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Light and lighting — Commissioning of lighting systems in buildings

PROOF/ÉPREUVE

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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).

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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.

This document was prepared by Technical Committee ISO/TC 274, *Light and lighting*.

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.

Introduction

Building users are demanding a better quality of visual environment while there is a need to reduce the impact on natural resources and minimize energy use from lighting. A successful control system design can help to deliver the correct quantity and quality of light where it is needed and when it is needed. The use of a well-designed, installed and commissioned control system can provide a high level of energy efficiency, support flexibility of use of a space and increase occupant satisfaction, especially when the controls are linked to the availability of daylight.

Commissioning is a quality-oriented process for achieving, verifying and documenting whether the performance of lighting systems and assemblies meets defined objectives and criteria. Potential benefits of the commissioning include:

— reduced energy consumption and operating costs;

— higher user acceptance and satisfaction;

— enhanced marketability and value of commercial property;

— full accountability by project participants for the quality of their work;

— verification that a lighting system performs as intended.

The purpose of this document is to identify the minimum requirements for commissioning of lighting systems, including roles and responsibilities (see Figure 1), commissioning activities, documentation requirements and system handover.

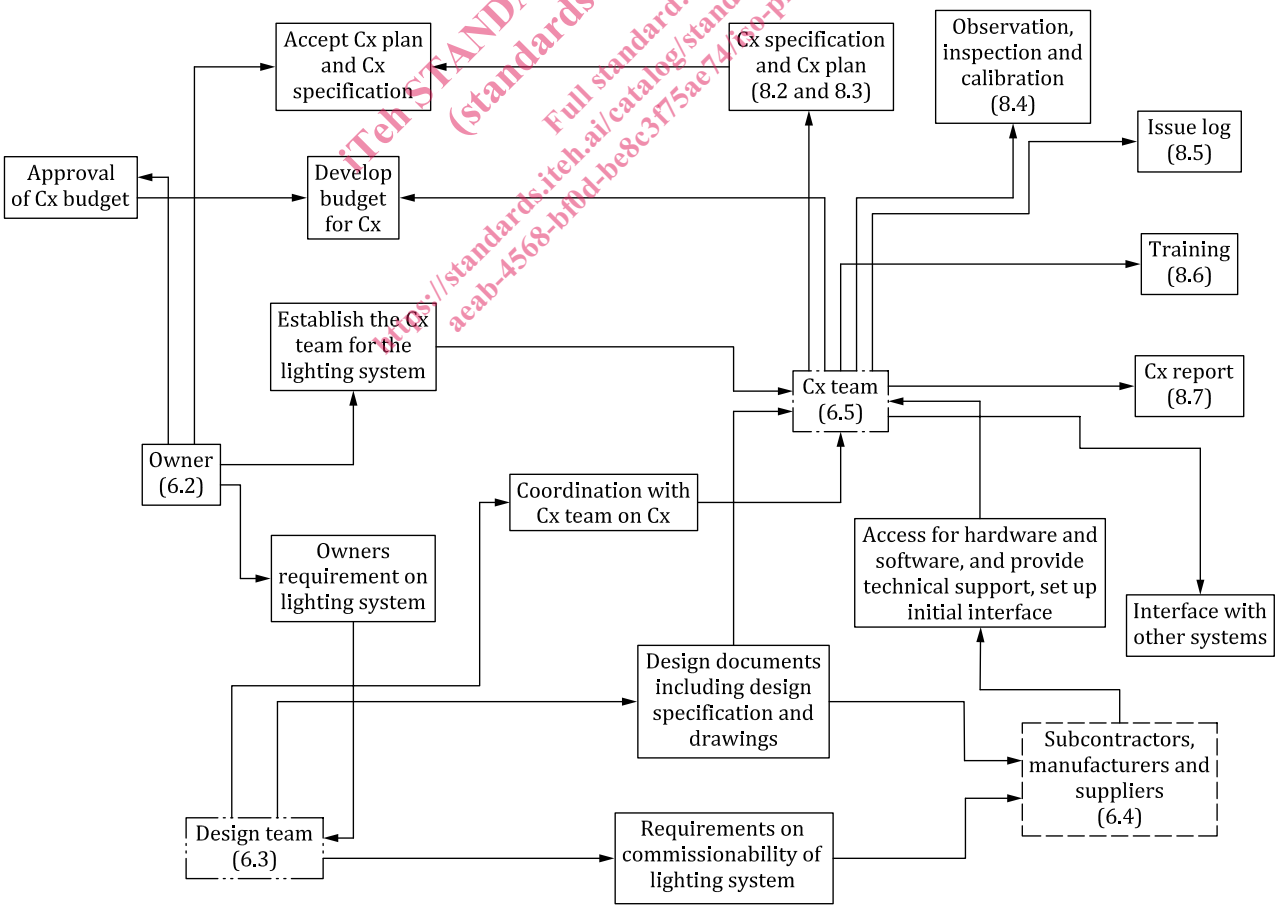

Figure 1 — Overview of roles and responsibilities during commissioning

Light and lighting — Commissioning of lighting systems in buildings

1 Scope

This document specifies requirements for the commissioning of lighting systems in buildings to meet design specifications. This document presents details of the commissioning of lighting systems without focusing on the technical characteristics of specific components.

This document can be applied to new installations of non-residential buildings and public spaces of multi-residence buildings.

This document does not cover the commissioning of lighting systems concerning the electrical power connection aspects which are deemed to be in compliance with relevant legislation or standards.

This document is not applicable to the commissioning of emergency lighting.

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 52000-1, *Energy performance of buildings — Overarching EPB assessment — Part 1: General framework and procedures*

CIE DIS 017:2016 *ILV: International Lighting Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 52000-1 and CIE DIS 017 and the following 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
lighting system
system designed to provide lighting

Note 1 to entry: The lighting system can be dedicated to:

