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**Performance of buildings — Building  
enclosure thermal performance  
verification and commissioning —**

**Part 1:  
General requirements**

*Performance des bâtiments — Vérification de la performance  
thermique de l'enveloppe des bâtiments et mise en service —  
Partie 1: Exigences générales*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 3, *Thermal insulation products*.

A list of all parts in the ISO 21105 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

This document is intended to provide a performance verification process to achieve a durable building enclosure that performs in accordance with the contract documents and owner's project requirements. The process described in this document will assist in developing the building owner's project requirements, defining system performance and acceptance attributes, design and construction activities and verifying the installed performance. This process forms the basis for the occupancy and maintenance guide to enable future users and maintenance personnel to maintain the building enclosure, in addition to considering future modifications to the building enclosure.

The commissioning process is developed on behalf of the owner. The process facilitates the owner's transfer of their expectations for the building to the design and construction team. The process is founded in collaboration among all parties comprising the commissioning team. The commissioning process is the most successful when the owner takes an active role in the process. This document engages the owner in commissioning by defining the tasks associated with the process that specifically serve their needs and add value to the project.

In addition to this document, the following documents are planned to be developed in the future:

ISO 21105-2, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 2: Foundation: Waterproofing, Vapour Barrier and Insulation*

ISO 21105-3, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 3: Above Grade Opaque Wall Areas*

ISO 21105-4, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 4: Fenestration*

ISO 21105-5, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 5: Horizontal Waterproofing*

ISO 21105-6, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 6: Roofing (steep slope roofs, low slope roofs, vegetated), including insulation and vapour barrier (as required), HVAC equipment enclosures, roof curbs, elevator penthouses, etc.*

ISO 21105-7, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 7: Sloped Glazing, (skylight, canopy, etc)*

ISO 21105-8, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 8: Interior Partitions providing environmental air barrier separation (such as infection control rooms, laboratories, etc.)*

ISO 21105-9, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 9: stairwells, elevator chases, mechanical pipe chases that penetrate the enclosure, overhead doors/rolling doors and contiguous interior space providing environmental air barrier separation (such as vestibules, loading docks, etc.)*

ISO 21105-10, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 10: Whole building enclosure, including below grade areas, waterproofing, facades and roof(s). All of the above as applicable*

ISO 21105-11, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 11: Re-commissioning and retro-commissioning of existing building enclosures*

ISO 21105-12, *Performance of buildings — Building enclosure thermal performance verification and commissioning — Part 12: Personnel Qualifications and Training*



# Performance of buildings — Building enclosure thermal performance verification and commissioning —

## Part 1: General requirements

### 1 Scope

This document describes a building enclosure commissioning process to achieve a well performing, durable and maintainable building enclosure. This document includes procedures, methods and documentation requirements describing the application of the commissioning process to a building enclosure at each phase of a project. These project phases span from predesign through owner occupancy and operation. This process is referred to throughout this document as building enclosure commissioning (BECx).

This document applies to new building construction and building re-commissioning. This document is for use by an owner, commissioning provider, building developer, owner's representative, construction manager, architect, contractor, and/or consultant, etc. Its purpose is to determine and complete the required tasks and activities to deliver a building enclosure which meets the performance requirements of the owner. Requirements for the project are established by the owner and/or commissioning provider (CxP).

This document identifies steps necessary to perform a building enclosure risk analysis. The analysis will result in tasks that define the level of BECx, commensurate with the owner's tolerance for risk associated with building enclosure performance.

The BECx process covered by this document is applicable to an individual assembly, a combination of assemblies or a whole enclosure assembly. For example, an individual assembly can be the fenestration, the air barrier or the thermal insulation. A combination of assemblies would include the fenestration, the air barrier and the complete heat transfer system, (e.g. both the insulation and roof assembly). A whole building enclosure assembly would include all heat, air and moisture control layers of the building enclosure, on all six sides of the building.

