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Extruded cellular unplasticized white PVC (PVC-UE) profiles – Specification

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Foreword

Publishing information

This British Standard was published by BSI and came into effect on 30 June 2010. It was prepared by Technical Committee PRI/82, *Thermoplastic materials*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

Together with BS EN 13245-2:2008 and BS EN 13245-3:2010, this British Standard supersedes BS 7619:1993, which is withdrawn.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

a) a modified impact test in alignment with product thickness;

b) adjusted dimensional tolerances to account for cut and non-cut widths;

c) the inclusion of an updated version of the colour fastness test; and

d) the removal of the water absorption test and the thermal expansion test.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

Extruded cellular unplasticized white PVC (PVC-UE) profiles are primarily used in a variety of applications as an alternative to traditional building materials. These applications can include claddings, fascias and decorative finishing trims.

Building products made from cellular PVC-UE are characterized by a high stiffness-to-weight ratio. This is due to the formation of a denser outer skin encapsulating a rigid closed cellular core during extrusion. Profiles can be cut post-extrusion to accommodate customer requirements. The relationship between the thickness and density of the outer skin and the density of the closed cellular core can be varied to obtain products with differing performance characteristics. The expansion of the core during extrusion derives from the use of either physical or chemical expanding agents.

1 Scope

This British Standard specifies the requirements of mono and co-extruded cellular white PVC-UE profiles for non-structural building applications, where they are subjected to ambient temperatures up to 50°C.

2 Normative references

The following referenced documents are indispensable for the application 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.

BS 476-7, *Fire tests on building materials and structures – Method of test to determine the classification of the surface spread of flame of products*

BS 3900-D10 (ISO 7724-3), *Methods of test for paints – Determination of colour and colour difference: Calculation*

BS EN 20105-A02:1995 (ISO 105-A02:1993), *Textiles – Tests for colour fastness – Grey scale for assessing change in colour*

BS EN ISO 4892-2:2006+A1:2009, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

BS EN ISO 4892-3:2006, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 extruded profile
product, created from raw plastic material that has been subjected to high temperatures and formed into a continuous profile

3.2 post-consumer waste (PCW)

3.2.1 PCWa
material, free from contamination and degradation, made from used PVC-UE profiles

3.2.2 PCWb
material, free from contamination and degradation, made from used PVC-U profiles

3.3 post-industrial waste (PIW)

3.3.1 PIWa
material, free from contamination and degradation, made from unused PVC-UE profiles including offcuts, which is reprocessed in the same factory as that in which it was previously extruded

3.3.2 PIWb
material, free from contamination and degradation, made from unused PVC-UE profiles, which is reprocessed in a different factory as that in which it was previously extruded

3.3.3 PIWc
material, free from contamination and degradation, made from unused PVC-U profiles

3.4 virgin material
material in granular or powder form without the addition of recycled material, which has only undergone processing for its own manufacture

4 Materials

4.1 General

Profiles shall be manufactured from either:

a) 100% virgin material (100% virgin core material and 100% virgin skin material, where applicable); or

b) recycled material conforming to **4.2** and **4.3**.

4.2 Post-industrial waste (PIW)

4.2.1 General

PIW used for the production of PVC-UE profiles shall only be used for the core of a profile. Any surfaces or sections of surface which might be visible after installation shall be covered by co-extrusion with a virgin material.

4.2.2 PIWa

PIWa shall be used for the core of a profile after restabilization and/or the inclusion of additives (e.g. modifiers, pigments, lubricants), where necessary. Any surfaces or sections of surface which might be visible after installation of the products shall be covered by co-extrusion with a virgin material.

4.2.3 PIWb

PIWb shall not be used.

4.2.4 PIWc

PIWc shall not be used.

4.3 Post-consumer waste (PCW)

4.3.1 General

PCW used for the production of PVC-UE profiles shall only be used for the core of a profile. Any surfaces or sections of surface which might be visible after installation shall be covered by co-extrusion with a virgin material.

4.3.2 PCWa

PCWa shall be used for the core of a profile after restabilization and/or the inclusion of additives (e.g. modifiers, pigments or lubricants), where necessary. Any surfaces or sections of surface which might be visible after installation of the products shall be covered by co-extrusion with a virgin material.

