TECHNOLOGY CENTRE

Technical Report

Title: Product weathertightness testing of a sliding rooflight sample for Vision AGI

Report No: N950-19-17694

Technical Report

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Customer: Vision AGI
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UKAS TESTING
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CONTENTS

1 INTRODUCTION

This report describes tests carried out at VINCI Technology Centre UK Limited at the request of Vision AGI.

The test sample consisted of a sliding rooflight sample manufactured by Vision AGI.

The tests were carried out on 22 March 2019 and were to determine the weathertightness of the test sample. The test methods were in accordance with BS 6375-1:2015 for weathertightness testing.

This test report relates only to the actual sample as tested and described herein.

The results are valid only for sample(s) tested and the conditions under which the tests were conducted.

The long-term durability of the façade system is not assessed by these test methods.

VINCI Technology Centre UK Limited is accredited to ISO/IEC 17025:2017 by the United Kingdom Accreditation Service as UKAS Testing Laboratory No. 0057.

VINCI Technology Centre UK Limited is Notified Body No. 1766.

VINCI Technology Centre UK Limited is certified by BSI for:

- ISO 9001:2008 Quality Management System,
- ISO 14001:2004 Environmental Management System,
- BS OHSAS 18001:2007 Occupational Health and Safety Management System.

The tests were witnessed by John Lascelles of Vision AGI.

2 CLASSIFICATION OF TEST RESULTS

TABLE 1

Test	Standard	Classification / Declared value
Air permeability	BS EN 12207	Class 4 ±900 pascals
Watertightness	BS EN 12208	Class E1050 1050 pascals
Wind resistance	BS EN 12210	Class C5 ±2000 pascals serviceability ± 3000 pascals safety

3 DESCRIPTION OF TEST SAMPLE

3.1 GENERAL ARRANGEMENT

The sample was as shown in the photo below and the drawing included as an appendix to this report.

