

Verification and Handover

Responsible

Credit: 3

Points: 1

Outcome

The building has been optimised and handed over to deliver a high level of performance in operation.

Criteria

Minimum Expectation	Nil	<ul style="list-style-type: none"> The building is set up for optimum ongoing management due to its appropriate metering and monitoring systems. The building has set environmental performance targets, designed and tested for airtightness, been commissioned, and will be tuned. The project team create and deliver operations and maintenance information to the facilities management team at the time of handover. Information is available to building users on how to best use the building.
Credit Achievement	1 point	<p>In addition to the <i>Minimum Expectation</i>:</p> <ul style="list-style-type: none"> An independent level of verification is provided to the design, planning, commissioning and tuning activities through the involvement of an independent commissioning agent. <p>or</p> <ul style="list-style-type: none"> The project uses a soft landings approach that involves the future facilities management team. <p>For large projects, both must occur.</p>

Additional information

Stage implementation

Strategy Brief Concept Design Tender Construction Handover Use

Synergies with other credits

- Energy Use
- Energy Source
- Grid Resilience
- Operations Resilience
- Clean Air

Sustainable Development Goals

- Goal 11 (Sustainable Cities and Communities)

Relevant reporting initiatives

- None

Requirements

Minimum Expectation

The project must comply with **all three** of the following criteria:

- Metering and Monitoring
- Commissioning and Tuning
- Building Information

Metering and Monitoring

Metering

The building must have accessible energy and water metering for all common uses, major uses, and major sources.

The meters must be connected to a monitoring system capable of capturing and processing the data produced by the meters.

The meters and automatic monitoring systems must:

- Provide continual information (up to 1-hour interval readings)
- Be commissioned and validated per the most current NABERSNZ protocol to support future achievement of a NABERSNZ rating, irrespective of the current viability of a NABERSNZ rating for the building or building type. Refer to "Validation requirements of metering systems" within the NABERSNZ rules.
- Electrical meters, both utility and sub-meters, should comply with IEC62053-21 standards and conform to ≤ Class 1 classification
- Gas Meters should comply with OIML R137 and conform to Class 1 requirements or NZS 5259:2015 (General requirements are from BS EN 1776:2015) and conform Class A requirements
- Water Meters should follow the Water New Zealand Good Practice Guide in regard to accuracy. Water NZ requires meters to meet the OIML R49 Standards with a minimum turn down ratio of R160.
- Where the building's Gross Floor Area (excluding car parking areas) is smaller than 1000m², unless specialist equipment with an annual power consumption of 100kwh/annum, is present in the building, a single meter for energy and a single meter for water will comply with this minimum requirement. If accessible to the building manager, the utility meter is acceptable provided it meets accuracy and data collection requirements above. If applicable, process loads and PV systems are to be metered separately.

Monitoring strategy

The monitoring system must accurately and clearly present the metered data and include reports on consumption trends for the automatic monitoring system. The monitoring strategy must be developed in accordance with a recognised Standard, such as CIBSE TM39 Building Energy Metering. The monitoring strategy must include a metering schedule and identify the location and types of meters.

The monitoring system must raise an alarm when the energy or water use increases beyond certain parameters and automatically issue an instant alert to the facilities manager. The process to assess, correct and validate alerts or faults must be detailed and contained in an accessible location.

The monitoring system must be commissioned to generate at a minimum annual and monthly reporting of building and meter energy data.

The project team must demonstrate the reporting and alarm functionality has been designed, installed, commissioned, and tested at practical completion to be awarded this credit. System capability for future implementation is not sufficient.

