5 strap or cradle for the application of force F_2 [see item d) in 5.2.1]
W_E weight of the end sealing device
W_C weight of the joint

NOTE Dimensional requirements and limits for the test arrangements are detailed in 6.1.

Figure 3 — Test arrangement for test detailed in in 9.5 and Annex A