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CIE S 008/E

Second edition
2002-05-15

Lighting of indoor work places

Éclairage intérieur pour des lieux de travail

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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.

International Standard ISO 8995 was prepared as Standard CIE S 008/E by the International Commission on Illumination, which has been recognized by the ISO Council as an international standardizing body. It was adopted by ISO under a special procedure which requires approval by at least 75 % of the member bodies casting a vote, and is published as a joint ISO/CIE edition.

The International Commission on Illumination (abbreviated as CIE from its French title) is an organization devoted to international cooperation and exchange of information among its member countries on all matters relating to the science and art of lighting.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8995 was prepared jointly by CIE TC 3-21 and ISO/TC 159, *Ergonomics*, Subcommittee SC 5, *Ergonomics of the physical environment*.

This second edition cancels and replaces the first edition (ISO 8995:1989), of which it constitutes a technical revision.

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CIE S 008/E-2001

Standard

Lighting of Indoor Work Places

Eclairage intérieur pour des lieux de travail

Beleuchtung von Arbeitsplätzen in Innenräumen

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Foreword

Standards produced by the Commission Internationale de l'Éclairage (CIE) are a concise documentation of data defining aspects of light and lighting, for which international harmony requires such unique definition. CIE Standards are therefore a primary source of internationally accepted and agreed data, which can be taken, essentially unaltered, into universal standard systems.

This International Standard was prepared jointly by CIE-TC 3-21 and ISO/TC 159/SC 5. It replaces publication CIE 29.2-1986 and deals with Lighting Requirements for Indoor Work Places.

Table of contents

FOREWORD	III
INTRODUCTION	1
1. SCOPE	1
2. NORMATIVE REFERENCES	1
3. DEFINITIONS	2
4. LIGHTING DESIGN CRITERIA	2
4.1 Luminous environment.....	2
4.2 Luminance distribution	3
4.3 Illuminance.....	3
4.3.1 Recommended illuminances at the task area	3
4.3.2 Scale of illuminance.....	4
4.3.3 Illuminances of immediate surroundings	4
4.3.4 Uniformity	4
4.4 Glare.....	5
4.4.1 Shielding against glare.....	5
4.4.2 Discomfort glare.....	5
4.4.3 Veiling reflections and reflected glare.....	6
4.5 Directionality	6
4.5.1 Modelling	6
4.5.2 Directional lighting of visual tasks.....	6
4.6 Colour aspects.....	6
4.6.1 Colour appearance.....	7
4.6.2 Colour rendering	7
4.7 Daylight.....	7
4.8 Maintenance	8
4.9 Energy considerations.....	8
4.10 Lighting of workstations with visual display terminals VDT	8
4.11 Flicker and stroboscopic effect.....	8
4.12 Emergency lighting.....	9
5. SCHEDULE OF LIGHTING REQUIREMENTS.....	9
6. VERIFICATION PROCEDURES	17
6.1 Illuminance.....	17
6.2 Unified glare rating.....	17
6.3 Colour rendering index (R_a).....	17
6.4 Colour appearance (T_{cp}).....	17
6.5 Maintenance	17
6.6 Luminaire luminance.....	17
6.7 Tolerances in measurements.....	18

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(standards.iteh.ai)

ISO 8995-1:2002

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LIGHTING OF INDOOR WORK PLACES

Introduction

Good lighting will create a visual environment that enables people to see, to move about safely and to perform visual tasks efficiently, accurately and safely without causing undue visual fatigue and discomfort. The illumination may be daylight, electric light or combination of both.

Good lighting requires equal attention to the quantity and quality of the lighting. While the provision of sufficient illuminance on the task is necessary, in many instances the visibility depends on the way in which the light is delivered, the colour characteristics of the light source and surfaces together with the level of glare from the system. In this standard opportunity was taken to specify for various work places and task types not just the illuminance but also the limiting discomfort glare and minimum colour rendering index of the source. Parameters to create comfortable visual conditions are proposed in the body of this standard. The recommended values are considered to represent a reasonable balance, having regard to the requirements for safe, healthy and efficient work performance. The values can be achieved with practical energy efficient solutions.

There are also visual ergonomic parameters such as perceptual ability and the characteristics and attributes of the task, which determine the quality of the operator's visual skills, and hence performance levels. In some cases enhancement of these influencing factors can improve performance without the need to raise illuminance. For example by improving the contrast of the task attributes, enlarging the task by the use of up to date visual aids (glasses) and by the provision of special lighting systems with local directional lighting capability.

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1. Scope

This standard specifies lighting requirements for indoor work places and for people to perform the visual tasks efficiently, in comfort and safety throughout the whole work period.

This standard does not explain how lighting systems or techniques should be designed to optimise solutions for specific work places. These may be found in the relevant CIE guides and reports.

2. Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying most recent editions of the standards indicated below. Members of CIE, the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO) maintain registers of currently valid international standards.

