



Australian Government
**Department of Climate Change
and Energy Efficiency**



CBD Tenancy Lighting Assessment for Offices Rules

VERSION 1.0



thinkchange

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This document is prescribed under the *Building Energy Efficiency Disclosure Act 2010* (BEED Act). The Rules described in this document should only be applied by people who have received training in the application of the Lighting Rules and who are Accredited Assessors under the BEED Act.

The Rules described in this publication may specify a preferred means of assessment, or provide different options for the means of assessment. For instance, the rules provide for both floor based and closer inspection methodologies when conducting a lighting assessment. Persons applying the rules in this publication should make their own decision on the most appropriate approach to assessment, including consideration of their safety, experience and qualifications and must comply with the safety procedures set out in chapter 5 of these rules and elsewhere, all relevant occupational health and safety standards and workplace safety laws.

Formatting conventions used in this document

Note text appearing with a grey tint in the background is explanatory text only. It is not part of the Rules.

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1 Introduction

The *Building Energy Efficiency Disclosure Act 2010* (BEED Act) requires corporations selling, leasing or subleasing certain large (>2000m²) office spaces to register a Building Energy Efficiency Certificate (BEEC). The BEEC is comprised of three parts, the second of which is a tenancy lighting energy efficiency assessment. The first part is a NABERS Energy rating for the building and the third part provides general energy efficiency guidance for building owners and tenants.

A CBD Tenancy Lighting Assessment of a building is based on a methodical survey of the general lighting system installed in the tenant office spaces of a building (the system that is reasonably expected to be left in a tenant space when the tenant leaves and the tenancy fitout removed).

For a lighting assessment to be valid under the BEED Act, it must be performed in accordance with these Rules as amended from time to time. Assessments may be audited for compliance. The Rules are supplemented as required by rulings, published on the CBD and the Department of Climate Change and Energy Efficiency websites, which apply the principles in the Rules to specific issues raised since the document was published.

The Department of Climate Change and Energy Efficiency through the CBD administrator assesses applications for and issues BEECs on behalf of the Commonwealth Government.

In addition to complying with the Rules, Assessors must exercise all due care and comply with all relevant occupational health and safety standards when undertaking an assessment.

The CBD Tenancy Lighting Assessment measures only the energy used by the lighting on an area basis. It does not measure lighting output, quality or suitability of the lighting for use in offices.

1.1 About CBD Tenancy Lighting Assessments for Offices

CBD Tenancy Lighting Assessments outcomes are expressed as Nominal Lighting Power Density (NLPD) for example:

NLPD	Comparison
<7.0 W/m ²	Excellent
7.0 to 10.0 W/m ²	Good
10.1 to 15.0 W/m ²	Median
>15.0 W/m ² +	Poor

Nominal Lighting Power Density (NLPD) is calculated and reported for each assessed functional space. It is calculated by dividing the total power of the general lighting system in the assessed space by the Net Lettable Area (NLA) of that space.

Lighting control systems determine how long lighting systems operate for and are therefore important in determining the overall efficiency of the lighting system. The best systems have the capacity to closely match lighting operating hours to occupancy. The CBD Tenancy Lighting Assessment also reviews the installed lighting control system and categorises it as being of basic, average or sophisticated capacity; a measure of its potential to closely match the operation of the lights with the needs of the occupants.

CBD Tenancy Lighting Assessments may be completed for all of the building, in which the total office space NLA is assessed, or for a selection of tenancies only within the building. Typically, an all building assessment would be undertaken if the building is being prepared for sale. Assessments of tenancies typically would be undertaken if these areas are to be advertised for lease or sub-lease.

1.2 About this document

1.2.1 Who the Rules are for

This document is prescribed under the BEED Act for use by CBD Accredited Assessors and Auditors while conducting and reviewing tenancy lighting energy efficiency assessments.

This document should only be used by people who have undertaken the Accredited Assessor Training Course – Lighting.

1.2.2 What's new in this version

This is the first version of the Rules.

