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Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods to prove the design of bolted flange joints

Tubes et raccords en plastiques thermodurcissables renforcés de verre (PRV) — Méthodes d'essai pour confirmer la conception des assemblages à brides boulonnées

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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 8483:2003), which has been technically revised. It also incorporates the Amendment ISO 8483:2003/Amd1:2012. The main changes compared to the previous edition are as follows:

— changed the Scope to mention that the test procedure is a destructive test and that the bending test is limited up to DN 600;

— changed the Scope to cover the proof of structural design of bolted flange joints;

— the Terms and definitions clause was added to this document;

— changed testing sequences from mandatory to recommended;

— 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;

— addition of an alternative bending test (Method B).

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 stiffness 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 of the pipeline, but not necessarily of 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 bolted flange joints

1 Scope

This document specifies methods of test for bolted flange joints for buried and above-ground glass-reinforced thermosetting plastics (GRP) piping systems. This document is only applicable to the joint and covers methods of test to prove its design. It assumes that the joint either is or is not intended to be subject to the effects of hydrostatic end thrust.

The tests detailed in 9.2, 9.4 to 9.6 inclusive are applicable to bolted flange joints intended to be used in buried or above-ground applications. The bending tests detailed in 9.3 can be used to prove the design where joints are either intended to be used in buried applications or are intended to be used in particular above-ground situations where the tests may be considered appropriate.

With the exception of the procedure detailed in 9.3, these test procedures are applicable to joints for pipes and fittings of all nominal sizes. The tests detailed in 9.3 are applicable to joints for pipes and fittings up to and including DN 600. The tests are applicable for evaluating joints intended for applications conveying liquids at temperatures specified in the referring standards.

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 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:

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

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

3.1
pressure
hydrostatic gauge pressure

Note 1 to entry: Expressed in bar.

3.2
bending
beam bending in the pipe and joint configuration as a result of a transverse force on the bolted flange joint

4 Principle

A test piece comprising one or two pieces of pipe jointed together with a bolted flange joint is subjected to a specified internal pressure. The procedure includes prolonged static tests at elevated pressures and cyclic testing to prove the structural design of the bolted flange joint.

A bolted flange joint is subjected to a specified internal negative pressure. This also simulates an external positive pressure.

All tests except the bending tests in 9.3 shall be carried out with or without end thrust. The bending test in 9.3 is only applicable for joints intended to resist end thrust.

Two methods are specified for the arrangement in 9.3, Method A and Method B. Method A is the default method. Method B may be agreed between the purchaser and manufacturer.

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 resistance to external pressure differential is to ensure adequate safety against infiltration of pollutants through the joint into the fluid carried in the piping system. Under these test conditions pipes with low stiffness can require support to prevent buckling.

NOTE 2 It is assumed that the following test parameters are set by the standard making reference to this document:

— whether GRP to GRP or GRP to metal flange tests are to be performed;

— the nominal size of the components to be connected by the joint;

— the pressure class of the components;

— the total effective length, L, of the test piece;

— the number of test pieces;

— if applicable, the conditioning to be applied;

— the test temperature;

— the sequence of testing, if appropriate;

— the test configuration;

— the bending force F_A or F_B;

— the permissible change in negative pressure.

In all these arrangements a joint of the same size and design shall be used. The same test piece may be used for more than one test procedure providing it is undamaged and of sufficient size to enable the test conditions to be achieved.

5 Apparatus

5.1 End-sealing devices

5.1.1 General

The end sealing devices shall be of sizes and type appropriate to the components under test.

5.1.2 Capable of applying the end loads

If the joint is to be tested with an end load then the end-sealing devices shall be anchored to the pipes to transmit the end thrust loads.

5.1.3 Not capable of applying the end loads

If the joint is to be tested without the end load then the end-sealing devices shall not be anchored to the pipes.

5.2 Supports

5.2.1 End thrust supports

End thrust supports, if required, comprising part of the rig, which shall be capable of supporting the end thrust induced by the internal pressure, but which shall not otherwise support the joint.

5.2.2 Straps or cradles

Straps or cradles for use as supports shall be of sufficient width for the pipe and joint components of the test piece (see Figures 1 and 2).

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

5.2.3 Special supports

Special supports shall be used, if necessary, to prevent buckling of the pipe barrel during external pressure differential testing (see 9.2).

5.3 Source of hydrostatic pressure

The source of hydrostatic pressure shall be capable of applying the required pressures including, as necessary, pressure cycle controls.

5.4 Pressure gauges

Pressure gauges shall be capable of measuring the positive and negative pressures. The gauges shall be calibrated to an accuracy of ±2 % of the value to be measured. The pressure shall be measured at the top of the pipe.

5.5 Vacuum pump

The vacuum pump shall be capable of producing the required negative gauge pressure (see 9.2).

5.6 Means for applying the required bending force

The means of applying the required bending force F_A or F_B (see 9.3, Annexes A and B) shall be calibrated to an accuracy of ±5 % of the value to be measured.

5.7 Bolt torque test apparatus

The bolt torque test apparatus shall incorporate the following items:

a) a flat-faced metallic flange of the same mating dimensions as the GRP flange (see Figure 4);

b) a calibrated wrench with means of measuring the torque applied to an accuracy of ±10 %;

c) bolts, nuts and washers for assembling the metallic flange to the flange under test.

