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Weathertightness testing of Smart Architectural Aluminium Limited's VS600 vertical sliding window to the requirements of BS6375: Part 1: 2009

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14 November 2013

Test report number 287105

UKAS TESTING

0578

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Prepared on behalf of BRE Global by

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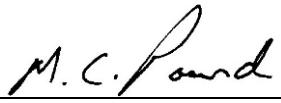
Signature 

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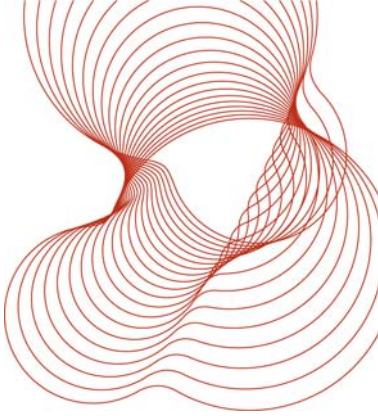


1 Introduction

This report details the results of weathertightness tests performed in accordance with the test methods defined in *BS 6375: Part 1: 2009 – Performance of windows and doors – Part 1: Classification for weathertightness and guidance on selection and specification*[1], on a VS600 vertical sliding window manufactured by Smart Architectural Aluminium Ltd, Technical Department, Smart Architectural Aluminium Ltd, Arnolds Way, Yatton, Bristol, North Somerset, BS49 4QN.

2 Origin of the test request

At the request of Mr Mark Walford of Smart Architectural Aluminium Ltd, Technical Department, Smart Architectural Aluminium Ltd, Arnolds Way, Yatton, Bristol, North Somerset, BS49 4QN, BRE Global Limited issued quotation number SQ5786 on 07 May 2013 covering the testing of the window to BS 6375: Part 1: 2009[1]. The quotation was accepted on 17 June 2013 by Mr D White of Smart Architectural Aluminium Ltd.

Testing was conducted by Mr M C Pound on 31 July 2013 against project number 287105 under the BRE Global Limited Terms and Conditions for Testing (PN145/7.0[2]) and UKAS BRE Specific procedures Series F[3].

The tests were witnessed by:

Mr M Walford – Technical Department, Smart Architectural Aluminium Ltd.

3 Details of the test specimen

A window specimen was submitted on 31 July 2013 for testing to the requirements of BS 6375: Part 1: 2009[1]. The specimen was allocated the unique BRE reference number 287105.

The design and component details of the window tested were as follows. This was based on the documentation provided and observations from the specimen.

3.1 Specimen 287105

Type: 973 mm wide x 1490 mm high aluminium framed window with two vertical sliding sashes. Drawings and photographs in Annex A and B of this report show cross sections of the frame members and window details.

Glazing/ Infill: The window sashes were glazed internally with insulating glass units each comprising 4 mm thick toughened glass and a 20 mm wide gap between them. Aluminium beads retained the glazing and glazing seals.

Seals: Top sash: Two rows of brush type seal at the top and sides and a single row of the same type of seal on the outdoor side of vertical joints and at the meeting rail.

Lower sash: Two rows of brush type seal at the bottom and sides and a single row at the meeting rail and on the outdoor side of vertical joints. There were also two short rows of brush type seal just below the side catches.

Window frame: There were single rows of seal at the top and bottom of the window frame.

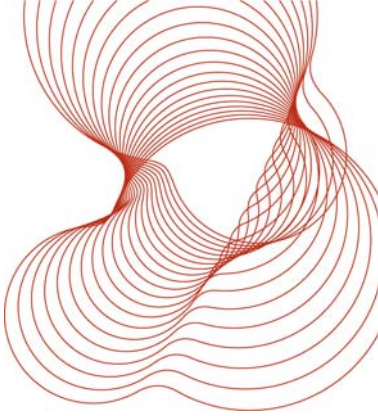
Hardware: Two lockable sash locks with the keeps on the upper sash meeting rail and the locks on the lower sash meeting rail. Two bolts either side of the lower sash meeting rail and at the top of the upper sash could disengage the sash to hinge from the bottom. The lower sash had a handle at the bottom rail and the upper sash had a pole ring to operate it.

Drainage: There were weather hoods at the top of the window frame and at the bottom of the lower sash. There were three slots in the sill below the sash, two hooded slots in the outdoor face of the lower sash frame and two drainage holes in the underside of the lower sash bottom rail.

Fixings: For the tests the specimen was fixed with screws and sealed into a timber sub-frame.

