Building Air Tightness
Consultation Paper
Instructions

We are seeking your written feedback on the proposed updates to Green Star – Design & As Built and Green Star - Interiors. Your feedback is important to us and will assist us to ensure the rating tools continue to promote best practice outcomes.

All feedback must be submitted by January 27th 2017.

How to give feedback

This is one of eight consultation papers.

1. Overview
2. Greenhouse Gas Emissions
3. Building Air Tightness
4. Life Cycle Assessment
5. Structural Engineered Timber
6. Construction Environmental Management
7. Metering & Monitoring
8. Innovation

The Overview paper is a summary of critical issues that you should be aware of. The others provide detail on specific issues.

You can respond to the Overview consultation paper, any of the detailed consultation papers, or all. You can give as much or as little feedback as you wish. You do not need to complete all the questions if you do not wish to. There are two ways to send feedback to us.

1. Respond to questions within the consultation papers then press submit. An email will be sent to GBCA.
2. Send a written submission. You can send us a written submission instead or in addition to written comments in the consultation papers. Please send your feedback to designandasbuilt@gbca.org.au.

If you are unsure where to put your comment, don’t worry, all comments will be considered. Just save your comments and press submit and it will be sent to GBCA or send it to us via email.

Further information

If you have questions on how to provide feedback, we will be hosting a free webinar on December 6th at 12:30pm. Click here to sign up. If you missed the date, it will be available for viewing from December 7th free of charge.

For further information or assistance with the submission papers or consultation process, please contact Naomi Martin (naomi.martin@gbca.org.au) or Karl Desai (karl.desai@gbca.org.au).

Respondent Details

1. Name
2. Company
3. Email
4. Are you submitting on behalf of your company? Y ☐ N ☐
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Request for Feedback

The Green Building Council of Australia (GBCA) is proposing to introduce a requirement for building air tightness testing within the ‘Commissioning and Tuning’ credit for Green Star – Design & As Built v1.2. This rating tool will be released in the second quarter of 2017.

This Consultation Paper seeks industry input on the proposed introduction, the language within the credit, and whether any additional guidance or aspects need to be clarified. The Consultation Paper has been developed with the assistance of the GBCA’s Building Air Tightness working group.

To assist in the consultation for this topic, a draft version of the ‘Commissioning and Tuning’ credit has been prepared and is attached as Appendix A. This draft credit includes the proposed requirements for building air tightness testing. It is recommended that this consultation paper be read in conjunction with this credit.

Interested parties are requested to provide feedback on this Consultation Paper no later than Friday 27 January 2017.

Background

The practice of testing a 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. Benefits include improved ventilation systems (efficiency, air quality), improved control over air movement, and improved thermal comfort levels for occupants.

The National Construction Code has long had a requirement to address air infiltration levels within the fabric of the façade. A number of articles and research papers have shown that Australian façade installations fall short of these requirements, resulting in leaky buildings, driving up energy consumption, increasing thermal discomfort, and introducing humidity to buildings.

Building air tightness testing can be used as a mechanism to commission the façade, and to ensure it has been built to the desired standard. This is particularly true for mechanically-ventilated buildings, where management of air infiltration is relevant to ensure the building is performing adequately and achieving high levels of indoor environment quality. However, due to the lack of uptake in Australia, building air tightness testing of any kind is not commonly done, leading to a lack of capacity to perform testing at scale, and a lack of information as to what appropriate levels of compliance are to ensure proper performance.

Since its inception, Green Star has had a requirement for commissioning the building envelope with the aim of improving energy efficiency of the asset. Whilst, anecdotally, commercial Green Star rated buildings are likely to comply with this requirement, other sectors may not be as stringent at addressing the tightness component of the façade systems.

Two years ago, GBCA introduced building air tightness testing as an Innovation Challenge in Green Star. Since then, it has become clear that it is not industry practice to ensure facades are performing to the desired standard, much less ensuring a minimum level of performance (or a maximum level of air permeability).
Overview

To address the long-term impact that this may have on energy consumption, carbon emissions and thermal comfort, GBCA now aims to ensure building air tightness is addressed in a core Green Star credit.

The introduction of building air tightness testing in Green Star will serve three principles:

- Ensure air tightness testing is seen as an important step in commissioning and verifying a building’s performance;
- Create an industry of practice around air tightness testing; and
- Collect information to improve the air tightness standards for buildings in Australia.

