BRITISH STANDARD

BS 7414:1991

Incorporating Amendment No. 1

Specification for

White PVC-U extruded hollow profiles with heat welded corner joints for plastics windows: materials type B

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Elements and Components (of Diverse Materials) for Buildings Standards Policy Committee (ECB/-) to Technical Committee ECB/46, upon which the following bodies were represented:

Association of Builders' Hardware Manufacturers
Association of Metropolitan Authorities
British Board of Agrément
British Plastics Federation
Consumer Policy Committee of BSI
Department of Health
Department of the Environment (Building Research Establishment)
Department of the Environment (Property Services Agency)
Flat Glass Manufacturers' Association
Glass and Glazing Federation
Institution of Fire Engineers
London Housing Consortium
Plastics Window Association Ltd.
Royal Institute of British Architects

This British Standard, having been prepared under the direction of the Elements and Components (of Diverse Materials) for Buildings Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 29 March 1991

The following BSI references relate to the work on this standard:
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Contents

Foreword

This British Standard has been prepared under the direction of the Elements and Components (of Diverse Materials) for Buildings Standards Policy Committee.

BS 7412 should be read in conjunction with this standard.

White PVC-U extruded hollow profiles with heat welded corner joints for plastics windows: materials type A, are specified in BS 7413.

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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, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies requirements for the raw materials and properties of the finished profile after manufacture for white PVC-U extruded hollow profiles with heat welded corner joints for plastics windows manufactured from materials type B.

Methods of test are given in Appendix A to Appendix K.

NOTE 1 Plastics windows made from PVC-U extruded hollow profiles are specified in BS 7412 and requirements for white PVC-U hollow profiles for plastics windows manufactured from materials type A are specified in BS 7413.
NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the definitions given in BS 6100-1.3.5 and BS 6100-1.5.1 apply together with the following.

2.1
die line

a continuous longitudinal mark on the external faces of a profile that originates during extrusion

2.2
face surface

a surface in a profile that is exposed to view when the window is closed

2.3
profile

a length of extruded material of defined cross section

2.4
sink mark

a depression on the surface of an extrusion

2.5
type B materials

materials complying with the requirements of Table 1

3 Raw materials

3.1 Composition

The profiles shall be made from type B materials consisting substantially of unplasticized polyvinyl chloride (PVC-U).

NOTE 1 Only those additives and pigments may be used that are necessary for the manufacture of the compound and for its subsequent conversion into sound, durable extrusions of good surface finish and mechanical strength as assessed by the requirements of Table 1 of this specification.
NOTE 2 Profiles may contain a percentage of regranulated or repulverized material (up to 10 %).

If reworked material is added or used it shall comprise the manufacturer's own clean reworked material from products complying with this standard and the resulting profile shall comply with this standard.

3.2 Physical properties

The PVC-U material from which the profiles are made shall comply with the requirements given in Table 1.

The tests shall be carried out on samples cut from the face surfaces of extruded profile except on samples for the apparent modulus of elasticity test which shall be carried out on pressed plaques prepared from milled sheet under the conditions specified in ISO 1163-2.

4 Profile properties

4.1 Storage and conditioning of test samples

All samples shall be stored at 20 ± 5 °C and shall not be tested sooner than 16 h after production. Samples shall be conditioned and tested in accordance with the requirements of the relevant appendix.

NOTE 1 For the purposes of quality control routine testing the storage time can be shorter than 16 h providing the final storage temperature of 20 ± 5 °C is obtained.
NOTE 2 The 20 ± 5 °C is a storage temperature not a conditioning temperature.

4.2 Appearance and finish

The colour of the profile shall be uniform when viewed by normal or corrected vision at a range of 1 m, in 45° north sky light viewing perpendicular to the surface as described in clause **14** of method A01 of BS 1006:1990. The external and internal face surfaces of the profile shall be free from foreign bodies, cracks, sink marks or die lines when similarly viewed.

In an assembled window unit the total colour difference (ΔE^*), measured to comply with BS 3900-D8, BS 3900-D9 and BS 3900-D10 between any one and any other of the lengths of profile used shall not exceed 1.0.

4.3 Manufacturing tolerances

4.3.1 The profiles shall be straight such that the longitudinal axis of the profile, as measured on the face surfaces, may deviate from the straight line by not more than 1 mm/m. The cross section of the profile shall conform in shape and dimensions to the manufacturer's drawing subject to the tolerances in **4.3.2**.

