

BUILDING AIR TIGHTNESS

Points available: 2

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INNOVATION CHALLENGE SUMMARY

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.

ELIGIBLE RATING TOOLS

- Green Star rating tools for Design and As Built (legacy rating tools)
- Green Star – Design & As Built (upon release from Oct. 2014)
- Green Star – Performance

TO CLAIM THIS INNOVATION CHALLENGE

To claim this Innovation Challenge your project team must carry out whole building air tightness testing in accordance with a recognised standard, and achieve best practice outcomes.

NEXT STEPS

1. Review the credit as outlined below.
2. Sign up for this Innovation Challenge using the Green Star Project Manager.
3. Receive approval from GBCA to use Innovation Challenge.
4. Submit documentation with Round 1 or Round 2 assessment submission.
5. Provide feedback to GBCA on the application of the Innovation Challenge to their project. This feedback is to be provided to the GBCA in written format to help inform improvements to the content of the Innovation Challenge.

It is expected that 500 to 1000 words would suffice and the feedback must include:

- a. The name of the Innovation Challenge claimed;
- b. The time period related to the implementation of the Innovation Challenge (how long it took to implement);
- c. The type of development the Innovation Challenge was applied to (NCC building class or building use);
- d. The perceived or demonstrated benefits to the owner and project team. This should form the core of the feedback provided. Qualitative and quantitative information may be used.

- e. The perceived or demonstrated difficulties with implementing the Innovation Challenge and suggestions for improvements. Qualitative and quantitative information may be used.

AIM OF CREDIT

To improve building facade passive energy performance by designing well sealed buildings and carry out whole building air tightness testing.

CREDIT CRITERIA

Up to 2 points are awarded where whole building air tightness testing is carried out in accordance with a recognised industry standard, and the following targets are met.

Whole building air tightness testing	1 point is awarded where whole building air tightness testing is carried out in accordance with a recognised industry standard. In addition to that, the project team must provide the test results that may be published anonymously to better advance and educate the industry.
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Best practice air tightness	2 points are awarded where whole building air tightness testing is carried out in accordance with a recognised industry standard and results demonstrate a 'best practice' outcome, as outlined in Table 1.
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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 is measured. During the test the building's external doors and windows are closed with internal doors wedged open with any mechanical and natural ventilation openings sealed.

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.

At least one of the following standards which are applicable to this procedure should be followed:

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

Whole building air tightness testing

For 1 point to be awarded, whole building air tightness testing must be carried out in accordance with recognised standards as described above.

This requirement must be included in the main building contract for a Design stage rating. In addition to that, 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.

For an 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.

The Certified Assessor(s) will not award points unless it is clear that the testing must be carried out as per one of the listed international standards.

Best practice air tightness testing

For the 2 points to be awarded whole building air tightness testing must be carried out in accordance with recognised standards as described above AND best practice targets must be achieved.

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 – 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. The 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 wall, 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.

GUIDANCE

Standards noted in this credit

- 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

Alternative Compliance Methods

A Credit Interpretation Request (CIR) may be submitted to the Green Building Council of Australia (GBCA) when a registered project wishes to advocate for an alternative yet equivalent method of meeting Compliance Requirements.

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 1 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 $20 \text{ m}^3/\text{hr}/\text{m}^2 @ 50 \text{ Pa}$.

Definitions

Whole building air tightness testing - This describes the use of a fan to pressurise and depressurise the building interior in order to determine the rate of air leakage through the building envelope under positive and negative pressure. This test method has been widely adopted in Europe, including in building codes, as a means of assessing and controlling the additional energy burden imposed on buildings by the heating and cooling load due to infiltration.

DOCUMENTATION REQUIREMENTS

DESIGN RATING

Short report

Extract from the main contract

Letter of confirmation

Short report listing the points claimed and referencing documentation submitted for this credit as outlined below.

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 good or 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 RATING / PERFORMANCE RATING

Submission Teplate

Whole building air tightness testing report

Letter of confirmation

Submission template:

- The points claimed
- Reference to submitted documentation for this credit.

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

REFERENCES

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 2014, <http://www.attma.org/>