

Envelope Airtightness Test Results Whole Building, Lit & Phil Library, Westgate Road, Newcastle

Carried out for Historic England

Report CAT-HIS01-NA001-LIT01-160825-666929

Tested by J Askem, I Leslie

16 August 2025



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Envelope Airtightness Test Results Whole Building, Lit & Phil Library, Westgate Road, Newcastle

Carried out for: Historic England
Accounts Payable
Rm 2/60 The Engine House
Fire Fly Avenue
Wiltshire
SN2 2EH


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1 INTRODUCTION

This report presents the results of the air permeability test, undertaken 16 August 2025, on the Whole Building at the Lit & Phil Library, Newcastle, to determine the air permeability of the existing building.

2 METHODOLOGY

Air leakage testing measures the air leakage through a test area at a given induced pressure normalised against the test envelope. The test area may comprise a whole building or part thereof.

The reported test(s) utilised the fan pressurisation or 'blower door' method. This method is undertaken by mounting a fan (or series of fans) in a suitable aperture (typically a door) in the structure to pressurise the test area. An internal/external pressure difference is created across the test area, in line with the requirements of the test standard. The fan speed is varied to induce different pressures across the structure. At each fan speed the air volume flow rate through the fan and the pressure across the structure envelope is recorded, and the air leakage coefficient calculated from the equation:

$$Q=C_L (\Delta p)^n$$

Where:

- Q is the air flow rate supplied to the building $m^3.s^{-1}$
- Δp is the pressure differential across the building Pa
- C_L is the air leakage coefficient $m^3.s^{-1}.Pa^{-n}$
- n is an exponent normally between 0.5 and 1.0

From the above equation the air flow rate, Q50 required to pressurise the building to 50Pa can be calculated.

The test procedure and calculation were carried out in accordance with the requirements of the appropriate ATTMA Standard (TSL1, TSL2, TSL3 or TSL4), CIBSE TM23:2022, ISO 9972:2015 Method B, and is UKAS accredited. The relevant equations and correction factors applied to the data can be found within the same test standard.

The results presented within this report are only applicable to the specified test area and the measurements recorded at the time of the test.

Opinions and interpretations expressed within this report are outside the scope of our UKAS accreditation. Smoke tests are not covered by our UKAS accreditation for airtightness testing of buildings.

Unless otherwise stated, the envelope areas and/or volumes used in producing the presented results were calculated by BSRIA Ltd.

3 TEST SUMMARY

3.1 TEST DETAILS

Site Address:	Lit & Phil Library Westgate Road Newcastle Upon Tyne, Tyne And Wear NE1 1SE
Building:	Lit & Phil Library
Test Area:	Whole Building
Test Regulation/Specification:	Part L2A of The Building Regulations

Design Air Leakage Criteria	Air Permeability @ 50Pa	Not specified
Measured Air Leakage	Air Permeability @ 50Pa	10.25 m ³ .h ⁻¹ .m ⁻² @ 50Pa

The Lit & Phil Library achieved an air leakage rate of 10.25 m³.h⁻¹.m⁻² @ 50Pa.

3.2 DEVIATIONS & OBSERVATIONS

Deviations from Test Measurement Requirements:

- None

Deviations from Required Building Conditions:

- None

Observations:

- Airline of roof assumed to be upper "Greenhouses". Reading room F03 domes appeared open to greenhouse at upper and lower perimeter. "Greenhouse" access was unavailable & viewed from below, the state of other roof lights was unclear.
- An initial test (not reported) was undertaken with all vents unsealed. The result of this test was 11.0 m³(h.m²)@50Pa.

Identified air leakage paths (further leakage paths - Appendix A):

- Some sash windows displayed a small gap at the meeting rail.