4.3.2 Tolerances on dimensions, outer wall thickness, surface flatness and on rebate grooves shall be as given in Table 2.

Table 1 — Physical properties of PVC-U type B material

Test	Test method	Minimum value
Softening point	BS 2782:Method 120B	80 °C
Apparent modulus of elasticity	BS 2782:Method 335A (Rate of strain = 5 mm/min)	3 000 MPa
Tensile yield stress at 23 °C	BS 2782:Method 320C (Rate of strain = 5 mm/min)	44 MPa
Impact strength	BS 2782:Method 359 (see Appendix A)	8 kJ/m^2
Tensile-impact strength	ISO 8256	
at 23 °C	Method A specimen type 5 (see Appendix B)	600 kJ/m^2
at 0 °C		400 kJ/m^2
Retention of tensile-impact strength after artificial ageing	Appendix C	75 % of original value

If internal webs are present they shall be controlled so that at all times reinforcement and other hardware are able to be fitted freely without prior web machining.

4.3.3 The mass of the profile per metre shall not be more than 5 % below the nominated value.

4.4 Heat reversion

Main frame subsill and casement or sash profiles shall be tested in accordance with Appendix E. The mean maximum reversion shall be not greater than 2 %. There shall also be not more than a 0.4 % difference between the individual face sides of the same sample. Glazing beads shall also be tested in accordance with Appendix E. The mean maximum reversion shall be not more than 3 % and there shall be not more than a 0.6 % difference between the face side and the opposite side of the same sample.

4.5 Heat ageing

When tested in accordance with Appendix F the profile shall show no bubbles, cracks or delamination.

4.6 Impact resistance at low temperature

When main frame subsill and casement or sash profiles are tested in accordance with Appendix G, no sample shall exhibit cracking through the entire wall thickness of the profile.

Ten samples per main frame, casement or sash profile shall be tested (five samples being used for each face) and there shall be no failures. Five samples per subsill profile shall be tested on the upper visible surface and there shall be no failures.

4.7 Colour fastness

When tested in accordance with Appendix H the maximum colour change allowed is that rated 3-4 on the grey scale specified in method A03 of BS 1006.

The maximum colour difference when assessed by instrumental measurement in accordance with BS 3900-D8, BS 3900-D9 and BS 3900-D10 shall not exceed 7.0 CIELAB colour difference units (ΔE^*).

Any samples which, though they develop acceptable colour difference, show surface erosion with the development of loose pigment (chalking) shall be unacceptable.

4.8 Weld factor

When tested in accordance with the method given in Appendix J, the weld factor shall be not less than 0.7.

NOTE It is acknowledged that this test has some drawbacks but it is the best test that is currently available.

4.9 Corner strength

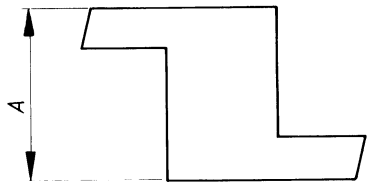
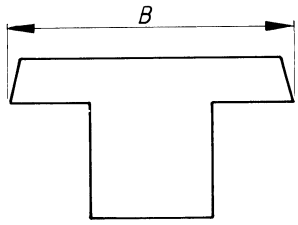
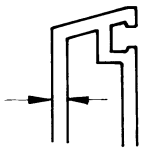
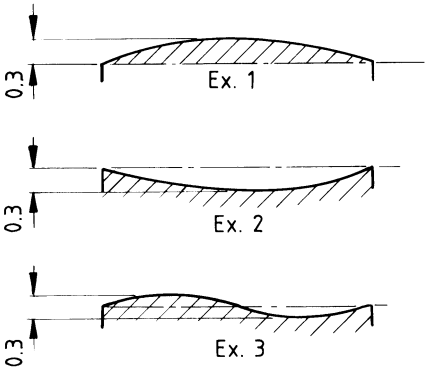
When tested in accordance with the method given in Appendix K, the weld joint shall not fracture below a stress level of 20 MPa.

5 Profile marking

The main frame subsill and casement or sash profiles shall be indelibly marked at approximately 1 m intervals, in a position that will not be visible when the window is closed, with this British Standard number, i.e. BS 7414:1991[1)], and with a mark enabling the manufacturer's name and date of manufacture of the extrusion to be traced without removal of the window. Subsills shall be similarly marked in a position that will be subsequently concealed by the window.

