British Standard

BRITISH STANDARD

BS EN
12814-2:2000

Testing of welded joints of thermoplastics semi-finished products —

Part 2: Tensile test

The European Standard EN 12814-2:2000 has the status of a British Standard

ICS 25.160.40

National foreword

This British Standard is the official English language version of EN 12814-2:2000.

The UK participation in its preparation was entrusted to Technical Committee PRI/80, Welding thermoplastics, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 12, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the Sector Committee for Materials and Chemicals, was published under the authority of the Standards Committee and comes into effect on 15 May 2000

ISBN 0 580 35894 1

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12814-2

January 2000

ICS 25.160.40

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 27 November 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 12814-2:2000 E

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 249, Plastics, the Secretariat of which is held by IBN.

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 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This standard 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 may 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 co-axial or co-planar welded assemblies made from thermoplastics materials filled or unfilled, but not reinforced, irrespective of the welding process used.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of, any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 527-1, *Plastics - Determination of tensile properties - Part 1: General principles.*

ISO 5893:1993, *Rubber and plastics test equipment - Tensile, flexural and compression types (constant rate of traverse) - Description.*

ISO/DIS 13953:1996, *Polyethylene (PE) pipes and fittings - Determination of the tensile strength of test specimens from a butt-fused joint.*

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

3 Symbols and designations

Symbols and designations are given in Table 1.

Table 1 - Symbols and designations

Symbols and abbreviations	Designations	Units
a	Minimum measured thickness of the test specimen within calibrated and parallel length	millimetre
a_n	Nominal thickness of the test piece	millimetre
b	Width of calibrated and parallel length of the test specimen	millimetre
b_1	Width of shoulder of the test specimen	millimetre
D_n	Nominal outside diameter of the tube	millimetre
F_r	The value of force of the unwelded test specimens taken from the same test piece, used in the calculation of f_s	Newton
f_s	The short-term tensile welding factor	
F_w	The value of force of the welded test specimen used in the calculation of f_s	Newton
L	Total length of the test specimen	millimetre
L_j	Minimum distance between the clamping jaws	millimetre
L_0	Calibrated and parallel length of the test specimen	millimetre
L_w	Maximum width of the weld bead of the test specimen	millimetre
r	Radius of shoulder of the test specimen	millimetre
σ_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
σ_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

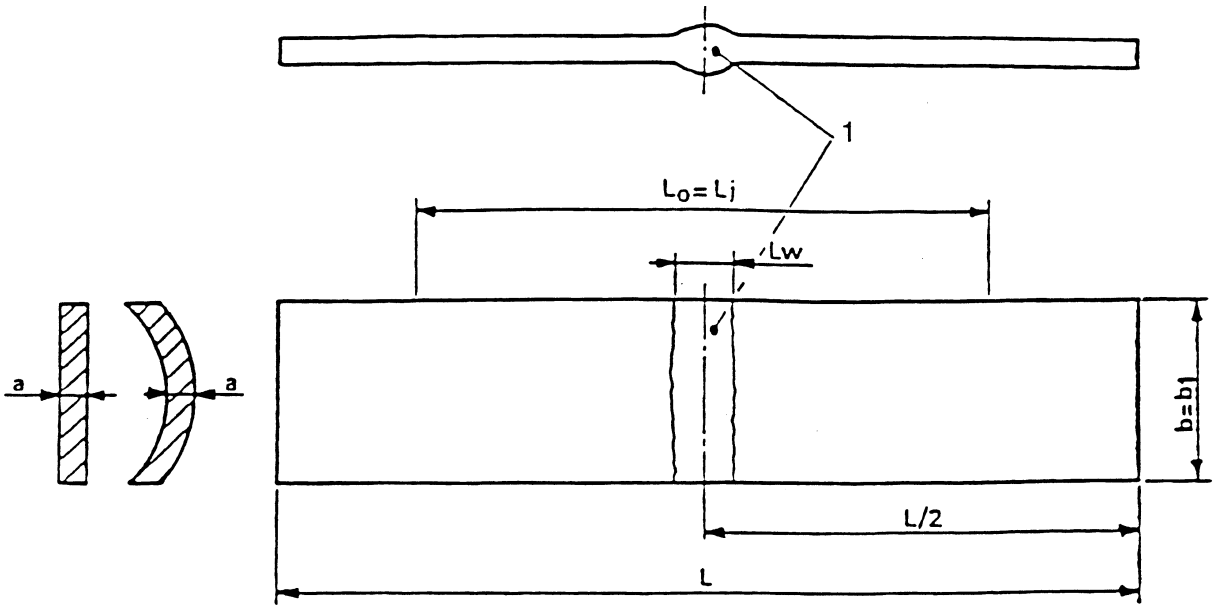
For tubes of nominal outside diameter D_n less than 20 mm the whole tube shall be tested and the minimum distance between the clamps shall be 200 mm.

