

PRODUCT ASSESSMENT SPECIFICATION

Enhanced security performance requirements for door assemblies –

Single and double leaf, hinged external door assemblies to dwellings

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Foreword

A2 PAS 24:2007+A2:2011 supersedes PAS 24:2007+A1:2009, which is withdrawn. **A2**

A1 This Product Assessment Specification (PAS) **A1** has been produced by BSI to provide a method for testing and assessing the enhanced security performance requirements of single and double leaf, hinged, external door assemblies to dwellings. It is intended that this **A1** PAS **A1** should be used in conjunction with PAS 23-1 which includes the assessment of weather and mechanical performance and performance in use. **A1** This PAS **A1** was developed from PAS 24-1 and introduces additional provisions for lock cylinders. These appear in **A1** 7.3 **A1** and Annex C.

In order to assess a lock's capability of withstanding a criminal attack, it is necessary for it to be exposed to skilled manual testing that simulates such an attack. Such a simulation cannot, by its very nature, be codified so as to be fully reproducible in all circumstances, and for these reasons a formal test method is not published in this **A1** PAS **A1**.

Instead, lock cylinders for which conformity to this **A1** PAS **A1** is claimed, are required to be submitted to **A1** a panel of expert assessors **A1** to be examined and assessed for their general vulnerability (see **A1** 7.3 **A1** and Annex C). Details of this examination vary according to the design and type of lock.

A1 The general nature of the assessment to which lock assemblies need to be submitted is detailed in Annex C, which should be regarded as normative for the purposes of designing and constructing products in conformity with this PAS.

The start and finish of text introduced or altered by Amendment No. 1 and Amendment No. 2 is indicated in the text by tags **A1** **A1** and **A2** **A2**. Minor editorial changes are not tagged.

Amendment No.1: 2009 modifies the requirements for the vulnerability assessment so as to allow manufacturers to undertake their own assessments and make a valid claim of conformity accordingly. Requirements concerning the necessary qualifications for personnel undertaking such assessments are specified in Annex D. **A1**

A2 Amendment A2 introduces the following principal changes:

- updated text in **A.11.2.1**;
- replacement of Figure 14 with Figure 14a to Figure 14d;
- updated text in **A.11.3.2** and **A.11.3.3**. **A2**

A1 *Text deleted.* **A1**

This Product Assessment Specification is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.

Acknowledgement is given to the following organizations which were consulted in the development of this specification:

■^{A1} Association of Chief Police Officers – Secured By Design;
Association of Composite Door Manufacturers; ■^{A1}
British Plastics Federation;
British Woodworking Federation;
Council for Aluminium in Building;
Door and Hardware Federation;
Glass and Glazing Federation;
Guild of Architectural Ironmongers;
■^{A1} Master Locksmiths Association; ■^{A1}
Steel Window Association;
■^{A1} *Text deleted* ■^{A1}
National technical committee representatives.

This Product Assessment Specification has been prepared and published by BSI which retains its ownership and copyright. BSI reserves the right to withdraw or amend this Product Assessment Specification on receipt of authoritative advice that it is appropriate to do so. This Product Assessment Specification will be reviewed at intervals not exceeding two years and any amendments arising from that review will be published in an amended Product Assessment Specification and publicized in *Update Standards*.

■^{A1} Annexes A, B, C and D ■^{A1} are normative.

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

Compliance with a Product Assessment Specification cannot confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 48, an inside back cover and a back cover.

Introduction

The concept of “enhanced security” in this Product Assessment Specification is based upon a relationship between resistance to forced entry by human intervention techniques and resistance to entry under multi-directional loading and hard and soft body impacts. This relationship has been identified following an extensive test programme conducted on a range of doorsets. It is acknowledged that in some cases the assessment of the security characteristics of doorsets by predetermined mechanical loading or impact may alone not give a suitable assessment of their resistance to human attack. To avoid this situation the testing is supplemented by a manual check test to identify any need for additional tests.

It is intended that this should be an evolving specification reflecting current design requirements and intrusion techniques.

