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AIVC/TightVent Webinar – Alternative methodologies to evaluate airtightness Low Pressure Pulse Method

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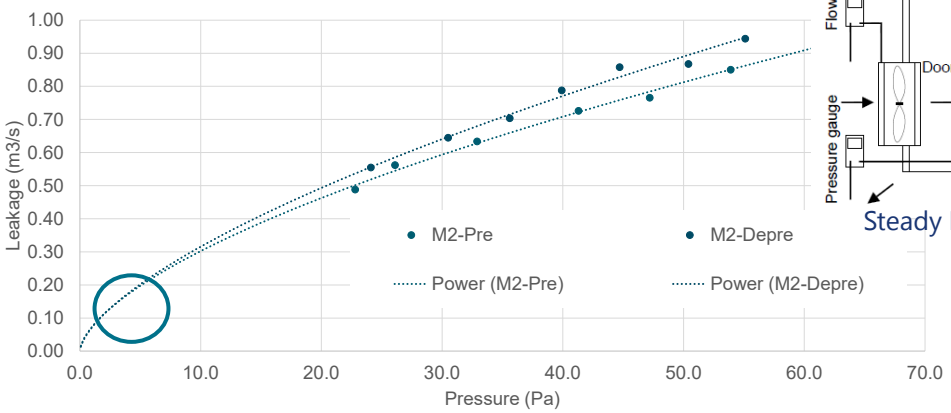
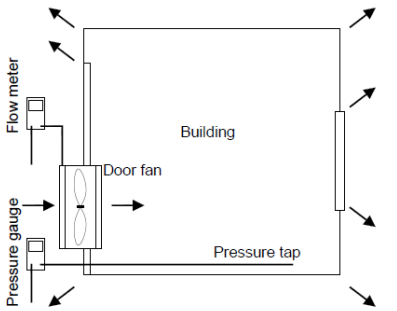
What is Pulse?

- Pulse is a low pressure technique for measuring airtightness @4Pa





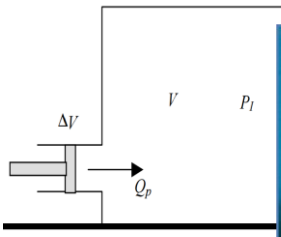
Steady Pressurisation method

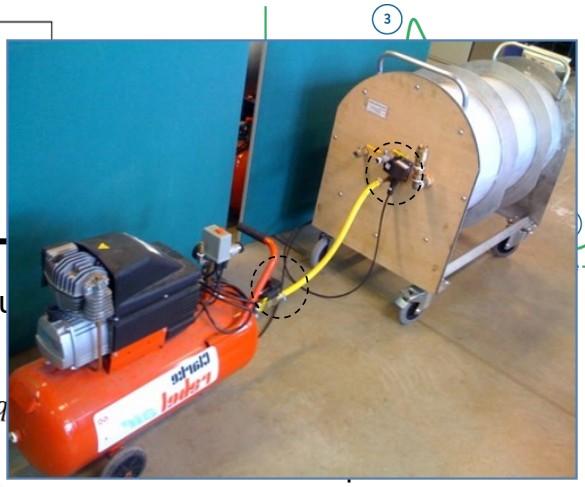
Power Law $Q = CP^n$

Research Motivation

- Primary motivation was a pursuit to develop a method for testing the air leakage of **large buildings** *circa mid 1990's*
- To develop method that didnt require large air flow
- To develop a method which was quicker to perform
- A method that could be performed at low pressures whilst still accounting for effects of wind and bouyancy

