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**Testing of Smart
Architectural Aluminium
Limited's Visofold 1000
folding doorset to the
requirements of Annex
A and B of PAS 24:2012**

Prepared for:

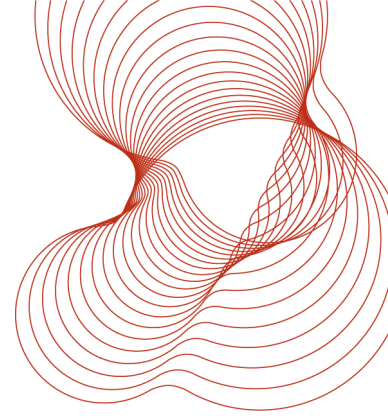
Smart Architectural Aluminium
Limited
Arnold's Way
Yatton
Bristol
North Somerset
BS49 4QN

18 August 2014

Test report number 292871



0578



Prepared on behalf of BRE Global by

Name Gareth Hulmes

Position Scheme Manager

Signature

Authorised on behalf of BRE Global by

Name Paul Dillon

Position Physical Security Certification Scheme Manager

Date 18 August 2014

Signature

BRE Global
Bucknalls Lane
Watford
Herts
WD25 9XX
T + 44 (0) 1923 664100
F + 44 (0) 1923 664994
E enquiries@breglobal.com
www.breglobal.com

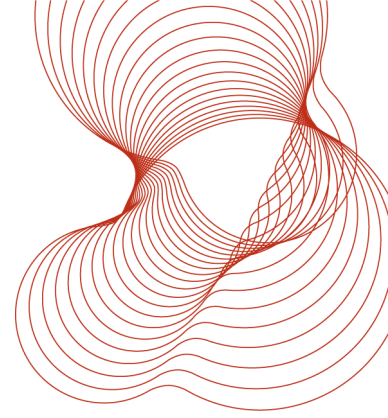
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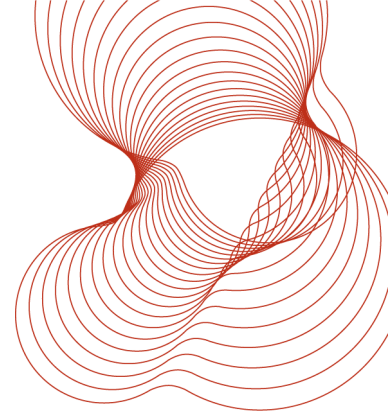
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1 Introduction

This report details the results of tests conducted on Smart Architectural Aluminium Limited's Visofold 1000 folding doorset to the requirements of Annex A and B of PAS 24:2012¹ *Enhanced security performance requirements for doorsets and windows in the UK – External doorsets and windows intended to offer a level of security suitable for dwellings and other buildings exposed to comparable risk*¹.

This test report does not cover other requirements of classification defined in clauses 4.1, 4.2, 4.3, 5 and 6 of PAS 24:2012¹.

2 Origin of test request

At the request of Mr Mark Walford of Smart Architectural Aluminium Limited, BRE Global Limited issued quotation SQ5925 on 21 January 2014 covering the testing of the Visofold 1000 folding doorsets to Annex A and B of PAS 24:2012¹. The quotation was accepted on 20 May 2014 by Mr Mark Walford.

The tests to PAS 24:2012¹ detailed in this report were carried out on 23 June 2014 and 14 July 2014 during BRE Global project 292871 under the BRE Global Limited Terms and Conditions for Testing (PN145/8.0²).

3 Details of test specimens

The following specimens were submitted for testing to the requirements of PAS 24:2012¹ (Annex A and B):

- One Visofold 1000 folding doorset on 23 June 2014; and
- Two Visofold 1000 folding doorsets on 14 July 2014.

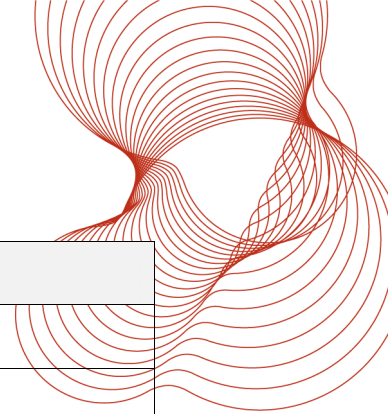
Those specimens were allocated unique BRE reference numbers.

A summary of the test specimens is detailed in the following sub-sections. The documents submitted by Smart Architectural Aluminium Limited detailing the construction of the doorsets are listed in Annex A.

Specimen 292871/01

Table 1 General description

Aspect	Detail
Name and address of manufacturer:	Smart Systems Limited.
Product designation (e.g. trade name / model):	Visofold 1000.
Configuration:	Outward opening. Type 3e. Three panel.