GBCA considered a number of options and methods as to where to introduce building air tightness testing, such as in ‘Greenhouse Gas Emissions’, or as a separate credit.

Upon discussion with the advisory groups and the building air tightness working group, it was agreed that building air tightness testing be introduced as a requirement to achieve points under ‘2.2 Building Commissioning’ or ‘2.3 Building Systems Tuning’.

The aim for introducing the requirement under ‘Commissioning and Tuning’ is to make it clear that air tightness testing is a process that should be undertaken as the building is constructed, or, at the very least, during building tuning. This introduction is aligned with the existing requirements in the credit to commission the façade.

At the introduction of the initiative, the requirement will involve a need to perform building air tightness testing in accordance with a recognised standard and the achievement of a minimum performance benchmark (or maximum air permeability).

The credit will be clear though that it is up to the project team to ensure the outcomes of the testing are in line with the building specifications and modelling. GBCA will not verify this is the case at this time.

O1. Do you agree with the introduction of air tightness testing into the core of the rating tool? Please explain why you agree with the introduction, or not.

O2. Do you agree with the proposed introduction of air tightness testing as a component of the ‘Commissioning and Tuning’ credit?
Technical Requirements

Applicability

The building air tightness test will apply to all building types, irrespective of their conditioning strategy. This includes natural and mixed-mode buildings, and multi-unit residential buildings.

Where there are considerations that should be made specific to building uses/types, this will need to be included in the credit. As an example, testing for industrial buildings (with minimal conditioned floor area) may have different parameters for testing when compared to testing for an office building (with fully conditioned floor area).

The testing is also intended to apply Australia-wide.

1. Should the testing requirements vary between building types? Are there any exclusions that should be made for building types or climate zones? Please refer to any best practice standards or guidelines where available.

Air Permeability Rates

The intention of the introduction is to have the façade comply with the specification values and modelling values. However, this will not be verified at this time for the introduction of this requirement. That will be up to the project team, the client, and the builder or façade provider to make sure that’s the case.

GBCA will verify that, if nothing else, the façade does not perform worse than a minimum performance benchmark (or maximum air permeability). That is, there is a floor for the level of performance that can be achieved to claim testing successful. The minimum performance benchmark (maximum air permeability) has been intentionally set as easily achievable upon introduction. This is in line with the need to create industry capacity as a first step, with future versions likely to verify higher level of air tightness.

The benchmark determined for residential and non-residential buildings is 15m³/(h.m²) at 50 Pascals and 20m³/(h.m²) at 50 Pascals, respectively. This is the benchmark all buildings must meet to achieve the requirement. Table 2.2 in the credit provides the maximum, normal and best practice values.

Two possible Innovation points are also proposed for achieving air tightness levels from the ATTMA TSL1 and TSL2 standards. These innovation points recognise a high degree of achievement in air tightness, incentivising good results.

2. Do you agree with the minimum performance benchmarks as set in Table 2.2? If not, what should these be?
Testing Standards

The building air tightness test is required to be completed in accordance with a recognised standard to ensure the validity of the methodology being used. The following standards are to be recognised:

- ASTM E779-10
- AS/NZS ISO 9972:2015
- ATTMA TSL1 Residential Dwellings – September 2016
- ATTMA TSL2 Non-Dwellings – October 2010
- EN 13829:2001

3. Do you agree with the approved testing standards listed in the credit? Should there be any additional standards recognised?

Testing Area Requirements

Smaller buildings (less than 5000m² envelope area) are required to complete a whole building test.

Larger buildings (greater than 5000m² envelope area) may test to a representative sample area in order to ease the transition for testing. The following is proposed for the sample area: “represent at least 10% of the building envelope area and the areas tested must be representative of the external envelope construction [including different façade types and building geometries] for the building as a whole”. This requirement has been taken from Section 5.3.1 in the ATTMA TSL2 standard with the proportion reduced from 20% in the standard to 10% in the credit.

4. Do you agree with these testing area requirements?
Guidance

Any critical information required to complete the building air tightness test should be described in the Guidance section. This should be Green Star specific and not provide detailed instruction that would typically be provided by the testing contractor.