This specification provides a means of evaluation against opportunist attack and does not purport to provide a means of evaluation of total security against unauthorized intrusion.

1 Scope

This Product Assessment Specification specifies test methods and acceptance criteria relevant to the enhanced security performance of single and double leaf, single swing, hinged, external door assemblies to dwellings, inward and outward opening, with or without integral or coupled side panels and fanlights. It includes double leaf door assemblies where the size, construction or configuration of the active and inactive leaves are identical or differ. The enhanced security performance requirements in this specification are not material-specific.

This PAS is applicable to new door assemblies as manufactured and prior to installation. It is only applicable to complete door assemblies or a range of door assemblies.

The ability to gain entry by manipulation of a cylinder is addressed in this PAS. However, entry by picking, by the deliberate breaking of glass or by attack on the frame fixing methods is not.

This PAS is not a test of component performance or installation requirements.

This PAS excludes double swing doors, sliding doors, sliding folding doors, pivoted doors and doors with two halves (stable door). It does not cover door assemblies where any frame member is longer than 3 m.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Product Assessment Specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 2911, *Specification for letter plates*.

BS 6206:1981, *Specification for impact performance requirements for flat safety glass and safety plastics for use in buildings*.

BS 6262, *Code of practice for glazing for buildings*.

BS 6262-4, *Glazing for buildings — Part 4: Safety related to human impact*.

BS 7950, *Specification for enhanced security performance of casement and tilt/turn windows for domestic applications*.

PAS 23-1, *General performance requirements for door assemblies — Part 1: Single leaf, external door assemblies to dwellings*.

BS EN 1303:2005, *Building hardware — Cylinders for locks — Requirements and test methods*.

BS EN ISO 10666, *Drilling screws with tapping threads — Mechanical and functional properties*.

BS EN 13724:2002, *Postal services. Apertures of private letter boxes and letter plates. Requirements and test methods*.

BS EN ISO 15480, *Hexagon washer head drilling screws with tapping screw thread.*

BS EN ISO 15481, *Cross recessed pan head drilling screws with tapping screw thread.*

BS EN ISO 15482, *Cross recessed countersunk head drilling screws with tapping screw thread.*

BS EN ISO 15483, *Cross recessed raised countersunk head drilling screws with tapping screw thread.*

3 Terms and definitions

For the purposes of this Product Assessment Specification the following terms and definitions apply.

3.1

entry

⟨where releasing the locking hardware from the inside requires the use of a removable key⟩
creation of an aperture through which a 500 mm long cylindroid with an elliptical section of 225 mm minor and 380 mm major diameters can pass freely

NOTE This simulates the passage of an intruder's body.

3.2

entry

⟨where releasing the locking hardware from the inside does not require the use of a removable key⟩
creation of an aperture through which a 500 mm long cylindroid of diameter 25 mm can pass freely

3.3

entry

⟨for the cutting test (A.5.4) only, where releasing the locking hardware from the inside does not require the use of a removable key⟩
creation of an aperture through which a 500 mm long cylindroid of diameter 50 mm can pass freely

3.4

door assembly

complete unit, as installed, consisting of the door frame, door leaf, any side panels or fanlights and essential hardware any of which may be obtained from separate sources

3.5

component failure (during mechanical load testing)

failure in which there is an increase in deflection with no further increase in the applied load

3.6

channel glazing

glazing in which the frame overlaps the glazing unit on both sides without the use of an independent glazing bead

3.7

infill medium

single glass, insulating glass units or infill panel

3.8

floor level

underside of the sill or threshold

3.9

range

group of door assemblies with defined limits of size, type, configuration, hardware, glazing, construction and security features.

3.10 technique

combination of tools and locations

NOTE Any change in either the tools or the locations constitutes a new technique.

3.11 midrail

structure between the opposing horizontal edges of infill panels or glazed apertures

3.12 location

area described by a circle with a radius of 50 mm from a selected point

3.13 false meeting stile

separate adaptor profile located along the meeting edge of either leaf and attached to that leaf

3.14 active leaf

leaf of a multi-leafed door assembly intended to be moved first to provide opening

NOTE Also referred to as the master leaf and normally containing the primary lock.