PHOTO 1411

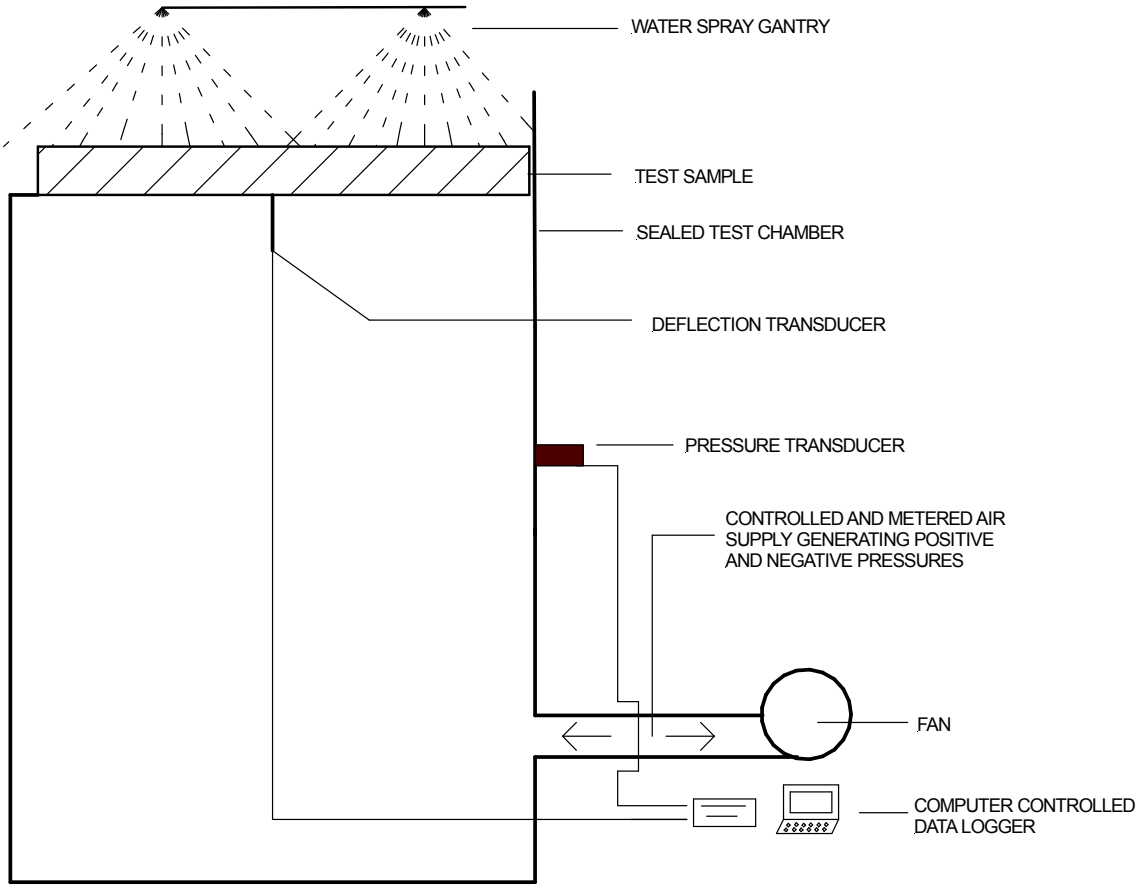
TEST SAMPLE

4 TEST RIG GENERAL ARRANGEMENT

The test sample was mounted on a rigid test rig with support steelwork designed to simulate the on-site/project conditions. The test rig comprised a well sealed chamber, fabricated from steel and plywood. A door was provided to allow access to the chamber. Representatives of Vision AGI installed the sample on the test rig. See Figure 1.

FIGURE 1

TEST RIG SCHEMATIC ARRANGEMENT



SECTION THROUGH TEST RIG

5 TEST SEQUENCE

The test sequence was as follows:

(1) Air permeability

(2) Watertightness – static

(3) Resistance to wind load – deflection

(4) Resistance to wind load – repeated pressure

(5) Air permeability

(6) Wind resistance – safety

6 AIR PERMEABILITY TESTING

6.1 INSTRUMENTATION

6.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber. A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

6.1.2 Air Flow

A laminar flow element mounted in the air system ductwork was used with a pressure transducer to measure the air flow into the chamber. This device was capable of measuring airflow through the sample to within 2%.

6.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air temperatures to within 1°C.

6.1.4 General

Electronic instrument measurements were recorded using a computer controlled data logger.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

The air flow readings are reported in terms of flow at standard conditions.

6.2 FAN

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

6.3 PROCEDURE (BS EN 1026:2016)

The sample shall be sealed over.

Three positive pressure differential pulses of 500 pascals were applied. Measurements of air flow were then taken at positive pressure differentials of 50, 100, 150, 200, 250, 300, 450, 600, 750 and 900 pascals. Each pressure increment was held for at least 10 seconds.

Three negative pressure differential pulses of -500 pascals were then applied. Measurements of air flow were then taken at negative pressure differentials of -50, -100, -150, -200, -250, -300, -450, -600, -750 and -900 pascals. Each pressure increment was held for at least 10 seconds.

The test was then repeated with the sample unsealed. The difference between readings being the air flow through the sample.

6.4 PASS/FAIL CRITERIA

The classification is based on a comparison of the air permeability of the test sample related to overall area and related to the total length of opening joint.

TABLE 2

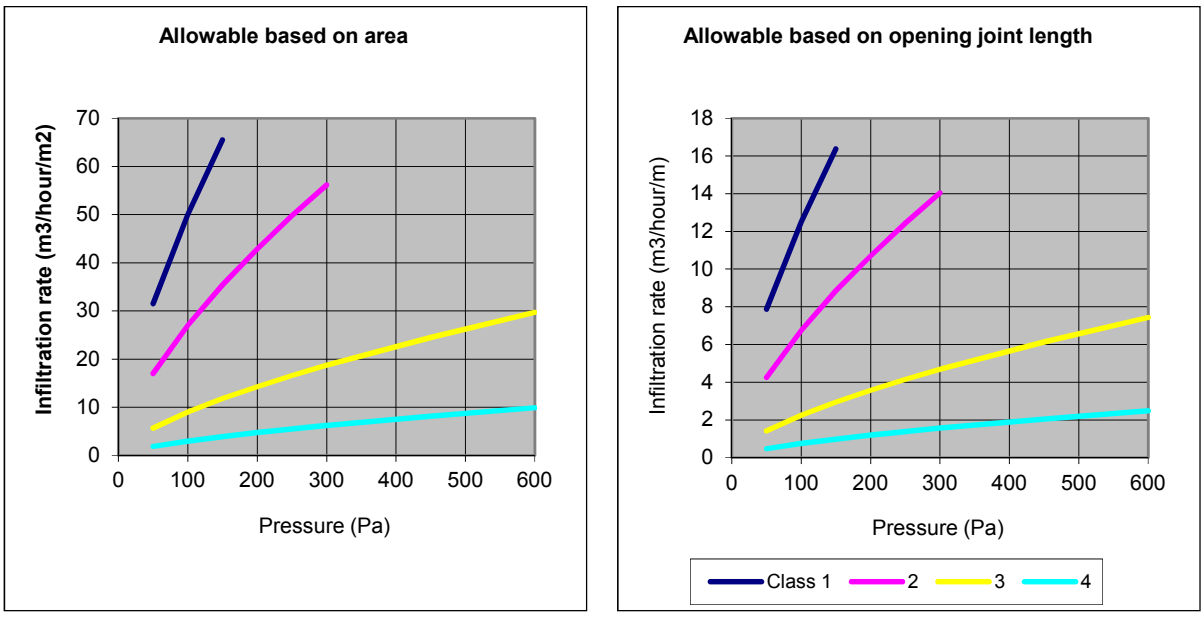
Class	Reference air permeability at 100 Pa (Q_{100})		Maximum test pressure pascals
	$m^3/hour/m^2$	$m^3/hour/m$	
1	50	12.50	150
2	27	6.75	300
3	9	2.25	600
4	3	0.75	600

