BS EN 514:2000

Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors — Determination of the strength of welded corners and T-joints

The European Standard EN 514:2000 has the status of a British Standard

ICS 83.140.99; 91.060.50

National foreword

This British Standard is the official English language version of EN 514:2000, which is included in a package of new European Standards being prepared by CEN/TC 33 relating to PVC-U profiles for windows and doors. Other standards included in the package are ENs 477, 478, 479, 513 and 12608. Although the English text versions of these European Standards will be adopted as British Standards as they become available, the existing British Standards for PVC-U profiles will be retained, but only until such time that the complete package of European Standards becomes available. The original group of British Standards will then be withdrawn and this will be notified in BSI *Standards Update*. This British Standard will supersede BS 7413:1991.

The UK participation in its preparation was entrusted by Technical Committee B/538, Doors, windows, shutters, hardware and curtain walling, to Subcommittee B/538/1, Windows, 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 subcommittee 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.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 14, an inside back cover and a back cover.

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English version

Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors - Determination of the strength of welded corners and T-joints

Profilés de polychlorure de vinyle non plastifié (PVC-U) pour la fabrication de fenêtres et de portes - Détermination de la résistance des assemblages soudés en angles et en T

Profile aus weichmacherfreiem Polyvinylchlorid (PVC-U) zur Herstellung von Fenstern und Türen - Bestimmung der Festigkeit verschweißter Ecken und T-Verbindungen

This European Standard was approved by CEN on 7 June 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.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 33 "Doors, windows, shutters, building hardware and curtain walling", the secretariat of which is held by AFNOR.

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.

The requirements are incorporated in the appropriate product standards.

Annex A, which is normative, gives a method for the calculation of the failure stress.
Annex B, which is informative, is a bibliography.

This European Standard will result in one of a series of standards on test methods which supports product standards for PVC-U profiles for the fabrication of windows and doors.

1 Scope

This European Standard specifies two test methods for the measurement of the failure load of welded corners and T-joints made from unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors. From the failure load the failure stress is calculated.

2 Definitions

For the purposes of this European Standard, the following definition applies

2.1 failure load: That load at which yield occurs, or, if yield does not occur, the load at which the test piece breaks.

3 Principle

Welded corners and T-joints made from unplasticized polyvinylchloride (PVC-U) profiles are subjected to a tensile bending or compression bending test at specified temperature and test speed.

The failure load is recorded and the failure stress is calculated.

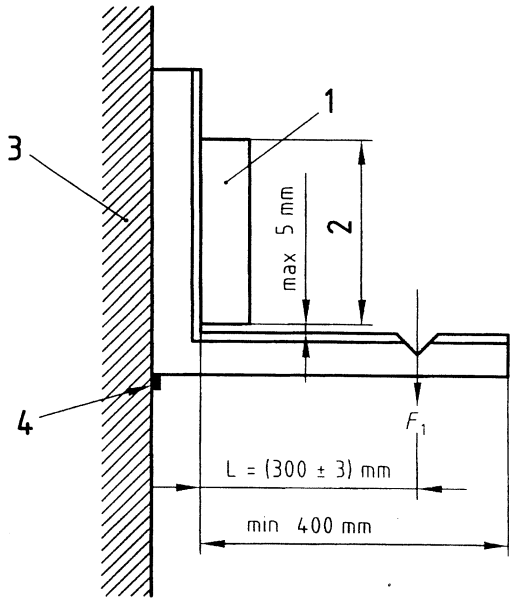
4 Apparatus

4.1 Tensile or compression testing machine with the following specifications:

a) measuring range of load: 2 kN to 20 kN;
b) load indication with zero point setting and peak recording;
c) measurement accuracy: ± 3 %;
d) test speed: (50 ± 5) mm/min.