4.3.3 PCWb

PCWb shall not be used.

5 Profile properties

5.1 Thickness and width

When measured using calibrated equipment or a shadowgraph with the resolution specified in Table 1, the thickness and width shall be in accordance with the profile dimensions specified in Table 1.

5.2 Length

When measured in accordance with **5.1**, the actual profile length shall be not less than the nominal length stated by the manufacturer.

5.3 Surface finish

When inspected in accordance with **6.3**, the surface finish of the profile shall be free from visible foreign bodies, cracks or sink marks.

5.4 Flatness

When tested in accordance with **6.5** and Annex B, the deviation of flatness along the surface of a PVC-UE profile over any 100 mm distance shall not exceed 0.6 mm.

Table 1 **Dimensional tolerances for the measurement of extruded profiles**
Dimensions in millimetres

Profile dimensions	Tolerance	Measuring instrument resolution
Thickness		
5 to 12	±0.5	0.05
>12	±0.75	0.05
Width (as extruded)		
0 to 50	±0.5	0.05
51 to 150	±1.0	0.05
151 to 250	±1.5	0.50
251 to 350	±2.0	0.50
≥ 351	±3.0	0.50
Width (as cut)		
0 to 50	±0.5	0.05
51 to 150	±1.1	0.05
151 to 250	±1.7	0.50
251 to 350	±2.2	0.50
≥351	±3.3	0.50

5.5 Bowing

When tested in accordance with **6.6** and Annex C the maximum bow in any plane shall not exceed the limits specified in Table 2.

Table 2 **Requirements for bow measurement of varying profile lengths**

Length	Maximum bow for each profile (d/2)
m	mm
<2	5
2–3	9
3–4	16
4–5	25
5–6	36
6–7	49
>7	46

NOTE See Figure D.1 for the combined maximum bow for two profiles (diameter, d).

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6 Testing

6.1 General

Test samples shall be stored at 23°C ±2°C.

6.2 Test samples for dimensions and dimensional tolerances

For dimensions and dimensional tolerances, samples shall be conditioned using calibrated equipment or a shadowgraph.

6.3 Test samples for surface finish

The test sample selected for inspection shall be not less than 200 mm in length. The test sample shall be viewed by normal or corrected vision from a distance of 1 m in natural light, or by the use of a calibrated light box with a D_{65} luminance daylight bulb. The test sample shall be viewed when placed at a right angle to the surface and shall conform to **5.3**.

6.4 Test samples for colour fastness

To test for colour change as a result of weathering, two test samples shall be tested in accordance with Annex A.

Profile test samples with a width of less than 50 mm or a flat area of less than 50 mm^2 shall be excluded from this test. Both test samples shall be of equal size.

6.5 Test sample for flatness

To determine the deviation of flatness across its surface, one test sample shall be selected. The test sample shall be a minimum of 300 mm in length and 100 mm in width. It shall be tested in accordance with Annex B.

6.6 Test samples for bowing

To test for deviation from straightness in the length of the profile, two test samples shall be selected. Each test sample shall be identically manufactured and measure identical dimensions. The test samples shall be tested in accordance with Annex C.

6.7 Test samples for resistance to impact

To test for resistance to impact, five test samples shall be prepared and tested in accordance with Annex D. Each test sample shall be cut from the extruded product and shall be a minimum of 150 mm in length and 50 mm in width.

Profiles having a width of less than 50 mm or a flat area of less than 50 mm^2 shall be excluded from this test.

6.8 Test samples for resistance to impact with the effects of ultraviolet light

To test for resistance to impact after extensive exposure to ultraviolet light, five test samples shall be prepared and tested in accordance with Annex E. Each test sample shall be cut from the extruded product and shall be a minimum of 150 mm in length and 50 mm in width.

Profiles having a width of 50 mm or a flat area of less than 50 mm^2 shall be excluded from this test.

7 Performance

7.1 Colour fastness and weathering resistance

When tested in accordance with Annex A, the change in colour shall be either:

a) of a grey scale value of ≥2 when assessed in accordance with the grey scale method in BS EN 20105-A02; or

b) $\Delta E^* < 6$ when assessed in accordance with BS 3900-D10.