[1)] Marking BS 7414:1991 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Table 2 — Tolerances on dimensions

(a) *Overall dimensions across face surfaces* The dimension *A* between internal and external face surfaces of the profile shall be subject to a tolerance of ± 0.3 mm and shall be held over the full width of the face surfaces.	
(b) *General overall dimensions* All other overall profile dimensions shall be subject to a tolerance of ± 0.5 mm. NOTE Dimension *B* illustrates an example of a general overall dimension.	
(c) *Outer wall thickness* All outer wall thicknesses shall be subject to a tolerance of ± 0.3 mm.	
(d) *Face surface flatness* When measured in accordance with the method described in Appendix D the difference between maximum and minimum readings across the face shall not exceed 0.3 mm. NOTE Three examples are shown (all dimensions are in millimetres). *Example 1.* Indicates a convex face surface. *Example 2.* Indicates a concave face surface. *Example 3.* Indicates convex and concave face surfaces combined.	
(e) *Extruded rebate grooves for fixings* All extruded grooves shall be subject to a tolerance of ± 0.3 mm.	

Appendix A Impact strength test

A.1 Test specimens

A minimum of ten specimens shall be cut from the face sides of profile material, with the length L of the specimens along the direction of extrusion. The specimens shall have the dimensions and notch configuration shown in Figure 1.

Notches shall be machined on unnotched specimens prepared in accordance with **6.1** of BS 2782-3:Method 359:1993 with the exception of the notch dimensions which shall be in accordance with Figure 1. Notching shall be carried out on a milling machine or lathe using a single tooth cutter, a planing machine using a single tooth cutter or by broaching.

NOTE It is emphasized that the notch quality is important in order to obtain valid results. The notch precision and surface finish should be inspected prior to test. Inspection may be by the use of an optical device with a magnification of × 50.

A.2 Procedure

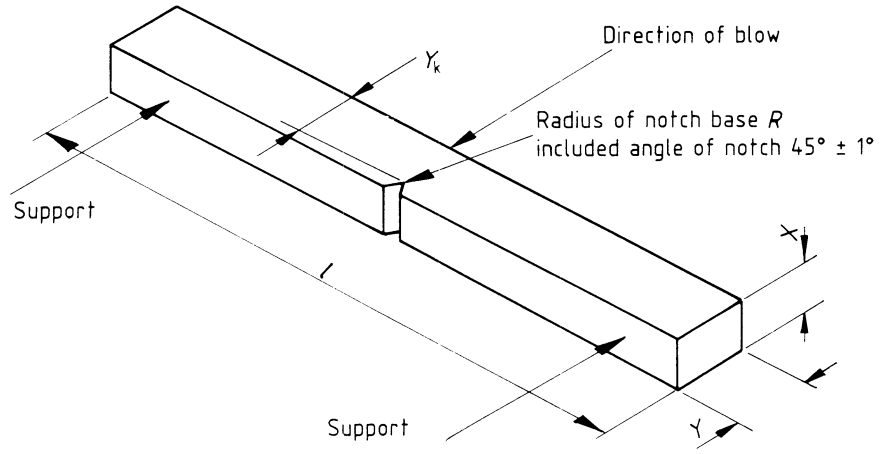
Condition and test the specimens by the method specified in BS 2782-3:Method 359.

NOTE 1 The pendulum used for the test is to have an impact energy of 1.0 J as characterized in Table 1 of BS 2782-3:Method 359:1993.

Calculate the arithmetic mean, the standard deviation and the coefficient of variation of the specimens tested.

NOTE 2 Some, or all, test specimens of certain materials may exhibit ductile breaks. If all specimens break in the ductile manner the impact strength is satisfactory. If a proportion of specimens tested break in the ductile manner, the impact strength of the material is as the value calculated from the results obtained only from those specimens broken in the brittle manner.

NOTE 3 Impact strength values obtained for a set of specimens which break in the brittle manner would normally be expected to achieve a coefficient of variation of less than 20 %. If the coefficient of variation for a set of specimens is greater than 20 %, it is recommended that a further set of specimens is tested.