1.2.3 Related documents

The Rules are part of the set of documents that govern how assessments are to be carried out and audited for CBD Tenancy Lighting Assessment for offices. Other documents in the set cover:

- supplementary rulings on specific issues
- auditing procedures for performance ratings
- Conditions of CBD assessor accreditation
- These Rules should be read in conjunction with the most recent version of the *NABERS Energy and Water for offices: Rules for collecting and using data for performance ratings* and any associated and current rulings for undertaking NABERS Energy and Water for offices ratings.
- Relevant industry OHS guidelines.

2 Key concepts and definitions

2.1 The assessment process

On completion of a CBD Tenancy Lighting Assessment, the assessor submits it to the CBD Administrator for checking. The checks may include an independent audit of the assessment, and the resolution of any technical issues raised during the assessment.

The main documents and tools used in preparing an assessment application are:

Document or tool	Description
CBD Tenancy Lighting Assessment for Offices Rules	This is the document you are reading. It is the quality standard. These are referred to throughout this document as the Rules.
Assessment Form	A software tool known as the CBD Lighting Assessment Calculation Spreadsheet used for entering assessment data and performing some processing and analysis to provide a summary of the lighting efficiency for the assessed spaces.

2.2 Definitions

This section lists the terms with particular meanings which must be used when interpreting this document.

Term	Definition
Acceptable data	Data which meets the applicable accuracy and validity requirements of the Rules.
Assessed NLA	This is the Net Lettable Area of the building or tenancy being assessed.
Assessment date	The date of the site inspection associated with the assessment. If the site inspection takes more than one day, it is the date of the first day of the inspection.
Assessment Form	A software tool known as the CBD Lighting Assessment Calculation Spreadsheet used for entering assessment data and performing some processing and analysis to provide a summary of the lighting efficiency for the assessed spaces.

Term	Definition
Assessment Validity Period	The 12-month period following the CBD Tenancy Lighting Assessment for which the assessment is valid.
Assessor	A CBD Accredited Assessor authorised to conduct assessments for BEEC applications in accordance with these Rules.
Auditor	A person appointed under the BEED Act to perform audits of CBD tenant lighting energy efficiency assessment.
Average	Arithmetical mean.
Ballast	Device connected between the power supply and one or more discharge lamps primarily to limit the current drawn by the lamp(s). Ballasts may be either electronic or magnetic.
Building Energy Efficiency Certificate (BEEC)	A Building Energy Efficiency Certificate includes: <ul style="list-style-type: none"> • a NABERS Energy star rating for the building; • an assessment of tenancy lighting in the area of the building that is being sold or leased; and • general energy efficiency guidance.
CBD Administrator	The body responsible for administering the CBD program, in particular for: <ul style="list-style-type: none"> • establishing and maintaining the standards and procedures to be followed in all aspects of the operation of the program, and • determining issues that arise during the operation of the program and the making of assessments, and • accrediting Assessors and reviewing assessments in accordance with CBD standards and procedures. • issuing Building Energy Efficiency Certificates (BEECs)
Commercial Building Disclosure Program (CBD Program)	The program through which the <i>Building Energy Efficiency Disclosure Act 2010</i> is administered.
Control gear	Lighting ballast, transformer or any other equipment required to start or operate a lamp.
Data	Information which depends for its accuracy on: <ul style="list-style-type: none"> • measurements to a known standard of accuracy, or • verified specifications with a given tolerance for accuracy, or • other objective evidence.