5. Is the guidance currently provided sufficient? Should there be any additional guidance included?

Suitably Qualified Practitioner

It is proposed that the testing contractor be a member of ATTMA (Air Tightness Testing and Measurement Association) or AIVAA (Air Infiltration and Ventilation Association of Australia).

6. Do you agree with this minimum requirement for the contractor’s competencies? Any further suggestions?

Documentation Requirements

It is proposed that the building air tightness report and documentation confirming that this has been sighted by the relevant parties be provided with the project’s As Built submission. Any non-conformance issues will need to be addressed with the communication of results to the relevant parties and not within this credit, so long as the minimum performance benchmark (maximum air permeability) is achieved.

7. Do you agree with these requirements? Should there be any additional requirements following the building air tightness testing?
Other comments

8. Any final comments / suggestions?
Appendix A: Draft Credit
2.2.3 Air Permeability Performance Testing

An air permeability test must be carried out by a suitably qualified practitioner, in accordance with an approved standard, over a minimum proportion of the building. The test results must not exceed a maximum air permeability rate in order for this credit element to be awarded. This credit element applies to all building types irrespective of their conditioning strategy. Testing is equally relevant to mechanically ventilated (e.g. more efficient HVAC systems) and mixed-mode / naturally-ventilated buildings (e.g. control of airflow).

Please see question 1 to provide feedback.

Suitably Qualified Practitioner

For the purposes of this credit element, a suitably qualified practitioner is defined as a member of either the Air Tightness Testing and Measurement Association (ATTMA) or Air Infiltration and Ventilation Association of Australia (AIVAA).

Additionally, the test results are required to be signed-off by the testing practitioner and main contractor. This ensures that the air permeability rate modelled at the design stage (for which the main contractor is responsible for achieving) is verified by the test and communicated to close the ‘feedback loop’.

Please see question 6 to provide feedback.

Testing Standards

The approved testing standards are:

- ASTM E779-10
- AS/NZS ISO 9972:2015
- ATTMA TSL1 Residential Dwellings – September 2016
- ATTMA TSL2 Non-Dwellings – October 2010
- EN 13829:2001

Please see question 3 to provide feedback.

Testing Area Requirements

For buildings with an envelope area less than 5,000m², a whole building test is required to be completed.

For buildings with an envelope area greater than 5,000m², testing to a representative sample area is deemed acceptable. This should “represent at least 10% of the building envelope area and the areas tested must be representative of the external envelope construction [including different façade types and building geometries] for the building as a whole” (adapted from Section 5.3.1 ATTMA TSL2, 2010). The methodology used to select the sample area and the extrapolation of results for the whole building must be outlined in the submission.

For multi-unit residential buildings, compartment testing of individual apartments is also acceptable.

Please see question 4 to provide feedback.
Building Air Tightness: Consultation Paper

Air Permeability Rate

The test results must not exceed the ‘maximum’ air permeability rate outlined in Table 2.2.

Please note, the project team should be aiming to achieve the air permeability rate as specified by the building’s design team. The intent of the air permeability test is to verify whether this is achieved. The ‘maximum’ rate outlined in Table 2.2 is intentionally conservative to ensure projects can satisfy this requirement without difficulty.

Table 2.2 Building Air Permeability Rates

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Air Permeability m³/(h.m²) at 50 Pascals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>Offices</td>
<td></td>
</tr>
<tr>
<td>Naturally ventilated</td>
<td>20.0</td>
</tr>
<tr>
<td>Mixed mode</td>
<td>20.0</td>
</tr>
<tr>
<td>Air conditioned / low energy</td>
<td>20.0</td>
</tr>
<tr>
<td>Factories / warehouses</td>
<td>20.0</td>
</tr>
<tr>
<td>Superstores</td>
<td>20.0</td>
</tr>
<tr>
<td>Schools</td>
<td>20.0</td>
</tr>
<tr>
<td>Hospitals</td>
<td>20.0</td>
</tr>
<tr>
<td>Museums and archival stores</td>
<td>20.0</td>
</tr>
<tr>
<td>Cold stores</td>
<td>20.0</td>
</tr>
<tr>
<td>Residential ²</td>
<td></td>
</tr>
<tr>
<td>Trickle ventilators and / or intermittent extractors</td>
<td>15.0</td>
</tr>
<tr>
<td>Passive stack</td>
<td>15.0</td>
</tr>
<tr>
<td>Continuous mechanical ventilation</td>
<td>15.0</td>
</tr>
<tr>
<td>Continuous mechanical ventilation – with heat recovery</td>
<td>15.0</td>
</tr>
</tbody>
</table>

¹ The ‘normal’ and ‘best practice’ air permeability rates are taken from ATTMA TSL2.
² All ‘residential’ air permeability rates have been adapted from ATTMA TSL1.