Dimensions

l is the specimen length:	50 ± 1
Y is the specimen breadth:	6.0 ± 0.2
X is the specimen (and profile wall) thickness:	2.5 minimum
Y_k is:	4.8 ± 0.2
R is the radius of the notch base:	0.1 ± 0.02

All dimensions are in millimetres.

Figure 1 — Specimen dimensions for the impact strength test

Appendix B Tensile-impact strength test

B.1 Test specimens

A minimum of twenty specimens shall be cut from the face sides of profile material, with the length l of the specimens along the direction of extrusion. The specimens shall have the dimensions shown in Figure 2 (specimen type 5 of ISO 8256).

The specimens shall be machined with a milling machine. All machined sides of the specimens shall be free of visible defects, scratches or other imperfections. The cutting action of the machining tool shall be in the direction of the length of the specimen.

B.2 Procedure

Condition and test the specimens in accordance with method A of ISO 8256.

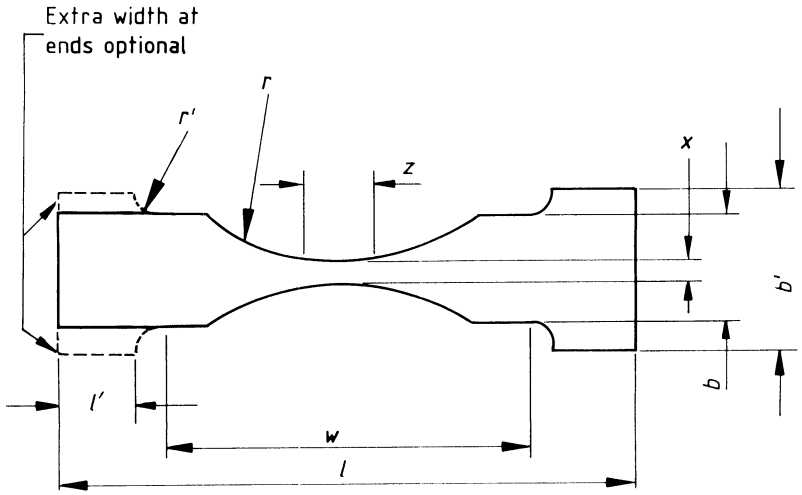
Test ten specimens at both temperatures of 23 °C and 0 °C.

NOTE 1 For tests at 0 °C, specimens should be broken within 10 s of removal from the cooling atmosphere.

NOTE 2 The pendulum used for the test should be chosen so that the energy absorbed in the test is between 20 % and 80 % of the maximum energy of the pendulum, i.e. a pendulum of 15 J or 25 J, as characterized in method A of ISO 8256. If two pendulums meet this criteria, the highest energy pendulum should be used.

B.3 Calculation

Calculate the arithmetic mean, the standard deviation and the coefficient of variation of the specimens tested.



Dimensions

l	= 80 ± 2
b	= 15 ± 0.5
x	= 5 ± 0.5
z	= 10 ± 0.2
w	= 50 ± 5
r	= 20 ± 1
b'	= 23 ± 2 (see note 2) or b = 15 ± 0.5
r'	= 4 ± 0.5
l'	= 11 ± 1

All dimensions are in millimetres.

NOTE 1 The thickness is the thickness of the face sides of the profiles from which the specimens are cut. The thickness is measured in the narrow zone of the specimen (zone Z).

NOTE 2 Width b' is optional.

Figure 2 — Specimen dimensions for the tensile-impact strength test

Appendix C Retention of tensile-impact strength after artificial ageing

C.1 Test specimens

Ten rectangular sample plates of 80 ± 2 mm × 23 ± 2 mm (the 80 mm dimension is along the direction of extrusion) shall be cut from the face sides of profile material.

C.2 Procedure

Expose the sample plates in a xenon lamp artificial weathering apparatus using the method and total radiation described in Appendix H. Ensure that the face surfaces of the samples are exposed to the lamp.

After irradiation, machine ten tensile-impact specimens from the exposed sample plates in accordance with **B.1** and measure their tensile-impact strength at 23 °C in accordance with **B.2**.

C.3 Calculation

Calculate the average retained tensile-impact strength expressed in percentage of the initial average value at 23 °C.

Appendix D Reference method for measuring face surface flatness and parallelism

NOTE Shadowgraphy or other suitable optical procedures are routinely used by the extruder for control checks of profile quality.
The method described below is a reference procedure suitable for use by both system supplier and fabricator.

