

Lighting Assessment in the Workplace



This booklet is prepared by the
Occupational Safety and Health Branch, Labour Department.

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1. *Introduction*

Good lighting plays an important role in safeguarding health at work by enabling employees to perform their work comfortably and efficiently. It also allows employees to read clearly labels and safety instructions (such as those affixed to chemical containers) to ensure compliance with safety measures for the prevention of hazards. Accordingly, there should be an appropriate level of the light falling on the surface on which employees are working. Excessive contrast, strong glare and light flickering in their fields of vision are also inappropriate.

To ensure good lighting, the person responsible for a workplace should arrange for a suitable assessment on the lighting levels in the workplace. This booklet is intended to help the responsible person understand the basic concepts of lighting assessment and the measurement of lighting levels with a luxmeter.

Readers who are not familiar with lighting requirements at work are also advised to read the publication, produced by the Labour Department, “Guidelines for Good Occupational Hygiene in a Workplace” which provides information on lighting at work in general, and on the specific illumination requirements for various tasks / activities.

2. *The Purpose of Lighting Assessment in the Workplace*

In simple terms, a lighting assessment is a careful examination of the lighting condition in the work environment. It serves to:

- a) identify the potential hazards arising from the work activity under the current lighting condition in the workplace, such as insufficient illumination, excessive contrast, glare or flicker;
- b) decide who may be harmed; and
- c) evaluate the risks and decide whether improvement measures are needed to protect the employees, including but not limited to the lighting provision.

3. *Approaches to Lighting Assessment*

There are basically two approaches to conducting a lighting assessment in the workplace: by means of a checklist and by lighting measurement.

3.1 Lighting Assessment by Checklist

This is a simple approach and usually does not involve measurements. For example, if the workplace is an office, the responsible person can follow the checklist provided in the publication “A Simple Guide to Health Risk Assessment – Office Environment Series – Lighting in Offices” produced by the Labour Department to assess the lighting condition there. With the checklist, the responsible person can spot out most lighting problems such as dim work environment, defective lamps, strong glare and reflections. Possible solutions to such problems are also provided in the publication. Similar concepts may also be applied to assess the lighting conditions in other workplaces like warehouses or retail shops.

3.2 Lighting Assessment by Measurement

In some situations, the responsible person should conduct lighting measurements for the purpose of verification, e.g. when the adequacy of the lighting level is in doubt for the tasks / activities involved.

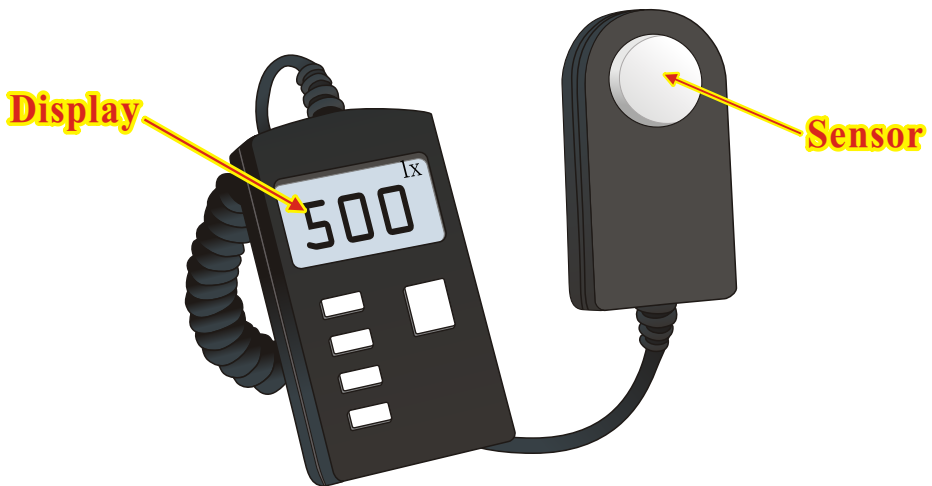
Compared with the checklist approach, lighting measurement has the advantage of providing objective, accurate and comprehensive information about the lighting condition. This information would be useful for the assessor to draw an evidence-based conclusion and formulate specific improvement measures.