At intermediate pressures, p_n, flow rates, Q_n, shall be calculated using $Q_n = Q_{100}(p_n/100)^{2/3}$ as shown in the graphs below.

The test sample will be classified as follows:

- If the measured air permeability falls in the same class by area and length of joint then the sample shall be classified in that class.
- If the measured air permeability falls in two adjacent classes by area and length of joint then the sample shall be classified in the most favourable class.
- If the measured air permeability falls in classes two apart by area and length of joint then the sample shall be classified in the mean class.
- If the measured air permeability falls in classes more than two apart by area and length of joint then the sample shall not be classified.

FIGURE 2



The area of the sample was 6.0 m^2.

Length of openable joints was 6.2 m.

6.5 RESULTS

TABLE 3

Pressure differential	Measured air flow through sample			
	Test 1 Date: 22 March 2019			
	Infiltration		Exfiltration	
(pascals)	(m^3/hour/m)	(m^3/hour/m^2)	(m^3/hour/m)	(m^3/hour/m^2)
50	0.15	0.15	0.00	0.00
100	0.35	0.37	0.00	0.00
150	0.52	0.53	0.00	0.00
200	0.77	0.80	0.15	0.15
250	0.77	0.80	0.27	0.26
300	1.03	1.07	0.63	0.61
450	1.56	1.62	1.48	1.44
600	2.08	2.15	2.42	2.34
Temperatures	Ambient = 10°C Chamber = 11°C			

TABLE 4

Pressure differential (pascals)	Average air flow through sample	
	(m^3/hour/m^2)	(m^3/hour/m)
±50	0.08	0.07
±100	0.18	0.18
±150	0.27	0.26
±200	0.48	0.46
±250	0.53	0.52
±300	0.85	0.82
±450	1.55	1.50
±600	2.28	2.21

The results are shown graphically in Figures 3 and 4.

TABLE 5

Pressure differential	Measured air flow through sample			
	Test 5 Date: 22 March 2019			
	Infiltration		Exfiltration	
(pascals)	(m^3/hour/m)	(m^3/hour/m^2)	(m^3/hour/m)	(m^3/hour/m^2)
50	0.24	0.25	0.00	0.00
100	0.08	0.08	0.00	0.00
150	0.05	0.05	0.16	0.17
200	0.39	0.40	0.08	0.08
250	0.50	0.52	0.24	0.25
300	0.71	0.73	0.40	0.42
450	1.06	1.10	1.10	1.13
600	1.81	1.87	1.71	1.77
750	2.21	2.28	2.58	2.67
900	2.45	2.53	3.58	3.70
Temperatures	Ambient = 10°C Chamber = 11°C			

TABLE 6

Pressure differential (pascals)	Average air flow through sample	
	(m^3/hour/m^2)	(m^3/hour/m)
±50	0.13	0.12
±100	0.04	0.04
±150	0.11	0.10
±200	0.24	0.23
±250	0.38	0.37
±300	0.58	0.56
±450	1.12	1.08
±600	1.82	1.76
±750	2.48	2.40
±900	3.12	3.02

The results are shown graphically in Figures 5 and 6.

