SLOVENSKI STANDARD
oSIST prEN ISO 13479:2020

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Cevi iz poliolefinov za transport tekočin - Ugotavljanje odpornosti proti širjenju razpoke - Metoda za preskus počasnega širjenja razpoke na zarezani cevi (ISO/DIS 13479:2020)

Polyolefin pipes for the conveyance of fluids - Determination of resistance to crack propagation - Test method for slow crack growth on notched pipes (ISO/DIS 13479:2020)

Rohre aus Polyolefinen für den Transport von Fluiden - Bestimmung des Widerstandes gegen Rissfortpflanzung - Prüfverfahren für langsames Risswachstum an gekerbten Rohren (Kerbprüfung) (ISO/DIS 13479:2020)

Tubes en polyoléfines pour le transport des fluides - Détermination de la résistance à la propagation de la fissure - Méthode d'essai de la propagation lente de la fissure d'un tube entaillé (essai d'entaille) (ISO/DIS 13479:2020)

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Polyolefin pipes for the conveyance of fluids — Determination of resistance to crack propagation — Test method for slow crack growth on notched pipes

Tubes en polyoléfines pour le transport des fluides — Détermination de la résistance à la propagation de la fissure — Méthode d'essai de la propagation lente de la fissure d'un tube entaillé (essai d'entaille)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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).

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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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/138, *Plastics pipes, fittings and valves for the transport of fluids* , SC 5, *General properties of pipes, fittings and valves of plastic materials and their accessories -- Test methods and basic specifications*.

This third edition cancels and replaces the second edition (ISO 13479:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

— warnings have been added to follow the method of test piece preparation and the test procedure precisely because of the influence on the result

— in case of premature failure alternative test pressures and times for PE 80 and PE 100 have been added to allow retest at a lower pressure for a longer time.

— an accelerated method by testing with an external detergent has been added.

Polyolefin pipes for the conveyance of fluids — Determination of resistance to crack propagation — Test method for slow crack growth on notched pipes

1 Scope

This document specifies a test method for determining the resistance to slow crack growth of polyolefin pipes, expressed in terms of time to failure in a hydrostatic pressure test on a pipe with machined longitudinal notches in the outside surface. The test is applicable to pipes of wall thickness greater than 5 mm.

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 161-1, *Thermoplastics pipes for the conveyance of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series*

ISO 1167-1:2006, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 6108, *Double equal angle cutters with plain bore and key drive*

ISO 11922-1, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*

ISO 15510:2014, *Stainless steels — Chemical composition*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 161-1 and ISO 11922-1 apply.

4 Principle

A length of pipe with four machined longitudinal external notches is subject to a hydrostatic pressure test whilst immersed in a water tank at 80 °C in accordance with ISO 1167-1 and ISO 1167-2. The time to failure or test period is recorded.

NOTE 1 It is assumed that the following test parameters are set by the standard or specification making reference to this test method:

a) the number of test pieces, if applicable (see 6.5);

b) the test pressure (see 8.1);

c) the test period (see 8.1).

NOTE 2 To accelerate the test, the pipe can be immersed in a tank containing a detergent instead of water, for example Arkopal® N100, see Annex D.

5 Apparatus

5.1 Pipe pressure-testing equipment, as specified in ISO 1167-1.

5.2 Notch-machining equipment, i.e. a milling machine with a horizontal mandrel rigidly fixed to the bed to enable the pipe to be securely clamped to give a straight test piece.

The mandrel shall support the pipe bore beneath and along the full length of the notch to be machined.

The milling cutter mounted on a horizontal arbor shall be a 60° double equal angle V-cutter, having a calculated cutting rate of (0,010 ± 0,002) (mm/r)/tooth (see example).

NOTE 1 It is important that the cutting rate is within the specified range, otherwise the results will not be valid.

EXAMPLE A cutter with 20 teeth rotating at 700 r/min, traversed at a speed of 150 mm/min, has a calculated cutting rate of 150/(20 × 700) = 0,011 (mm/r)/tooth.

NOTE 2 Vibration of the cutter can affect the radius formed at the bottom of the notch and should be minimised.

The milling cutter shall be carefully protected against damage. The cutter shall be subject to a running-in treatment amounting to 10 m of notching at the specified cutting rate, prior to its first use for the preparation of test pieces. It shall not be used for any other material or purpose and shall be replaced after 500 m of notching.

The cutter shall be checked for damage or wear after each 100 m of cutting. The cutter teeth shall be compared with a new cutter by examination with a microscope using a magnification of 10 to 20 times. If there is any evidence of damage or wear it shall be replaced.

The quality of the cutter and machining process can be checked by carrying out notching of a sample and visually checking the notch tip radius after cutting the cross section of the pipe.

5.3 End caps, type A in accordance with ISO 1167-1.

6 Test piece preparation

6.1 General

Prior to any measurements the test piece shall be conditioned at (23 ± 2) °C for at least 4 h.

