

Lighting Comfort

Aim of Credit

To encourage and recognise well-lit spaces that provide a high degree of comfort to users.

Credit Criteria

0	Minimum Lighting Comfort*	It is a requirement for this credit that lights are flicker free and that the lights accurately address the perception of colour in the space
1	General Illuminance and Glare Reduction*	1 point is awarded where in the nominated areas: 1.1 Lighting levels comply with best practice guidelines And 1.2 Glare is eliminated
2	Individual Control and Surface Illuminance	1 additional point is awarded where in the nominated areas: 2.1 Occupants have the ability to control the lighting in their immediate environment And 2.2 A combination of lighting and surfaces improve uniformity of lighting to give visual interest

* For spaces where the lighting will be not be installed at time of submission, compliance may be demonstrated by a commitment to compliance.

Compliance Requirements

Nominated Area

For the purposes of this credit, the nominated area is all primary spaces, apart from those spaces excluded for functional reasons.

Where the functional requirements of the space require that lighting requirements differ from the requirements of this credit, these areas may be excluded. The reasons for exclusion must be justified by the project team. For example, an operating theatre or cinema should be excluded from the nominated area for this credit.

Primary Space

Primary spaces are defined as all areas where a person is expected to remain for an extended period of time. Examples of primary spaces include:

- Living spaces
- Kitchens
- Offices, either open plan or private
- Classrooms, laboratories, computer labs
- Ward rooms, nurse's stations, clinic rooms

- Kitchen and preparation areas where food is being sold;
- Retail / sales floor, exhibition halls, galleries, multi-purpose rooms (as a general setting)
- Occupied industrial spaces, warehouse areas, shop floors, work stations.

Where it is unclear, a primary space would typically be defined as a space where a person would remain either for 1 hour continuously, or 2 hours cumulatively in one day.

Bedrooms, sleeping areas and bathrooms would not usually be considered primary spaces.

Nominated Hours

Nominated hours are to be defined by the project team. The project team shall provide a summary of space types, uses and nominated hours.

0. Minimum Lighting Comfort

Flicker-free lighting refers to luminaires that have either:

- A minimum Class A1 ballast;
- High frequency ballasts for all fluorescent lamps, or
- Electronic ballasts in High Intensity Discharge (HID) lighting.

To address the perception of colour, all light sources must have a minimum Colour Rendering Index (CRI) of 80, unless the project team can demonstrate that, in a particular area, the activity is not impeded by a lower CRI. The project team shall support their justification by ensuring their selection complies with the guidance provided in Table 7.2 in AS 1680.1:2006.

1. General Illuminance and Glare Reduction

1.1 General Illuminance

The appropriate lighting levels for each task within each space type is defined as lighting with a maintained illuminance that meets the levels recommended in the relevant standard and does not exceed these levels by more than 25%. The relevant table in the standard for the different space types and activity types are listed in Table 1.

Type of task/activity	Values
Circulation and General areas	Table D1 of AS1680.2.1 -2008
Offices	Table 3.1 of AS1680 2.2 -2008
For workspaces and other activities not covered by the above	Table 3.1 of AS1680.1 - 2006

Table 1: Standards for Best Practice General Illuminance

The maintained illuminance should be calculated on an area-weighted average for each distinct space or area. A space may contain areas with illuminance levels above what is required in the standard as long as it is balanced to achieve an average of less than the credit requirement over the whole space.

The maintained Illuminance values must achieve a uniformity of no less than what is specified in Table 3.2 of AS1680.1:2006 with an assumed standard maintenance factor of 0.8.

Where maintained illuminance values for a particular space are not specified, the values to be used must relate to the closest type of task as defined in AS1680.1:2006 Table 3.1. These values must be justified in the short report. If a different maintenance factor is used, please submit a CIR prior to the submission for approval.

Demonstrating compliance

Compliance with this credit can be demonstrated through modelling of the whole building or a representative floor or section. The modelled area must be representative of the typical lighting layouts found throughout the entire design. Fitout items (e.g. partitions, equipment, and furniture) must be included in the modelling. Where the model has been simplified, the reason for the simplifications must be justified.

The lighting engineer must then justify how the area is representative of the design, and certify that all other areas comply with this criterion.

Alternative compliance

Compliance can be demonstrated through measurement. These must be carried in a fully fitted out space in accordance with Appendix B of AS1680.1:2006. It is noted that where compliance is demonstrated via measurement, measurements must be provided on a grid of no more than 1m × 1m. Projects seeking to use measurement to demonstrate compliance must contact the GBCA and provide information on how their measurement strategy compares against Appendix B of AS1680.1:2006. This must be done prior to a Round 1 submission.