Dimensions: 973 mm wide x 1490 mm high (overall). Area: 1.45 m²

Length of opening joint = 5.51 m



4 Test programme

BS 6375: Part 1: 2009[1] specifies that the air permeability test is performed under both positive and negative test pressures and that the average of the measurements defines the results. It also specifies that water tightness test method A is used and that deflections measured during the resistance to wind load test do not exceed 1/150 of the span. The weathertightness test comprised of three parts in the sequence:

1. Air permeability to BS EN 1026: 2000[4]; by application of a series of test air pressure differentials across the specimen with measurement of the air permeability of it at each pressure step. The maximum positive and negative pressure differential was 600 Pa reached in pressure steps of 50, 100, 150, 200, 250, 300, 450 and 600 Pa.

2. Watertightness to BS EN 1027: 2000[5]; by applying specified amounts of water spray to the outside face of the specimen while incrementally increasing the air pressure differential across it. The test pressure, time and position of any water penetration are recorded. The maximum positive air pressure differential was 300 Pa. Pressure (Pa)/time (min) steps were 0/15, 50/5, 100/5,150/5, 200/5, 250/5 and 300/5.

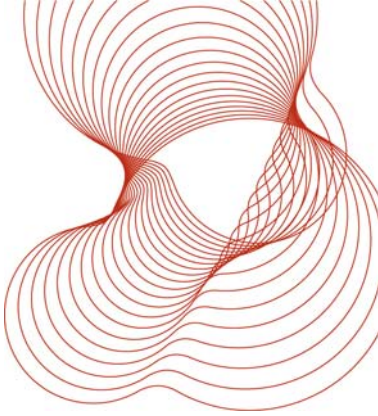
3. Resistance to wind load to BS EN 12211: 2000[6]; by application of a series of positive and negative test air pressures. Measurements and inspections are made to assess relative frontal deflection and resistance to damage from wind loads.

   The resistance to wind load test included a deflection test, a repeated pressure test and operational test, an air permeability test and finally a safety test. For the purpose of the resistance to wind load test three test pressures were defined:

   P1 applied to measure the deflections of parts of the test specimen.
   P2 50 cycles of pulsating pressure to assess performance under repeated wind loads.
   P3 applied to assess the safety of the test specimen under extreme conditions.

   The values of P1, P2 and P3 are related as follows: P2 = 0.5P1, P3 = 1.5P1.
   For these tests the values are: P1 = 1600 Pa, P2 = 800 Pa and P3 = 2400 Pa.

   Note: The repeat air permeability test is an integral part of the resistance to wind load test and its significance is as an indicator of damage that may occur during that test.



5 Classification of results

BS 6375: Part 1: 2009[1] classifies the results for products in the UK. For a window to be included in an exposure category the appropriate test pressures for air permeability, watertightness and resistance to wind shall be attained or exceeded. The relevant product standard BS EN 14351-1:2006[7] also states that classification of air permeability is based on the averages of the positive and negative air leakage values at each pressure step.

The specimen was tested to a UK exposure category of 1600 (1600 Pa). The classifications set in BS 6375: Part 1: 2009[1] for a UK exposure category of 1600 for windows are: Air permeability at Class 2/300 Pa when tested to 300 Pa or class 3 or 4 when tested to 600 Pa, watertightness at Class 5A/200 Pa and resistance to wind load at Class A4 at P1 1600 Pa, P2 800 Pa and P3 2400 Pa.

When averages of the measurements of air permeability per square metre and length of the opening joints on the specimen give rise to adjacent air permeability classes then the specimen shall be classified in the most favourable class (according to BS EN 12207[8] Clause 4.6).

The BS EN classifications are explained below:

Air permeability: BS EN 12207: 1999[8]. The classification is based on a comparison of the air permeability of the test specimen related to both overall area and length of opening joint. There are four classes; Class 4 is applicable to the most airtight specimens while Class 1 describes those with most air leakage. To meet any class the measured air permeability of the specimen must not exceed the upper limit at any test pressure step in that class.

Watertightness: BS EN 12208: 2000[9]. The classification is based on a comparison of the watertightness of the test specimen related to test pressures and duration of the test. There are nine classes; 1A/1B up to 9A for test pressures from 0 Pa to 600 Pa. For specimens that remain watertight over 600 Pa for 5 minutes a class Exxx is used. The xxx is the maximum test pressure e.g. 750 Pa. To meet any class the specimen must remain watertight for 5 minutes up to and at the test pressure set for that class.