Innovation points are awarded where projects achieve the ‘normal’ or ‘best practice’ air permeability rates. See the Innovation section for detail. ||R2.02.01

Please see question 2 to provide feedback.
INNOVATION

Exceeding Green Star Benchmarks – Building Air Permeability Rates

Up to two (2) additional points may be awarded where projects can demonstrate achieving air permeability rates from the ‘normal’ column (1 point) or ‘best practice’ column (2 points) as stated in Table 2.2.

GUIDANCE

AIR PERMEABILITY TESTING (2.2.3)

To test a building’s air permeability the building must be pressurised in accordance with a standard using a fan and the resulting air flow rate measured. Typically, the building’s external doors and windows must be closed with internal doors wedged open, and with any mechanical and natural ventilation openings sealed. See the relevant standard for detailed guidance.

Testing results are to be stated in terms of air permeability of the building envelope. 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. Where compartment tests are completed for multi-unit residential buildings, results must be stated in terms of air permeability of the envelope of individual apartments.

HVAC Operation

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. 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 the CAN/CGSB 149.15-96 standard, CIBSE Technical Memorandum 23 and ATTMA for further information relating to the procedural requirements.

Timing

Testing is most effective when undertaken early in the construction phase of the project. Air leaks, gaps and other non-conformance items can be addressed more easily at this stage to achieve optimal air permeability results. Re-testing may take place when measures to improve air permeability have been undertaken. The main contractor is required to accept responsibility for the final test results by signing off on them.

Please see question 5 to provide feedback.

Referenced Documents

The following Standards and Guidelines are approved for use with this credit’s Compliance Requirements.

ASTM E779-10
ATTMA TSL1 Residential Dwellings – September 2016
ATTMA TSL2 Non-Dwellings – October 2010
EN 13829:2001
ISO 9972:2006
DOCUMENTATION REQUIREMENTS

‘DESIGN REVIEW’ SUBMISSION (OPTIONAL)

Projects teams shall submit documentation or information marked with an asterisk* for a ‘Design Review’ rating.

Project teams are encouraged to read the Introduction section of the Submission Guidelines, in particular ‘How documentation is described in the Submission Guidelines’, for further information on ‘Design Review’ rating submissions.

AS BUILT SUBMISSION

All project teams shall submit the following documentation:

Submission Template*

Supporting Documentation

Project teams shall provide documentation supporting credit compliance. The following documents may be used to demonstrate compliance:

- Whole building air tightness testing report detailing of test methodology, air flow rates and statement of the building air permeability achieved.
- Signed confirmation from the testing practitioner and main contractor that the results have been sighted.

Please see question 7 to provide feedback.
Appendix B: Full Mark-up
COMMISSIONING AND TUNING

Credit 2
Points available: 4

AIM OF CREDIT
To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential and as designed.

CREDIT CRITERIA
To qualify for points in this credit a minimum requirement must be met.

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Points Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>Environmental Performance Targets</td>
<td>In order for the minimum requirement to be met, documented targets for the environmental performance of the project must be set.</td>
</tr>
<tr>
<td>2.1</td>
<td>Services and Maintainability Review</td>
<td>1 point is available where a comprehensive services and maintainability review of the project is performed.</td>
</tr>
<tr>
<td>2.2</td>
<td>Building Commissioning</td>
<td>1 point is available where comprehensive pre-commissioning and commissioning activities are performed for all nominated building systems, including air permeability testing.</td>
</tr>
<tr>
<td>2.3</td>
<td>Building Systems Tuning</td>
<td>1 point is available where a tuning process is in place that addresses all nominated building systems, including air permeability testing.</td>
</tr>
<tr>
<td>2.4</td>
<td>Independent Commissioning Agent</td>
<td>1 additional point is available for utilisation of an Independent Commissioning Agent (ICA) to advise, monitor, and verify the commissioning and tuning of the nominated building systems throughout the design, tender, construction, commissioning and tuning phases.</td>
</tr>
</tbody>
</table>

COMPLIANCE REQUIREMENTS
The requirements of this credit are project-specific and based on the complexity of the designed and installed building systems.