FIGURE 3

Test 1 average air permeability test results based on area

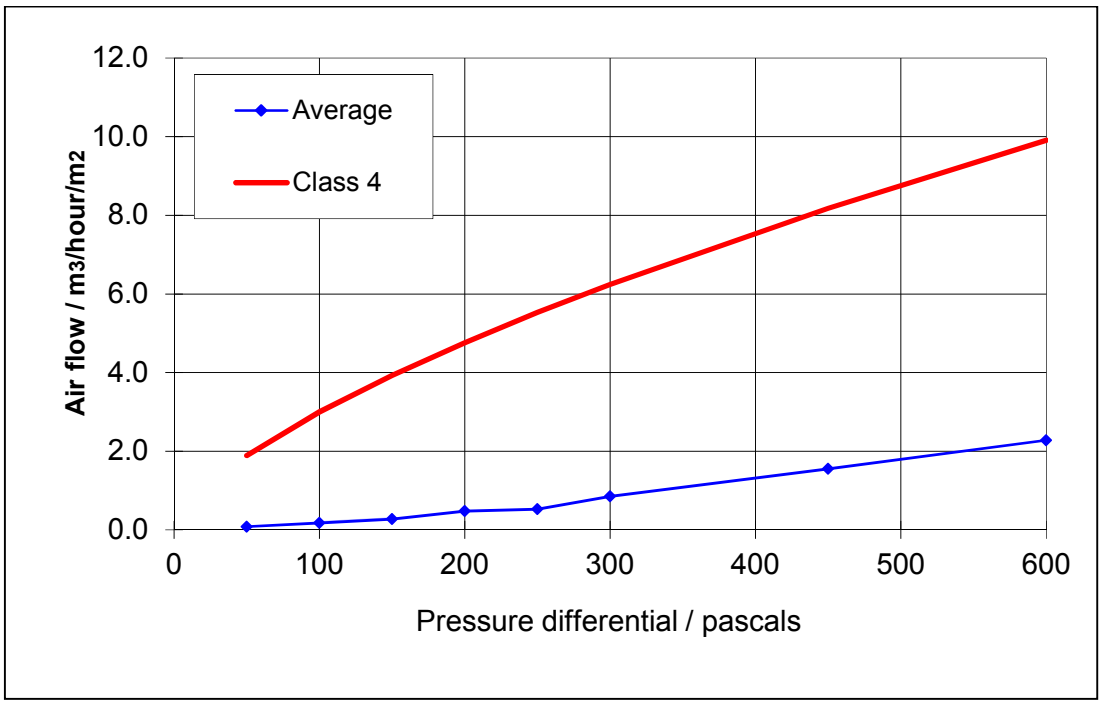


FIGURE 4

Test 1 average air permeability test results based on length of opening joint

