

ENVIRONMENT - INTERIOR LIGHTING DESIGN

The latest standards and guides for work place lighting not only provide guidance on suitable light levels for a wide variety of indoor work places, but now have a real focus on helping the designer create a comfortable working environment.

The most pertinent documents for interior lighting are:

- CIBSE Lighting design guides - The visual environment for display screen use/office lighting design guide
- BS EN 12464-1: 2002 - Lighting of indoor work places

CIBSE Lighting Guides

Lighting Guide 3 (LG3) was first published in 1989 by CIBSE, covering the lighting of spaces with visual display terminals (VDT). It was updated in 1996, taking into account Health and Safety DSE regulations. The 2001 addendum was issued by The Society of Light and Lighting (SLL), which act as the professional body for lighting in the UK. The addendum, takes into account changing international standards, new technology and new screen types, e.g. colour screens with high resolution compared with green & white screens with low resolution.

Lighting Guide 7 (LG7) was published in 2005 and superseded LG3:2001 for office lighting. LG3 is due to be re-written and will focus on the lighting of non-office work spaces.

The more recent changes can be summarised as follows:

- **Withdrawal of the category rating system**

There has been a tendency amongst some in the industry to specify 'Category 2' luminaires as a default, without any thought to the actual working environment. 'Categorised' louvres also create an oppressive 'cave effect' which can result in an uncomfortable working environment.

- **Recommendation for wall and ceiling illuminance**

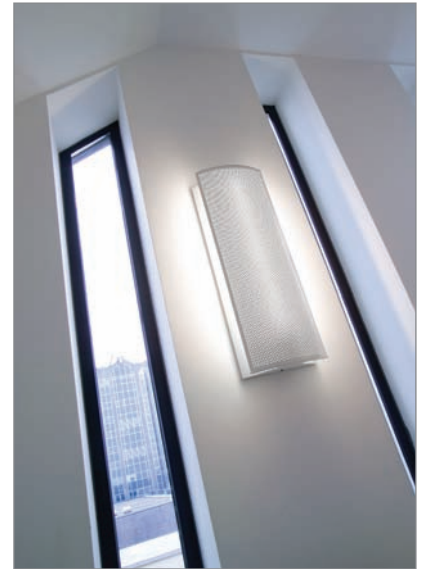
The guide provides recommendations to address the dark and gloomy effect that can be created by 'categorised' louvres, including the sharp wall cut off and bright scalloping. To avoid this, the walls and the ceiling should be lit as follows:

- i The average wall illuminance above the working plane should be at least 50% of the average horizontal illuminance on the working plane, avoiding bright scallops or patches.
- ii The ceiling average illuminance should be at least 30% of the average horizontal illuminance on the working plane.

Please refer to latest guides for advise on reflectance values.

- **Luminance limits**

The recommended luminance limits have been brought in line with BS EN 12464, to 1000 cd/m² or 200 cd/m². This can be increased up to 1500 cd/m² and 500 cd/m² respectively if positive polarity software only is used. The designer needs to select luminaires with the appropriate luminance limit based on the type(s) of screens likely to be used in the space. In cases where the designer does not have information about the VDT's to be used, luminaires should be selected with a luminance limit of 200 cd/m² at 65° elevation (old Cat 2), or 55° (old Cat 1) in special circumstances. The default luminance limit is for negative polarity software, and can be increased to 500 cd/m² or 1500 cd/m² for positive polarity. For indirect lighting, the average luminance for surfaces lit directly should not exceed 500 cd/m², with the peak intensity not exceeding 1500 cd/m². Luminance should vary gradually across the surface.



CIBSE Lighting Guides (cont'd)

- **Luminance limits**

The guides require that the designer and installer of the installation complete and sign a Certificate of Conformity to demonstrate that all known visual and ergonomic criteria were fully considered during the design process and installed as specified.

Due to the regular development of these guides, Cooper Lighting and Security recommends you visit CIBSE on www.cibse.org to ensure the latest guides are being referred to.

BS EN 12464: 2002 - Lighting of indoor places

Published in January 2003, this standard specifies the requirements for lighting systems for most indoor work places and their associated areas. The standard "neither provides specific solutions, nor restricts the designer's freedom from exploring new techniques or the use of innovative equipment."

In addition to the required illuminance for the application, the standard states that "good lighting practice is to be used," ensuring that lighting quantity and quality creates a suitable lit environment that satisfies the human need for visual comfort, visual performance and last but not least, safety. This lit environment is defined by reference in the standard to the following parameters:

- **Luminance distribution**

The luminance distribution controls the adaptation level of the eye, and affects visual acuity and comfort. Excessively high and low luminance values and/or contrasts can cause glare, eye fatigue and a dull environment and should be avoided. Preferred wall and reflectance value ranges are listed.

- **Illuminance**

Maintained illuminance values are specified and are set to meet visual comfort and performance needs. The average illuminance for each task area should not fall below the value given. Illuminance levels for immediately surrounding areas, in relationship to the task area are listed, along with uniformity requirements.