6.2 Test pieces

Each test piece shall comprise a length of pipe sufficient to give a minimum free length of pipe of ($3d_n$ ± 5) mm between the end caps, when fitted for pressure testing in accordance with ISO 1167-2, where d_n is the nominal outside diameter of the pipe. For pipes with a nominal outside diameter d_n > 315 mm, a minimum free length of ($3d_n$ ± 5) mm shall be used where practicable; otherwise, a minimum free length of greater than or equal to 1 000 mm shall be used.

6.3 Notch location and measurement of dimensions

Positions shall be marked for machining four notches equally spaced around the pipe circumference (see Figure 1). Measure the mean outside diameter, d_{em}, of the test pipe and the wall thickness of the pipe in the centre of the pipe at each notch position in accordance with ISO 3126.

6.4 Machining the notches

6.4.1 If the wall thickness of the test piece is greater than 50 mm, the material shall be machined with a slot drill of 15 mm to 20 mm diameter to leave approximately 10 mm to be removed by the V-cutter, used in accordance with 6.4.2. Machining of notches shall not take place within 24 h of production of the pipe.

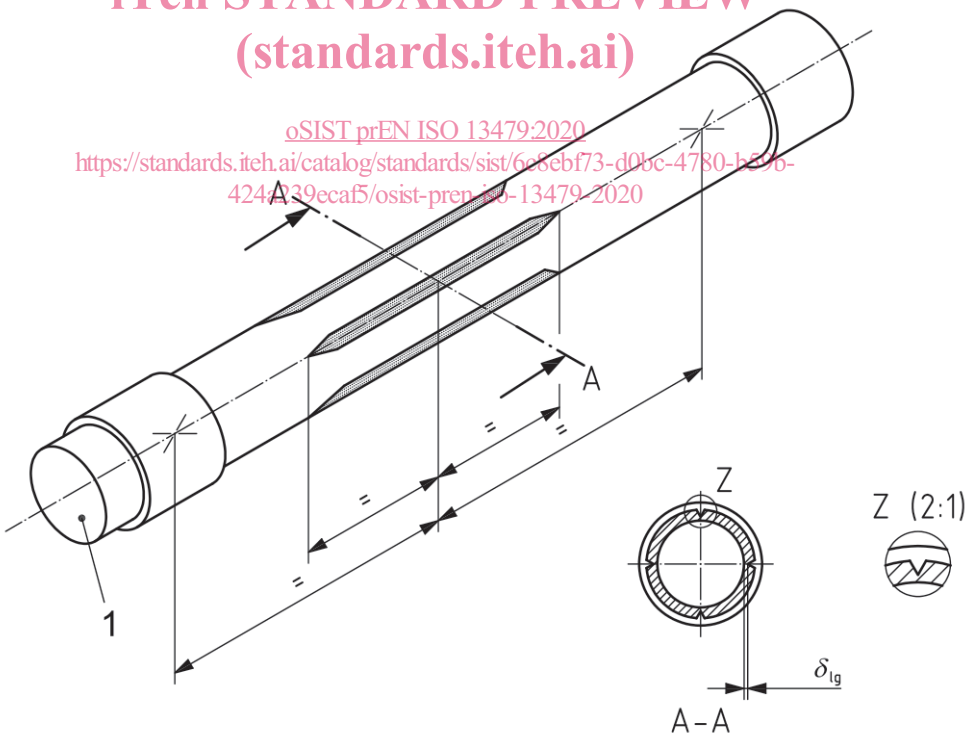
6.4.2 Each notch shall be machined by climb milling (see Figure 2) to such a depth as to produce a pipe wall ligament thickness of between 0,78 and 0,82 times the minimum wall thickness, as specified in ISO 11922-1, for the diameter and pressure series of the pipe as shown in Table A.1, see Note 1. The ends of each notch shall be aligned circumferentially as shown in Figure 1 and Figure 2. It is important that the climb milling technique is used, otherwise the results will not be valid.

The length of each notch, at full depth, shall be equal to the pipe nominal outside diameter ± 1 mm. For pipes greater than 315 mm in diameter with a free length of pipe of less than (3 d_n ± 5) mm, the length of each notch, at full depth, shall be equal to the free length minus (500 ± 1) mm, in accordance with 6.2.

NOTE 1 To achieve a remaining ligament within the required tolerance range, it is advisable to aim for a remaining ligament at the maximum of the tolerance range. This is because the pipe wall can move due to the release of residual stresses, resulting in a deeper than anticipated notch.

NOTE 2 Vibration of the cutter can affect the radius formed at the bottom of the notch and should be minimised.

