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Second edition
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Plastics piping systems — Test method for the resistance of plastic pipe/pipe or pipe/fitting assemblies to tensile loading

Systèmes de canalisations en plastiques — Méthode d'essai de la résistance en traction des assemblages tube/tube ou tube/raccord en plastique

Reference number
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Foreword

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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 5, *General properties of pipes, fittings and valves of plastic materials and their accessories – Test method and basic specifications*.

This second edition cancels and replaces the first edition (ISO 13951:2001), which have been technically revised. The reason for modification is for applicability for mechanical fittings to other plastics materials, other sizes and/or other test conditions and alignment with texts of other standards on test methods.

The modifications are:

— no material is mentioned;

— test parameters are omitted, although the original test parameters can be found in Annex A;

— no requirements are given;

— editorial changes have been introduced.

Plastics piping systems — Test method for the resistance of plastic pipe/pipe or pipe/fitting assemblies to tensile loading

WARNING — Persons using this document should be familiar with normal laboratory practice, if applicable. The use of this International Standard can involve hazardous materials, operations, and equipment. This International Standard 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 International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies a method for testing the resistance to longitudinal tensile loading of uniaxial plastic pipe/pipe or pipe/fitting assemblies with electrofusion joints, butt fusion joints, or mechanical fittings (made of plastics or metals). For electrofusion joints and butt fusion joints, this test method is limited to nominal pipe diameters up to and including 250 mm.

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*

3 Principle

The test consists of subjecting a plastic pipe/pipe or pipe/fitting assembly to a longitudinal stress by the application of a given constant load for 1 h, followed by application of a load at a constant speed until yielding or failure occurs. The leak tightness of the test piece is verified before the constant load, after the constant load, and at the end of the test.

4 Test parameters and requirements

The test parameter of the standard which refers to this International Standard shall be used and the requirements shall be fulfilled. If the parameter is not given in the referring standard, the one given in Annex A shall apply. The test is carried out at a temperature of (23 ± 2) °C.

The following test parameter should be given by the standard which refers to this International Standard.

a) test stress [MPa]

5 Apparatus

5.1 Room, which can be controlled at a temperature of (23 ± 2) °C.

5.2 Tensile-testing machine or other equipment, sufficiently powerful to allow tests to be carried out up to the yield point of the pipe. The tensile machine shall be capable of sustaining, between its clamping jaws, a constant load, within a load tolerance of ±2 %, and a speed of (25 ± 2,5) mm/min.

5.3 Force-measuring device, capable of checking conformity to the specified loading conditions (see 5.2 and 8.2).

5.4 Test piece clamping device, capable of clamping the test piece in the machine.

5.5 Time measuring device.

5.6 Recording manometer or contact manometer, covering the range 0 mbar to 55 mbar.

5.7 Compressed-air supply, capable of controlling the pressure at (50 ± 5) mbar.

5.8 Set of pipes equipped with valves, which can be used to link the test piece to the manometer and the pressure supply or to isolate the test piece manometer unit from the pressure supply.

5.9 Thermometer, capable of checking conformity to the specified test temperature (see 5.1 and Clause 7).

6 Test pieces

6.1 Sampling

The pipes and fittings used to produce the test pieces shall be obtained by sampling as specified in the product standard.

For electrofusion couplers where $d_n \geq 180$ mm and where the conduct of tensile tests on fitting/pipe assemblies is beyond the limits of the available test equipment, the testing of joint segments might be appropriate. Testing of segment test pieces shall not be undertaken, however, unless a correlation with testing of complete pipe/joint assemblies has been established.

6.2 Preparation

Each test piece shall comprise a complete pipe/pipe, pipe/fitting/pipe, or fitting/pipe/fitting assembly.

Pipes of the same nominal pressure (PN) or design SDR as that of the fitting shall be used for the test.

All joints shall be made in accordance with the manufacturer's instructions and, whenever applicable, the instructions specified in the relevant standards.

NOTE 1 For PE, the relevant International Standards are ISO 11413[1] and ISO 12176-2[4] for electrofusion joints and ISO 11414[2] and ISO 12176-1[3] for butt fusion joints.

The free length, l_0, of the pipes or spigot ends (between the jaws and the joint/fitting) shall be at least three times the nominal outside diameter d_n, with a minimum of 250 mm.

Determine the mean wall thickness of the pipe, according to ISO 3126. Attach seals to the free ends of the pipes so that the test piece will remain leak tight at a pressure of 50 mbar. Connect one of these ends to the pressure supply.

NOTE 2 It is recommended to reinforce, by means of an internal brace or an electrofusion coupler, the free ends of the pipes that are to be connected to the clamping jaws of the tensile-testing machine.

7 Conditioning

Immediately prior to testing in accordance with Clause 8, condition each test piece at (23 ± 2) °C at a time such that testing will not be carried out less than 24 h after the jointing of the pipe/fitting.

8 Procedure

8.1 Setting up the test piece

Connect the ends of a test piece to the jaws of the tensile-testing machine such that the load is applied along the axis of the pipe.

Link the test piece to the pressure supply and introduce a pressure of (50 ± 5) mbar into the test piece and check the leak tightness of the test piece, e.g. by using a soap solution.

8.2 Constant-load tensile test

While maintaining the pressure of (50 ± 5) mbar apply a tensile load to the test piece so that a load, which corresponds to a longitudinal stress in the pipe wall is reached within 30 s. This load is calculated using Formula (1):

$$F_T = 2 \times \sigma_T \times \pi \times e_m \times (d_n - e_m) \quad (1)$$

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).

Verify the leak tightness after applying the constant load, e.g. by using a soap solution. Maintain the test piece at this constant load for 1 h, within a load variation of ±2 %.

Verify the leak tightness after the test period while maintaining the constant load, e.g. by using a soap solution.

If the test piece is still leak tight, continue immediately with the second part of the test in accordance with 8.3. Otherwise, report the observations in accordance with Clause 9.

8.3 Constant-speed tensile test

While maintaining the pressure of (50 ± 5) mbar, extend the test piece by applying a tensile load along the longitudinal axis of the test piece at a crosshead speed of (25 ± 2,5) mm/min.

Unless the assembly is pulled apart or one of the test piece components fails otherwise, stop the test when yield of the pipe occurs.

In the case of yield, verify the leak tightness after completion of the test, e.g. by using a soap solution.

NOTE Yield of plastic materials is the transition from elastic to plastic deformation, usually characterized by a decrease or a shoulder in the stress-strain curve.

9 Test report

The test report shall include the following information:

a) a reference to this International Standard (i.e. ISO 13951) and the referring standard;

b) the nominal pressure class (PN) or the design SDR 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, the manufacturer's code, and the fusion-jointing procedure used;

d) the test temperature;

e) the test stress;

f) the number of test pieces tested;

g) the result of the constant-load tensile test (8.2);

h) the result of the constant-speed tensile test (8.3);

i) the type(s) of failure;

j) any observations made during the test;

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

l) the test laboratory;

m) the date of the test.

Annex A
(normative)

Test parameters

The test stress shall be equal to 6 MPa (6 N/mm^2).