MC 600 - Curtain Wall System

CWCT – Standard for systemised building envelopes – 2005

Smart Systems Ltd

Test Report No. R4791391132 Rev 2

DATE: February 4, 2025

UL Solutions

UKAS TESTING 5772

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Rev 1 (Revised Report) – this report has been amended as shown in Section 10 and it replaces previous report No. R4791391132 dated 29th January 2025.

Rev 2 (Revised Report) - this report has been amended as shown in Section 10 and it replaces previous report No. R4791391132 Rev 1 dated 31st January 2025.

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1. Introduction

This report describes tests carried in order to determine the weather tightness of the sample with respect to air leakage, water penetration, wind and impact resistance on sample supplied as follow:

Test Details	
Customer:	Smart Systems Ltd Arnolds Way Bristol BS49 4QN
Product Tested	MC 600 - Curtain Wall System
Test Standard:	CWCT – Standard for systemised building envelopes – 2005
Date of Test:	14th and 15th November 2024 6th, 10th and 12th December 2024
Test Conducted at:	UL International (UK) Limited Halesfield 2 Telford Shropshire TF7 4QH
Test Conducted by:	P Seymour Laboratory Technician J Dove Laboratory Technician C Niven Laboratory Assistant
Test Supervised by:	M Witkowska Laboratory Manager
Test Witnessed by:	M Walford Smart Systems Ltd J Candy Smart Systems Ltd

Report Authorisation	
Report Compiled by:	R Cooper Project Handler
Authorised by:	Dave Price Senior Engineering Associate

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2. Summary of Results

2.1 The test methods

The performance of the sample tested has been assessed against the criteria described in below standards.

CWCT Standard Test Methods for Building Envelopes - December 2005	
Air Leakage (Infiltration & Exfiltration)	CWCT Section 5
Water Penetration – Static	CWCT Section 6
Water Penetration – Dynamic Aero Engine	CWCT Section 7
Water Penetration – Hose	CWCT Section 9
Wind Resistance – Serviceability	CWCT Section 11
Wind Resistance – Safety	CWCT Section 12
Impact – Safety (Soft body)	CWCT Section 15

2.2 Decision Rule

Classifications reported in Section 6 indicate that the product conforms with the relevant accuracy requirements of the testing standards (as summarised below) and the expanded measurement uncertainty (k= 2 for approximately 95% coverage probability) is no greater in magnitude than the accuracy requirements defined in Section 4 of BS EN 12207:2000 and Section 4 and Section 5 of BS EN 12210:2016.

2.3 Measurement Uncertainty

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%, and for the air leakage measurements is ±1.2 % whereas for the wind resistance measurements is ±1.3 %.

2.4 Summary of Results

The following summarises the results of testing carried out, in accordance with the relevant testing and classification standards.

Test Type	Peak Test Pressure	Result	Classification
Test 1 - Air Leakage (Infiltration)	600 Pa	Pass	A4
Test 2 - Air Leakage (Exfiltration)	100 Pa	(See note[1])	N/A
Test 3 - Water Penetration (Static Pressure)	600 Pa	Pass	R7
Test 4 - Wind Resistance (Serviceability)	2400 Pa	Pass	N/A
Test 5 - Repeat Air Leakage (Infiltration)	600 Pa	Pass	A4
Test 6 - Repeat Air Leakage (Exfiltration)	100 Pa	(See note[1])	N/A
Test 7 - Repeat Water Penetration (Static Pressure)	600 Pa	Pass	R7
Test 8 - Water Penetration (Dynamic Aero Engine)	600 Pa	Pass	N/A
Test 9 - Water Penetration - Hose	-	Pass	N/A
Test 10 - Wind Resistance - Safety	3600 Pa	Pass	N/A
Test 11 - Impact Resistance - Safety	-	Pass	I5 & E5
Dismantle, Inspect & Report	Pass		

Note[1]: *There is no classification or performance requirement for exfiltration testing in CWCT Standard for Systemised Building Envelopes – Section 5.*

The test sample successfully passed all of the above CWCT test requirements, and all tests are either equal to or in excess of the requirements for current BS EN Standards for Curtain Walling.

More comprehensive details are reported in Section 6.

These results are valid only for the conditions under which the test was conducted.

All measurement devices, instruments and other relevant equipment were calibrated and traceable to National Standards.

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3. Description of Test Sample

The description of the test sample in this section has been supplied by Smart Systems Ltd and has not been verified by UL International (UK) Limited.

See Section 7 for test sample drawings as provided by Smart Systems Ltd.

Product Description

Full product name:	MC 600
Product type:	Curtain Wall
Product description:	Stick Build Curtain Wall
Manufactured by:	Smart Systems Ltd

Framing Members

Material:	Aluminium
Finish:	Powder Coated
Mullion Ref:	MC619. ACMC6119 End Caps
Transom Ref:	MC614, MC616. MC619
Mullion/Transom Jointing method:	2 Part Fixing Bracket, Anti Rotation Spring Pin. Transom End Pad Sealed to Mullion and Transom with ACSIL04
Fixing Screw Ref:	ACIM 062, ACET060
Max Span of Mullion between floors:	3900mm
Max Span of Transom between Mullions:	1695mm
Expansion joint:	10mm Splice Joint. With Aluminium 1000mm Internal Sleeve. ACMC689. ACMC644 Splice Joint Covers
Thermal Breaks:	Vertical MC005, Horizontal MC005
Construction tolerance allowed between framing members (+/-)	1mm

Glazing & Infills

Glazing unit thickness as tested	28mm
Max glazing weight:	160 Kg
Infill types:	Double Glazed Units
Glazing retention method:	Pressure Plate
Pressure Plate Ref:	MC150
Pressure Plate Screw Ref:	ACMC6345

Panels / Tiles / Brickslip

Material:	Aluminium External skin/ EPS 300E Expanded Polystyrene Core/ Aluminium internal skin
Finish:	Powder Coating
Thickness:	28mm
Max height of panel:	2400mm
Max width of panel:	100mm

Fixing method:	Glazed into system around Perimeter

Interface Details (curtain wall to window/door inserts)

Window interface detail:	Glaze In Parallel Opening Window

Additional Part Codes

Vertical External Capping	DK053 With ACMC660 End Caps
Horizontal External Capping	MC652
Transom to Mullion Fixing Bracket.	ACMC611
Anti Rotation Spring Pin.	ACMC650
Glazing infill to cill pressing	MC165
Glazing Support.	ACMC6030
Sealant around internal window perimeter	ACSIL04
Backing cord to perimeter sealant.	ACVG561
Perimeter EPDM Adhesive	OBEX 0771FR
ACMC706 Internal gasket sealant.	Soudal Silirub EPDM
ACMC151 External gasket sealant.	Soudal Silirub EPDM
Transom End Pads.	ACMC6014, ACMC6016, ACMC6019

Sealing

Gasket Materials:	EPDM
Internal gasket ref:	ACMC706
Pressure plate gasket ref:	ACMC151
External EPDM perimeter Seal	OBEX Cortex 0500FR Class B Membrane
Internal EPDM Perimeter Seal	OBEX Cortex 0500FR Class B Membrane
External Perimeter Silicone Seal	Soudal Silirub 2
External Transom Seal	ACMC6035 Transom Glazing Trim
External sealant type:	Low Modulus
External sealant supplier and ref:	Soudal. Silirub 2

Drainage

Drainage type (pressure equalised etc.):	Drained Down though External Pressure Plate Gaskets
Size	5mm x 25mm

Brackets & Fixings

Fixing bracket ref:	Be Spoke, 10 mm Steel L type brackets. M10 Bolts, Washers, Nyloc Nuts

Opening Vent full description

Product range name:	Alitherm 700
Configuration:	Parallel Opening
Opening direction:	Outwards

Outer Frame

Outer frame width:	1325mm	**Outer frame material:**	Aluminium
Outer frame height:	1475mm	**Outer frame gasket**	
Outer frame Part Numbers		Gasket type:	EPDM
Top:	ETC717	Manufacturer:	Aliplast
Bottom:	ETC717	Product name:	Flipper Gasket
Lock side:	ETC717	Product code:	ACET160
Hinge side:	ETC717	**Threshold**	
Outer frame section size		Manufacturer:	
Width:	67mm	Product name:	
Depth:	70mm	Product code:	
Reinforcing:	NA	Material:	
Manufacturer:		**Outer frame joint method**	
Product name:		Head:	Glue And Crimp
Product code:		Foot:	Glue And Crimp
Material:			

Leaf

Leaf width:	1247mm	**Leaf material:**	Aluminium
Leaf height:	1397mm	**Leaf gasket**	
Leaf Part Numbers		Gasket type:	EPDM
Top:	ETC721	Manufacturer:	Aliplast
Bottom:	ETC721	Product name:	Flipper Gasket
Lock side:	ETC721	Product code:	ACET160
Hinge side:	ETC721	**Leaf midrail:**	NA
Leaf section size		Manufacturer:	
Width:	70.5mm	Product name:	
Depth:	70mm	Product code:	
Reinforcing:	NA	Material:	
Manufacturer:		**Leaf joint method**	
Product name:		Head:	Glue And Crimp
Product code:		Foot:	Glue And Crimp

Glazing

Glass unit		**Glazing gasket**	
Manufacturer:	Cornwall Glass	Gasket type:	EPDM
Inner thickness:	6mm	Manufacturer:	Vekker
Spacer material:	Aluminium	Product name:	E Gasket, Wedge
Outer thickness:	6mm	Product code:	ACVG31, ACVG34
Unit sizes:	1130mmx 1230mm	**Glazing clip**	NA
Bead		Manufacturer:	
Manufacturer:	Smart Systems	Product name:	
Product name:	Alitherm 700	Product code:	
Product code:	ETC766	**Glazing tape details**	NA
Bead size:	31mm x 16.5mm	Manufacturer:	
Bead material:	Aluminium	Product name:	