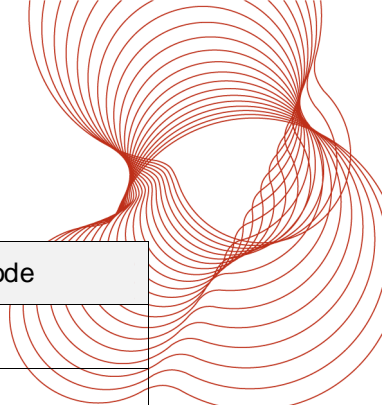
Aspect	Detail
Material:	Aluminium.
Overall dimensions:	2700 mm wide by 2500 mm high.
Description of outer frame:	DV 14.
Description of sash:	DV 26.
Description of hardware:	<p>Fuhr multipoint lock and keep incorporating two hook locks, two compression roller cams, one latch and deadbolt.</p> <p>Nine intermediate hinges, one bottom roller carrier, one top guide carrier, one D handle.</p> <p>Hoppe Tokyo handle set with 50 mm/50 mm Mila cylinder (ref: 5050EDPCM6.ACDV258) fitted to active leaf.</p> <p>Key locking shoot bolt handle operating a gear box and locking rods with end guides with single sided 45 mm Mila cylinder (ref: 4510EHPCM6.ACMX01604) fitted to centre leaf.</p>
Description of glazing/infill:	<p>6 mm toughened glass outer pane.</p> <p>16 mm air cavity.</p> <p>6 mm toughened glass inner pane.</p>
Description of seals:	EDPM weathering seals and glazing gaskets.

Table 2 Outer frame details

Component description	Supplier	Part No./Code
Outer frame	Smart Systems.	DV 14.
Outer frame jointing method:	Mechanical cleats glued and sealed.	
Outer frame surface treatment:	Powder coated.	

Table 3 Sash/leaf details

Component description	Supplier	Part No./Code
Sash profile	Smart Systems Limited.	DV26.
Rebate Adaptor	Smart Systems Limited.	DV76.



Component description	Supplier	Part No./Code
Sash/leaf jointing method:		Mechanical cleats glued and sealed.
Sash/leaf surface treatment:		Powder coated.

Table 4 Hardware details

Hardware Description	Supplier	Part No./Code	Fixings
Fuhr multi point lock. Fuhr full length keep.	Fuhr.	ACDV 722.723.	M4 machine screws in to fixing plate. ACDV241. ACDV262.
Intermediate hinges.	Banks.	ACDV331.	M5 machine screws in to steel fixing plate with No.10 self-tapping screw. ACIM062.
Bottom roller carrier.	Banks.	ACDV 332.	M5 machine screws into steel fixing plate with No.10 self-tapping screw. ACIM062
Top guide carrier.	Banks.	ACDV 333	M5 machine screws into steel fixing plate with No.10 self-tapping screw. ACIM062.
Shoot bolt assembly.	Banks.	ACDV227,ACDV328, ACDV229.ACDV229	M5 machine screws. No. 7 CSK self-tapping screws. ACET 061.
Hoppe Tokyo Handle set.	Hoppe.	1710RH/3239N-ZA.	M6 machine screws.
Is a key required to unlock the hardware from the inside?			Yes.