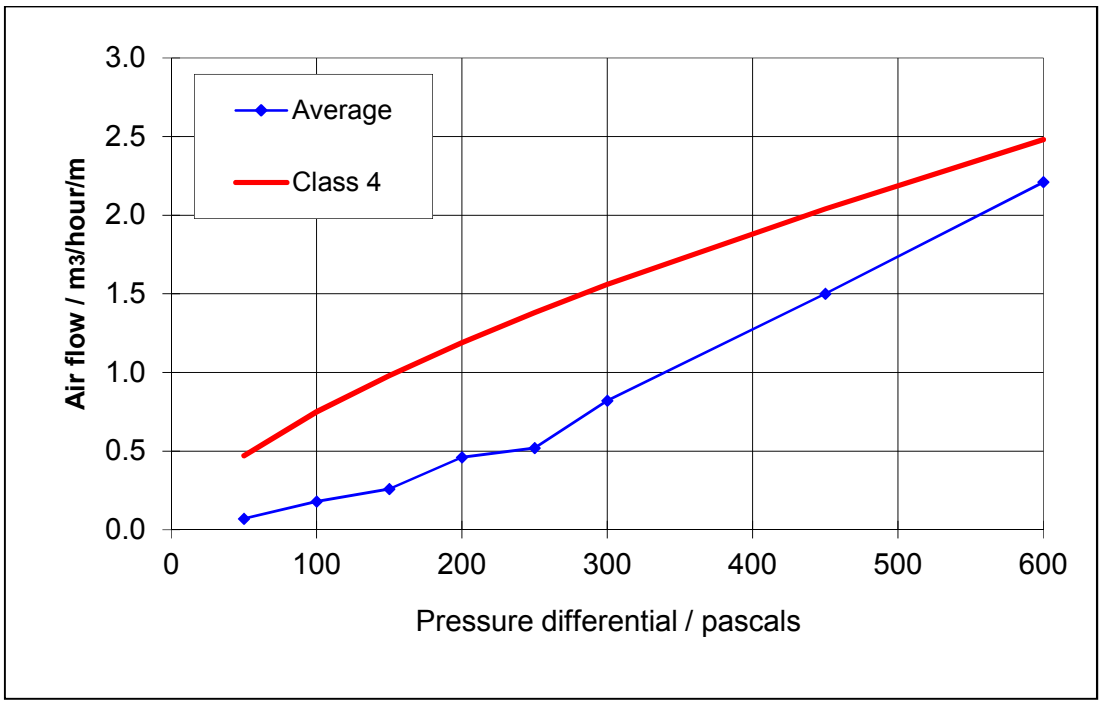


FIGURE 5

Test 5 average air permeability test results based on area

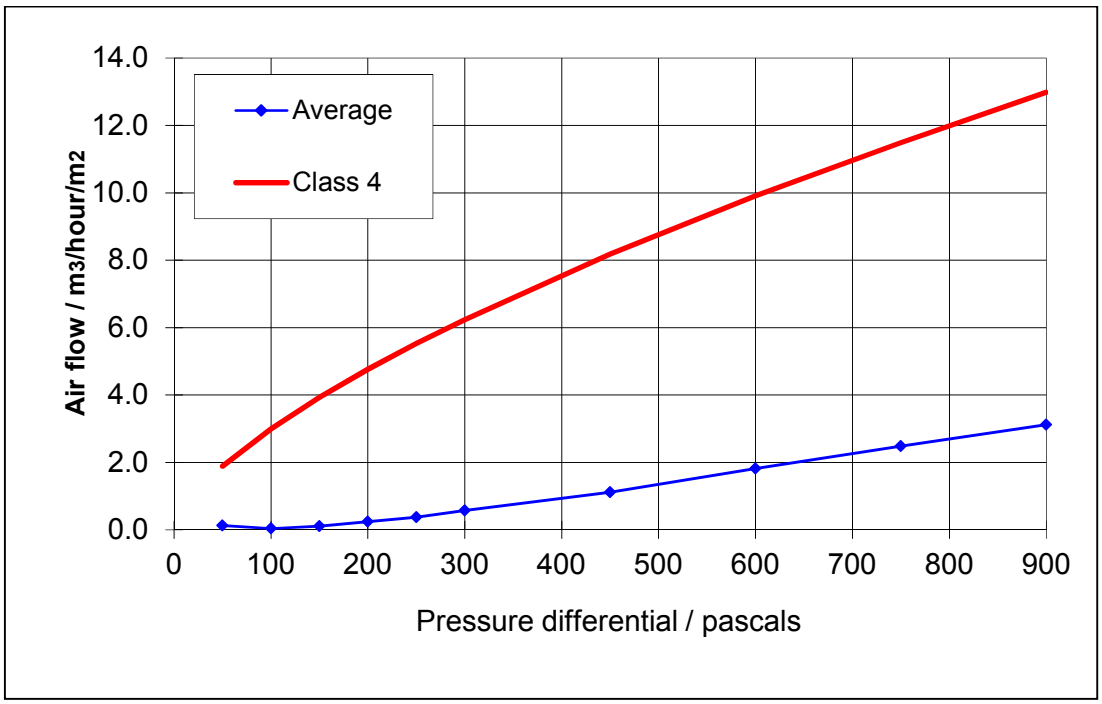
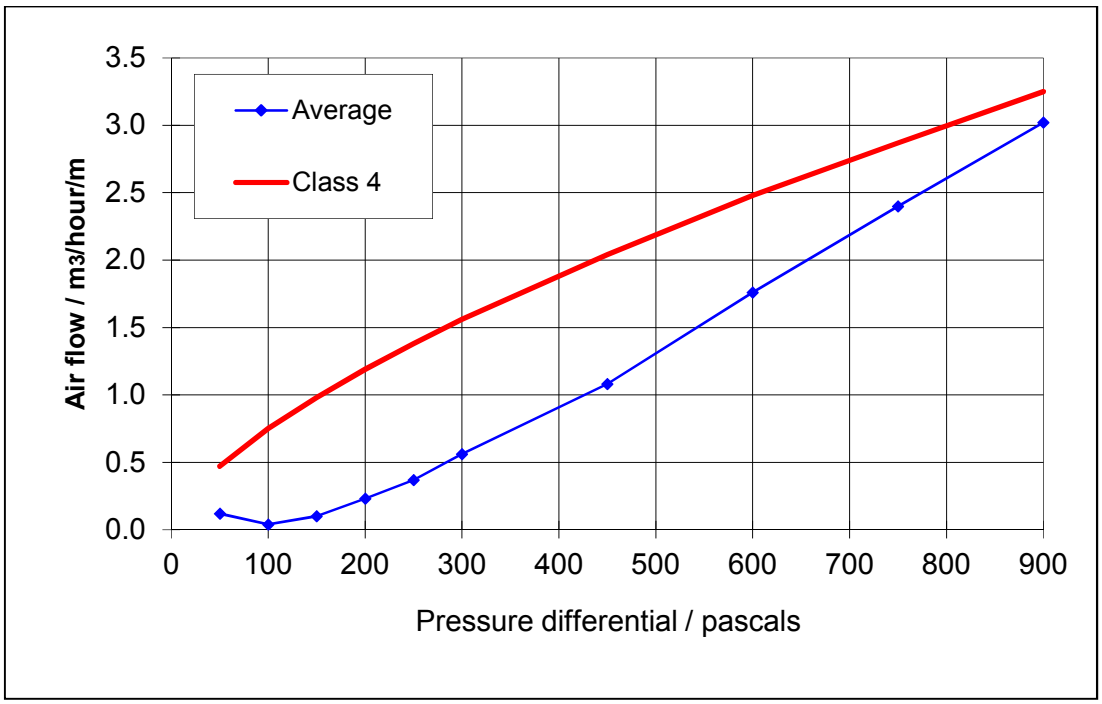