a) the support of (a) specified visual task(s) under specified conditions considering other requirements such as human comfort, safety, the appearance of the surrounding environment and energy consumption;

b) the support of other than human tasks.

Note 2 to entry: The lighting system can include a set of light sources, other physical components, communication protocols, *user interfaces* (3.5), software and networks to provide central control and monitoring functions.

Note 3 to entry: The light source(s) and the related equipment can be integrated in a single item, e.g. an LED module, a lamp or a luminaire.

Note 4 to entry: A lighting system can be networked to provide central or remote control and monitoring functions.

Note 5 to entry: A lighting system can be connected to or integrated with other systems or devices.

[SOURCE: CIE DIS 017:2016, 17-29-029]

3.2
commissioning
Cx
<lighting system> quality-oriented process for verifying and documenting whether the performance of a building's systems and assemblies meets the defined design specification

Note 1 to entry: Typically, a *lighting system* (3.1) is classed as a technical building system.

Note 2 to entry: Adjustment can be made if applicable, e.g. the aiming angle of luminaires or sensors, or programming in order to meet the design specifications.

3.3
calibration
adjustment of control devices to meet the performance requirements of the *lighting system* (3.1) specification

[SOURCE: CIBSE Commissioning Code M: Commissioning Management, 2003, modified; used with permission.]

3.4
commissioning team
Cx team
individuals or entities who, through coordinated actions, are responsible for planning and implementing the *commissioning* (3.2)

3.5
user interface
device intended to provide a direct means of communication between the user and the *lighting system* (3.1), which enables the user to control and monitor the operation of the lighting system

4 General aspects

4.1 Benefits of commissioning for lighting systems

As lighting systems are becoming increasingly connected and interactive, a deficiency in one or more components can prevent the correct operation of the lighting system. Commissioning is a process for identifying and remedying any deficiencies caused by improper installation, calibration or operation. The purpose of commissioning is to ensure that the operation of a lighting system meets the design specifications.

4.2 The need for commissioning

The scope of commissioning will depend upon the owner or tenant's requirements for the lighting system, and the corresponding design solution for this requirement, which shall be defined in the design documents. This specification can be supplemented by companion technical documents and guidelines to describe the specific details for the proper implementation of the commissioning relative to a specific lighting system.

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4.3 Content of commissioning for lighting systems

Commissioning shall be conducted to ensure that the lighting systems function as close to the design specification as possible after installation. The following points shall be checked and verified:

— It shall be verified that all components of a lighting system have been properly installed and connected and are operating.