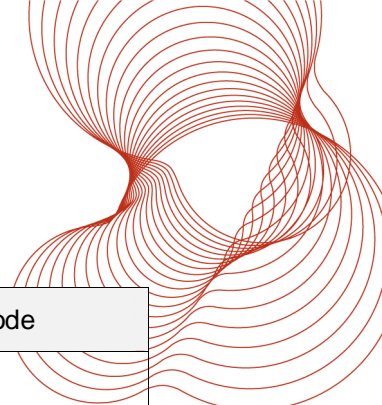


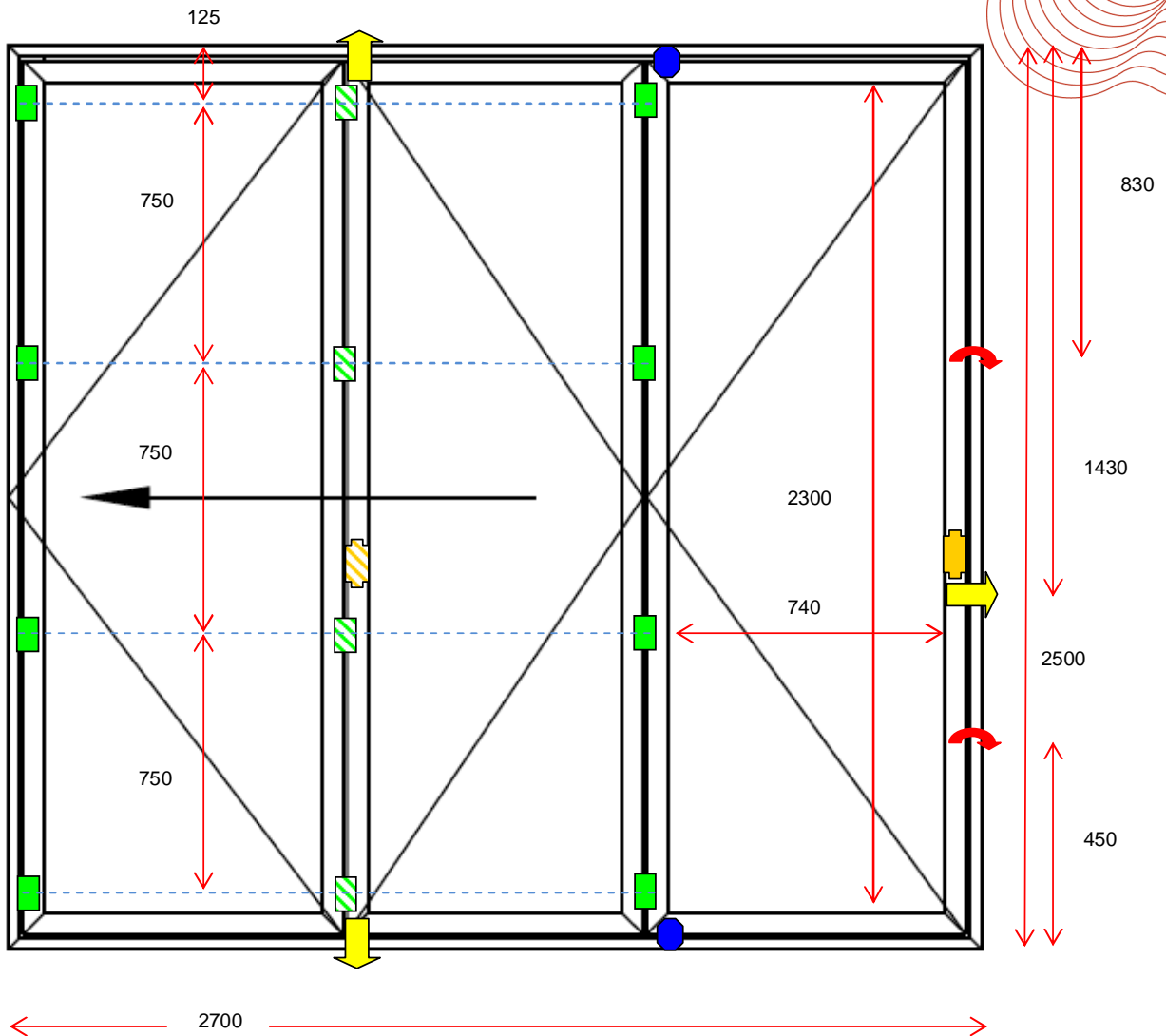
Table 5 Glazing/infill details

Component description	Supplier	Part No./Code
Glazing bead.	Smart Systems Limited.	DV67.
Outside glazing gasket.	Leeser.	ACVG31.
Internal wedge gasket.	Leeser.	ACVG34.
Glazing thickness and composition:	6 mm toughened glass outer pane. 16 mm air cavity. 6 mm toughened glass inner pane.	
Internally or externally glazed:	Internally.	

Table 6 Gasket details

Component description	Supplier	Part No./Code
Pane gasket	Reddiplex.	ACDV 272.
Frame gasket	Reddiplex.	ACDV 272, ACDV 268.
Sash gasket	Reddiplex.	ACDV 272.

Figure 1 Specimen 292871/01 (external view)



-  Hook bolt
-  Hinge (Internal face)
-  Hinge
-  Key lock (Internal face)
-  Key and handle
-  Deadbolt/shootbolt
-  Hinge bolt
-  Locking cam

All dimensions in mm

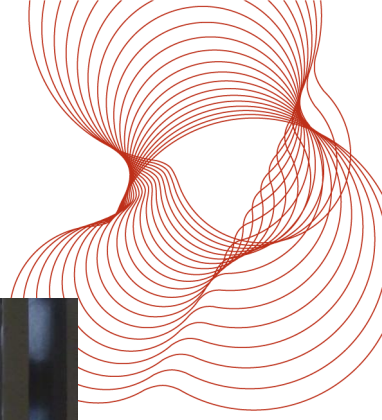


Figure 2 Internal face of folding doorset



Figure 3 View of lower hook bolt and cam



Figure 4 View of deadbolt and latch





Figure 5 View of roller hinge



Figure 6 View of centre leaf shootbolt

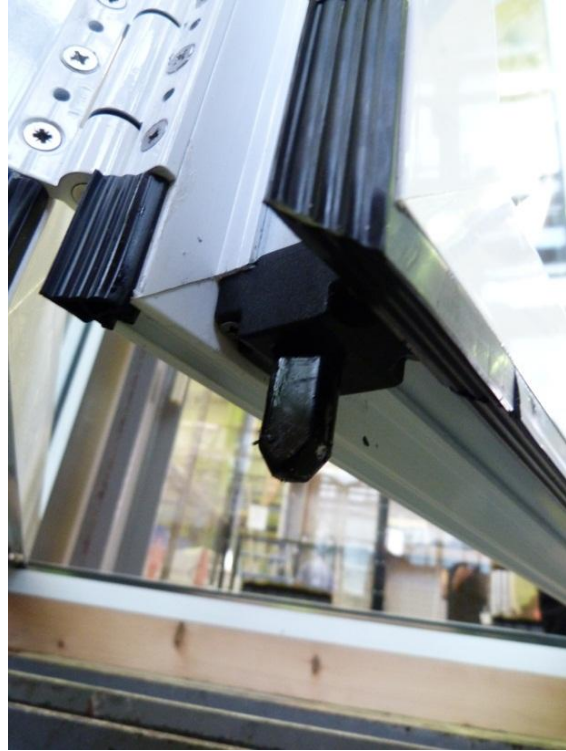
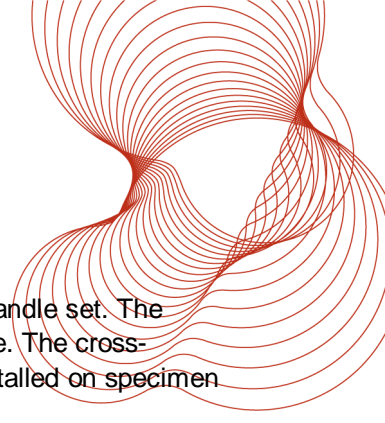