FIGURE 6

Test 5 average air permeability test results based on length of opening joint



7 WATERTIGHTNESS TESTING

7.1 INSTRUMENTATION

7.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

7.1.2 Water Flow

An in-line water flow meter was used to measure water supplied to the spray gantry to within 5%.

7.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air and water temperatures to within 1°C.

7.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

7.2 FAN

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

7.3 WATER SPRAY

The water spray system comprised nozzles spaced 700 mm apart and mounted 400 mm from the face of the sample. The nozzles provided a full-cone circular pattern with a 120° spread. The spray system delivered water uniformly against the exterior surface of the sample.

7.4 PROCEDURE (BS EN 1027:2000)

The door was opened and locked closed.

Three positive pressure differential pulses of 500 pascals were applied to prepare the test sample.

Water was sprayed onto the sample at a rate of 2.0 litres/minute per nozzle for 15 minutes at zero pressure differential. With the water spray continuing the pressure differential across the sample was then increased in the following increments, each held for 5 minutes: 50, 100, 150, 200, 250, 300, 450, 600, 750, 900 and 1050 pascals.

Throughout the test the interior face of the sample was examined for water penetration.

7.5 PASS/FAIL CRITERIA

There shall be no water penetration to the internal face of the sample throughout testing. At the completion of the test there shall be no standing water in locations intended to remain dry.

7.6 RESULTS

Test 2 Date: 22 March 2019

No water leakage was observed throughout the test.

Chamber temperature= 12°C
Ambient temperature = 11°C
Water temperature = 9°C

8 WIND RESISTANCE TESTING

8.1 INSTRUMENTATION

8.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

8.1.2 Deflection

Displacement transducers were used to measure the deflection of principle framing members to an accuracy of 0.1 mm. The gauges were set normal to the sample framework at mid-span and as near to the supports of the members as possible and installed in such a way that the measurements were not influenced by the application of pressure or other loading to the sample. The gauges were located at the positions shown in Figure 7.

8.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air temperatures to within 1°C.

8.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

8.2 FAN

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

8.3 PROCEDURE (BS EN 12211:2000)

8.3.1 Resistance to wind load – deflection

Three positive pressure differential pulses of 2200 pascals were applied to prepare the sample and the displacement transducers zeroed.

The sample was subjected to a positive pressure differential pulse from 0 to 2000 (P1) pascals to 0. The pressure was applied as rapidly as possible but not quicker than 100 pascals/second and maintained for 30 seconds.

Three negative pressure differential pulses of -2200 pascals were applied to prepare the sample and the displacement transducers re-zeroed.

The sample was then subjected to a negative pressure differential pulse from 0 to -2000 (P1) pascals to 0. The pressure was applied as rapidly as possible but not quicker than 100 pascals/second and maintained for 30 seconds.

Displacement readings were taken at each peak and 60 seconds after returning to zero pressure.

8.3.2 Resistance to wind load – repeated pressure

50 negative and positive cycles were applied to the sample.

Each cycle was between -1000 (P2) pascals and 1000 (P2) pascals.

The pressure was held for 7 ±3 seconds at each positive and negative peak and the variation between peaks took 7 ±3 seconds.