7.2 Fire performance

The products shall have a surface spread of flame rating of either 1, 2 or 3 when tested in accordance with BS 476-7.

7.3 Resistance to impact

When tested in accordance with Annex D, a minimum of four samples out of the five tested shall not exhibit splits or cracks on the impacted surface.

7.4 The effects of ultraviolet light on resistance to impact after ageing

When tested in accordance with Annex E, a minimum of four samples out of the five tested shall not exhibit splits or cracks on the impacted surface.

8 Marking

PVC-UE profiles or packaging for PVC-UE profiles shall be marked or labelled with, as a minimum, the following information.

a) The manufacturer's name or trademark.

b) The manufacturer's traceability code.

c) The manufacturer's product description, including length and/or product reference.

d) The number and date of this British Standard, i.e. BS 7619:2010. [1)]

[1)] Marking BS 7619:2010 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 solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Annex A (normative) Method of test for colour fastness

A.1 Principle

Test samples are subjected to a specified regime of artificial weathering and the change in colour determined.

A.2 Apparatus

A.2.1 *Weathering apparatus* conforming to BS EN ISO 4892-2:2006+A1:2009, method A, that shall be fitted with a xenon arc lamp with filters which provide the nearest spectral distribution of terrestrial daylight practicable.

A.3 Test samples

Condition the two test samples (see **6.4**) at 23 °C ±2 °C for a minimum of 60 min. Within 1 min of removing a test sample from the conditioning atmosphere, continue with the procedure in accordance with **A.4**.

NOTE The use of a thermally controlled water bath is permissible for conditioning test samples.

A.4 Procedure

A.4.1 Retain one test sample as an unexposed control test sample.

A.4.2 Expose the other test sample to the xenon arc lamp emitting heat and light to a total of 8 GJ/m^2, integrated over a wavelength range of 290 nm to 800 nm in accordance with BS EN ISO 4892-2:2006+A1:2009, method A.

NOTE The irradiation can be determined by the use of calibrated integrating detectors placed in the plane of the test samples, where available. Otherwise the duration of exposure should be computed from the manufacturer's design irradiance for the stated wavelength range appropriate to the lamps, wattage schedule and filters employed. The total time of exposure to the lamps normally falls within the range 2 250 h ±500 h.

A.4.3 Subject the test sample to 18 min of water spray-on followed by 102 min of water spray-off. During the water spray-off period, measure the relative humidity.

NOTE If the test is being carried out accurately, the relative humidity should be at 65% ±5%.

A.4.4 At the end of the spray-off period, measure the temperature taken from a black area.

NOTE If the test is being carried out accurately, the standard temperature taken from a black area (not an ambient temperature) should be at 60 °C ±3 °C.

A.4.5 Repeat **A.4.2**, **A.4.3** and **A.4.4** for 2 000 spray-on–spray-off cycles (totalling 4 000 h) to represent a weathering period of 5 y.

A.4.6 Assess the colour difference between exposed and unexposed test samples in accordance with **A.5**.

A.5 Assessment of changes

A.5.1 The assessment of colour changes shall be completed not more than 24 h after completion of the procedure in **A.4** and removal from the apparatus.

A.5.2 A visual assessment shall be carried out following the procedure set out in BS EN 20105-A02 or BS 3900-D10. The type of colour change and changes in colour consistency shall be recorded and measured as a pass or fail in accordance with **7.1**. Surface erosion shall be visually assessed and recorded.

Annex B (normative) Method of test for flatness

B.1 Principle

Deviations of the surface flatness of a PVC-UE profile are measured when tested against a perfectly flat steel surface. This is measured either using a calibrated steel rule and a calibrated feeler gauge (see **B.2**), or else using a measuring device including a flat-bed base plate made of ground tool steel (see **B.3**).

*NOTE Both Method A and Method B are acceptable for determining whether the flatness of a test sample conforms to **5.4**; however, Method A (see **B.2**) tends to be most commonly used.*

Using Method A, a flat, calibrated steel rule is placed over a test sample and an attempt is made to slide a calibrated feeler gauge of a specified thickness between the two. The flatness of the test sample is determined by whether the feeler gauge is able or unable to come between the two surfaces.