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

Table 2 - Dimensions of type 1 test specimens

Dimensions in millimetres

D_n or a_n	b	L_0	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 :			
$a_n \leq 10$	15	120	≥ 170
$10 < a_n \leq 20$	30	120	≥ 300
$a_n > 20$	$1{,}5a_n$	200	≥ 400



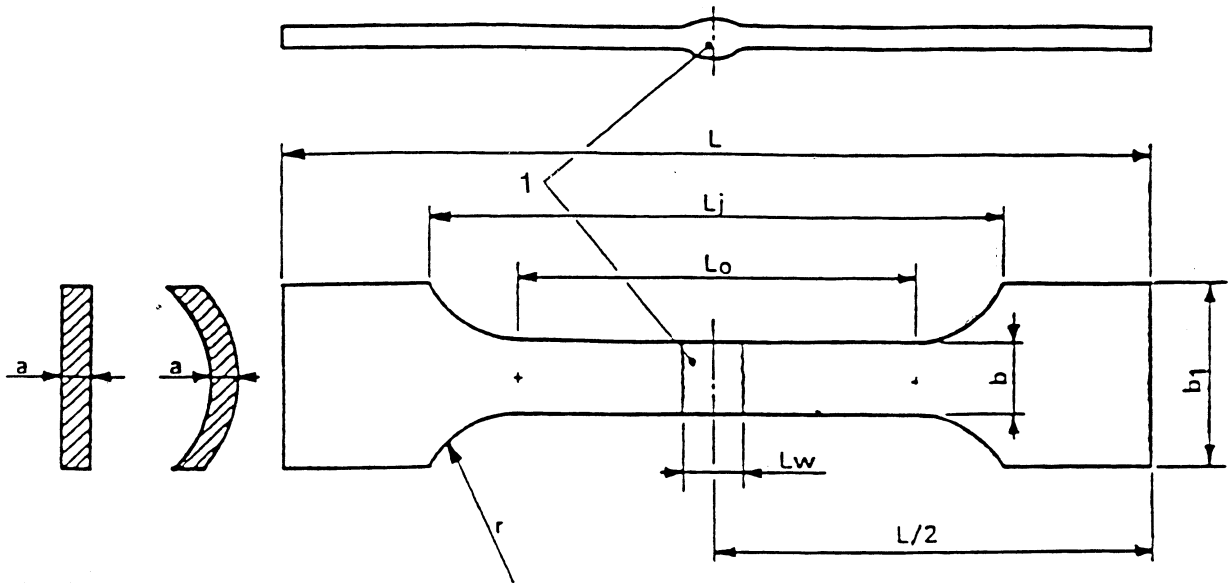
Key
1 Weld

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

Table 3 - Dimensions 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 :					
$a_n \leq 10$	10	20	120	≥ 170	60
$10 < a_n \leq 20$	30	40	120	≥ 300	60
$a_n > 20$	$1{,}5a_n$	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 ±2 % of the average value of b.

The forms of the test specimens are given in Figures1 and 2.

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/-5) °C.

The test speeds and tolerances shall be in accordance with 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 A.

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 and thus a better differentiation of the weld quality, the test specimens should be as described in ISO/DIS 13953:1996 or in annex B.