Resistance to wind load: BS EN 12210[10]: 1999. The classification is based on a comparison of the resistance to wind loads of the test specimen when subjected to test pressures P1, P2 and P3. There are five classes; 1 up to 5 for P1 test pressures from 400 Pa to 2000 Pa. For specimens that are tested to P1 pressures exceeding 2000 Pa a class Exxxx is used. The xxxx is the actual test pressure P1 used e.g. 2400 Pa. To achieve any class the resistance of the specimen to wind load must meet all the requirements for that class.

Note: This report has results for air permeability under positive and negative test pressures and a graph showing the average air permeability for them at each pressure step.

6 Test rig and preparatory procedures

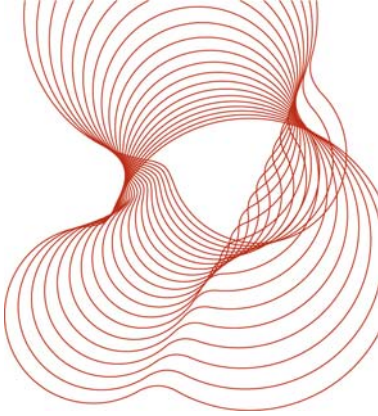
The test specimen was conditioned for at least 4 hours within temperature and humidity ranges specified in the test standards of 10°C to 30°C and 25% to 75% RH respectively.

The water temperature in the watertightness test was within the specified range of 4°C to 30°C.

The specimen was mounted in the BRE test rig 'G', to form one wall of a pressure box, with the outdoor face enclosed in the box.

A spray bar with three full circular cone nozzles was mounted in the pressure box to apply water to the outside face of the specimen. The water flow rate per nozzle was 2 L/min in accordance with BS EN 1027[5] spraying method 1A.

Transducers were mounted on independent supports to measure deflections of a frame member. Deflections were measured on the span at the positions indicated in Figure A2.

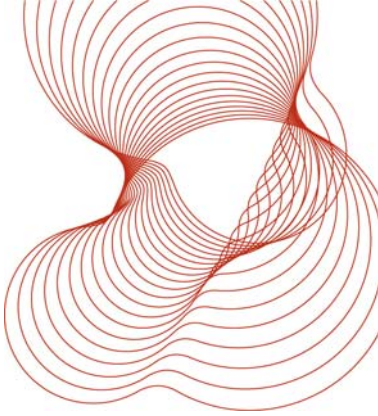


7 Test results summary

The test results are summarised in Table 1. Figures showing the detail of the Smart Architectural Aluminium Ltd, 973 mm wide x 1490 mm high, vertical sliding VS600 window and detailed results are given in Annex A.

Table 1 Summary of weathertightness test results

BS 6375: Part 1: 2009, BS EN 12207, 12208 and 12210 requirements:					
Air permeability		**Watertightness**		**Resistance to wind loads**	
Requirements	**Results**	**Requirement**	**Results**	**Requirements**	**Results**
Class 2 at 300 Pa	Met the requirements of Class 3 for the average of positive and negative test results	Class 5A at 200 Pa	Class 7A at 300 Pa Met & exceeded Class 5A	Class A4 P1 = 1600 Pa P2 = 800 Pa P3 = 2400 Pa	Met all of the require-ments for Class A4



8 Conclusions

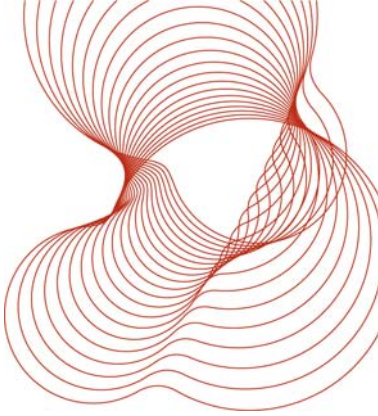
When the specimen Smart Architectural Aluminium Ltd aluminium, 973 mm wide x 1490 mm high, VS600 vertical sliding window was tested to the standards described herein to a UK exposure category of '1600' it was found to be:

- Sufficiently airtight to attain Class 3 based on the averages of results under positive and negative test pressures thus meeting the BS 6375: Part 1: 2009[1] requirements for Class 3 at 600 Pa.
- Resistant to water penetration using method 1A to Class 7A up to and at 300 Pa thus meeting the BS 6375: Part 1: 2009[1] requirements for Class 5A at 200 Pa. The specimen also met the Class 7A requirement up to and at 300 Pa in BS EN 12208[9].
- Resistant to wind loads of ±1600 Pa causing deflections less than 1/150 of the span of a frame member. Resistant to repeated pressure cycles of ±800 Pa and able to sustain the corresponding safety test pressure of ±2400 Pa. The overall classification for resistance to wind load was Class A5 thus meeting the requirements of BS 6375: Part 1: 2009[1].