D.1 Apparatus

D.1.1 *A surface plate* complying with BS 869 or BS 817 (cast iron or granite).

D.1.2 *A reversible dial gauge* with an accuracy of ± 0.001 mm.

D.1.3 *A dial gauge stand.*

D.1.4 *A universal angle plate.*

D.2 Test sample

The sample tested shall fit into the bed of the angle plate. Ideally it should be at least 100 mm in length, although shorter samples may be tested provided they will rest on the angle plate without moving.

D.3 Procedure

NOTE This procedure measures both surface flatness and parallelism.

Measure off points at 5 mm intervals at right angles to the sample length using a set square and lead pencil.
Set one end of the sample at the edge of the angle plate. Adjust the angle plate so that the measuring gauge reads the same (within its accuracy tolerance) at the two extremes of traverse across the face of the profile. The face to be measured is then set parallel to the surface plate.

Move the measuring device across the face of the profile, taking readings at the prescribed 5 mm intervals. Plot the readings on graph paper.

Remove the test piece, and mark the profile at 5 mm intervals as previously described. Once again plot the readings.

D.4 Calculations

The readings for the two surfaces shall be plotted on the same graph paper using the different colours to distinguish them. Join up the individual plot points for each surface and by inspection/calculation decide if the major faces meet the tolerances given in Table 2(d).

Appendix E Heat reversion test

E.1 Apparatus

E.1.1 *A thermostatically controlled electrically heated air oven with circulating fan* the whole interior of which is controlled at a temperature of 100 ± 2 °C. The heating capacity shall be such that after insertion of the test pieces, the test temperature is regained within 15 min.

E.1.2 *A talc dusted stainless steel plate* not exceeding 2 mm thick.

E.2 Test pieces

Three test pieces, 200 ± 5 mm long, shall be taken from each profile. On each of the two face sides of the profile samples, lines shall be drawn across the face 10 ± 1 mm from the ends of the samples.

E.3 Conditioning

The test pieces shall be conditioned at 20 ± 5 °C for at least 30 min prior to testing.

E.4 Procedure

Measure at temperature T within the range 20 ± 5 °C the distances between the pairs of marks on each face within ± 0.1 mm. Designate these distances $L_{o,1}$, $L_{o,2}$, $L_{o,3}$, ... $L_{o,n}$. Then place the samples horizontally in the orientation that will give the minimum contact area on the talc dusted stainless steel plate in the oven for 1 h at 100 ± 2 °C and commence the test when the test temperature is regained. Remove the samples from the oven and allow to cool by exposure to air at T ± 2 °C. Remeasure the distances between the pairs of lines as near to the centre of the face as possible, but avoiding any local variation caused by internal webs in the profile. Designate these distances $L_{i,1}$, $L_{i,2}$. The reversion value for each individual face of the sample is expressed as:

$$\% \text{ shrinkage} = \frac{(L_{o,n} - L_{i,n})}{L_{o,n}} \times 100$$

Record these individual values and their mean for each of the three samples.

NOTE The measurement L_i should be made along the chord of a curved sample and not along the centreline of the sample.

Appendix F Heat ageing test

F.1 Apparatus

F.1.1 *A thermostatically controlled electrically heated air oven with circulating fan.*

F.1.2 *A talc dusted stainless steel plate* not exceeding 2 mm thick.

F.2 Procedure

Place a sample of profile approximately 200 mm long horizontally on the talc dusted stainless steel plate in an air circulating oven for 30 min at 150 ± 3 °C. Allow the sample to cool to room temperature, and inspect the sample with normal corrected vision.

Appendix G Impact resistance at low temperature test

G.1 Apparatus

G.1.1 *Equipment to provide a means of securely supporting and impacting a profile sample*, consisting of sample supports with half round top edges (radius 5 ± 0.2 mm) fixed onto a base and a hemispherically ended impactor with a radius of 25 ± 0.5 mm.

G.1.2 *A thermostatically controlled freezer with circulating fan.*

G.2 Test conditions

Before the test, the samples shall be stored for at least 4 h at – 10 ± 2 °C and the test shall be carried out not more than 10 s after the sample is removed from store.

G.3 Procedure

Support the profile sample 300 ± 5 mm long at 200 ± 0.1 mm centres in the apparatus with one of its "face" sides uppermost. Drop a 1 kg – 0, + 10 g hemispherically ended impactor onto the mid-span position from a height of 1.5 m – 0, + 10 mm.

