



LIGHTING SYSTEMS - CEM REFRESHER

ONLINE TRAINING COURSE

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ENERGY SPECIALIST CURRICULUM





ENERGY PERFORMANCE ASSESSMENT OF LIGHTING SYSTEMS

FOR ENERGY PROFESSIONALS

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WHAT SHOULD YOU LEARN





- Introduction
- Purpose of the Performance Test
- Performance Terms and Definitions



INTRODUCTION

Lighting is provided in industries, commercial buildings, indoor and outdoor for providing comfortable working environment. The primary objective is to provide the required lighting effect for the lowest installed load i.e highest lighting at lowest power consumption.



PURPOSE OF THE PERFORMANCE TEST

Most interior lighting requirements are for meeting average illuminance on a horizontal plane, either throughout the interior, or in specific areas within the interior combined with general lighting of lower value.

The purpose of performance test is to calculate the installed efficacy in terms of lux/watt/m² (existing or design) for general lighting installation. The calculated value can be compared with the norms for specific types of interior installations for assessing improvement options.

The installed load efficacy of an existing (or design) lighting installation can be assessed by carrying out a survey as indicated in the following pages.



PERFORMANCE TERMS AND DEFINITIONS

✓ Lumen is a unit of light flow or luminous flux. The lumen rating of a lamp is a measure of the total light output of the lamp. The most common measurement of light output (or luminous flux) is the lumen. Light sources are labeled with an output rating in lumens.

✓ Lux is the metric unit of measure for illuminance of a surface. One lux is equal to one lumen per square meter.

✓ Circuit Watts is the total power drawn by lamps and ballasts in a lighting circuit under assessment.

✓ Installed Load Efficacy is the average maintained illuminance provided on a horizontal working plane per circuit watt with general lighting of an interior. Unit: lux per watt per square metre (lux/W/m²)



PERFORMANCE TERMS AND DEFINITIONS +

✓ **Lamp Circuit Efficacy** is the amount of light (lumens) emitted by a lamp for each watt of power consumed by the lamp circuit, i.e. including control gear losses. This is a more meaningful measure for those lamps that require control gear. Unit: lumens per circuit watt (lm/W)

✓ **Installed Power Density.** The installed power density per 100 lux is the power needed per square metre of floor area to achieve 100 lux of average maintained illuminance on a horizontal working plane with general lighting of an interior. Unit: watts per square metre per 100 lux (W/m²/100 lux)

$$\text{Installed power density (W/m}^2\text{/100 lux)} = \frac{100}{\text{Installed load efficacy (lux/Wm}^2\text{)}}$$
$$\text{Installed Load Efficacy Ratio (ILER)} = \frac{\text{Actual Lux/Wm}^2}{\text{Target Lux/Wm}^2} = \frac{\text{Target Wm}^2/100\text{lux}}{\text{Actual Wm}^2/100\text{lux}}$$



PERFORMANCE TERMS AND DEFINITIONS +

✓ **Average maintained illuminance** is the average of lux levels measured at various points in a defined area.

✓ **Color Rendering Index (CRI)** is a measure of the effect of light on the perceived color of objects. To determine the CRI of a lamp, the color appearances of a set of standard color chips are measured with special equipment under a reference light source with the same correlated color temperature as the lamp being evaluated. If the lamp renders the color of the chips identical to the reference light source, its CRI is 100. If the color rendering differs from the reference light source, the CRI is less than 100. A low CRI indicates that some colors may appear unnatural when illuminated by the lamp.



PREPARATION (BEFORE MEASUREMENTS)

Before starting the measurements, the following care should be taken:

✓ All lamps should be operating and no luminaires should be dirty or stained

✓ There should be no significant obstructions to the flow of light throughout the interior, especially at the measuring points.

✓ Accuracies of readings should be ensured by

- Using accurate illuminance meters for measurements
- Sufficient number and arrangement of measurement points within the interior
- Proper positioning of illuminance meter
- Ensuring that no obstructions /reflections from surfaces affect measurement.





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