The results detailed in this report relate only to the specimen 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 certificate for the product issued 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 doors performance to the requirements of BS 6375: Part 1: 2009[1].

Copies of this report shall only be distributed in full without any abridgement or amendment.



9 References

1. BS 6375: Part 1: 2009 Performance of windows and doors – Part 1: Classification for weathertightness and guidance on selection and specification. British Standards Institution. London.
2. PN145/7.0 *Standard terms and conditions of testing and assessments.* BRE Global Limited.
3. UKAS BRE Specific procedures Series F. BRE Global Limited.
4. BS EN 1026: 2000 Windows and doors – Air permeability – Test method. British Standards Institution. London.
5. BS EN 1027: 2000 Windows and doors – Watertightness – Test method. British Standards Institution. London.
6. BS EN 12211: 2000 Windows and doors – Resistance to wind load – Test method. British Standards Institution. London.
7. BS EN 14351-1:2006 Windows and doors – Product standard, performance characteristics – Part 1: Windows and external pedestrian doorsets without resistance to fire and /or smoke leakage characteristics. British Standards Institution. London.
8. BS EN 12207: 2000 Windows and doors – Air permeability – Classification. British Standards Institution. London.
9. BS EN 12208: 2000 Windows and doors – Watertightness – Classification. British Standards Institution. London.
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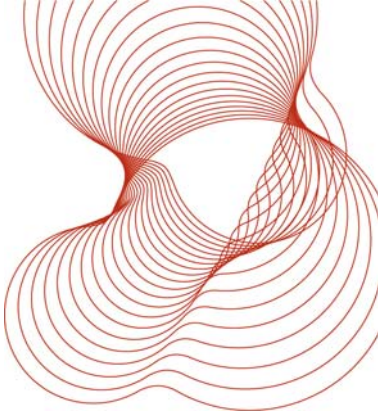


Annex A – Weathertightness test results

Table A1 Air permeability under positive air pressure; test results

Pressure differential Pa	Air flow through the specimen m^3/h	Air flow per unit area of the specimen $m^3/h.m^2$	Air flow per m of opening joint on the specimen $m^3/h.m$
50	5.11	3.52	0.93
100	10.50	7.24	1.91
150	13.97	9.63	2.53
200	15.70	10.83	2.85
250	19.09	13.17	3.46
300	22.19	15.31	4.03
450	28.82	19.88	5.23
600	35.84	24.72	6.50

Table A2 Air permeability under negative air pressure; test results

Pressure differential Pa	Air flow through the specimen m^3/h	Air flow per unit area of the specimen $m^3/h.m^2$	Air flow per m of opening joint on the specimen $m^3/h.m$
50	5.12	3.53	0.93
100	10.63	7.33	1.93
150	15.48	10.68	2.81
200	17.83	12.30	3.24
250	18.92	13.05	3.43
300	23.41	16.15	4.25
450	29.30	20.21	5.32
600	32.33	22.30	5.87

Table A3 Averages of air permeability under positive and negative air pressures; test results

Pressure differential Pa	Average air flow per unit area of the specimen $m^3/h.m^2$	Average air flow per m of opening joint on the specimen $m^3/h.m$
50	3.53	0.93
100	7.29	1.92
150	10.16	2.67
200	11.57	3.05
250	13.11	3.45
300	15.73	4.14
450	20.05	5.28
600	23.51	6.19

Figure A1 Test results: Air permeability under positive and negative air pressure; showing limits and averages of air permeability measured under positive and negative test pressures