3.15 inactive leaf

leaf of a multi-leafed door assembly intended to be moved after the active leaf

NOTE Also referred to as the slave leaf.

3.16 integral side panel

fixed element within the outer frame of the door assembly

3.17 coupled side panel

fixed element with its own outer frame attached to the outer frame of the door assembly

4 Sample selection

A minimum of three identical door assemblies shall be selected, increased to four when the door assembly includes at least one non-glass infill medium. Samples shall be selected by the test authority and agreed with the supplier/manufacture. Where a range of door assemblies is to be considered, the number and type of samples chosen shall be representative of the product range which the supplier/manufacture wishes to have assessed.

NOTE 1 The sample numbers quoted in the test clauses are relevant to the tests conducted on a limited range of configurations. For more extensive ranges a larger number of samples is required.

The cumulative effect of the tests shall be avoided with the exception that for any one configuration:

- the mechanical loading test in **A.6** and the additional mechanical loading test in **A.8** shall be conducted on a single sample; and
- the manual test (infill medium removal) in **A.5.1**, the soft body impact test in **A.9** and the hard body impact test aimed at the door leaf in **A.10.2.2** shall be conducted on another single sample.

NOTE 2 Other tests may be carried out on separate door assemblies.

The samples selected shall include the most adverse and vulnerable aspects of the design, size and configuration. The following list, which is not exhaustive, identifies some of the features that may influence the security of a door assembly:

- a) maximum distance between points which secure the leaf to the outer frame;
- b) hardware: locking and hinge options, fixings and changes with respect to leaf size;
- c) directions of opening;
- d) infill medium options;
- e) infill medium installation methods;
- f) reinforcement used in any system;
- g) flexing of transoms and mullions;
- h) size;
- i) openings, e.g. letterplate, cat flap etc..
- j) false meeting stile configuration on double doors;
- k) location of hardware in inactive leaf in double doors.

For the purpose of these tests, all glass supplied in the samples shall be toughened to meet class A of BS 6206:1981.

5 Testing

5.1 Test methods

The methods of test shall be as specified in annex A.