Figure 7 View of non-runner hinge

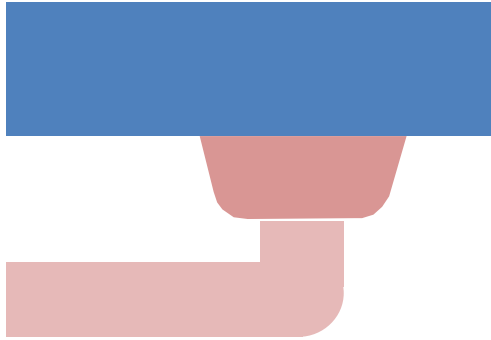




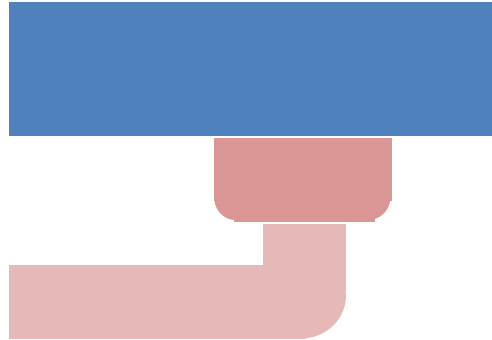
Specimen 292871/02

Specimen 292871/02 was identical to specimen 292871/01 with the exception of the handle set. The apparent difference between the handle sets was their horizontal cross sectional profile. The cross-sectional profiles are shown below. The client advised the incorrect handle set was installed on specimen 292871/02.

Horizontal cross-section of handle set on specimen 292871/01



Horizontal cross-section of handle set on specimen 292871/02



Specimen 292871/03

Specimen 292871/03 was identical to specimen 292871/01. No tests were conducted on this specimen.

4 Test Programme

The tests were carried out in accordance with the procedures described in:

1. Annex A and B^{*} of PAS 24:2012¹.
2. BRE Specific procedures Series F^{3†}.

The tests were conducted in the sequence listed in Table 7.

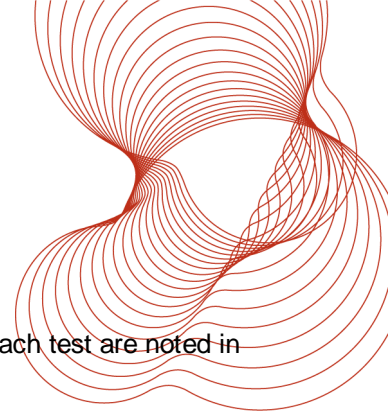
In order to carry out the tests the windows were fitted into the BRE Global Limited security test rig.

The specimens were tested by Mr Paul Dillon and Mr Gareth Hulmes of BRE Global Limited.

At the start of the test the temperature was recorded as 20.2°C and relative humidity 30.4%. The temperature and humidity of the laboratory was recorded and found to be within the limits specified in Clause B.4.2 of PAS 24:2012¹ for a period of 24 hours before the testing and for the duration of the testing.

^{*} Due to specimen delivery times the specimens were only stored for a period of 3 hours prior to the commencement of testing.

[†] Due to the number of specimens supplied, the order of tests was re-arranged in order to obtain maximum possible test data.



5 Summary of test results

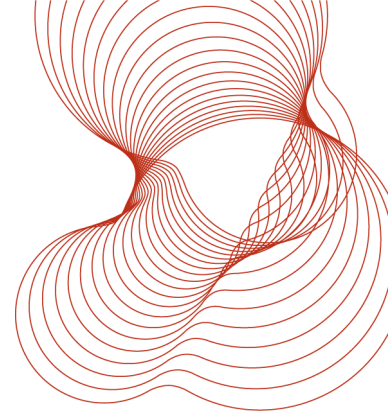
A summary of the results of each test is given in Table 7. Full details of the results of each test are noted in Annex B of this report.

Table 7 Results of PAS 24:2012¹ tests on Smart Architectural Aluminium Limited's Visofold 1000 folding doorset

Test	Test method	Result	Observations/Comments
Specimen 292869b/01			
Mechanical loading test	B.4.5	Pass	No entry achieved.
Security hardware and cylinder test (Part 1 and Part 2)	A.3	Pass	No entry achieved.
Specimens 292869b/02			
Mechanical infill removal test	B.4.4.3	Pass	No entry achieved.
Manual infill removal test	B.4.4.2	Pass	No entry achieved.
Soft body impact test	B.4.8	Pass	No entry achieved.
Hard body impact test	B.4.9	Pass	No entry achieved.
Manipulation test	B.4.3	Pass	No entry achieved.
Manual cutting test	B.4.4.4	Pass	No entry achieved.
Manual check test	B.4.6	Pass	No entry achieved.

No additional mechanical loading tests were conducted on either specimen. This was because no entry was gained during the manual check test.

No tests were conducted on letter plates. This was because the specimens did not incorporate such devices.



6 Conclusions

The Visofold 1000 folding doorset specimens submitted by Smart Architectural Aluminium Limited, met the enhanced security requirements defined in Annex A and B (for doorsets) of PAS 24:2012 for a W K classification*.

The results detailed in this report relate only to the specimens tested.

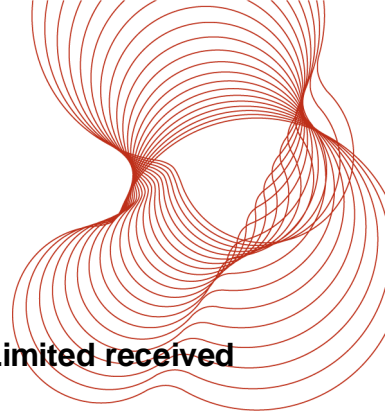
This report should not be used to convey or infer approval or certification of the product by BRE Global Limited unless it is supported by a valid product certificate of approval by BRE Global Limited and is listed in the Red Book. Furthermore, this report should not be used to convey or infer conformity of products of alternative sizes and configurations without further testing or expert assessments, because such differences may affect the windows performance to the requirements of PAS 24:2012¹.