The project team shall have commissioning process activities completed for all nominated building systems that serve the project. See the Guidance section for the definition of nominated building systems.
2.0 ENVIRONMENTAL PERFORMANCE TARGETS

It is a minimum requirement for this credit that the project team must set and document environmental performance targets for the project.

One common method for demonstrating compliance with this is through the development (early in the design phase) of a design intent report or an owner's project requirements (OPR) document. This document must be prepared by the design team (and ICA project team where applicable) at the design phase stage and outline at least the following items:

- Description of the basic functions, operations, and maintenance of the nominated building systems including:
  - A description of its intended operation and maintenance requirements; and
  - A list of what the main components are (including controls), their operation and the importance of their efficient use.
- The targets for the project energy and water consumption and energy and water budgets for all nominated building systems.
- Description of how energy, water, and aspects of indoor environment quality are metered and monitored. This includes a meter diagram that illustrates how energy and water budgets are confirmed in operation.

2.1 SERVICES AND MAINTAINABILITY REVIEW

One (1) point is awarded where a project team can demonstrate that a comprehensive services and maintainability review has been conducted, led by the head contractor or the owner's representative (or the ICA where applicable), during the design stage and prior to construction.

The services and maintainability review is to facilitate input from the design team, the facilities manager and operations staff (if known), and any relevant suppliers and subcontractors (if engaged). The review must address the following aspects for all nominated building systems:

- Commissionability;
- Controllability;
- Maintainability;
- Operability, including ‘Fitness for Purpose’; and
- Safety.

The services and maintainability review and its outcomes must be summarised in a ‘Service and Maintainability Report’. This report must be agreed and signed off by the involved parties. Action items resulting from this review shall be incorporated in the design intent report or OPR as outlined in 2.0. Information on the requirements of this review are outlined in the approved standards and guidelines (refer to Guidance section).
2.2 BUILDING COMMISSIONING

One (1) point is awarded when a project team can demonstrate that the pre-commissioning and commissioning activities have been performed based on the approved standards and guidelines (refer to the Guidance section) for all nominated systems. This includes an air permeability test being carried out by a suitably qualified practitioner, in accordance with an approved standard, and a maximum air permeability rate not being exceeded.

To demonstrate compliance, the following must be documented:

2.2.1 Commissioning Specification

The contractual tender or construction documentation must list the commissioning requirements for each system. It is not sufficient to state that systems must be commissioned to the relevant standard. Instead, the documentation must:

- List the design parameters for each system;
- List the required commissioning activities;
- Define how each system is intended to operate; and
- List the acceptable tolerances during commissioning.

Contractual documentation must clearly indicate divisions of responsibilities, pre-commissioning procedures, commissioning requirements, witnessing requirements, phased completion requirements (if needed), post occupancy checks, and any training requirements for the operator.

2.2.2 Commissioning Plan

A commissioning plan shall be developed and include at least the following, the:

- Objectives, or basis, of the design;
- Scope of the commissioning plan;
- Commissioning team list, the individual responsibilities and interface matrix;
- General sequence of commissioning;
- Proposed commissioning procedures;
- Witnessing requirements;
- Commissioning program; and
- Requirements for subcontractor commissioning manuals.

For a project to claim this criterion, the commissioning must have taken place in accordance with the requirements laid out in the contractual documentation and the commissioning plan. The commissioning report must certify that this is the case, and be signed by the designer, the head or main contractor, the commissioning manager (or ICA), and the project manager (or owner’s representative).

The person responsible for the commissioning of the nominated services must have specific and demonstrable knowledge of the types of systems to be commissioned. As an example, a general subcontractor is unlikely to be able to fill this role.
|| 2.2.3 Air Permeability Performance Testing

An air permeability test must be carried out by a suitably qualified practitioner, in accordance with an approved standard, over a minimum proportion of the building. The test results must not exceed a maximum air permeability rate in order for this credit element to be awarded.

This credit element applies to all building types irrespective of their conditioning strategy. Testing is equally relevant to mechanically ventilated (e.g. more efficient HVAC systems) and mixed-mode / naturally-ventilated buildings (e.g. control of airflow).