5.2 Assessment

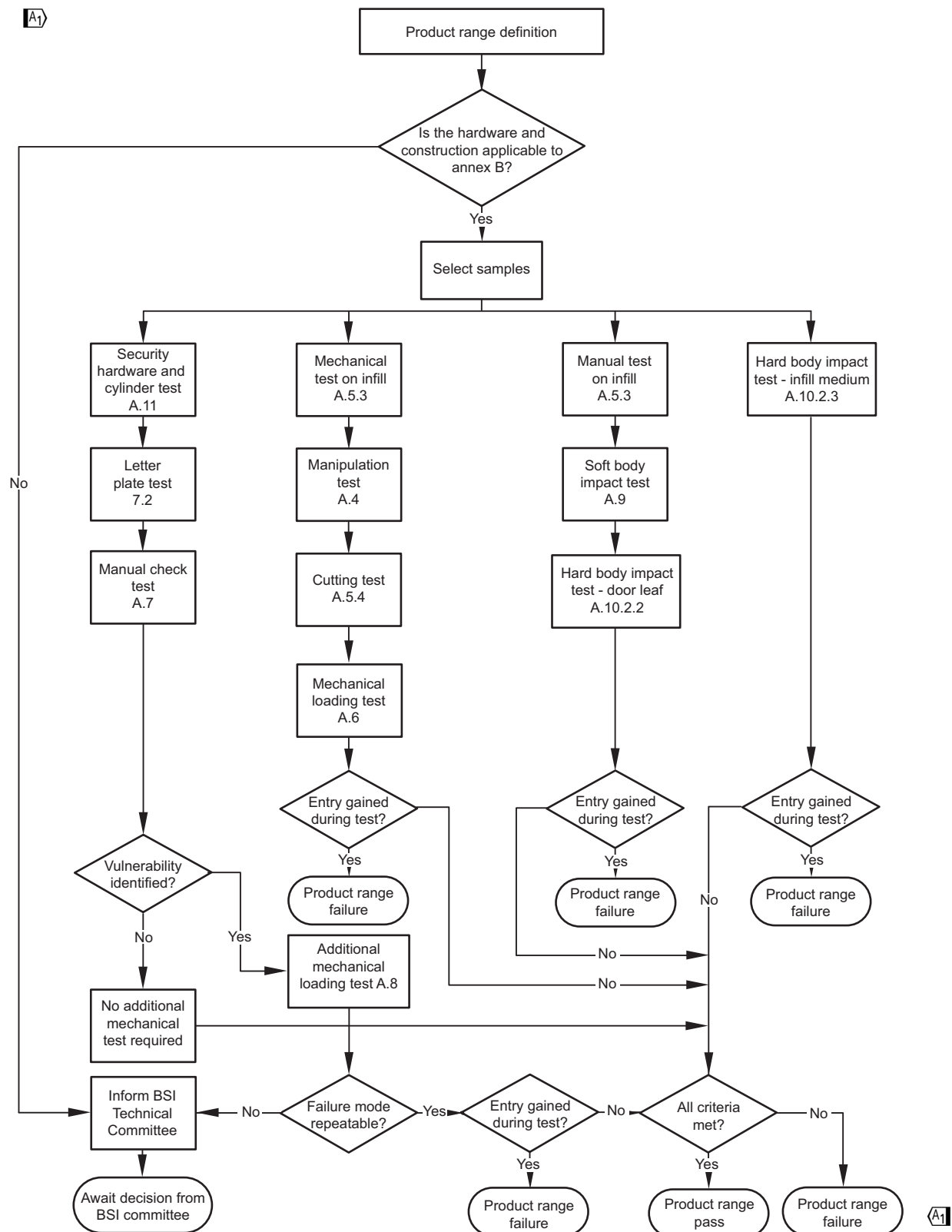
Assessment shall follow the steps summarized as a flow chart in Figure 1.

5.3 Test report

The test report shall include the following information.

- a) A concise description of the door assembly including at least the following information, checked before test:
 - manufacturer's name and specific product identification;
 - types of door assembly;
 - materials and if applicable, their surface treatment;
 - overall width and overall height of each test sample;
 - method of frame jointing;
 - framing profile and reinforcement details where applicable;
 - types of beading, gaskets, methods of glazing and any security feature in the glazing rebate;
 - type and thickness of glass and overall thickness of infill medium;
 - types and details of hardware;
 - types and details of hardware fixings;
 - detailed drawing(s) of the doorset elevation viewed from the outside, including the position of the hardware.

- b) The definition of the door assembly range applicable to the report including any size limitation and door assembly configuration.
- c) The results obtained during each test.
- d) A diagram of the test apparatus or its reference.
- e) The laboratory ambient temperature at the time of test.
- f) The test organization, date of test and test engineer.
- g) A statement that the results are valid only for the conditions under which the test was conducted and for the specific range of door assemblies.
- h) A summary of the results and assessment of the range.



A1 NOTE Additional lock cylinders are assessed in accordance with 7.3. **A1**

Figure 1 — Flow chart

6 Requirements for test apparatus

6.1 General

The test apparatus shall support the sample rigidly. For all tests the sample shall be installed vertically and square so that the door opens and closes smoothly and is secured to prevent movement in the test apparatus.

When conducting the manual tests the test apparatus shall allow for free unrestricted access to the exterior face of the door. The sample shall be mounted at ground level with the outer frame flush with the outer face of the test apparatus.

When carrying out the mechanical test the test apparatus shall be provided with the means of applying the loads, parallel and perpendicular to the plane of the test sample, to within a measured accuracy of $\pm 2\%$ and controlled to an accuracy of $\pm 5\%$.

NOTE Typical loading configurations are shown in Figures A.1 to A.4.