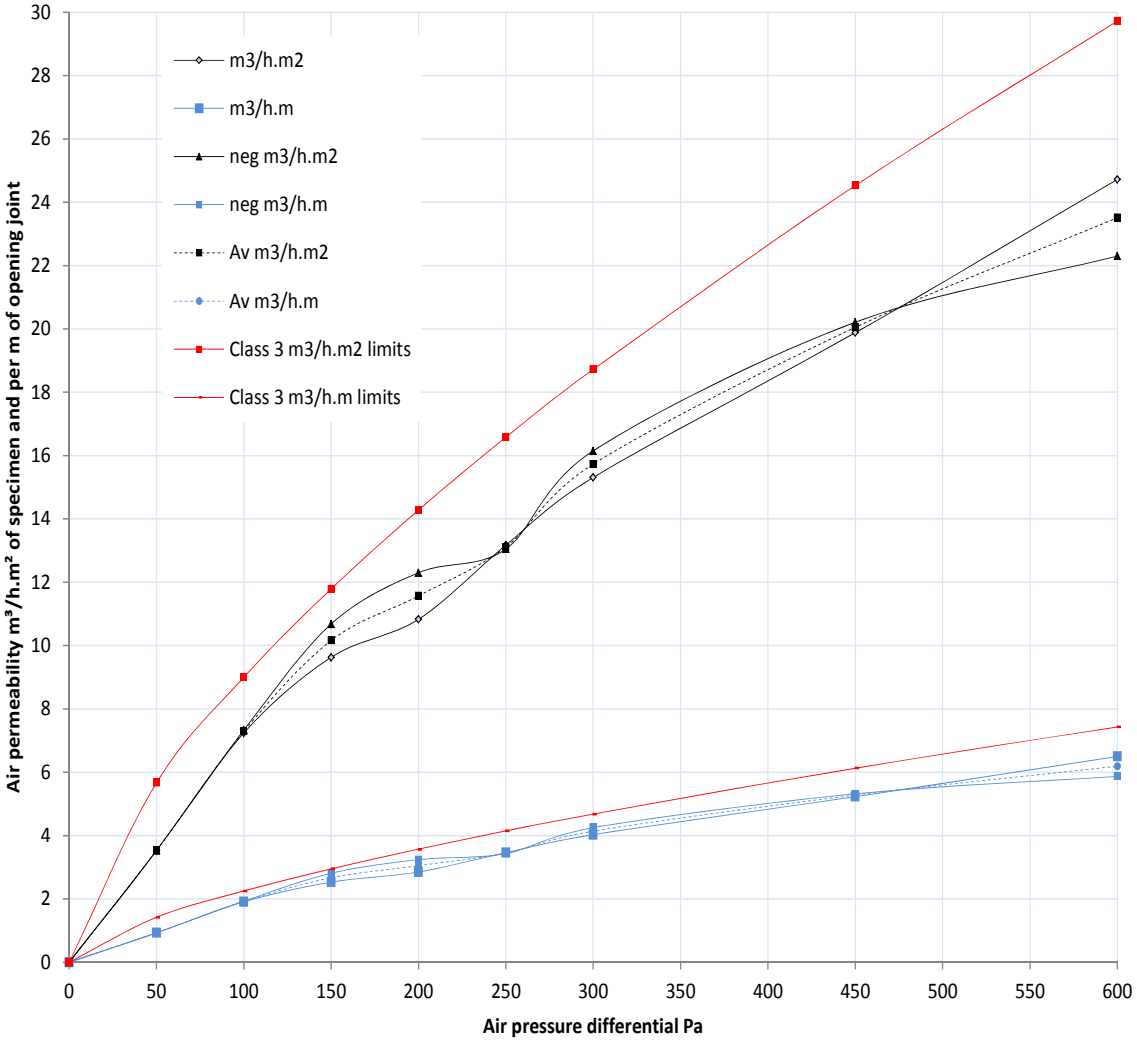


Table A4 Watertightness test results

Pressure differential Pa	Duration Minutes	Water leaks
0	15	Nil
50	5	Nil
100	5	Nil
150	5	Nil
200	5	Nil
250	5	Nil
300	5	Nil

Test laboratory conditions: Air temperature 19.7°C. Test chamber air temperature 19.2°C Air pressure 1007 mb. Relative humidity 81% at 19.7°C. Water temperature 18°C

Table A5 Deflections measured on a frame member in the resistance to wind load test at ±1600 Pa.

Position deflection measured	Positive pressure P1 to +1600 Pa		Negative pressure P1 to -1600 Pa	
	Deflection		Deflection	
	mm	defl./span	mm	defl./span
Right hand stile of centre leaf	0.97	1/866	0.49	1/1714

Note: The deflection at the mid-point of a member is measured relative to its ends, e.g. with reference to Figure A2: Deflection at the mid-point = deflection at the mid-point – average of deflections at the two ends of the same member.