ISO 3864	Safety colours and safety signs
ISO 6309	Fire protection - safety signs
ISO 6385	Ergonomic principles in the design of work systems
ISO 9241 Parts 6/7/8	Ergonomic requirements for office work with visual display terminals
CIE 13.3 - 1995	Method of measuring and specifying colour rendering of light sources
CIE 16 - 1970	Daylight
CIE 17.4 - 1987	International lighting vocabulary 4th ed. – equivalent to IEC 50(845)
CIE 19.2 - 1981	An analytic model for describing the influence of lighting parameters upon visual performance
CIE 40 - 1978	Calculations for interior lighting - basic method
CIE 58 - 1983	Lighting for sports halls

ISO 8995:2002(E)
CIE S 008/E-2001

CIE 60 - 1984	Vision and the visual display unit work station
CIE 62 - 1984	Lighting for swimming pools
CIE 96 - 1992	Electric light sources. State of the art - 1991
CIE 97 - 1992	Maintenance of indoor electric lighting systems
CIE 103/5 - 1993	The economics of interior lighting maintenance
CIE 117 - 1995	Discomfort glare in interior lighting
CIE 129 - 1998	Guide for lighting of exterior work areas

3. Definitions

In general the terms used in this standard are defined in the CIE Lighting Vocabulary (CIE 17.4 – 1987), but there are few more terms that are defined below:

- 3.1 visual task:** The visual elements of the task to be carried out.
- 3.2 task area:** The partial area in the work place in which the visual task is located and carried out.
- 3.3 immediate surrounding:** A zone of at least 0,5 m width surrounding the task area within the field of vision.
- 3.4 maintained illuminance (\overline{E}_m):** Value below which the average illuminance on the specified surface should not fall.
- 3.5 unified glare rating (UGR):** The CIE discomfort glare measure.
- 3.6 limiting unified glare rating (UGR_L):** The maximum allowable design UGR value for the lighting installation.
- 3.7 Shielding angle:** the angle measured from the horizontal, down to which the lamp(s) is screened by the luminaire from direct view by an observer.
- 3.8 Working plane:** the reference surface defined as the plane at which work is usually done. <https://standards.iteh.ai/catalog/standards/sist/a0fbda5e-47cc-4d79-bead-bc08671c4023/iso-8995-1-2002>

4. Lighting design criteria

4.1 Luminous environment

Good lighting practice for work places is more than just providing good task visibility. It is essential that tasks are performed easily and in comfort. Thus the lighting must satisfy the quantitative and qualitative aspects demanded by the environment. In general lighting is to ensure:

- visual comfort, where the workers have a feeling of well-being,
- visual performance, where the workers are able to perform their visual tasks, speedily and accurately even under difficult circumstances and during long periods,
- visual safety, to see one's way around and detect hazards.

To satisfy these, attention to all parameters contributing to the luminous environment is required.

The main parameters are:

- luminance distribution,
- illuminance,
- glare,
- directionality of light,
- colour aspect of the light and surfaces,
- flicker,
- daylight,
- maintenance.

Design values for the quantifiable parameters of illuminance, discomfort glare and colour rendering are given in clause 5 for the various activities.

Note: In addition to the lighting there are other visual ergonomic parameters which influence operators visual performance, such as:

- a) the intrinsic task properties (size, shape, position, colour and reflectance of detail and background)
- b) ophthalmic capacity of the operator (visual acuity, depth perception, colour perception).

Attention to these factors can enhance visual performance without the need for higher illuminance.

4.2 Luminance distribution

The luminance distribution in the field of view controls the adaptation level of the eyes, which affects task visibility.

A well balanced adaptation luminance is needed to increase:

- visual acuity (sharpness of vision),
- contrast sensitivity (discrimination of relatively small luminance differences),
- efficiency of the ocular functions (such as accommodation, convergence, pupillary contraction, eye movements, etc.).

Diverse luminance distribution in the field of view also affects visual comfort and should be avoided:

- too high luminances can give rise to glare.
- too high luminance contrasts will cause visual fatigue due to continuous readaptation of the eyes.
- too low luminances and too low luminance contrasts result in a dull and non-stimulating working environment.
- attention should be given to adaptation in moving from zone to zone within a building.

The luminances of all surfaces are important and will be determined by the reflectance of and the illuminance on the surfaces. The range of useful reflectances for the major interior surfaces are:

- | | |
|-------------------|-----------|
| - ceiling: | 0,6 - 0,9 |
| - walls: | 0,3 - 0,8 |
| - working planes: | 0,2 - 0,6 |
| - floor: | 0,1 - 0,5 |

4.3 Illuminance

The illuminance and its distribution on the task areas and the surrounding area have a major impact on how quickly, safely and comfortably a person perceives and carries out the visual task. For spaces where the specific area is unknown the area where the task may occur is taken as the task area.

All values of illuminances specified in this standard are maintained illuminances and will provide for visual safety at work and visual performance needs.

4.3.1 Recommended illuminances at the task area

The values given in clause 5 are the maintained illuminances over the task area on the reference surface which may be horizontal, vertical or inclined. The average illuminance for each task shall not fall below the values given in clause 5 regardless of the age and condition of the installation. The values are valid for normal visual conditions and take into account the following factors:

- requirements for visual tasks,