4.2 Test arrangements

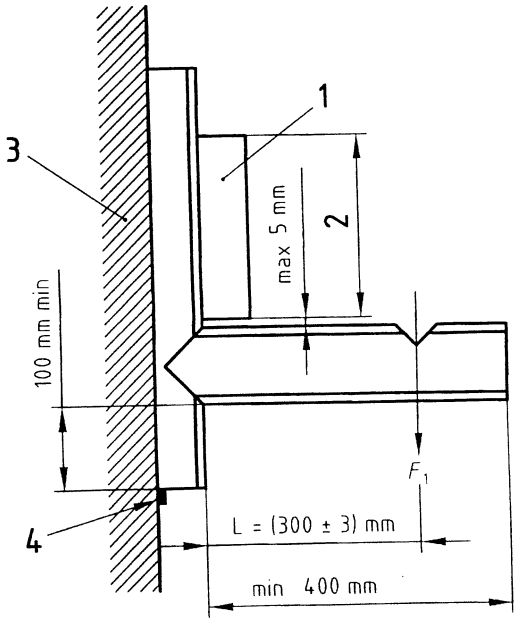
4.2.1 Corner weld samples for tensile bending test (see figure 1)



1 clamping device
2 rigid support over a minimum clamping length of 400 mm
3 frame
4 optional support block (5 ± 0,5) mm

Figure 1: Example of a test rig for a tensile bending test of corners

4.2.2 T-joint weld samples for tensile bending test (see figure 2)



1 clamping device
2 rigid support over a minimum clamping length of 400 mm
3 frame
4 optional support block (5 ± 0,5) mm