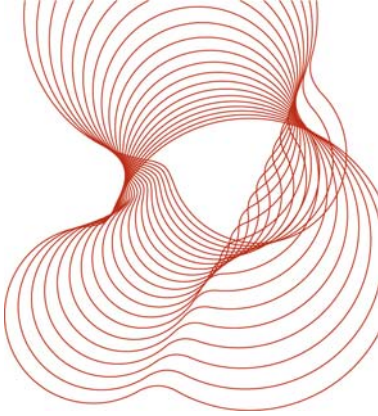


Table A6 Damage or functional defects after repeated pressures to P2 at ±800 Pa

Repeated pressure	Damage or functional defects
50 cycles to P2 at ±800 Pa	None

Table A7 Second air permeability test results under positive air pressures

Pressure differential Pa	Air flow through the specimen m³/h	Air flow through specimen measured at first air permeability test m³/h	Comparison to the air permeability measured previously (see Table A1)
50	4.43	5.11	After the test pressures P1 and P2 were applied the amounts of air flowing through the test specimen were not significantly different to those measured previously
100	9.57	10.50	
150	13.31	13.97	
200	14.94	15.70	
250	18.49	19.09	
300	21.83	22.19	
450	28.51	28.82	
600	35.71	35.84	

Table A8 Second air permeability test results under negative air pressures

Pressure differential Pa	Air flow through the specimen m³/h	Air flow through specimen measured at first air permeability test m³/h	Comparison to the air permeability measured previously (see Table A2)
50	4.86	5.12	After the test pressures P1 and P2 were applied the amounts of air flowing through the test specimen were not significantly different to those measured previously
100	10.66	10.63	
150	15.54	15.48	
200	18.17	17.83	
250	18.62	18.92	
300	23.72	23.41	
450	29.25	29.30	
600	32.45	32.33	

Table A9 Condition of the specimen after the safety test to P3 at ±2400 Pa

Safety test	Condition after test
One pressure pulse to pressure: P3 at – then + 2400 Pa	No parts became detached and the test specimen remained closed

Figure A2 The test specimen – indoor face showing points 1, 2 and 3 where deflections were measured