- **Glare**

Glare must be limited to avoid errors, fatigue and accidents. Glare can be experienced as either:

- i Discomfort Glare
- ii Disability Glare

If the limits of discomfort glare are met, disability glare is not usually a problem. The glare rating for a scheme should be calculated using the Unified Glare Rating (UGR) tabular method and must be below the rating listed for the application. Minimum shielding angles for bright light sources are specified.

- **Directional lighting**

Directional lighting may be used, creating a modelling effect. This is to be used to enhance the general appearance of an interior by ensuring structural features, objects and occupants are lit to give a pleasing effect. The lighting should not be too directional, creating harsh shadows, or too diffuse resulting in an undefined, dull environment. This section should be read in conjunction with the CIBSE guidelines on the illumination of walls and ceilings. BS EN 12464, reflecting its aim of not providing specific solutions, specifies no target values.



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BS EN 12464: 2002 - Lighting of indoor places (cont'd)

- **Colour appearance and rendering**

The colour appearance of the lamps used should suit what is deemed as natural for the application e.g. relative to wall colours, furniture, climate etc. Lamps with a colour rendering index value lower than Ra 80 should not be used where people work or stay for long periods. Therefore, where fluorescent lamps are used in normal commercial interiors, triphosphor versions should be used.

- **Lamp flicker**

Lamp flicker and stroboscopic effects, which create discomfort and dangerous situations, should be avoided. This can be achieved by use of high frequency control gear in typical applications.

- **Maintenance factor**

Schemes should be designed with an overall maintenance factor calculated for lamp ageing, lamp survival, luminaire and room surface dirt deposition and specified maintenance schedules. This allows calculation of a maintained illuminance level to be derived.

- **Energy & daylight**

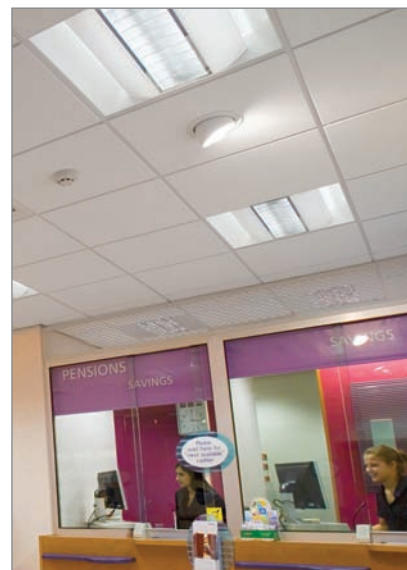
Schemes should be designed without waste of energy, without compromising the visual aspects of the installation. This may include utilising controls that make use of the available daylight, automatically dimming and brightening the lamps as daylight increases or reduces.

- **Display Screen Equipment (DSE)**

Luminaire luminance limits are specified for areas with DSE workstations. These are provided at elevation angles of 65° and above from the downward vertical (old LG3 Cat 2) with screens that are vertical or inclined up to 15° tilt angle. In special circumstances, the luminance limits should be applied for lower elevation angles of the luminaire (e.g. old LG3 Cat 1).

Luminance limits for luminaires which can be reflected in DSE screens

Screen classes in accordance with ISO 9241-7	I	II	III
Screen quality	Good	Medium	Poor
Average luminance of luminaires that are reflected in the screen	1000 cd/m ²		200 cd/m ²



Cooper Lighting and Security recommend that reference be made to the current edition to ensure compliance. Details can be found on www.bsi-global.com

Practical scheme design

In order to comply with the wide-ranging requirements of the CIBSE guides and BS EN 12464, each element briefly described should be carefully considered before choosing the luminaires to achieve the desired effect within the installation. It is unlikely that one luminaire type alone will meet the requirements in full and provide a satisfactory result. Each installation will also differ in design, as each application varies in terms of surface colours, furniture, ergonomics, task, limiting glare requirements, available daylight, etc.

These documents aim to encourage the designer to look more closely at the working environment required and to create a comfortable and balanced lighting solution, taking into consideration the factors listed, rather than reverting to a default luminaire suitable for all applications. It is therefore more likely that schemes that successfully achieve the standard and guidance documents will consist of a combination of luminaire types, in order to achieve a balanced lighting solution.

The combination of luminaires can include:

- Recessed or surface direct downlight luminaires
- Semi-recessed or recessed direct/indirect luminaires
- Suspended direct/indirect luminaires (where ceiling heights permit)
- Wall washer luminaires
- Wall mounted or floor standing uplighters

The resultant installation will provide efficient illumination of the task area, whilst wall and ceiling are evenly illuminated to provide a visually comfortable lit environment.

Demonstration of compliance

Evidence of conformity can be provided by use of a suitable computer software tool, using verified data. Information available as output from software, such as the Cooper Lighting Design System includes:

- Illuminance: working plane, walls and ceiling
- Unified Glare Rating (UGR) data
- Luminaire luminance
- Uniformity

In addition, the Cooper Lighting Solutions catalogue provides data on lamp colour rendering and appearance properties.

Further information on the application of CIBSE lighting guides and BS EN 12464: 2002 and assistance on product selection is available by contacting our Technical Support and Application Department. Tel: 01302 303240

