PAS 24:2016

BSI Standards Publication

Enhanced security performance requirements for doorsets and windows in the UK

Doorsets and windows intended to offer a level of security suitable for dwellings and other buildings exposed to comparable risk

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Publishing and copyright information

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 84, an inside back cover and a back cover.

Foreword

Publishing information

This Product Assessment Specification (PAS) is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 29 February 2016. It was prepared by Subcommittee B/538/1, *Windows and doors*, under the authority of Technical Committee B/538, *Doors, windows, shutters, hardware and curtain walling*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This PAS supersedes PAS 24:2012, which is withdrawn.

Information about this document

This PAS has been produced by BSI to provide a method for testing and assessing the enhanced security performance requirements of doorsets and window types intended to resist the levels and methods of attack experienced in the UK and normally associated with the casual or opportunist burglar. It is believed that these attacks are the result of an opportunity presenting itself with no particular regard to the likely reward that success might bring. Burglary attempts covered by this document are likely to avoid noise and unnecessary risk. As risk is associated with time, the period spent attempting to gain entry is limited.

For both doorsets and windows it offers two routes to demonstrating suitable security performance.

For doorsets, one route is based on the traditional UK test methods detailed in previous editions of PAS 24 and the other is a European approach based on BS EN 1627. In both cases, cylinders and associated security hardware are subjected to additional assessment against attack methods seen in the UK.

For windows, one method of demonstrating suitable security performance is based on BS 7950. The other method is based on BS EN 1627.

It is recognized that, within a free and open market, the controls that can be applied to such assessments and claims might not be adequate to offer the degree of assurance that is expected of the types of products specified in this PAS. Particularly in view of the security nature of this PAS, users are therefore strongly advised to consider the desirability of third-party certification, inspection and testing. Appropriate conformity attestation arrangements are described in BS EN 45011, for example.

Users seeking assistance in identifying appropriate assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

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

This PAS covers doorsets and windows of all material types. Products are required to meet the material specific requirements as covered by the product standards for doorsets and windows such as BS 7412, BS 4873, BS 6510, BS 8529 and BS 644. Other characteristics such as weathertightness are covered by the BS 6375 series of standards that also references this document.

The distinction between a doorset and a window is based on the intended use as declared by the manufacturer. Products intended for pedestrian access are declared, tested and classified as doorsets in accordance with **4.4** of this standard.

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

- the scope has been widened;
- text has been amended to allow for easy egress hardware on all doorsets;
- the cutting test has been made more practical;
- the classification has been simplified; and
- more robust requirements have been introduced for letter plates.

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.

1 Scope

This Product Assessment Specification specifies test methods and acceptance criteria relevant to the enhanced security performance of doorsets and windows intended to resist attack normally associated with the casual or opportunistic burglar.

It is applicable to doorsets and windows listed in a) and b) below.

Standard loading cases for use with Annex B and Annex C have been prepared for the following products.

a) Windows: singular and multilight:
    1) top hung, side hung, bottom hung, butt hinged;
    2) top and side hung projected;
    3) top hung and side hung fully reversible;
    4) tilt and turn and turn and tilt;
    5) vertical and horizontal sliding;
    6) fixed and fixed casements (dummy vents);
    7) parallel opening;
    8) double opening (French windows);
    9) vertical and horizontal pivot.

b) Doorsets:
    1) single and double leaf;
    2) single and double swing;
    3) hinged;
    4) sliding (single and multi-track);
    5) pivot;
    6) folding sliding (single and multi-track);
    7) stable;
    8) with or without integral side panels and fanlights.

The security performance requirements in this PAS are not material specific.

This PAS is applicable to new window and doorsets as manufactured and prior to installation. It is only applicable to complete window and doorsets or a range thereof.

The ability to gain entry by manipulation of a lock cylinder is addressed in this PAS. Entry by deliberate breaking of the glass, lock picking using tools only available to a locksmith, attack on electrical controls, electronic components and electrical supply or by attack on the frame fixing methods is not addressed. This PAS does include a requirement for the infill medium material.

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

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 644, *Timber windows – Fully finished factory-assembled windows of various types – Specification*

BS 4873, *Aluminium alloy windows and doorsets – Specification*

BS 6262 (all parts), *Glazing for buildings*

BS 6375 (all parts), *Performance of windows and doors*

BS 6510, *Steel-framed windows and glazed doors – Specification*

BS 7412, *Specification for windows and doorsets made from unplasticized polyvinyl chloride (PVC-U) extruded hollow profiles*

BS 8529, *Composite doorsets – Domestic external doorsets – Specification*

BS EN 356:2000, *Glass in building – Security glazing – Testing and classification of resistance against manual attack*

BS EN 1303:2015, *Building hardware – Cylinders for locks – Requirements and test methods*

BS EN 1627:2011, *Pedestrian doorsets, windows, curtain walling, grilles and shutters – Burglar resistance – Requirements and classification*

BS EN 12600:2002, *Glass in building – Pendulum test – Impact test method and classification for flat glass – Pendulum test – Impact test method and classification for flat glass*

BS EN 13724:2013, *Postal services – Apertures of private letter boxes and letter plates – Requirements and test methods*

Other publications

[N1] DOOR AND HARDWARE FEDERATION. *TS 008 Enhanced security and general requirements for letter plate assemblies and slide through boxes.* DHF: 2015. [1)]

3 Terms and definitions

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

3.1 active leaf
leaf of a multi-leafed doorset intended to be moved first to provide opening

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

3.2 channel glazing
glazing system in which the frame overlaps the infill medium on both sides without the use of an independent glazing bead

[1)] Available from <http://www.dhfonline.org.uk/docs/1104%20-%20TS%20008%20Dec%202015(1).pdf> [last viewed 2 February 2016].

3.3 component failure

3.3.1 primary component failure
first occasion a deflection of 50 mm or greater in the opening direction occurs at the loading point under test

3.3.2 secondary component failure
second or subsequent occasion a deflection of 50 mm or greater in the opening direction occurs at the loading point under test

3.4 continuous hinge
continuous uninterrupted hinge similar to those found on piano lids

3.5 coupled side panel
fixed element with its own outer frame attached to the outer frame of the doorset

3.6 doorset
complete unit, primarily intended for pedestrian access, consisting of the door frame, door leaf or leaves, any integral side panel or fanlight and essential hardware excluding coupled assemblies

3.7 dummy vent
vent which is permanently fixed in the closed position

3.8 electromagnetic lock
locking device that consists of an electromagnet and armature plate, such that a current passing through the electromagnet attracts the armature plate holding the door shut

3.9 entry
⟨for all tests except the cutting test in zone 2⟩
creation of an aperture through which a 500 mm long cylindroid of diameter 50 mm can pass freely

3.10 entry
⟨for the cutting test (see **B.4.4.4**) in zone 2⟩
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 1 This simulates the passage of an intruder's body. The aperture may encroach into zone 1.

NOTE 2 The above entry definitions are only relevant for the annexes in this PAS. Separate failure criteria are given in BS EN 1627.

3.11 false mullion
section fitted to a leaf within a double leaf doorset or casement stile in a window to provide a rebate for the opposed leaf or casement to close onto and to create the impression of a mullion when in the locked position

3.12 fixed light
infill medium that is permanently retained within the outer framing members of the window

3.13 floor level
underside of the doorset sill or threshold

3.14 folding sliding door
concertina-style folding and sliding door system with or without single or double-leaf doorsets capable of providing a large opening area

3.15 horizontal sliding door
fully glazed horizontal sliding door system, usually consisting of a fixed leaf and horizontal sliding leaf(s) that slide in front of each other

NOTE Horizontal sliding doors are often called "sliding patio doors".

3.16 inactive leaf
leaf of a multi-leafed doorset intended to be moved after the active leaf

NOTE Also referred to as the "slave leaf".

3.17 infill medium
single glass, insulating glass units or infill panel

3.18 integral side panel
fixed element within the outer frame of the doorset

3.19 key unlocking hardware
hardware that requires a removable key to effect the unlocking function

NOTE The locking function may be effected with or without the key.

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

3.21 midrail
structure between the opposing horizontal edges of infill panels or glazed apertures in a doorset

3.22 opening face
leading face of a leaf or casement when opened, i.e. the exterior face of an open-out leaf or casement and the interior face of an open-in vent

3.23 parallel opening window
window that does not tilt, turn or slide and that opens outwards where all edges of the sash remain parallel with the outer frame

3.24 plane
plane of the infill medium

3.25 range
group of doorsets or windows with defined limits of size, type, configuration, hardware, glazing system, infill mediums, construction and security features

3.26 technique
combination of tools and locations

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

3.27 vent
moveable individual glazed unit of a window

4 Enhanced security requirements

4.1 General

4.1.1 Classification of use

To claim conformity to this PAS, doorsets and windows shall be classified according to their intended use for all relevant characteristics in accordance with BS 6375 (all parts) and shall meet the requirements of the relevant material specific standard such as BS 7412, BS 4873, BS 6510, BS 8529 and BS 644.

4.1.2 Doorsets

To claim conformity to this PAS, doorsets shall meet the requirements of **4.2**, **4.3**, **4.4** and Annex A of this PAS and either Annex B of this PAS or BS EN 1627:2011, RC3.

Additionally, where a cylinder falling within the scope of BS EN 1303:2015 is used within the doorset, the cylinder shall meet the requirements of key-related security (digit 7) grade 5 as detailed in BS EN 1303:2015 and shall also meet the requirements of BS EN 1303:2015, **4.9.2**, resistance to drilling security, grade 2.

NOTE A cylinder meeting the requirements of TS 007:2014 [1], three star or a cylinder and security hardware meeting the requirements of TS 007:2014 [1], combined rating of three star, would satisfy the above requirements and those of Annex A.

Where doorsets conform to BS EN 1627:2011, RC3, a letter plate may be added if the letter plate meets the requirements of **4.3**.

4.1.3 Windows

To claim conformity to this PAS, windows shall meet the requirements of **4.2**, **4.3** and **4.4** and either Annex C of this PAS or BS EN 1627:2011, RC2N.

4.2 Infill medium requirements

Where doorsets, coupled side panels and windows adjacent to doorsets contain glass, each glazed area shall include at least one pane of laminated glass meeting the requirements of BS EN 356:2000, Class P1A or higher, and shall be glazed in accordance with BS 6262.

Where windows contain glass and non-key unlocking hardware, each glazed area shall include at least one pane of laminated glass meeting the requirements of BS EN 356:2000, Class P1A or higher, and shall be glazed in accordance with BS 6262.

4.3 Letter plates

Where a letter plate is included:

a) the letter plate shall have a maximum aperture size of (260 x 40) mm; and

b) the letter plate shall meet the installation height requirements specified in BS EN 13724:2013, **5.4.1.2**; and

c) the letter plate shall meet the requirements of TS 008:2015 [N1], Enhanced security grade 2 with all fixing accessible from the external face removed. The TS 008:2015 test may be conducted on the letter plate when installed in a doorset or mounted in a test block as detailed in TS 008:2015 [N1].

NOTE TS 008:2015 [N1] details a number of characteristics that might be applicable in particular circumstances such as fire resistance.

4.4 Classification

All doorsets shall be designated as D.

All windows shall be designated as W.

*NOTE See **4.1** regarding product conformity to this PAS.*

5 Marking

Each doorset and window shall be permanently marked, in a position that is visible and readily accessible when the product is open and not visible when the product is closed, with the following information:

a) the number and date of this Product Assessment Specification, i.e. PAS 24:2016; [2)]

b) the date of manufacture of the product (at least the year and quarter);

c) the name or trade mark of the manufacturer or other means of identifying the manufacturer; and

d) the classification in accordance with **4.4**.

NOTE Marking may be covered by easily removable trim or located on the top rail of the door leaf, window sash or casement.

6 Design and general requirements

6.1 Doorsets

Where a doorset includes dummy vents, fixed lights, fixed panels and/or opening lights these shall meet the requirements for a doorset, as detailed in **4.1.2**.

6.2 Installation instructions

The manufacturer shall supply with each doorset and window full instructions for assembly, installation, operation and maintenance.

[2)] Marking PAS 24:2016 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) Security hardware and cylinder test and assessment

A.1 Objective

The objective of this annex is to provide a method of testing the door furniture, hardware, lock and cylinder's resistance to manual attack and to assess the vulnerability of a cylinder to an attack using knowledge, skill and professional ability.

A.2 Test tools

A.2.1 Tools group A

A.2.1.1 *Assorted mild steel wire*, not more than 2 mm in diameter and not more than 700 mm in length.

A.2.1.2 *Two credit cards*, of size [(55 ±5) × (85 ±5)] mm and (0.7 ±0.3) mm thick.

A.2.1.3 *Two paint scrapers*, with a blade width of approximately (75 ±15) mm in width.

A.2.1.4 *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. [3)]

A.2.1.5 *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 or chrome tool grade steel.

A.2.2 Tools group B

A.2.2.1 *One wood chisel*, of length (250 ±20) mm overall and a blade width of (25 ±2) mm.

A.2.2.2 *One wood chisel*, of length (250 ±20) mm overall, and a blade width of (6 ±1) mm.

A.2.2.3 *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.2.2.4 *One brick bolster*, of length (250 ±25) mm and a blade width of (60 ±15) mm.

A.2.2.5 *One crosspoint screwdriver*, of length (200 ±20) mm overall, a shank diameter of (6 ±1) mm and point size 2.

A.2.2.6 *One cross head screwdriver*, of length (200 ±20) mm overall, a shank diameter of (6 ±1) mm and point size P(Z)2, e.g. a Pozidriv screwdriver [4)].

[3)] Stanley is a trademark owned by Stanley Black and Decker and is an example of a suitable product available commercially. This information is given for the convenience of the users of this standard and does not constitute an endorsement by BSI of this product.

[4)] Pozidriv is a trademark owned by the Phillips Screw Company and the American Screw Company and is an example of a suitable product available commercially. This information is given for the convenience of the users of this standard and does not constitute an endorsement by BSI of this product.

A.2.3 Tools group C

A.2.3.1 *Self-gripping pliers*

a) *Straight jaw self-gripping pliers,* with a nominal length between the end of the fixed jaw and the non-adjustable section of the handle of (210 ±10) mm. Each serrated gripping surface shall be (13 ±3) mm wide at the end, (16 ±3) mm at the throat and (36 ±7) mm in length. When the ends are closed on a (12 ±0.5) mm block the distance between the serrated gripping surfaces shall be (12 ±2) mm (see Figure A.1 and Figure A.2).

b) *Curved jaw self-gripping pliers*, with a nominal length between the end of the fixed jaw and the non-adjustable section of the handle of (210 ±10) mm. Each serrated gripping surface shall be (11 ±3) mm wide at the end, (13 ±3) mm at the throat and (30 ±5) mm in length. When the ends are closed on a (12 ±0.5) mm block, it shall be possible to insert a (15 ±0.1) mm diameter bar between the serrated gripping surfaces at the widest point (see Figure A.3 and Figure A.4).

NOTE Irwin Vise-grip [5] straight and curved jaw locking pliers model 10WRC and model 10R have been used successfully.

A.2.3.2 *Torque gauge*, with a 16 mm spigot end, calibrated with a location pin to centre of nut (extension length) of (31.8 ±1) mm and capable of applying a (180 ±10) Nm torque. The overall length of the tools shall be (420 ±40) mm.

NOTE A Norbar [6] model 200TH has been used successfully.

A.2.3.3 *Shallow curve head attachment*, suitable for use with the torque gauge detailed in **A.2.3.2** manufactured from a nail bar with dimensions as shown in Figure A.5 and Figure A.6.

NOTE A modified Stanley Wonder bar [7] has been used successfully.

A.2.3.4 *Hooked head attachment*, suitable for use with the torque gauge detailed in **A.2.3.2** manufactured from a nail bar with dimensions as shown in Figure A.7 and Figure A.8.

NOTE A modified Stanley Wonder bar[7] has been used successfully.

A.2.3.5 *Selection of steel self-cutting traction screws with deep thread and gimlet point*, self-tapping thread with drill point, single and twin start. Screws shall be up to a maximum nominal diameter of 5.5 mm and maximum nominal length of 60 mm.

A.3 Procedure

A.3.1 General

A locking mechanism is deemed to have failed if, during the test, entry is gained, as defined in **3.9**.

Conduct the test on all doorset locking mechanisms.

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[5] Irwin Vise-grip is a trademark owned by Irwin Industrial Tool Company and is an example of a suitable product available commercially. This information is given for the convenience of the users of this standard and does not constitute an endorsement by BSI of this product.

[6] Norbar is a trademark owned by Norbar Limited and is an example of a suitable product available commercially. This information is given for the convenience of the users of this standard and does not constitute an endorsement by BSI of this product.

[7] Stanley Wonder Bar is a trademark owned by Stanley Limited and is an example of a suitable product available commercially. This information is given for the convenience of the users of this standard and does not constitute an endorsement by BSI of this product.

Carry out the test from the exterior face of the doorset with full knowledge of the sample's construction and hardware details.

Conduct **A.3.2**, Part 1, of this test on all doorset locking mechanisms using any of the following: sample 1 (see Annex B), a complete new sample or new hardware fixed to sample 1, using the tools specified in **A.2.1** (Tools group A), **A.2.2** (Tools group B) and **A.2.3** (Tools group C).

Conduct **A.3.3**, Part 2, of this test on all doorsets that contain a cylinder as a component of the locking mechanism, using any of the following: sample 1 (see Annex B), a complete new sample or new hardware fixed to sample 1, using the tools specified in **A.2.1** (Tools group A), **A.2.2** (Tools group B) and **A.2.3** (Tools group C).

When using the tools listed in **A.2.3.2**, **A.2.3.3** and **A.2.3.4**, the torque applied shall not exceed 180 Nm when measured by the torque gauge.

When using any tool specified in **A.2.1**, **A.2.2** and **A.2.3** to strike the assembly, the impact point of the tool shall not travel more than 100 mm.

A maximum of two self-cutting traction screws, as described in **A.2.3.5**, shall be used during the Part 2 test (see **A.3.3**). Those traction screws selected shall be of a type, length and diameter that are most likely to enable entry to be gained to the cylinder.

The second screw may only be considered if the first breaks during insertion or due to the application of forces other than nominally axial. If, however, the thread of the screw is damaged due to protection within the cylinder, or the cylinder part breaks or fractures, the use of a second screw is not permissible.

*NOTE 1 The test organization may request up to six additional cylinder sets in order to establish the location on the cylinder face and type, diameter and length of traction screw most likely to result in a successful attempt of activities v) and vi) (see **A.3.3**).*

NOTE 2 The operation of the lever or knob furniture is permitted without the aid of tools.

A.3.2 Part 1

Part 1 of the test consists of three activities. Where applicable, conduct each activity as detailed in i), ii) and iii). The total test time shall consist of attack time and rest time. During the attack time the activities described in i), ii) and iii) shall be performed. Changing the attachments detailed in **A.2.3.3** and **A.2.3.4** shall form part of the rest time. Time taken to consider the vulnerability of the assembly during the test shall also form part of the rest time.

The total attack time shall not exceed 3 min. The total rest time shall not exceed 7 min.

Activities are as follows:

i) attempt to remove, dislodge or otherwise gain access to the cylinder and/or lock by attacking any protective item;

ii) attempt to break and defeat any cylinder by applying a twisting and/or bend force;

iii) if access to the internal workings of the hardware, cylinder or lock is gained then attempt to defeat the lock and gain entry by operating any accessible mechanism.

NOTE Access to the internal workings such as lever lock mechanisms may be gained via the key hole.

A.3.3 Part 2

Part 2 of the test consists of four activities. Where applicable, conduct each activity as detailed in iv), v), vi) and vii). The total test time shall consist of attack time and rest time. During the attack time, the activities described in iv), v), vi) and vii) of this subclause shall be performed. Changing the attachments detailed in **A.2.3.3** and **A.2.3.4** shall form part of the rest time. Time taken to consider the vulnerability of the assembly during the test shall also form part of the rest time.

The total attack time shall not exceed 3 min. The total rest time shall not exceed 7 min.

Activities are as follows:

iv) attempt to remove, dislodge or otherwise gain access to the cylinder by attacking any item protecting the cylinder;

*NOTE 1 This activity may be omitted based on the knowledge gained in **A.3.2**, or if it is unlikely to improve the chances of defeating the vulnerability in question. Attempts to break or defeat the cylinder by applying a twisting and/or bending force are permitted. This may include removal of part of the cylinder itself.*

v) attempt to screw the self-cutting traction screw into any exposed part of the cylinder so that it provides suitable fixing force for activity vi);

vi) attempt to break and defeat the cylinder by applying a nominally axial force to the screw using the hooked head attachment and torque gauge;

NOTE 2 A hardwood block may be used to raise the heel of the attachment to increase the likelihood of cylinder breakage and decrease the likelihood of screw failure.

vii) if access to the internal workings of the hardware, cylinder or lock is gained, then attempt to defeat the lock and gain entry by operating any accessible mechanism.

A.4 Cylinder vulnerability assessment

A.4.1 Principles of assessment

The assessment is to be undertaken by a panel of three expert assessors qualified in accordance with **A.4.6**. Each expert shall undertake an individual assessment and report back independently. In order for conformity to Annex A to be claimed, each member of the panel shall report the test sample as having satisfactorily withstood the test, or where a suitable test key cannot be manufactured due to the design of the product, each expert shall confirm that the product is not vulnerable to the attack method described in this annex. The test is intended to assess the vulnerability of a cylinder to an attack using knowledge, skill and professional ability. It is not intended to assess the cylinder's ability to resist attack involving significant force or by the use of tools only available to locksmiths.

A.4.2 Submission of assessment samples

A total of 12 complete cylinder assemblies shall be submitted. These shall be representative of normal production and shall contain the most vulnerable combination of variations as determined by the panel. Four samples shall be supplied to each assessor, one for examination and three for assessment purposes. Where a range of products is assessed, the panel shall agree with the manufacturer which samples are required for assessment, and the decision shall be based on the examination of detailed drawings, specimens and discussions with the interested parties. If, during the assessment process, an assessor identifies a particular vulnerability and believes that further tests are required, a maximum of two further samples shall be requested.

A.4.3 Preparation of the assessment sample

The test sample and a typical lock shall be mounted in accordance with the manufacturer's instructions in a wooden block or similar, with a thickness that equates to the minimum door thickness for which the cylinder is intended to be used. The sample shall be verified as being fully functional. During the test the cylinder and lock shall be mounted in a rigid fixture at a working height similar to the intended location when installed in a door; nominally 1 000 mm from floor level.

Any protective furniture incorporated into the lock assembly shall be included as part of the test sample. The side on which any protective furniture is fitted shall be treated as the attack face.

A.4.4 Assessment procedure

Each assessor shall dismantle and examine the first sample prior to testing and assessing the second sample. There is no overall limit for the time required to dismantle and examine the first sample.

A cylinder is deemed to have failed if, during the test it is possible from the attack side for any of the locksmith experts to rotate the cylinder cam by more than 90°.

Cylinders used in a lock design shall be assessed in accordance with the following procedure.

The maximum duration of the assessment shall be 3 min, with a further 4 min allowed to conduct any modification deemed necessary in accordance with iv).

i) Sample cylinders shall have combinations in which all step heights are in the mid-range, and are as close together as possible, but which also conform to the manufacturer's specification and the requirements of BS EN 1303:2015.

ii) During assessment, cylinders shall be installed in a lock, which in turn shall be mounted as detailed in **A.4.3**.

iii) The test key used for this assessment shall be machine cut by the manufacturer and shall comprise all bottom (lowest) steps. A test key shall be rejected if the assessor does not consider it to be representative of a machine cut key, or is of the opinion that the steps are cut in such a way that it would reduce the likelihood of defeating the cylinder.

iv) The length of the test key and its shoulder shall not be modified by the manufacturer; this may be done by the assessor.

v) Where cylinders using a side bar code are supplied, the test key shall exhibit that side bar code.

vi) In the case of double-sided cylinders, where one side only is intended for use on the outside of the door, only this side shall be subjected to the test and the higher security side shall be clearly marked accordingly.

vii) Using the permissible tools (see **A.4.5**), each assessor shall attempt to defeat the cylinder within the defined times, using manipulation techniques.