“Illuminance” is a common parameter to be measured in a lighting assessment. It refers to the amount of light falling on a unit area of the work surface and its measurement unit is “lux (lx)”. It is used to evaluate the adequacy of lighting for seeing an object. The remaining parts of this publication will explain more about the instrument for measuring illuminance, and the basic principles for measurement.

Notwithstanding the above, readers should note that suitable illuminance is only one of the requirements for good lighting. In doubtful or complicated situations, other lighting parameters may also need to be measured for a more accurate assessment and the person responsible for a workplace should seek assistance from people with the relevant knowledge and experience.

4. *Illuminance Measuring Instrument*

Illuminance is measured by a luxmeter, which is a handy instrument with a sensor for light detection. The measured illuminance is directly displayed in lux (lx). In general, luxmeters conforming to internationally recognised specifications, such as BS 667:2005¹, DIN 5032-7:1985² or CIE Publication No. 69 (1987)³, should be used. There should be regular calibration, typically once a year, to ensure accurate measurement.



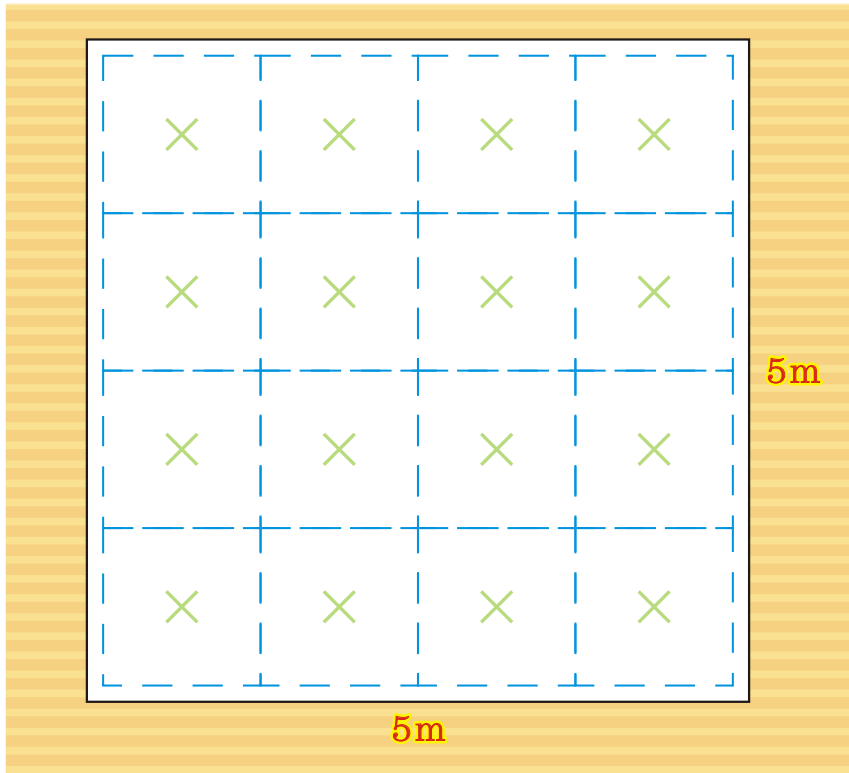
A good luxmeter with error less than 10% is available in the market.

- ¹ British Standard, *BS 667:2005 Illuminance Meters – Requirements and Test Methods*, 2005.
- ² German Standard, *DIN 5032-7:1985 Photometry; Classification of Illuminance Meters and Luminance Meters*.
- ³ International Commission on Illumination Publication, *CIE Publication No. 69 (1987) Methods of Characterizing Illuminance Meters and Luminance Meters: Performance, Characteristics and Specifications*.