The test apparatus shall provide sufficient support so that the in plane movement and perpendicular to plane movement of the sample's sub frame is not more than 2 mm or 1/800 of the length of the support edge, whichever is the greater, measured at the centre of the supported edge, when subjected to a 4.5 kN load.

A suitable bracket, as shown in Figure A.5, shall be used to apply the loads.

The apparatus shall provide frame support to prevent perpendicular to the plane movement of the sample's outer frame with respect to the timber sub-frame. The supported area shall be a minimum of 200 mm in length and $7.5 \text{ mm} \pm 2.5 \text{ mm}$ wide measured from the outer edge of the profile as shown in Figure A.6.

The apparatus shall also provide support to prevent movement of transoms and mullions when the perpendicular to plane load is applied to locking points adjacent to the transom or mullion. The supported area shall be sufficient to prevent significant indentation of the frame material.

6.2 Mechanical load test

For the mechanical load test the perpendicular to plane load shall be applied via a loading pad with a nominal area of 1 000 mm² with a minor dimension of not less than 25 mm as shown in Figure A.7.

NOTE 1 Where this size of loading pad is impracticable, a pad with a minor dimension of not less than 15 mm and a nominal area of 1 000 mm² may be used.

In all cases the line of action of the applied load shall be applied to the geometric centre of the loading pad. When hardware is mounted on the face of the leaf in a position to prevent the use of the loading pad within the radial tolerance a loading bridge shall be used. This bridge shall apply the load simultaneously at two points to the leaf with the force line as close as possible to the contact area of the locking point within a radial tolerance of 50 mm. The two loading points of the bridge shall be equally spaced about the force line with a maximum span of 300 mm. The total loading area shall be nominally 1 000 mm² with a minor dimension of not less than 20 mm.

NOTE 2 A suitable bridge is shown in Figure A.8.

The method of attaching the loading pad(s) shall not detrimentally affect the sample under test.

6.3 Infill medium removal test

For the infill medium removal test the perpendicular-to-plane load shall be applied via an articulated pad secured to a nominal 150 mm × 150 mm plywood block of 25 mm minimum thickness.

6.4 Soft body impact test

The soft body impact energy shall be applied by the pendulum fall of a leather sphericoconical bag of approximately 350 mm diameter filled with fine dry sand to a total mass of 30 kg ± 0.05 kg (this corresponds to a sand density of 1 500 kg/m³ and a grain size of <2 mm). The impactor shall be suspended by a cable of at least 1.5 m in length, such that the movement of the impactor is in a vertical plane perpendicular ±5° to the impacted face of the component (a typical impact apparatus is illustrated in Figure A.9).

6.5 Hard body impact test

The hard body impact energy shall be applied by the pendulum fall of a cylindrical steel block having a mass of 50 kg ± 0.05 kg. The nose of the impactor shall be 50 mm ± 0.5 mm in diameter and 175 mm ± 35 mm in length. The overall length of the impactor shall be 820 mm ± 10 mm.

The impactor shall be arranged to swing in an arc normal to the plane of the door and its longitudinal axis shall be horizontal at the moment of impact. The impactor shall be suspended by a cable or cables of at least 1.5 m.

NOTE A typical impact apparatus is illustrated in Figure A.10.

7 Enhanced security performance requirements

A1 7.1 General **A1**

When a door assembly is tested in accordance with the test methods in annex A it shall not be possible to gain entry under the conditions of **A.4**, **A.5**, **A.6**, **A.8**, **A.9**, **A.10** and **A.11**.

A1 7.2 Letter plates

Where a letter plate is included in the door assembly:

- a) the letter plate shall have a maximum aperture size of 260 mm × 40 mm; and
- b) the letter plate shall meet the installation height requirements specified in BS EN 13724:2002, **5.3.1**; and
- c) the fixing shall not be removable from the attack side of the door; and
- d) the letter plate assembly shall be tested in accordance with BS EN 13724:2002, **6.6.5**, with the exception that the test shall be conducted with the letter plate mounted in any of the door assemblies submitted for test. All loads shall be applied to the frame of the letter plate and from the outside of the door assembly. Following the test, the aperture shall not exceed the dimensions in a).