6.4.3 Measure and record the depth of each notch and the ligament thickness, δ_{Lg}.

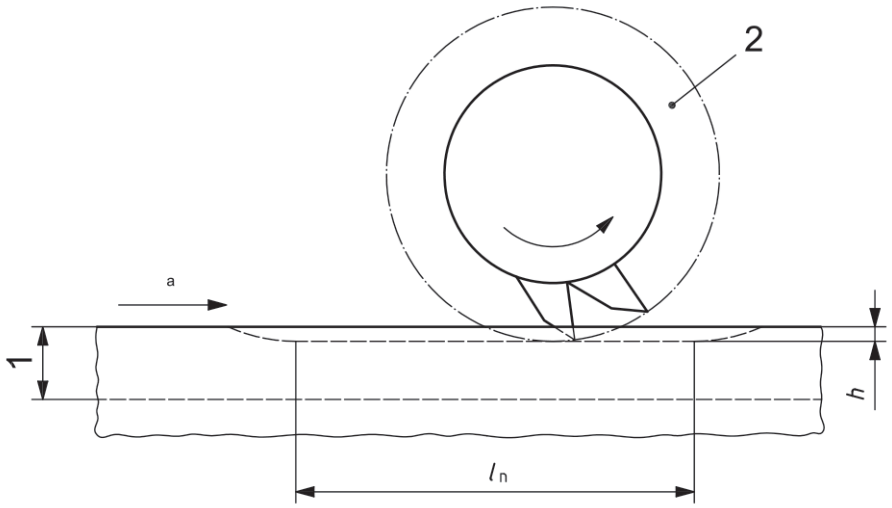


Key

1 end cap

δ_{lg} ligament thickness: 0,78 to 0,82 times minimum ISO wall thickness, in millimetres

Figure 1 — Pipe test piece



Key

1 pipe wall
2 60° double equal angle cutter
h notch depth, in millimetres
l_n notch length ($1 \times d_n$) centred on test piece
a Direction.

Figure 2 — Notching method

6.5 Number of test pieces

Prepare a minimum of three test pieces, unless specified otherwise in the referring standard or specification.

7 Conditioning

The test pieces shall be filled with water, immersed in a water tank at 80 °C and allowed to condition for 24 h +/- 1 h for wall thickness up to 25 mm and 48 h +/- 1 h for greater wall thickness.

8 Procedure

8.1 Hydrostatic-pressure testing

8.1.1 Pressurize the test piece with water in accordance with ISO 1167-1 at a test temperature of 80 °C, applying and maintaining the pressure specified by the referring standard.

8.1.2 Connect the test piece(s) to the pressurizing equipment and bleed off the air. After conditioning in accordance with Clause 7, progressively and smoothly apply the test pressure, in the shortest time practicable between 30 s and 1 h, depending upon the size of the test piece and the capability of the pressurizing equipment.

8.1.3 Maintain the pressure until either the test piece ruptures or the time specified by the referring standard has elapsed, whichever occurs first. Record the time under pressure to the nearest hour. In the case of failure, record the location of the failure for each test piece.

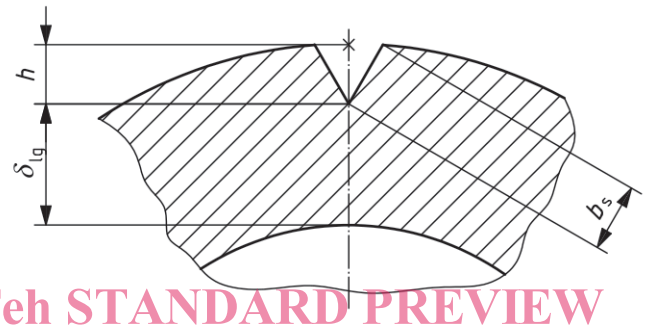
Table B.1 gives recommended applicable pressure levels, dependent on material type and pipe series.

8.1.4 If the sample fails prematurely, a retest can be performed at a selected lower pressure with a longer time. Annex C gives this information for polyethylene.

8.2 Ligament thickness measurement after testing

Measurement after testing shall be carried out if premature failure has occurred, or for the purpose of verifying notch depth measurement according to 6.4.3, using the following method. If the remaining ligament is found to be outside the tolerance range, the test result shall be discarded.

On completion of the pressure test, remove the test piece from the water tank and allow to cool to ambient temperature. Cut a section of pipe out from around the position of each notch. Open up the notch to give clear access to one of the machined surfaces of the notch. Measure the width of the machined surface of the notch, b_s, to an accuracy ± 0,1 mm with a microscope or equivalent means, as shown in Figure 3. If required by the referring standard, measure the depth of penetration of the crack.



Key

b_s width of machined surface of notch

h notch depth

δ_{Lg} ligament thickness

Figure 3 — Measurement to calculate notch depth

Calculate the notch depth, h, in millimetres, using the Equation (1):

$$h = 0{,}5\left[d_{em} - \sqrt{\left(d_{em}^2 - b_s^2\right)} \right] + 0{,}866\, b_s \quad (1)$$

where

b_s is the width of machined surface of the notch, in millimetres;

d_{em} is the measured mean pipe outside diameter, in millimetres.

Calculate the ligament thickness, δ_{lg}, from the notch depth and the individual average wall thickness alongside each notch position. Record the values obtained.

9 Test report

The test report shall include the following information:

a) reference to this document, ie ISO 13479, and to the referring standard or specification if applicable;

b) all details necessary for complete identification of the pipe (manufacturer, type of pipe and production date);

c) the cutter size and number of teeth;