Figure 2: Example of a test rig for a tensile bending test of T-joints

4.2.3 Corner weld samples for compression bending test (see figure 3)

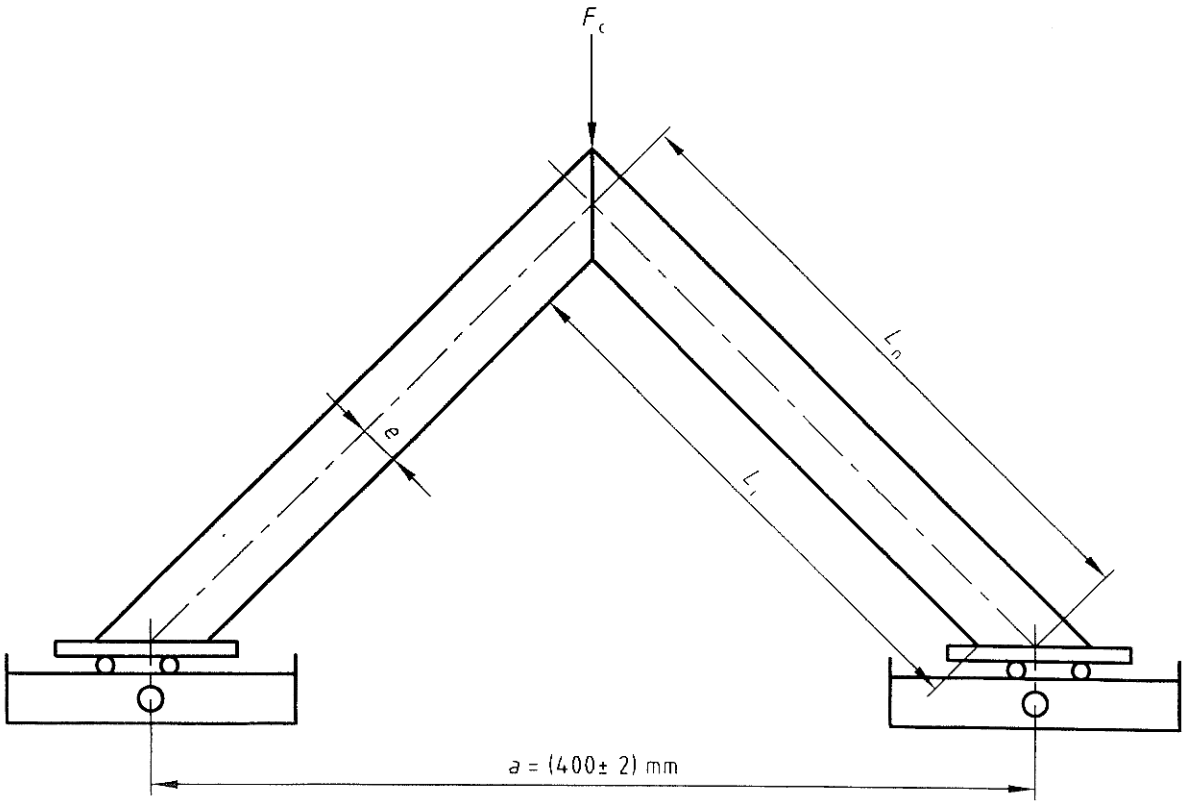


Figure 3: Example of a test rig for compression bending test of corner joints

4.2.4 T-joint weld samples for compression bending test (see figure 4)

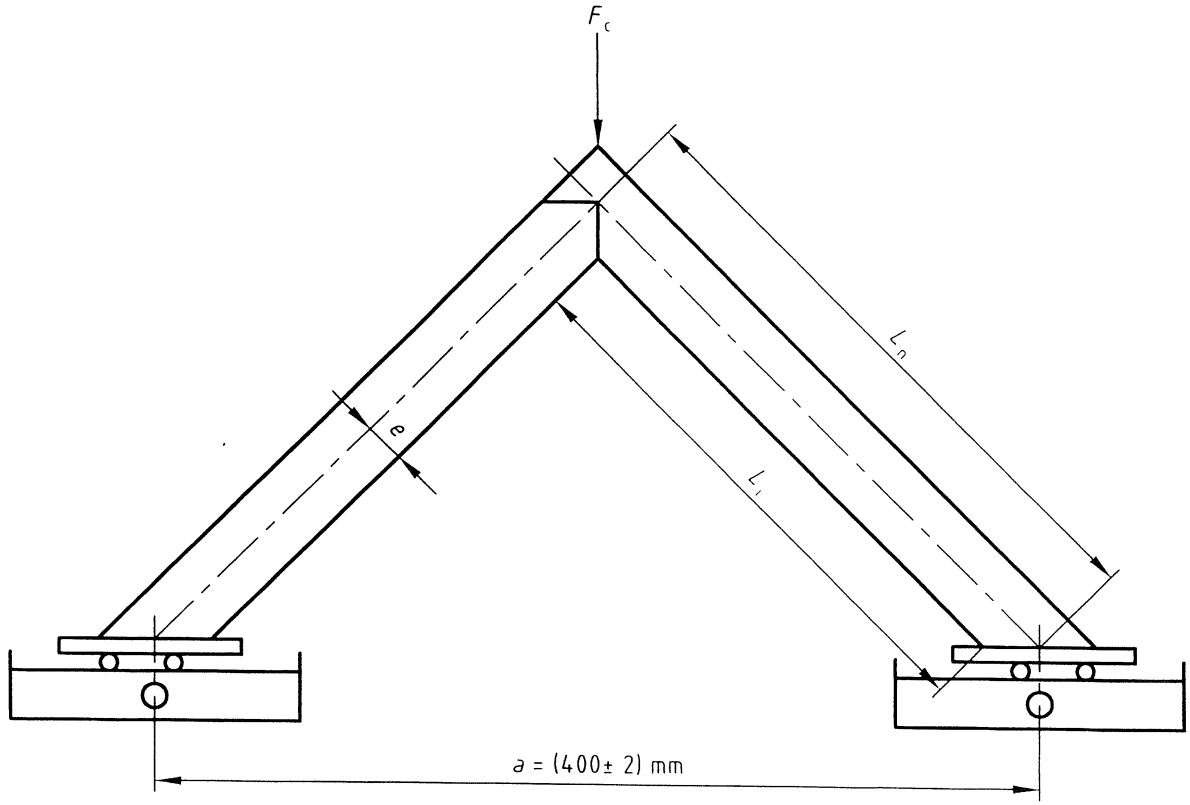


Figure 4: Example of a test rig for compression bending testing of corners

5 Test piece

5.1 Welding of the corner test piece

The test piece is a welded corner with an angle of (90 ± 1) °.
Two lengths of profile cut at 45 ° are heat welded.