A.4.5 Permissible assessment tools

Only the tools listed in Table A.1 may be used in undertaking the cylinder vulnerability assessment.

NOTE The list is intended to give a general description of the tools allowed. It is not intended to give precise dimensions, or to fully detail the type of tool.

Table A.1 **List of tools permitted for use in the assessment of the cylinder**

Item	Additional details
Picking tools – cylinders	Rake pick – HPC novice pick set Tensioner
Test key	[see **A.4.4** iii) and iv)]
Impactor	Any proprietary impactor appropriate to the manipulation techniques considered in **A.4.4**.
Resilient device for attaching to the test key	–
Petroleum-based water displacement lubricant spray	–

NOTE Other tools might be used as impactors, e.g. the handle of a screwdriver.

A.4.6 Assessment panel

The assessment shall in all cases be undertaken by a panel of three locksmiths each of whom can demonstrate expertise and experience such as to be able to form a reliable and disinterested judgement as to the probability of a lock being able to withstand the types of attack simulated by the procedures specified in **A.4.4**.

NOTE 1 Such expertise and experience could be demonstrated by the following criteria: a recognized qualification in locksmithing, achieved by examination (e.g. BLI; ALOA) and supplemented by:

- *ten years' experience as a practising locksmith; and*
- *current full membership in good standing, of not less than five years' continuous duration, of a professional locksmithing body.*

NOTE 2 For assessments undertaken by a lock manufacturer, the experts may be directly employed or may be contracted for the purpose. A register containing details of some of those known to be appropriately qualified within the UK can be accessed by application to the BSI Knowledge Centre.

Figure A.1 **Typical straight jaw self-gripping pliers**

Dimensions in millimetres

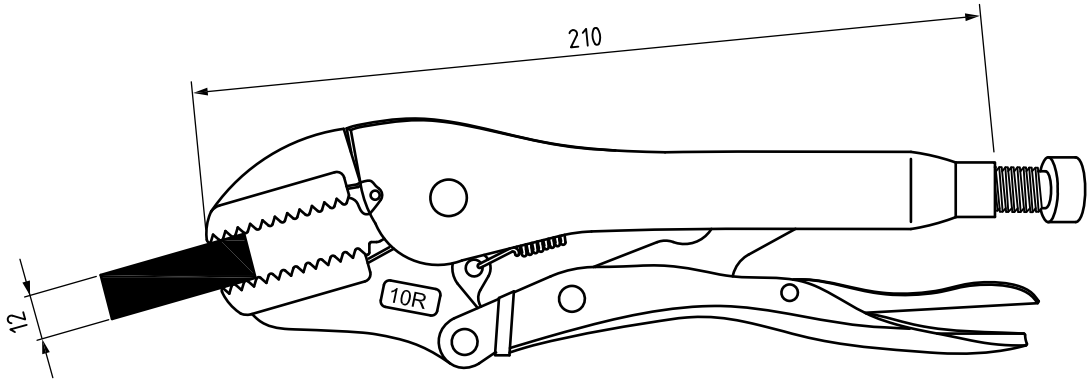


Figure A.2 **Typical straight jaw detail**

Dimensions in millimetres

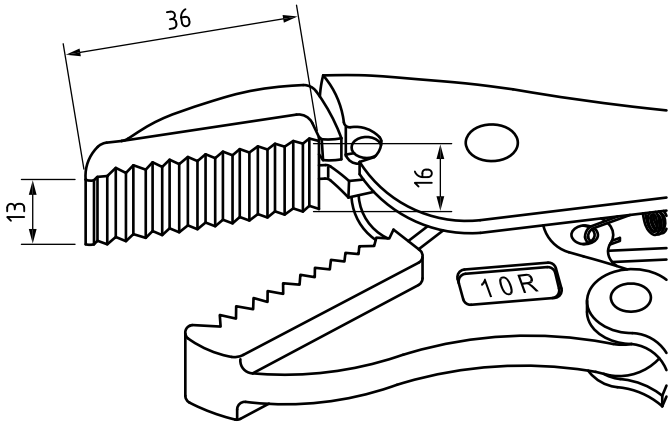
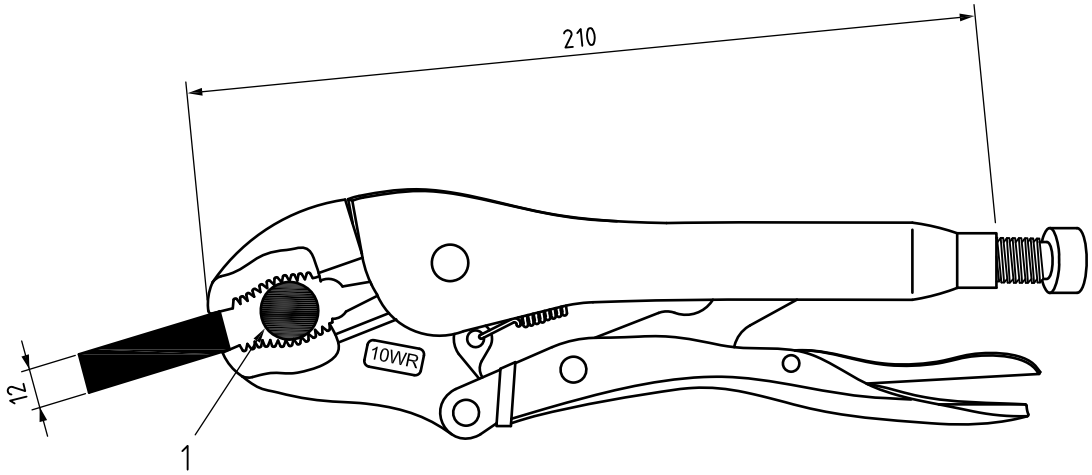


Figure A.3 **Typical curved jaw self-gripping pliers**

Dimensions in millimetres



Key

1 15 mm diameter

Figure A.4 **Typical curved jaw detail**

Dimensions in millimetres

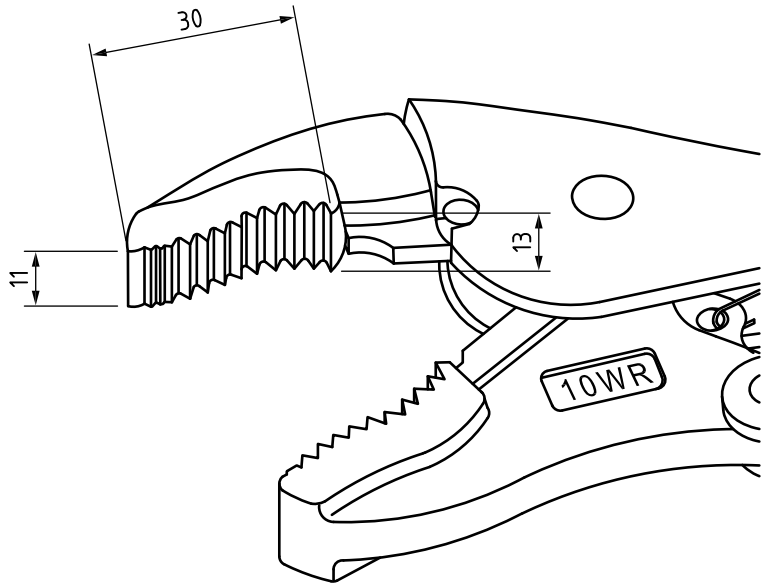
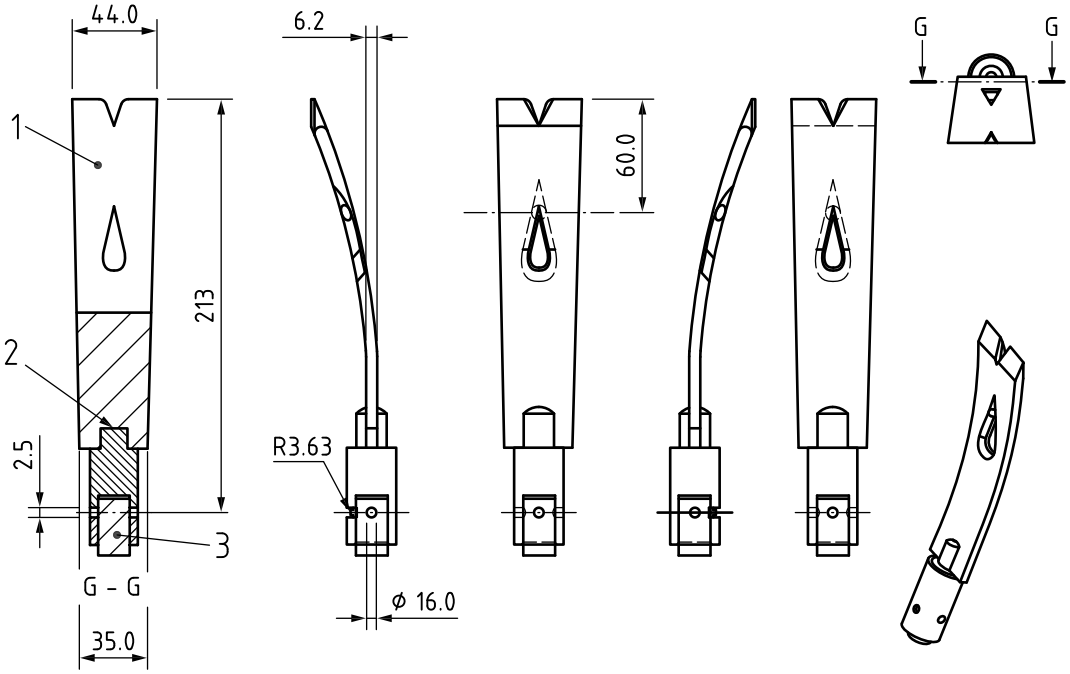


Figure A.5 **Typical shallow curve head**

Dimensions in millimetres

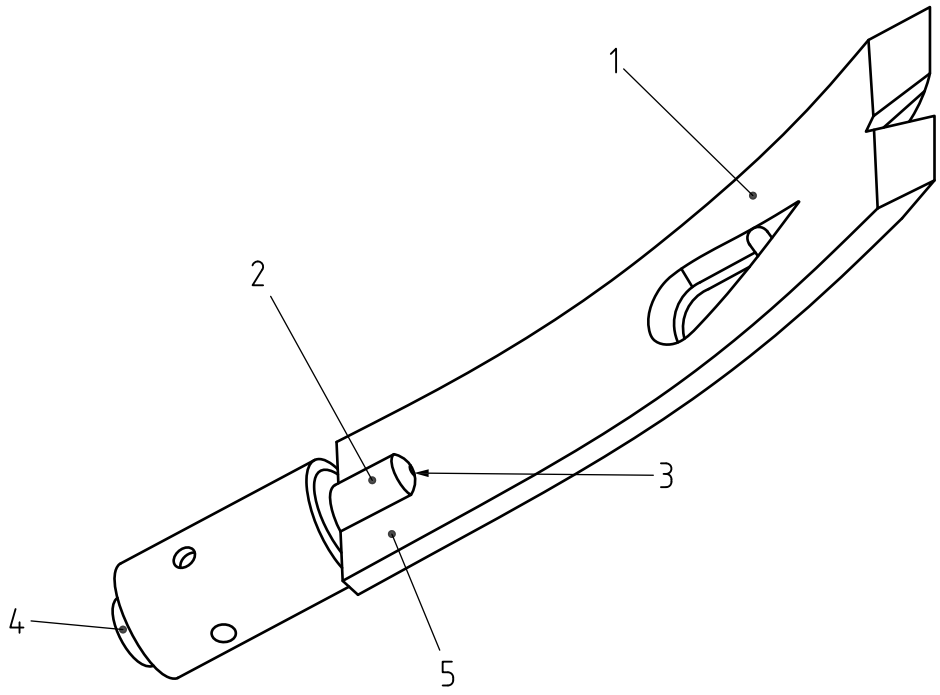


Key

1 Shallow hook
2 Weld joint
3 Torque wrench head

NOTE Assumes a torque gauge location pin to pivot point dimension of 27 mm.

Figure A.6 **Typical shallow curve head**



Key

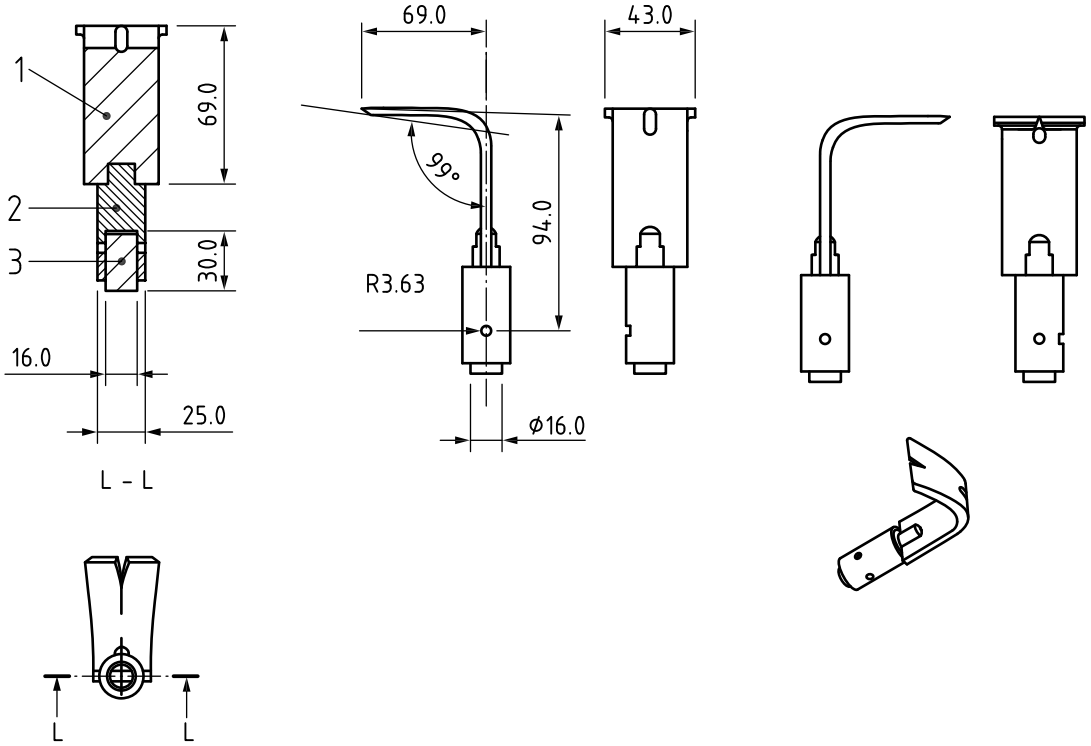
1	Stanley Wonder Bar or equivalent	4	Torque wrench head
2	Weld joint	5	Weld line: weld joint to Stanley Bar
3	Weld line: weld joint to Stanley Bar		

NOTE Assumes a torque gauge location pin to pivot point dimension of 27 mm.

Stanley is a trademark owned by Stanley Black and Decker and is an example of a suitable product available commercially. This information is given for the convenience of the users of this standard and does not constitute an endorsement by BSI of this product.

Figure A.7 **Typical hook attachment**

Dimensions in millimetres

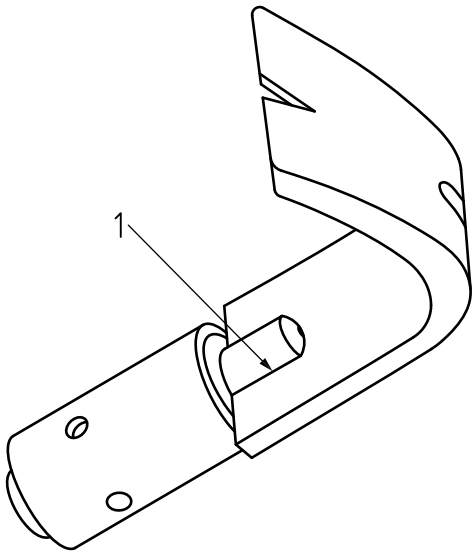


Key

1 Steep hook
2 Weld joint
3 Torque wrench head

NOTE Assumes a torque gauge location pin to pivot point dimension of 27 mm.

Figure A.8 **Typical hook attachment**



Key

1 Weld line: steep hook end of Stanley Wonder Bar to weld joint

NOTE Assumes a torque gauge location pin to pivot point dimension of 27 mm.

Stanley is a trademark owned by Stanley Black and Decker and is an example of a suitable product available commercially. This information is given for the convenience of the users of this standard and does not constitute an endorsement by BSI of this product.

Annex B (normative) Enhanced security performance requirements for doorsets

B.1 General

The objective of this annex is to assess the ability of a doorset to resist mechanical loading. A doorset is deemed to have failed if, during the test, entry is gained as defined in **3.9** and **3.10**, as appropriate.

NOTE An example of the steps which may be undertaken in an assessment have been summarized as a flow chart in Figure B.1.

B.2 Sample selection

The number of samples selected for test shall be agreed between the testing organization and the manufacturer. All samples shall be representative of production. The effect of cumulative testing may be avoided with the exception that for any one configuration:

a) the mechanical loading test in **B.4.5** and the additional mechanical loading test in **B.4.7** and the repeat manipulation test in **B.4.3.2** shall be conducted on a single sample; and

b) the manual test (infill medium removal) in **B.4.4.2**, the soft body impact test in **B.4.8** and the hard body impact test aimed at the door leaf in **B.4.9.2.2** shall be conducted on another single sample.

NOTE 1 The configuration of a product consists of its key components, its number, the size and shape of any glazing and its operation.

All remaining tests may be carried out on either these two samples or on any number of other samples. If the manufacturer wishes, all tests may be carried out on a single sample.

NOTE 2 The sample numbers quoted in the test clauses are relevant to the tests conducted on a typical sample selection of three doors without non-glass infill medium and four where at least one non-glass infill medium is include in the design.

For the purpose of these tests, all glass supplied in the test samples shall be toughened to conform to class 1 (C) φ of BS EN 12600:2002, where φ may be 1, 2 or 3.

*NOTE This requirement is for test samples only, infill medium requirements for doorsets are given in **4.2**.*

Where a range of doorsets is to be tested, the number and type of samples chosen shall be representative of the product range. The samples selected shall include the most adverse and vulnerable aspects of the design, size and configuration.

*COMMENTARY ON **B.2***

The following list, which is not exhaustive, identifies some of the features that can influence the security of a doorset:

a) maximum distance between points that 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;

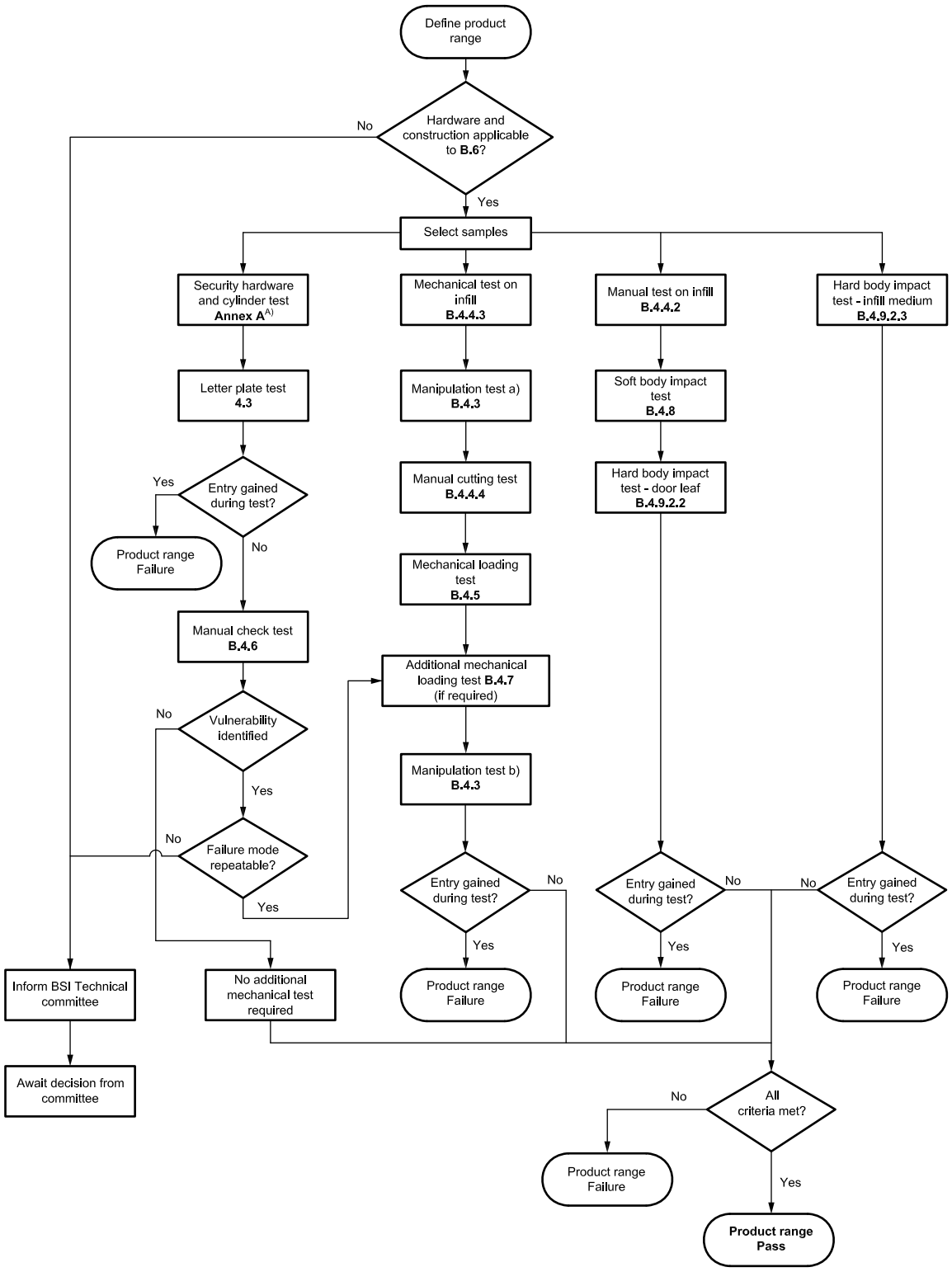
h) size;

i) openings, e.g. letterplate, cat flap;

j) false mullion configuration on double doors; and

k) location of hardware in inactive leaf in double doors.

Figure B.1 **Flow chart for doorsets**



A) Product achieving a TS 007 3 star classification might be deemed to have satisfied the requirements of Annex A.

B.3 Requirements for test apparatus

B.3.1 General

The test apparatus shall support the sample rigidly. For all tests the sample shall be installed vertically and square, in accordance with the manufacturer's instructions 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 such that the test apparatus does not impede the manual test.

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 ±5%.

NOTE 1 Typical loading configurations are shown in Figure B.3 to Figure B.6.

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 B.7, 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 ±2.5) mm wide when measured from the outer edge of the profile as shown in Figure B.8.

The upper member of the doorset sub-frame shall be supported to prevent vertical movement when applying vertical loads to the test sample. The apparatus shall also provide support, in the form of a prop, 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.

NOTE 2 A supported area of 1 000 mm^2 has been proven to avoid significant indentation.

B.3.2 Mechanical load test

For the mechanical load test, the perpendicular-to-plane load shall be applied via a loading pad having a nominal area of 1 000 mm^2 and a minor dimension of not less than 25 mm, as shown in Figure B.9.

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 mm^2 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 mm^2, having a minor dimension of not less than 20 mm.

NOTE 2 A suitable bridge is shown in Figure B.10.

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

NOTE 3 (4 × 25) mm self-tapping screws have been used successfully.

B.3.3 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 × 150) mm plywood block of not less than 25 mm thickness.

B.3.4 Soft body impact test

The soft body impact energy shall be applied by the pendulum fall of a leather spheroconical bag of approximately 350 mm diameter filled with fine dry sand to a total mass of (30 ±0.05) kg (this corresponds to a sand density of 1 500 kg/m^3 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 B.11).

B.3.5 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 ±0.05) kg. The nose of the impactor shall be (50 ±0.5) mm in diameter and (175 ±35) mm in length. The overall length of the impactor shall be (820 ±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 B.12.