Using Method B, a test specimen is placed on the flat bed of a measuring device and this is used to measure several points across lengths of the test sample. This is repeated across the width of the test sample and measurements for the maximum deviation from flatness of the test sample obtained.

B.2 Method A

B.2.1 Apparatus

B.2.1.1 *Calibrated steel rule*, having a straight edge, 100 mm (±1 mm) in length.

B.2.1.2 *Calibrated feeler gauge*, having a thickness of 0.6 mm.

B.2.2 Test sample

Select a test sample in accordance with **6.5**.

B.2.3 Procedure

B.2.3.1 Lay the calibrated steel with the straight edge over the face of the test sample.

B.2.3.2 Slide the calibrated feeler gauge over the centre section of the test sample, between the straight edge and the test sample.

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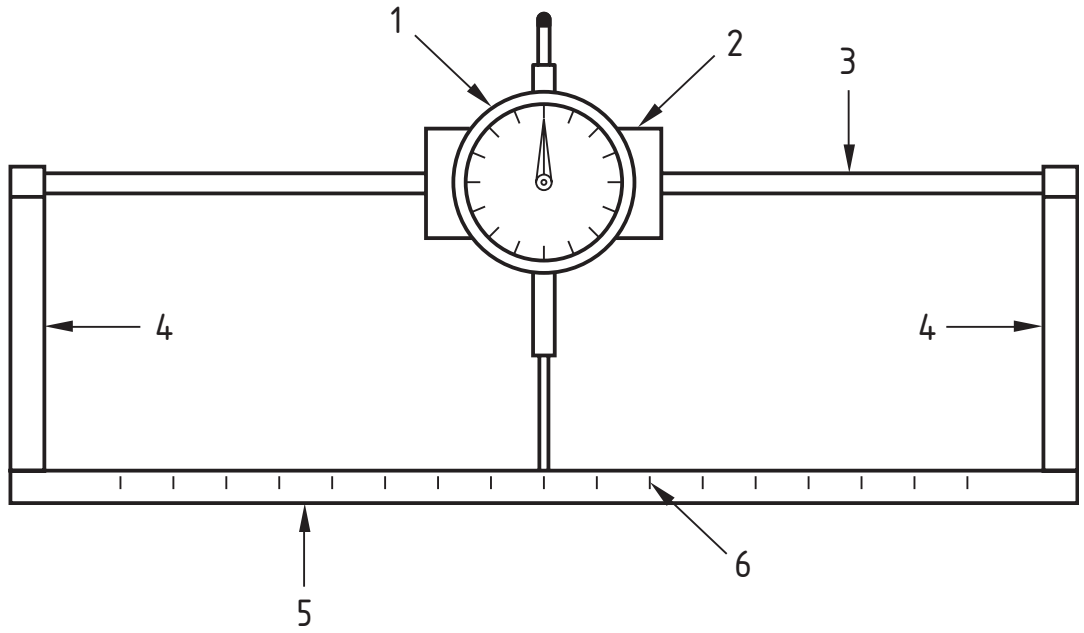
B.2.3.3 If the calibrated feeler gauge slides fully between the test sample and the calibrated steel, record the test result as a fail. If the calibrated feeler gauge cannot slide fully between the test sample and the calibrated steel, record the test result as a pass.

B.3 Method B

B.3.1 Apparatus

B.3.1.1 *Measuring device*, (see Figure B.1) consisting of a flat-bed base plate made of ground tool steel. This shall have a linear scale marked on it, with a centre line marked as zero and graduations marked out from the centre at 25 mm increments. A dial test indicator (DTI) shall be rigidly mounted above and parallel to the flat base. It shall be mounted on a carriage that travels along a slide frame and contains two linear bearings.

Figure B.1 **Product flatness measuring device**



Key

1 Dial test indicator (DTI)
2 Carriage (including linear bearings)
3 Cross-slide frame
4 Pillar
5 Flat-bed base (parallel to cross-slide)
6 Graduated scale (25 mm increments)

B.3.2 Test sample

One test sample shall be selected in accordance with **6.5**.

B.3.3 Procedure

B.3.3.1 Set up the measuring device so that prior to insertion of the test sample, the plunger of the DTI is in contact with the flat base. Adjust the DTI to read zero.