Hardware

	Manufacturer:	Product description:	Product code:	Quantity:
Hinges:	Securistyle	Parallel, Opening Control Stays	ACETPPS59L ACETPPS59R ACETPPS67R ACETPPS67L	1 1 1 1
Hinge fixing:	Righton	Flange Head Screw	ACET068	20
Hinge protectors:	NA			
Hinge protector fixings:	NA			
Window lock:	ERA	Basic Lock Kit	ACET710	1 Set
Window lock fixings:	Righton	No.7 csk	ACET060	
Cylinder:	NA			
Cylinder fixing:	NA			
Handle:	Winlock	Cranked Handle	ACET165	1 Pair
Handle fixings:	Righton	M5 Machine Screw	ACET069	4
Keeps:	J Banks	Corner and Center Keeps	ACET710	1 Set
Keep fixings:	Righton	No7 csk	ACET060	
Drip bar:	Smart Systems	Drip Bar	ETC572	1
Drip bar fixings:	Smart Systems	Revit	ACVL061	6 off
Locking Shoot Bolts	ERA	Shoot Bolts	ACET714	2 off
Drain Caps	Smart Systems Ltd	Drain Caps	ACET131	6 off

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Drawings

Drawing/s must be provides covering the below; - Full drawing of sample including front elevation - Cross Sections - Hardware Locations - Fixings - Drainage Points Note: Drawings are required to show all relevant dimensions.	As detailed in Section 7
Test sample size:	7250mm x 8000mm

Confirmation

Customer is to confirm that the samples provided for testing are representative of standard production. Please note: the details given above, as well as the drawings supplied by the customer as confirmed as typical of normal production are not verified by UL International (UK) Limited.	
Company:	Smart Systems Ltd
Name:	Mark Walford
Position:	R and D Engineer
Date:	13th December 2024

Sample during testing

Photograph No. 1 - Dynamic Test

Photograph No. 2 - Hose Test

4. Test Arrangement

4.1 Test Chamber

A specimen, supplied for testing in accordance with CWCT requirements, was mounted on to a rigid test chamber constructed from steel, timber and plywood sheeting.

The pressure within the chamber was controlled by means of a centrifugal fan and a system of ducting and valves. The static pressure difference between the outside and inside of the chamber was measured by means of a differential pressure transmitter.

4.2 Instrumentation

4.2.1 Static Pressure

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

4.2.2 Air Flow

A laminar flow element, mounted in the air system ducting, was used along with differential pressure transducers to measure the airflow required to obtain pressures within the test chamber and has the capability of measuring airflow through the sample to an accuracy within 2%.

4.2.3 Water Flow

An in-line flowmeter, mounted in the spray frame water supply system, was used to measure water flow to the test sample to an accuracy of + 5%.

4.2.4 Deflection

Digital linear measurement devices with an accuracy of +/- 0.1 mm were used to measure deflection of principle framing members.

4.2.5 Temperature & Humidity

A digital data logger capable of measuring temperature with an accuracy of ± 1°C and humidity with an accuracy of ±5 %RH was used.

4.2.6 Barometric Pressure

A digital barometer capable of measuring barometric pressure with an accuracy of ±1 kPa was used.

4.2.7 General

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

4.3 Pressure Generation

4.3.1 Static Air Pressure

The air supply system comprised of a centrifugal fan assembly and associated ducting and control valves and was used to create both positive and negative static pressure differentials. The fan provided a constant airflow at the required pressure and period required for the tests.

Note: References are made to both positive and negative pressures in this document, it should be noted that in these instances, positive pressure is when pressure on the weather face of the sample is greater than that on the inside face and vice versa.

4.3.2 Dynamic Aero Engine

A wind generator was mounted adjacent to the external face of the test sample and used to create positive pressure differential during dynamic testing.

4.4 Water Spray System

4.4.1 Spray frame arrangement

A water spray system was used which comprised of nozzles spaced on a uniform grid, not more than 700 mm apart and mounted approximately 400 mm from the face of the sample. The nozzles provided a full cone pattern, as per the requirements outlined by CWCT. The system delivered water uniformly to the entire surface of the test sample at a rate of not less than 3.4 lt/m2/min.

4.4.2 Hose arrangement

The water was applied using a brass nozzle which produced a solid cone of water droplets with a nominal spread of 30˚. The nozzle was provided with a control valve and a pressure gauge between the valve and the nozzle. The water flow to the nozzle was adjusted to produce 22 $\pm$ 2 litre/min when the water pressure at the nozzle inlet was 220 $\pm$ 20kPa

4.5 Impactor

4.5.1 Soft Body Impactor (as specified in BS EN 12600:2002)

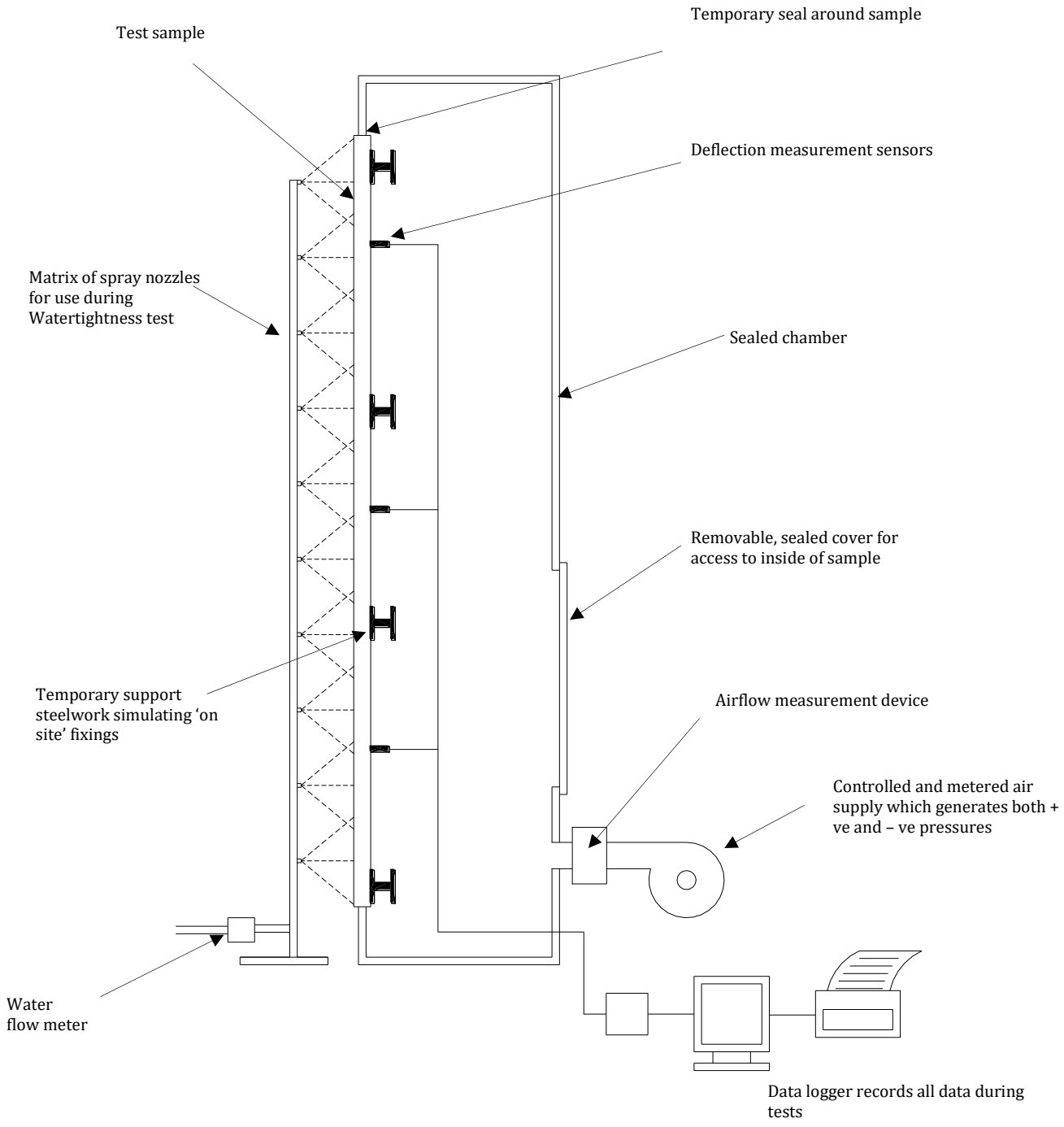
The BS EN 12600 impactor, as per the requirement of CWCT Section 15 & BS EN 13049:2003 was used and calibrated at appropriate intervals and traceable to National Standards.

It comprised of two specified pneumatic tyres; two equal steel weights and a means of their connection, to give a total mass of 50 Kg ± 0.1 Kg. It was suspended by means of a steel cable of 5 mm diameter. The tyres were inflated to a pressure of 0.35, ± 0.02 MPa – 3.5 bar.

All measurement devices, instruments and other relevant equipment were calibrated and are traceable to National Standards.

Figure 1 – Test arrangement

General Arrangement of a Typical Test Assembly



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5. Test Procedures

5.1 Sequence of Testing

Test 1 - Air Leakage (Infiltration)
Test 2 - Air Leakage (Exfiltration)
Test 3 - Water Penetration (Static Pressure)
Test 4 - Wind Resistance (Serviceability)
Test 5 - Repeat Air Leakage (Infiltration)
Test 6 - Repeat Air Leakage (Exfiltration)
Test 7 - Repeat Water Penetration (Static Pressure)
Test 8 - Water Penetration (Dynamic Aero Engine)
Test 9 - Water Penetration - Hose
Test 10 - Wind Resistance - Safety
Test 11 - Impact Resistance – Safety

5.2 Air Permeability - Infiltration

Three (3) preparatory pulses of 1200 Pa (50% of design wind load) positive pressure were applied to the test sample. An airtight seal comprising of plastic sheeting and adhesive tape was then attached to the face of the test sample.