In addition, if the letter plate is fitted to a door with **A1** hardware that does not require a removable key to effect unlocking from the inside **A1**, it shall be positioned no less than 400 mm from the internal locking point, or shall be fitted with a suitable security device such as a deflector plate. The 400 mm minimum dimension shall be measured in the plane of the door leaf, from the centre point of rotation of the non **A1** key-unlocking **A1** hardware, typically a thumb turn, and the nearest edge or corner of the internal aperture of the letter plate.

7.3 Cylinders for locks

Where a cylinder falling within the scope of BS EN 1303 is used within the door assembly, the cylinder shall meet the requirements of key-related security (digit 7) grade 5 as detailed in BS EN 1303:2005 and shall also meet the requirements of BS EN 1303:2005, **4.9.1**, resistance to drilling security, grade 2.

Additionally, cylinders shall be submitted for assessment in accordance with Annex C and shall pass the panel's assessment. **A1**

A1 7.4 Classification

Door assemblies successfully meeting the requirements in 7.1, using, where applicable, the entry definition 3.1, shall be classified as K.

The classification K allows the door assembly to be fitted with a lock cylinder operated from both sides by a removable key. This type of cylinder is commonly known as a key/key cylinder.

Door assemblies successfully meeting the requirements in 7.1, using, where applicable, the entry definition 3.2, shall be classified as KT.

The classification KT allows the door assembly to be fitted with either:

- a) a cylinder operated by a non-removable key or fixed element on the inside and a removable key on the outside. This type of cylinder is commonly known as a key/thumb turn cylinder; or
- b) a lock cylinder operated from both sides by a removable key. **A1**

8 Design and general performance requirements

8.1 General

All door assemblies shall meet the requirements of PAS 23-1.

8.2 Glazing

Where doors contain glazing they shall be glazed in accordance with BS 6262.

Glazing installed in doors that do not require the use of a removable key to release the hardware from the inside shall be laminated glass.

NOTE Attention is drawn to BS 6262-4 which requires safety glass in most door assemblies.

8.3 Sidelights and fanlights

Dummy vents and opening lights shall meet the requirements of BS 7950. Full height sidelights shall be fixed lights.

A1 Text deleted. **A1**

9 Installation instructions

The manufacturer shall supply with each door assembly full instructions for assembly, installation **A1**, operation **A1** and maintenance.

10 Marking

Each door assembly shall be permanently marked, in a position that is **A1** visible and readily accessible when the door is open and **A1** not visible when the door is closed, with the following information:

- a) the number and date of this Product Assessment Specification, i.e. PAS 24:2007¹⁾;
- b) the date of manufacture of the door assembly;
- c) the name or trade mark of the manufacturer or other means of identifying the manufacturer;
- A1** d) the classification according to 7.4.

NOTE Marking may be covered by easily removeable trim. **A1**

¹⁾ Marking PAS 24:2007 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 Product Assessment Specification. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third party certification, which may also be desirable.

Annex A (normative)

Test methods

A.1 General

Check that all glass fitted to the test samples is toughened.

A.2 Sample preparation

When conducting any of the tests specified in this annex the door assembly shall be fixed in a timber or aluminium sub-frame of rectangular section (nominal 75 mm × 100 mm). Unless otherwise stated, the test sample shall be stored and tested in an environment within the range of 15 °C to 30 °C and 25 % r.h. to 75 % r.h., for a minimum of 24 h.

The door assembly shall be fixed to the sub-frame using suitable fixings at centres as specified in the system supplier's instructions. The fixings shall enter the sub-frame through the door frame.

All protective packaging shall be removed before testing.

NOTE The test house may cover glazing with a safety film, applied on the attack side prior to impact tests.

The hardware shall be checked for correct operation.

Before testing, samples shall be closed and locked from the outside. If applicable, any keys shall be removed.

A.3 Tools

A.3.1 (Group A) *Assorted mild steel wire*, each not more than 2 mm in diameter and not more than 700 mm in length.