B.4 Test methods

B.4.1 General

Check that all glass fitted to the test samples is toughened (see **B.2**).

B.4.2 Sample preparation

When conducting any of the tests specified in this annex, the doorset shall be fixed in a timber or aluminium sub-frame of rectangular section [nominal (75 × 100) mm]. Unless otherwise stated, the test sample shall be stored and tested in an environment with the range of 15 °C to 30 °C and 25% RH to 75% RH, for a minimum of 12 h.

The doorset shall be fixed to the sub-frame using suitable fixings at centres, in accordance with 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 organization may cover infill medium 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.

B.4.3 Manipulation test

B.4.3.1 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. The test engineer shall have detailed knowledge of the sample and the hardware installed (for example, the location and direction of travel of all locking points).

B.4.3.2 Procedure

The manipulation test shall be conducted prior to the manual cutting test (**B.4.4.4**). The overall attack time shall be 15 min; although no single test technique shall be used for more than 3 min.

Repeat the manipulation test after the additional mechanical loading test (**B.4.7**), if the additional mechanical loading test is not required repeat the manipulation test after the mechanical loading test (**B.4.5**) The overall attack time shall be 3 min with the primary intention of releasing threaded fasteners exposed as a result of the mechanical load tests.

Conduct this test on sample 2 using the tools listed in **A.2.1** (Tools group A) and, where applicable, tools listed in **A.2.2.3**, **A.2.2.5** and **A.2.2.6** (Tools group B).

Attempt various methods of manipulation such as removal of trim sections, insertion of an implement to disengage locking devices, undoing threaded fasteners in accessible hardware, blows by hand to dislodge locking devices and 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 to the head of any threaded fastener becomes available, attempts to unscrew the fastener shall be made using the tools given in **A.2.2.3**, **A.2.2.5** and **A.2.2.6**. Tools described in **A.2.2.3**, **A.2.2.5** and **A.2.2.6** 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.

B.4.4 Cutting and infill medium removal test

B.4.4.1 General

Where the infill medium retention varies within a doorset, each variation shall be subjected to the tests given in **B.4.4.2** and **B.4.4.3**.

Where the infill medium construction or the fabric of the door varies within a doorset, each variation shall be subjected to the test given in **B.4.4.4**.

B.4.4.2 Infill manual test

Conduct this test on any infill medium, including glass. Conduct the test on sample 3 using the tools specified in both **A.2.1** (Tools group A) and **A.2.2** (Tools group B).

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.

B.4.4.3 Infill mechanical test

Conduct this test on sample 2 (see Clause **B.2**).

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° 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.

B.4.4.4 Manual cutting test

Conduct this test on sample 2 (see Clause **B.2**).

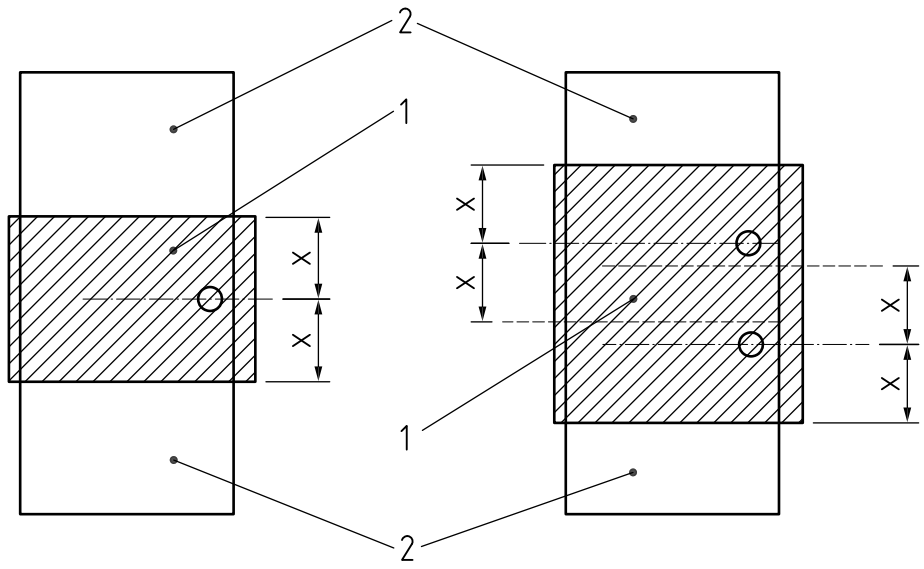
Two tests are conducted, one in zone 1 and a second in zone 2.

Zone 1 is a horizontal band with an upper limit 400^{0}_{-10} mm above the centre of rotation of the upper hardware unlocking point and a lower limit 400^{0}_{-10} mm below the centre of the rotation of the lower unlocking point as shown in Figure B.2. In the case of a single hardware unlocking point zone 1 is a horizontal band with limits 400^{0}_{-10} mm above and below the centre of rotation of the hardware unlocking point.

Zone 2 covers any point of the doorset not in zone 1.

Using the tools described in **A.2.1.3** (paint scrapers), **A.2.1.4** (craft knife), **A.2.2.1** (wood chisel 25 mm blade) and **A.2.2.2** (wood chisel 6 mm blade), attempt to gain entry, as defined in **3.9** for zone 1, and **3.10** for zone 2, by generating an aperture in the infill panel or fabric of the door leaf. Glass shall not be subjected to this test. Only one tool shall be used at any one time. Methods including, but not limited to, cutting and gouging, shall be used. When using a tool to strike the infill panel or fabric of the door leaf, the impact point of the tool shall not travel more than 100 mm, thus controlling the impact force. The test shall be directed at the surface and core of the infill panel or fabric of the door leaf from the exterior face of the doorset for a period of not more than 3 min.

Figure B.2 **Cutting test zones**



Key
1 Zone 1
2 Zone 2
X 400^{0}_{-10} mm
O Rotation point of unlocking hardware

B.4.5 Mechanical loading test

B.4.5.1 Objective

The objective of the mechanical loading test is to assess whether the sample can withstand a specified sequence of loading without creating an entry as defined in **3.9**.

B.4.5.2 Loading procedure

Conduct this test on sample 2 (see Clause **B.2**).

Apply and remove the loads over a period of not more than 5 min at each loading point.

The loading shall consist of an application of a parallel-to-plane load which is applied and maintained until a perpendicular-to-plane load has been applied and removed.

For single leaf doors, load all loading points, as detailed in Table B.1 and Table B.2 (see Figure B.13).

For double leaf doors, load all loading points, as detailed in Table B.3 and Table B.4 (see Figure B.13).

For folding sliding doors, load all loading points, as detailed in Table B.5 (see Figure B.16).

For horizontal sliding doors, load all loading points, as detailed in Table B.6. In the case of horizontal and folding sliding doors, hardware providing a sliding, rolling action or pivot shall be considered as a loading point.

The required loads shall be applied to each designated loading point in turn until all loading points have been subjected to test. If, during the loading, primary component failure (as defined in **3.3.1**) occurs, the effect this failure has on the security of the product shall be assessed by loading all designated points up to but not including the loading point that exhibited this primary component failure. If further primary component failure occurs the process shall be repeated with all designated loading points up to but not including the loading point that exhibited this primary component failure being subjected to test, including those that may have been previously loaded. If secondary component failure occurs (as defined in **3.3.2**) this shall not initiate a further sequence of loading but the present sequence shall be completed. Loading shall be continued until there has been a complete sequence of loading with no further primary component failure.

B.4.5.3 Parallel-to-plane loading

NOTE Details of loading configurations are given in Figure B.3 to Figure B.5.

B.4.5.3.1 General

Apply a parallel-to-plane load of 1.5 kN progressively and without shock over a period of between 10 s and 20 s. Maintain this parallel-to-plane load until either the perpendicular-to-plane loading is completed and removed or a 100 mm perpendicular-to-plane movement is achieved. Remove the load without shock over a period not exceeding 30 s.

Apply the load through a suitable bracket(s) as shown in Figure B.7.

B.4.5.3.2 Parallel-to-plane loading along the edge

Apply the force at the corner of the leaf with a line of action which is parallel to the edge and directed towards the adjacent corner (see Figure B.3).

B.4.5.3.3 Parallel-to-plane loading at right angles to the edge

Apply the force at the leaf frame between the corners with a line of action which is at right angles to the edge and directed towards the opposite edge (see Figure B.4). On a doorset that is supplied with a fanlight or sidelight apply an equal and opposing force to the mullion or transom at the location of the locking point (see Figure B.5 and Table B.3).

In the case of double leaf and folding sliding doorsets, apply an equal and opposite force as detailed in the standard loading cases in Table B.3, Table B.4, Table B.5 and Table B.6.

B.4.5.4 Perpendicular-to-plane loading

For hinged and pivot doorsets, apply the perpendicular-to-plane load to the face of the leaf at the position given in the standard loading cases detailed in Table B.1 to Table B.5 and in the direction of opening.

For sliding doors, apply the perpendicular plane load to the face of the leaf at the position given in the standard loading cases detailed in Table B.6 and in the most onerous direction.

The most onerous direction shall be identified by the review of the force applied when attempting to manually remove the leaves during the manual check test in **B.4.6**.

The direction of loading on a sliding door leaf shall be away from the frame element, towards a stop or in the direction the leaf is fitted into the frame. This might mean that each leaf of a sliding doorset has a different loading direction for the perpendicular load.

During the test, ensure that the load passes through the centre of the contact area of the locking point with a radial tolerance of 50 mm. Apply the load via a loading pad, as shown in Figure B.9. Apply the load within 5° perpendicular to the plane.

Where two adjacent loading points on the same leaf are within 100 mm, a single loading point that is of equal distance between them shall be used.

For double doorsets, each leaf-to-leaf locking point shall be considered as a single loading point. The perpendicular-to-plane load shall be applied to the active leaf and propping applied to the false mullion or inactive leaf in the same horizontal plane ±25 mm as the applied load and adjacent to the visible edge of the active leaf but not directly restricting the movement of the active leaf.

If, during the application of the perpendicular load, a doorset component failure occurs, the remaining load shall be applied in a period of between 10 s and 20 s. This period shall start from the moment doorset component failure occurred. If further doorset component failures occur, the total time to apply the load or reach the stated deflection shall be not greater than 40 s.

When loading a leaf adjacent to a transom or mullion, this member shall be propped on the opposing face to prevent movement adjacent to the point where the perpendicular-to-plane load is applied. The position of the prop shall be ±25 mm from the position of the interlocking point, as measured along the transom or mullion.

When loading an active or inactive leaf, propping shall be applied as detailed in Table B.4, Table B.5 and Table B.6.

Apply a load of 4.5 kN progressively and without shock over a period of between 10 s to 20 s, until either it has been held for between 8 s to 12 s or entry, as defined in **3.9**, has been gained.

B.4.6 Manual check test

B.4.6.1 Objective

The objective of the manual check test is to explore the possibility that there might be weaknesses and vulnerabilities in the product that are not covered in the standard cases. The manual check test is carried out from the exterior face of the sample and conducted with full knowledge of the sample's construction and hardware details.

B.4.6.2 Tools

B.4.6.2.1 *Two flat bladed screwdrivers*, of length of (270 ±20) mm, a shank diameter of (8 ±1.5) mm and a blade width of (8 ±1.5) mm.

B.4.6.2.2 *Two nail bars*, of length (300 ±20) mm.

B.4.6.3 Procedure

Conduct this test on sample 1.

Carry out the test from the exterior face of the doorset and with full knowledge of the sample's construction and hardware details.

NOTE 1 Attack methods and attempts might vary according to the design and construction of the doorset.

Attempt to gain entry by levering at any location and in any direction such that the combined direction and location of the forces exhibited by the standard loading cases used in **B.6** shall not be replicated.

Attempts shall be made to gain entry by defeating any hinge, locking point and fixing point or other potentially vulnerable locations. Attempts shall be made to apply loads to ends of locking devices and attacks made at unsupported corners.

NOTE 2 The operation of lever or knob furniture is permitted without the aid of tools.

Additionally, in the case of double doors, the vulnerability of (where applicable) the fixing of false meeting styles to leaf shall be explored.

The overall attack time for this test shall be one continuous period of 15 min; no single test technique shall be used for more than 3 min and no location shall be attacked for more than 6 min.

The door shall be tested with any one or two of the tools specified in **B.4.6.2** for each technique.

If entry is gained, the method of entry shall be recorded, the direction of applied loads noted, new loading positions and directions defined for parallel-to-plane and perpendicular-to-plane loads, and an additional mechanical loading test shall be performed in accordance with **B.4.7**.

B.4.7 Additional mechanical loading test

An additional mechanical loading test shall be conducted if entry was gained in **B.4.6**. The test shall be carried out in accordance with **B.6**, on sample 2, using the loading configuration as defined in Table B.1 to Table B.6, as applicable. If entry is gained during the additional mechanical loading test, the doorset shall be regarded as having failed.

Where entry is gained in the manual check test and a mechanical loading test cannot be devised to replicate the mode of failure, such doorsets shall be considered to be unclassified and outside the scope of this PAS.

B.4.8 Soft body impact test

B.4.8.1 Objective

The objective of this test is to assess the doorset's resistance to impacts using a soft body striking the leaf between 0.8 m and 1.7 m above floor level.

B.4.8.2 Impact points

Impacts shall be carried out on all doorset types and regardless of the infill medium.

For doorsets other than stable doorsets, apply the soft body impacts to the exterior of the doorset, on the vertical centre line of the door leaf and of any side light, at the following positions, within ±25 mm:

a) where there is a midrail present between 0.8 m and 1.7 m from the floor level:
   - at the centre of the lower infill or 0.8 m from floor level, whichever is higher;
   - at the centre of the midrail;
   - at the centre of the upper infill or 1.7 m from floor level, whichever is lower;

b) where a midrail is not present between 0.8 m and 1.7 m, at distances of 0.8 m, 1.25 m and 1.7 m from floor level.

In addition, for double leaf doorsets, sliding doorsets and folding sliding doorsets, apply a soft body impact on the junction between the meeting edges of the door leaves, at distances of 0.8 m, 1.25 m and 1.7 m from floor level.

For stable doorsets, apply the soft body impacts to the exterior surface of the test sample on the vertical centre line of the door leaf and vertical centre line of any side light. The impacts shall be at the horizontal centre of the lower half leaf, meeting edge between leaves and the horizontal centre of the upper half leaf within ±25 mm.

NOTE The impact points for a typical doorset are shown in Figure B.14.

B.4.8.3 Procedure

Conduct this test on sample 3.

At rest, the impact surface of the impactor shall be within 10 mm of the surface of the doorset and within 25 mm in any direction of the designated impact point. Raise the centre of gravity of the impactor through a vertical height of (800 ±10) mm. Allow the impactor to fall freely and strike the doorset once only.

Repeat so that each point is impacted three times.

If glass breakage occurs, the glass shall be replaced. If the glass breaks three times, this test shall be terminated and the product range declared as unclassified. The test report shall contain details of the replacement of any infill medium.

The cause of breakage of the toughened glass shall be identified and rectified before submitting samples for further testing.

B.4.9 Hard body impact test

B.4.9.1 Objective

The objective of this test is to assess the hardware, infill medium and its retention system to hard body impact.

B.4.9.2 Impact points

B.4.9.2.1 General

The hard body impacts shall be applied to the exterior face of the doorset so that the centre of the nose of the impactor strikes the defined impact point within ±25 mm in any direction. Locations shall be determined using measurements (see **B.4.9.2.2**) taken when the door is closed. All impact points shall be impacted in the order detailed in Figure B.15.

B.4.9.2.2 Door leaf impact points (using sample 3)

Impact points on single leaf doorsets and the active leaf on double leaf, sliding and folding sliding doorsets shall be:

a) on the lock cylinder when fitted;

b) at each corner of the leaf at points (60 × 60) mm from the visible edges;

c) on the door leaf at each locking point;

d) on the door leaf at each hinge point;

e) on a midrail (if present) at points 60 mm from the joint with the stiles (if a vee joint is present, impact 60 mm from the point of the vee).

If two impact points from the list [b) to e)] are within 100 mm of each other they shall be replaced by a single impact point that is of equal distance between them. Impact points on the inactive leaves of double doorsets, sliding doorsets and folding sliding doorsets shall be:

1) on the inactive leaf at each leaf-to-frame locking point;

2) at each location, as detailed in a) to e), if any constructional detail or component affecting the performance of the loading point is different on

the inactive leaf from that tested on the active leaf. When two impact points detailed in 1) and 2) are within 100 mm of each other, they shall be replaced by a single impact point that is of equal distance between them.

The following locations shall not be considered as impact points:

i) a keep located on the inactive leaf and engaging with hardware located on the active leaf;

ii) a false mullion to leaf fixing points.

B.4.9.2.3 Infill medium impact points (using sample 4)

Infill medium impact points shall be:

a) at the centre of non-glass infill mediums; and

b) at each corner of the infill medium at points (60 × 60) mm from the visible edges of the following non-glass infill mediums:

1) if the non-glass infill mediums are nominally the same size, only one panel shall be tested;

2) if a number of different size panels are used, then the following two panels shall be tested:

i) the panel that has the largest minor dimension; and

ii) the panel that has the smallest major dimension through which the 50 mm diameter bar could pass if the panels were removed.

NOTE The impact points for a typical doorset are shown in Figure B.14.

B.4.9.3 Procedure

For impact points detailed in **B.4.9.2.2**, conduct this test on sample 3. Impact the door leaf points, as shown in Figure B.15, and assess the doorsets' ability to resist these impacts using the appropriate entry definition.

For impact points detailed in **B.4.9.2.3**, conduct this test on sample 4. Impact the infill medium points, as shown in Figure B.15, and assess the performance of the infill medium and retention systems' ability to resist these impacts using the appropriate entry definition.

At rest, the impact surface of the impactor shall be within 10 mm of the surface of the doorset and within 25 mm in any direction of the designated impact point. Raise the centre of gravity of the impactor through a vertical height of (165 ±5) mm. Allow the impact to fall freely and strike the doorset once only.

Repeat so that each point is impacted three times.

If glass breakage occurs more than twice during the impact test, the glass shall be replaced with plywood of the same nominal thickness and overall dimensions so that the impact test can be completed. The test report shall contain details of any infill medium replacement.

B.5 Test report

The test report shall include the following information:

a) a concise description of the doorset including at least the following information, checked before test:

- manufacturer's name and specific product identification;
- types of doorset;
- 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; and
- detailed drawing(s) of the doorset elevation viewed from the outside, including the position of the hardware;

b) the definition of the doorset range applicable to the report, including any size limitation and doorset configuration;

c) the results obtained during each test;

d) a diagram of the test apparatus or its reference;

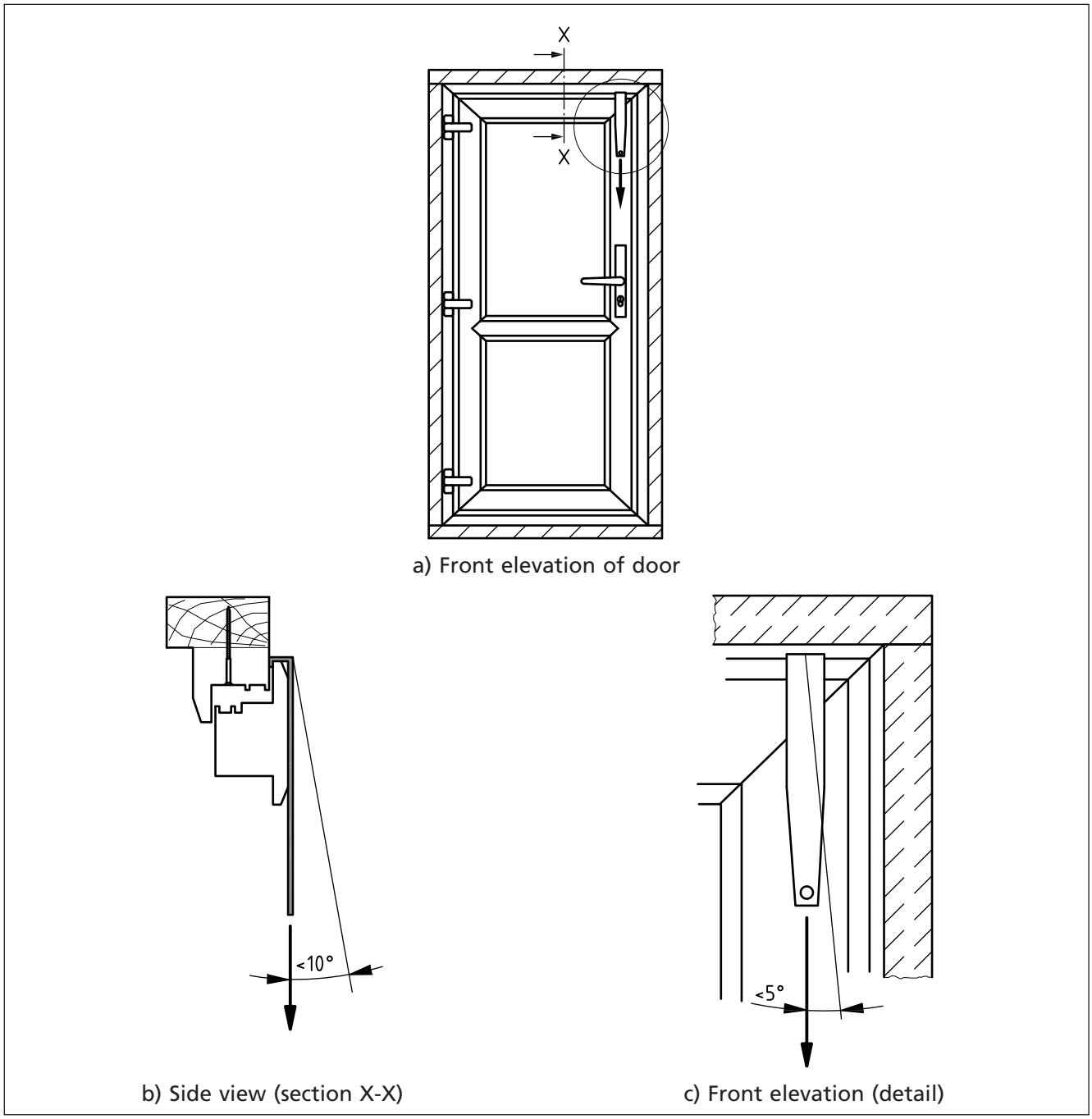
e) the laboratory ambient temperature at the time of test;

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 doorsets; and

h) a summary of the results and assessment of the range.

