



SLOVENSKI STANDARD
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Preskušanje zvarjenih spojev plastomernih polizdelkov - 2. del: Trgalni preskus

Testing of welded joints of thermoplastics semi-finished products - Part 2: Tensile test

Prüfen von Schweißverbindungen aus thermoplastischen Kunststoffen - Teil 2:
Zugversuch

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Essais des assemblages soudés sur produits semi-finis en thermoplastiques - Partie 2 :
Essai de traction

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EUROPEAN STANDARD
NORME EUROPÉENNE
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English Version

Testing of welded joints of thermoplastics semi-finished products - Part 2: Tensile test

Essais des assemblages soudés sur produits semi-finis
en thermoplastiques - Partie 2 : Essai de traction

Prüfen von Schweißverbindungen aus
thermoplastischen Kunststoffen - Teil 2: Zugversuch

This European Standard was approved by CEN on 20 December 2020.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 12814-2:2021) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2021, and conflicting national standards shall be withdrawn at the latest by July 2021.

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

This document supersedes EN 12814-2:2000.

In comparison with the previous edition, the following technical modifications have been made:

- the reference standards ISO 5893 and ISO 13953 have been changed to undated;
- a new annex (Annex A), describing the tensile test specimen geometry for overlap joints, has been added.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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EN 12814-2:2021 (E)**1 Scope**

This document specifies the dimensions, the method of sampling, the preparation of the test specimens and the conditions for performing the tensile test in order to determine the short-term tensile welding factor.

A tensile test can be used in conjunction with other tests (e.g. bend, tensile creep, macro) to assess the performance of welded assemblies, made from thermoplastics materials.

The test is applicable to welded semi-finished products made from thermoplastics materials filled or unfilled, but not reinforced, irrespective of the welding process used.

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.

EN 13100-1, *Non destructive testing of welded joints of thermoplastics semi-finished products - Part 1: Visual examination*

EN ISO 527-1, *Plastics - Determination of tensile properties - Part 1: General principles (ISO 527-1)*

ISO 5893, *Rubber and plastics test equipment - Tensile, flexural and compression types (constant rate of traverse) - Specification*

ISO 13953, *Polyethylene (PE) pipes and fittings - Determination of the tensile strength of test specimens from a butt-fused joint*

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3 Terms, definitions, symbols and abbreviated terms**3.1 Terms and definitions**

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No terms and definitions are listed in this document.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.2 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in Table 1 apply.

Table 1 — Symbols and abbreviated terms

Symbols and abbreviated term	Designations	Units
a	Minimum measured thickness of the test specimen within calibrated and parallel length	mm
a_n	Nominal thickness of the test piece	mm
b	Width of calibrated and parallel length of the test specimen	mm
b_1	Width of shoulder of the test specimen	mm
D_n	Nominal outside diameter of the tube	mm
F_r	The value of force of the unwelded test specimens taken from the same test piece, used in the calculation of f_s	N
f_s	The short-term tensile welding factor	None
F_w	The value of force of the welded test specimen used in the calculation of f_s	N
L	Total length of the test specimen	mm
L_j	Minimum distance between the clamping jaws	mm
L_o	Calibrated and parallel length of the test specimen	mm
L_w	Maximum width of the weld bead of the test specimen	mm
r	Radius of shoulder of the test specimen	mm
a_r	The value of stress of the unwelded test specimens taken from the same test piece, used in the calculation of f_s	N/mm ²
a_w	The value of stress of the welded test specimens used in the calculation of f_s	N/mm ²

4 Principle of the test

The test specimen is extended along its major longitudinal axis at constant speed until the test specimen fractures or yields. During this procedure the load sustained by the test specimen is measured.

5 Sampling procedures

The test specimens (welded and unwelded) shall be cut perpendicular to the welded joint at least eight hours after welding.

Each test specimen shall be marked in order to identify its original position within the test piece.

No heat treatment or mechanical straightening operations shall be carried out on the test specimen.

6 Dimensions of test specimens

For tubes of nominal outside diameter D_n less than 20 mm, the whole tube shall be tested and the minimum distance between the clamps shall be 200 mm.

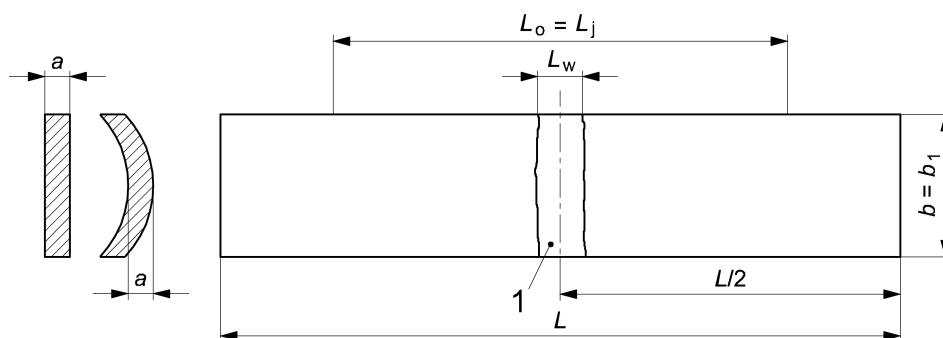
The dimensions of test specimens are given in Table 2 and Table 3.