5.2 Welding of the T-joint test piece

The test piece is a welded T-joint with an angle of (90 ± 1) °. The T-joint is fabricated by heat welding one piece of, for instance, sash or outer frame profile at least 500 mm long and one piece of, for instance, transom profile at least 400 mm long.
Before welding, the sash or outer frame profile is notched at 2 x 45 ° to a depth in accordance with the formula:

0,5 · **(*w*-*s*)**

where:

w = width of transom profile;
s = welder head stroke.

The transom profile end is sawn into a symmetrical 90 ^{o} point.

The position of the 90 ^{o} notch in the sash or frame profile is such as to leave a minimum 400 mm leg measured from the top of the transom profile (see figure 2).

NOTE: The document DVS 2207 Part 25 clauses 2 to 8 contain information about welding procedures which may be of relevance.

5.3 Tensile bending test piece

5.3.1 The inside leg length of the test piece for corner testing shall be at least 400 mm (see figure 1).

5.3.2 The T-joint test piece is fabricated with the sash or frame arms of inside length at least 400 mm and 100 mm, and the transom or mullion stem length at least 400 mm (see figure 2).

5.4 Compression bending test piece

5.4.1 The legs of the corner test piece are cut at an angle of (45 ± 1) ^{o} in such a way that the neutral axes of the end sections are located vertically over the axes of rotation of the carriage (approximately the middle of the main chamber of the profile) (see figure 3). The inside length of the legs L_i in millimetres is obtained from the following formulae:

$$L_i = L_n - 2e$$

$$L_n = \frac{400}{\sqrt{2}} = 283$$

$$L_i = 283 - 2e$$

where:

L_n = the length of the neutral axis of the profile in millimetres;
e = the distance between the inside of the section and the neutral axis in millimetres.

5.4.2 The short arm of the T-joint test piece is cut off level with the outer face of the stem to produce a 90 ^{o} corner. Further preparation of the corner is in accordance with 5.4.1 (see figure 4).

5.5 Number of test pieces

A minimum of three samples per profile type, all made on the same welder head, shall be tested to obtain a mean value.

6 Conditioning

The test pieces shall be conditioned at (23 ± 5) °C for at least two hours immediately prior to testing.

7 Procedure

7.1 Test temperature

The test is carried out at a temperature of (23 ± 5) °C.

7.2 Tensile bending test

7.2.1 Clamp the test piece in the apparatus as shown in figures 1 or 2. Contoured support blocks may be used, if necessary, to limit twisting.

7.2.2 Apply the load to the test piece in such a way that the speed of application is 50 mm/min.

7.2.3 Continue until the test piece fails.

7.2.4 Note the failure load F_t and calculate the failure stress in accordance with annex A.

7.3 Compression bending test

7.3.1 Place the test piece on the trolley as shown in figures 3 or 4. In order to avoid excessive deflection, the open frame end of the T-joint can be supported in the corner area by inserting a cavity filling block (e.g. a piece of metal reinforcement or a wooden block).

7.3.2 Apply the load to the test piece in such a way that the speed of application is 50 mm/min.

7.3.3 Continue until the test piece fails.

7.3.4 Note the failure load F_c and calculate the failure stress in accordance with annex A.

8 Test report

The test report shall include the following information:

a) reference to this European Standard;

b) the name of the test laboratory;

c) full identification of the profile(s);

d) identification of the joint

1) the type of the joint (corner or T-joint);

2) the presence or absence of welding sprue (bead);

3) if more than one welding head is in use, the nominated head;

e) the date of testing;

f) the welding conditions;

g) the test method (tensile bending or compression bending);

h) for compression bending testing the inside length of the leg of the test piece;

i) the test temperature;

j) the failure load for every test piece;

k) the calculated failure stress for every test piece and the average failure stress;

l) all operating details not specified in this European Standard, as well as any incidents likely to have influenced the results.