Term	Definition
Data type	<p>A category of data used in an assessment. Data types for CBD Tenancy Lighting Assessments are:</p> <ul style="list-style-type: none"> • Net Lettable Area for Assessed Area • Area for Nominal Lighting Power Density (NLPD) calculation • Luminaire details: <ul style="list-style-type: none"> ○ Lamp type and quantity ○ Nominal lamp power ○ Ballast type • Lighting controls
Fitout works	Construction activity undertaken to install, remodel, replace or remove an office fitout.
Functional Space	A space identified by an Assessor as a distinct space in accordance with Section 4.3 <i>Dividing the Net Lettable Area into Functional Spaces</i> .
General Lighting System	This is the lighting system which is normally in place in tenant office space when a tenant moves into that space, excluding exit and emergency lighting. It is the system that the assessor reasonably expects to remain when the tenant vacates and the tenant fitout is removed. It does not include desk-mounted task lighting or architectural or feature lighting installed by the tenant. It is typically represented by the ceiling mounted lighting in open plan office space.
Grid method	A method of calculating nominal lighting power density where the general lighting system consists of a standard array of a single type of luminaire.
Lamp	Source of artificial optical radiation
Lighting control system	A system that manages the operating time of a lighting installation in response to external inputs such as light switches, occupancy sensors, time clocks, light sensors, etc
Luminaire	An electrical appliance used to create artificial light and/or illumination. It includes the body, one or more lamps, any control gear and any reflectors or lenses for directing the light.
NABERS	The National Australian Built Environment Rating System is a national initiative owned and operated by the NSW Office of Environment and Heritage (website: www.nabers.com.au)
Net Lettable Area (NLA)	The floor area, determined as set out in the Property Council of Australia (PCA) March 1997 <i>Method of Measurement for Lettable Area</i> , of spaces that can be used as offices within the premises to be assessed.

Term	Definition
Nominal Lighting Power Density (NLPD)	A measure of the power density of the installed general lighting system expressed as W/m ² . It is based on total nominal luminaire power in a space (power of lamps plus any control gear) divided by the floor area of that space.
Not Assessable	Defined area or situation that can be classified in accordance with the Rules as “Not Assessable”
Proposed system	A lighting system which is not installed but for which there is a contractual commitment to install with 3 months of the assessment date. The proposed system may result from the building owner’s intention to upgrade the lighting system or from a make-good clause in the lease agreement that requires the incumbent tenant to return the lighting system to its original state when vacating the tenancy.
Representative area	An area chosen from within a functional space that has a lighting installation which is representative of the general lighting system of the entire functional space. The representative area may be comprised of smaller sample areas and is used in the representative area method of assessment.
Representative area method	A method of calculating nominal lighting power density where there is an irregular array of luminaires or where there is more than one luminaire type represented in the general lighting system within the functional space.
Rules	CBD Tenancy Lighting Assessment for Offices Rules (including rulings).
Sample area	A part of representative area. Sample areas are used to meet the minimum NLA requirement of a representative area when there is insufficient contiguous floor space to meet the minimum requirement.
Total luminaire power	The total nominal power rating of a luminaire including that required for the lamps and any control gear.
Transformer	Magnetic transformer or electronic step-down converter used to reduce voltage for extra low voltage (typically 12V) lighting systems.

2.3 Interpretation

2.3.1 Current version

The Rules are revised from time to time. Rulings on specific cases are published as addenda when necessary, and periodically the Rules will be revised to incorporate the rulings.

Assessments must comply with the version of the Rules (including rulings) current on the day the assessment is submitted, unless the CBD Administrator has specifically approved otherwise.

All rulings and new versions of the Rules are published on the CBD website www.cbd.gov.au in the secure section for registered users.

2.3.2 Rulings

These Rules are intended to cover most office buildings in Australia. However, it is always possible that some aspect of a building's design or operation raises a new issue that is not clearly covered by the existing rules.

Whenever Assessors are unsure how to apply the Rules to a particular issue or situation, they must contact the CBD Administrator for technical advice or to request a specific ruling on the case.

Once a ruling is published on the CBD website it is effective from that date and becomes part of these Rules.

Assessors will receive emails notifying them of rulings and should ensure their email address with the CBD administrator is current.

2.3.3 Precedence

1 Rulings

A published ruling always takes precedence if there is any conflict with any other provision of these Rules. If there is a conflict between rulings, the most recent takes precedence.

2 Secondary material

These Rules include some material which is secondary to the substantive provisions, including:

- introductions and explanations (such as summaries, flowcharts, diagrams, notes, examples and glossaries) intended only to help readers understand its substantive provisions
- forms and notices intended only to assist in conducting an assessment.

The substantive provisions of these Rules (including rulings) always take precedence if there is any misunderstanding or conflict¹ with:

- any other material contained in these Rules, or
- any other documentation or forms associated with CBD Tenancy Lighting Assessments.

¹ Contact the CBD Administrator if you believe that a section of the Rules is inconsistent with another section or with other documentation or forms.

2.4 Proposed new methods

Assessors may find they need to use a new method for obtaining or interpreting data for an assessment. For example, they may encounter a new lighting technology or control system strategy; or they may need to develop a proposed new method to use available data acceptably.

Assessors who wish to use a new method must contact the CBD Administrator to request approval beforehand. The request should include:

- a complete explanation of the circumstances, including the reason why an existing method cannot be used, and
- a complete explanation of the method proposed and all calculations required, and
- an analysis of the possible error involved in use of the method.

2.4.1 Standard for acceptable data

The standard for acceptable data for a new method will be specified when the method is approved by the CBD Administrator. In general, data must be derived from measurements or records which have been independently verified and are known by a third party without a significant interest in the operation or performance of the building or its equipment (such as a consultant or technician engaged to provide independent advice) or by the assessor to be accurate.

2.4.2 Documentation required

The documentation required for a new method will be specified when the method is approved. In general, it must include copies of the original records which the method requires for data, and documentation of all calculations, assumptions, and interpretations involved.

2.5 Summary of data and documentation needed

The following information is required for an assessment. Individual assessments may also require additional information or documentation depending on the particular circumstances of the premises.

A more detailed checklist is included as Section 10.1 *Appendix A – Information checklist for assessments*.

Topic	Data and documentation needed
Information about the assessment application	Information about: <ul style="list-style-type: none"> • the premises to be assessed, • the person or organisation commissioning the assessment, • Date of assessment, and • Assessor name and ID

Topic	Data and documentation needed
Assessed NLA – the NLA of the building or tenancy being assessed.	Lease documents, or documentation of subsequent negotiations and changes, showing office tenancy boundaries. Survey, lease or third-party data
Luminaire details	A schedule of all luminaires used in the assessment including the quantity, type and power of lamps and the type of any ballast or transformer in the luminaire. Where total luminaire power is used, the source of the information on which the total luminaire power is based e.g. direct measurement, manufacturer’s data etc.
Representative area	Details of the representative areas and any sample areas that are used in calculations including a mark-up of floor plans showing the extent of the representative area
Proposed system documentation	Details of the contractual arrangements that triggered the assessment of the proposed system and a copy of all documentation that the assessment of the proposed system was based on.

2.6 Assessment date and validity period

2.6.1 Time allowed for assessment

A Lighting Assessment must be submitted within 4 months of the assessment date unless the CBD Administrator allows extra time to compensate for time taken to issue technical advice or rulings before the application could be submitted.

Where the assessment is submitted within 4 months of the assessment date, or a longer period approved by the CBD Administrator as above, the approved lighting assessment will be valid for 12 months from the date the assessment is certified by the CBD Administrator.

If the assessment is not submitted within 4 months, it will not be accepted and must be redone.

3 Data and documentation required

3.1 Acceptable data

3.1.1 Principles

1 Data and estimates must be as specified

A CBD Tenancy Lighting Assessment for offices must be based on the data specified in:

- the relevant provisions of these Rules (including applicable rulings), and then
- the relevant sections of the Assessment Form.

2 Data must be of acceptable standard

The decision process for determining acceptable data in Section 3.1.2 Standards for acceptable data must be followed, except where another process is specifically allowed by a provision of these Rules.

Note: Some sections of these Rules provide that, if specific procedures are followed for some input data, the requirement for compliance with Section 3.1.2 Standards for acceptable data is then deemed to be satisfied.

3.1.2 Standards for acceptable data

1 Data

If accurate and verifiable data is available, it must be used. The following order of preference applies, subject to any specific requirements applied in relevant provisions of these Rules:

- 1) data obtained directly by the Assessor (such as reading the nominal lamp power from the label of an installed lamp)
- 2) data provided by a third party without a significant interest in the operation or performance of the building or its equipment (such as a consultant or technician engaged to provide independent advice) which has been authenticated by the assessor.
- 3) data provided by the organisation commissioning the assessment, or a third party with a significant interest in the operation or performance of the building or its equipment (such as a facility manager, technical contractor or equipment supplier) which has been authenticated by the assessor.

2 Unacceptable data

If information is required for an assessment but none of the requirements above in *Section 3.1.2 Standards for acceptable data* can be satisfied, the premises cannot be assessed.

3.2 Site inspection

Assessors are required to visit and inspect the premises during their assessment, in order to:

- Become familiar with the layout, services and features of the premises,
- Confirm that documentation provided for the assessment is accurate, complete and up-to-date,
- Identify all luminaires that are to be used in the assessment,
- Confirm the definition and boundaries of all Functional spaces,
- Determine the appropriate assessment methodology for each Functional space; either the grid method or the representative area method,
- Gather sufficient information to enable calculation of the nominal lighting power density in each Functional space,
- Identify the type of lighting control system that applies to each Functional space.
- Resolve any other issues that arise.

Note: There may be circumstances where access to all or part of the premises is not possible on safety or security grounds. In this event the Assessor must explain why they could not access these spaces, and fully document the reasons on the assessment form. If there are known impacts on the quality of the information obtained for the assessment then these must also be fully described.

3.3 Record-keeping

3.3.1 Documentation required

It is not essential that the records that contain data used for an assessment are the original documents, such as signed leases.

While access to original documents is highly desirable, there may be practical difficulties or delays in obtaining them. An assessment may therefore be based on copies of leases and other records as long as the Assessor is satisfied that they are, or can be verified to be, true and complete records of the original documents or files.

Drawings marked up by the assessor that depict the functional spaces assessed and the representative areas where used.

Note that summaries, or other derivative documents that quote the original source documents, are not the same as verifiable copies of the originals.

3.3.2 Records to be kept seven years for audit

Assessors must keep for audit all records on which an assessment is based, including records of assumptions made and all information and calculations used, for seven years from the date the assessment was lodged.

3.3.3 Records to be kept by Assessors

The records kept must be the actual documents used for the assessment, or verifiable copies. Summaries are not acceptable.

The records kept by Assessors must be to such a standard that it would be possible for another Assessor or an Auditor to repeat accurately the assessment from only the documents provided.

Records to be kept include:

- Marked-up drawings that depict the functional spaces assessed and the representative areas where used. The mark-up must show the representative areas on the floor plan including orientation of the floor plate and the location of luminaires within the area.
- Photographs of the luminaires and lamps that support the data used in the assessment and photographs of the ceiling grid showing luminaire spacing and layout.
- Copy of any lease or contractual document that will result in a guaranteed change to the lighting system. This is only required if a proposed system has been assessed..

3.4 Evidence

Evidence and complete documentation must be collected in order to fully justify the lighting assessment performed. As a rule of the thumb, the lighting assessment must be repeatable and auditable purely based on the evidence collated by the Assessor. The sections below detail the required documentation for various aspects of the lighting assessment.

3.4.1 Assessed area

The Assessor must retain the following documentation, complying with *Section 3.1 Acceptable data*, to validate the area data:

- data validating the assessed area:
 - NLA schedules provided by the building owner, or
 - Surveys, leases, or other third-party documentation, or
 - Assessor's calculations based on plans or site measurements
- calculations or written information confirming the floor area of all functional spaces in the premises to be assessed, and
- written information and Assessor's notes relating to functional spaces classified as "Not Assessable" and the reason for the determination.

3.4.2 Luminaire details

Photographs of all luminaire types identified should be retained. Photographs shall be of sufficient quality that the information that they are intended to convey (e.g. lamp power) is easily discernible. Photographs shall also include a date stamp of the day they were taken and named to include the site and the functional space being assessed.

3.4.3 NLPD Assessment

The Assessor must maintain a record of any calculations performed to determine the grid spacing as discussed in *Section 6 NLPD assessment*.

Where the grid method is used, a mock-up diagram showing the arrangement of luminaires and grid spacing should be drawn.

Where the representative method is used for an irregular array of luminaires, the following must be implemented:

- Mark up the representative area on the floor plan.
- Record the NLA of the representative area and how the NLA was obtained.
- Sketch a diagram showing the arrangement of luminaires and grid spacing.

3.4.4 Assessment of Proposed Lighting Systems

The following documentation must be filed by the Assessor where an additional assessment of a proposed lighting system is conducted:

- Copy of a signed contract committing the building owner to the upgrade. The contract must show the completion date, or
- Copy of the lease agreement that satisfies requirements stated in *Section 9.2 Eligibility of proposed systems, and*
- Detailed design documentation such as those specified in *Section 9.2 Eligibility of proposed systems*.

4 Assessed Area

4.1 Background

The assessed area is the NLA of the office space being assessed. All office space is included in the assessment regardless of its condition or whether or not it is occupied.

Because the CBD Tenancy Lighting Assessment is based on a rate (W/m²) that does not depend on total area, precise measurement of the NLA of assessed area is not critical to the assessment.

The NLA of the assessed area indicates the overall coverage of the assessment, whether compliance with the BEED Act is required and the relative importance of the assessment of each functional space.

4.2 Determining office NLA

The office NLA of the premises to be assessed must be determined and documented by the Assessor. It is expected that the information will be provided by the building owner at the time of commissioning the assessment.

If the NLA data is not provided or, if the assessor is concerned that the data is inconsistent with what is observed on site then the assessor shall make their own assessment of the NLA based on one of the following:

- 1) direct measurement from current plans or scaled prints, measured in accordance with the Property Council of Australia March 1997 *Method of Measurement for Lettable Area*; or
- 2) site measurements in accordance with the Property Council of Australia March 1997 *Method of Measurement for Lettable Area*.

Because measurement accuracy is not critical to the assessment $\pm 10\%$ is sufficient.

4.3 Dividing the NLA into functional spaces

The premises to be assessed must be divided into functional spaces in order to clearly identify where lighting efficiency may vary from one part of a building to another. These spaces should be based on existing functional distinctions such as physical boundaries, leases, or operational divisions.

Functional spaces must be the smaller of:

- 1) each individual contiguous floor of the building (for buildings with multiple units or towers, each floor of each unit or tower), or
- 2) each individual and distinct tenancy, regardless of its size.

A CBD Tenancy Lighting Assessment must include assessments of each functional space within the Assessed area.

If desired, functional spaces may be smaller and based on the functional spaces used for a base building NABERS rating if this facilitates the assessment.

Note: This clause is intended to make it easier for the assessor to use a common set of functional spaces if they are also doing the building NABERS rating.

5 Luminaire details

5.1 Background

The first part of CBD Tenancy Lighting Assessment is a calculation of the nominal lighting power density of the general lighting system. The starting point for this calculation is to identify all the luminaires and determine the nominal power consumption of each.

The total luminaire power is used, along with the area that the luminaires serve to determine the nominal lighting power density which is the basis of the assessment.

5.2 Safe work methods

Assessors should carry out assessments with all due care, in accordance with any applicable occupational health and safety standards and with minimal disruption to the owner or tenant of the relevant building or area.

Assessors are responsible for ensuring the safety of their work for themselves and other building users, including undertaking a job safety analysis and having a documented safe work method before carrying out any inspections.

Luminaires should be de-energised and cool before any physical inspection is undertaken.

Additional safety training is provided in the Accredited Assessor Training Course – Lighting, and assessments should be carried out in accordance with that training and the Rules. If a person has not undertaken the training, they should not attempt to carry out assessments in accordance with these Rules.