1.2 Glare Reduction

To consider this credit criterion met, glare from lamps must be eliminated from the nominated area. There are three methods for achieving this, two prescriptive methods, and a performance method.

Option A - prescriptive method	All bare light sources have been fitted with baffles, louvers, translucent diffusers, ceiling design, or other means that directly obscure the light source from all viewing angles by occupants, including looking directly upwards.
Option B - prescriptive method	The Unified Glare Rating (UGR) calculated for the lighting on a representative floor does not exceed the maximum values listed in Table 8.2 of AS1680.1-2006. This is achieved by using luminaires with the same UGR value in the

	nominated area as listed in the manufacturer's datasheet.
Option C-performance method	The Unified Glare Rating (UGR) calculated for the lighting on a representative floor does not exceed the maximum values listed in Table 8.2 of AS1680.1-2006. The UGR rating must be calculated in accordance with the procedure outlined in Section 8.3.3 of AS1680.1-2006. Either the CIE (International Commission on Illumination) unified glare rating (UGR) system (as defined in section 8.3.3 of AS1680.1:2006) or the luminance limiting system (as defined in section 8.3.4 of AS1680.1:2006) can be used to demonstrate compliance with this option.

Demonstrating compliance – Performance Method

Compliance with this credit can be demonstrated through modelling of the whole building or just a representative floor or section. The modelled area must be representative of the typical lighting layouts found throughout the entire design. Fitout items (e.g. partitions, equipment, and furniture) must be included in the modelling. Where the model has been simplified, the reason for the simplifications must be justified.

The lighting engineer must then justify how the area is representative of the design, and certify that all other areas comply with this criterion.

2. Individual Control and Surface Illuminance

2.1 Individual Control

For this criterion to be satisfied, an occupant must have control over the light levels in their immediate environment. This includes turning the lights on and off and adjusting their light levels.

The key to this criterion is to identify what the immediate environment is. For example in an open plan office, the immediate environment is the light shone in the workstation; in unit it is the light hitting the work surface in the kitchen where food is prepared.

One light can be controlled by one or more individuals, however, the project team must justify why and how, this is conducive to individual control. For example, in an open plan office a single light can be controlled by two adjacent tables. However, in other environments, a single light is unlikely to provide satisfactory results when controlled by two individuals.

This criterion can be met by the following:

- providing a two component lighting system
- individual desk lamps
- digital dimmable lighting control system, provided that the user has control over their environment through a manual dimming switch or a computer interface linked to a digital lighting control system, or an automatic intelligent light fitting which

automatically detects presence and daylight and responds by adjusting the light level to set the Illuminance value .

2.2 Surface Illuminance

Option A - prescriptive method	All the spaces in the nominated area comply with having: An average surface reflectance for ceilings of at least 0.75; and A direct/indirect lighting system is present such that the ceiling area has an average surface illuminance of at least 30% of the lighting levels on the working plane. The average surface reflectance value corresponds to a matte flat white ceiling. The surface reflectance value can be obtained from the manufacturer's data sheet for the final finish. At least 90% of the ceiling must have this finish. Small amounts of light fittings or items can be disregarded.
Option B - Performance method	All the spaces in the nominated area must be modeled to show that: The average ceiling luminance (excluding light fixtures) does not exceed 0.5 kcd/m² and the maximum luminance at any point on the ceiling does not exceed 1.5 kcd/sqm; The ceiling area has an average surface illuminance of at least 30% of the lighting levels on the working plane; and, In rooms less than 100sqm, or in rooms where more than 20% of workstations are located within 3m of walls: the wall area above the working plane [FM3] has an average surface illuminance of at least 50% of the lighting levels on the working plane. <u>Surface reflectance values</u> It is recommended that the surface finishes comply with the following: • The finishes are matte; and • The average surface reflectance values are as follows: • A minimum of 0.75 for ceilings; • A minimum of 0.5 for walls; • A minimum of 0.3 for workstation surfaces; and, • A minimum of 0.2 for floors However, the project team can deviate from these values if they can demonstrate that the average illuminances in the surfaces comply with this criterion. Transparent glass windows or glass partitions may be excluded from the area required to comply with reflectance and surface illuminance criteria. <u>Modelling guidance</u> The illuminance values for ceilings, walls, and floors must be calculated in accordance with AS/NZS 1680.1:2006 Appendix B. The material and reflectance values must correspond to the installed items. Where these are not available, reflectance may be estimated from AS 1680.1 Table E1. Where the reflectance values are not included in the

	standard, or through manufacturer's data, the closest conservative value must be used; alternatively, a CIR can be submitted. The average reflectance value should be calculated as follows: Tabulate reflectance values used for all surfaces and their respective areas. Calculate an area weighted average for all walls and ceilings. In addition to the above, the gloss factor for all surfaces should be no more than 20% for all surface finishes.
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Demonstrating compliance – Performance Method

Compliance with this credit can be demonstrated through modelling of the whole building or just a representative floor or section. The modelled area must be representative of the typical lighting layouts found throughout the entire design. Fitout items (e.g. partitions, equipment, and furniture) must be included in the modelling. Where the model has been simplified, the reason for the simplifications must be justified.

