
**Thermoplastics pipes —
Determination of tensile properties —
Part 3:
Polyolefin pipes**

*Tubes en matières thermoplastiques — Détermination des
caractéristiques en traction —*

Partie 3: Tubes en polyoléfines





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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 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 methods and basic specifications*.

This second edition cancels and replaces the first edition (ISO 6259-3:1997) which has been technically revised.

ISO 6259 consists of the following parts, under the general title *Thermoplastics pipes — Determination of tensile properties*:

- Part 1: *General test method*
- Part 2: *Pipes made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C) and high-impact poly(vinyl chloride) (PVC-HI)*
- Part 3: *Polyolefin pipes*

Introduction

This part of ISO 6259 specifies a method for determining the tensile properties of polyolefin pipes.

It can provide data for further testing for the purpose of research and development.

It cannot be regarded as significant for applications in which the conditions of application of the force differ considerably with those in this test method, such applications requiring the appropriate impact, creep and fatigue tests.

The tests of tensile properties are intended to be principally regarded as tests of material in the form of pipe. The results can be useful as a material process control test, but are not a quantitative assessment of long term pipe performance.

ISO 6259 has been drawn up on the basis of ISO 527.

For ease of use, it has been thought preferable to draw up a complete document that can be used for determining the tensile properties of thermoplastics pipes. For greater detail, reference can be made to ISO 527.

However, let it be noted that ISO 527 is applicable to materials in sheet form, whereas ISO 6259 is applicable to materials in pipe form.

As it was considered essential to test the pipes as supplied, i.e. without reduction in thickness, difficulties are those in the choice of test piece.

ISO 527 specifies test pieces a few millimetres thick, whereas the thickness of a pipe can be in excess of 50 mm. This is why certain changes have been made on this point.

For thin-walled pipes, the test piece can be obtained by die cutting, while for thick pipes, it can be obtained only by machining.

At present, ISO 6259 comprises three parts. The first part gives the general conditions under which the tensile properties of thermoplastics pipes are to be determined. The other two parts provide, respectively, particular information on the execution of tests on pipe made from different materials (see the Foreword).

The basic specifications for the various materials are given in informative annexes in the relevant parts.

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Thermoplastics pipes — Determination of tensile properties —

Part 3: Polyolefin pipes

1 Scope

This part of ISO 6259 specifies a method of determining the tensile properties of polyolefin (polyethylene, cross-linked polyethylene, polypropylene, and polybutene) pipes, and the following properties:

- the stress at yield;
- the elongation at break.

This part of ISO 6259 also gives the corresponding basic specifications in [Annexes A to D](#) for information purposes only.

2 Normative reference

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 527-1:2012, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 6259-1:2015, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6259-1 apply.

4 Principle

See ISO 6259-1:2015, Clause 4, applicable to thermoplastics materials covered by this part of ISO 6259.

5 Apparatus

See ISO 6259-1:2015, Clause 5, applicable to thermoplastics materials covered by this part of ISO 6259.

6 Test pieces

6.1 Selection of the test pieces

6.1.1 General

The test pieces shall be obtained by die cutting or machining.

NOTE 1 When the thickness of the pipe is less than or equal to 12 mm, the test pieces are to be die cut preferably. When the thickness of the pipes is greater than 12 mm the test pieces are to be machined preferably.

NOTE 2 Care ought to be taken when using die cutting to avoid damaging the test specimen or producing non parallel sides.

6.1.2 Dimensions of test pieces

Test pieces shall be either of Type 1, the shape and dimensions of which are given in Figure 1 and Table 1, Type 2, the shape and dimensions of which are given in Figure 2 and Table 2, or Type 3, the shape and dimensions of which are given in Figure 3 and Table 3. The choice of test piece is dependent on the wall thickness of the pipe from which it is taken (see 6.2).

NOTE 1 The Type 1 test piece is identical to the Type 1B specified in ISO 527-2 [1]. The Type 2 test piece is identical to the Type 2 specified in ISO 6259-2 [2]. The Type 3 test piece is identical to the Type B test piece in ISO 13953 [3].