Leakage through the test chamber and joints between the chamber and test sample was determined by measuring the air flow at the following positive pressures; 50, 100, 150, 200, 250, 300, 450 and 600 Pa each step being held for at least 10 seconds.

Although not required by CWCT Section 5, an additional air pressure step of 250 Pa has been added during the air leakage tests to satisfy the requirements of EN 12153:2000.

Test results for the sample were determined by repeating the above sequence with the sample unsealed. The difference between the readings being the air leakage through the sample.

A check for concentrated air leakage was conducted following the above sequence.

5.3 Air Permeability - Exfiltration

Three (3) preparatory pulses of 1200 Pa (50% of design wind load) negative pressure were applied to the test sample. An airtight seal comprising of plastic sheeting and adhesive tape was then attached to the face of the test sample.

Leakage through the test chamber and joints between the chamber and test sample was determined by measuring the air flow at the following positive pressure; 50 and 100 Pa, which was held for at least 10 seconds.

Test results for the sample were determined by repeating the above sequence with the sample unsealed. The difference between the readings being the air leakage through the sample.

5.4 Watertightness – Static Pressure

Three (3) preparatory pulses of 1200 Pa (50% of design wind load) positive pressure were applied to the test sample.

Water was sprayed on to the sample as described in section 4.4.1 for 15 minutes at zero (0) Pa. The water spray continued and the pressure was increased in the following positive increments; 50, 100, 150, 200, 300, 450 and 600 Pa, each stage being held for 5 minutes.

The interior face of the sample was continuously monitored for water ingress throughout the test.

5.4.1 Water Penetration – Dynamic Aero Engine

Water was sprayed on to the sample as described in section 4.4.1.

The sample was subjected to airflow from the wind generator, as described in 4.3.2, which achieved average deflections equal to those produced at a static pressure differential of 600 Pa and these conditions were met for the specified 15 minutes.

The interior face of the sample was continuously monitored for water ingress throughout the test.

5.4.2 Water Penetration – Hose

Working from the exterior, selected areas of curtain wall were wetted from the bottom up, progressing from the lowest horizontal joint then the intersecting vertical joints.

Water was applied to the sample for 5 mins per 1.5 m length of joint, as described in section 4.4.2.

Throughout the water penetration testing, and for 30 minutes following the cessation of spraying, the internal face of the sample was examined for water penetration. The emergence of any water on the inside face would be recorded, and the location and extent of any leakage noted on a drawing of the test specimen.

5.5 Wind Resistance

5.5.1 Wind Resistance – Serviceability

Three (3) preparatory pulses of 1200 Pa (50% of design wind load) positive pressure were applied to the test sample. Upon returning to 0 Pa, any opening parts of the test specimen were opened and closed five (5) times, secured in the closed position and finally sealed with tape. All deflection sensors were then zeroed.

The sample was then subjected to positive pressure stages of 600, 1200, 1800 and 2400 Pa (25%, 50%, 75% and 100% of design wind load) and held at each step for 15 seconds (± 5 secs).

The deformation status of the sample was recorded at each step at characteristic points as stated in the standard, following which the pressure was reduced to 0 Pa and any residual deformations recorded within 1 hour of the test.

The above test sequence was then repeated, including preparation pulses, at a negative pressure differential. All sensors other than those used for recording the movement of framing members adjacent to their fixings to building structure were zeroed following preparation pulses.

Following each of the above tests, the sample was inspected for permanent deformation or damage.

5.5.2 Wind Resistance – Safety

Three preparatory positive air pressure pulses of 1200 Pa (50% of design wind load) positive pressure were applied to the test sample, and the deflection sensors were zeroed.

The sample was subjected to a positive pressure pulse of 3600 Pa (2400 Pa x 150%). The pressure was applied as rapidly as possible but in not less than 1 second and was maintained for 15 seconds (± 5 secs).

Following this pressure pulse and upon returning to zero (0) pressure, residual deformations were recorded and any change in the condition of the specimen was noted.

After the above sequence, a visual inspection was conducted, any moving parts were operated and any damage or functional defects noted.

The above test sequence was then repeated, including preparation pulses, at a negative pressure differential. The deflection sensors were zeroed following the preparation pulses.

Following each of the above tests, the sample was inspected for any permanent deformation or damage.

5.6 Impacting

5.6.1 Impact Test Procedure

The test sample was tested using a drop height which corresponded with the required performance level.

The Impactor, as described in section 4.5.1, was suspended on a wire cord and allowed to swing freely, without initial velocity, in a pendulum motion until it hit the sample normal to its face. Only one impact was performed at any single position.

Tests were conducted at the specified drop height of 950 mm to the selected impact points and the impactor was not allowed to strike the sample more than once.

Following each impact, an additional impact was conducted at a drop height of 100 mm as per the requirements of BS EN 14019:2016.

Drop heights were set to an accuracy of ± 10 mm.

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6. Test Results

6.1 Air Leakage

Permissible air infiltration rate as CWCT standard test methods for building envelopes – Section 5:

Fixed glazing 1.5 m3/hr/m2
Opening joints 2.0 m3/hr/m

The permissible air infiltration rate at intermediate test pressures was determined as specified by CWCT standard test methods for building envelopes – Section 5.

Air permeability measured at maximum test pressure in the 2nd test should not increase by more than 0.3 m3/hr/m2 for fixed glazing above those recorded in the 1st test, as required in CWCT standard for systemised building envelopes: section 3 & BS EN 13116: 2001.

6.2 Air Permeability - Classification

Calculated area of test sample 60.6 m^2
Measured length of opening joints 5.10 m

6.2.1 Fixed Glazing

Pressure Differential Pa	Maximum Air Permeability Rate – Infiltration $m^3/hr/m^2$		Maximum Air Permeability Rate – Exfiltration $m^3/hr/m^2$	
	Test 1		Test 2	
	Ambient temperature (° C)	11.7	Ambient temperature (° C)	11.7
50	0.17		0.10	
100	0.14		0.14	
150	0.20			
200	0.19			
250	0.21			
300	0.18			
450	0.27			
600	0.31			

No areas of concentrated leakage were found during testing.

6.2.2 Opening Joint

Pressure Differential Pa	Maximum Air Permeability Rate – Infiltration $m^3/hr/m$		Maximum Air Permeability Rate – Exfiltration $m^3/hr/m$	
	Test 1		Test 2	
	Ambient temperature (° C)	11.7	Ambient temperature (° C)	11.7
50	0.00		0.00	
100	0.00		0.00	
150	0.10			
200	0.20			
250	0.51			
300	0.20			
450	0.00			
600	0.00			

Figure 2: Air permeability – Area

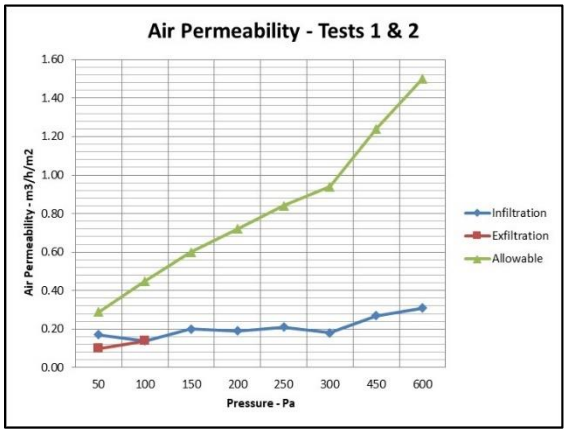
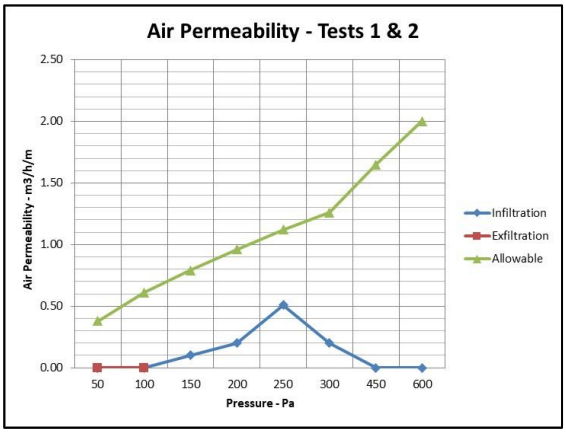


Figure 3: Air permeability – Length of joint



6.2.3 Repeat Air Permeability Tests 5 & 6

6.2.4 Fixed Glazing

Pressure Differential Pa	Maximum Air Permeability Rate – Infiltration $m^3/hr/m^2$		Maximum Air Permeability Rate – Exfiltration $m^3/hr/m^2$	
	Test 5		Test 6	
	Ambient temperature (° C)	7.9	Ambient temperature (° C)	7.9
50	0.08		0.00	
100	0.13		0.04	
150	0.18			
200	0.19			
250	0.25			
300	0.23			
450	0.31			
600	0.37			

No areas of concentrated leakage were found during testing.