5. *Illuminance Measurement for General Lighting*

In ordinary workplaces, general lighting is provided to give uniform illumination over the work area to meet the lighting requirement for a particular type of work activity, e.g. office, reception or storage. To determine the adequacy of general lighting for the work area, an assessor may measure the illuminance there.

In doing so, the work area should first be divided into a number of equal small areas which should be as nearly square as possible. For example, for an ordinary medium-sized work area of less than 50m² where the lighting is at a height of around 2.5m, the work area is normally divided into a minimum of 16 small squares. For a work area of size up to around 100m², the recommended minimum number of small squares is 25. If the work area is even larger, a minimum number of 36 small squares is recommended. In general, more small squares are preferred for a larger work area. For further guidelines on setting small squares for illuminance measurement, readers may refer to “Code for Lighting 2006”, published by the Chartered Institution of Building Services Engineers.



For an ordinary workroom of dimensions 5 m x 5 m, take illuminance measurements at the centres of 16 equally divided squares.

After setting the small squares, the assessor may take illuminance measurement at the centre of each square with a luxmeter. The results indicate whether the lighting is evenly distributed. In addition, the average value of these measurements represents the average illuminance for the whole work area. To evaluate whether an appropriate level of illuminance is provided for the purpose, the average value should be compared with the optimum average

illumination provided in the publication “Guidelines for Good Occupational Hygiene Practice in a Workplace”.

Readers should also note that two work areas with two different work activities should be separately evaluated. In other words, the office and the storage room of a company should be separately measured and assessed.

6. *Illuminance Measurement for a Task / an Activity*

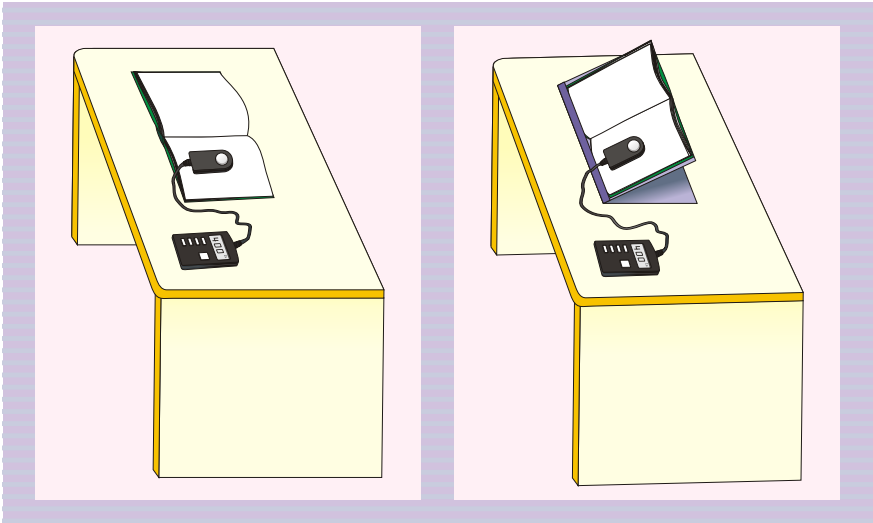
In some workplaces, there may be visually-demanding tasks / activities for which more illumination is required than for the surroundings. In these circumstances, local lighting may be provided in the vicinity of the task or installed close to the work location. To assess whether lighting for an individual task is adequate, the assessor should measure the illuminance at the task position.

In measuring illuminance at a task position, four representative points on the work plane should normally be selected and the illuminance measured at each point. The average of these measurements is then calculated as the average illuminance at the task position. To evaluate whether the illuminance is adequate, the average illuminance should be compared with the optimum average illumination recommended for the task.