NOTE 2 In order to avoid slippage in the grips, it is recommended that the width of the ends of the test piece (*B*) be increased in proportion to the thickness (*e_n*) in accordance with Formula (1):

$$B = e_n + 15 \text{ (mm)}$$

(1)

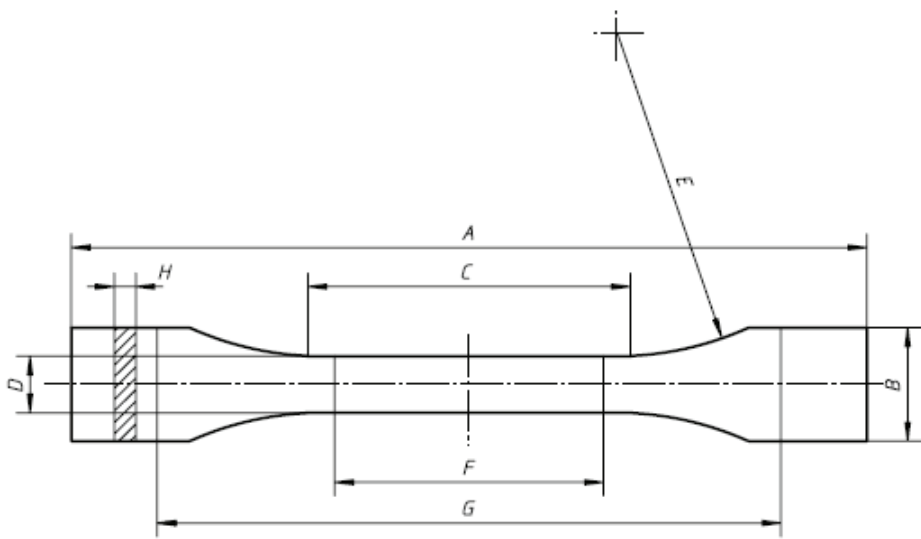


Figure 1 — Type 1 test piece

Table 1 — Dimensions of Type 1 test pieces

Symbol	Description	Dimensions mm
A	Overall length (min.)	150
B	Width of ends ^a	20 ± 1
C	Length of narrow, parallel-sided portion	60 ± 1
D	Width of narrow, parallel-sided portion	10 ± 0,2
E	Radius	60 ± 1
F	Gauge length	50 ± 1
G	Initial distance between grips	115 ± 5
H	Thickness	that of the pipe
^a This dimension can be larger in accordance with Note 2 of 6.1.2.		

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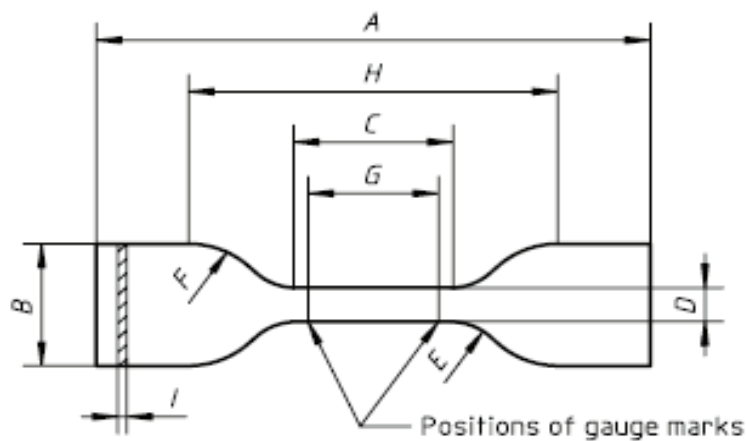


Figure 2 — Type 2 test piece

Table 2 — Dimensions of Type 2 test pieces

Symbol	Description	Dimensions mm
A	Overall length (min.)	115
B	Width of ends	25 ± 1
C	Length of narrow, parallel-sided portion	33 ± 2
D	Width of narrow, parallel-sided portion	$6+0,4$ 0
E	Small radius	14 ± 1
F	Large radius	25 ± 2
G	Gauge length	25 ± 1
H	Initial distance between grips	80 ± 5
I	Thickness	that of the pipe

