EU Environmental Technology Verification pilot programme

Statement of Verification

Technology:	Low Pressure PULSE Air Test Process
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The verification process, the results of which are summarised in this Statement of Verification, complies with the **EU ETV General Verification Protocol 1.3** and with **ISO 14034:2016** Environmental Management - Environmental Technology Verification (ETV)

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Accreditation Mark

UKAS INSPECTION

4601

Type A
Inspection Body

Accredited to
ISO/IEC 17020:2012

BRE Global Verified ETV

Internet address where this Statement of Verification is available:
https://ec.europa.eu/environment/ecoap/etv

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1. Technology description

The 'Low Pressure PULSE Air Test Process' (LPP) utilizes Build Test Solutions Ltd's innovative airtightness testing technology (PULSE LPP test unit) which releases 1-3 bursts of air from a compressed air tank into a building, analyses the building's pressure response, and calculates the building's air permeability.

2. Application

The 'Low Pressure PULSE Air Test Process' enables pressurisation testing of buildings at pressures typically ranging from 1Pa to 8Pa, and calculation of a building's air permeability at 4Pa.

2.1. Matrix

Thermal performance of buildings.

2.2. Purpose

Determination of air permeability of buildings.

2.3. Conditions of operation and use

Equipment operated in accordance with manufacturer's instructions and testing conducted in accordance with industry standards.

2.4. Verification parameters definition summary

Parameter	Units
Performance parameters	
• LPP test pressure	Pa
• Accurate measurement/calculation of the following;	
o Air leakage rate (ALR)	m^3/h
o Effective leakage area (ELA)	m^2
o Air Permeability (AP_4)	$m^3/h \cdot m^2$
o Air changes per hour (ACH)	*None*
• Time taken to complete LPP process	s
• Maximum relevant percentage difference (RPD) between test results	%
• Compressed air tank volume	l
Operational parameters	
• Envelope volume of test building	m^3
• Envelope area of test building (A_E)	m^2
• Test building Air Permeability at 50Pa	$\leq 10 m^3/(h \cdot m^2)$
• Wind speed	m/s
• Clearance around the 'Air Exhaust Nozzle'	m

3. Test and analysis design

Practical testing was carried out on the Innovation Park at BRE Watford, UK, and was subject to a test system audit. Five buildings of different construction type, building volume, envelope area, and configuration were selected as being representative of common housing stock.

3.1. Existing and new data

Existing data were not accepted as they related to a different size PULSE LPP unit which operated using an earlier version of the PULSE software. New data were obtained from the practical testing on the Innovation Park.

3.2. Laboratory or field conditions

Testing was conducted on Wednesday 1 August 2018 between the hours of 09:00 and 17:30. Within this time period, Build Test Solutions Ltd recorded indoor temperatures ranging from 21.4°C to 22.9°C and wind speeds from 0.1m/s to 0.9m/s.

3.3. Matrix compositions

The buildings on which the Low Pressure PULSE Air Test Process was assessed are constructed using different building materials/methods including timber frame, steel frame, SIPS, and aerated clay block. They are a mixture of 2 and 3 storey, detached and semi-detached properties and are fully constructed, finished, and furnished.

3.4. Test and analysis parameters

- Volume of test building
- Envelope area of test building
- Air permeability of test building
- Wind speed
- Correct siting of LPP equipment
- Correct preparation of building according to industry standards

3.5. Test and analysis methods summary

All tests were performed by Build Test Solutions Ltd's qualified personnel and witnessed by BRE Global's assessors during a Test System Audit. The industry recognised blower door method of airtightness testing was performed once before and once after a sequence of 4 tests using the Low Pressure PULSE Air Test Process.

3.6. Parameters measured

The time taken to complete the LPP test process was measured by BRE Global at selected points during the Test System Audit. Wind speed was measured by Build Test Solutions Ltd before and after each Blower Door test. Building volume and envelope area were calculated by Build Test Solutions Ltd from architect's plans provided by BRE Global. The LPP software measured the building's pressure response to the compressed air pulses and calculated the airtightness characteristics specified in section 4 below.