Underlying Principle – Temporal inertia model





- The continuity equ
  Inertia model

$$\frac{1}{\rho_i} V \frac{d\rho_i}{dt} = Q_p\{t\} - q$$

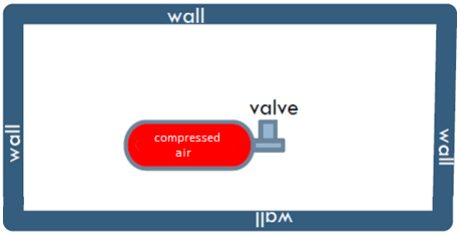
$$p_i/\rho_i{}^{\gamma} = \mathrm{C}$$

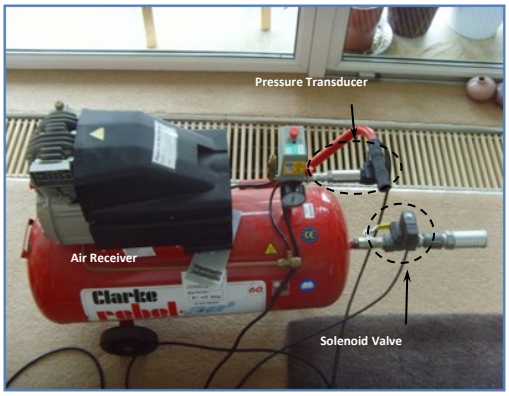
inertia term

$$q\{t\} = Q_p\{t\} - \frac{V}{\gamma p_i}\frac{dp_i}{dt}$$

$$\Delta p\{t\} = aq\{t\}^2 + bq\{t\} + \rho_i \frac{l_e}{A}\frac{dq}{dt}$$

Underlying Principle – Nozzle technique





Mass flow rate

$$\dot{m}_p(t) = -V'[P(t)/P_0]^{(1-\gamma)/\gamma}\dot{P}(t)/(\gamma R T_0)$$

Uniform internal density

$$Q_p\{t\} = \dot{m}_p(t)/\rho_i$$

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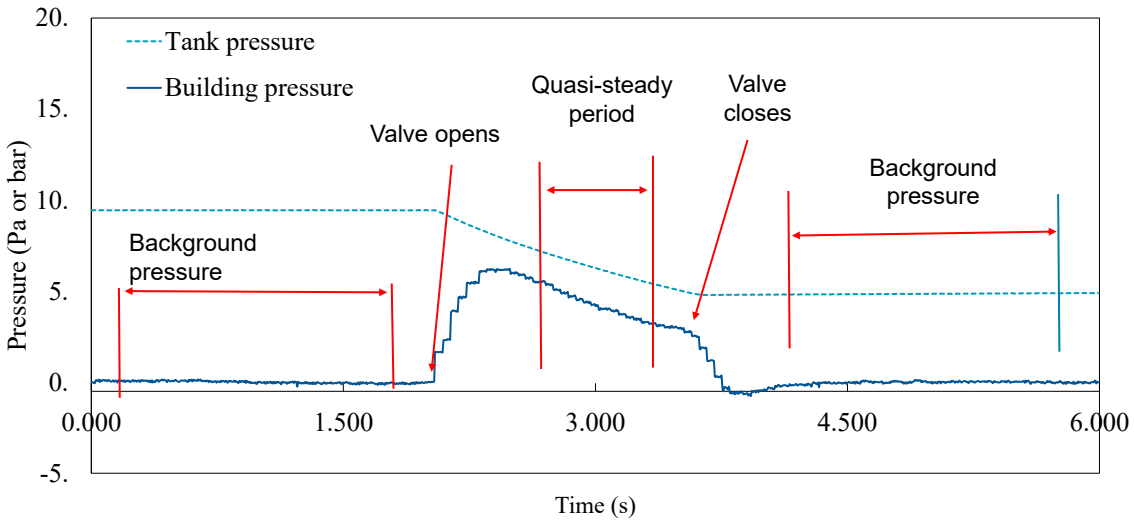
Pulse shape



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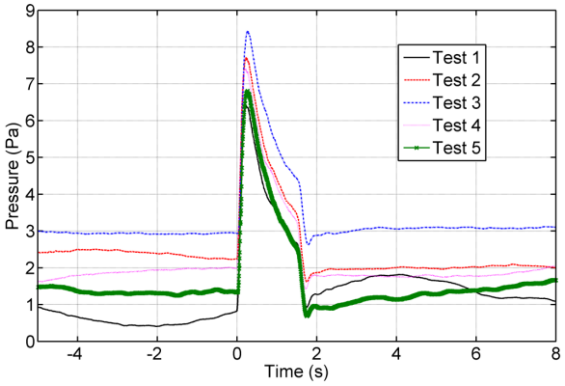
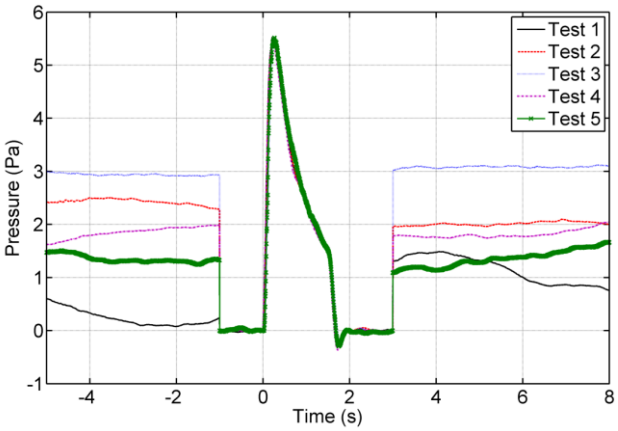
Background pressure change correction





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Testing & Validation

Early testing:

- Repetitive testing in lab chambers and real buildings, in sheltered and unsheltered environments
- CFD modelling of pressure distribution within the air receiver (Pulse tank)
- CFD modelling and experimental validation of the pressure distribution in a building

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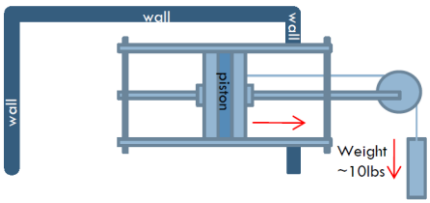
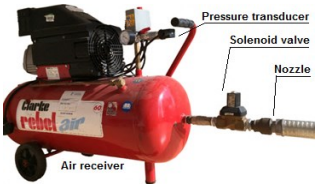
Pulse Progression over the past 20 years





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- ‘Low Pressure Pulse (LPP)’ = the technique
- ‘Pulse’ a patented trademarked product

PULSE

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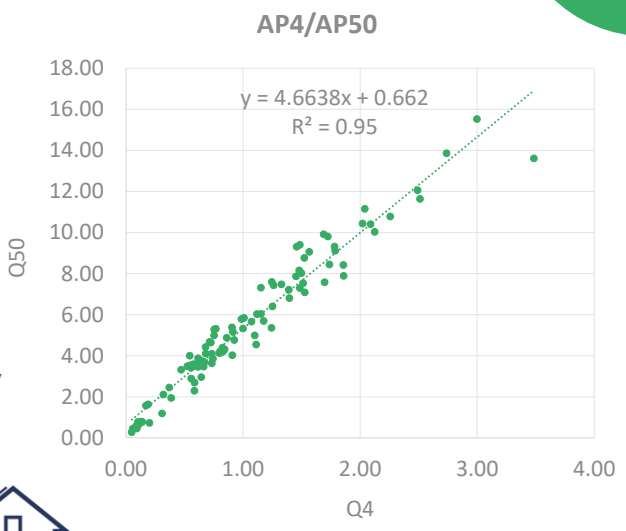
Further testing and validation

- 119 homes BDT vs Pulse
  - Pulse RPD of 4.4%
  - Strong linear agreement with BDT
- 24 homes – Pulse, blower door and tracer gas decay
- BRE ISO 14034 Environmental Technology Verification (ETV)
- National Physics Laboratory 3rd party review



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Low Pressure Pulse (LPP) Airtightness

- Low pressure rapid air leakage testing (4Pa)
- Measured air change rates that are representative of normal occupied conditions
- Simple user operation
- Low disruption
- Extensive validation
- Approved under UK Building Regulations (CIBSE TM23)

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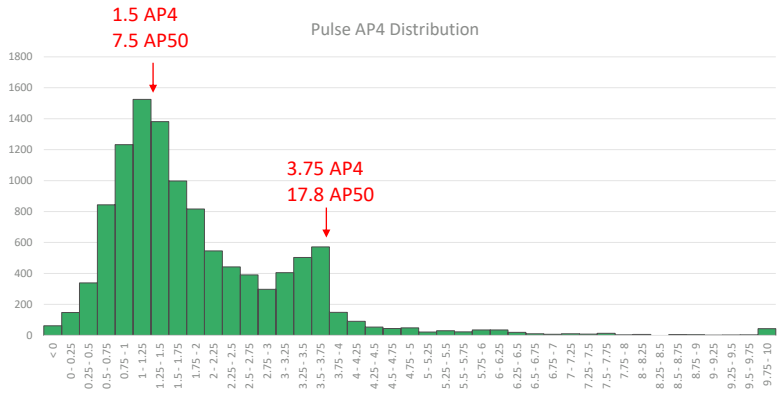
Low Pressure Pulse (LPP) Airtightness

- 20,000 Pulse tests and counting
- Large proportion in existing homes
- Median air permeability 1.8 m3/h/m2 @4Pa 8.9m3/h/m2 @50Pa



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Summary

- Air tightness testing needn't be a one size fits all single product market
- UK Regulations have set a precedent with **CIBSE TM23**, a globally accessible third party standard.
- **Global market** for Pulse across numerous fields – new and existing homes, non-residential buildings and specialist environments. Very different to blower door fan and thus offers numerous new opportunities
- There is a large detailed and comprehensive evidence base for LPP and the Pulse product – commercial, academic and 3rd party inc. ETV

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Thank you

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