INTERNATIONAL STANDARD

ISO 13951

First edition
2001-04-01

Plastics piping systems — Test method for the resistance of polyolefin 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 polyoléfines

Reference number
ISO 13951:2001(E)

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Printed in Switzerland

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13951 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*.

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

1 Scope

This International Standard specifies a method for testing the resistance to tensile loading of polyolefin pipe/pipe or pipe/fitting assemblies with electrofusion joints, butt-fusion joints or mechanical fittings. This method is applicable to assemblies with nominal pipe diameters less than or equal to 250 mm.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 11413:1996, *Plastics pipes and fittings — Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting*.

ISO 11414:1996, *Plastics pipes and fittings — Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion*.

ISO 12176-1:1998, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 1: Butt fusion*.

ISO 12176-2:2000, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 2: Electrofusion*.

3 Principle

The test consists of subjecting a polyolefin 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 airtightness of the test piece is verified before, during and at the end of the test.

The test is carried out at a temperature of 23 °C ± 2 °C.

4 Apparatus

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

4.2 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 mm/min ± 2,5 mm/min.

4.3 Force-measuring device, capable of checking conformity to the specified loading conditions (see 4.2 and 7.2).

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

4.5 Stopwatch.

4.6 Recording manometer or **contact manometer**, covering the range 0 mbar to 50 mbar.

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

4.8 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.

4.9 Thermometer, capable of checking conformity to the specified test temperature (see 4.1 and clause 6).

5 Test pieces

5.1 Sampling

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

5.2 Preparation

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

All joints shall be made in accordance with the manufacturer's instructions and, whenever applicable, the instructions specified in the relevant standards. Reference is made to ISO 11413 and ISO 12176-2 for electrofusion joints and ISO 11414 and ISO 12176-1 for butt fusion joints.

The free lengths of the pipes or spigot ends (between the jaws and the joint/fitting) shall be equal to 250 mm.

Attach seals to the free ends of the pipes so that the test piece will remain airtight at a pressure of 50 mbar. It shall be possible to connect one of these ends to the pressure supply.

NOTE 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.

5.3 Number of test pieces

The number of test pieces shall be as specified in the referring product standard.

NOTE Testing of at least three test pieces is recommended.

6 Conditioning

Immediately prior to testing in accordance with clause 7, condition each test piece for a minimum of 6 h at 23 °C ± 2 °C, starting the period of conditioning at a time such that testing will not be carried out less than 24 h after the fusion-jointing of the pipe/fitting.

7 Procedure

7.1 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 mbar ± 5 mbar into the test piece.

Isolate the test piece from the pressure supply and check the airtightness of the test piece, e.g. by using a soap solution.

7.2 Constant-load tensile test

Apply a tensile load to the test piece so that a load, which corresponds to a longitudinal stress in the pipe wall of 12 MPa is reached within 30 s. This load is calculated from the following equation:

$$F = \sigma \times S$$

where

F is the tensile load, in newtons (N);

σ is the tensile stress, equal to 12 MPa $(12\ \text{N/mm}^2)$;

S is the cross-sectional area of the pipe wall, in square millimetres (mm^2), calculated using the measured mean outside diameter and the minimum wall thickness.

Maintain the test piece at this constant load for 1 h, within a load variation of $\pm$ 2 %.

Verify the airtightness, e.g. by using a soap solution.

If the test piece is still intact, continue immediately with the second part of the test in accordance with 7.3. Otherwise, report the observations in accordance with clause 8.

7.3 Constant-speed tensile test

Extend the test piece by applying a rate of displacement of the driven grip of the test machine of 25 mm/min $\pm$ 2,5 mm/min.

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

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

NOTE Yield of the pipe is defined as a visible necking and elongation of the pipe or a decrease of the load during the tensile test.

8 Test report

The test report shall include the following information:

a) a reference to this International Standard and the referring standard;

b) 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;

c) the test temperature;

d) the number of test pieces tested;

e) the result of the constant-load tensile test (7.2);

f) the result of the constant-speed tensile test (7.3);

g) the type(s) of failure;

h) any observations made during the test;

i) any factors that may have affected the results, such as any incidents or operating details not specified in this International Standard;

j) the test laboratory;

k) the date of the test.

ICS 23.040.01

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