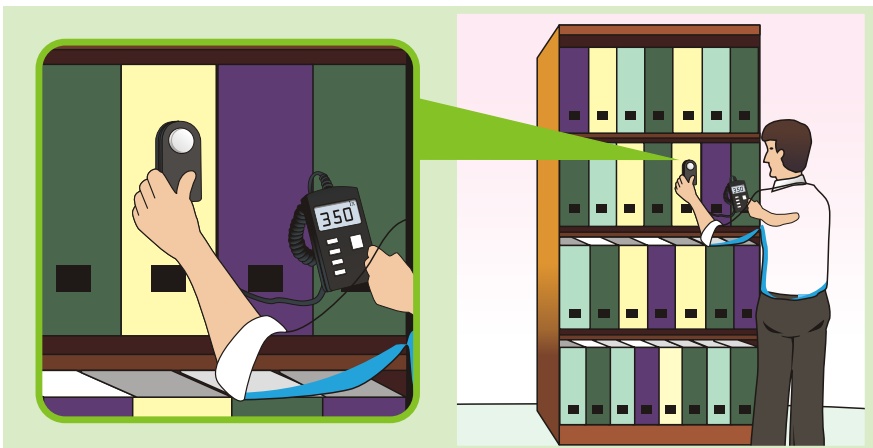
In measuring illuminance at a task position, the following points should be noted:

- ◆ Illuminance measurement should be taken at the height of the work plane. In case there is no specified plane for the task, the measurement should be taken at a horizontal plane at around 0.8m above the floor.
- ◆ The light sensor of the luxmeter should be placed on the work plane, which is normally a horizontal plane, but is an

inclined plane if the object is to be read on such a plane, e.g. an easel. Similarly, the work plane is a vertical plane if the object is to be read vertically.

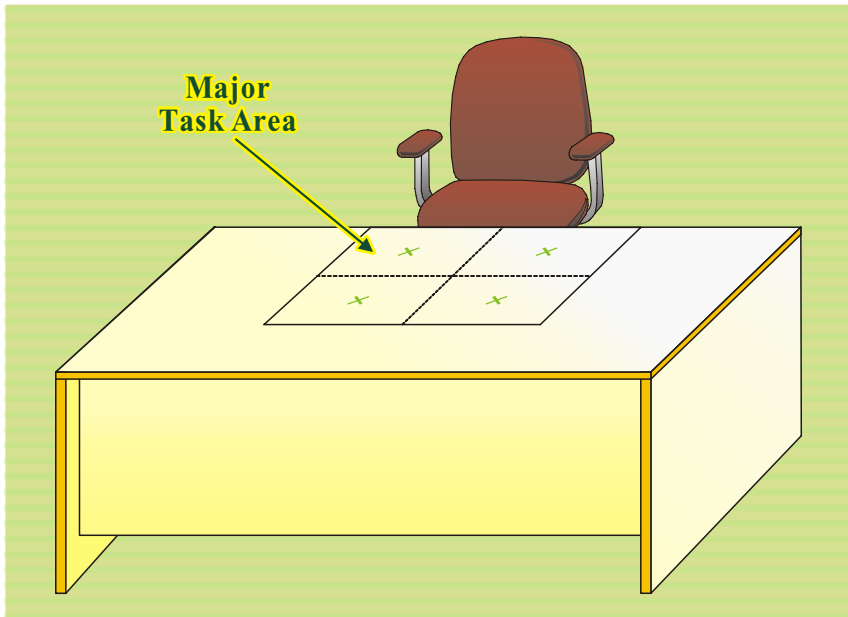


The light sensor of the luxmeter should be placed on the work plane.