Figure B.3 **Parallel-to-plane loading along the edge**

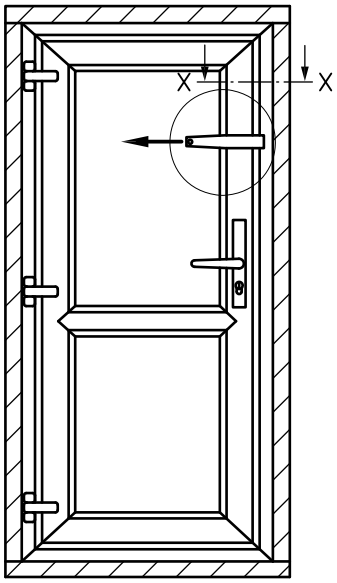


a) Front elevation of door

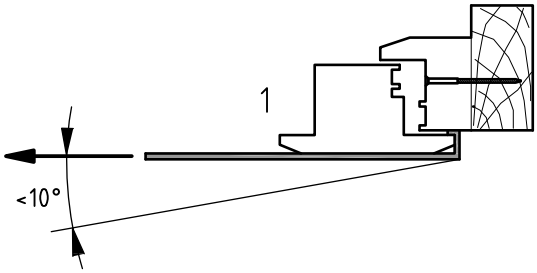
b) Side view (section X-X)

c) Front elevation (detail)

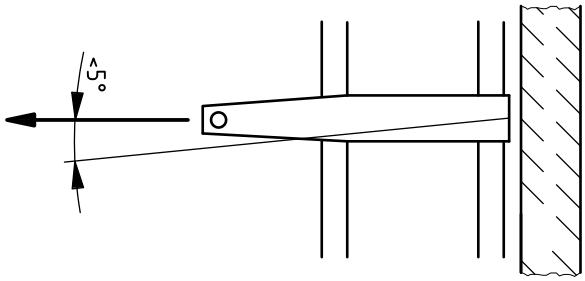
Figure B.4 **Parallel-to-plane loading at right angles to the edge**



a) Front elevation of door



b) Side view (section X-X)

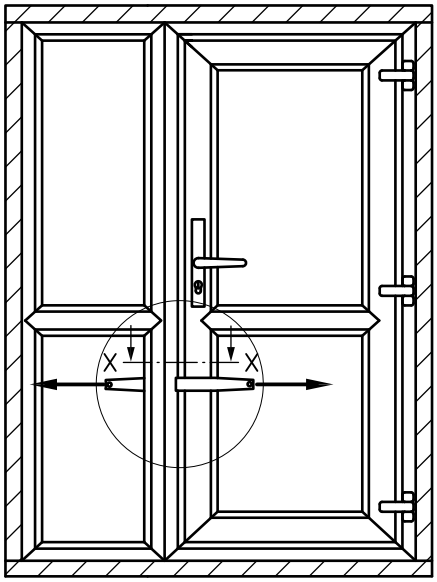


c) Front elevation (detail)

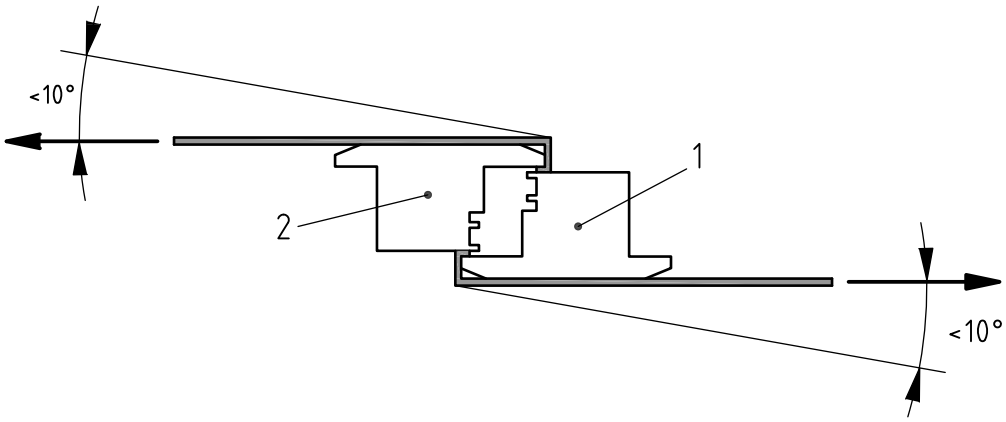
Key

1 Opening vent

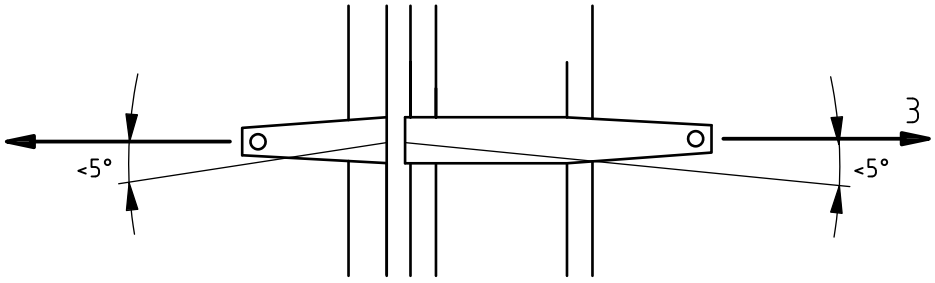
Figure B.5 **Parallel-to-plane loading at a mullion or transom**



a) Front elevation of door



b) Plan view (section X-X)

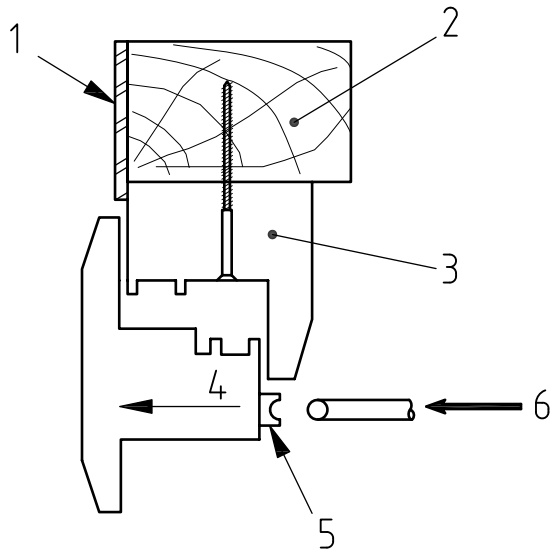


c) Front elevation (detail)

Key

1 Opening vent
2 Transom or mullion
3 Opposing force on transom and mullions only

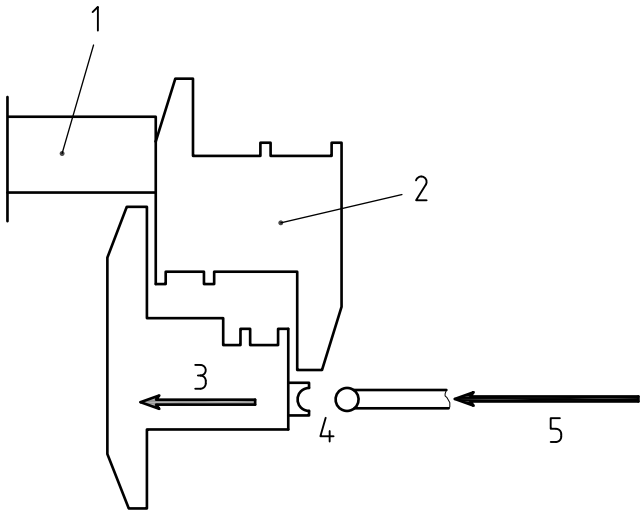
Figure B.6 **Perpendicular-to-plane loading**



a) Frame-supported condition

Key

1 Frame support
2 Timber sub-frame
3 Outer frame
4 Direction of door opening/movement
5 Loading pad
6 Perpendicular to plane force



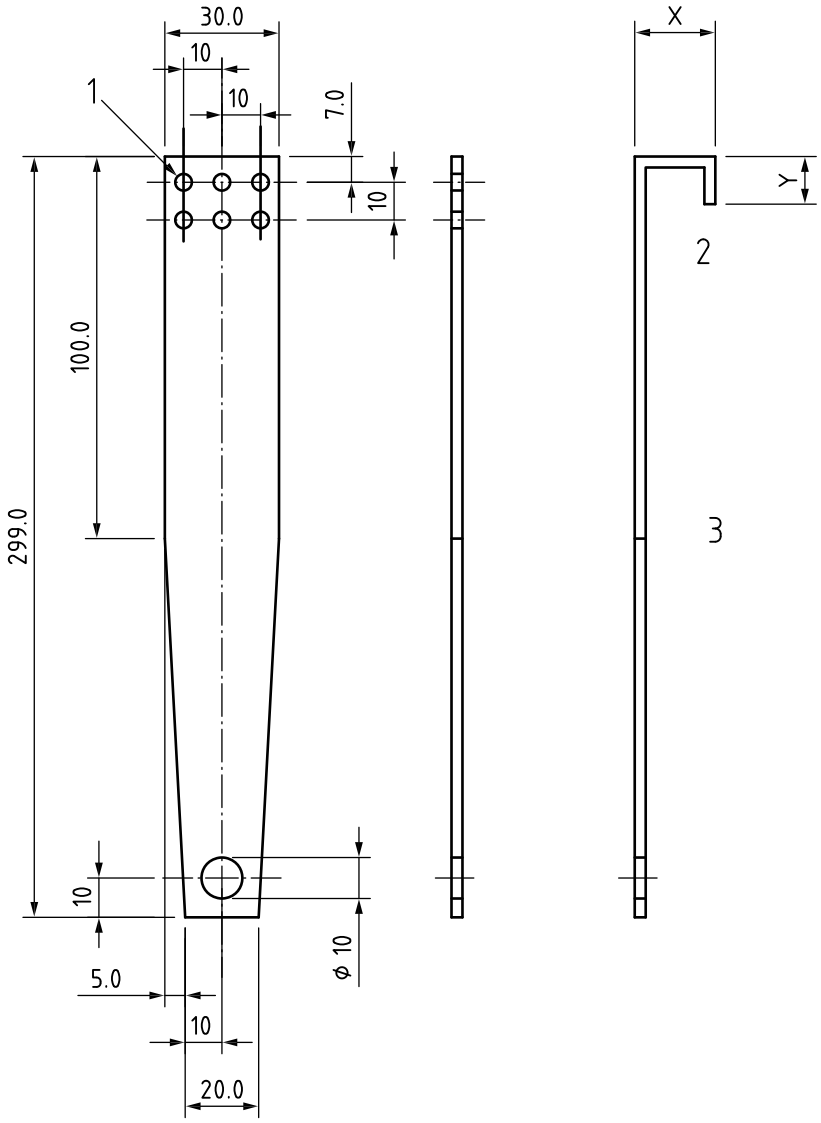
b) Propped condition

Key

1 Prop
2 Transom or mullion
3 Direction of door opening/movement
4 Loading pad
5 Perpendicular to plane force

Figure B.7 **Example of a suitable test bracket**

Dimensions in millimetres



Key

1 6 off holes ø 4.5

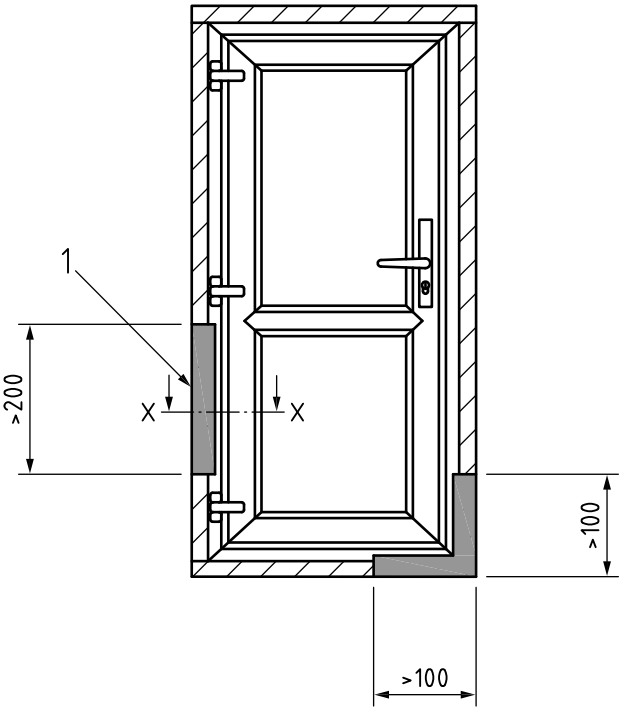
2 Alternate end configuration

3 Dimensions X and Y to suit the profile being tested

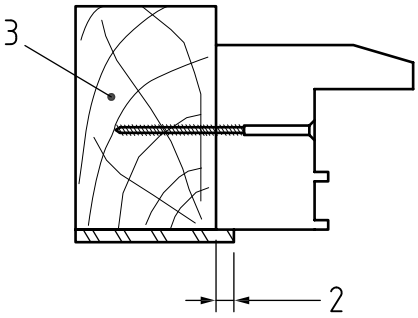
NOTE In this example, the test bracket is 3 mm thick stainless steel. This has been successfully used in tests.

Figure B.8 **Frame support**

Dimensions in millimetres



a) Front elevation



b) Plain view (section X-X)

Key

1 Moveable frame support equally spaced about point of applied load
2 Support area (7.5 ±2.5) mm, min. 200 mm length
3 Timber sub-frame

Figure B.9 **Loading pad for mechanical loading**

Dimensions in millimetres

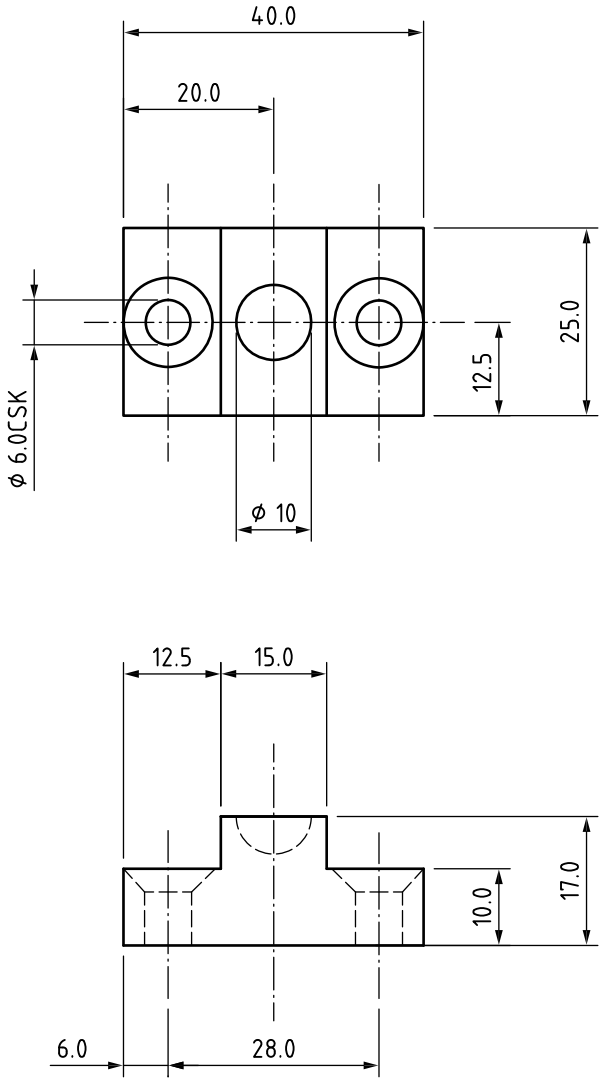
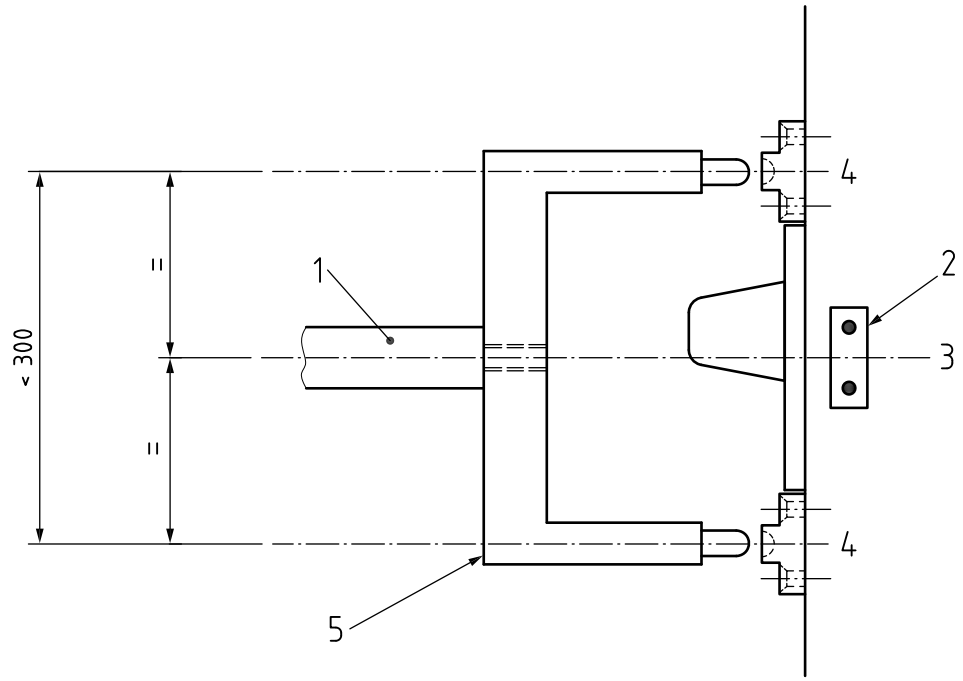


Figure B.10 **Example of loading bridge**

Dimensions in millimetres

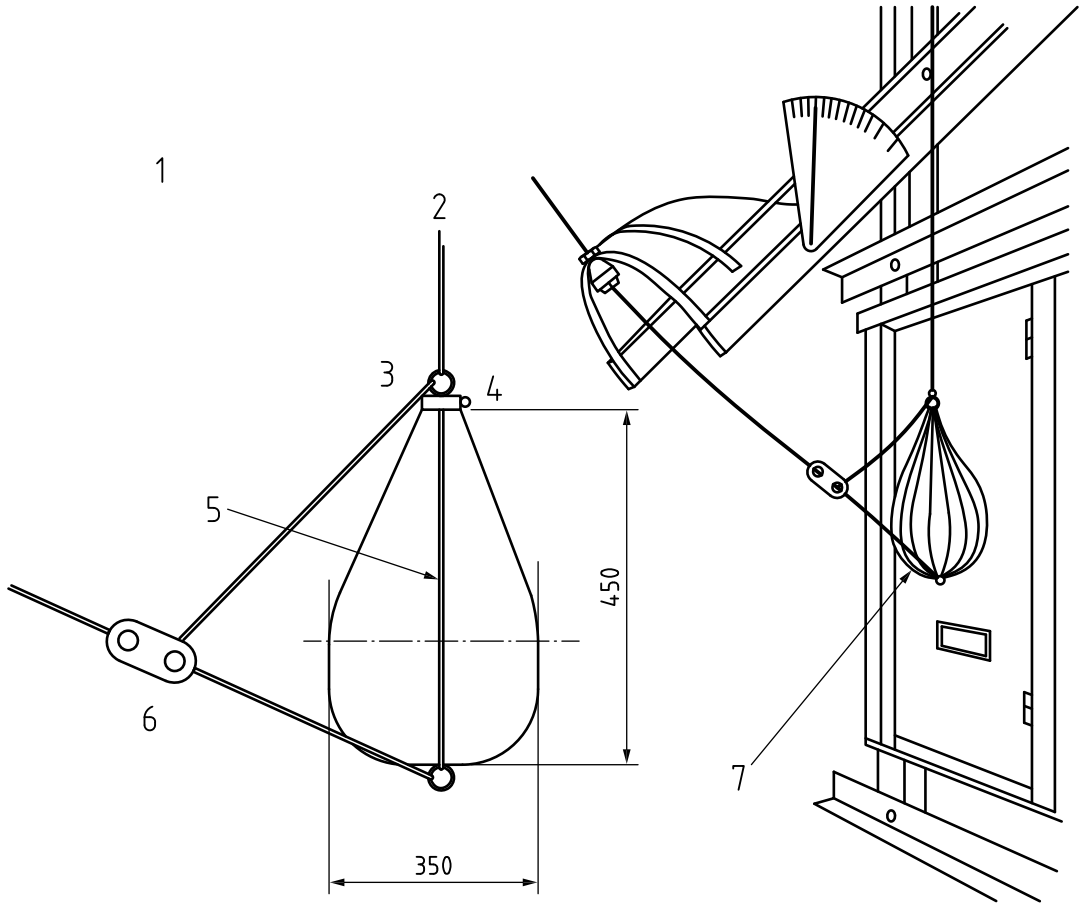


Key

1 Piston ram
2 Locking point
3 Line of force
4 Combined loading area of both loading pads nominally 1 000 mm²
5 Bridge

Figure B.11 **Soft body impact test apparatus**

Dimensions in millimetres

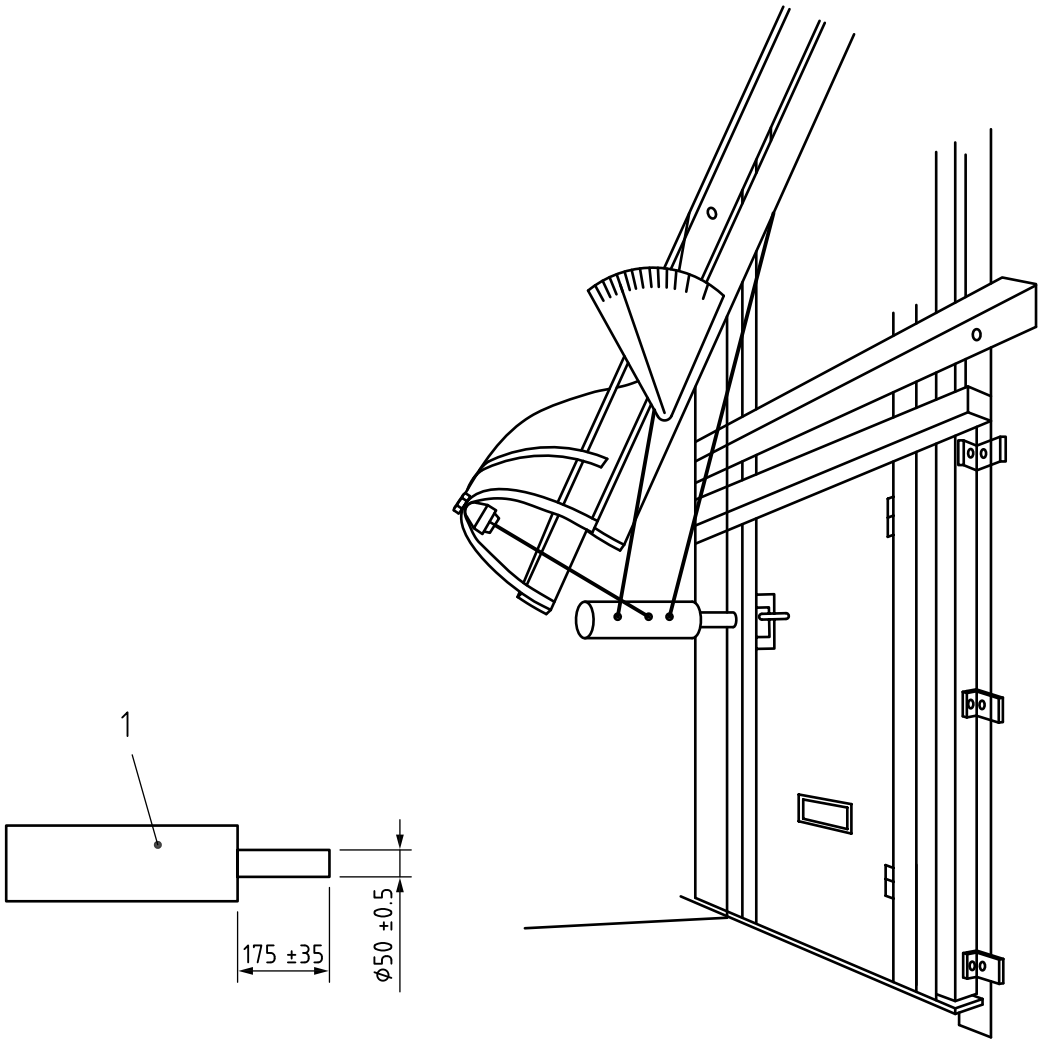


Key

1 Total mass of impactor (30 ±0.05) kg (without wire cable and support hook)
2 Wire cable ø 3 mm
3 Aluminium flange ø (50 × 20) mm
4 Band clamp fitting
5 Steel rod ø 10 mm
6 Release hook
7 Sphero-conical leather bag containing dry sand of approximate density 1 500 kg/m that passes through a sieve of 2 mm mesh

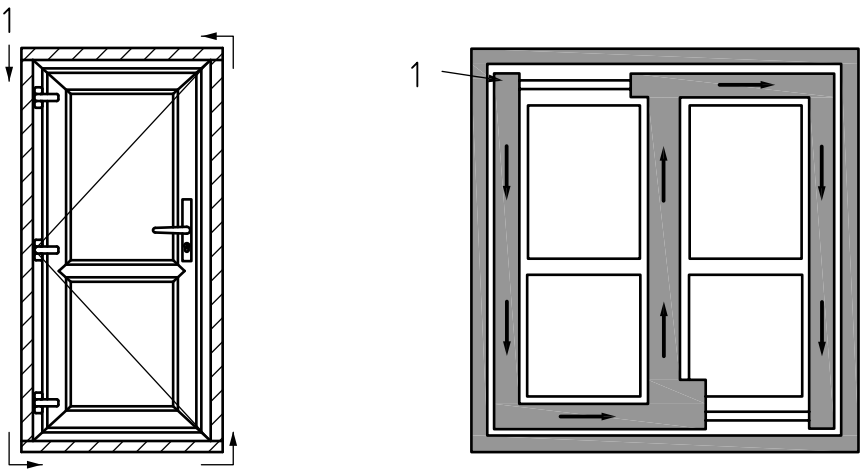
Figure B.12 **Hard body impact test apparatus**