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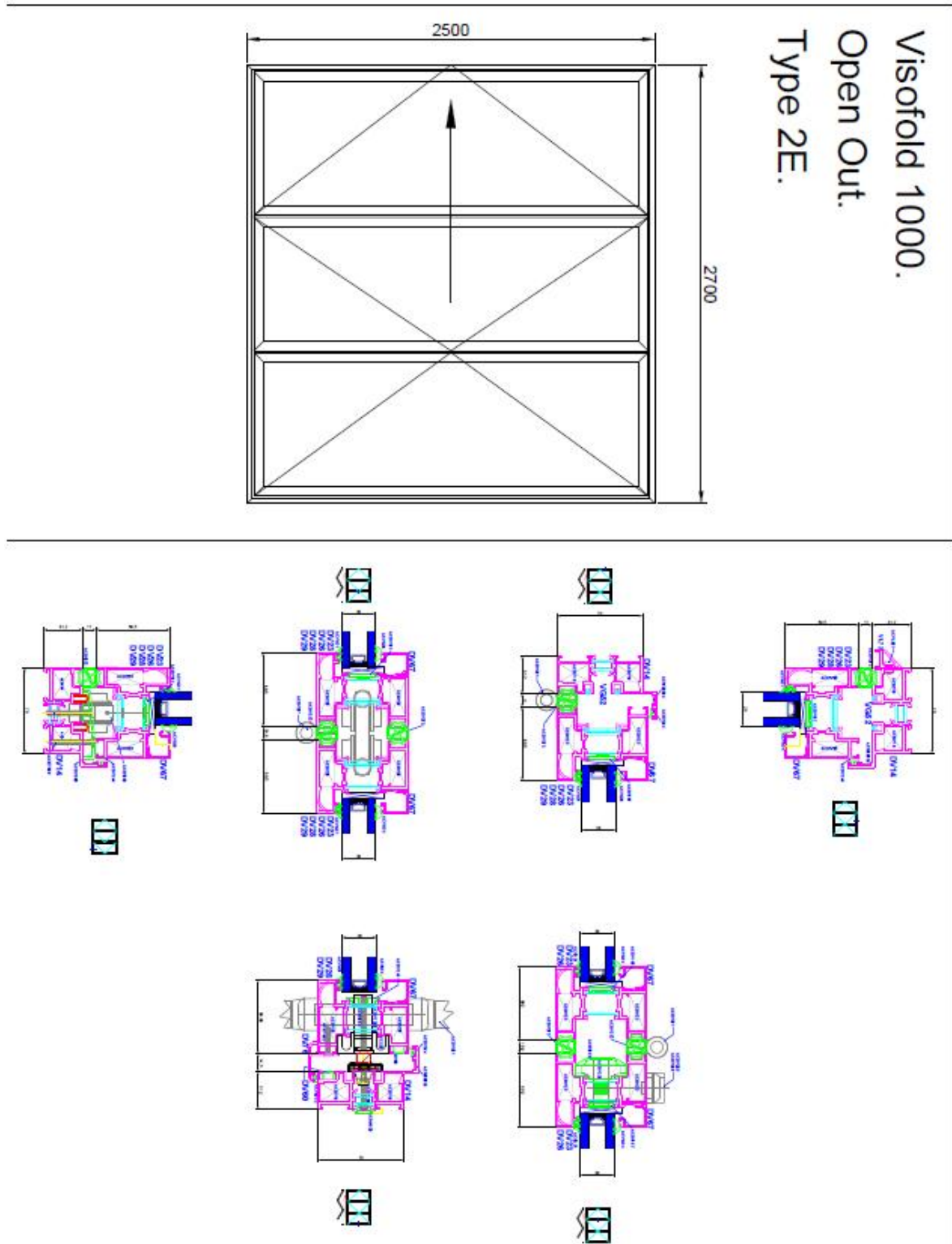
7 References

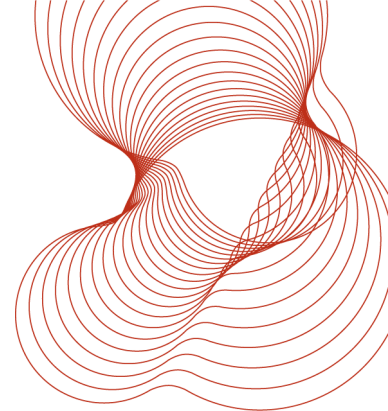
1. PAS 24:2012 *Enhanced security performance requirements for doorsets and windows in the UK – External doorsets and windows intended to offer a level of security suitable for dwellings and other buildings exposed to comparable risk*. British Standards Institution.
2. PN145/8.0 Standard terms and conditions of testing. BRE Global Limited, 6 April 2008
3. BRE Specific procedures Series F. BRE Global Limited.

* This is based on the doorset being fitted with a handle set identical to that incorporated on specimen 292871/01.