This document describes requirements for any third-party consultants and/or building enclosure commissioning providers (BECxP) to document their technical qualifications, independence and knowledge of the BECx process, including their education, training, and experience.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 17024, *Conformity assessment — General requirements for bodies operating certification of persons*

### 3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <http://www.electropedia.org/>

**3.1  
architect of record**

**AoR**  
design *party* (3.17) having responsibility for the project design and *contract documents* (3.13)

**3.2  
basis of design**

**BOD**  
documents recording narratives, lists, calculations, technical concepts, performance parameters, assumptions, decisions, product selections, etc. that bridge the objectives conveyed in the *owner's project requirements* (3.16) and the *contract documents* (3.13)

**3.3  
building enclosure assembly**

single assembly which comprises one portion of the overall building enclosure system design

**3.4  
building enclosure commissioning provider**

**BECxP**  
*party* (3.17) retained by the owner or *CxP* (3.9) their agent who has demonstrated the knowledge, education and experience in the technical capabilities required to perform the tasks described by the program

**3.5  
building enclosure commissioning**

**BECx**  
process of enhancing the delivery of the design and construction of a building enclosure by verifying and documenting the building enclosure concepts, designs, materials, components, assemblies and systems that have been designed, installed and performance tested, and are maintainable, in accordance with the *OPR* (3.16)

**3.6  
building enclosure commissioning specification**

*contract document* (3.13) developed during the design of the *commissioning* (3.7) phase and included in the project manual detailing the, scope, acceptance and implementation of the commissioning process

**3.7  
commissioning**

**Cx**  
quality-centred process for enhancing the delivery of a project by verifying and documenting that all systems and assemblies are planned, designed, reviewed, installed, tested, operated and maintained to meet the *OPR* (3.16)

**3.8  
commissioning plan**

**BECx plan**  
document that describes the organization, schedule, allocation of resources, and documentation requirements of *commissioning* (3.7)

**3.9  
commissioning provider**

**CxP**  
commissioning authority  
commissioning agent  
**CxA**  
*party* (3.17) retained by the owner who leads, plans, schedules and coordinates the *commissioning team* (3.11) to implement the *commissioning* (3.7) process



**3.10****commissioning report**

final deliverable in the commissioning process which provides the information needed to understand, operate and maintain the facility and its assemblies

**3.11****commissioning team**

*parties* (3.17) including the owner, CxP (3.9), BECxP (3.4), AoR (3.1), contractor, sub-contractor and testing agency necessary to complete the *building enclosure commissioning* (3.5)

**3.12****construction observation**

site visits performed by the BECxP (3.4) at intervals to coincide with significant construction detail installations and the schedule

**3.13****contract documents**

CDs

set of drawings and specifications (project manual), which form the basis for the construction contract and articulates the OPR (3.16), and overall design that is provided by the AoR (3.1) of the project

**3.14****design review**

examination of the drawings and specifications for compliance with the OPR (3.16)

**3.15****field testing**

on-site testing of building enclosure materials, components, assemblies and systems, conducted by an authorized manufacturer's technical representative, contractor, independent testing agency and/or BECxP (3.4)

**3.16****owner's project requirements**

OPR

written document that details the ideas, concepts and criteria required by the owner, and the requirements upon which the predesign, design and construction phases are based

**3.17****party**

entity legally responsible for a portion of the work

**3.18****re-commissioning**

*commissioning* (3.7) applied to a previously commissioned building enclosure to verify that the building enclosure has maintained compliance with the OPR (3.16)

**3.19****substantial completion**

phase defined in the owner-contractor agreement, close to the end of the construction period

**4 Commissioning process**

The BECx process commences with the predesign phase, followed by the design phase, the construction phase and concludes with the occupancy/maintenance/operation phase. If defined by the owner, the BECx process will extend into the occupancy phase of the building.

This document establishes the activities and tasks to be performed by the commissioning team by first undertaking a risk analysis. The analysis includes such factors as the building environment and the complexity of the design of the enclosure to identify a level of commissioning and specific tasks in the BECx process to achieve the building enclosure performance goals and OPR. The owner, CxP and/or

BECxP shall compile and document the risk analysis, budget and guide the BECx process and tasks. Once determined by the risk analysis, the scope of work shall specify the required tasks associated with a particular tolerance of risk for the building type or use, and define the BECx process.