B.3.3.2 Repeat at points a distance of 25 mm apart along the length of the cross-slide frame within the extent of the travel of the carriage. Check that the DTI indicates zero at each position to confirm that the slide frame is parallel to the baseplate.

B.3.3.3 Lift up the plunger on the DTI so that it is clear of the flat-bed by a distance greater than the thickness of the test sample.

B.3.3.4 Place the test sample centrally on the baseplate, and lower the DTI plunger until it comes into contact with the upper surface of the test sample.

B.3.3.5 Measure the extreme points of any surface of the test sample designed to be flat.

B.3.3.6 Repeat the test at points a distance of 100 mm apart across the width of the face of the test sample.

B.3.3.7 Record the maximum face flatness deviation in millimeters.

B.3.3.8 Record a pass or a fail in accordance with **5.4**.

Annex C (normative) Method of test for bowing in the length of the profile

C.1 Principle

Bowing in the length of the profile on either a horizontal or a vertical plane is evident when two identical sample profiles are placed on a flat surface either face-to-face or back-to-back, or edge-to-edge. The space between the two profiles at the mid-point is measured and divided by two to indicate the deviation from a perfectly flat PVC-UE profile that does not bow.

NOTE This test is not applicable to profiles which lie flat under their own weight.

C.2 Apparatus

C.2.1 *Calibrated steel rule*, having a straight edge of 100 mm ±1 mm in length.

C.3 Test samples

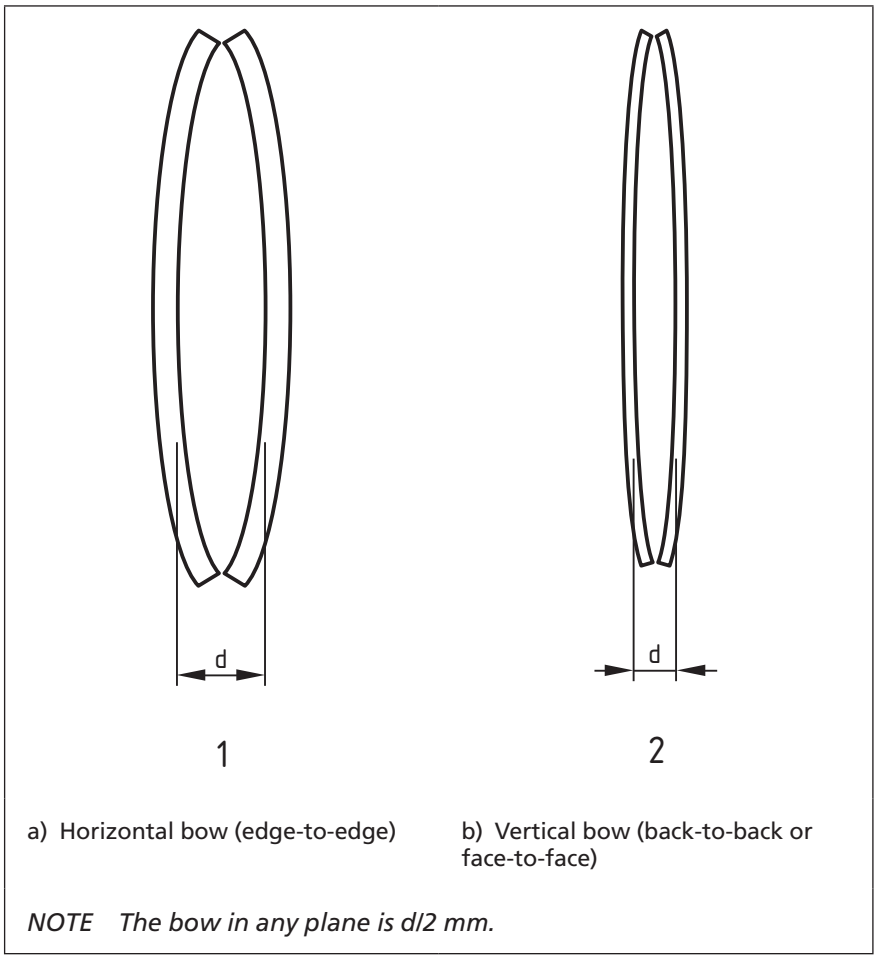
Two test samples shall be selected in accordance with **6.6**.