Annex A - Document supplied by Smart Architectural Aluminium Limited received 27 May 2014





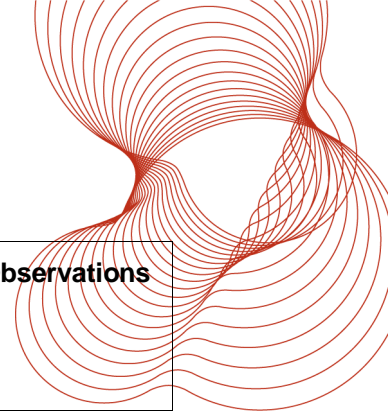
Annex B - Test Results

Clause B.4.5 - Mechanical loading test (Specimen 292871/01)

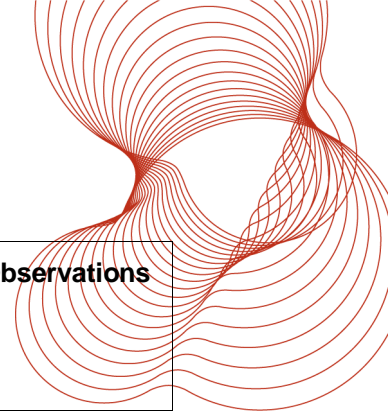
The test was conducted in accordance with the requirements of Clause B.4.5 in accordance with the loading cases defined in Table B.5.

Test date: 23 June 2014

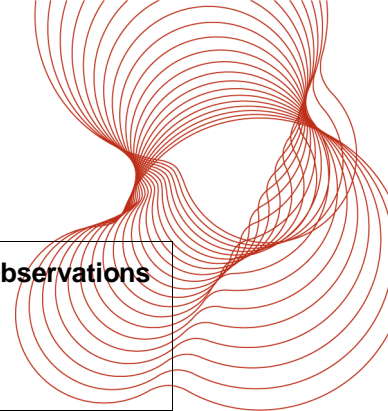
Location	Case <i>(From Table B.5 in PAS24:2012)</i>	Parallel to plane load	Perpendicular to plane load	Prop applied	Observations
Top hinge (leaf to frame).	1	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.
Second to top hinge (leaf to frame).	1	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.
Second to bottom hinge (leaf to frame).	1	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.
Bottom hinge (leaf to frame).	1	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.
Bottom shootbolt (leaf to frame).	5	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.



Location	Case <i>(From Table B.5 in PAS24:2012)</i>	Parallel to plane load	Perpendicular to plane load	Prop applied	Observations
Bottom hinge (leaf to leaf).	2	At right angles to the edge towards the opposite edge (1.5 kN) with an equal and opposite load on the central leaf.	4.5 kN	Prop applied to central leaf close to the loading position	Load held.
Second to bottom hinge (leaf to leaf).	2	At right angles to the edge towards the opposite edge (1.5 kN) with an equal and opposite load on the central leaf.	4.5 kN	Prop applied to central leaf close to the loading position	Load held.
Second to top hinge (leaf to leaf).	2	At right angles to the edge towards the opposite edge (1.5 kN) with an equal and opposite load on the central leaf.	4.5 kN	Prop applied to central leaf close to the loading position	Load held.
Top hinge (leaf to leaf).	2	At right angles to the edge towards the opposite edge (1.5 kN) with an equal and opposite load on the central leaf.	4.5 kN	Prop applied to central leaf close to the loading position	Load held.
Top shootbolt (leaf to frame).	5	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.

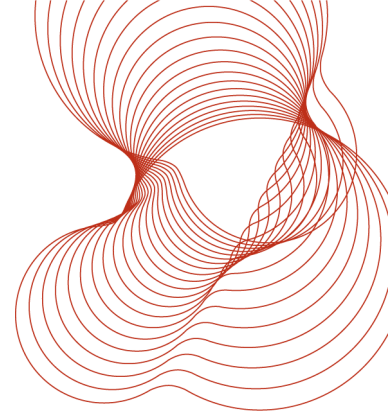


Location	Case <i>(From Table B.5 in PAS24:2012)</i>	Parallel to plane load	Perpendicular to plane load	Prop applied	Observations
Top roller (leaf to frame).	11	At right angles to the edge towards the opposite edge (1.5 kN).	<4.5 kN	No	The roller disengaged from the guide resulting in a maximum entry gap of 100 mm.
			1.5 kN	No	Load held. Maximum gap created 100 mm.
Top hinge (leaf to leaf).	2	At right angles to the edge towards the opposite edge (1.5 kN) with an equal and opposite load.	4.5 kN	Prop applied to central leaf close to the loading position	<i>Load not applied. This was because the top hinge was integrated with the top roller. The top roller held the subsequent 1.5kN load.</i>
Second to top hinge (leaf to leaf).	2	At right angles to the edge towards the opposite edge (1.5 kN) with an equal and opposite load.	4.5 kN	Prop applied to central leaf close to the loading position	Load held.
Second to bottom hinge (leaf to leaf).	2	At right angles to the edge towards the opposite edge (1.5 kN) with an equal and opposite load.	4.5 kN	Prop applied to central leaf close to the loading position	Load held.



Location	Case <i>(From Table B.5 in PAS24:2012)</i>	Parallel to plane load	Perpendicular to plane load	Prop applied	Observations
Bottom hinge (leaf to leaf).	2	At right angles to the edge towards the opposite edge (1.5 kN) with an equal and opposite load.	4.5 kN	Prop applied to central leaf close to the loading position	Load held.
Bottom roller (leaf to frame).	11	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.
Bottom roller cam.	7	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.
Bottom hookbolt (leaf to frame).	5	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.
Centre deadbolt (leaf to frame).	5	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held. Maximum non-permanent deflection was 10 mm.
Top hookbolt (leaf to frame).	5	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.
Top roller cam.	7	At right angles to the edge towards the opposite edge (1.5 kN).	4.5 kN	No	Load held.