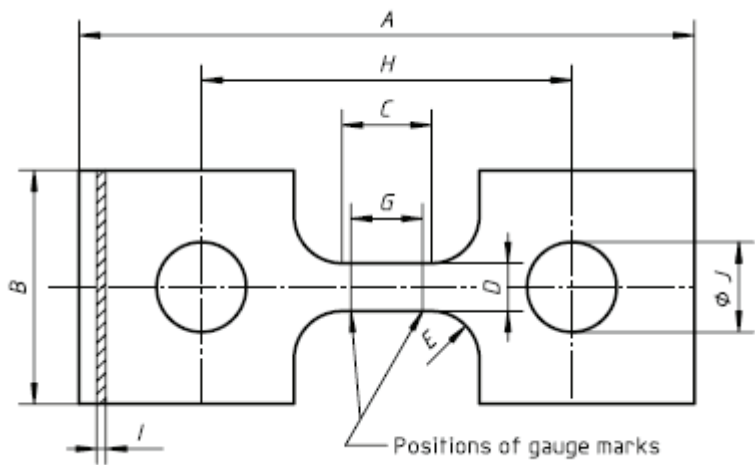


Figure 3 — Type 3 test piece

Table 3 — Dimensions of Type 3 test pieces

Symbol	Description	Dimensions mm
A	Overall length (min.)	250
B	Width of ends	100 ± 3
C	Length of narrow, parallel-sided portion	25 ± 1
D	Width of narrow, parallel-sided portion	25 ± 1
E	Radius	25 ± 1
G	Gauge length	20 ± 1
H	Initial distance between centres of loading pins	165 ± 5
I	Thickness	that of the pipe ^a
J	Diameter of hole	30 ± 5
^a The thickness of specimens taken from pipe of >50 mm thickness can be reduced by machining so that the reduced thickness of the parallel gauge portion of the specimen shall be at least twice the width, i.e. ≥ 50 mm. It is recommended to machine from both sides of the test specimens of >50 mm wall thickness so that the test piece originates from the centre of the pipe wall.		

6.2 Preparation of test pieces

The test pieces shall be taken from the centre of strips cut from the length of pipe in accordance with ISO 6259-1:2015, 6.2.1. The type of test piece shall be selected according to the thickness of the pipe as shown in Table 4.

Table 4 — Type of test piece to be used

Nominal wall thickness of pipe e_n mm	Type of test piece
$e_n \leq 5$	Type 2
$5 < e_n \leq 12$	Type 1
$12 < e_n \leq 25$	Type 1 or Type 3
$e_n > 25$	Type 3

6.3 Cutting method

Use a cutting die with a profile corresponding to that of the Type 1 or Type 2 test piece, depending on thickness of the pipe, see ISO 6259-1:2015, 5.6.

Cut out the test piece at ambient temperature, applying the die cutter to the inner surface of the strip and exerting a continuous uniform pressure.

6.4 Machining method

See ISO 6259-1:2015, 6.2.2.3.

7 Conditioning

See ISO 6259-1:2015, Clause 7.

8 Test speed

The test speed, i.e. the speed of separation of the grips, shall depend on the thickness of the pipes, as specified in Table 5. The tolerance on test speed is in accordance with ISO 527-1:2012, Table 1.

If other speeds are used, the correlation between these and the specified speed shall be shown. The speed specified shall be used in cases of dispute.

Table 5 — Test speeds

Nominal wall thickness of pipe e_n mm	Type of test piece	Test speed mm/min
$e_n \leq 5$	Type 2	100
$5 < e_n \leq 12$	Type 1	50
$12 < e_n \leq 25$	Type 1 Type 3	25 10
$e_n > 25$	Type 3	10

9 Procedure

See ISO 6259-1:2015, Clause 9.

NOTE If there is a specified requirement for elongation of the test pieces, the test can be stopped when this requirement is exceeded.

10 Expression of results

See ISO 6259-1:2015, Clause 10.

11 Test report

See ISO 6259-1:2015, Clause 11.

Annex A (informative)

Polyethylene pipes — Basic specification

It is recommended that the elongation at break of polyethylene pipes including PE-RT, measured under the test conditions given in ISO 6259-1, is as follows:

$$e_b \geq 350 \%$$

NOTE No basic specification is given for the stress at yield.

Annex B (informative)

Cross-linked polyethylene pipes — Basic specification

It is recommended that the elongation at break of cross-linked polyethylene pipes, measured under the test conditions given in ISO 6259-1, is as follows:

$$e_b \geq 350 \%$$

NOTE No basic specification is given for the stress at yield.

Annex C (informative)

Polypropylene pipes — Basic specification

It is recommended that the elongation at break of the following types of polypropylene pipe:

- homopolymer;
- block copolymer (heterophasic);
- random copolymer,

measured under the test conditions given in ISO 6259-1, is as follows:

$$e_b \geq 200 \%$$

NOTE 1 For thicker wall pipes, lower values of elongation at break may apply.

NOTE 2 No basic specification is given for the stress at yield.

Annex D (informative)

Polybutene pipes — Basic specification

It is recommended that the elongation at break of polybutene pipes of wall thickness ≤ 5 mm, measured under the test conditions given in ISO 6259-1, is as follows:

$$e_b \geq 125 \%$$

NOTE 1 For thicker wall pipes lower values of elongation at break may apply.

NOTE 2 No basic specification is given for the stress at yield.

Bibliography

- [1] ISO 527-2:2012, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*
- [2] ISO 6259-2:1997, *Thermoplastics pipes — Determination of tensile properties — Part 2: Pipes made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly (vinyl chloride) (PVC-C) and high-impact poly (vinyl chloride) (PVC-HI)*
- [3] ISO 13953:2001, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

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