4 TEST CONDITIONS

4.1 BUILDING INFORMATION

Type of building	Library
Estimated year of construction	1825
Primary heating	Unknown
Primary ventilation	Unknown
Primary air conditioning	Unknown

4.2 BUILDING PREPARATION

All external doors closed

All external windows closed

All internal doors open

All drainage traps filled with water

Basement. Door to the narrow low height corridor closed (Store 2 external space).

Roof windcatcher chimneys sealed apart from the two tallest ones at gable ends of Library skylight. Some window extract fans were closed by integral dampers. No other vents were sealed.

Female room F08 and Reference & Silence Room G15, window ajar.

Reference & Silence Room G15, window ajar.

Male Toilets G14, extract fan not sealed.

The fan assembly was installed in the Main entrance (inner door) & Lotus escape door (outer door).

5 TEST EQUIPMENT

Equipment Used	Identifier	Calibration Expiry Date
Flow Meter(s)		
Retrotec Blower Door	BF03-02	11/07/2026
Retrotec Blower Door	BF03-03	11/07/2026
Retrotec Blower Door	BF06-01	21/11/2025
Retrotec Blower Door	BF06-03	22/11/2025
Micromanometer(s)		
TEC DG700	MO55	27/06/2026
TEC DG700	MO30	25/11/2025
TEC DG700	MO34	20/11/2025
TEC DG700	MO46	27/06/2026
Thermometer(s)		
Testo 110 Temperature Probe	TP15	11/11/2025
Barometer(s)		
Druck DPI705 Pressure Meter	BO18	21/08/2025

6 SUMMARY OF RESULTS

6.1 Calculated Results

Variable	Notation	Units	Value
Footprint	-	m ²	652.90
Volume	V	m ³	n/a
Envelope area	S _p	m ²	3369.60
Leakage coefficient	C _L	m ³ .h ⁻¹ .Pa ⁻ⁿ	3495.200
Air flow coefficient	C _{env}	m ³ .h ⁻¹ .Pa ⁻ⁿ	3480.87
Flow index	n	-	0.586
Correlation coefficient	r ²	-	0.995
Air flow rate at 50Pa	Q ₅₀	m ³ .h ⁻¹	34553
Equivalent leakage area (approximate)	Q ₅₀ /5.57	m ²	1.72
Air changes per hour at 50Pa	N ₅₀ (Q ₅₀ /V)	m ³ .h ⁻¹ .m ⁻³	n/a
Leakage per m ² of envelope at 50Pa	AP ₅₀ (Q ₅₀ /S _p)	m ³ .h ⁻¹ .m ⁻²	10.25