6.2.5 Opening Joint

Pressure Differential Pa	Maximum Air Permeability Rate – Infiltration $m^3/hr/m$		Maximum Air Permeability Rate – Exfiltration $m^3/hr/m$	
	Test 5		Test 6	
	Ambient temperature (° C)	7.9	Ambient temperature (° C)	7.9
50	0.00		0.20	
100	0.25		0.49	
150	0.18			
200	0.18			
250	0.22			
300	0.63			
450	0.65			
600	0.84			

Figure 4: Air permeability – Area

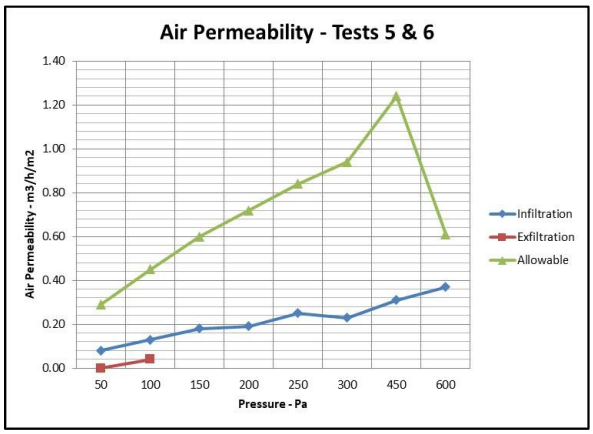
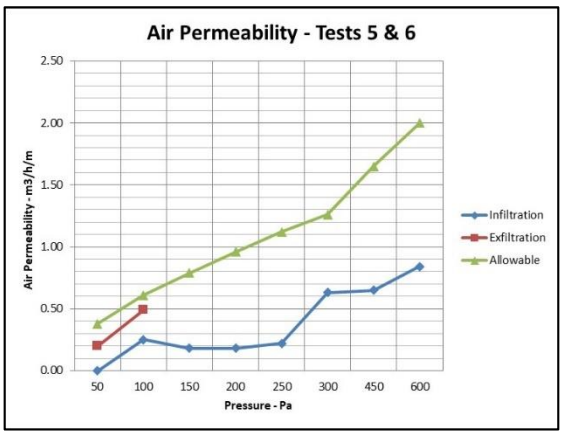


Figure 5: Air permeability – Length of joint



6.3 Watertightness Testing

6.3.1 Watertightness Penetration - Classification

Classification according to CWCT & BS EN 12154:2000	
Tests 3 & 7 – Water Penetration - Static	R7

6.3.2 Test 3 – Water Penetration - Static

Temperatures (°C)	**Water**	10.7
	Ambient	12.8

Observations	
Air Pressure (Pa)	**Comments**
0 x 15 mins	No Leakage Observed
50 x 5 mins	No Leakage Observed
100 x 5 mins	No Leakage Observed
150 x 5 mins	No Leakage Observed
200 x 5 mins	No Leakage Observed
300 x 5 mins	No Leakage Observed
450 x 5 mins	No Leakage Observed
600 x 5 mins	No Leakage Observed

There was no water leakage observed during the water spray.

6.3.3 Test 7 – Repeat Water Penetration - Static

Temperatures (°C)	**Water**	10.4
	Ambient	8.2

Observations	
Air Pressure (Pa)	**Comments**
0 x 15 mins	No Leakage Observed
50 x 5 mins	No Leakage Observed
100 x 5 mins	No Leakage Observed
150 x 5 mins	No Leakage Observed
200 x 5 mins	No Leakage Observed
300 x 5 mins	No Leakage Observed
450 x 5 mins	No Leakage Observed
600 x 5 mins	No Leakage Observed

There was no water leakage observed during the water spray.

6.3.4 Test 8 – Water Penetration – Dynamic Aero Engine

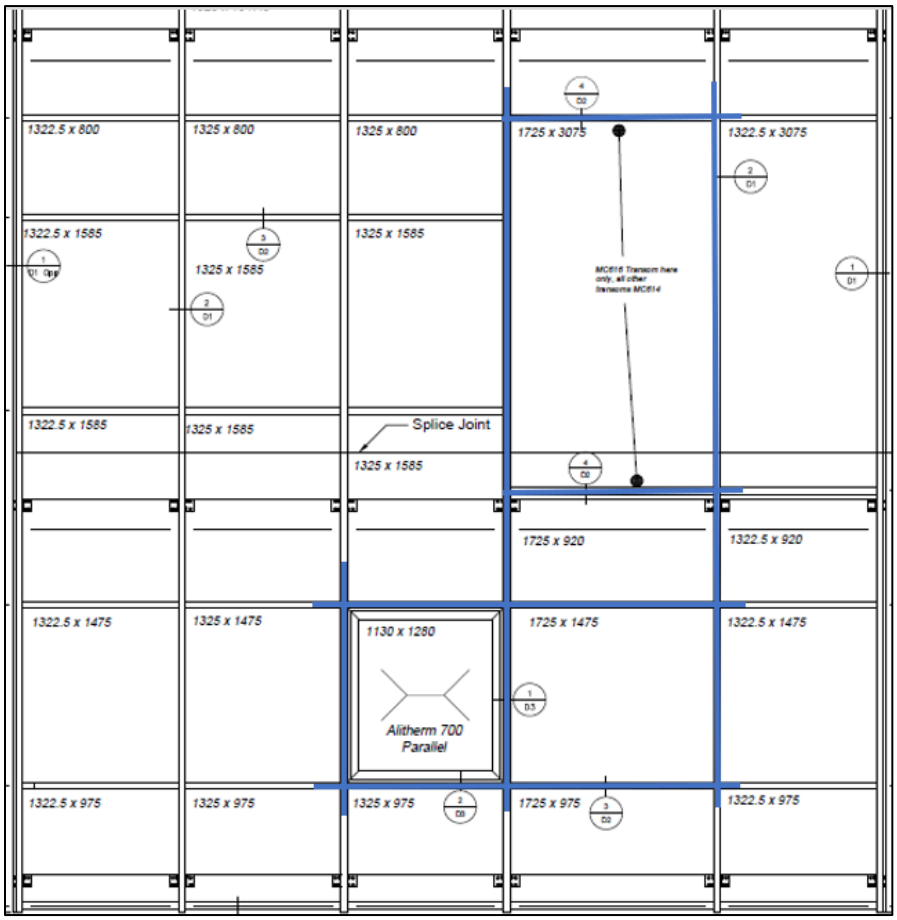
Temperatures (°C)	**Water**	12.3
	Ambient	6.9

The sample was subjected to testing as described in section 5.3.2, for a period of not less than 15 minutes, during which no water leakage was observed through the sample.

6.3.5 Test 9 – Water Penetration – Hose

The sample was subjected to hose testing, as described in section 5.3.4. During the test, and for 30 minutes following the cessation of spraying, the sample was monitored for water ingress and none was found.

Figure 6: Hose Test Areas



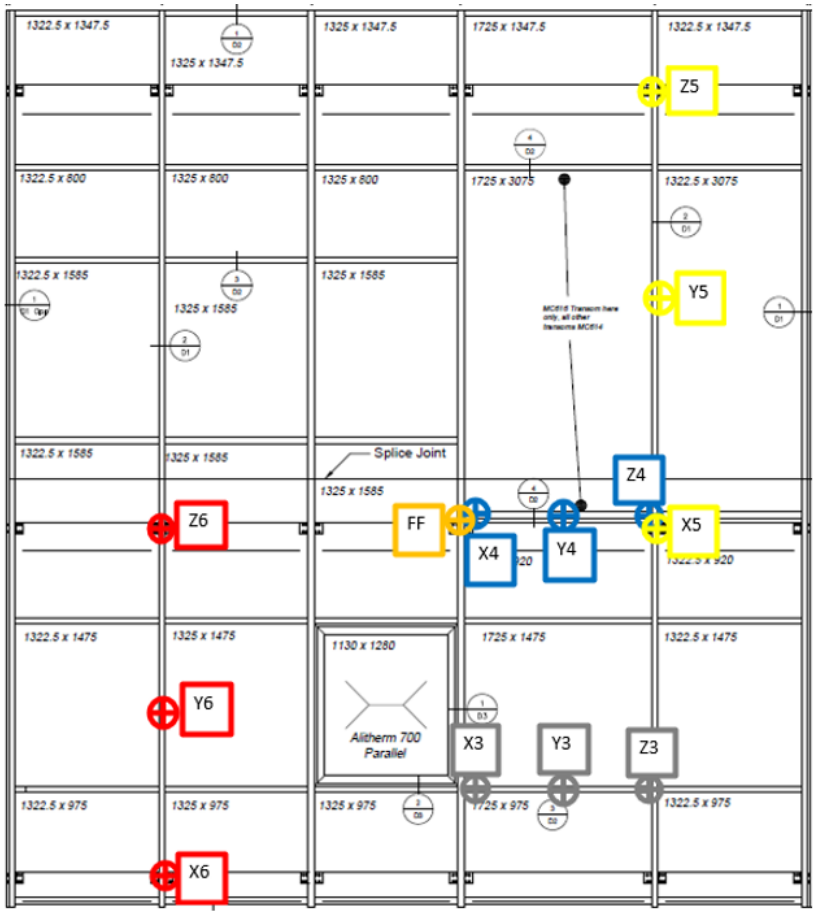
6.4 Wind Resistance

Probe Group Identification	Calculation of deflection
Group A comprised of probes X3, Y3 & Z3	= Probe Y3 – ((Probe X3 + Probe Z3)/2)
Group B comprised of probes X4, Y4 & Z4	= Probe Y4 – ((Probe X4 + Probe Z4)/2)
Group C comprised of probes X5, Y5 & Z5	= Probe Y5 – ((Probe X5 + Probe Z5)/2)
Group D comprised of probes X6, Y6 & Z6	= Probe Y6 – ((Probe X6 + Probe X6)/2)

Probe FF was a single displacement probe positioned to record movement of the framing member adjacent to a support bracket.

An inspection carried out following tests 4 and 10, after both positive and negative pressure testing, showed no evidence of any permanent deformation or damage to the test sample.