Table 2 — Dimension of type 1 test specimens

Dimension in millimetres

D_n or a_n	b	L_o	L
$20 \leq D_n < 50$	$a_n + \frac{D_n}{10}$	80	≥ 120
$50 \leq D_n < 100$	$a_n + \frac{D_n}{10}$	120	≥ 170
$D_n \geq 100$ or flat assemblies: $a_n \leq 10$ $10 < a_n \leq 20$ $a_n > 20$	15 30 $1,5 a_n$	120 120 200	≥ 170 ≥ 300 ≥ 400

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Key

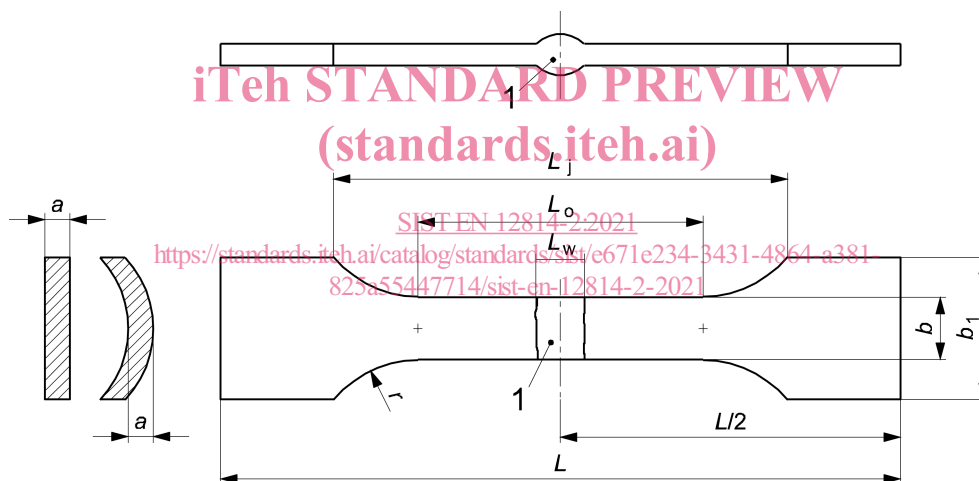
1 weld

Figure 1 — Type 1 test specimen for flat and tubular assemblies

Table 3 — Dimension of type 2 test specimens

Dimensions in millimetres

D_n or a_n	b	min. b_1	L_0	L	r
$20 \leq D_n < 50$	$a_n + \frac{D_n}{10}$	$b + 10$	80	≥ 120	60
$50 \leq D_n < 100$	$a_n + \frac{D_n}{10}$	$b + 10$	120	≥ 170	60
$D_n \geq 100$ or flat assemblies:					
$a_n \leq 10$	15	20	120	≥ 170	60
$10 < a_n \leq 20$	30	40	120	≥ 300	60
$a_n > 20$	$1,5 a_n$	80	200	≥ 400	60

**Key**

1 weld

Figure 2 — Type 2 test specimen for flat and tubular assemblies

Where the beads are left intact in service, they shall be left intact for the test. Where the beads are removed in service, they shall be removed prior to testing.

The tolerance for b shall be ± 1 mm and the minimum value shall be 6 mm. The tolerance for L_0 shall be ± 2 mm.

The variation of b over the length L_0 shall not exceed $\pm 2\%$ of the average value of b .

The forms of the test specimens are given in Figure 1 and Figure 2.

For overlap joints, the dimensions and form of the test specimens are given in Annex A.

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7 Cutting of test specimens

The tensile test specimens shall be cut with parallel sides as shown in Figures 1 and 2. During cutting, heating of the test specimen shall be minimized.

Cutting of the test specimen shall not produce notches.

After cutting, a visual examination of the weld according to EN 13100-1 shall be carried out and recorded.

8 Mechanical testing

Test specimen shall be conditioned to a temperature of (23 ± 2) °C and unless otherwise specified, the test shall be carried out at a room temperature of (23 ± 2) °C.

The test speeds and tolerances shall be in accordance with EN ISO 527-1.

For all materials the test speed shall be chosen to ensure that the test is terminated in about one minute. Examples of test speeds for some relevant thermoplastics materials are listed in Annex B.

At least five test specimens shall be tested for each welded and unwelded test piece.

Welded and unwelded test specimens shall be of the same geometry and shall be tested at the same speed with the same distance between the clamps.

If all welded test specimens fracture or yield within the calibrated length, but outside of the weld (L_w), the unwelded test specimen do not need to be tested, and the short-term tensile welding factor shall be taken as 1.

In order to achieve a failure in the weld, the test specimens shall be as described in ISO 13953 (Type A only, for thickness less than 25 mm) or in Annex C.

9 Test equipment

The test equipment shall conform to the requirements given in ISO 5893.

The crosshead displacement shall be continuous, uniform and in accordance with Clause 8.

10 Determination of the short-term tensile welding factor

In order to determine the short-term tensile welding factor, welded and unwelded test specimens shall be tested.

The short-term tensile welding factor is determined from the arithmetic mean values of the fracture stresses of the welded test specimens, σ_w , and the unwelded test specimens σ_r , where:

$$\sigma_w = \frac{F_w}{ab}$$

$$\sigma_r = \frac{F_r}{ab}$$

If the test specimens yield prior to fracture, the yield stress shall be used instead of fracture stress.

Short term tensile welding factor $f_s = \frac{\bar{a}_w}{\bar{a}_r}$

if $\bar{a}_w > \bar{a}_r$, then $f_s = 1$.