NOTE Because of the influence of profile geometry on impact strength, whenever possible, the sample should be impacted at a point mid-way between two supporting webs, where a web is defined as a membrane connecting two walls of the profile.

Appendix H Colour fastness test

H.1 Apparatus

H.1.1 *A xenon arc lamp weathering apparatus* as specified in BS 2782-5:Method 540B fitted with light filters which provide the nearest spectral distribution of incident radiation to that specified for simulated solar radiation in Annex C of BS 2782:Method 540B:1982.

NOTE It is recognized that precise matching of this distribution is not currently attainable. Particular emphasis should be given to matching the wavelength range 300 nm to 400 nm. Irradiance below 300 nm should not exceed 1 W/m^2.

H.2 Operating conditions

Water spray cycle: 18 min on, and 102 min off.

NOTE Pending the revision of ISO 4892:1981, which is equivalent to BS 2782:Method 540B:1982, the above cycle is preferred but results obtained using other cycles maintaining a similar on/off time ratio are acceptable.

Relative humidity in the dry period: 65 ± 5 %.

Maximum black panel temperature at the end of the dry period: 45 ± 3 °C.

H.3 Duration of exposure

Expose the outer, weather face of the test samples to a total irradiation integrated over the wavelength range 300 nm to 890 nm of 8 GJ/m^2. Determine the irradiation by the use of appropriately calibrated integrating detectors placed in the plane of the samples where available. Otherwise compute the duration of exposure from the manufacturer's design irradiance for the stated wavelength range appropriate to the lamps, wattage schedule and filters employed.

NOTE The total time of exposure to the lamps will normally fall within the range 2 250 ± 500 h.

H.4 Assessment of colour difference

Assess the colour difference between exposed and unexposed control samples on completion of the exposure period and at least three uniformly spaced intermediate times. Make the assessment as soon as possible following completion of the exposure period, preferably within 24 h.

Make the visual assessment by following the procedure set out in method A03 of BS 1006. Note the nature and uniformity of any colour change together with surface erosion, if present.

NOTE 1 Visual assessment should preferably be supported by instrumental colour difference measurement in accordance with BS 3900-D8, BS 3900-D9 and BS 3900-D10 the results being expressed in CIELAB colour difference units.

NOTE 2 The use of instrumental colour measurement is intended to assist the resolution of cases which are marginal pass/fail, judged visually. Instrumental measurement alone will not diagnose the presence of patchy discolouration or surface erosion.

Use the maximum colour difference rating observed during the course of the test to judge acceptability in accordance with the limits set in **4.7**.

Appendix J Weld factor test

J.1 Procedure

Butt-weld samples of profile together at an angle of 180°. Cut a sample complying with BS 2782:Method 320C from the visible or face surface of the welded profiles so that the weld lies in the middle of the length.

NOTE The weld bead is not finished or machined in any way.

Prepare at least five samples for each profile conditioned at 20 ± 5 °C for 1 h before tensile testing in accordance with BS 2782:Method 320C at a test rate of 5 mm/min.

J.2 Calculation

Calculate the weld factor $f_s = P_w/P_c$ from the mean maximum load value of the welded samples (P_w) and the control samples (P_c).

Appendix K Corner strength test

K.1 Procedure

Cut two sections of profile at an angle and weld to form a 90° angle, or else cut a welded corner from the frame. The specimen shall be welded with sprue limiters in position on the welding machine set at a maximum of 2.5 mm apart. The weld shall not be finished by grooving, knifing or any other method except for the outside edge of the corner which may be cleaned to permit the sample to seat fully onto the support.

Place the welded angle in the apparatus: see Figure 3. The profile leg to be clamped shall be clamped over a minimum length of 400 mm with suitable packing pieces or purpose designed contour blocks over the full length of the clamped area to provide firm support. The packing pieces shall extend from within 5 mm of point "A" to the end of the clamped leg of the specimen.

Carry out the test at 20 ± 5 °C on at least three samples. Test at a rate of 50 ± 5 mm/min. The load shall remain vertical at all times and at a constant horizontal distance of 300 ± 5 mm from point "A". The load shall be applied by suitable means, such as a profiled wheel, to permit the point of application to move smoothly along the sample. Record the load at break.