Figure 7: Positions of Deflection Measurement Probes



6.4.1 Test 4 – Wind Resistance – Serviceability

Temperatures (°C)	Ambient	5.3

Measured Length of Framing Member (mm)		Allowable Deflection	
		Ratio	Calculated (mm)
Group A	1650	L/200	8.3
Group B	1650	L/200	8.3
Group C	3500	L/300	16.7
Group D	2748	L/300	13.7

Frontal deflection shall recover by either 95%, or 1mm, whichever the greater.

The total movement of framing members adjacent to points of support shall be less than 2mm following the removal of both peak positive and peak negative loads.

6.4.1.1 Wind Resistance, Serviceability – Positive Pressure

Positive Pressure Pa	Results (mm)			
	Group A	Group B	Group C	Group D
0	0.0	0.0	0.0	0.0
600	0.6	0.4	0.6	1.7
1200	1.2	0.8	1.1	3.4
1800	1.8	1.2	1.8	5.4
2400	2.4	1.7	2.5	7.3
Residuals Immediately following test	0.1	0.1	0.2	0.4

6.4.1.2 Wind Resistance, Serviceability – Negative Pressure

Negative Pressure Pa	Results (mm)			
	Group A	Group B	Group C	Group D
0	0.0	0.0	0.0	0.0
600	0.6	0.4	0.7	2.5
1200	1.2	0.7	1.4	4.4
1800	1.7	1.2	2.0	6.4
2400	2.3	1.5	2.8	8.3
Residuals Immediately following test	0.0	0.1	0.1	0.5

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6.4.1.3 Wind Resistance, Serviceability – Framing Member at Point of Support

Total movement – Following the Removal of Peak Positive to Peak Negative Pressures – (+2400 to – 2400 Pa)

Probe reference number FF	
Deflection movement following removal of peak positive pressure	0.7 mm
Deflection movement following negative preparatory pulses	0.4 mm
Deflection movement following removal of peak negative pressure	0.7 mm
Total movement	-0.4 mm

6.4.2 Test 10 – Wind Resistance – Safety

Temperatures (°C)	Ambient	8.2

Measured Length of Framing Member (mm)		**Allowable Residual Deformation**	
		Ratio	**Calculated (mm)**
Group A	1650	L/500	3.3
Group B	1650	L/500	3.3
Group C	3500	L/500	7.0
Group D	2748	L/500	5.5

6.4.2.1 Wind Resistance, Safety – Positive Pressure

Positive Pressure Pa	**Results (mm)**			
	Group A	**Group B**	**Group C**	**Group D**
0	0.0	0.0	0.0	0.0
3600	3.6	2.5	10.7	3.5
Residuals Immediately following test	0.1	0.1	0.6	0.1

6.4.2.2 Wind Resistance, Safety – Negative Pressure

Negative Pressure Pa	**Results (mm)**			
	Group A	**Group B**	**Group C**	**Group D**
0	0.0	0.0	0.0	0.0
3600	3.6	2.5	12.2	4.1
Residuals Immediately following test	0.1	0.2	0.5	0.2

6.5 Impacting

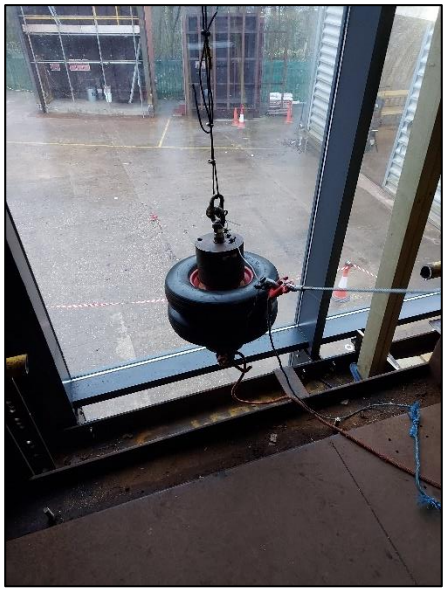
6.5.1 Test 11 – Impact – Safety (Soft Body)

Test Dates	10.12.24	12.12.24
Ambient Temperatures (°C)	5.7	6.4
Humidity (%RH)	55	97

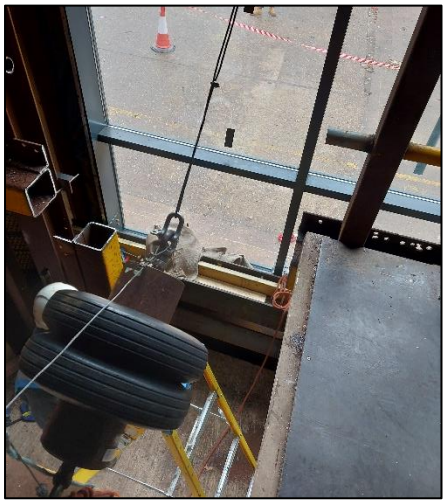
Impact Reference	Test Classification	Drop Height (mm)	Observations	Result
I1	I 5	950 100	No Damage No Damage	Pass Pass
I2	I 5	950 100	No Damage No Damage	Pass Pass
I3	I 5	950 100	No Damage No Damage	Pass Pass
E1	E 5	950 100	Dented Capping No Further Damage	Pass Pass
E2	E 5	950 100	Dented Capping No Further Damage	Pass Pass
E3	E 5	950 100	Dented Capping No Further Damage	Pass Pass
E4	E 5	950 100	Dented Capping No Further Damage	Pass Pass
E5	E 5	950 100	No Damage No Further Damage	Pass Pass
E6	E 5	950 100	Dented Capping No Further Damage	Pass Pass

Class Achieved	I 5 & E 5

Photograph No. 3 - Showing impactor during internal testing



Photograph No. 4 - Showing impactor during internal testing



Photograph No. 5 - Showing impactor during external testing

Photograph No. 6 - Showing impactor during external testing

6.5.2 Impact Locations

Figure 8: Positions of impact - Internal

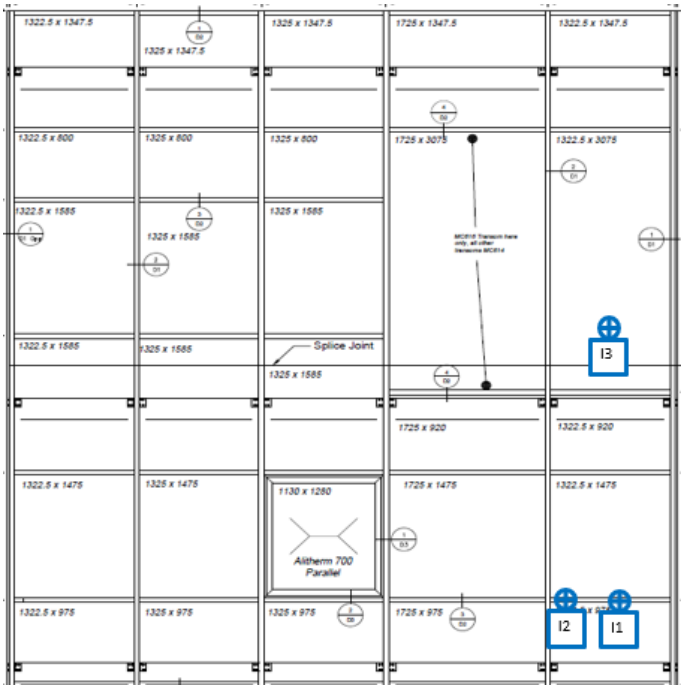
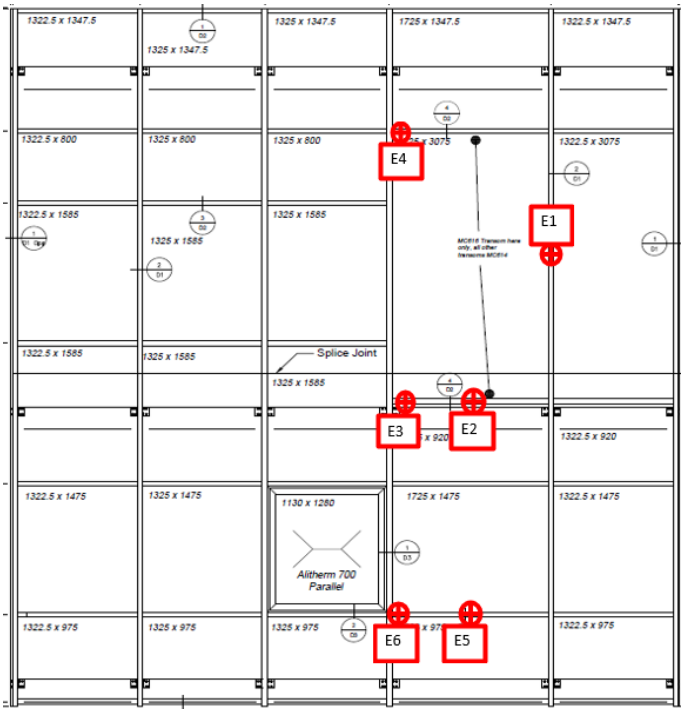
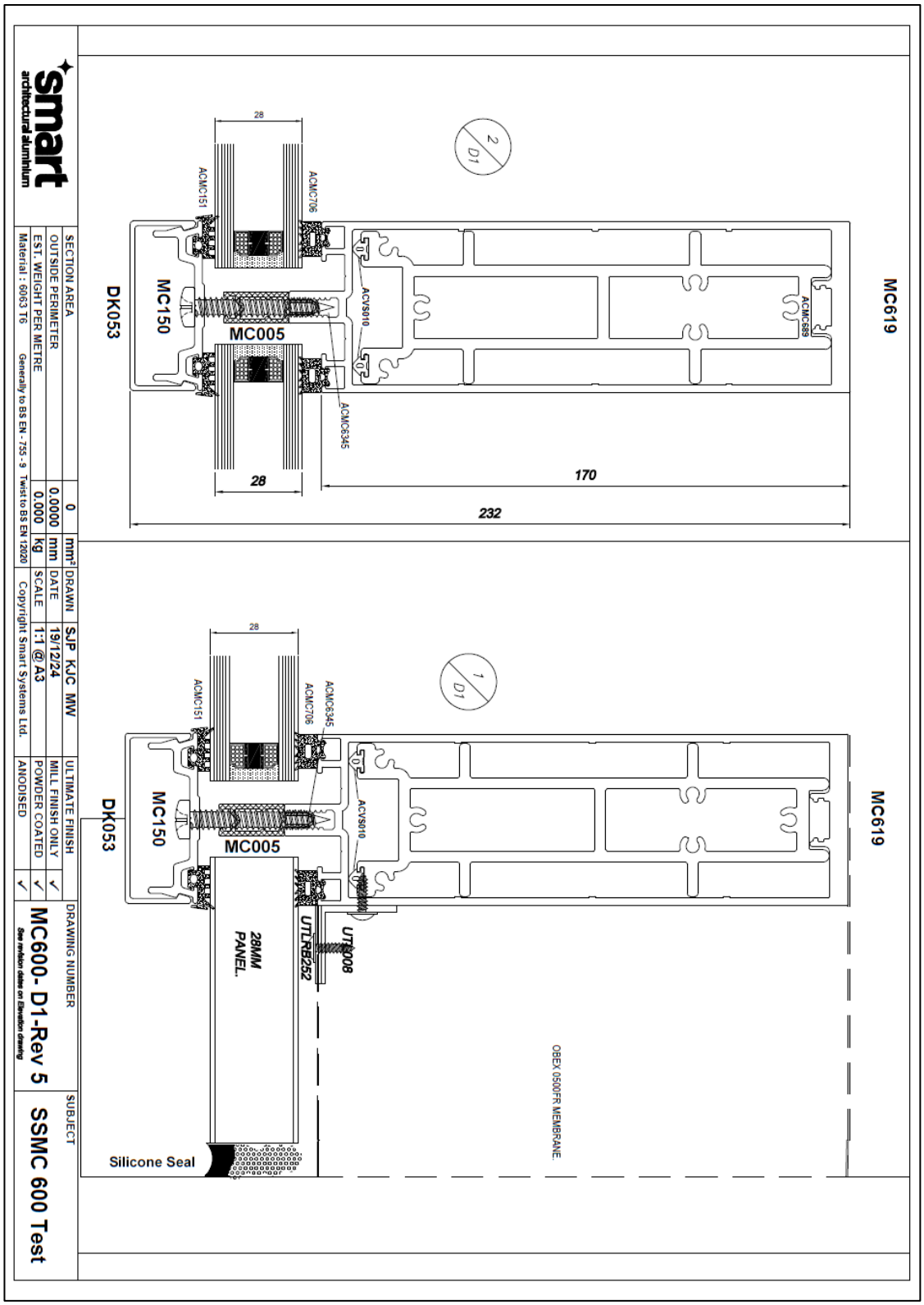
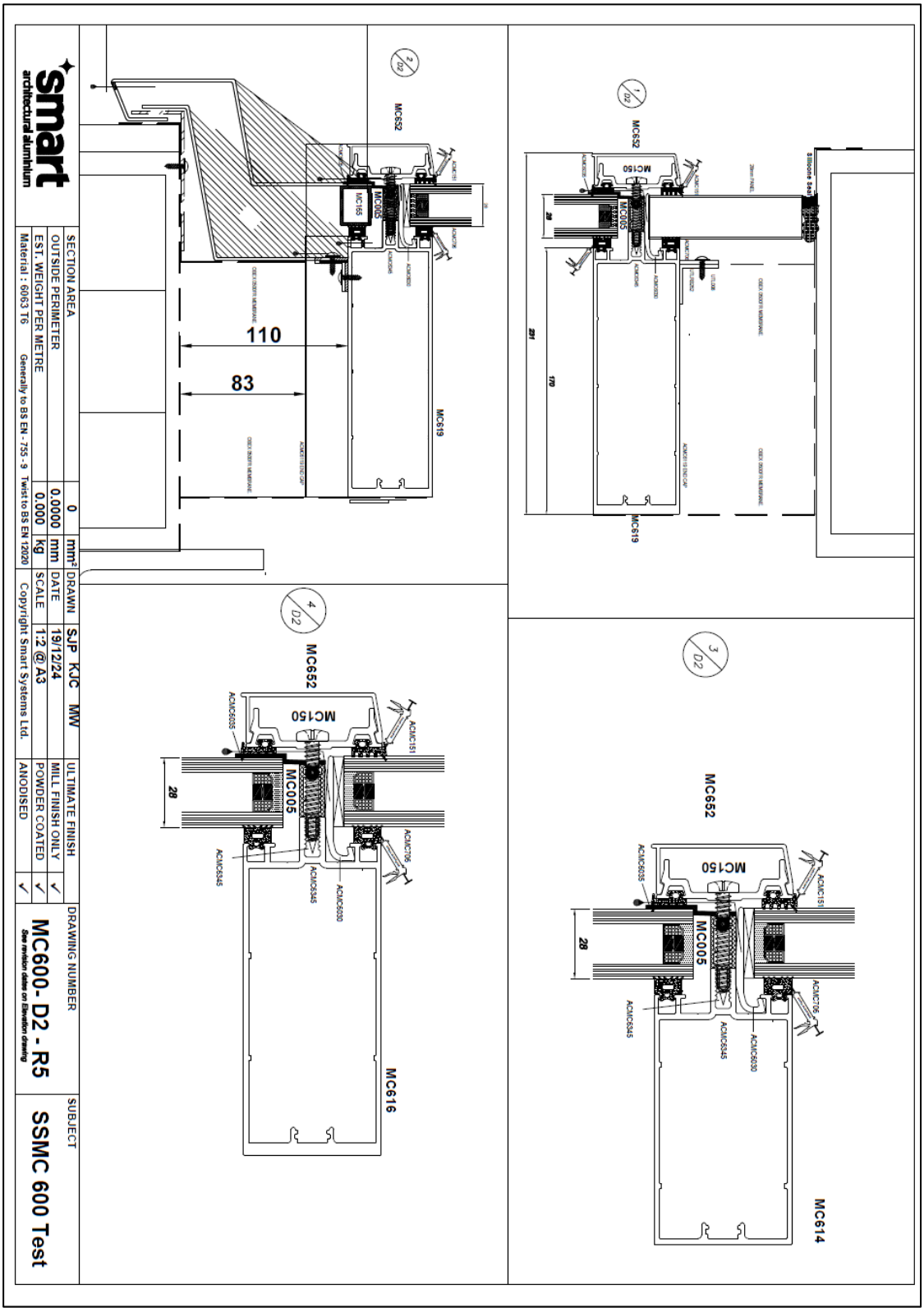


Figure 9: Positions of impact - External



7. System Drawings




smart
architectural aluminium
SECTION AREA 0 mm²
OUTSIDE PERIMETER 0.0000 mm
EST. WEIGHT PER METRE 0.000 kg
Material : 6063 T6
Generally to BS EN - 755 - 9 Twist to BS EN 12020
DRAWN SJP KJC MW
DATE 19/12/24
SCALE 1:2 @ A3
Copyright Smart Systems Ltd.
ULTIMATE FINISH
MILL FINISH ONLY
POWDER COATED
ANODISED
DRAWING NUMBER
MC600- D2 - R5
See revision dates on Elevation drawing
SUBJECT
SSMC 600 Test
MC652
MC150
MC005
MC155
MC619
MC616
MC614
ACMC151
ACMC6035
ACMC706
ACMC6345
ACMC6030
110
83
28
221
170