Commissioning and Tuning

The project team must perform the following

- Prior to construction:
 - Set environmental performance targets
 - Perform a services and maintainability review
 - Design for airtightness
- During construction and practical completion:
 - Commission the building
 - Engage building tuning service provider
 - Test for airtightness
- After practical completion:
 - Tune the building over the next 12 months

Environmental performance targets and information

At design, the project team must set and document environmental performance targets for the project outlining:

- The targets for the project energy and water consumption for each individual nominated building system
- Metering diagrams for energy and water
- Operational monitoring expectations of energy, water, and indoor environment quality
- Descriptions of the functions, intended operation, and maintenance requirements of individual nominated building systems
- Airtightness targets

Examples of common methods 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. The document must provide a clear description of the basic functions, operations, and maintenance of the nominated building systems. It lists targets for the project energy and water consumption for all individual nominated building systems.

All targets must be signed off by the asset owner.

Services and maintainability review

During design, the project team must conduct a services and maintainability review of the building. The review must include all project team roles involved within the design process i.e. Owner's Representative, Design consultants, Architect, Sustainability/ESD Consultant, Facilities Manager, Head Contractor and the Independent Commissioning Agent (where nominated).

The review must address the following:

- Commissionability
- Controllability
- Maintainability
- Operability
- Safety of all systems.

The services and maintainability review and its outcomes must be summarised in a 'Service and Maintainability Report'. All items must be addressed, closed-out and documented within the final Services and Maintainability Report and signed off by all involved parties prior to tender.

Building commissioning

A commissioning specification and plan must be developed during design, and prior to practical completion and included in the construction documentation listing requirements for each system.

All building systems must be commissioned per a recognised commissioning standard (CIBSE or ASHRAE commissioning guides).

The contractual tender or construction documentation must list the commissioning requirements for each system. It is not enough to state that systems must be commissioned to the relevant standard. The person responsible for the commissioning of the nominated services must have specific and demonstrable knowledge of the types of systems to be commissioned.

Airtightness

Airtightness must be included as part of the commissioning process during the following stages:

- Concept design: review of design including an air barrier system schematic
- Design Development: review for tightness including air barrier continuity on building plans, sections, and details. Scope of work and necessary coordination between trades and responsibilities must be demonstrated
- Pre-Construction: A plan for stages of commissioning for air tightness must be defined and included in the project timeline
- Construction: The building must undertake airtightness testing in accordance with the pre-construction phase air-tightness testing plan. Testing must be carried out by a suitably qualified practitioner. If a quantitative test to determine an air permeability rate is used, it must be conducted on the whole building system according to AS/NZS ISO 9972:2015 Thermal performance of buildings determination of air permeability of buildings - Fan pressurisation method. On sections smaller than the whole building qualitative procedures such as ASTM E1186-17 may be used.

Building systems tuning

The owner or developer must contractually commit to a tuning process that includes quarterly adjustments and measurements for at least the first 12 months after occupation.

The commitment must include:

- A building tuning manual or plan
- A description of the building tuning team
- Confirmation the owner has engaged parties to tune the nominated systems
- Roles & responsibilities of each party within the tuning team, including deliverables
- The building tuning plan can be detailed within the commissioning plan. Where the tuning plan or manual is separate to the commissioning plan, it must refer to using the commissioning plan and the commissioning records & results as the baseline data.

The building tuning team must include:

- The facilities manager
- The Independent Commissioning Agent (ICA) or other building owner's representative
- The head contractor
- The services design professionals

These individuals must be available to address specific tuning issues where required.

Building Information

Operations and maintenance information

The project team must provide operations and maintenance information for all nominated building systems to the building owner (or designated representative). This means:

- Appropriate content for all nominated building systems has been developed and provided
- The appropriate user group has access to the information they require to deliver best practice environmental outcomes
- Guidance on keeping information up to date is provided to the facilities management team in these documents

Building logbook

The project team must develop a building logbook to present to the building owner (or designated representative) before practical completion of the project. The building logbook must:

- Be developed in line with CIBSE TM31: Building Logbook Toolkit
- Cover all nominated building systems
- Include links or references to all relevant operations and maintenance information

Building user information

Building user information is a source of up-to-date, relevant information for the building user.

Building user information must be able to be updated and edited by the facilities management team, or other appropriate stakeholder groups, to ensure it remains current and relevant to users throughout the life of the building.

All building user information must be available to the building owner and facilities management team at the time of practical completion.

Credit Achievement

In addition to the *Minimum Expectation*, the project must comply with **one** of the following criteria:

- Soft Landings Approach
- Independent Commissioning Agent

For buildings with a Total Building Services Value of over \$20m, **both** requirements must be met.

Soft Landings Approach

The soft landings approach is described in 'The Soft Landings Framework Australia and New Zealand' published by CIBSE ANZ, based on the BSRIA guide.

- The soft landings framework has five parts:
 - Briefing (Stage 1)
 - Design development (Stage 2)
 - Pre-handover (Stage 3)
 - Initial after care (Stage 4)
 - Years 1 to 3 aftercare (Stage 5)

Stages 1 to 4 are required for purposes of this credit. Stage 5 is optional, but highly encouraged.

The Soft Landings Framework document contains sample worksheets. Project teams are required to fill them in for Stage 1 to 3. Project teams are required to describe the actions that will be taken for Stage 4.

The facilities management team (or building owner's representative) for the building must be involved in the soft landings approach. This means, the facilities management team must:

- Be involved in commissioning and handover process
- Take part in the development of a brief technical guide for the building and the building operations and maintenance manual
- Sign-off on the operations and maintenance manual

- Be trained before handover. The training must include a demonstration of the building management system and any control mechanisms. The demonstration must be comprehensive and allow for additional items to be developed, such as logbooks or other manuals.

The facilities management team must have continued access to critical design and construction team members for two years after practical completion to allow for transitioning the responsibility for the building.

Independent Commissioning Agent

An ICA must be appointed to advise, monitor, and verify the commissioning and tuning of the nominated building systems throughout the design, tender, construction, commissioning, and tuning phases.

The specified commissioning requirements must be overseen by a qualified independent commissioning professional(s).

Submission content

Submissions for this credit must contain:

- **Submission form**
- **Evidence** to support claims made in the submission

Recommended evidence:

Metering and Monitoring

- Plan drawings showing the location of all energy and water meters in the project and the associated energy and water uses
- Schematic drawings, which are clearly coordinated with the plan drawings and the metering plan demonstrating adequate meter coverage and appropriate calculations or check mechanisms to allow provision of reporting and error detection as per the credit compliance requirements
- Letter of confirmation from the contractor/metering provider/manager demonstrating that the metering systems are continually and automatically monitored by a system that is able to produce alerts if any inaccuracies are found
- Commissioning reports demonstrating correct operation of meter reading, reporting and alarm generation
- Copy of Monitoring Strategy document specific to the building, including calculations demonstrating that all significant water and energy sources and uses are adequately covered in terms of both usage and accuracy verification
- Accuracy certificates for meters
- Completed Metering Validation sheets/documents to demonstrate metering system meets the NABERS Protocol for validation of non-utility meters

Commissioning and Tuning

- Service and Maintainability Report, where the service and maintainability review is summarised
- Extract(s) from the Commissioning Report demonstrating that comprehensive pre-commissioning activities and commissioning activities have been performed
- Building Tuning Commitment or contract demonstrating that there is a requirement for a building tuning process
- Building airtightness testing report detailing of test methodology, air flow rates, details of airtightness considerations from schematic design through to construction and statement that the target air permeability from Environmental Performance Targets has been achieved
- Signed confirmation from the testing practitioner and main contractor that the results have been sighted.

Building Information

- Owner's project requirements document, or an equivalent document, defining the nominated building systems
- Operations and maintenance information
- Building logbook

- Building user information.

Soft Landings Approach

- Evidence of implementation of BSRIA framework.

Independent Commissioning Agent

- CV of the Independent Commissioning Agent detailing the qualifications and experience relevant to the project
- Letter from building owner confirming the appointment of an ICA
- Evidence of implementation of BSRIA framework.

Alternate documentation can also be used by project teams to demonstrate compliance.

The recommended evidence listed above is applicable to the as built submission. See the *Design Assessment* section in the Introduction for more information on submitting evidence for the Design assessment.

The key requirement is that evidence is provided to support each claim made within the Submission form.

Guidance

Air tightness commissioning

The commissioning process for airtightness should be applied to the whole building or project. The requirement of this credit is to integrate attention to air tightness into the commissioning process and conduct testing to learn as much about the process as possible. The project team should set reasonable goals and verify that those goals have been met.

The following is provided as reference only and are not additional requirements.

- Pre-design phase: the process of commissioning for airtightness begins at the project inception, when broad expectations and goals for performance are defined. As a minimum, goals for performance should be linked or comparable to best practice guidelines such as ATTMA TSL1 and 2.
- At preliminary design phase: This includes creation of an air barrier system schematic, definitions of different space conditioning requirements, and delineation of the extent of the conditioned building envelope. This process should fit in the same timeline with other such building envelope commissioning steps, such as definition of fire separation boundaries in the building.
- Design development phase: review for air tightness should be completed. The air barrier system includes façade elements, but also interior separations between conditioned and unconditioned spaces, and integration of HVAC, electrical, communications, and plumbing elements into the system. This includes plan reviews for air barrier continuity on building plans, sections, and details. To be considered:
 - Constructability and construction sequence
 - Costs of completion of the air barrier system
 - Scope of work and necessary coordination between trades and responsibilities
 - A plan for stages of commissioning for air tightness should be defined and included in the project timeline
- Pre-construction phase: builder and mechanical contractor statements of understanding and commitment of resources and personnel necessary for, and commitment to assist with, airtightness test preparation, regardless of scale of planned testing. Tests should be carried out according to the commissioning plan
- Verification phase: the aim of the airtightness testing is to verify the air permeability targets. The testing should verify the as-built performance of the building envelope. Should there be a discrepancy, the project team should address this as part of the commissioning process.

Testing for airtightness

Airtightness testing should be carried out on the whole building, or across sample areas of the whole building by a suitably qualified practitioner. Testing should be completed on a total of either 5,000m² or 20% of the building's envelope area, whichever is greater. Sample areas tested should be representative of the range of external envelope constructions, including different façade types, junctions and building geometries. Priorities should be placed on typical assemblies as well as critical, or high-risk, assemblies.

Project teams conducting partial testing should do so prior to the envelope being fully completed, to provide early indication of weak points and allow time to address any issues identified during the testing process. Such tests may be considered qualitative and evaluate the effectiveness of the air barrier system. Nearer project completion, a quantitative test such as a AS/NZS ISO 9972:2015 on a whole building may also be used. For any testing conducted, documentation of deficiencies should be distributed to the project team, included in the commissioning report, and signed off by the design team.

Suitably qualified practitioner

For the purposes of this credit element, a suitably qualified practitioner is defined as a member of the Air Tightness Testing and Measurement Association (ATTMA) or a testing member of the Air Infiltration and Ventilation Association of Australia (AIVAA). Please note, there are different membership types within AIVAA – in order for this requirement to be met, the practitioner must be a 'testing member' or hold an ATTMA Level 2 Registered Air Tightness Tester certification. This requirement is intended to ensure a quality testing outcome given the testing practitioner's membership with an industry recognised body. Should project teams wish to demonstrate an alternative yet equivalent qualification, a Technical Question must be submitted.

For a current listing of members, please visit the following websites:

- Air Tightness Testing and Measurement Association: <https://www.bcta.group/attma/members/international-members/>
- Air Infiltration and Ventilation Association of Australia: <https://aivaa.asn.au/who-is-aivaa/>

CIBSE TM39 Building Energy Metering standard

Although this Standard has been created to be used for developing energy metering and monitoring strategies, for the purpose of this credit, the same principles described in the Standard shall be used for developing water metering and monitoring strategies.

Operational monitoring expectations

- Energy: Performance measurement procedures including quarterly reporting against targets
- Water: Performance measurement procedures including quarterly reporting against targets
- Indoor Environment Quality: can be via occupant comfort survey targets, HVAC system maintenance targets, quarterly reporting of indoor air quality, thermal comfort, or lighting comfort performance measurements

Metering schedule

The schedule should address the estimated loads for energy and water and list:

- Incoming input (electricity, gas, water etc)
- End Use (lighting, HVAC)
- Estimated energy consumption for the end use
- Which meters provide the required information
- Initial estimated end consumption

Soft landings

For information on how to implement a "Soft Landings' approach, please see <https://www.bsria.com/uk/consultancy/project-improvement/soft-landings/>

Metering - cold shell spaces

Where base building metering and monitoring strategy relies on connection of tenant meters guidance must be created for tenants regarding metering requirements, including rules for connection of meters and programming of monitoring systems. Project teams to demonstrate this guidance has been created for tenants in leasing documentation.

Monitoring systems – cold shell spaces

Where base building metering and monitoring strategy relies on connection of tenant meters guidance must be created for tenants regarding metering requirements, including rules for connection of meters and programming of monitoring systems. Project teams to demonstrate this guidance has been created for tenants in leasing documentation.

Definitions

Air barrier system schematic

The schematic is to clearly define:

- Building envelope boundaries and any penetrations within these boundaries
- Key testing / commissioning points, including source of pressurization, pressure measurement points and envelope areas
- Air sources and expected flow rates
- Leakage sources and expected flow rates
- Expected relative pressures for each building compartment, including acceptable ranges

The schematic is to provide sufficient detail to assist in guiding the building pressure test process and to provide a clear design and acceptance criteria for the test.

Automatic monitoring system

Automatic monitoring systems are defined as systems that record consumption and demand of energy, water, and indoor environment quality. These systems can process this information to produce reports at user adjustable intervals.

Independent commissioning agent

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
- A registered professional engineer or qualified technician with demonstrated knowledge and competency of commissioning of each of the nominated systems, and has previous experience with the commissioning process of at least 2 projects similar in scope (type, size and complexity).

The qualified ICA role can be fulfilled by one or multiple persons, if 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.

Small buildings

Small buildings are defined as those with a Gross Floor Area (1000m² excluding car parking) smaller than 1000m². Buildings with similar attributes to a small building that are outside the area definition can submit a Technical Question to obtain additional clarification.

Total Building Services Value

Building services are defined as lighting, heating, ventilation, vertical transportation, acoustics, hydraulic, power supply, energy management and security and safety systems. The project team can choose to use the building services contract value or the cost of the building services equipment provided. The same definition is adopted throughout the submission.

Examples of building systems making up the Total Building Services Value 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.
- Any other system that has an impact on the energy or water consumption of the building as identified by building owner or building operator.

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
- 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
- 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.

Supporting information

The following resources support this credit:

- AIRAH DA27 Building Commissioning 2011
- AIRAH DA28 Building Management and Control Systems (BMCS) 2011
- ASHRAE Commissioning Guideline 1.1-2007 (for mechanical services)
- ASHRAE Guideline 0-2005
- AS/NZS ISO 9972:2015 Thermal performance of buildings – Determination of air permeability of buildings – Fan pressurisation method
- ASTM E779-10 Standard test method for determining air leakage rate by fan pressurisation
- ATTMA TSL2 Non-Dwellings – October 2010
- CIBSE Commissioning Code M (and the ancillary codes for relevant services)
- CIBSE ANZ Soft Landings Framework, <https://www.cibse.org/networks/regions/australia-new-zealand/anz-regional-news/anz-regional-news-archive/the-soft-landing-framework-australia-new-zealand-m>
- NIBS Guideline 3-2012 National Institute of Building Sciences Building Enclosure Commissioning Process BECx
- WTS001_Softlanding-Brochure_FA-LR.pdf.aspx
- Green Star Verification and Handover Guide
- 'Validating Non-Utility Meters for NABERS ratings' protocol, issued by the NSW Office of Environment and Heritage
- BSRIA Soft Landings Framework
- SA TA 5342:2021 Standards Australia Technical Specification for Building Commissioning