9 Test equipment

The test equipment shall conform to the requirements given in ISO 5893:1993.

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 $f_s = \dfrac{\overline{\sigma_w}}{\overline{\sigma_r}}$

If $\overline{\sigma_w} > \overline{\sigma_r}$, then $f_s = 1$

At least ten test specimens (five welded and five unwelded) shall be used in the evaluation of the short-term tensile welding factor. No test specimen shall be disregarded unless failure occurs in the clamps.

In the case of the type 1 test specimens, failure within a distance of 1 times specimen width (b) from the clamps shall be regarded as failure in the clamp.

If type 1 test specimens consistently fail in the clamps then type 2 test specimens shall be used.

In the case of type 2 test specimens, failure outside of the calibrated length (L_0) shall be regarded as failure in the clamp.

In the case of the whole tube tensile test, failure within a distance of $1{,}5D_n$ from the clamps shall be regarded as failure in the clamp.

11 Test report

The test report shall refer to this standard and it shall include at least the following information:

a) description and identification of the test piece and test specimens;

b) appearance of the test pieces before the test:

   1) visual examination of weld;

   2) beads removed or not;

c) weld type;

d) maximum width of the weld bead, if applicable (L_w);

e) nominal outside diameter of the tube, if applicable (D_n);

f) number of test specimens;

g) type of test specimen;

h) appearance of all surfaces of the test specimens, (e.g. flaws, scratches, visual imperfections);

i) thickness of test specimen (a);

j) width of calibrated and parallel length (b);

k) calibrated and parallel length (L_0);

l) total length of the test specimen (L);

m) width of the test specimen shoulder, if applicable (b_1);

n) radius of shoulder (r);

o) distance between the clamping jaws;

p) temperature of the test specimen (°C);

q) room temperature during the test (°C);

r) the crosshead speed (mm/min);

s) visual examination of the ruptured surface, if applicable;

t) individual values of measured forces (F_w and F_r);

u) individual values of calculated stresses (σ_w and σ_r);

v) values of calculated average stresses ($\overline{\sigma_w}$ and $\overline{\sigma_r}$);

w) calculated value of the short term tensile welding factor (f_s);

x) identification of the laboratory;

y) date of the test;

z) name and signature of the responsible person for the test report.

Annex A (informative)

Test speed for some thermoplastics materials

The test speeds used for some thermoplastics materials are given in Table A.1:

Table A.1 - Test speed for some thermoplastics materials

Material	Speed mm/min
PVC	10
PVDF, PP-H, PP-B	20
PE, PP-R	50

Annex B (informative)

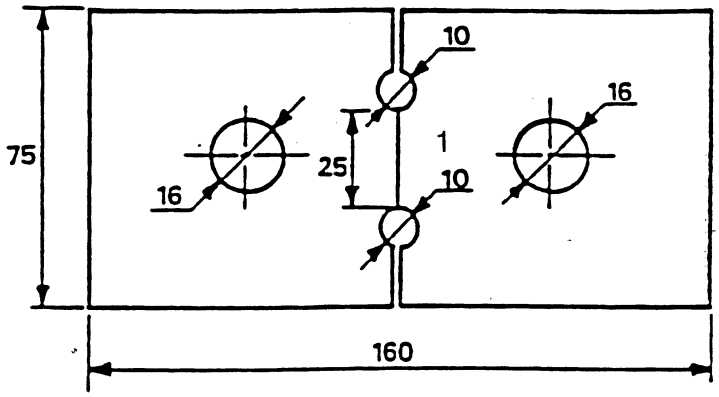
Notched tensile test specimen

If a short-term tensile welding factor of 1,0 is achieved then a notched tensile test can be used in order to optimize welding parameters, etc.

However, the values determined using the notched tensile test shall not be correlated with the values of f_s determined using type 1 or type 2 test specimens.

The test specimen used for the notched tensile test is described in Figure B.1:

Dimensions in millimetres



Key
1 Weld line

Figure B.1 - Notched tensile test specimen

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL