

Building Air Tightness

Points Available: 2

Developed in partnership with Umow Lai.

Aim

To improve passive energy performance of building façades by designing well sealed buildings and carrying out whole building air tightness testing.

Rating Tool Eligibility



Green Star
Design & As Built



Green Star
Performance



Legacy Green Star
Rating Tools

Why is this Innovation Challenge Important?

The practice of testing whole building's air tightness (or air permeability) is common in Europe and North America as it is recognised that well sealed buildings perform measurably better for both energy efficiency and thermal comfort.

Australian building's air tightness is comparably very poor and contributes to poor energy efficiency and thermal comfort. There is also no requirement for whole building air tightness testing in Australia and there have only been a handful of relatively small buildings tested in Australia to date.

Compliance Requirements

To test a building's air tightness the building must be pressurised (to 50 Pascal) using a fan and the resulting air flow rate measured. During the test, the building's external doors and windows must be closed with internal doors wedged open, and with any mechanical and natural ventilation openings sealed.

The building air tightness test must be carried out in accordance with at least one of the following standards:

- EN 13829:2001
- ISO 9972:2006
- ASTM E779-10
- ATTMA TSL2 Non-Dwellings – October 2010

For testing a large multi-storey building it may be possible and more practical to use the building's own HVAC system air supply fan(s) to pressurise the building, with the building's exhaust fans turned off and the external exhaust grille sealed off. The building's fans should be capable of creating a pressure difference across the building envelope of at least 60 Pascal. Also, there should be a method of controlling the air volume flow rate by a fan speed controller or control dampers in series with the fan(s). Please refer to CIBSE Technical Memorandum 23 and ATTMA for further information relating to the procedural requirements.

Points Allocation

Whole Building Air Tightness Test

1 point is awarded where a whole building air tightness test is carried out in accordance with a recognised industry standard.

Best Practice Air Tightness Results

1 additional point is awarded where the above is achieved and the building air tightness test results demonstrate a 'best practice' outcome, as outlined in Table 1.

Whole Building Air Tightness Test

In order for one (1) point to be awarded, a whole building air tightness testing must be carried out in accordance with at least one of the recognised international standards listed above.

The following requirements apply, depending on the stage of the project; for a:

- **Design Review / Design rating**, this requirement must be included in the main building contract. In addition, the building owner must include a commitment to provide the results to the GBCA with the condition that they may be published anonymously to better advance and educate the industry.
- **As Built rating**, the results of the testing must be provided to the GBCA with the condition that they may be published anonymously to better advance and educate the industry.

Best Practice Air Tightness Results

In order for the one (1) additional point to be awarded, the 'Whole Building Air Tightness Test' requirements must be met and the building air tightness test results must achieve best practice targets. The following table outlines best practice targets:

Building Type	Best Practice Outcome (m ³ /hr/m ² @ 50 Pa)
Offices (naturally ventilated)	3.0
Offices (mixed mode)	2.5
Offices (mechanically ventilated)	2.0
Hospitals	5.0
Schools	3.0
Museums and Archival Stores	1.0
Cold Stores	0.2
Retail superstore	1.0
Industrial (i.e. factories and warehouses)	2.0
Dwelling (naturally ventilated)	5.0
Dwelling (mechanically ventilated/mixed mode)	1.0
Other	3.0

Table 1 – Best Practice Air Permeability Targets

The figures in Table 1 have been extracted from a combination of CIBSE Technical Memorandum 23:2000 and ATTMA TSL2.

Best Practice Air Tightness Levels

Testing results may be stated as one of two variables: air leakage index or air permeability. The values are similar, but differ in terms of the building envelope area used for normalisation.

- **Air leakage index** is based on the internal envelope surface area of the walls, roofs and floors, but only where floors are NOT in contact with the ground (i.e. suspended floors).
- **Air permeability** is based on the internal envelope surface area of the walls, roofs and floors, irrespective of whether any floors are in contact with the ground.

The figures outlined in Table 1 are related to air permeability, not air leakage index.

Alternative Compliance Methods

A Credit Interpretation Request (CIR) may be submitted to the Green Building Council of Australia (GBCA) when an applicant wishes to advocate for an alternative yet equivalent method of meeting the Compliance or Documentation Requirements. Any CIRs submitted for this Innovation Challenge will be processed as free-of-charge.

Guidance

Whole Building Air Tightness Testing

The practice of testing building's air permeability is common in Europe and North America as it is recognised that well sealed buildings offer the following benefits:

- Lower energy consumption due to reduced fan power.
- Increased building control.
- Increased building modelling accuracy.
- Improved occupant comfort levels.

Moreover, it is a key requirement for international high performance building standards, such as Passivhaus.

Australian building's air permeability standards are comparably very relaxed and contributes to poor energy efficiency. The National Construction Code (NCC) Section J3 – Building Sealing only requires basic measures such as draught proofing and does not apply a test methodology to ensure the application is effectively designed or correctly installed.

Additionally, the NCC JV3 specification stipulates that energy modelling infiltration rates are defined as one air change per hour (ach) at atmospheric pressure. Based on the methodology outlined in CIBSE TM23 this is approximately equivalent to an air permeability of $20 \text{ m}^3/\text{hr}/\text{m}^2 @ 50 \text{ Pa}$.

Referenced Standards

- CIBSE TM23:2000 – Testing Buildings for Air Leakage
- EN 13829:2001 – Thermal performance of building - Determination of air permeability of buildings - Fan pressurization method
- ISO 9972:2006 – Thermal performance of buildings - Determination of air permeability of buildings - Fan pressurization method
- ASTM E779-10 – Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
- ATTMA TSL2 Issue 1 – Air testing standard for non-dwellings for Part L2 2010

Additional Information

- AIRAH 2012, 'Air Tightness of Australian Office Buildings'
http://www.airah.org.au/imis15_prod/Content_Files/EcoLibrium/2012/March%202012/2012_03_01.pdf
- Passivhaus 2014, <http://www.passivhaus.org.uk/>
- The Air Tightness Testing and Measurement Association, <http://www.attma.org/>

Documentation Requirements

Design Review / Design Submission

Provide the following required documentation:

- **Submission Template** outlining how the project has achieved the Innovation Challenge requirements. The Submission Template also enables project teams to provide feedback on the Innovation Challenge to inform future developments.

Provide documentation to support the claims made within the Submission Template. This may include:

- **Extract from main contract** – describing contractor's requirements to carry out whole building air tightness testing to one of the accepted international standards upon completion of the building. This includes requirements to achieve the 'best practice' target level as outlined in Table 1, also including requirement to carry out remedial works and retesting until the relevant target is achieved.
- **Letter of commitment from the building owner** – confirming commitment to:
 - Carry out whole building air tightness testing to one of the accepted international standards upon completion of the building; and
 - To provide results to the GBCA with the condition that they can be published anonymously to better advance and educate the industry.

As Built Submission

Provide the following required documentation:

- **Submission Template** outlining how the project has achieved the Innovation Challenge requirements. The Submission Template also enables project teams to provide feedback on the Innovation Challenge to inform future developments.

Provide documentation to support the claims made within the Submission Template. This may include:

- **Whole building air tightness testing report** – including details of test methodology, air flow rates and statement of the building air permeability achieved.
- **Letter of confirmation from the building owner** – confirming that the GBCA can publish the results anonymously to better advance and educate the industry.