Please see question 1 to provide feedback.

Suitably Qualified Practitioner

For the purposes of this credit element, a suitably qualified practitioner is defined as a member of either the Air Tightness Testing and Measurement Association (ATTMA) or Air Infiltration and Ventilation Association of Australia (AIVAA).

Additionally, the test results are required to be signed-off by the testing practitioner and main contractor. This ensures that the air permeability rate modelled at the design stage (for which the main contractor is responsible for achieving) is verified by the test and communicated to close the ‘feedback loop’.

Please see question 6 to provide feedback.

Testing Standards

The approved testing standards are:

- ASTM E779-10
- AS/NZS ISO 9972:2015
- ATTMA TSL1 Residential Dwellings – September 2016
- ATTMA TSL2 Non-Dwellings – October 2010
- EN 13829:2001

Please see question 3 to provide feedback.

Testing Area Requirements

For buildings with an envelope area less than 5,000m², a whole building test is required to be completed.

For buildings with an envelope area greater than 5,000m², testing to a representative sample area is deemed acceptable. This should “represent at least 10% of the building envelope area and the areas tested must be representative of the external envelope construction [including different façade types and building geometries] for the building as a whole” (adapted from Section 5.3.1 ATTMA TSL2, 2010). The methodology used to select the sample area and the extrapolation of results for the whole building must be outlined in the submission.

For multi-unit residential buildings, compartment testing of individual apartments is also acceptable.

Please see question 4 to provide feedback.
**Air Permeability Rate**

The test results must not exceed the ‘maximum’ air permeability rate outlined in Table 2.2.

Please note, the project team should be aiming to achieve the air permeability rate as specified by the building’s design team. The intent of the air permeability test is to verify whether this is achieved. The ‘maximum’ rate outlined in Table 2.2 is intentionally conservative to ensure projects can satisfy this requirement without difficulty.

**Table 2.2 Building Air Permeability Rates**

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Air Permeability m³/(h.m²) at 50 Pascals</th>
<th>Maximum</th>
<th>Normal¹</th>
<th>Best Practice¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Naturally ventilated</td>
<td></td>
<td>20.0</td>
<td>7.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Mixed mode</td>
<td></td>
<td>20.0</td>
<td>5.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Air conditioned / low energy</td>
<td></td>
<td>20.0</td>
<td>5.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Factories / warehouses</td>
<td></td>
<td>20.0</td>
<td>6.0</td>
<td>2.0</td>
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<tr>
<td>Superstores</td>
<td></td>
<td>20.0</td>
<td>5.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Schools</td>
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<td>20.0</td>
<td>9.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Hospitals</td>
<td></td>
<td>20.0</td>
<td>9.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Museums and archival stores</td>
<td></td>
<td>20.0</td>
<td>1.5</td>
<td>1.0</td>
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<tr>
<td>Cold stores</td>
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<tr>
<td>Residential²</td>
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<tr>
<td>Trickle ventilators and / or</td>
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<td>15.0</td>
<td>7.5</td>
<td>3.0 – 5.0</td>
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<td>intermittent extractors</td>
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<td>Passive stack</td>
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<td>15.0</td>
<td>7.5</td>
<td>3.0 – 5.0</td>
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<td>Continuous mechanical ventilation</td>
<td></td>
<td>15.0</td>
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<td>2.0 – 4.0</td>
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<tr>
<td>– with heat recovery</td>
<td></td>
<td>15.0</td>
<td>3.75</td>
<td>1.0 – 2.0</td>
</tr>
</tbody>
</table>

¹ The ‘normal’ and ‘best practice’ air permeability rates are taken from ATTMA TSL2.
² All ‘residential’ air permeability rates have been adapted from ATTMA TSL1.

Innovation points are awarded where projects achieve the ‘normal’ or ‘best practice’ air permeability rates. See the Innovation section for detail.

Please see question 2 to provide feedback.
2.3 BUILDING SYSTEMS TUNING

One (1) point is awarded where, following practical completion and prior to occupation, the owner/client has formally committed to a tuning process for all nominated building systems. At a minimum, the commitment must include quarterly adjustments and measurement for the first 12 months after occupation and a review of building system manufacturer warranties. The scope of the tuning works will determine the relevant tuning period.

The building tuning process will require the analysis of data from the monitoring systems and assessment of feedback from occupants on building conditions. During the tuning period, the owner/client must commit to take steps to adjust nominated building systems to account for all identified deficiencies.

The commitment from the building owner must confirm that there is a requirement for a building tuning process and responsibilities are assigned to have all nominated building systems tuned after practical completion. This commitment can be included in the Commissioning Plan or provided as a separate document from the building owner. The commitment must include at least the following:

- Operating and Maintenance Manuals have been developed in accordance with approved standards and guidelines (refer to Guidance);
- A building tuning manual, or a building tuning plan, has been developed in accordance with the approved standards and guidelines;
- A building tuning team has been created including the facilities manager, the owner's representative and the ICA (if applicable). The head contractor and the services design professionals are available to address specific tuning issues where required; and
- The owner has engaged parties to tune the nominated systems. This engagement includes requirements for:
  - Verification that nominated systems are performing to their design potential at full and part load conditions;
  - Reviews of environmental performance against the environmental targets;
  - Collection of user feedback to match the system performance with the occupant's needs;
  - Adjustment of all the systems to account for all deficiencies discovered; and
  - Management, communication, and assignment of responsibilities for the tuning process within the team; and.
  - Air permeability testing to be carried out in accordance with 2.2.3. If air permeability testing was carried out during commissioning, this will suffice.
2.4 INDEPENDENT COMMISSIONING AGENT

This point can only be awarded if at least one of the credit requirements for 2.1, 2.2 or 2.3 has been achieved.

One (1) point is awarded where an Independent Commissioning Agent (ICA) has been appointed to advise, monitor, and verify the commissioning and tuning of the nominated building systems throughout the design, tender, construction, commissioning and tuning phases.

When this point is claimed, the specified commissioning requirements must be overseen by a qualified independent commissioning professional (separate from the design team) who is engaged directly by the client/building owner and reports directly to the owner (or the owner’s representative).

An Independent Commissioning Agent (ICA) fulfils the roles of this criterion. A facilities manager employed by the client qualified in the commissioning of these systems also fulfils this criterion.

DEFINITIONS

Independent Commissioning Agent (ICA)
The ICA is defined as a person who is:

- An advocate for, and reports directly to, the project owner;
- Independent of any consultant, contractor or sub-contractor organisation that has been involved in the design or installation of the nominated systems; and
- A registered professional engineer or qualified technician with demonstrated knowledge on nominated systems commissioning, and has previous experience with the commissioning process of at least 2 projects similar in scope.

The qualified independent commissioning professional role can be fulfilled by one or multiple persons, provided that all meet the requirements laid out above. It can also be fulfilled by a person who is part of the client’s organisation, if the person is qualified to do so. An independent commissioning company may also meet these requirements.

Nominated Building Systems

This credit requires nominated building systems to be defined by the project team. Examples of nominated building systems could include, but are not limited to:

- Mechanical systems (such as HVAC and refrigeration systems; mechanically operable systems such as blinds and actuated shading devices).
- Building Management and Control System (BMCS).
- Lighting and associated controls.
- Electrical systems (such as electrical generation, electrical supply, distribution systems, security and access systems, and alarm systems).
- Hydraulic systems (such as gas and water supply distribution systems, sewage collection and distribution systems, stormwater collection and distribution systems; pumps).
- Fire detection systems, smoke alarm systems and emergency warning systems.
- Fire protection systems, including pumps and other equipment.
- Lifts and any other vertical transport devices.
Building Air Tightness: Consultation Paper

- Building envelope, such as facades, roofs and glazing systems.
- Any other system that have an impact on the energy or water consumption of the building as identified by building owner or building operator.
- Building envelope, such as facades, roofs and glazing systems.

Owner's Project Requirements

A common method for demonstrating that nominated building systems have been defined is through the owner’s project requirements (OPR) document, or an equivalent document containing the same information. The OPR (or equivalent document) should be prepared by the design team and outline at least the following items:

- Description of the basic functions, operations, and maintenance of the nominated building systems, including:
  - A description of its intended operation and maintenance requirements; and
  - A list of what the main components are (including controls) and the importance of their efficient use.
- The targets for the energy and water consumptions and budgets for nominated building systems; and
- Description of how energy, water, and aspects of indoor environment quality are metered and monitored. This typically would include a meter diagram that illustrates how energy and water budgets could be confirmed in operation.

INNOVATION

Exceeding Green Star Benchmarks – Supplementary or Tenancy Fitout Systems Review

One (1) additional point may be awarded where project teams and building owners carry out a comprehensive services and maintainability review of supplementary or tenancy fitout systems, in addition to all nominated base building systems as outlined above. This review must be undertaken to ensure the design and function of such systems are properly integrated with base building systems.

Market Transformation – Soft Landings Framework

One (1) additional point may be awarded where project teams carry out commissioning and tuning of the building in accordance with the Soft Landings Framework (BSRIA).

Exceeding Green Star Benchmarks – Building Air Permeability Rates

Up to two (2) additional points may be awarded where projects can demonstrate achieving air permeability rates from the ‘normal’ column (1 point) or ‘best practice’ column (2 points) as stated in Table 2.2.
GUIDANCE

AIR PERMEABILITY TESTING (2.2.3)

To test a building’s air permeability the building must be pressurised in accordance with a standard using a fan and the resulting air flow rate measured. Typically, the building’s external doors and windows must be closed with internal doors wedged open, and with any mechanical and natural ventilation openings sealed. See the relevant standard for detailed guidance.

Testing results are to be stated in terms of air permeability of the building envelope. 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. Where compartment tests are completed for multi-unit residential buildings, results must be stated in terms of air permeability of the envelope of individual apartments.

HVAC Operation

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. 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 the CAN/CGSB 149.15-96 standard, CIBSE Technical Memorandum 23 and ATTMA for further information relating to the procedural requirements.

Timing

Testing is most effective when undertaken early in the construction phase of the project. Air leaks, gaps and other non-conformance items can be addressed more easily at this stage to achieve optimal air permeability results. Re-testing may take place when measures to improve air permeability have been undertaken. The main contractor is required to accept responsibility for the final test results by signing off on them.

Please see question 5 to provide feedback.

Referenced Documents

The following Standards and Guidelines are approved for use with this credit’s Compliance Requirements.

AIRAH DA27 Building Commissioning 2011
AIRAH DA28 Building Management and Control Systems (BMCS) 2011
CIBSE Commissioning Code M (and the ancillary codes for relevant services)
ASHRAE Commissioning Guideline 1.1-2007 (for mechanical services)
ASTM E779-10
ATTMA TSL1 Residential Dwellings – September 2016
ATTMA TSL2 Non-Dwellings – October 2010
EN 13829:2001
ISO 9972:2006
DOCUMENTATION REQUIREMENTS

‘DESIGN REVIEW’ SUBMISSION (OPTIONAL)

Projects teams shall submit documentation or information marked with an asterisk* for a ‘Design Review’ rating.

Project teams are encouraged to read the Introduction section of the Submission Guidelines, in particular ‘How documentation is described in the Submission Guidelines’, for further information on ‘Design Review’ rating submissions.

AS BUILT SUBMISSION

All project teams shall submit the following documentation:

Submission Template*

Supporting Documentation

Project teams shall provide documentation supporting credit compliance. The following documents may be used to demonstrate compliance:

- **Evidence of Targets for Environmental Performance** where the environmental performance targets are documented as outlined in the Compliance Requirements. The relevant sections must be highlighted.
- **Service and Maintainability Report** where the service and maintainability review is summarised as outlined in 2.2. The relevant sections must be highlighted.
- **Extract(s) from the Commissioning Report** demonstrating that comprehensive pre-commissioning activities and commissioning activities have been performed as outlined in 2.2. The relevant sections must be highlighted.
- **Building Tuning Commitment** or contract demonstrating that there is a requirement for a building tuning process as outlined in the 2.3. The relevant sections must be highlighted.
- **CV of the Independent Commissioning Agent** detailing the qualifications and experience relevant to the project.
- **Whole building air tightness testing report** detailing of test methodology, air flow rates and statement of the building air permeability achieved.
- **Signed confirmation** from the testing practitioner and main contractor that the results have been sighted.

**Please see question 7 to provide feedback.**
## REVISIONS AND AMENDMENTS

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<tr>
<td>1</td>
<td>01/07/2015</td>
<td>Minor wording corrections throughout to improve clarity. Added ‘Design Review’ note to <em>Documentation Requirements</em> section.</td>
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<tr>
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