Figure A3 The outdoor face of the test specimen

Annex B – Profiles used within specimen 287105

Figure B4 Frame cross sections and configuration

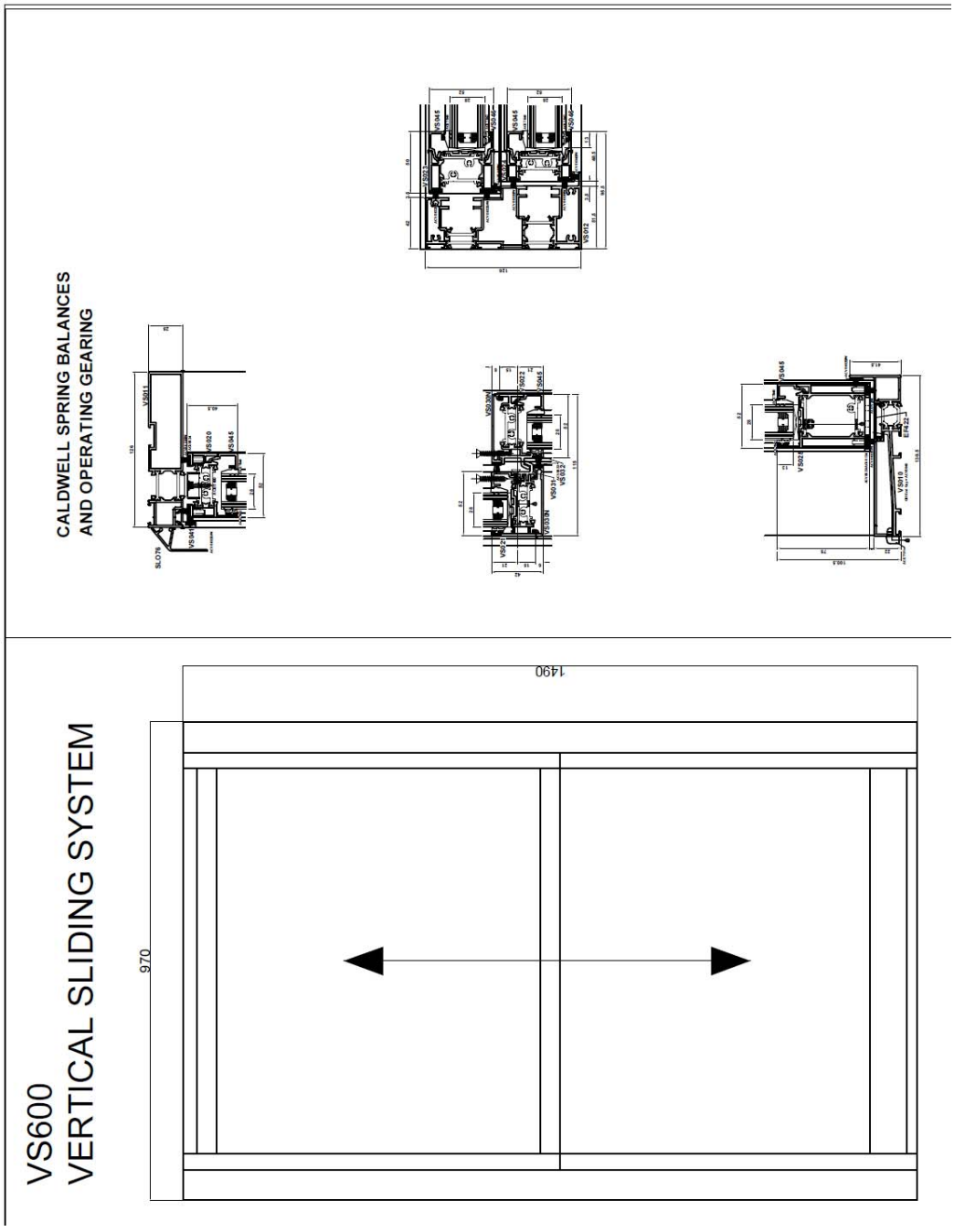
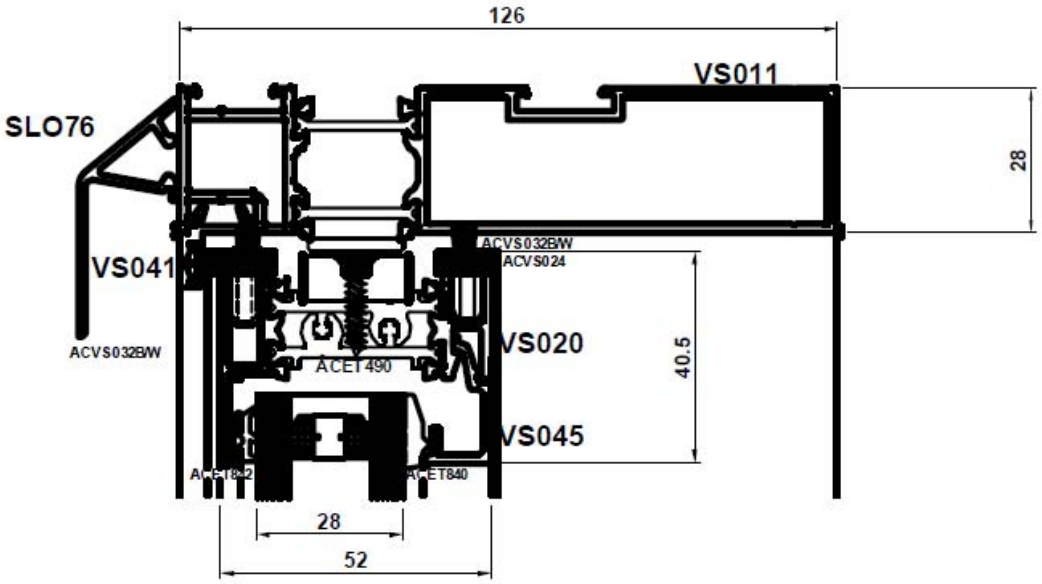