The BECx process is completed by a BECxP who is qualified to perform the building enclosure (BE) assembly or system commissioning. The BECxP is part of the overall Cx team, under direction of the CxP for the project. The owner or the CxP shall hold the contract for the BECxP. Procurement/tender of the BECxP is via request for qualifications. The proposing BECxP shall provide documented experience of building enclosure commissioning via previous project case histories/studies, personnel resumes that are intended to be assigned to the project, and demonstration of the technical capabilities required to evaluate and verify the BE assemblies to be commissioned. This assures that the BECx process provides added value to the owner. At the time of request for qualifications, a budget estimate shall be provided by the proposing BECxP.

An overview of the procedures, methods and documentation requirements for each task or activity from pre-design through occupancy and operation are included in [Clause 7](#). The minimum scope of work, minimum documentation requirements and acceptance requirements for each task are to be developed by this Cx team describing the BECx program for each type of building enclosure assembly.

The BECx program follows the process described below:

- The owner and CxP begin the process by defining an overall acceptable level of risk for the building enclosure assemblies.
- The minimum tasks or activities that are to be performed at each phase of the project design and the construction delivery are defined. This is known as a level of BECx.
- To enhance the minimum task list and scope of work, the owner and CxP shall increase the frequency of repeating specific tasks during a phase. However, to achieve the specific level of commissioning, each task shall be performed as stipulated by the owner and CxP at the selected level of the BECx program.
- The owner and CxP determine the building enclosure assemblies to be commissioned. The building enclosure assemblies include one or more of the following:
  - Foundation: waterproofing, vapour barrier and insulation;
  - Above grade opaque wall areas: air/moisture barrier, heat transfer control/continuity, including all types of insulation;
  - Fenestration: glazed curtain wall, window wall, storefront, windows and doors, etc.;
  - Horizontal waterproofing: balcony, plaza, etc.
  - Roofing: steep slope roofs, low slope roofs, vegetated, including insulation and vapour barrier (as required), HVAC equipment enclosures, roof curbs, elevator penthouses, etc., sloped glazing, (skylight, canopy, etc.);
  - Interior partitions providing environmental air barrier separation, such as infection control rooms, laboratories, etc.;
  - Stairwells, elevator chases, mechanical pipe chases that penetrate the enclosure, overhead doors/ rolling doors and contiguous interior space providing environmental air barrier separation (such as vestibules, loading docks, etc.);
  - Whole building enclosure, including below grade areas, waterproofing, facades and roof(s).
- The owner and CxP assemble the commissioning team to perform the tasks for the level of BECx and the assemblies to be commissioned.

## 5 Risk assessment to determine the level of BECx

The owner and the CxP shall first determine the BECx level and BECx tasks to be completed for the Cx program. Levels of BECx are:

Level 1: Basic - minimum

Level 2: Intermediate - medium

Level 3: Comprehensive - maximum

[Annex A](#) contains information related to determining a level of quality assurance and commissioning based upon each of the following risk factors:

- a) owner risk tolerance;
- b) cost of loss per square meter of area repaired;
- c) building use or function (including potential future use);
- d) area of building enclosure;
- e) building enclosure design complexity;
- f) environment;
- g) level of innovation and/or performance, and/or building sustainability;
- h) owner's number of prior projects and bidding requirements;
- i) level of commitment of the owner's representatives to the project throughout all phases;
- j) schedule;
- k) project delivery method;
- l) experience and knowledge of contractor.

Using [Table 1](#), the owner and CxP shall determine the level of BECx program required based upon the risk assessment. [Table 1](#) applies to commercial buildings:

**Table 1 — Risk assessment criteria**

	<b>Level of BECx</b>	<b>Value of points:</b>	<b>1 Point</b>	<b>2 Points</b>	<b>3 Points</b>
To calculate the score: Assign a point score (1, 2 or 3) adjacent to <u>only one</u> of the risk factor criteria:					
	<b>Risk factors<sup>a</sup></b>				
A	Owner risk tolerance	High tolerance		Medium tolerance	Low tolerance
B	Cost of loss per square meter of area repaired	Low cost		Medium cost	High cost
C	Area of building enclosure - m <sup>2</sup>	Less than or equal to 5,000 m <sup>2</sup>		Less than or equal to 15,000 m <sup>2</sup>	Greater than 15,000 m <sup>2</sup>
D	Building enclosure design complexity	Basic		Custom	Complex, custom design
E	Environment	Low exposure		Medium exposure	High exposure
<sup>a</sup> If the risk assessment criteria is not applicable to the specific project, the points should be zero.					