K.2 Calculation

Using simple plane bending theory (calculations incorporating out of plane bending show no significant change in the calculated stress), the maximum stress (θ_A) is given by:

$$\theta_A = \frac{PL}{\left(\frac{I}{v}\right)_{zz'}}$$

where

P is the load at break of weld (in N);

L is the distance from load axis P to A (see Figure 3) (in mm);

I is the moment of inertia of the profile cross section, with respect to an axis zz′, perpendicular to the plane of the frame and passing through the geometrical centre of gravity G of the cross section (in mm^4);

v is the distance from the zz′ axis to the point A, most remote in that direction from the centre of gravity (see Figure 4) (in mm).

Calculate the I value for each profile type, by the following equations.

a) Position of the centre of gravity y_G

$$y_G \times S = \Sigma_i\, y_i \times S_i \qquad (1)$$

where

S is the cross-sectional area of profile (in mm^2);

S_i is the cross-sectional area of an elementary rectangle from many of which the section can be composed (see Figure 4) (in mm^2);

y_i is the distance from the centre of gravity of S_i to the reference axis (in mm).

b) Moment of inertia with respect to zz′ (I)

$$I = \frac{1}{12}\Sigma_i b_i h_i^3 + \Sigma_i (b_i h_i) d_i^2$$

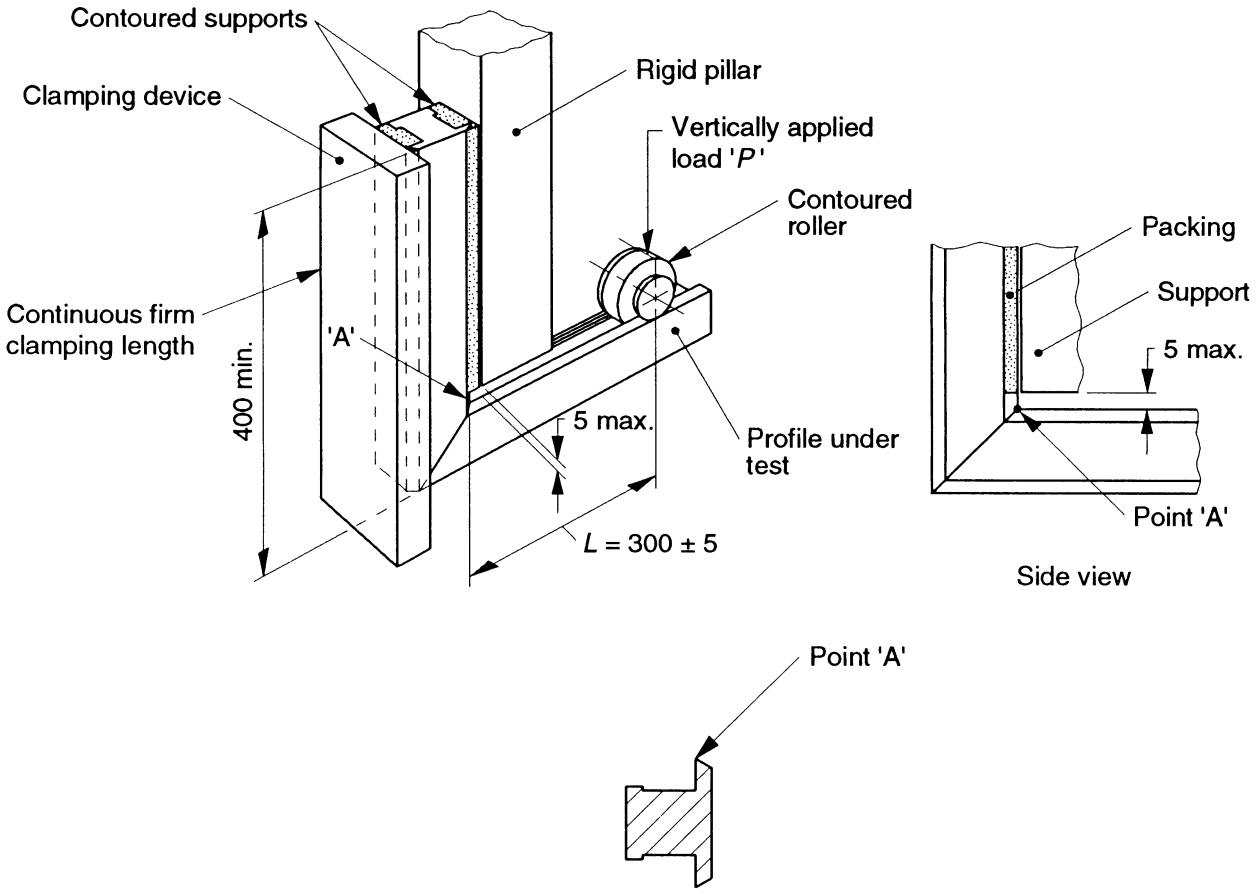
where

b_i, h_i, d_i are the dimensions shown in Figure 4.

NOTE 1 $(b_i h_i) = S_i$.

NOTE 2 In equations (1) and (2), the summation is extended to all the elements (i) into which the cross section of the profile has been composed.

NOTE 3 In equations (1) and (2), the dimensions used to calculate the I value are those nominal values taken from the manufacturer's profile detail drawings.



All dimensions are in millimetres.

Figure 3 — Apparatus for corner strength test (see **K.1**)

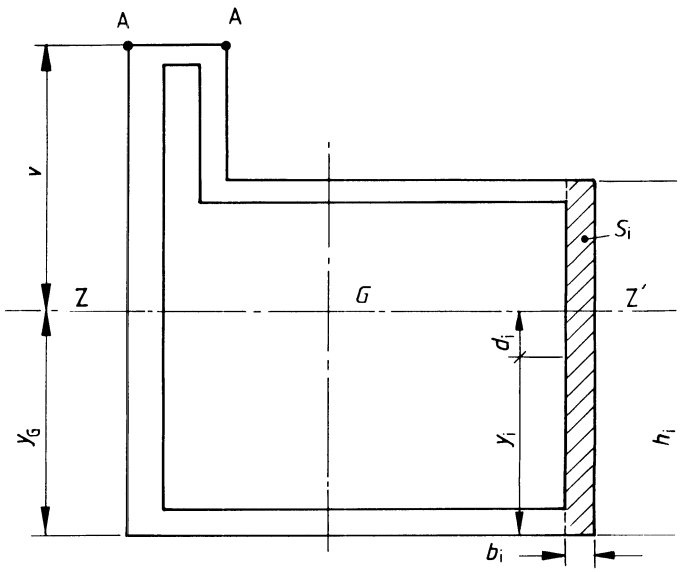


Figure 4 — Points of maximum tensile bending stress