6 Test pieces

6.1 Test arrangement for tests detailed in 9.2, 9.4 and 9.5

The test piece shall comprise an assembly of one or two pieces of pipe of the correct size and pressure class, as specified in the referring standard and the joint to be tested. The total effective length, L, of the assembly shall not be less than that specified in the referring specification and shall allow, if required, the joint under test to be located in the middle of the test arrangement.

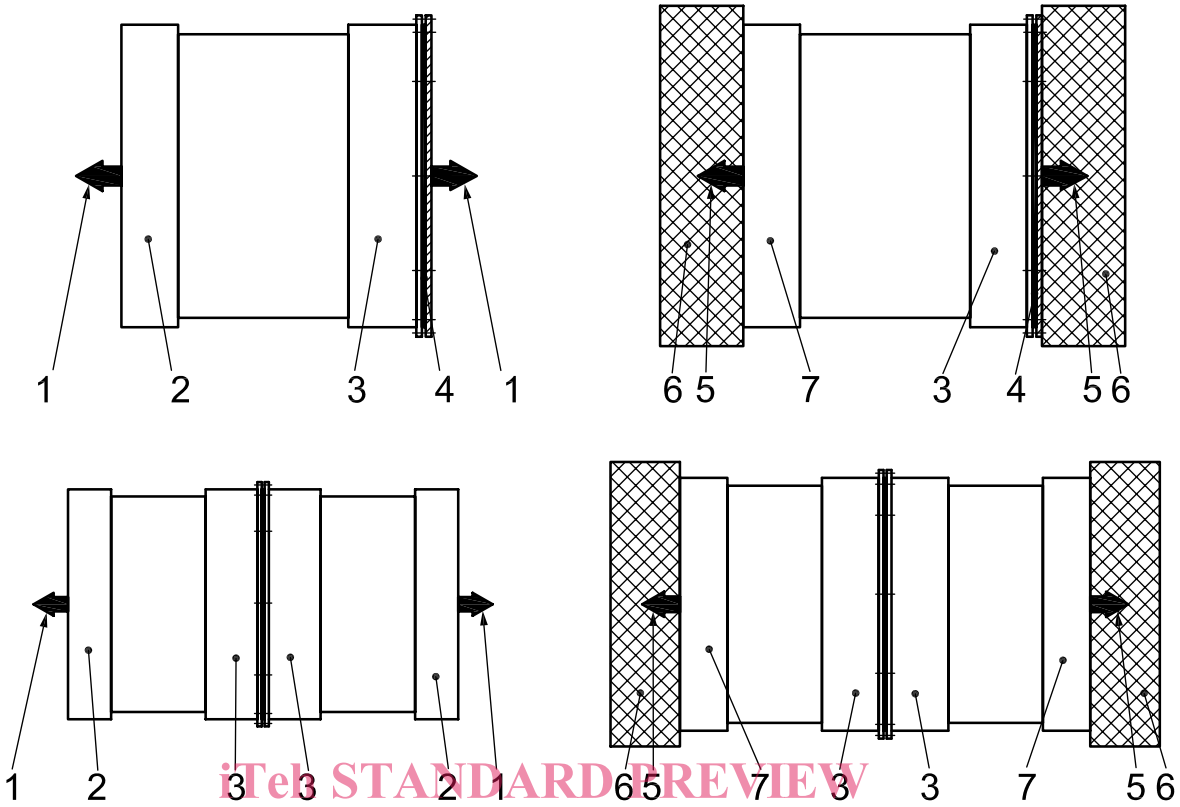
The test arrangement is shown in Figure 1.

NOTE In Figure 1 two different joint conditions are shown, namely metallic flange to GRP flange and GRP flange to GRP flange. These two conditions will not necessarily give the same results due to different stresses and strains being induced.

The referring specification shall state which condition is to be used.

The joint shall be assembled in accordance with the manufacturer's recommendations.

Conditioning, in accordance with Clause 7, shall commence immediately after assembly of a test joint.



a) Arrangements with end loads b) Arrangements without end loads

Key

1 thrust transmitted to test piece
2 end-sealing device fixed to test piece
3 test flange
4 metallic blank flange
5 thrust resisted by test rig
6 rest rig
7 end-sealing device not fixed to test piece

NOTE 1 The arrangement can be used either horizontally (as shown) or vertically.

NOTE 2 The upper two Figures show the test joint located at one end, the lower both Figures show the test joint centrally.

Figure 1 — Typical test arrangements for the tests detailed in 9.2 and 9.4

6.2 Test arrangement for tests detailed in 9.3

The test piece shall comprise an assembly of two pieces of pipe of the correct size and pressure class, as specified in the referring standard, between which the joint to be tested is located.

Two methods are provided for the arrangement in 9.3, Method A and Method B.

NOTE Method A is the default method (see Clause 4).

The test arrangement for Method A and Method B are shown in Figure 2 and Figure 3 respectively. Details for Method A are given in Annex A, details for Method B are given in Annex B.

The joint shall be assembled in accordance with the manufacturer's recommendations.