C.4 Procedure

C.4.1 Place the two test samples on a flat surface face-to-face or back-to-back to measure bow in the vertical plane (bow), or edge-to-edge to measure bow in the horizontal plane bow (straightness).

C.4.2 Use the calibrated steel rule to measure the distance between face-to-face, back-to-back, or edge-to-edge at the mid point between the product lengths as shown in Figure C.1.

Figure C.1 **Schematic representation of bowing**



a) Horizontal bow (edge-to-edge)

b) Vertical bow (back-to-back or face-to-face)

NOTE The bow in any plane is d/2 mm.

C.4.3 Divide the resulting value by two to obtain the maximum bow for each profile.

C.4.4 Record the measurements.

C.4.5 Evaluate the measurements against the values in Table 2 to ascertain a pass or a fail.

Annex D (normative) Method of test for resistance to impact

D.1 Principle

The impact of a falling weight on to the surface of a PVC-UE profile from a height demonstrates the PVC-UE profile's resistance to force by the reaction of the surface. Cracking or splitting indicates a failure to resist a particular level of impact.

D.2 Apparatus

D.2.1 *A falling weight impact machine*, having the following features*:*

a) a main frame, rigidly fixed in a vertical position;

b) two guide rails, or a guiding tube, fixed rigidly to the main frame, allowing a low friction means of guiding a striker;

c) a flat, wooden sample support plate, adjusted to the geometry of the profile to support it completely when tested;

NOTE The support plate could, for example, be made of plywood of a min. 32 mm thickness.

d) a release mechanism, set to release a striker from a height which can be adjusted to 1 500 mm, as measured from the top surface of the sample; and

e) a hardened metallic hemispherical striker, having a 25 mm ±0.5 mm radius and a mass of 1 000 g ±5 g. The striker shall be free from flat areas and other imperfections.

D.3 Test sample

Five test samples shall be temperature conditioned for a minimum of 60 min at 23 °C ±2 °C. Each test sample shall undergo the impact resistance test in accordance with **D.4** within 1 min of being removed from the conditioning atmosphere.

NOTE The use of a thermally controlled water bath is permissible for conditioning test samples.

D.4 Procedure

D.4.1 Place the test sample on the sample support plate with the external surface facing upwards.

D.4.2 Drop the striker on to it from a height calculated from the formula given below.

$$H = 20t + 100$$

where:

H = Drop height (mm)

t = Nominal thickness (mm)

D.4.3 Remove the test sample from the machine and examine with normal or corrected vision.

D.4.4 Record a fail result if the impacted surface of the sample has split or cracked. Record a pass result if the impacted surface of the sample has not split or cracked, even if the surface has been dented.

Annex E (normative) Method of test for the resistance to impact with the effects of ultraviolet light

COMMENTARY ON ANNEX E
*The weakening over time of a PVC-UE profile is partially through its exposure to the ultraviolet light contained in natural daylight. The result of such weakening is a reduced resistance to force exerted on it. The natural ageing process can be artificially reproduced in an exposure chamber (**E.2.1**) using ultraviolet light.*

E.1 Principle

PVC-UE test samples are subjected to a cycle of ultraviolet light within the exposure chamber and then subjected to an impact test (see Annex D) to assess their reduced resistance to impact.

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E.2 Apparatus

E.2.1 *Exposure chamber*, providing artificial ageing in accordance with BS EN ISO 4892-3:2006, method A, using exposure cycle number 1.

E.*3* Test samples

Five test samples shall be prepared and conditioned in accordance with **D.3**.

E.4 Procedure

E.4.1 Expose one surface of each test sample to a total time of 1 000 h in the exposure chamber (**E.2.1**).

E.4.2 Calculate the correct drop height for each test sample using the following formula.

$$H = (20t + 100)/2$$

where:

H = Drop height (mm)

t = Nominal thickness (mm)

E.4.3 Carry out the resistance to impact test procedure in accordance with **D.4** for each test sample, using the drop height calculated in **E.4.2**.

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