Dimensions in millimetres



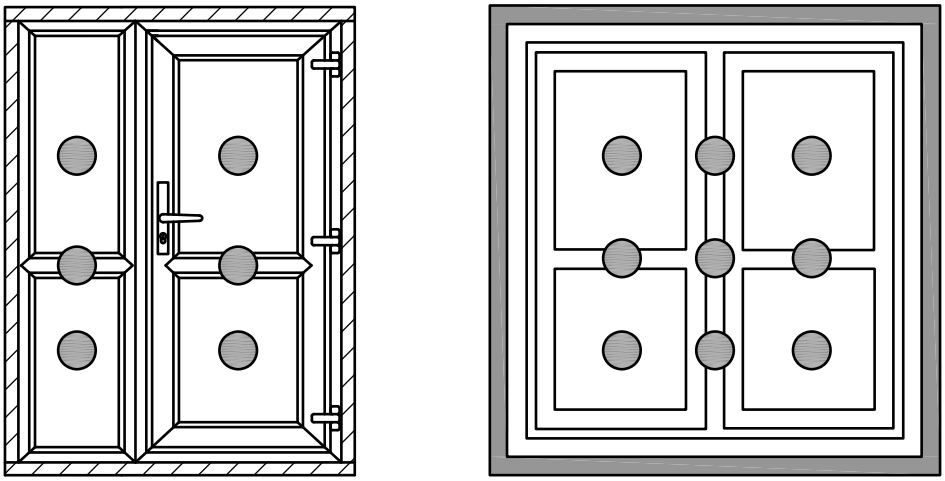
Key
1 Hard-body impactor

Figure B.13 **Mechanical loading sequence: single and multiple leaf**



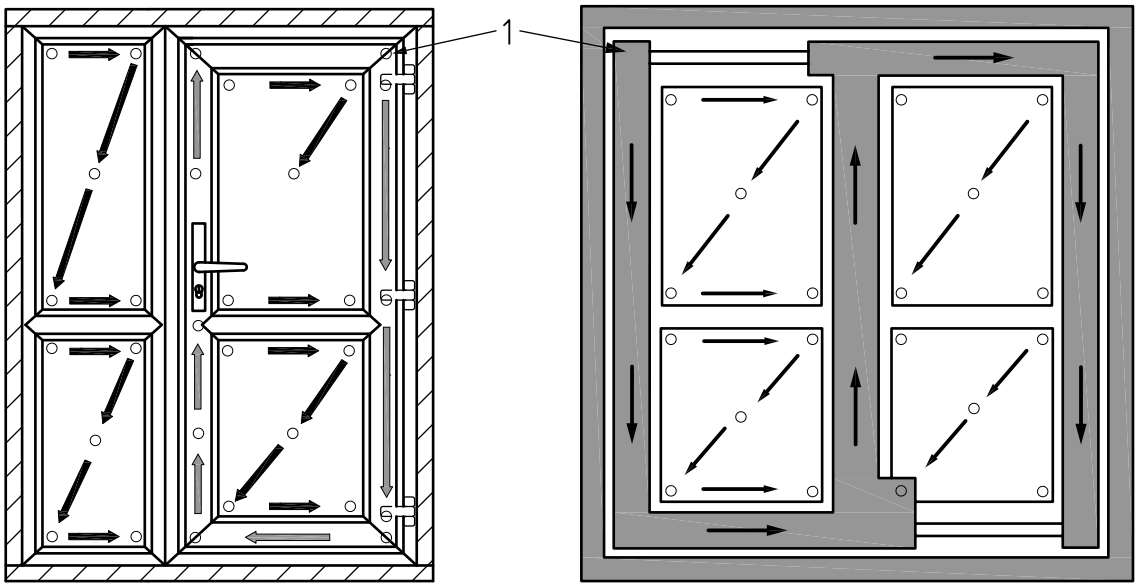
Key
1 Start

Figure B.14 **Soft and heavy body impact points: single and multiple leaf**



NOTE The impact points apply to each leaf in multiple leaf doorsets.

Figure B.15 **Hard body impact points and sequence: single and multiple leaf**



Key
1 Start

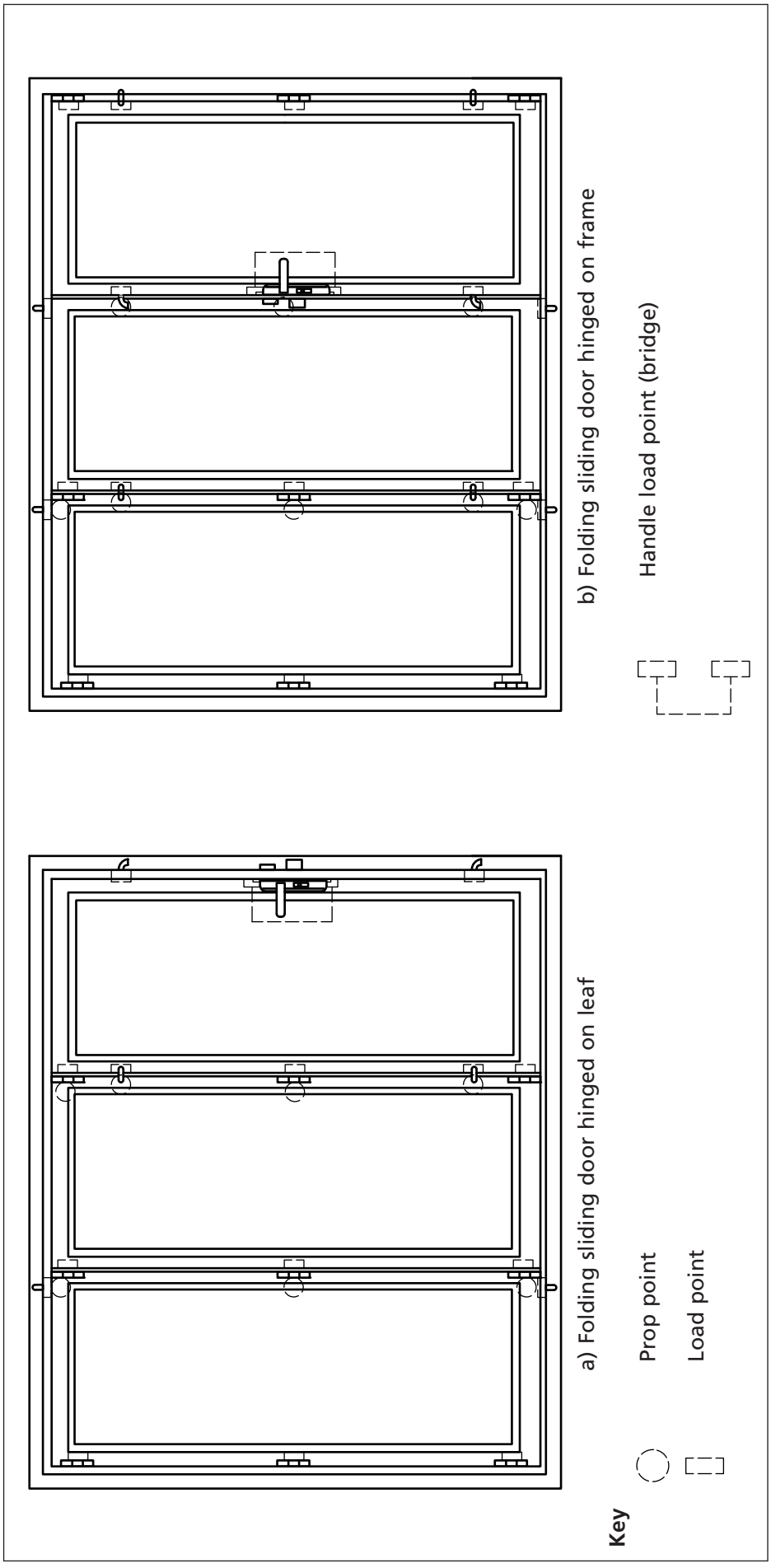


Figure B.16 **Example of propping case for folding sliding doors**

B.6 Standard loading cases

The parallel-to-plane, equal and opposite parallel-to-plane, perpendicular-to-plane, propping conditions, loading positions and direction described in Table B.1 to Table B.6 shall be applied whenever the construction features listed are present. Not all cases are applicable to any particular doorset, but those that are present shall be used.

NOTE 1 The standard loading case tables (Table B.1 to Table B.6) are based upon the principle of a replication of single or multiple levers acting on the product in the form of a major load applied in the direction of opening or removal of the opening/removable element, with a minor load applied perpendicular to the major load in a direction to disengage local hardware or fixings.

Where the surround of the opening/removable element is not restrained by the test rig, equal loads in the opposite direction or propping shall be provided to resist movement of the surround during test.

NOTE 2 This can lead to multiple loads at a location subject to the detail of the product.

Table B.1 **Standard loading cases for single-leaf doorsets without integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
1) Hinges and pivots	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
2) Rising butt hinges and all types of lift off hinges	**First test:** Along the hinged edge in an upwards direction	**First test:** None	**First test:** Centred over hinge	**First test:** None
	Second test: At right angles to the hinged edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hinge	**Second test:** None
3) Shoot and mortice bolts	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None
4) Cams and roller cams with or without mushroom restraint sliding parallel to the edge of the frame into keeps including hook bolts	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** None
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hook bolt, cam or roller cam	**Second test:** None
5) Dog bolts or other hardware specifically to provide security where there is not normally contact until the door is forced and with contact length not greater than 150 mm and/or contact areas not greater than 500 mm^2	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None
6) Top of continuous hinge	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
7) Centre of continuous hinge	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
8) Bottom of continuous hinge	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
9) Electromagnetic lock	At right angles to the edge and towards the opposite edge	None	Centred over electromagnetic lock	None

All tests at any loading point shall be carried out before moving on to the next point.

Table B.2 **Standard loading cases for single-leaf doorsets with integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
1) Hinges and pivots fixed to outer frame	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
2) Hinges fixed to mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hinge	Propped on transom or mullion
3) Rising butt hinges and all types of lift off hinges fixed to outer frame	**First test:** Along the hinged edge in an upwards direction	**First test:** None	**First test:** Centred over hinge	**First test:** None
	Second test: At right angles to the hinged edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hinge	**Second test:** None
4) Rising butt hinges and all types of lift off hinges fixed to mullion	**First test:** Along the hinged edge in an upwards direction	**First test:** None	**First test:** Centred over hinge	**First test:** Propped on transom or mullion
	Second test: At right angles to the hinged edge and towards the opposite edge	**Second test:** At right angles to the edge and away from the opposite edge	**Second test:** Centred over hinge	**Second test:** Propped on transom or mullion
5) Shoot and mortice bolts into outer frame	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None
6) Shoot and mortice bolts into mullion or transom	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over bolt	Propped on transom or mullion
7) Cams and roller cams with or without mushroom restraint sliding parallel to the edge of the frame, including hook bolts, where the keeps are located on the outer frame	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** None
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hook bolt, cam or roller cam	**Second test:** None
8) Cams and roller cams with or without mushroom restraint sliding parallel to the edge of the frame, including hook bolts, where the keeps are located on a transom or mullion	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** Propped on transom or mullion
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** At right angles to the edge and away from the opposite edge	**Second test:** Centred over hook bolt, cam or roller cam	**Second test:** Propped on transom or mullion

Table B.2 **Standard loading cases for single-leaf doorsets with integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
9) Dog bolts or other hardware specifically to provide security where there is not normally contact until the door is forced and with contact length not greater than 150 mm and/or contact areas not greater than 500 mm^2 and where the hardware is adjacent to the outer frame	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None
10) Dog bolts or other hardware specifically to provide security where there is not normally contact until the door is forced and with contact length not greater than 150 mm and/or contact areas not greater than 500 mm^2 and where the hardware is adjacent to a transom or mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over bolt	Propped on transom or mullion
11) Top of continuous hinge	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
12) Top of continuous hinge, leaf to mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hinge	–
13) Centre of continuous hinge, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
14) Centre of continuous hinge, leaf to mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hinge	–
15) Bottom of continuous hinge, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None

Table B.2 **Standard loading cases for single-leaf doorsets with integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
16) Bottom of continuous hinge, leaf to mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hinge	–
17) Electromagnetic lock, leaf to outer frame	At right angles to the edge and towards the opposite edge	None	Centred over electromagnetic lock	None
18) Electromagnetic lock, leaf to leaf	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over electromagnetic lock	With prop applied to member supporting the armature plate
All tests at any loading point shall be carried out before moving on to the next point.				

Table B.3 **Standard loading cases for all double doors, active and inactive leaf without integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
1) Hinges and pivots	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
2) Rising butt hinges and all types of lift off hinges	**First test:** Along the hinged edge in an upwards direction	**First test:** None	**First test:** Centred over hinge	**First test:** None
	Second test: At right angles to the hinged edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hinge	**Second test:** None
3) Shoot and mortice bolts, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None
4) Shoot and mortice bolts, leaf to leaf	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over bolt	With prop applied to member supporting the lock keeps
5) Cams and roller cams with or without mushroom restraint sliding parallel to the edge of the leaf into keeps and hook bolts, leaf to frame	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** None
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hook bolt, cam or roller cam	**Second test:** None

Table B.3 **Standard loading cases for all double doors, active and inactive leaf without integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
6) Cams and roller cams with or without mushroom restraint sliding parallel to the edge of the leaf into keeps and hook bolts, leaf to leaf	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** With prop applied to member supporting the lock keeps
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** At right angles to the edge and towards the opposite edge	**Second test:** Centred over hook bolt, cam or roller cam	**Second test:** With prop applied to member supporting the lock keeps
7) Dog bolts or other hardware specifically to provide security where there is not normally contact until the door is forced and with contact length not greater than 150 mm and/or contact areas not greater than 500 mm^2	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None
8) Top of continuous hinge	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
9) Centre of continuous hinge	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
10) Bottom of continuous hinge	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
11) Electromagnetic lock, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over electromagnetic lock	None
12) Electromagnetic lock, leaf to leaf	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over electromagnetic lock	With prop applied to member supporting the armature plate

All tests at any loading point shall be carried out before moving on to the next point.

Table B.4 **Standard loading cases for all double doors, active and inactive leaf with integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
1) Hinges and pivots fixed to outer frame	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
2) Hinges fixed to mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hinge	Propped on transom or mullion
3) Rising butt hinges and all types of lift off hinges fixed to outer frame	**First test:** Along the hinged edge in an upwards direction	**First test:** None	**First test:** Centred over hinge	**First test:** None
	Second test: At right angles to the hinged edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hinge	**Second test:** None
4) Rising butt hinges and all types of lift off hinges fixed to mullion	**First test:** Along the hinged edge in an upwards direction	**First test:** None	**First test:** Centred over hinge	**First test:** Propped on transom or mullion
	Second test: At right angles to the hinged edge and towards the opposite edge	**Second test:** At right angles to the edge and away from the opposite edge	**Second test:** Centred over hinge	**Second test:** Propped on transom or mullion
5) Shoot and mortice bolts, leaf to outer frame	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None
6) Shoot and mortice bolts, leaf to transom or mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over bolt	Propped on transom or mullion
7) Shoot and mortice bolts, leaf to leaf	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over bolt	With prop applied to member supporting the locking keeps
8) Cams and roller cams with or without mushroom restraint sliding parallel to the edge of the leaf into keeps and hook bolts, leaf to outer frame	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** None
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hook bolt, cam or roller cam	**Second test:** None

Table B.4 **Standard loading cases for all double doors, active and inactive leaf with integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
9) Cams and roller cams with or without mushroom restraint sliding parallel to the edge of the leaf into keeps and hook bolts, leaf to transom or mullion	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** Propped on transom or mullion
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** At right angles to the edge and away from the opposite edge	**Second test:** Centred over hook bolt, cam or roller cam	**Second test:** Propped on transom or mullion
10) Cams and roller cams with or without mushroom restraint sliding parallel to the edge of the leaf into keeps and hook bolts, leaf to leaf	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** With prop applied to member supporting the locking keeps
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** At right angles to the edge and away from the opposite edge	**Second test:** Centred over hook bolt, cam or roller cam	**Second test:** With prop applied to member supporting the locking keeps
11) Dog bolts or other hardware specifically to provide security where there is not normally contact until the door is forced and with contact length not greater than 150 mm and/or contact areas not greater than 500 mm^2 and where the hardware is located adjacent to the outer frame	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None

Table B.4 **Standard loading cases for all double doors, active and inactive leaf with integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
12) Dog bolts or other hardware specifically to provide security where there is not normally contact until the door is forced and with contact length not greater than 150 mm and/or contact areas not greater than 500 mm^2 and where the hardware is located adjacent to a transom or mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hardware	Propped on transom or mullion
13) Top of continuous hinge, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
14) Top of continuous hinge, leaf to mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hinge	–
15) Centre of continuous hinge, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
16) Centre of continuous hinge, leaf to mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hinge	–
17) Bottom of continuous hinge, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
18) Bottom of continuous hinge, leaf to mullion	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hinge	–
19) Electromagnetic lock, leaf to outer frame	At right angles to the edge and towards the opposite edge	None	Centred over electromagnetic lock	None
20) Electromagnetic lock, leaf to leaf	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over electromagnetic lock	With prop applied to member supporting the armature plate
All tests at any loading point shall be carried out before moving on to the next point.				

Table B.5 **Standard loading cases for folding sliding doors, active and inactive leaf without integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
1) Hinges and pivots, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over hinge	None
2) Hinges, leaf to leaf Both sides of the folding leaf shall be considered where the hinge is not symmetrical	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over hinge	With prop applied to the edge of a leaf (see Figure B.15)
3) Rising butt hinges and all types of lift off hinges, leaf to frame	**First test:** Along the hinged edge in an upwards direction	**First test:** None	**First test:** Centred over hinge	**First test:** None
	Second test: At right angles to the hinged edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hinge	**Second test:** None
4) Rising butt hinges and all types of lift off hinges, leaf to leaf	**First test:** Along the hinged edge in an upwards direction	**First test:** None	**First test:** Centred over hinge	**First test:** With prop applied to the edge of a leaf (see Figure B.15)
	Second test: At right angles to the hinged edge and towards the opposite edge	**Second test:** At right angles to the hinged edge and away from the opposite edge	**Second test:** Centred over hinge	**Second test:** With prop applied to the edge of a leaf (see Figure B.15)
5) Shoot and mortice bolts, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None
6) Shoot and mortice bolts, leaf to leaf	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over bolt	With prop applied to member supporting the locking keeps
7) Cams and roller cams with and without mushroom restraint sliding parallel to the edge of the leaf into keeps and hook bolts, leaf to frame	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** None
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** None	**Second test:** Centred over hinge	**Second test:** None

Table B.5 **Standard loading cases for folding sliding doors, active and inactive leaf without integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
8) Cams and roller cams with or without mushroom restraint sliding parallel to the edge of the leaf into keeps and hook bolts, leaf to leaf	**First test:** Along the edge in a direction to disengage the bolt	**First test:** None	**First test:** Centred over hook bolt, cam or roller cam	**First test:** With prop applied to member supporting the locking keeps
	Second test: At right angles to the edge and towards the opposite edge	**Second test:** At right angles to the edge and away from the opposite edge	**Second test:** Centred over hook bolt, cam or roller cam	**Second test:** With prop applied to member supporting the locking keeps
9) Dog bolts or other hardware specifically to provide security where there is not normally contact until the door is forced and with contact length not greater than 150 mm and/or contact areas not greater than 500 mm^2, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over bolt	None
10) Dog bolts or other hardware specifically to provide security where there is not normally contact until the door is forced and with contact length not greater than 150 mm and/or contact areas not greater than 500 mm^2, leaf to leaf	At right angles to the edge and towards the opposite edge	At right angles to the edge and away from the opposite edge	Centred over bolt	With prop applied to member supporting the locking keeps
11) Rollers used to allow doorsets to slide in a track to allow folding, leaf to frame	At right angles to the edge and towards the opposite edge	None	Centred over sliding roller	None
All tests at any loading point shall be carried out before moving on to the next point.				

Table B.6 **Standard loading cases for horizontal sliding doors, active and inactive leafs without integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
1) At the non-meeting corners of master and slave sliding leaves	A: 4.5 kN in the direction of opening B: 1.5 kN vertical away from frame edge (up or down as appropriate)	None	At corners A: 1.5 kN B: 4.5 kN	None
1a) At leaf-to-leaf locking corners of bi-parting doorsets	A: 4.5 kN in the direction of opening on active B: 1.5 kN vertical away from frame	A: 4.5 kN in the direction of opening on inactive B: None	A: 1.5 kN B: 4.5 kN	None
2) At meeting edge corners of door leaves	A: None B: 1.5 kN vertical away from frame edge (up or down as appropriate)	None	A: 4.5 kN at the corner B: 1.5 kN at the corner	A: 4.5 kN opposing load at corner B: None
3) Interlock devices	None	None	4.5 kN centred over the device	4.5 kN opposing load centred over device
4) Continuous leaf interlock devices	None	None	4.5 kN at 500 mm centres from corners of leaf	4.5 kN opposing load
5) Shoot bolts (vertical acting)	1.5 kN centred over bolt and towards opposite edge	None	4.5 kN centred over bolt	None
6) Cam or hook bolts, leaf to frame	A: 1.5 kN in the direction to disengage the bolt B: 1.5 kN centred over bolt and towards opposite edge C: 4.5 kN perpendicular to door edge	None	A: 4.5 kN centred over bolt B: 4.5 kN centred over bolt C: None	None
6a) Cam or hook bolts, leaf to leaf	A: 1.5 kN in the direction to disengage the bolt B: 1.5 kN centred over bolt and towards opposite edge C: 4.5 kN on active leaf	A: None B: 1.5 kN parallel C: 4.5 kN on inactive leaf	A: 4.5 kN centred over bolt B: 4.5 kN centred over bolt C: None	A: On inactive leaf B: On inactive leaf C: None

Table B.6 **Standard loading cases for horizontal sliding doors, active and inactive leafs without integral side panels or fanlights**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
7) Dead bolts	A: 1.5 kN centred over bolt and towards opposite edge B: 4.5 kN perpendicular to door edge	None	A: 4.5 kN centred over bolt B: None	None
8) Rollers used to allow doorsets to slide in a track, leaf to frame	4.5 kN at right angles to the edge and towards the opposite edge	None	1.5 kN centred over sliding roller	None
9) At centre of edges of fixed and inactive leaf	1.5 kN centred over loading point and towards opposite edge	None	4.5 kN at centre of each edge	None
10) At corners of fixed and inactive leaf	A: 1.5 kN centred over loading point and towards opposite horizontal edge B: 1.5 kN centred over loading point and towards opposite vertical edge	None	A: 4.5 kN at each corner of fixed and inactive leaf B: 4.5 kN at each corner of fixed and inactive leaf	None
All tests at any loading point shall be carried out before moving on to the next point.				

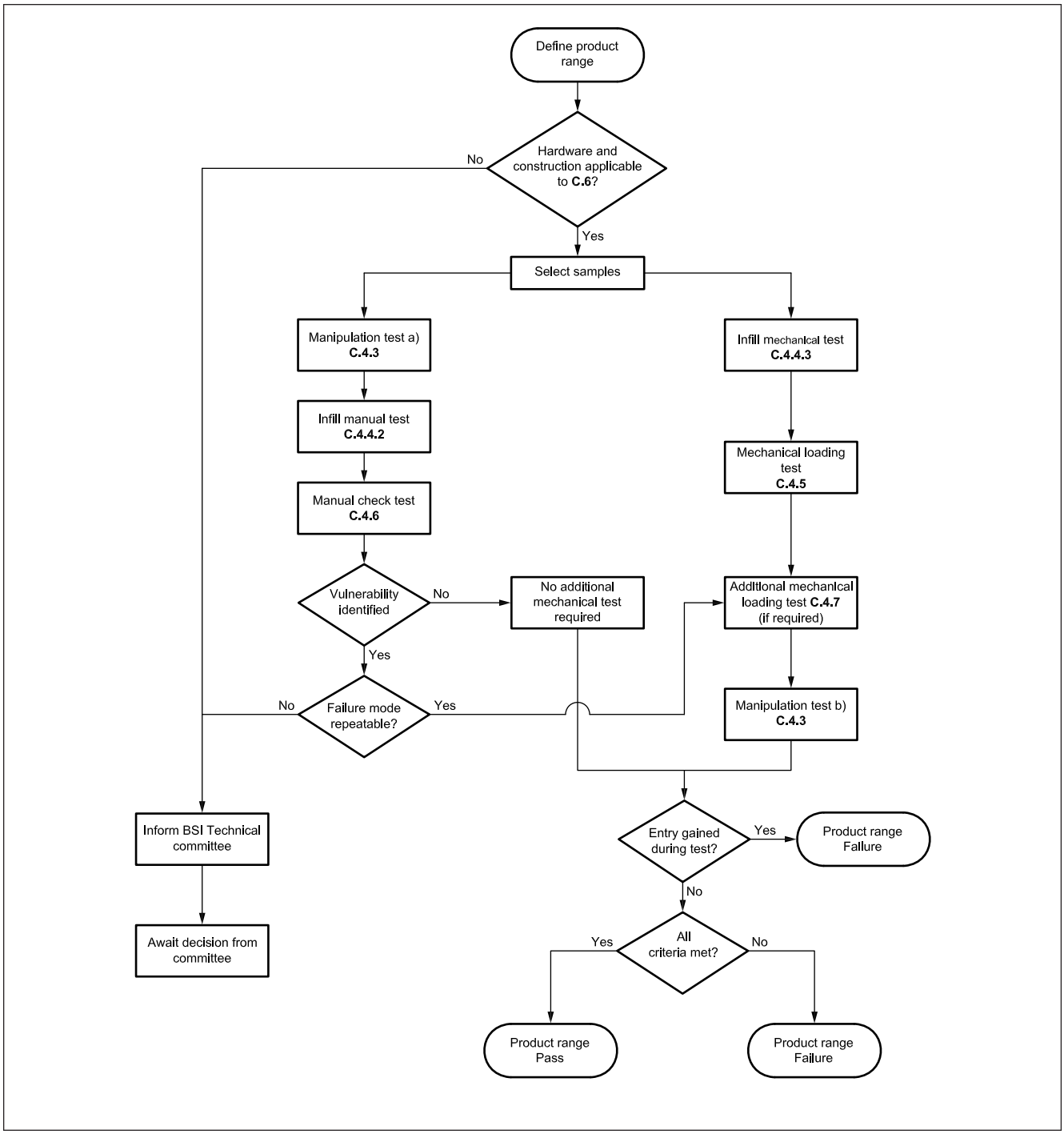
Annex C (normative) Specification for enhanced security performance of windows

C.1 General

The objective of this annex is to assess the ability of a window to resist mechanical loading. A window is deemed to have failed, if during the test, entry is gained, as defined in **3.9**.

NOTE An example of the steps which may be undertaken in an assessment have been summarized as a flow chart in Figure C.1.

Figure C.1 **Flow chart of test procedures**



C.2 Sample selection

Two identical windows shall be selected, one for manual and one for mechanical testing. Sample pairs shall be selected by the test organization and agreed with the supplier/manufacturer. Where a range of windows is to be considered, the number and type of samples chosen shall be representative of the product range which the manufacturer/supplier wishes to have assessed. The samples selected shall include the most adverse and vulnerable aspects of the design, size and configuration.

For the purpose of these tests, all glass supplied in the test samples shall be toughened to conform to class 1 (C) φ of BS EN 12600:2002, where φ may be 1, 2 or 3.

*COMMENTARY ON **C.2***

The following list, which is not exhaustive, identifies some of the features that might influence the security of the window:

a) maximum distance between points that secure the vent to the outer frame (including dummy vents);

b) glazing methods to cover internal, external and channel glazing systems, types of glazing beads, gaskets, security clips, tapes and glazing blocks;

c) single and/or double glazing, including thickness;

d) reinforcements used in any system; and

e) hardware: locking and hinge options, fixings and changes with respect to vent size.

C.3 Apparatus

The test apparatus shall support the sample rigidly. The test frame or additional support shall not overlap the sample frame by more than 10 mm. For both mechanical and manual tests the sample shall be installed vertically in the test apparatus and secured to prevent movement. A suitable test arrangement is shown in Figure C.2.

When conducting the manual test, the apparatus shall allow for free unrestricted access to the exterior face of the window with the sample mounted at a height of (800 ±100) mm from the working floor level to the underside of the sill or sub-sill. The outer frame of the window shall be fitted flush with the outer frame of the test apparatus such that the test apparatus does not impede the manual test (see Figure C.3).

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

In the case of vertical sliding windows, parallel-to-plane loads applied vertically, in the direction of normal opening, shall also be controlled to an accuracy of ±5%. Other parallel-to-plane loads shall be controlled to an accuracy of +2% to –10%. Typical loading configurations are shown in Figure C.4, Figure C.5, Figure C.6 and Figure C.7. A suitable bracket as shown in Figure C.8 shall be used to apply the loads.

The apparatus shall provide frame support to prevent perpendicular-to-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 ±2.5) mm wide, as measured from the outer edge of the profile as shown in Figure C.9. In addition, the apparatus shall provide frame support to prevent parallel-to-plane movement of the timber sub-frame.

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 (see Figure C.10). The supported area shall be checked and confirmed to be sufficient to prevent significant indentation of the frame material.

NOTE A supported area of 1 000 mm² has been proven to avoid significant indentation.

The perpendicular-to-plane load shall be normally applied via a loading pad with a nominal area of 1 000 mm² having a minor dimension of not less than 25 mm (see Figure C.11). 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 vent in a position to prevent the use of the loading pad within the radial tolerance, then a loading bridge may be used. This bridge shall apply the load simultaneously at two points to the vent 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 200 mm. A suitable bridge is shown in Figure C.12. The method of attaching the loading pad(s) shall be checked to not detrimentally affect the sample under test.

C.4 Testing methods

C.4.1 General

Check that all glass fitted in the sample is toughened.

If at any time the glass breaks during the test, it shall be replaced with toughened glass or a further sample may be submitted at the discretion of the manufacturer.

The tests shall be conducted with a laboratory temperature of between 15 °C and 30 °C. Samples shall be conditioned at the laboratory temperature for a minimum of 12 h prior to testing.

C.4.2 Sample preparation

When conducting any of the tests detailed in this annex the window shall be fixed into a timber sub-frame [nominal (100 × 50) mm in section] in accordance with the defined installation requirements. For open-out windows and vertical sliders, the opening face of the outer frame shall be mounted flush with the timber sub-frame [see Figure C.3c)]. For open-in windows, one sample shall be mounted with the non-opening face of the outer frame flush with the timber sub-frame (sample 1) and one sample mounted with the opening face of the outer frame flush with the timber sub-frame (sample 2), see Figure C.13. Masonry fixings shall be substituted by wood screws of similar diameters, quantity and position.

The sub-assembly shall then be mounted into the test apparatus as described in **C.3**, square and without twist.

During the test the hardware shall be locked and, where applicable, the key removed.

C.4.3 Manipulation test

C.4.3.1 Objective

The objective of this test is to establish that there is no inherent vulnerability in the design of the window which from the outside would permit entry by the locking system being operated, unfastened or disengaged.

The test engineer shall have detailed knowledge of the sample and the hardware installed (for example, the location and direction of travel of all locking points).

C.4.3.2 Procedure

Test a) shall be conducted prior to the infill medium removal test (see **C.4.4**) and test b) following the mechanical loading tests (see **C.4.5**) and, if appropriate, the manual check test (see **C.4.6**).

- Test a): The overall attack time shall be 15 min, although no single test technique shall be used for more than 3 min.
- Test b): The overall attack time shall be 3 min with the primary intention of releasing threaded fasteners exposed as a result of the mechanical loading tests.

Conduct this test on sample 1 using the tools specified in **A.2.1** (Tools group A).

Examples of methods of manipulation include the removal of trim sections, the insertion of a tool to slide latches or bolts, undoing threaded fasteners in externally fixed hardware and blows by hand to dislodge locking devices.

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 listed in **A.2.2.3**, **A.2.2.5** and **A.2.2.6**. Tools listed in **A.2.2.3**, **A.2.2.5** and **A.2.2.6** shall not be used for any other purpose, such as levering, 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.

C.4.4 Infill medium removal test

C.4.4.1 General

Where the infill medium retention varies within a window, each variation shall be subjected to the tests given in **C.4.4.2** and **C.4.4.3**.

C.4.4.2 Infill manual test

Conduct this test on sample 1 using the tools specified in **A.2.1** (Tools group A) and **A.2.2** (Tools group B).

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.

C.4.4.3 Infill mechanical test

Conduct this test on sample 2.

Apply a perpendicular-to-plane load of 2.0 kN to each corner of the infill medium in turn and in a direction towards the inside, progressively and without shock over a period of 10 s to 20 s and within 5° perpendicular to the plane.

Apply the load via an articulated pad secured to a nominal (150 × 150) mm plywood block of 25 mm minimum thickness, and maintain until it has been held for 8 s to 12 s. If failure of the glazing system is exhibited at the corners then continue the loading test along each section in an attempt to deglaze the window.

C.4.5 Mechanical loading test

C.4.5.1 Objective

The objective of the mechanical loading test is to assess whether the sample can withstand a specified sequence of loading without creating an entry.

C.4.5.2 Loading procedure

Conduct this test on sample 2.

Apply and remove the loads at each loading point within a 5 min period (at each loading point).

The loading consists of an application of parallel-to-plane load which is maintained until a perpendicular-to-plane load has been applied and removed.

The loading points are defined in **C.6** (see Figure C.14).

The required loads shall be applied to each designated loading point in turn until all loading points have been subjected to test. If, during the loading, primary component failure (as defined in **3.3.1**) occurs, the effect this failure has on the security of the product shall be assessed by loading all designated points up to but not including the loading point that exhibited this primary component failure. If further primary component failure occurs the process shall be repeated with all designated loading points up to, but not including, the loading point that exhibited this primary component failure being subjected to test, including those that may have been previously loaded. If secondary component failure occurs (as defined in **3.3.2**) this shall not initiate a further sequence of loading but the present sequence shall be completed. Loading shall be continued until there has been a complete sequence of loading with no further primary component failure.

C.4.5.3 Parallel-to-plane loading

C.4.5.3.1 Windows, not including vertical sliding windows

Apply a parallel-to-plane load of 1.0 kN progressively and without shock over a period of not more than 30 s. Maintain this parallel-to-plane load until either the perpendicular-to-plane loading is completed and removed or a perpendicular-to-plane movement of 150 mm is achieved. Remove the load without shock over a period not exceeding 30 s.

Apply the load through suitable bracket(s) as shown in Figure C.8. Locate the bracket on the opening face of the vent frame.

NOTE 1 Parallel-to-plane loads are either parallel-to-plane along the edge or parallel-to-plane at right angles to the edge.

For loads that are parallel-to-plane along the edge, apply the force at the corner of the vent with a line of action which is parallel to the edge and directed towards the adjacent corner.

For loads that are parallel-to-plane at right angles to edge, apply the force at the vent frame between the corners and with a line of action which is at right angles to the edge and directed towards the opposite edge. On multilights only, apply an opposing force to the mullion or transom (fixed or non-fixed) on the opposite side to the opening face, where the locking point is between the vent frame and the mullion or transom.

NOTE 2 Details of loading applications are given in Figure C.4, Figure C.5 and Figure C.6.

C.4.5.3.2 Vertical sliding windows

For parallel-to-plane loads of 1.0 kN applied in directions other than the normal vertical opening direction, apply these loads as detailed in **C.4.5.3.1**.

For parallel-to-plane loads of 3.0 kN applied vertically in the normal direction of opening, apply the loads depending on the type of locking hardware fitted to the windows.

Apply the load through suitable bracket(s) as shown in Figure C.8. Locate the bracket on the opening face of the vent frame.

*NOTE 1 Parallel-to-plane loading for vertical sliding windows are of two types. These are detailed in this subclause and in **C.6**.*

NOTE 2 Details of typical loading applications are given in Figure C.15.

Apply a load of 3.0 kN progressively and without shock over a period of between 10 s and 20 s until either it has been held for between 8 s and 12 s or until entry (as defined in **3.9**) has been gained.

C.4.5.4 Perpendicular-to-plane loading

C.4.5.4.1 Non-vertical sliding windows

Apply a perpendicular-to-plane load to the face of the vent frame and in the direction of opening for an opening vent or in the direction of removal for a dummy vent and fixed light. Ensure that the line of force of this load passes as closely as possible through the centre of the contact area of the locking point within a radial tolerance of 50 mm. Apply the load within 5° perpendicular to the plane. Where two adjacent loading points are within 100 mm, use a single loading point midway between the original loading points. Apply the load as closely to the outer edge of the vent frame as is practicable.

In multilight windows, prop the mullion or transom to prevent movement adjacent to the point where the perpendicular-to-plane load is applied (see Figure C.10).

NOTE Propping is only carried out when loading vent to mullion/transom locking points.

Apply a load of 3.0 kN progressively and without shock over a period of between 10 s and 20 s until either it has been held for between 8 s and 12 s or until entry (as defined in **3.9**) has been gained.

If the 3.0 kN load is held, then remove it without shock over a period not exceeding 20 s.

C.4.5.4.2 Vertical sliding windows

Apply the perpendicular-to-plane loading directed from the exterior of the sample towards the interior. In loading cases given in Table C.1, 11) and 12), apply an equal and opposite force to the outer meeting rail. Where two adjacent loading points are within 100 mm, use a single loading point midway between the original loading points. Apply the load as closely to the outer edge of the vent frame as is practicable.

*NOTE Perpendicular-to-plane loading for vertical sliding windows is of two types. These are detailed in this subclause and in **C.6**.*

For loads exerting a force of 1.0 kN, apply the perpendicular-to-plane load progressively and without shock over a period of not more than 30 s. Maintain this load until either the parallel-to-plane loading is completed and removed or a parallel-to-plane movement of 150 mm is achieved. Remove the load without shock over a period not exceeding 30 s. Apply the load through suitable bracket(s) as shown in Figure C.8.

For loads exerting a force of 3.0 kN, apply the load depending on the type of locking hardware fitted to the window.

Apply a load of 3.0 kN progressively and without shock over a period of between 10 s and 20 s until either it has been held for between 8 s and 12 s or entry (as defined in **3.9**) has been gained.

C.4.6 Manual check test

C.4.6.1 Objective

The objective of the manual check test is to explore the possibility that there might be weaknesses and vulnerabilities in the product that are not covered in the standard cases. The manual check test is carried out from the exterior face of the sample and conducted with full knowledge of the sample's construction and hardware details.

C.4.6.2 Procedure

Conduct this test on sample 1.

Using the tools specified in **B.4.6.2**, attempt to gain entry by levering at any location and in any direction such that the combined direction and location of the forces exhibited by the standard loading cases given in **C.6** are not replicated.

Attempts shall be made to gain entry by defeating any hinge, locking point, fixing point or other potentially vulnerable locations. Make all attempts from the exterior face of the sample.

The overall attack time limit for this test is 15 min. No single technique shall be used for more than 3 min and no location shall be attacked for more than 6 min.

The test shall be conducted with any one or two of the tools specified in **B.4.6.2** for each technique.

If entry is gained, the method shall be recorded, the direction of applied loads noted, new loading positions and directions defined for parallel-to-plane and perpendicular-to-plane loads. An additional mechanical loading test shall also be performed in accordance with **C.4.7**.

Where entry is gained in the manual check test and a mechanical loading test cannot be devised to replicate the mode of loading, such windows shall be considered as outside the scope of this specification.

C.4.7 Additional mechanical loading test

Carry out an additional mechanical loading test in accordance with **C.4.5**, on sample 2, using the loading configurations as defined by **C.4.6**.

Where entry is gained in the manual check test and a mechanical loading test cannot be devised to replicate the mode of loading, such windows shall be considered as outside of the scope of this specification.

C.5 Test report

The test report shall include a minimum of the following information.

a) A concise description of the window, including at least the following information, checked before the test:

- manufacturer's name and specific product identification;
- types of opening lights;
- materials and, if applicable, their surface treatment;

- overall width and overall height;
- method of frame jointing;
- framing, profile and reinforcement details, where applicable;
- types of beading, gaskets, methods of glazing and any security feature present in the glazing rebate;
- type and thickness of glass and overall thickness of glazing unit;
- types and details of hardware;
- types and details of hardware fixings;
- detailed drawing(s) of the window elevation viewed from the outside, including the positions of the hardware.

b) The definition of the window range (see **3.26**) applicable to the report including size limitation and window configuration.

c) The results obtained during each test.

d) A diagram of the test apparatus or its reference.

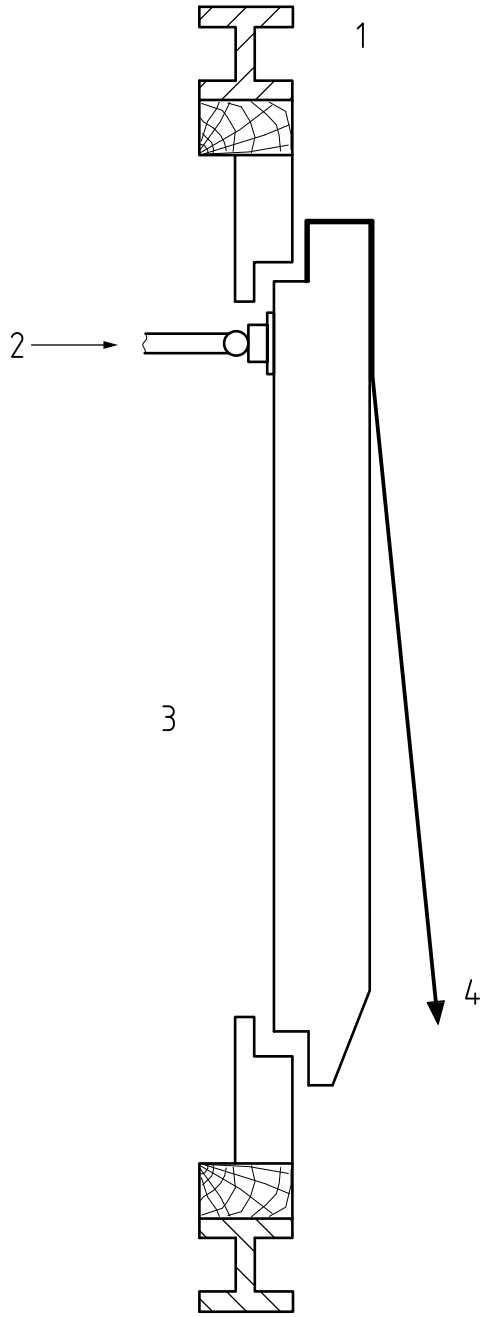
e) The laboratory ambient air temperature at the time of test.

f) The testing organization, date of test, test engineer and any witnesses.

g) A statement that the results are valid only for the conditions under which the test was conducted and for the specific window range (see **3.26**).

h) A summary of the result and assessment for the range.

Figure C.2 **Typical test arrangement**

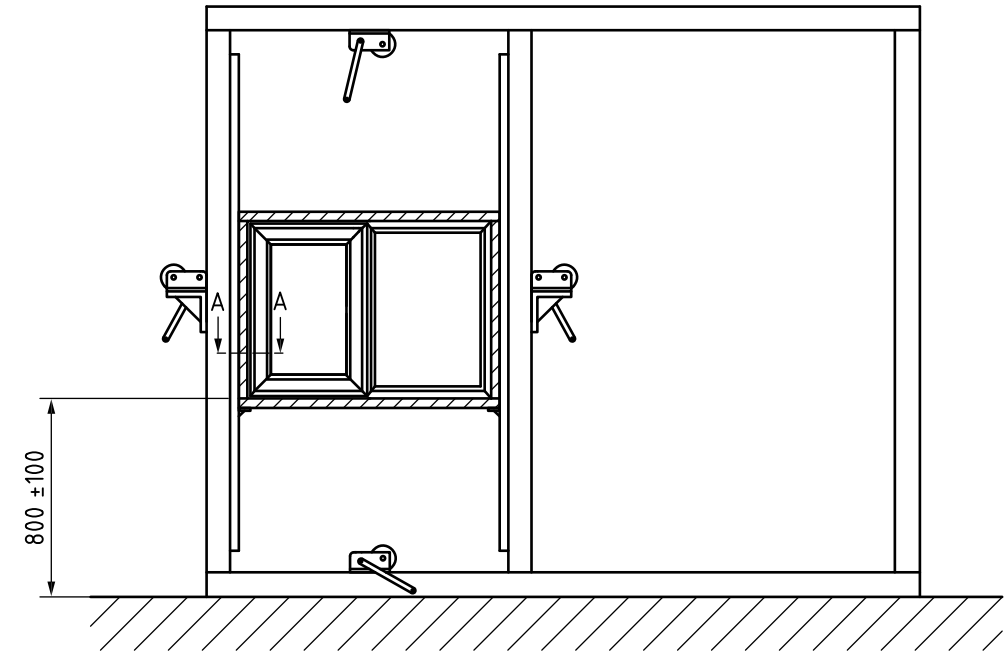


Key

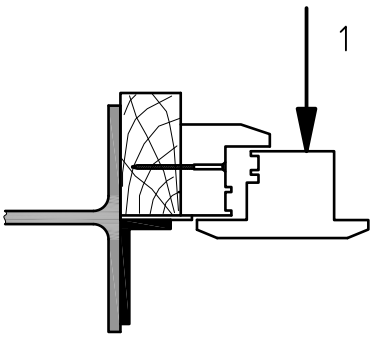
1	Rigid test frame	3	Test sample
2	Perpendicular-to-plane load	4	In plane load