Although component failure was exhibited by the top roller, no entry was achieved through the doorset as a result of the mechanical load test.



Clause B.4.4.3 - Infill mechanical tests (Specimen 292871/02)

The test was conducted in accordance with the requirements of Clause B.4.4.3.

Test date: 14 July 2014

Location	Observations
Glazing unit (active leaf)	
Top corner locking edge	No failure of infill retention system
Top corner hinge edge	No failure of infill retention system
Bottom corner hinge edge	No failure of infill retention system
Bottom corner locking edge	No failure of infill retention system

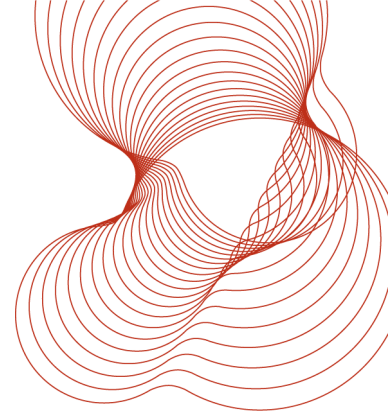
No tests were conducted on the central or third leaf. This was because the glazing retention system on those leaves was identical to that on the active leaf.

Clause B.4.4.2 - Infill manual test (Specimen 292871/02)

The test was conducted in accordance with the requirements of Clause B.4.4.2.

Test date: 14 July 2014

Attack Location	Tools	Overall Time (min:secs)	Observations
Method 1			
Remove bottom gasket.	6 mm screwdriver	00:08	Bottom gasket removed.
Remove vertical gaskets.	6 mm screwdriver and small screwdriver	03:00	It was not possible to remove any further gaskets. It was not possible to remove the glazing. No entry achieved.
Method 2			
Lever back the profiles to release the glazing unit.	6 mm screwdriver, small screwdriver and craft knife	03:00	It was not possible to deform the profiles. It was not possible to remove the glazing. No entry achieved.



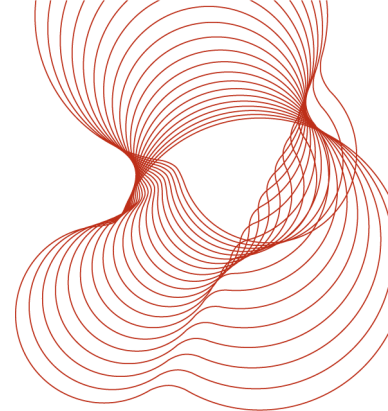
Clause B.4.8 - Soft body impact tests (Specimen 292871/02)

The test was conducted in accordance with the requirements of Clause B.4.8.

Test date: 14 July 2014

Impact location	Observations
0.8 m from floor level	
Active leaf	No visible damage to door leaf or hardware.
Active leaf to centre leaf hinge edge	No visible damage to door leaf or hardware.
Centre leaf	No visible damage to door leaf or hardware.
Centre leaf to third leaf hinge edge	No visible damage to door leaf or hardware.
Third leaf	No visible damage to door leaf or hardware.
1.25 m from floor level	
Active leaf	No visible damage to door leaf or hardware.
Active leaf to centre leaf hinge edge	No visible damage to door leaf or hardware.
Centre leaf	No visible damage to door leaf or hardware.
Centre leaf to third leaf hinge edge	No visible damage to door leaf or hardware.
Third leaf	No visible damage to door leaf or hardware.
1.7 m from floor level	
Active leaf	No visible damage to door leaf or hardware.
Active leaf to centre leaf hinge edge	No visible damage to door leaf or hardware.
Centre leaf	No visible damage to door leaf or hardware.
Centre leaf to third leaf hinge edge	No visible damage to door leaf or hardware.
Third leaf	No visible damage to door leaf or hardware.

No entry was achieved through the doorset as a result of applying soft body impacts to the above locations.



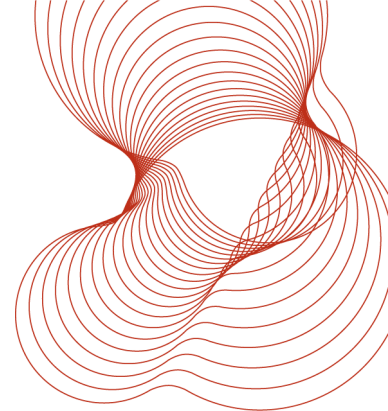
Clause B.4.9 - Hard body impact tests (Specimen 292871/02)

The test was conducted in accordance with the requirements of Clause B.4.9.

Test date: 14 July 2014

Impact location	Observations
Top corner and top hinge (third leaf left hand side).	No visible damage.
Upper middle hinge (third leaf left hand side).	No visible damage.
Lower middle hinge (third leaf left hand side).	No visible damage.
Bottom corner and bottom hinge (third leaf left hand side).	No visible damage.
Bottom shootbolt (left hand centre leaf).	No visible damage.
Bottom corner and bottom hinge (third leaf right hand side).	No visible damage.
Lower middle hinge (right hand third leaf).	No visible damage.
Upper middle hinge (right hand third leaf).	No visible damage.
Top corner and top hinge (third leaf right hand side).	No visible damage.
Top shootbolt (left hand centre leaf).	No visible damage.
Top corner and top hinge (right hand centre leaf).	No visible damage.
Upper middle hinge (right hand centre leaf).	No visible damage.
Lower middle hinge (right hand centre leaf).	No visible damage.
Bottom corner and bottom hinge (active leaf).	No visible damage.
Bottom leading corner (active leaf).	No visible damage.
Bottom cam (active leaf).	No visible damage.
Bottom hook lock (active leaf).	No visible damage.
Cylinder (active leaf).	No visible damage.
Dead bolt (active leaf).	No visible damage.
Top hook lock (active leaf).	No visible damage.
Top cam (active leaf).	No visible damage.
Top leading corner (active leaf).	No visible damage.