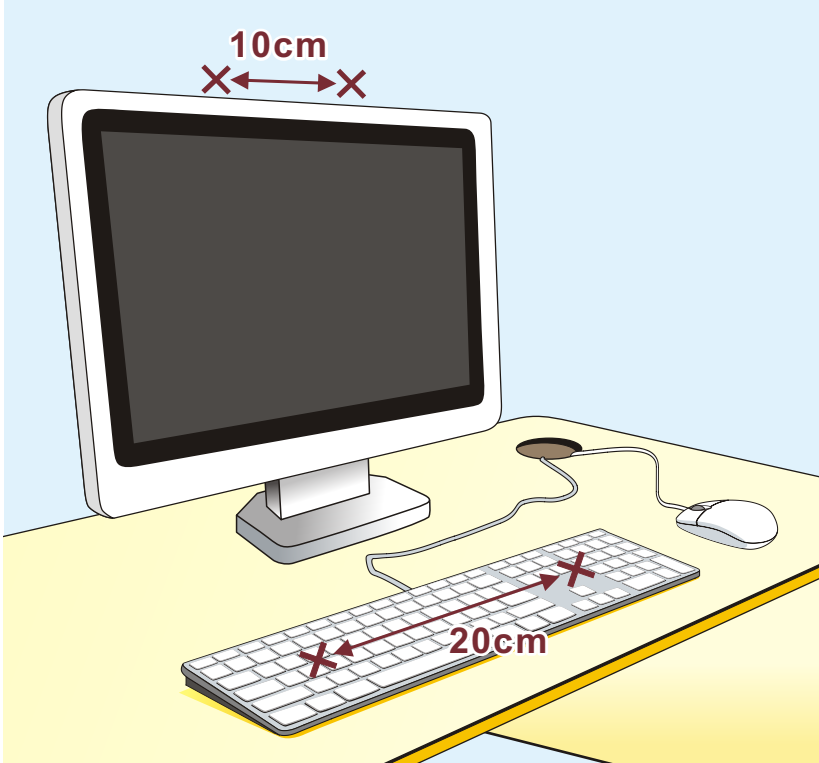
The light sensor of the luxmeter should be placed vertically if the object is read vertically.

For example, if the task position is mostly at the central front area of an ordinary writing desk or a counter (as shown in the following figure), this area may be divided into 4 equal areas as shown and measurement taken at the centre of each area.



For a writing desk or a counter, take measurement at the centre of each of the 4 equally divided areas of the major task area.

However, if the task position is at a computer workstation, the illuminance may be measured in a slightly different manner. Two measurement points may be taken at the keyboard position, 20cm apart, and two others on the top of the screen, 10 cm apart, as shown in the figure on the next page. The sensor of the luxmeter should be placed horizontally when taking the measurements.

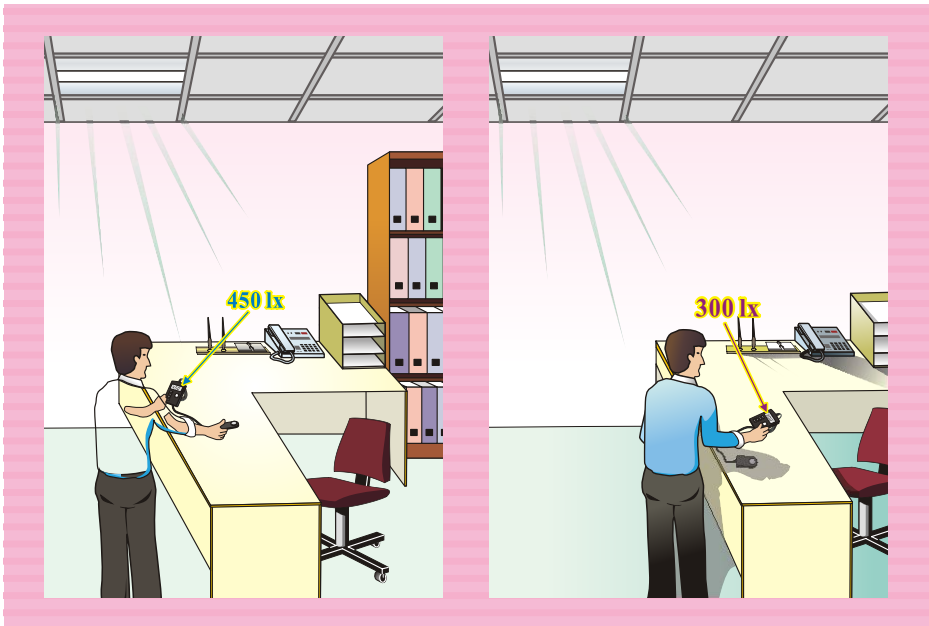


For a computer workstation, take two measurements at the keyboard position and two others on the top of the screen.