6.2 Environmental Conditions

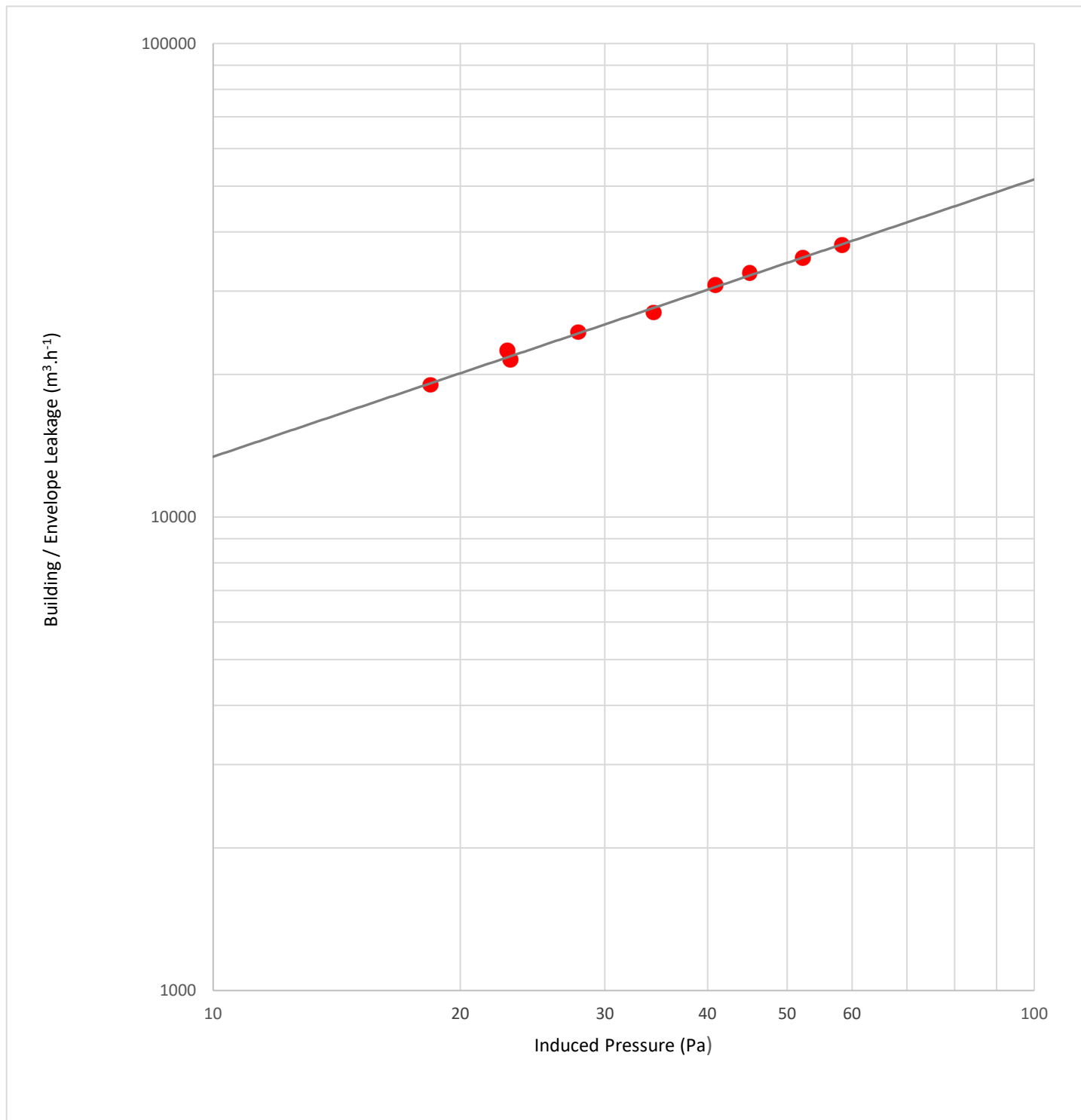
	Pre-Test		Post Test		Average
Windspeed (Beaufort Scale)	0 - Calm		0 - Calm		n/a
Barometric Pressure (mbar)	1028		1028		1028
Average Internal Temperature (°C)	21.5		21.0		21.3
Average External Temperature (°C)	20.0		20.0		20.0
Zero Flow Building Pressure Differential (Pa)	ΔP_{0,1+}	0.00	ΔP_{0,2+}	0.00	n/a
	ΔP_{0,1-}	-1.44	ΔP_{0,2-}	-1.75	n/a
	ΔP_{0,1}	-1.44	ΔP_{0,2}	-1.75	-1.59

6.3 Test Measurements

Corrected Differential Building Pressure (Pa)	Air Flow Rate (m ³ .h ⁻¹)
18.39	19013
22.84	22407
27.84	24546
34.39	27017
40.94	30869
45.04	32752
52.29	35270
58.44	37511
23.04	21463

6.4 FIGURES

Figure 6.1: 17:00, 16 August 2025. Whole Building, Lit & Phil Library



APPENDIX A

Figure A.1 Air leakage path



A couple of sash windows stuck slightly ajar.

Figure A.2 Air leakage path



Some leakage from all three "Greenhouses" between the lower edge of roof glass and frame (which were the only locations easily checkable). Seals shrunk or a gap was intentional.

End of Report