Annex A (normative)

Method for the calculation of the failure stress

A.1 Tensile bending test

The failure stress of a welded corner or T-joint depends on the failure load, the profile geometry and the test arrangement (see figures 1 or 2). It is calculated by the formula:

$$\sigma_t = \frac{(L \cdot F_t)}{W}$$

where:

F_t = the failure load determined by tensile bending testing [N];

L = the distance between the corner in the highest flange and the point of application of the load [mm];

W = the moment of resistance in the loading direction = I/e [mm^3];

I = the moment of inertia about the neutral axis zz' (see figure A.1) of the cross section of the profile given by the manufacturer [mm^4]; for T-joints with different profiles, the lower moment of inertia shall be used;

e = the distance between the critical point A and the neutral axis zz' (see figure A.1) [mm];

σ_t = the failure stress by tensile bending [N/mm^2].

A.2 Compression bending test

The failure stress of a welded corner or T-joint depends on the failure load, the profile geometry and the test arrangement (see figure 3 or 4). It is calculated by the formula:

$$\sigma_c = F_c \cdot \left| \left(a/2 - e/\sqrt{2} \right) / 2W \right|$$

where:

F_c = the compression bending failure load [N];

W = the moment of resistance in the loading direction = I/e [mm^3];

I = the moment of inertia about the neutral axis zz' (see figure A.1) of the cross section of the profile given by the manufacturer [mm^4]; for T-joints with different profiles, the lower moment of inertia shall be used;

e = the distance between the critical point A and the neutral axis zz' (see figure A.1) [mm];

a = the distance between the axes of rotation of the carriages = (400 ± 2) mm;

σ_c = the failure stress by compression bending [N/mm^2].

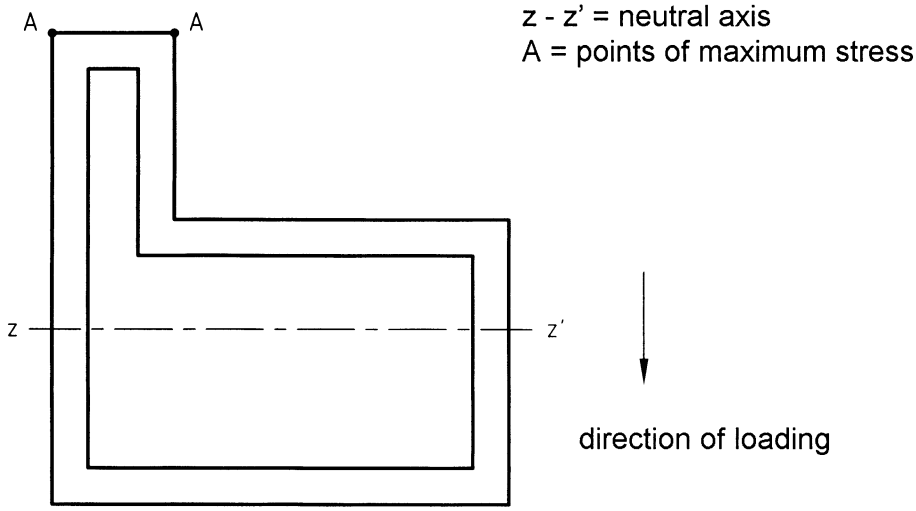


Figure A.1: Position of point of maximum bending stress

Annex B (Informative)

Bibliography

The following documents have served as reference documents in the preparation of this European Standard:

DVS 2207 Teil 25 - Schweißen von thermoplastischen Kunststoffen. Heizelementstumpfschweißen. Schweißen von Fensterprofilen aus PVC-U (October 1989).

Guide Technique UEAtc - Pour l'agrément des fenêtres en PVC (Juillet 1990).

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