No entry was achieved through the doorset as a result of applying hard body impacts to the above locations.



Clause B.4.3 - Manipulation test (Specimen 292871/02)

The test was conducted in accordance with the requirements of Clause B.4.3.

Test date: 14 July 2014

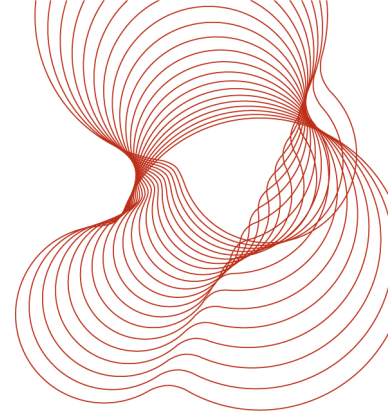
Attack Location	Tools	Overall Time (min:secs)	Observations
Lever back the leading edge astragal and attempt to disengage the lower hook lock.	Two small screwdrivers and a paint scraper	03:00	It was not possible to deform the astragal sufficiently to access the hook bolt or cam. No entry achieved.
Centre deadbolt.	Two paint scrapers and two small screwdrivers	01:30	Attempted to gain access the deadlock and disengage it. No entry achieved.
Hinge.	Two small screwdrivers	01:30	Attempted to overcome hinge by punching the hinge pin out and separating the knuckles. No entry achieved.
Test stopped.	It was evident that entry would not be achieved through the doorset with the tools available. The test operator stopped the test. No entry was achieved.		

Clause B.4.4.4 - Manual cutting test (Specimen 292871/02)

The test was conducted in accordance with the requirements of Clause B.4.4.4.

Test date: 14 July 2014

Attack Location	Tools	Overall Time (min:secs)	Observations
Door leaf frame profile.	6 mm wood chisel and craft knife	03:00	Attempted to cut hole through the door leaf frame profile. It was not possible to pierce the profile. No entry achieved.



Clause A.3 - Security hardware and cylinder test (specimen 292871/01)

The test was conducted in accordance with the requirements of Clause A.3.

Test date: 14 July 2014

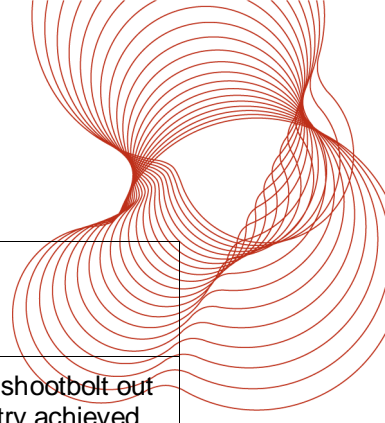
Test method	Attack time (min:secs)	Observations	Total rest time (min:secs)
Method 1			
Lever off handle set to access and remove cylinder.	03:00	Tools inserted behind the handle set and levering forces applied to the handle set. The handle set could not be removed.	03:00
Method 2			
Grip handle set with self-gripping pliers and twist to remove handle set and remove cylinder.	01:30	Straight jaw self-gripping pliers used to remove the handle set. However, it was not possible to grip the handle set using the self-gripping pliers effectively. This was ineffective.	01:30
Method 3			
Lever out spinning disc	01:30	Disc removed.	01:30
Insert self-drilling screw into the cylinder and pull the cylinder out of the door.	01:30	Two screws were used. Neither screw could be sufficiently inserted in to the key way. No entry achieved.	03:00

Clause B.4.6 - Manual check test (Specimen 292871/02)

The test was conducted in accordance with the requirements of Clause B.4.6.

Test date: 14 July 2014

Attack Location	Tools	Overall Time (min:secs)	Observations
Leading edge above and below handle	One screwdriver, one nail bar	03:00	Attempted to lever the leading edge. The astragal was partially removed. However, no entry achieved.
Between middle hinges (active leaf to centre leaf)	One screwdriver, one nail bar	01:30	Attempted to lever the leaves apart. This was ineffective. No entry achieved.
	Two nail bars	01:30	Attempted to lever the leaves apart. This was ineffective. No entry achieved.



Attack Location	Tools	Overall Time (min:secs)	Observations
Local to central leaf shootbolt.	Two nail bars	01:30	Attempted to lever the shootbolt out of engagement. No entry achieved.
Hinge to frame edge.	Two nail bars / screwdrivers	01:30	Attempted to lever the hinge to frame edge of the third leaf. No entry achieved.
Testing stopped	It was evident that entry through the doorset was unlikely to be achieved in the maximum allowed time of 15 minutes using the tools permitted by the standard. Therefore the manual check test was halted. No entry was achieved. No additional loading test was required.		

Clause 4.3 - Letter plate test

No tests were conducted. This was because the specimens did not incorporate a letter plate.

=====REPORT ENDS=====