Figure C.3 **Test sample mounting**

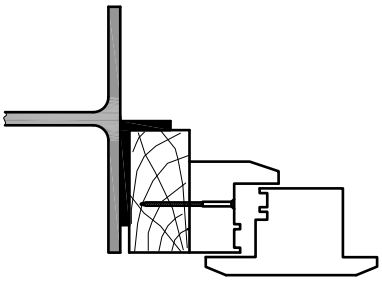
Dimensions in millimetres



a) Typical mounting of test window



b) Mechanical loading test



c) Manual check test

Key

1 Load

Figure C.4 **Parallel-to-plane loading: along the edge**

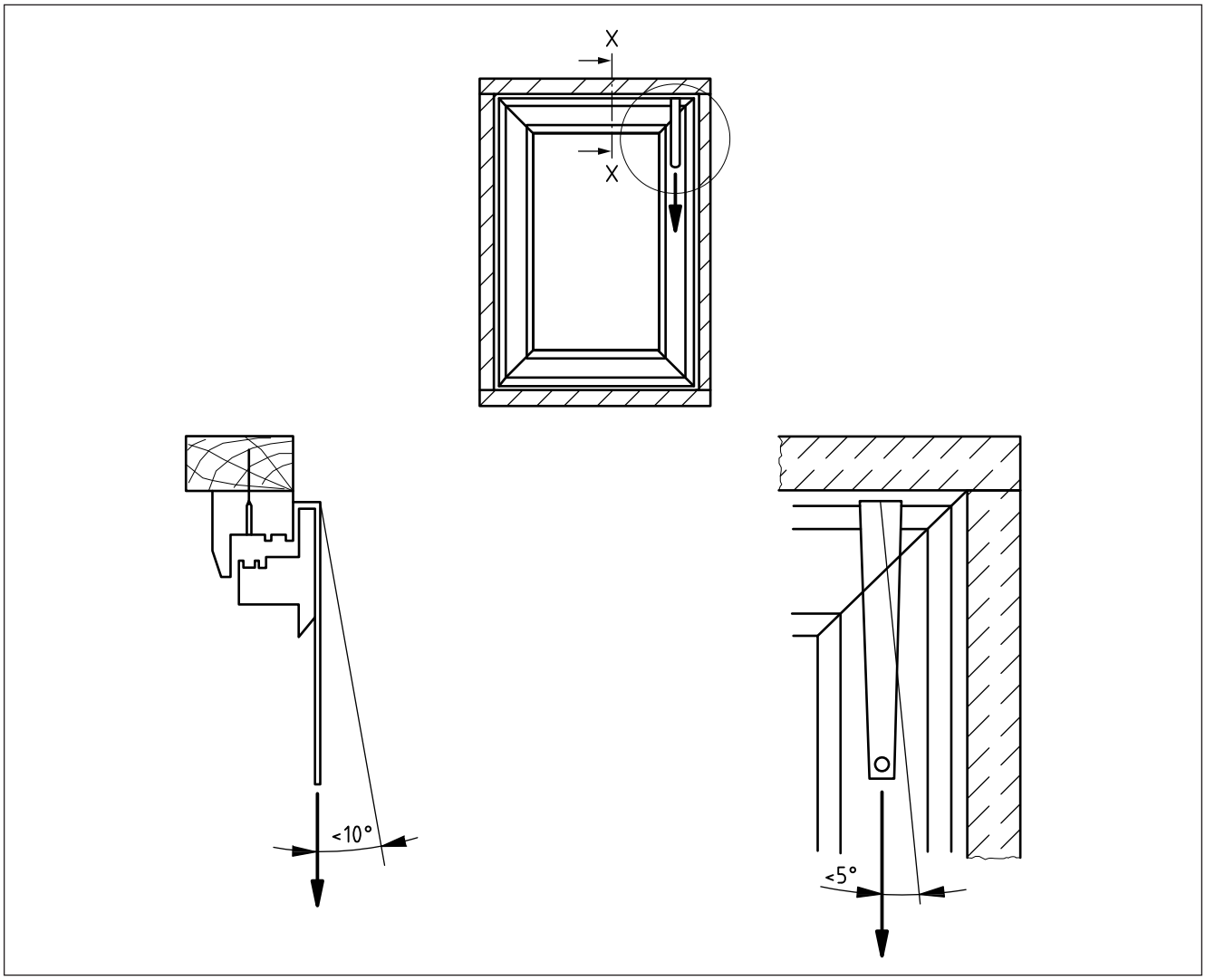
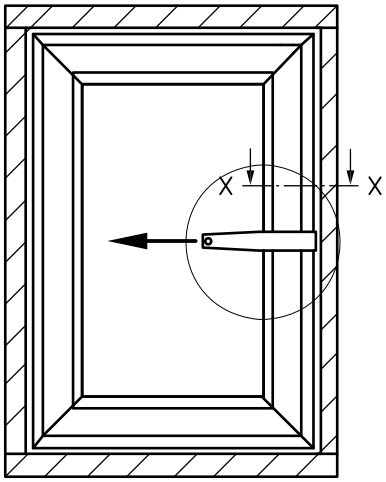
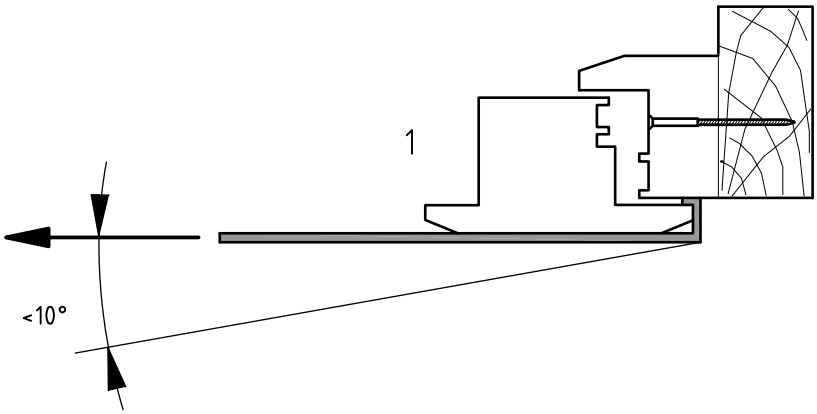


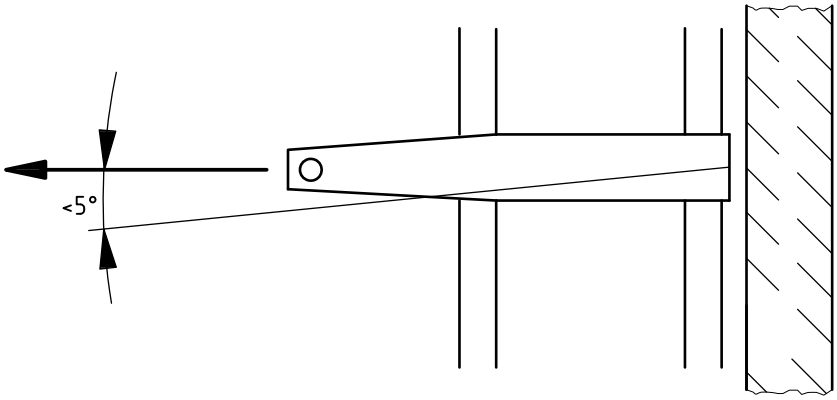
Figure C.5 **Parallel-to-plane loading: at right angles to the edge**



a) Elevation of window



b) Cross-section through X-X with angular tolerance for loads

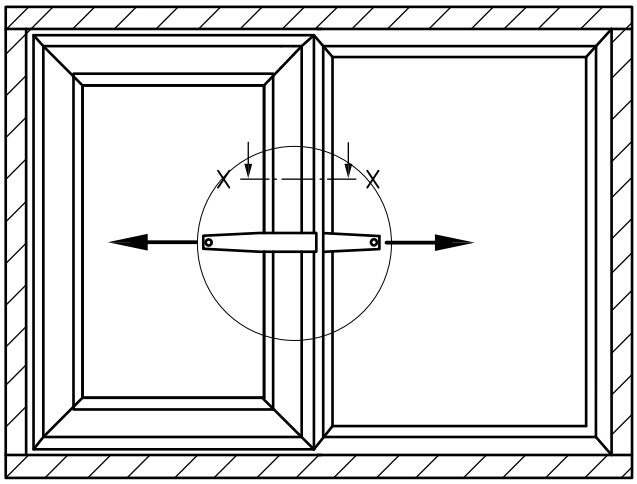


c) Elevation with angular tolerance of loads

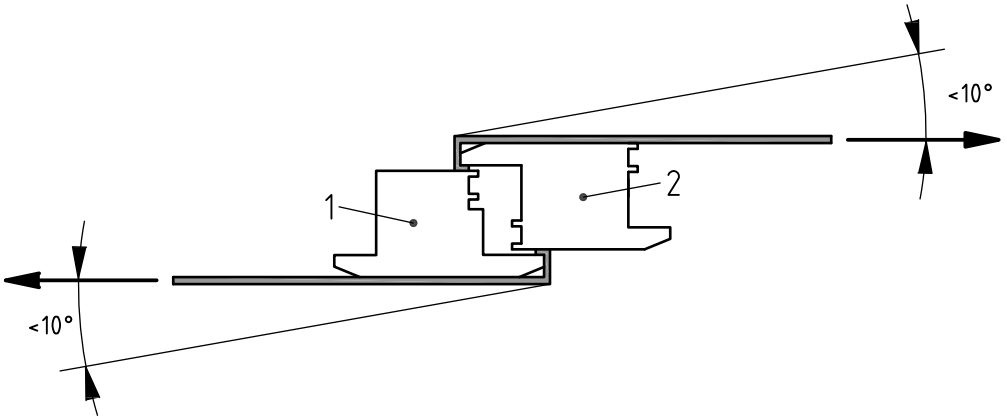
Key

1 Opening vent

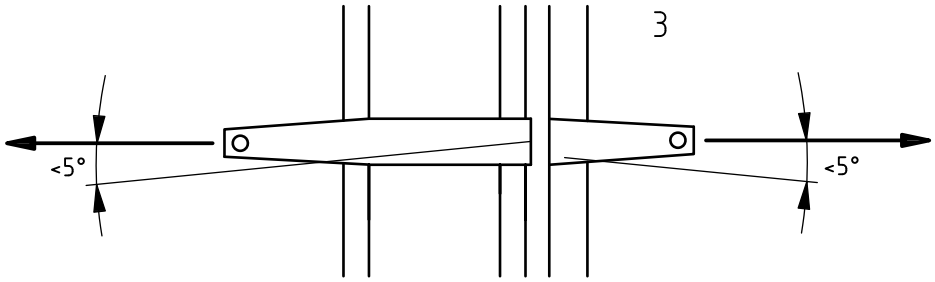
Figure C.6 **Parallel-to-plane loading: at a mullion or transom**



a) Elevation of window



b) Cross-section through X-X with angular tolerance for loads

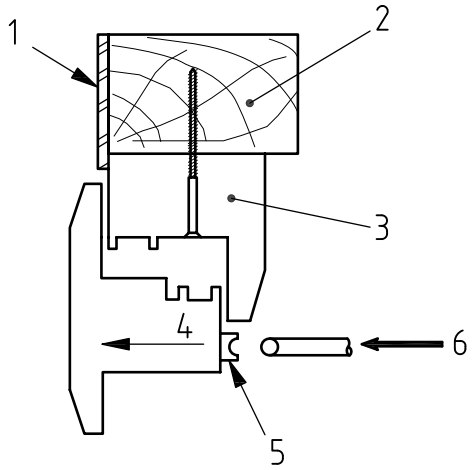


c) Elevation with angular tolerance of loads

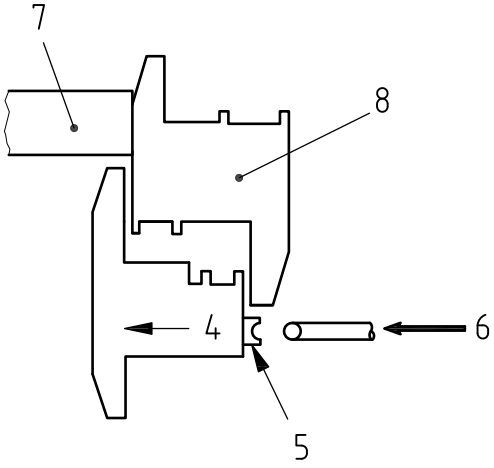
Key

1 Opening vent
2 Transom or mullion
3 Opposing force on transom and mullions only

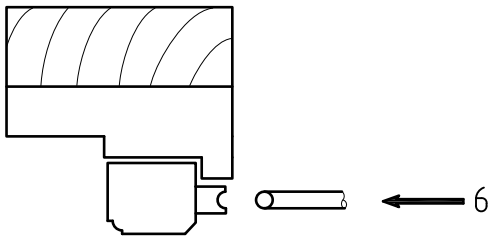
Figure C.7 **Perpendicular-to-plane loading**



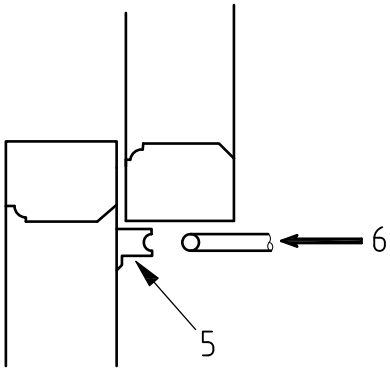
a) Typical casement window



b) Typical casement window with mullion or transom arrangement



c) Typical vertical sliding window

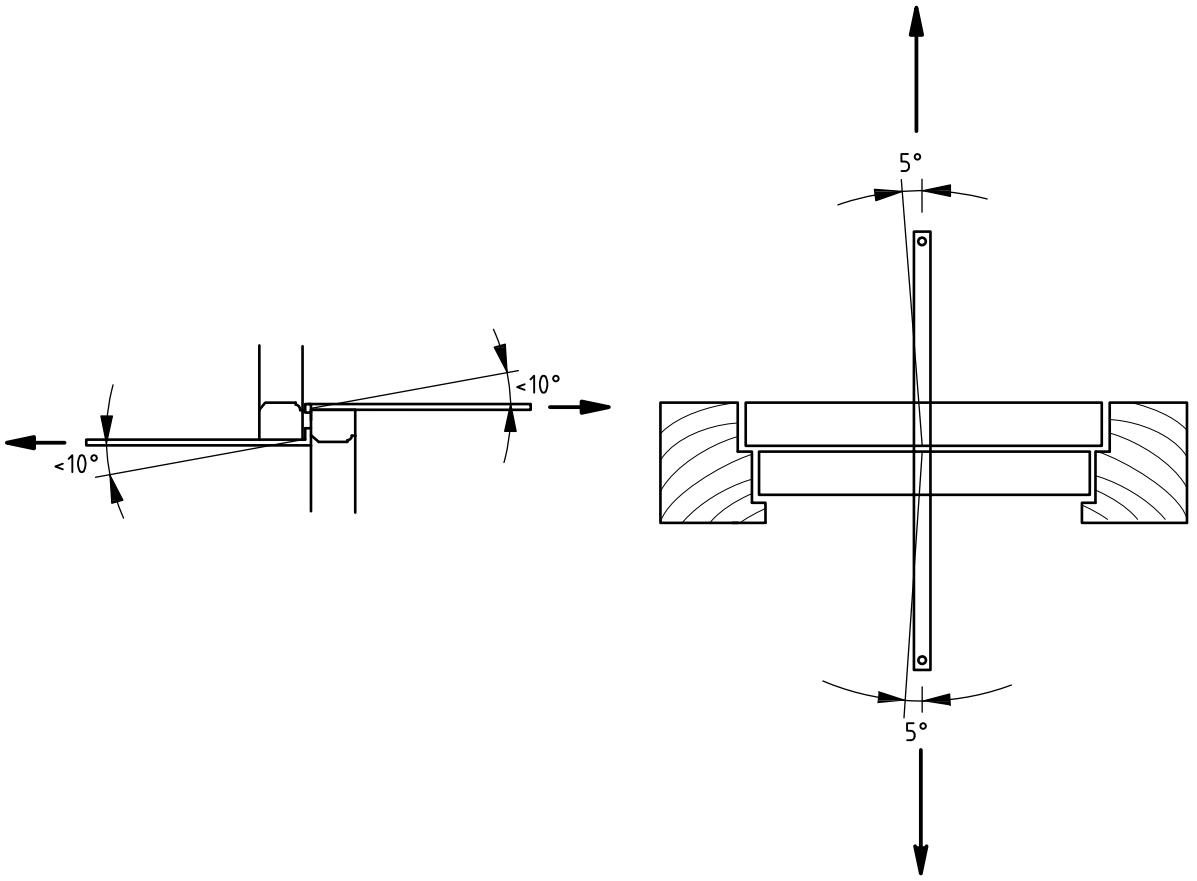


d) Typical vertical sliding window meeting rail cross-sections

Key

1	Frame support	5	Loading pad
2	Timber sub-frame	6	Perpendicular-to-plane force
3	Outer frame	7	Prop
4	Direction of vent opening/movement	8	Transom or mullion

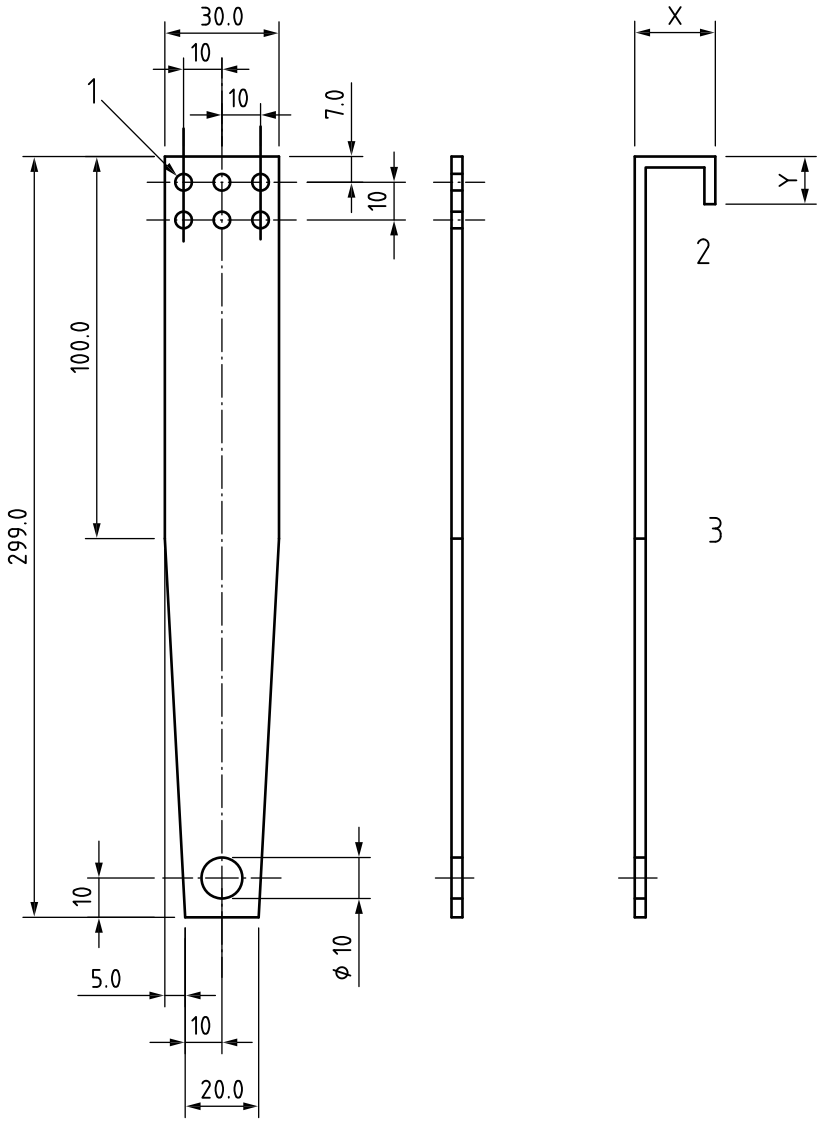
Figure C.7 **Perpendicular-to-plane loading**



e) Typical vertical sliding window with equal and opposite loading

Figure C.8 **Typical test bracket**

Dimensions in millimetres



Key

1 6 off holes ø 4.5

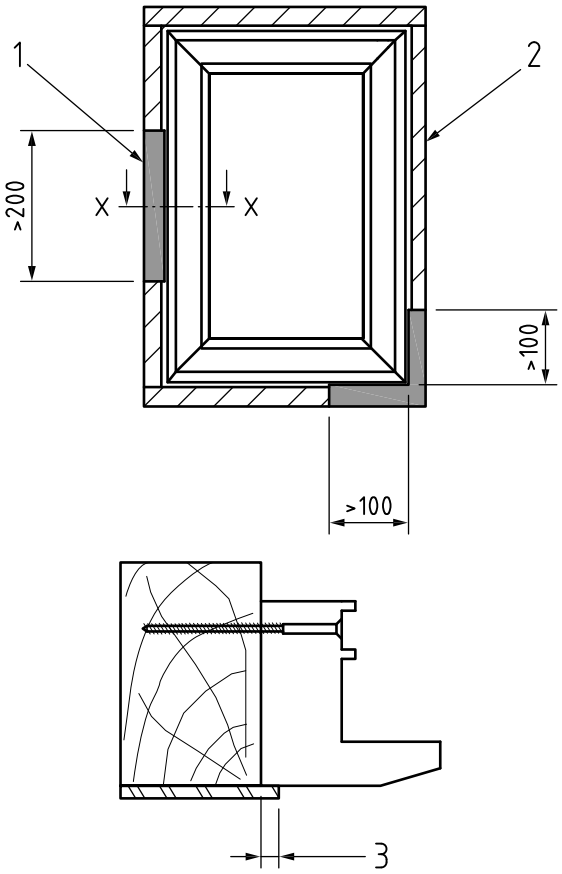
2 Alternate end configuration

3 Dimensions X and Y to suit the profile being tested

NOTE 3 mm stainless steel gauge.

Figure C.9 **Typical outer frame support**

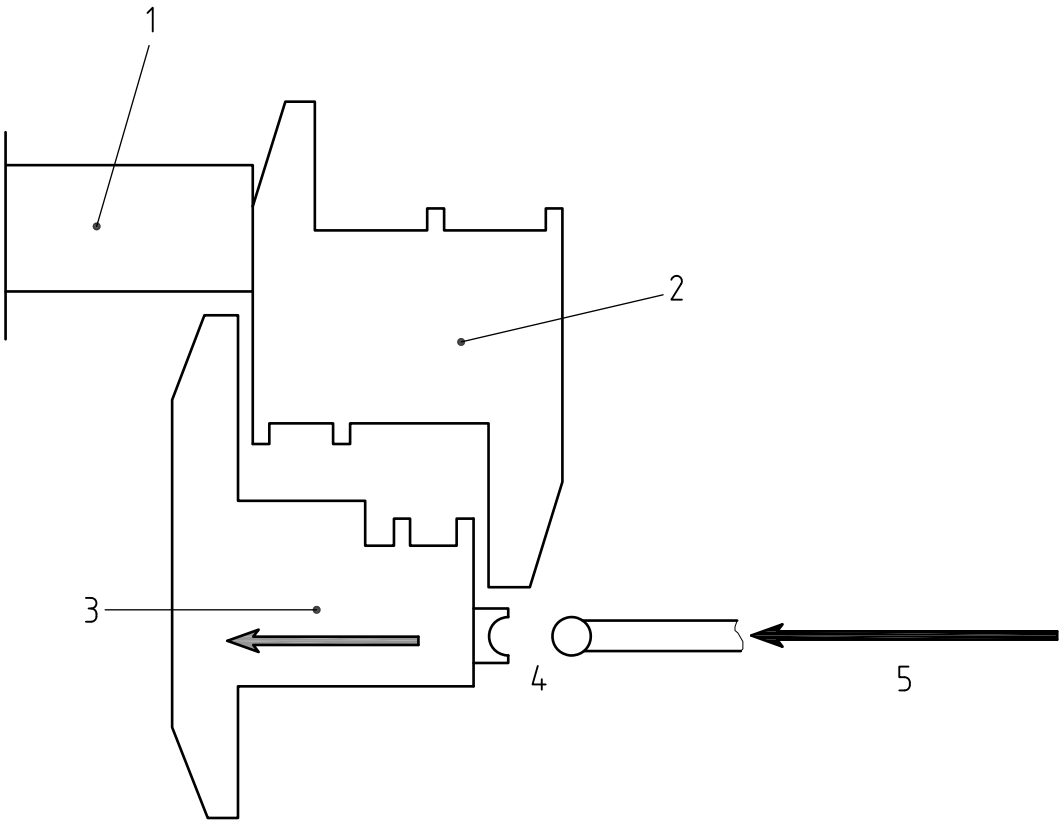
Dimensions in millimetres



Key

1 Moveable frame support equally spaced about point of applied load
2 Timber sub-frame
3 Support area (7.5 ±2.5) mm, min. 200 mm in length

Figure C.10 **Typical mullion and transom support**



Key

1 Transom or mullion prop
2 Transom or mullion
3 Direction of vent opening or movement
4 Loading pad
5 Perpendicular-to-plane force