Figure B5 Frame cross sections



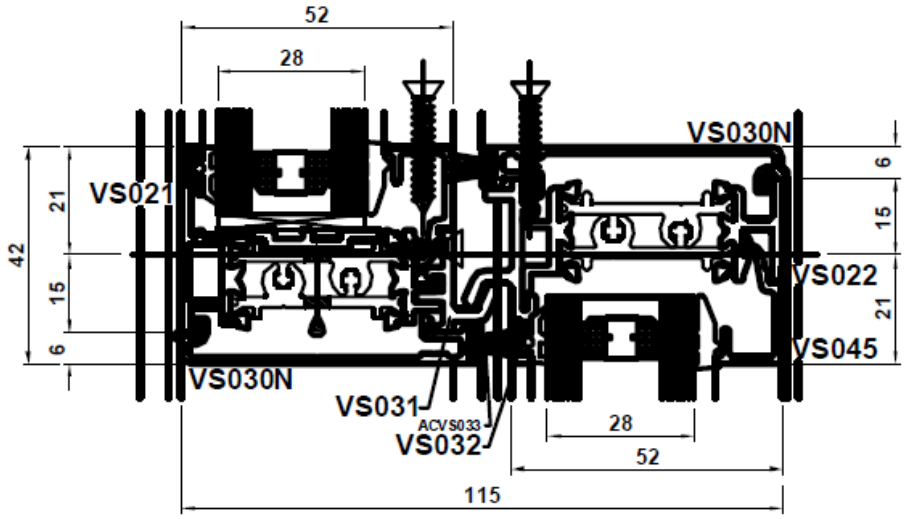
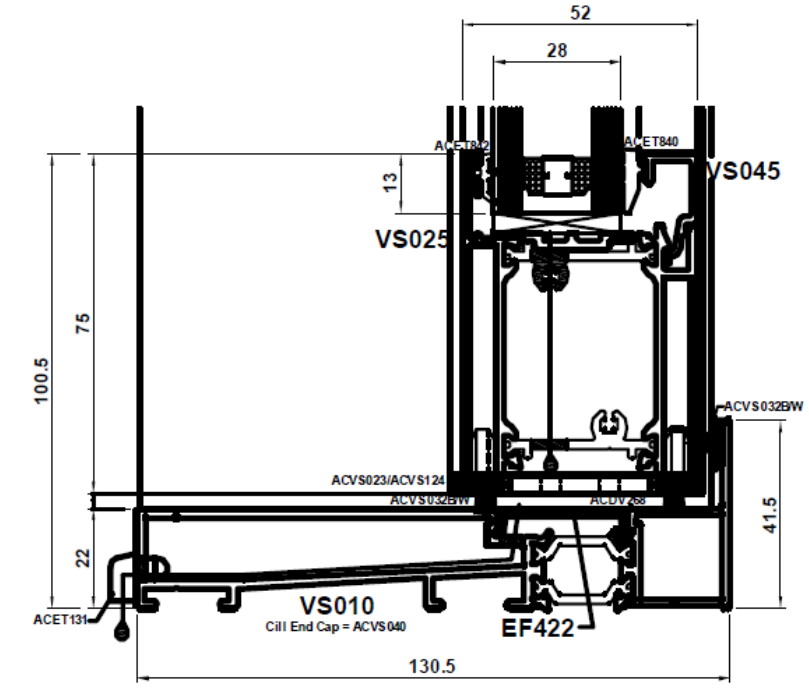
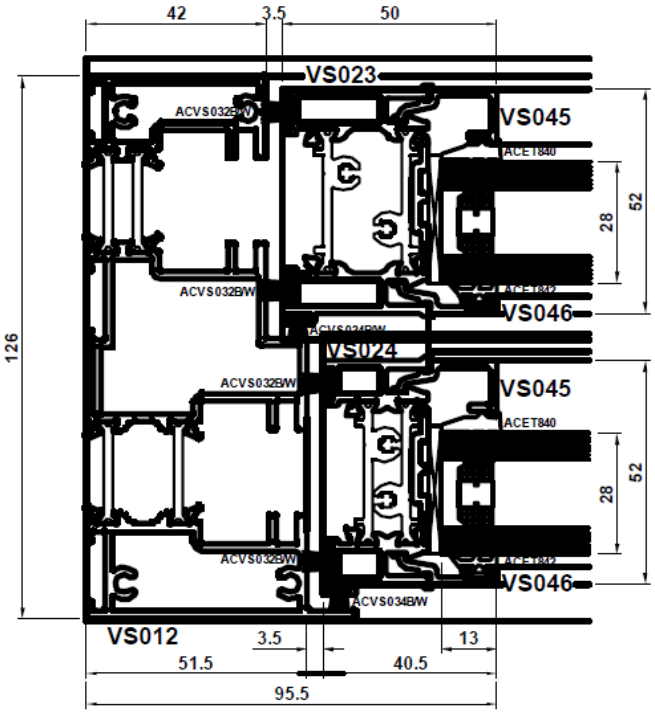


Figure B6 Frame cross sections





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