4. Verification results (performance, operational and environmental parameters)

A single 58.5 litre Low Pressure PULSE (BTS-PUL-001-585) airtightness measurement instrument measured the air leakage characteristics of 5 selected buildings, with volumes from 232m^3 to 311m^3 and envelope areas from 236m^2 to 291m^2, and generated ALR, ELA, AP_4, and ACH results at 4Pa in under 15 minutes with a maximum relative percentage difference (RPD) of ±5% between tests results.

- ALR = Air leakage rate
- ELA = Effective leakage area
- AP_4 = Air Permeability
- ACH = Air changes per hour

Performance parameters

Calculation of compressed air tank volume:

A UKAS accredited laboratory used calibrated scales to determine the mass of the compressed air tank empty, then filled with water. The filled mass was deducted from the empty mass to determine a compressed air tank volume of 58.5 litres.

Results generated at 4Pa:

During testing of the 5 selected test buildings the LPP test unit generated pressure differences ranging from 0.3555Pa to 22.3914Pa. For the LPP testing performed in all test buildings it was possible to calculate air permeability at 4Pa without extrapolation.

LPP process completed in under 15 minutes:

One test on each of two of the selected test buildings was timed from start to finish. The time measurement started once the LPP test unit was sited within the building being tested. The times recorded covered set-up of the equipment including software boot-up and parameter data entry, charging of the compressed air tank (to different starting pressures using 2 different compressors), release of the pre-programmed compressed air pulses and measurement of the building's pressure response, generation of air permeability results and pack-down of the equipment.

The results were:

Test Building 2: A THOMAS compressor (2750TGHI52/48) was used to charge the compressed air tank from empty (0bar) to 9.35bar (±0.15bar). The full LPP test sequence took 13 minutes and 19 seconds.

Test Building 4: A DÜRR compressor (AG-132/0643 2200) was used to charge the compressed air tank from empty (0bar) to 5.85bar (±0.05bar). The full LPP test sequence took 12 minutes and 5 seconds.

Maximum relative percentage difference (RPD) of ±5% between tests results:

To determine the maximum relative percentage difference (i.e. the consistency of test results) a 'Reference' (mean average) of the Air Permeability at 4Pa for each tested building was calculated and the 'Difference' between the Reference and each individual test on the same building was determined and applied to the following equation:

$$\text{Relative Percentage Difference} = \frac{\text{Difference}}{\text{Reference}} \times 100$$

From all the LPP testing conducted on the BRE Innovation Park the highest Maximum Relative Percentage Difference determined was 4.4% which is within the claimed tolerance of ±5%.

Operational parameters

Building volume:

The volume of each test building was calculated from architect's plans. The 5 selected test buildings had calculated volumes ranging from 232m^3 to 311m^3 which is within the operating capabilities of a single 58.5 litre LPP test unit (BTS-PUL-001-585).

Building envelope area:

The envelope area of each test building was calculated from architect's plans. The 5 selected test buildings had calculated envelope areas ranging from 236m^2 to 291m^2 which is within the operating capabilities of a single 58.5 litre LPP test unit (BTS-PUL-001-585).

Existing airtightness of test buildings:

Using the blower door test method, it was established that the five selected test buildings each had an air permeability of ≤10m^3/(h·m^2) at 50Pa which is within the operating capabilities of the PULSE test equipment.

5. Additional information, including additional parameters[1]

For correct and safe operation of the Low Pressure PULSE Air Test Process (LPP) test equipment the document '*Build Test Solutions Ltd - PULSE Air Tightness Measurement Instrument - Model: BTS-PUL-001-585 - Main Case -* ***Instruction Manual and Safety Guidelines***' must be adhered to. The testing for this verification was conducted in accordance with *Version 5.0: 10 August 2018* which was the version current at the time.

6. Quality assurance and deviations

This verification was conducted according to the documented procedures of BRE Global. These procedures fall within the scope of BRE Global's Schedule of Accreditation to ISO/IEC 17020:2012 issued by the United Kingdom Accreditation Service (UKAS). The verification process included independent internal and external review of the Specific Verification Protocol, Verification Report, and this Statement of Verification.

This Statement of Verification is valid only when presented alongside the Verification Report Ref No. IN20170128UK03E.

[1] with comments or caveats where appropriate