Publication(s) referred to

BS 817, *Specification for surface plates.*

BS 869, *Specification for toolmakers' flats and high precision surface plates.*

BS 1006, *Methods of test for colour fastness of textiles and leather.*

BS 2782, *Methods of testing plastics.*

BS 2782:Method 120A, Method 120B, Method 120D and Method 120E, *Determination of Vicat softening temperature for thermoplastics.*

BS 2782 Method 320A to Method 320F, *Tensile strength, elongation and elastic modulus.*

BS 2782 Method 335A, *Determination of flexural properties of rigid plastics.*

BS 2782:Method 359, *Determination of Charpy impact strength of rigid materials (Charpy impact flexural test).*

BS 2782:Method 540B, *Method 540B Methods of exposure to laboratory light sources (xenon arc lamp, enclosed carbon arc lamp, open-flame carbon arc lamp, fluorescent tube lamps).*

BS 3900, *Methods of test for paints.*

BS 3900-D8, *Determination of colour and colour difference: principles.*

BS 3900-D9, *Determination of colour and colour difference: measurement.*

BS 3900-D10, *Determination of colour and colour difference: calculation.*

BS 6100, *Glossary of building and civil engineering terms.*

BS 6100-1.3.5, *Doors, windows and openings.*

BS 6100-1.5.1, *Co-ordination of dimensions; tolerances and accuracy.*

BS 7412, *Specification for plastics windows made from PVC-U extruded hollow profiles.*

BS 7413, *Specification for white PVC-U extruded hollow profiles with heat welded corner joints for plastics windows: materials type A.*

ISO 1163, *Plastics — Unplasticized compounds of homopolymers and copolymers of vinyl chloride.*

ISO 1163-2, *Determination of properties.*

ISO 4892, *Plastics — Methods of exposure to laboratory light sources.*

ISO 8256, *Plastics — Determination of tensile-impact strength.*

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