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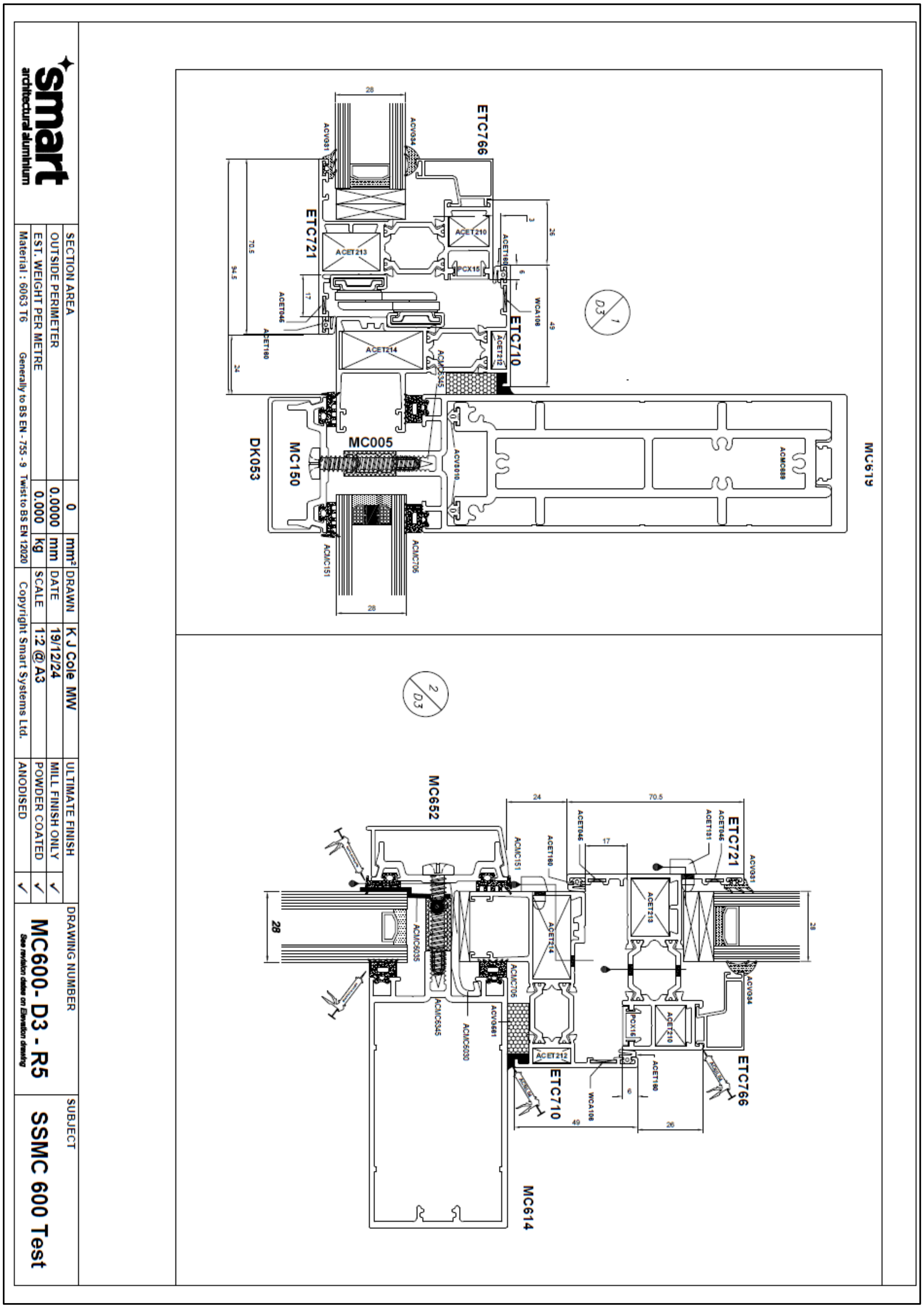
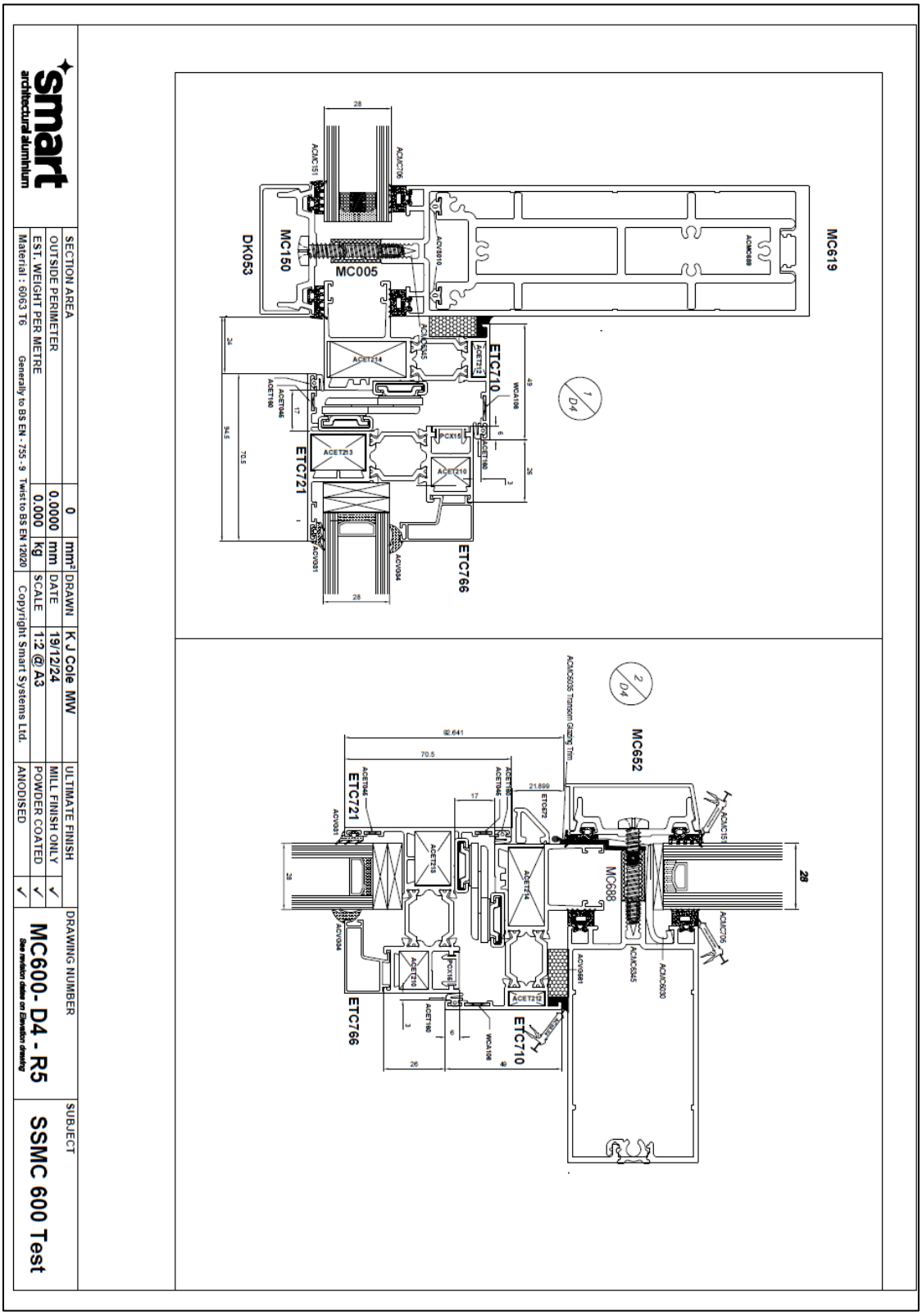
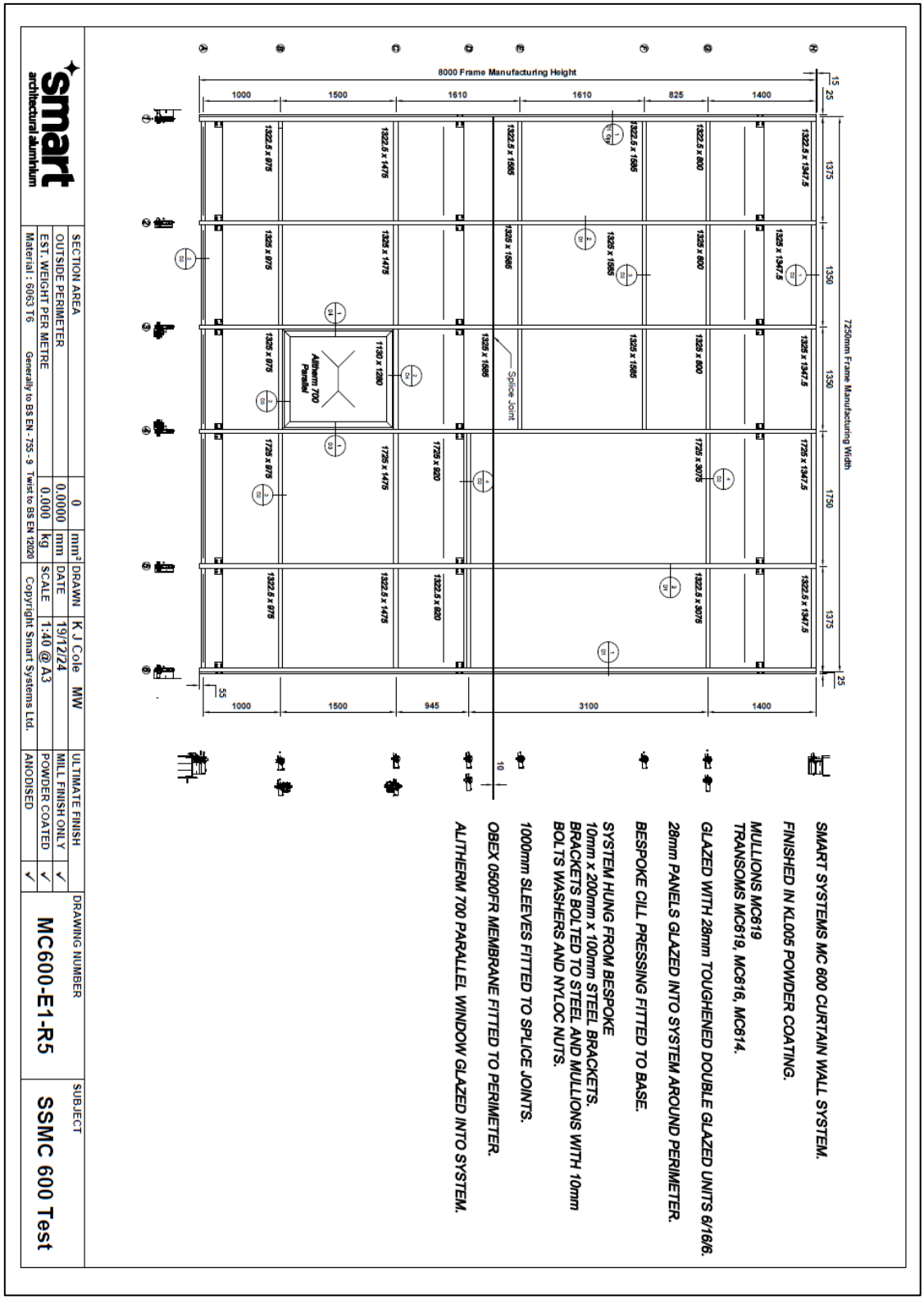



