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Light and lighting — Energy performance of lighting in buildings — Calculation of the impact of daylight utilization

Lumière et éclairage — Performance énergétique de l'éclairage des bâtiments — Calcul de l'impact de l'utilisation de la lumière du jour

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Contents

Page

Foreword

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This document was prepared by Technical Committee ISO/TC 274, *Light and lighting,* in collaboration with the International Commission on Illumination (CIE).

This first edition of ISO/CIE 10916 cancels and replaces ISO/CIE 10916:2014, which has been technically revised.

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

This document is part of a set of standards which allows users to rate the overall energetic performance of buildings. Facades and rooflights have a key impact on the building's energy balance. This document supports daylighting and lighting-energy-related analysis and optimization of facade and rooflight systems. It is specifically devised to establish conventions and procedures for the estimation of daylight penetrating buildings through vertical facades and rooflights, as well as on the energy consumption for electric lighting as a function of daylight provided in indoor spaces.

Light and lighting — Energy performance of lighting in buildings — Calculation of the impact of daylight utilization

1 Scope

This document defines the calculation methodology for determining the monthly and annual amount of usable daylight penetrating non-residential buildings through vertical facades and rooflights and the impact thereof on the energy demand for electric lighting. This document is applicable for existing buildings and the design of new and renovated buildings.

This document provides the overall lighting energy balance equation relating the installed power density of the electric lighting system with daylight supply and lighting controls (proof calculation method).

The determination of the installed power density is not in the scope of this method, neither are controls relating, for instance, to occupancy detection. Provided the determination of the installed power density and control parameters using external sources, the internal loads by lighting and the lighting energy demand itself can be calculated. The energy demand for lighting and internal loads by lighting can then be taken into account in the overall building energy balance calculations:

— heating;

— ventilation;

— climate regulation and control (including cooling and humidification);

— heating the domestic hot-water supply of buildings.

For estimating the daylight supply and rating daylight-dependent electric lighting control systems, a simple table-based calculation approach is provided. The simple method describes the division of a building into zones as required for daylight illumination-engineering purposes, as well as considerations on the way in which daylight supplied by vertical facade systems and rooflights is utilized and how daylight-dependent lighting control systems affect energy demand. Dynamic vertical facades with optional shading and light redirection properties are considered, i.e. allowing a separate optimization of facade solutions under direct insolation and under diffuse skies. For rooflighting systems, standard, static solutions like shed rooflights and continuous rooflights are considered. The method is applicable for different latitudes and climates. For standard building zones (utilizations), operation times are provided.

For detailed analysis, an approach to calculate the effect of daylight on the lighting energy demand on an hourly or sub-hourly basis is provided. Unlike the simple table-based annual calculation approach, which is regression based, this method relies on an emulation concept. Relevant quantities are modelled explicitly and are then interacting directly with sensors, actuators and functional elements of the building automation and control system (BACS) or are triggering user interaction. By this approach, model configuration and parametrization from the design stage can seamlessly be used in the BACS configuration.

To support overall building performance assessment, additional daylight performance indicators on the overall building level are provided.

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.

CIE S 017:2020, *ILV: International Lighting Vocabulary*