— The aiming of luminaires shall be verified in the case of adjustable luminaires.

— In the case of local control of the lighting system or any part of it, the correct operation of the local control shall be verified.

— The system-wide functioning of the lighting system shall be tested and verified according to the design specification.

— It should be verified that daylighting systems such as solar shading systems or daylight redirecting systems have been properly installed and connected and are operating.

— Where applicable, interactions with other systems in the building shall be tested to ensure the correct response to system inputs from and the correct communication of system outputs to the external system(s).

4.4 The acceptance of commissioning deliverables

The process for each activity and deliverable shall include an acceptance step as defined in the commissioning plan (Cx plan). This step shall formalize the acceptance of the commissioning deliverable by the owner or tenant.

5 Commissioning methods and selection

5.1 Classification of commissioning methods

This document covers two methods for the commissioning of lighting systems.

Method 1 is the basic method that requires the commissioning activities listed in 7.4 to be conducted between the installation stage and operation stage to guarantee the lighting system has been installed, calibrated and configured according to the design documents.

Method 2 is a full life-cycle commissioning method, requiring that the commissioning activities listed in Clause 7 be conducted, and the commissioning team be involved throughout the whole process from the design stage to the post occupation stage to ensure the design of commissionable lighting systems and that the lighting system meets the requirements in the design specification. Minor changes may be made depending upon the agreed contract and clients' written confirmation of the change required.

5.2 Selection of commissioning methods

The increasing use of solid-state lighting technology, the growing scientific insight on the impact of light on humans and also individuals' diverse demands for lighting functions bring a significant incentive for the application of lighting control. However, the resulting complexity of installed systems need more professional skills to design, install and maintain. Therefore, a commissioning method should be selected on the basis of the complexity of the lighting system (see Table 1).

Table 1 — Principles for commissioning method selection

<table>
<tr><th colspan="3" rowspan="2">Control strategy</th><th rowspan="2">Characteristics</th><th colspan="2">Commissioning method</th></tr>
<tr><th>Method 1</th><th>Method 2</th></tr>
<tr><td colspan="3">Manual control</td><td>Solely depending on human behaviour</td><td>•</td><td></td></tr>
<tr><td rowspan="3">Automatic control</td><td colspan="2">Non-programmable control</td><td>Control through hardware
Difficult to modify control parameters</td><td>•</td><td></td></tr>
<tr><td rowspan="2">Programmable control</td><td>Non-self-learning</td><td>Programmable
Modify control parameters manually</td><td>•</td><td>○</td></tr>
<tr><td>Self-learning</td><td>Learns from previous switching patterns</td><td>•</td><td>○</td></tr>
<tr><td colspan="6">Key
• The method shall be performed.
○ The method is recommended.</td></tr>
</table>

As the lighting system performance can change through time, and occupants' requirements for the lighting system operation can also change through time, ongoing commissioning should be performed as required to meet the clients' requirements and energy efficiency for the lighting system.

6 Roles and responsibilities

6.1 General

In order to maximize the value and benefits from commissioning it is necessary to specify the roles and responsibilities of all the responsible parties related to commissioning, including the owner or tenant, the design team, the contractors and subcontractors, manufacturers, suppliers and Cx team.

6.2 Owner or tenant

The owner or tenant shall be responsible for the composition of the Cx team, approval of the necessary budget for commissioning and design, ensuring that the Cx team is involved during the early stage of design, providing requirements on lighting systems to the design team and confirmation and acceptance of the plan and targets for commissioning. The owner or tenant should also coordinate actions among the relevant participants during the Cx process.

The owner or tenant may subcontract some or all of these functions to a third party.

6.3 Design team

The design team is responsible for addressing human and technical issues concerning the visual environment (see ISO 16817). The design of the lighting system has a major impact on the success and feasibility of the commissioning.

Therefore, the design team shall be at least responsible for:

a) providing the Cx team with all necessary design documents for developing the Cx plan and working in collaboration with the Cx team in the early design stage to maximize the functionality, operability, maintainability and ease of commissioning of the lighting system;

b) reviewing the Cx plan and participating in all relevant activities during the Cx process;