MC619
DK053
MC150
MC005
ETC710
ETC766
ETC721
MC652
MC688
ACET214
ACET213
ACET210
ACET212
ACET180
ACET146
ACET145
ACET144
ACET215
ACET216
ACET217
ACET218
PCX15
WCA108
ACM5035 Transom Glazing Trim
92.641
70.5
21.899
17
94.5
SECTION AREA 0 mm²
OUTSIDE PERIMETER 0.0000 mm
EST. WEIGHT PER METRE 0.000 kg
Material : 6063 T6
Generally to BS EN - 755 - 9 Twist to BS EN 12020
DRAWN K J Cole MW
DATE 19/12/24
SCALE 1:2 @ A3
Copyright Smart Systems Ltd.
ULTIMATE FINISH
MILL FINISH ONLY ✓
POWDER COATED ✓
ANODISED ✓
DRAWING NUMBER
MC600- D4 - R5
See revision dates on Elevation drawing
SUBJECT
SSMC 600 Test
smart architectural aluminium



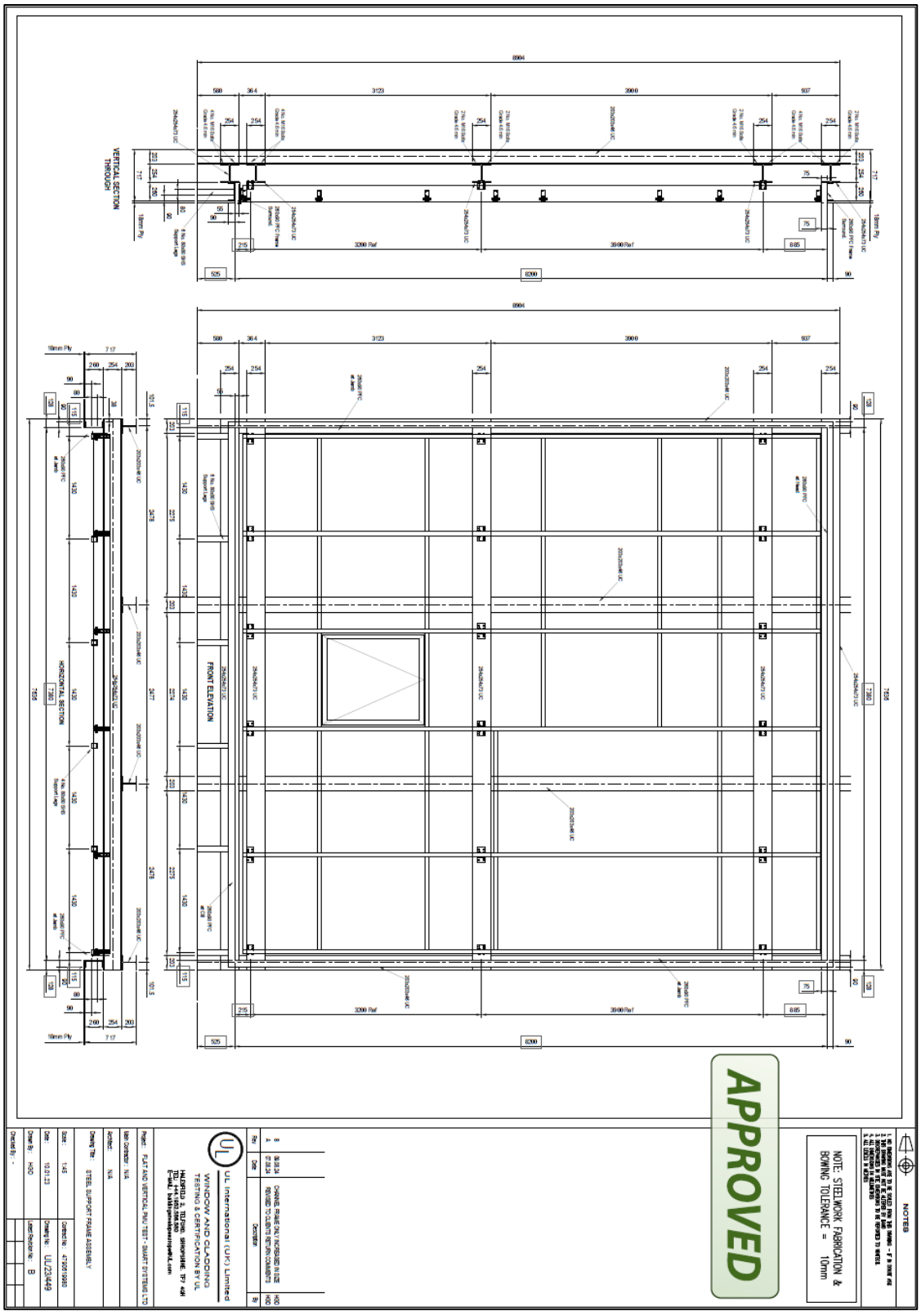
SECTION AREA	0	mm²	DRAWN	K.J Cole	MW	ULTIMATE FINISH	
OUTSIDE PERIMETER	0.0000	mm	DATE	19/12/24		MILL FINISH ONLY	✓
EST. WEIGHT PER METRE	0.000	kg	SCALE	1:40 @ A3		POWDER COATED	✓
Material : 6063 T6 Generally to BS EN - 755 - 9 Twist to BS EN 12020			Copyright Smart Systems Ltd.			ANODISED	✓

smart architectural aluminium

DRAWING NUMBER: MC600-E1-R5

SUBJECT: SSMC 600 Test

8. Support Steelwork Drawing



9. Dismantling

The dismantling was conducted on 16th and 17th December 2024 by representatives of Smart Systems Ltd and was witnessed by representatives of UL International (UK) Limited.

There was no water evident in the system in parts designed not to be wetted, and it was found that the system fully complied with the system drawings in section 7 provided by Smart Systems Ltd at the time of the dismantle.

Photograph No. 7 - Sample prior to dismantle

Photograph No. 8 - Full sample with glazing removed

Photograph No. 9 - T connection with glazing removed showing glazing packers

Photograph No. 10 - Transom connection on mullion

Photograph No. 11 - Opening vent removed

Photograph No. 12 - Glazing packers

Photograph No. 13 - Pressure plate gasket profile

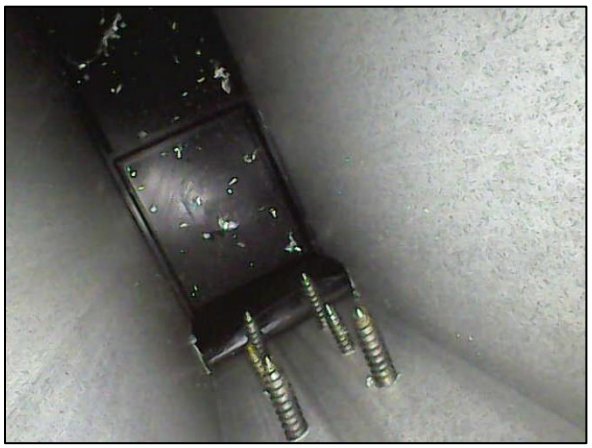
Photograph No. 14 - Cruciform joint details

Photograph No. 15 - Transom mullion connection with glazing removed. Please note build up of swarf shown is due to transoms having to be cut-out with electric saws as part of the dismantling process

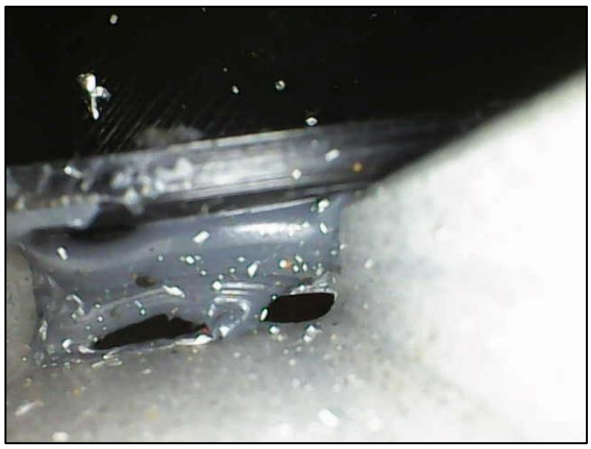
Photograph No. 16 - Bottom mullion transom connection and holes drilled for inspection purposes

Photograph No. 17 - Bottom LHS with glazing removed

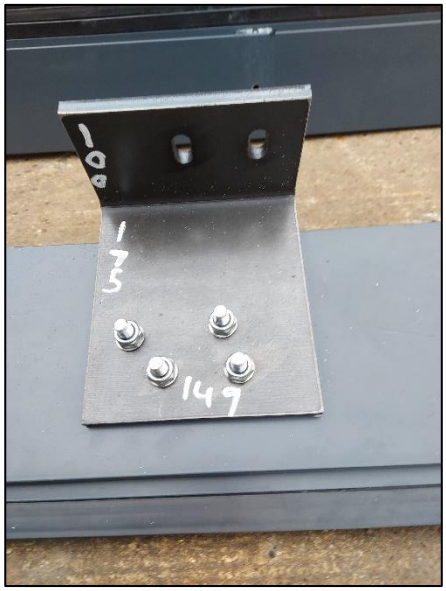
Photograph No. 18 – Swarf inside bottom of mullion due to holes drilled for inspection purposes



Photograph No. 19 - Sealant inside bottom of mullion



Photograph No. 20 - Floor level bracket 100mm x 195mm x 147mm



Photograph No. 21 - Mullion 170mm x 55mm

Photograph No. 22 - Mullion profile

10. Amendments

Revision No.	Amendments	Date of Amendment
Rev 1	1. Product description updated/replaced in Section 3	31st January 2025
Rev 2	2. Photographs and description updated in Section 9 as per client's request	4th February 2025

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----- END OF REPORT -----