8.3.3 Wind resistance – safety

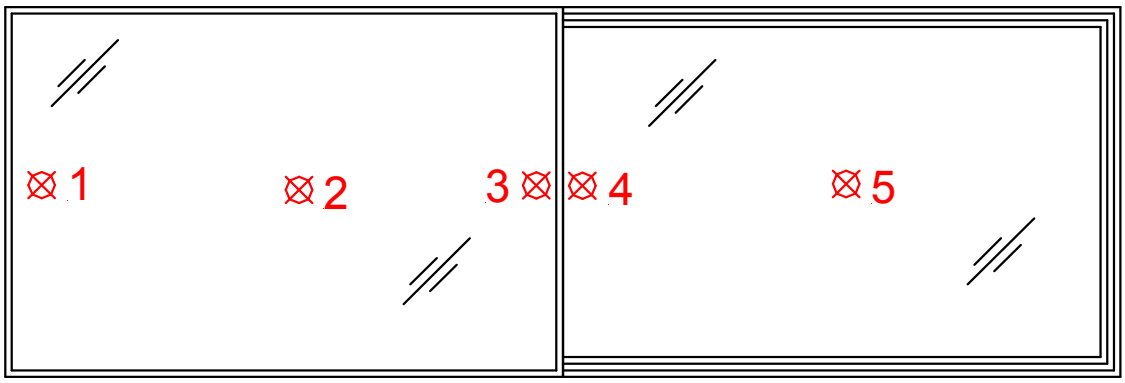
A cycle of -3000 (P3) pascals, zero, 3000 (P3) pascals and zero was applied to the sample.

The time between each step was 7 ±3 seconds and the pressure was held for 7 ±3 seconds.

FIGURE 7

DEFLECTION GAUGE LOCATIONS

Plan View



⊠ Deflection gauge

8.4 PASS/FAIL CRITERIA

8.4.1 Calculation of permissible deflection

Gauge number	Member	Span (L) (mm)	Permissible deflection (mm)	Permissible residual deformation
2	Glass	2000	Class C: L/300 = 6.6	1 mm

8.4.2 Resistance to wind load

Bending or twisting of hardware and splitting or cracking of framing members shall be permitted provided no parts become detached and the sample remains closed

8.5 RESULTS

Test 3 (deflection) Date: 22 March 2019

The deflections measured during the wind resistance test, at the positions shown in Figure 7, are shown in Table 7.

Summary Table:

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
2	Glass	2000 -2002	3.1 -3.8	0.2 -0.2

No damage to the test sample was observed.

Ambient temperature = 11°C
Chamber temperature = 10°C

Test 4 (repeated pressure) Date: 22 March 2019

No damage to the test sample was observed.

Ambient temperature = 11°C
Chamber temperature = 11°C

Test 6 (safety) Date: 22 March 2019

No damage to the sample was observed.

Ambient temperature = 12°C
Chamber temperature = 12°C

TABLE 7

RESISTANCE TO WIND LOAD – DEFLECTION TEST RESULTS

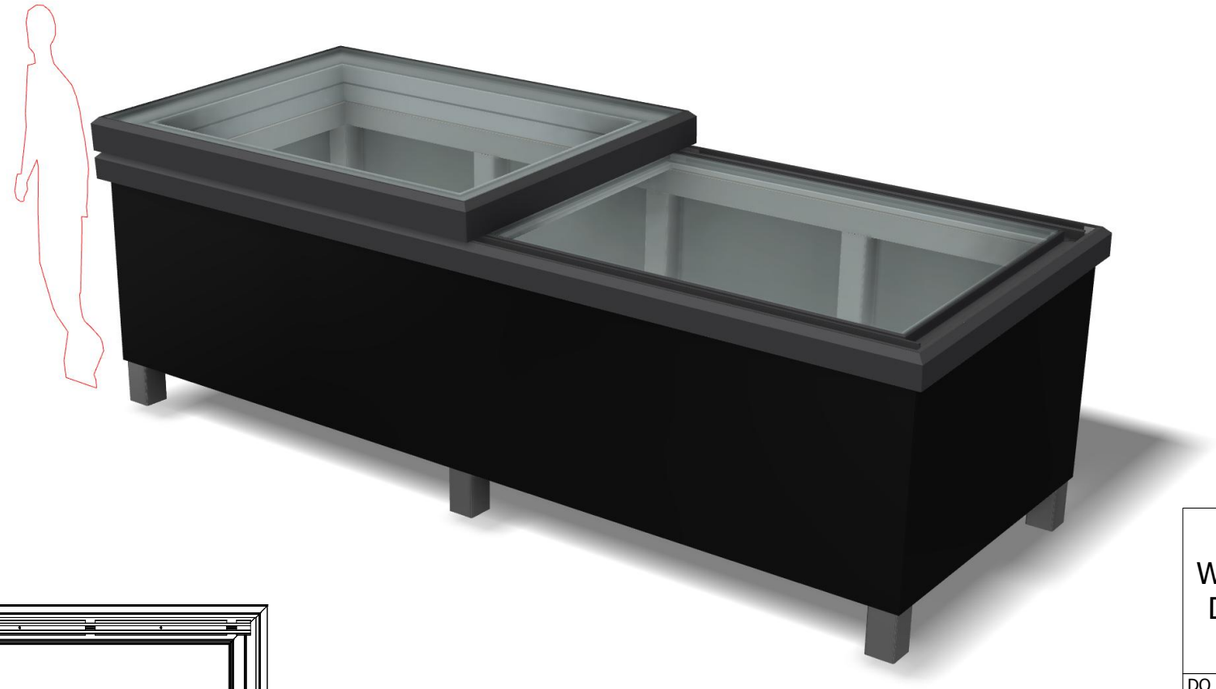
Position	Pressure (pascals) / Deflection (mm)			
	2000	Residual	-2002	Residual
1	0.7	0.1	-3.3	0.1
2	3.7	0.2	-6.7	-0.1
3	0.6	0.0	-2.5	0.1
4	1.0	0.0	-1.0	0.1
5	3.2	0.2	-4.4	-0.2
2 *	3.1	0.2	-3.8	-0.2

