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Plastics piping systems — Mechanical joints between fittings and pressure pipes — Test method for resistance to pull-out under constant longitudinal force

Systèmes de canalisations en plastique — Assemblages mécaniques entre raccords et tubes sous pression — Méthode d'essai de résistance à l'arrachement sous une force longitudinale constante

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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).

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For an explanation of 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 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 5, *General properties of pipes, fittings and valves of plastic materials and their accessories — Test methods and basic specifications*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 155, *Plastics piping systems and ducting systems,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 3501:2015), which has been technically revised.

The main changes are as follows:

— the reference to leakage has been removed from the test report;

— editorial corrections have been introduced.

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.

Plastics piping systems — Mechanical joints between fittings and pressure pipes — Test method for resistance to pull-out under constant longitudinal force

WARNING — Persons using this document should be familiar with normal laboratory practice, if applicable. The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This document specifies a method for checking the ability of assembled uniaxial joints between fittings and plastic pressure pipes to withstand longitudinal tensile stresses. The test applies regardless of the design and material of the fitting used for jointing plastics pipe.

This test method is not applicable to fusion-welded joints.

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 17456:2006, *Plastics piping systems — Multilayer pipes — Determination of long-term strength*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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

4 Principle

An assembled joint is subjected to a longitudinal tensile force calculated as a function of the pipe dimensions and the maximum permissible induced hoop stress of the relevant pipe.

5 Test parameters and requirements

The test parameters of the standard which refers to this document shall be used and the requirements shall be fulfilled. If one or more parameters are not given in the referring document, the ones given in Annex A shall apply.

The following test parameters should be given by the standard which refers to this document:

a) pull-out force (N);

b) test duration (h);

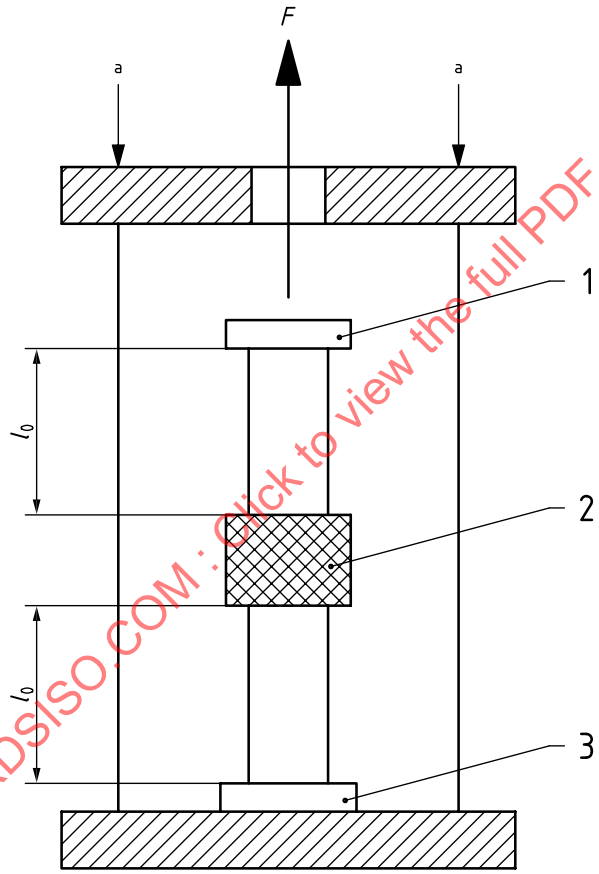
c) test temperature (°C);

d) free length (mm).

6 Apparatus

Tensile loading equipment, capable of applying a constant tensile force, with a tolerance of ±2 %, along the longitudinal axis of the pipe(s) connected to the mechanical fitting being tested.

The tensile force can be applied directly or via a lever arm, using dead weights or a fluid-activated loading cylinder. The test framework, as illustrated in Figure 1, shall be designed to permit the transmission of the applied force to the joint and fitting assembly without reduction by frictional losses generated by the supporting structure.



Key

1 end load bearing type A end cap
2 fitting to be tested
3 end load bearing type A end cap
F applied longitudinal end load force
l_0 pipe free length
[a] End load reaction forces generated within the loading framework.

Figure 1 — Typical apparatus

The test temperature shall be maintained at ±2 °C of the specified temperature.

7 Test pieces

The test specimen shall consist of one or more joints formed by the assembly of at least one fitting and one or more pieces of plastic pressure pipe of the size and quality for which the fitting is designed.

The fittings and pipes shall not be tested until 24 h after their production. For practical reasons, the manufacturer can wait a shorter time before testing. In case of dispute, a duration of 24 h shall apply.

The assembly of the joint should be carried out in accordance with the manufacturer's instructions.

8 Procedure

Determine the mean wall thickness of the pipe, according to ISO 3126. Secure the test specimen in the apparatus. Apply the calculated force gradually over a period of 30 s. Hold the specimen in constant tension for the specified test period.

Inspect the joint(s) for, and record any, indications of loosening of the joint or partial or complete separation from the fitting by pull-out.

9 Test report

The test report shall include the following information:

a) a reference to this document (ISO 3501:2021) and to the referring standard;

b) the nominal pressure class or S series of the components [e.g. fitting(s), pipe] comprising the joint(s) under test;

c) all details necessary for identification of the test pieces, including the nominal size of the pipes and fittings used to produce the test pieces, the type of material and the manufacturer's code;

d) the test period;

e) the test temperature;

f) the calculated force;

g) the pipe free length (l_0);

h) information on the loosening of the joint or partial or complete separation of the joint by pull-out;

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

j) the date of test.

Annex A
(normative)

Test parameters

A.1 General

The test parameters in Table A.1 shall be used, if applicable.

Table A.1 — Example

Test duration h	Test temperature °C
1	23

The free length, l_0, of each pipe shall be at least three times the nominal outside diameter, d_n, with a minimum of 250 mm.

If, for pipes with d_n greater than 315 mm, the specified minimum free length cannot be achieved, a shorter free length can be chosen with a minimum of two times d_n, unless otherwise specified in the referring standard or specification. If a climate chamber is needed and the minimum free length cannot be achieved, a shorter free length, l_0, of at least 150 mm can be used.

For solid wall pipes, the force, F_T, shall be calculated by using Clause A.2. Co-extruded pipes are considered to be solid wall pipes.

For multilayer pipes, the force, F_T, shall be calculated by using Clause A.3.

A.2 Solid wall pipe

From the dimensions of the solid wall pipe, calculate the cross-section of the pipe wall, and from this figure, calculate the force, F_T, necessary to produce a longitudinal stress of 1,5 times the maximum permissible working stress of the material from which the pipe is made, using Formula (A.1):

$$F_T = 1{,}5 \times \sigma_T \times \pi \times e_m \times (d_n - e_m) \quad \text{(A.1)}$$

where

σ_T is the applicable test stress given in the referring standard (MPa);

e_m is the mean wall thickness of the pipe (mm);

d_n is the nominal outside diameter of the pipe (mm).

A.3 Multilayer pipe

Using the dimensions of the multilayer pipe, calculate the force, F_T, using Formula (A.2):

$$F_T = \frac{1{,}5 \times p_T \times \pi \times (d_n - e_m)^2}{20} \quad \text{(A.2)}$$