The lighting engineer must then justify how the area is representative of the design, and certify that all other areas comply with this criterion.

*** Areas where lighting is not installed at time of submission**

In areas where the lighting is to be installed by a tenant, points may be claimed by demonstrating that a tenant guide has been provided to the tenant before the tenancy agreement was signed.

The guide must state that tenant shall install lighting that meets criterion 0 and 1 of this credit. That is that it is flicker-free, act, accurately addresses the perception of colour in the space, lighting levels comply with best practice guidelines and glare is eliminated.

Alternatively, the building owner may include clauses in a tenant's lease specifying that the tenant shall install lighting that meets criteria 0 and 1. For examples of green leasing clauses, refer to the Better Buildings Partnership Green Lease Toolkit.

<http://www.betterbuildingspartnership.co.uk/working-groups/green-leases/green-lease-toolkit/>

*Point Calculation for Buildings with a combination of owner installed lighting and tenant installed lighting

Where the nominated area of a project includes areas where the lighting is installed by the building owner and areas where the lighting is installed by the tenant, partial points shall be awarded on an area-weighted average.

Guidance

Standards noted in this credit

- AS1680.1 Interior and workplace lighting - general principles and recommendations.

- AS1680.2.1 – 2008 Interior lighting; Circulation spaces and other general areas
- AS1680.2.2 – 2008 Interior lighting; Office and screen-based tasks.

Definitions

Light Source - A man-made light source created to produce optical radiation; and includes lamps, tubes, semi-conductors and any electrically powered source of light. Light sources are often mounted in a luminaire.

Matte Finishes - Finishes with a gloss factor of no more than 20%.

Classes of Ballasts - All ballasts sold in Australia must have an energy efficiency index label. A ballast can be classified under seven different classes of efficiency. The details of this label are specified in AS/NZS60921 and AS/NZS60929 but can be summarised as follows:

- Class D: magnetic ballasts with very high losses
- Class C: magnetic ballasts with moderate losses
- Class B2: magnetic ballasts with low losses
- Class B1: magnetic ballasts with very low losses
- Class A3: electronic ballasts
- Class A2: electronic ballasts with reduced losses
- Class A1: dimmable electronic ballast

Flicker-Free Lighting - For the purpose of this credit, flicker free lighting refers to luminaires that have either:

- A minimum Class A2 ballast;
- High frequency ballasts for all fluorescent lamps, or
- Electronic ballasts in High Intensity Discharge (HID) lighting.

Average maintained illuminance - Refers to the average illuminance of light sources and luminaires to the end of their usable life and cleaning cycle (with dust and other factors taken into account).

Digital dimmable lighting control system - A digital dimmable lighting control system is a system where each luminaire can be addressed and re-addressed, controlled, and dimmed individually and in groups, OR, where one or more luminaires can be controlled and dimmed via a digital signal.

Two component lighting system - Two component lighting system is defined as a system where a lower lux level is provided to the general space, with additional task lighting provided to suit individual tasks.

Surface illuminance - Surface illuminance is defined in AS/NZS 1680.1:2006.

Working Plane - The working plane is defined in AS1680.1:2006 Table 3.2.

Work setting – A work settings is a retail counter, a reception counter, a workstation, a kitchen bench or similar furniture designed for a specific task.

Unified Glare Rating -The UGR system, commonly called the glare index, is a glare evaluation system that uses the formula based method in CIE 117 to evaluate the suitability of a lighting system to a space. Information on the UGR system is provided in AS1680.1:2006.

Work setting - A work settings is a retail counter, a reception counter, a workstation, a kitchen bench or similar furniture designed for a specific task.

Documentation Requirements

'Design Review' Submission (Optional)

Project teams are to submit information / documentation marked with an asterisk* for 'Design Review'

As Built Submission

All project teams are to submit the following:

Submission Template*

- Nominated areas
- Nominate hours
- A description of how the following criteria have been met
 - Flicker free lighting
 - Accurate Colour
 - General Illuminance
 - General Glare Reduction
 - Individual Control
 - Surface Illuminance

Project teams are required to provide documentation supporting credit compliance. The following documents may be used to demonstrate compliance.

- Lighting Drawings
- Architectural Drawings
- Lighting Specifications / Schedules
- Product Data Sheets
- Isolux Plot Drawings

Please provide your feedback on the technical content of this credit:

DRAFT CONTENT