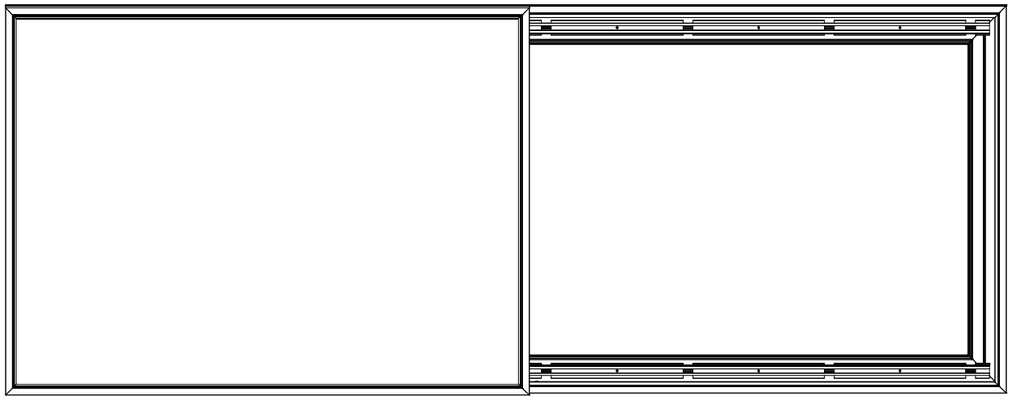
* Mid-span reading adjusted between end support readings

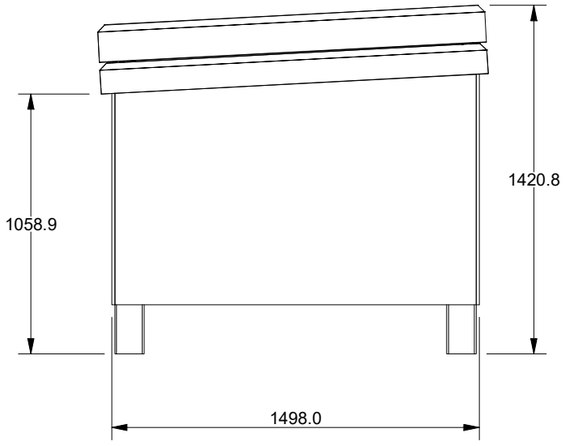
9 APPENDIX - DRAWING

The following unnumbered page is a copy of Vision AGI drawing numbered 300-VINCI-001.

END OF REPORT







WORKSHOP DRAWING

VISION AGI

DO NOT SCALE THIS DRAWING.
IF IN DOUBT ASK.

All dimensions in mm unless stated otherwise.
Remove all burrs and sharp corners.
Tolerances unless otherwise stated:

Whole numbers	± 0.50mm
One decimal place	± 0.20mm
Two decimal places	± 0.10mm
Angles	± 0.5°

Quantity:	N/A
Material:	N/A
Finish:	N/A
Weight:	N/A

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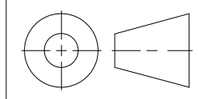

PRODUCT/PROJECT:
Sliding Over Fixed

DESCRIPTION:
Vinci Testing Drawing

MODIFICATION DETAILS

ISSUE	DESCRIPTION	NAME/DATE
-	**First Issue**	**JWL 30/10/2018**

DRAWN JWL 30/10/2018	CHECKED BY: EW 30/10/2018
SCALE 1:25 @A3	
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