Figure C.11 **Typical loading pad**

Dimensions in millimetres

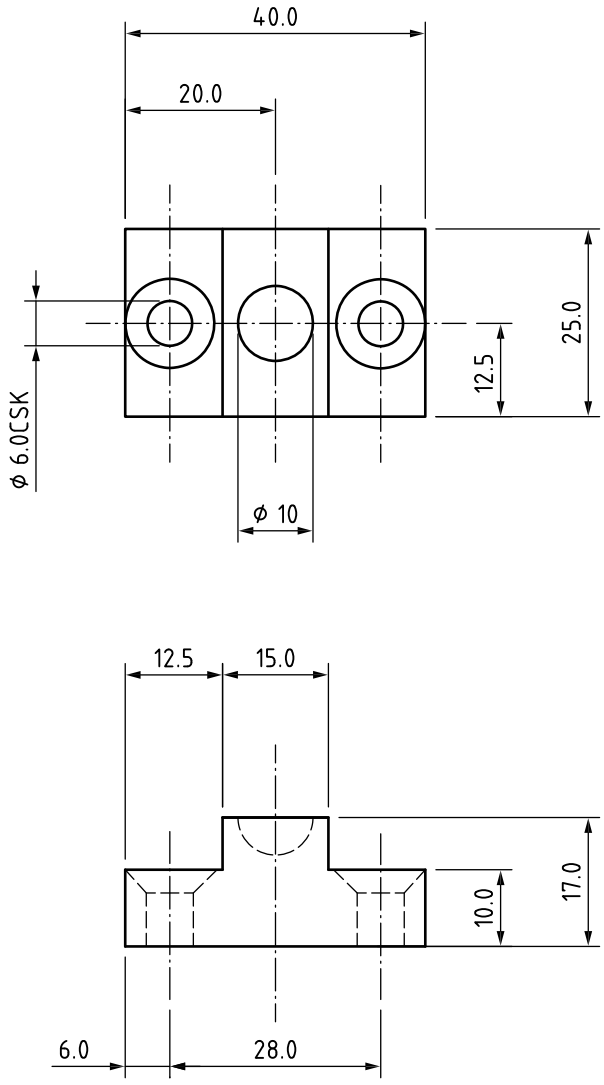
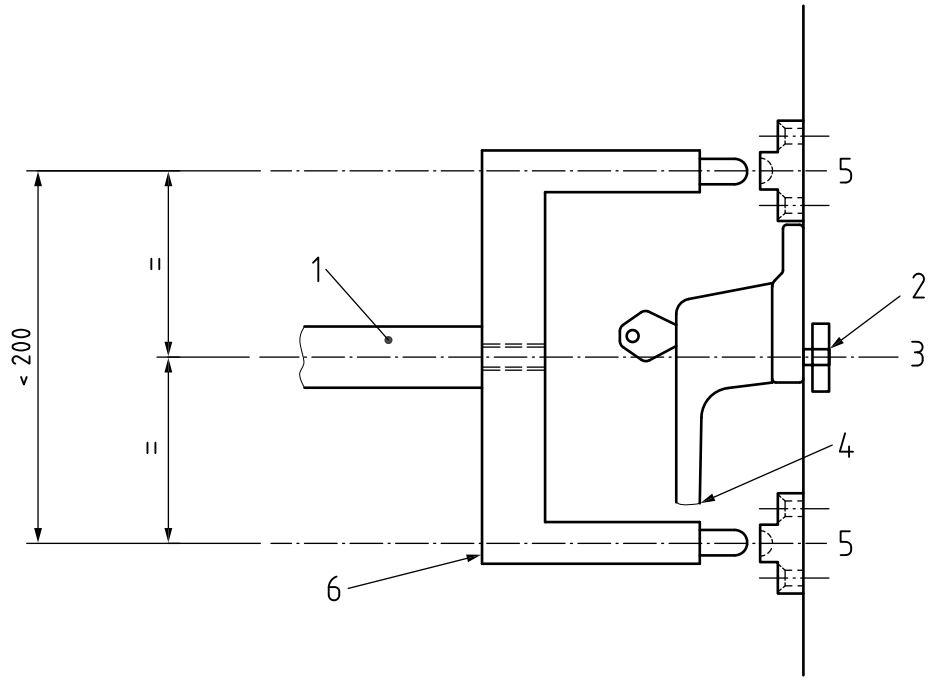


Figure C.12 **Typical loading bridge**

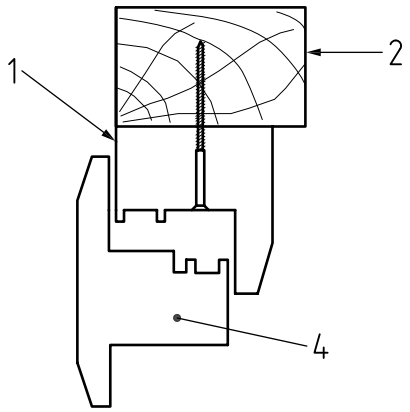
Dimensions in millimetres



Key

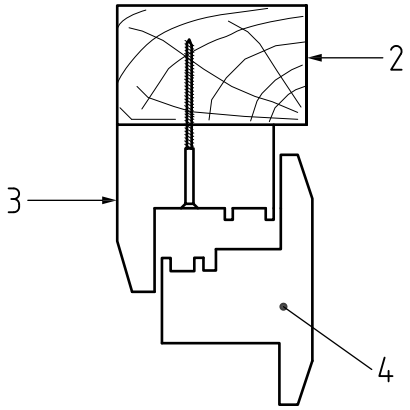
1	Piston ram	5	Combined loading area of both loading pads to be 1 000 mm² nominal
2	Locking point		
3	Line of force	6	Bridge
4	Shortened handle, where required		

Figure C.13 **Typical installation of test window into timber sub-frame**



Open out window sample 1 and 2

Open in window sample 2



Open in window sample 1

Key

1 Opening face of outer frame flush with the timber sub-frame
2 Nominal (100 × 50) mm timber sub-frame
3 Non-opening face of outer frame flush with the timber sub-frame
4 Opening vent

Figure C.14 **Typical loading sequences**

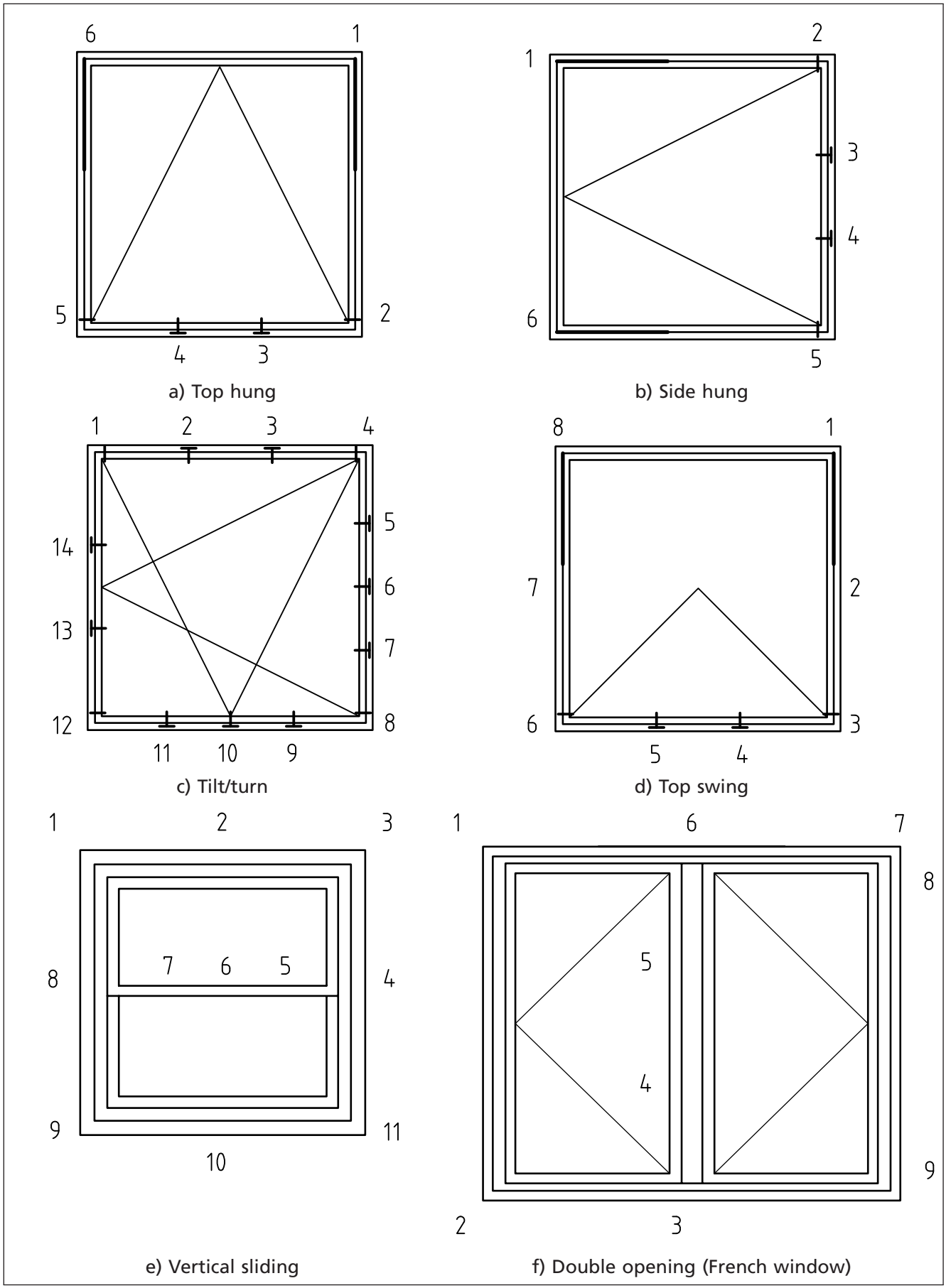
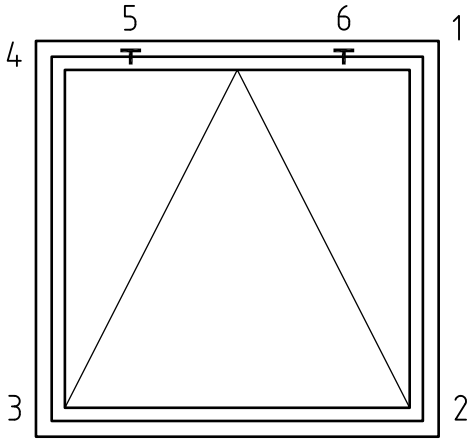
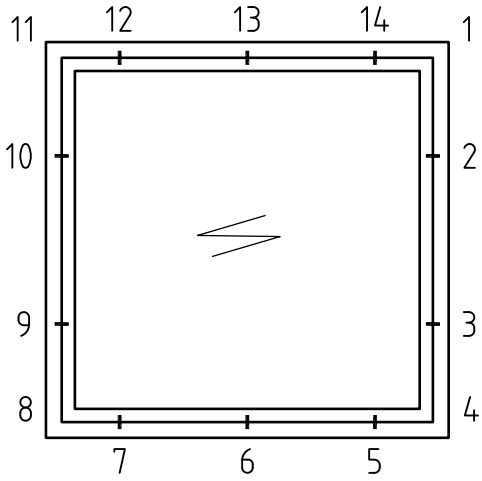


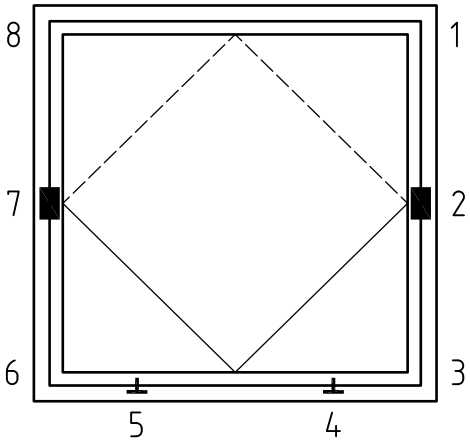
Figure C.14 **Typical loading sequences**



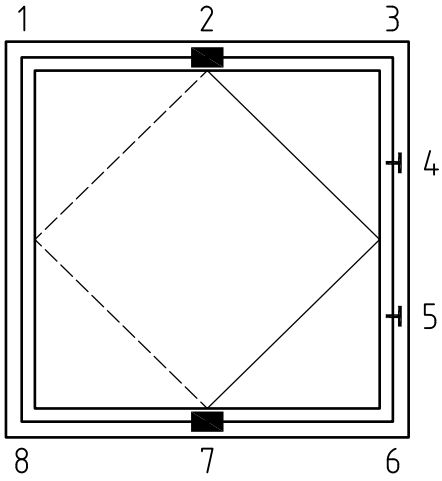
g) Bottom hung



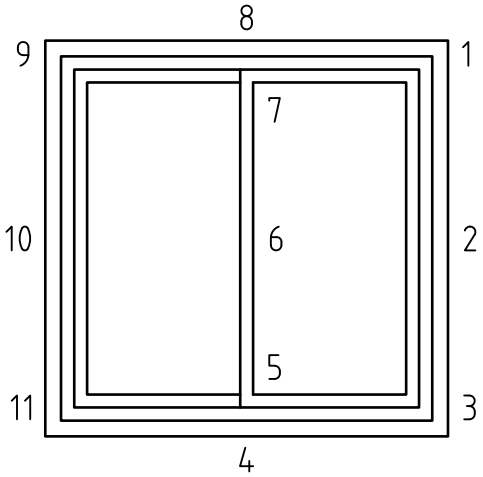
h) Fixed casement (Dummy vent)



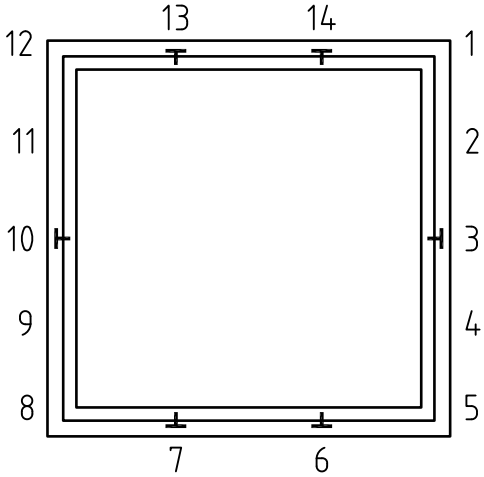
i) Horizontal pivots



j) Vertical pivots

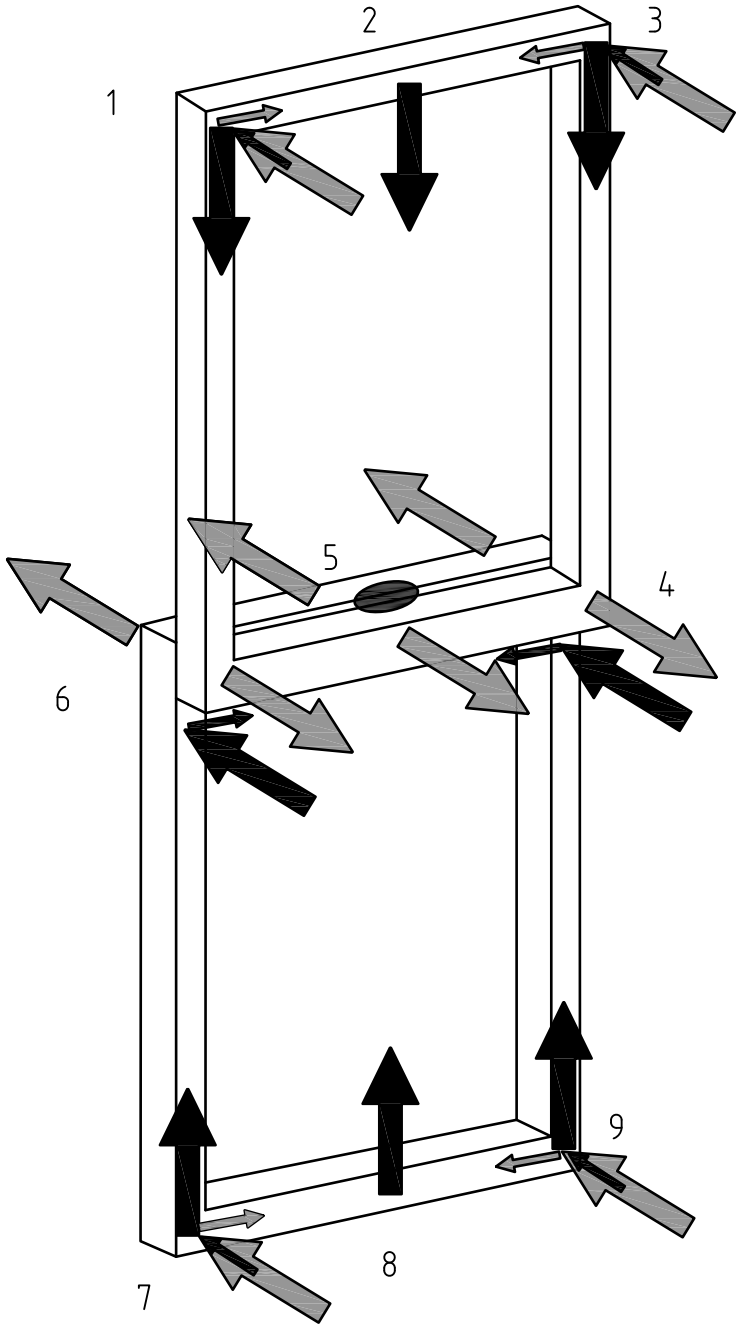


k) Horizontal slider



l) Parallel opening

Figure C.15 **Local configuration for a typical vertical sliding window**



Key

Small arrow, 1 kN — Grey arrows, test A

Large arrow, 3 kN — Black arrows, test B

NOTE Numbers indicate typical loading points.

C.6 Standard loading cases

The parallel-to-plane and perpendicular-to-plane loading positions and directions given in Table C.1 shall be applied wherever the construction features listed are present. Not all loading cases apply to every window, but those that are present shall be used.

Table C.1 **Standard loading cases**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
1) Variable geometry stay and top swing sash guide fixed to outer frame	1.0 kN towards the other stay	None	3.0 kN at the corner	None
2) Variable geometry stay and top swing sash guide fixed to transom or mullion	1.0 kN towards the other stay	1.0 kN at right angles to the edge and away from the other stay	3.0 kN at the corner	Propped on transom or mullion
3) Butt hinge fixed to outer frame	1.0 kN at right angles to the edge towards the opposite edge	None	3.0 kN centred over the hinge	None
4) Butt hinge fixed to transom or mullion	1.0 kN at right angles to the edge towards the opposite edge	1.0 kN at right angles to the edge and away from the opposite edge	3.0 kN centred over the hinge	Propped on transom or mullion
5) At each corner of tilt and turn vent, dummy vent and opening corner of casement vent or top swing sash	**First test:** 1.0 kN in the direction to disengage the nearest locking point	**First test:** None	**First test:** 3.0 kN at the corner	**First test:** None
	Second test: 1.0 kN at right angles to the first test towards the opposite edge	**Second test:** None	**Second test:** 3.0 kN at the corner	**Second test:** None
6) Bolts, mushroom bolts, cams and roller cams with or without mushroom restraints fixed to outer frame	**First test:** 1.0 kN in the direction to disengage the nearest locking point	**First test:** None	**First test:** 3.0 kN at the corner	**First test:** None
	Second test: 1.0 kN at right angles to the first test towards the opposite edge	**Second test:** None	**Second test:** 3.0 kN at the corner	**Second test:** None
7) Bolts, mushroom bolts, cams and roller cams with or without mushroom restraints where keep is fixed to transom, mullion or opening vent	**First test:** 1.0 kN along the edge in the direction to disengage the bolt	**First test:** None	**First test:** 3.0 kN centred over the bolt	**First test:** Propped on transom, mullion or opening vent
	Second test: 1.0 kN at right angles to the edge towards the opposite edge	**Second test:** 1.0 kN at right angles to the edge away from the opposite edge	**Second test:** 3.0 kN centred over the bolt	**Second test:** Propped on transom, mullion or opening vent

Table C.1 **Standard loading cases**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
8) Dog bolts or other hardware specifically to provide security where hardware is fixed to outer frame	**First test:** 1.0 kN at right angles to the edge **Second test:** 1.0 kN along the edge towards the opposite edge	**First test:** None **Second test:** None	**First test:** 3.0 kN centred over the hardware **Second test:** 3.0 kN centred over the hardware	**First test:** None **Second test:** None
9) Dog bolts or other hardware specifically to provide security where hardware is fixed to transom or mullion	**First test:** 1.0 kN at right angles to the edge **Second test:** 1.0 kN along the edge towards the opposite edge	**First test:** None **Second test:** 1.0 kN at right angles to the edge away from the opposite edge	**First test:** 3.0 kN centred over the hardware **Second test:** 3.0 kN centred over the hardware	**First test:** Propped on transom or mullion **Second test:** Propped on transom or mullion
10) On dummy vents, all hardware and fixing fixed to outer frame	1.0 kN at right angles to the edge towards the opposite edge	None	3.0 kN centred over the hardware or fixing	None
11) On dummy vents, all hardware and fixing fixed to transom or mullion	1.0 kN at right angles to the edge towards the opposite edge	1.0 kN at right angles to the edge away from the opposite edge	3.0 kN centred over the hardware or fixing	Propped on transom or mullion
12) Cockspur handles where hardware is connected to outer frame	**First test:** 1.0 kN along the edge in the direction to disengage the handle **Second test:** 1.0 kN at right angles to the edge towards the opposite edge	**First test:** None **Second test:** None	**First test:** 3.0 kN centred over the handle pivot using a bridge **Second test:** 3.0 kN centred over the handle pivot using a bridge	**First test:** None **Second test:** None
13) Cockspur handles where hardware is connected to transom or mullion	**First test:** 1.0 kN along the edge in the direction to disengage the handle **Second test:** 1.0 kN at right angles to the edge towards the opposite edge	**First test:** None **Second test:** 1.0 kN at right angles to the edge away from the opposite edge	**First test:** 3.0 kN centred over the handle pivot using a bridge **Second test:** 3.0 kN centred over the handle pivot using a bridge	**First test:** Propped on transom or mullion **Second test:** Propped on transom or mullion
14) Fully reversible and pivot windows where hardware is fixed to outer frame	1.0 kN at right angles to the edge towards the opposite edge	None	3.0 kN centred over pivot point	None

Table C.1 **Standard loading cases**

Standard loading case	Parallel-to-plane load	Equal and opposite parallel-to-plane load	Perpendicular-to-plane load	Propping condition
15) Fully reversible and pivot windows where hardware is fixed to transom and mullion	1.0 kN at right angles to the edge towards the opposite edge	1.0 kN at right angles to the edge away from the opposite edge	3.0 kN centred over pivot point	Propped on transom or mullion
16) At non-meeting corners of sliding windows	**First test:** 3.0 kN in the direction of normal opening	**First test:** None	**First test:** 1.0 kN at corner	**First test:** None
	Second test: 1.0 kN towards the opposite edge	**Second test:** None	**Second test:** 3.0 kN at corner	**Second test:** None
17) At the centre of the non-meeting edge of sliding windows	3.0 kN at right angles to the edge towards the opposite edge	None	None	None
18) At the meeting edge corners of sliding windows	**First test:** None	**First test:** None	**First test:** 3.0 kN on the meeting edge corners	**First test:** 3.0 kN opposing load at corner
	Second test: 1.0 kN at right angles to the frame edge towards the opposite edge	**Second test:** None	**Second test:** 3.0 kN at the sash meeting edge corners	**Second test:** None
19) At each sash to sash locking point of sliding windows	None	None	3.0 kN centred over the locking point	3.0 kN opposing load
20) At each corner of parallel opening windows	**First test:** 1.0 kN in the direction to disengage the nearest locking point	**First test:** None	**First test:** 3.0 kN at the corner	**First test:** None
	Second test: 1.0 kN at right angles to the first test towards the opposite edge	**Second test:** None	**Second test:** 3.0 kN at the corner	**Second test:** None
21) Scissor stay pivot point on parallel opening windows where the scissor stay is fixed to outer frame	1.0 kN at right angles to the edge towards the opposite edge	None	3.0 kN centred over pivot	None
22) Scissor stay pivot point on parallel opening windows where the scissor stay is fixed to the transom or mullion	1.0 kN at right angles to the edge towards the opposite edge	1.0 kN at right angles to the edge away from the opposite edge	3.0 kN centred over pivot	Propped on transom or mullion

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 7950, *Specification for enhanced security performance of windows for domestic applications* [8)]

BS EN 45011, *General requirements for bodies operating product certification systems*

Other publications

[1] DOOR AND HARDWARE FEDERATION. *TS 007 Enhanced security performance requirements for replacement cylinders and/or associated security hardware.* DHF: 2014. [9)]

[8)] This standard is withdrawn.

[9)] Available from <http://www.dhfonline.org.uk/docs/1074%20-%20TS%20007%20Jan%202014.pdf> [last viewed 2 February 2016].

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