A.3.2 (Group A) *Two credit cards*, of size (55 ± 5) mm × (85 ± 5) mm and (0.7 ± 0.3) mm thick.

A.3.3 (Group A) *Two paint scrapers*, with a blade width of approximately (75 ± 15) mm width.

A.3.4 (Group A) *One craft knife*, with a maximum overall length of 180 mm, a straight blade (0.6 ± 0.1) mm thick and an exposed blade of length (28 ± 7) mm, e.g. a Stanley-trimming type knife.

A.3.5 (Group A) *Two flat blade screwdrivers*, of length (150 ± 20) mm overall, a shank length of (75 ± 15) mm, a shank diameter of (3 ± 0.5) mm and a blade width of (3 ± 1) mm. The shank shall be of vanadium/chrome tool grade steel.

A.3.6 (Group B) *One wood chisel*, of length (250 ± 20) mm overall and a blade width (25 ± 2) mm.

A.3.7 (Group B) *One wood chisel*, of length (250 ± 20) mm overall, and a blade width of (6 ± 1) mm.

A.3.8 (Group B) *One flat blade screwdriver*, of length (200 ± 20) mm overall, a shank diameter of (6 ± 1) mm and a blade width of (6 ± 1) mm.

A.3.9 (Group B) *One brick bolster*, of length (250 ± 25) mm and a blade width of (60 ± 15) mm.

A.3.10 (Group B) *One crosspoint screwdriver*, of length (200 ± 20) mm overall, a shank diameter of (6 ± 1) mm and point size 2.

A.3.11 (Group B) *One cross head screwdriver*, of length (200 ± 20) mm overall, a shank diameter of (6 ± 1) mm and point size PZ2 (posi-drive).

A.4 Manipulation test

A.4.1 Objective

The objective of this test is to establish that there is no inherent vulnerability in the design which, from the outside, would permit entry by the hardware being operated, released or disengaged. This test shall be carried out with knowledge of the sample and the hardware installed.

A.4.2 Procedure

Conduct this test on sample 2 using the tools specified in group A of A.3 and where applicable tools A.3.8, A.3.10 and A.3.11 in group B of A.3.

Attempt various methods of manipulation such as removal of trim sections, insertion of an implement to disengage locking devices, undoing threaded fasteners in externally fixed hardware, blows by hand to dislodge locking devices, removal of any hinge pin.

The test engineer may apply a force sufficient to explore any potential vulnerability but this force shall not result in permanent set or plastic deformation of any tool. If access of the head of any threaded fastener becomes available, attempts to unscrew the fastener shall be made using the tools defined in A.3.8, A.3.10 and A.3.11. Tools described in A.3.8, A.3.10 and A.3.11 shall not be used for any other purpose, such as levering, etc., during this test. Manipulation at any location shall be terminated if permanent set, plastic deformation or breakage of a tool occurs. Damaged tools shall be replaced and the test continued at other locations.

The aperture within any letter plate shall not be used to gain entry during this test.

Although there is no overall time limit for this test, no one technique shall be used for more than 3 min.

A.5 Cutting and infill medium removal test

A.5.1 General

Where the infill medium retention method varies within a doorset each variation shall be subject to A.5.2 and A.5.3.

Where the infill medium construction or the fabric of the door varies within a doorset each variation shall be subjected to A.5.4.

A.5.2 Infill manual test

Conduct this test on any infill medium, including glazing. Conduct the test on sample 3 using the tools specified in both group A and group B of A.3.

Attempt to remove gaskets, beads, security devices (if applicable) and the infill medium from the exterior face of the glazing system for a period of 3 min.

A.5.3 Infill mechanical test

Conduct this test on sample 2 (see Clause 4).

Apply a load of 2.0 kN progressively and without shock to every corner of any infill medium and each corner of the boundaries of components within the infill medium in turn and in a direction towards the inside, over a period of 10 s to 20 s and within 5° of the perpendicular to the plane and maintain until it has been held for 8 s to 12 s. If local failure of the infill medium retention system is exhibited, repeat the loading tests at points along the remainder of the retention system in an attempt to gain entry.