7. *Salient Points in Illuminance Measurement in General*

In measuring illuminance for general lighting or for a task / an activity, the following points should be noted:

- ◆ Except for measuring the impact of the operator on the task / activity, the path between the lighting source and the point of measurement should be clear as far as practicable. In particular, the assessor should avoid obstructing the normal light path, and should move sideways, back and forth to ascertain that he / she is not blocking the light falling on the light sensor of the luxmeter.



The reading of measurement decreases when the light path is blocked.

- ◆ Select the lowest measurement range of the luxmeter as appropriate. This gives a more precise reading.

- ◆ The measurement points should not be too close to walls or obstructions.
- ◆ Daylight should be shielded by blinds or curtains when assessing artificial lighting only.

The above introduces some basic concepts on illuminance measurement. Readers should note that the information is not exhaustive and should not be applied as rigid rules in all cases. In many situations, the assessor may have to take other factors into consideration and make due variation in the course of measurement according to his/her professional judgement.

8. *Assessment Records*

Finally, the results of any lighting assessment should be properly documented for reference and follow-up actions. The illuminance measurement data and the calculated average illuminance should be properly recorded. Other relevant information that should also be recorded includes:

- a description of the work area and the task/activity.
- the position of the measurement points.
- details of the lighting fixtures including their position, type and size.
- identification of the luxmeter, such as the model number and serial number.
- the date and time of testing.
- the person who conducted the assessment.
- the conclusions and improvement measures suggested.

9. *References*

For further information on lighting, you may refer to the following publications:

- ▶ Labour Department, *Guidelines for Good Occupational Hygiene Practice in a Workplace*
- ▶ Labour Department, *A Simple Guide to Health Risk Assessment - Office Environment Series - Lighting in Offices*
- ▶ Chartered Institution of Building Services Engineers, *Code for Lighting 2006*
- ▶ Chartered Institution of Building Services Engineers, *Code for Interior Lighting, 1994*
- ▶ Canada Occupational Health and Safety Regulations, Part VI
- ▶ Interpretations, Policies and Guidelines (IPGs) on Occupational Health and Safety, Part II of the Canada Labour Code, *Measurement of Lighting Levels in the Workplace, Canada Occupational Health and Safety Regulations (COHSR), Part VI, 928-1-IPG-039, 1990*
- ▶ National Research Council Canada, *The Effect of Office Design on Workstation Lighting: Simulation Results*, Newsham, G.R.; Sander, D.M., IRC-IR-847, December 2003
- ▶ Illuminating Engineering Society of North America, *The IESNA Lighting Handbook Reference & Application, 9th Edition, 2000*

- ▶ Health and Safety Executive, *HSG38 Lighting at Work, 2nd Edition, 1997*
- ▶ British Standard, *BS 667:2005 Illuminance Meters - Requirements and Test Methods, 2005*
- ▶ German Standard, *DIN 5032-7:1985 Photometry; Classification of Illuminance Meters and Luminance Meters*
- ▶ International Commission on Illumination Publication, *CIE Publication No. 69 (1987) Methods of Characterizing Illuminance Meters and Luminance Meters: Performance, Characteristics and Specifications*

10. *Enquiries*

For enquiries about this booklet or advice on occupational health and hygiene matters, please contact the Labour Department's Occupational Safety and Health Branch through:

Telephone : 2852 4041

Fax : 2581 2049

E-mail : enquiry@labour.gov.hk

Information on the services offered by the Labour Department and on major labour legislation can also be found on our website at <http://www.labour.gov.hk>.

Information on the services provided by the Occupational Safety and Health Council can be obtained through its hotline 2739 9000.

11. *Complaints*

If you have any complaint about unsafe workplaces and practices, please call the Labour Department Occupational Safety and Health complaint hotline on 2542 2172. All complaints will be treated in the strictest confidence.