5.3 Luminaire schedule

Assessors must create a schedule of all luminaires installed in the base lighting system. For each luminaire, collect or assign the following information:

- Luminaire name – A short name assigned by the assessor which will be used in the assessment calculation process. The name shall be unique to each luminaire type on the site and shall follow a consistent naming convention.
- Luminaire description – a free form description of the luminaire in detail that should include the type of luminaire, details of the number, type and power of lamps, the type of control gear (transformer, ballast or the like) being used and the type of light diffusion.
- The type of lamp and control gear selected from the list summarised in Table 1. If not on the list, use “other”.
- The quantity of lamps in the luminaire.
- The nominal lamp power – based on visual inspection

This information, when entered into the Assessment Form will generate a nominal lighting power for each luminaire.

Inputs shall be in accordance with *Section 2.4.1 Standard for acceptable data*. An electrician or other appropriate trades person must be called to access the light fittings or ceiling space, if the Assessor does not have the appropriate qualifications to undertake this work themselves (Note that this may need agreement of the building owner and tenant). Failing this, a default 'worst case' (e.g. magnetic ballast or T8 lamp) must be noted in the report with reasons why the default value was included.

Note also that the Rule does not require luminaire ballasts to be visually inspected.

Composite luminaires that include more than one lamp type or different numbers of lamps shall be broken down into the lowest common module and scheduled as such. As an example, a luminaire may be built up of modules of 2 x 36 W units that are joined together with a 50 W low voltage halogen lamp in between. The 2 x 36 W modules and the 1 x 50 W modules should be scheduled as separate luminaires.

Where the lamp and control gear type is reported as "other", the Assessor shall determine the total power of the luminaire by direct measurement or reference to published data noting that an electrician may be required to conduct the power measurement.

Photographs of all luminaire types identified need to be retained in accordance with the requirements identified in *Section 3.4.2 Luminaire details*.

Table 1: Lamp and ballast combinations included in Assessment Form

Type	Description
T5	T5 fluorescent lamp with electronic ballast
T8 MAG	T8 fluorescent lamp with magnetic ballast
T8 EL	T8 fluorescent lamp with electronic ballast
T12	T12 fluorescent lamp with assumed magnetic ballast
CFLi	Single ended compact fluorescent lamp with integral ballast
CFLn MAG	Single ended compact fluorescent lamp with remote (non-integral) magnetic ballast
CFLn EL	Single ended compact fluorescent lamp with remote (non-integral) electronic ballast
HAL ELV MAG	12V (ELV = extra low voltage) halogen lamp with magnetic transformer
HAL ELV EL	12V (ELV = extra low voltage) halogen lamp with electronic transformer
HAL LV	Mains voltage (LV = low voltage = 230-240V) halogen or incandescent lamp
MH MAG	Metal halide lamp with magnetic ballast
MH EL	Metal halide lamp with electronic ballast
MV	Mercury vapour lamp with assumed magnetic ballast

Type	Description
Other	Other lamp/ballast types not listed here

5.4 Lamp Details

5.4.1 Lamp Type

For each luminaire type, lamp details are required. In the Assessment Form, the lamp type is selected from a drop-down menu which lists common lamp technologies. Commonly encountered lamp types are listed in Appendix B – Common lamp types.

5.4.2 Nominal Lamp Power

The preferred method for identification of lamp nominal power is by visual inspection of the lamps installed in the existing luminaires. In most cases, the nominal wattage will be marked on the lamp or its base.

If observation and documented evidence (such as as-installed luminaire schedules) are not available for the existing lamps, a default evaluation of “T8 lamps” and appropriate wattage for the length of lamp must be recorded for linear fittings, with reasons for using the default.

Note that T5 lamps are available in high efficiency and high output variants that are physically the same but with significantly different power rating.

5.4.3 Lamps per Luminaire

The number of lamps per luminaire is determined by visual inspection, i.e. how many lamps are present in each luminaire.

Some luminaire reflectors can give the impression of more lamps than are actually present. Care should be taken to sight and count the number of lamps correctly.

Some luminaires may have positions for a larger number of lamps than are installed. If de-lamping has occurred and is consistent, e.g. all luminaires are operating with two lamps when there are three lamp positions, the luminaires may be considered as having two lamps. The assessment should include a note in the “Performance comments” field that the luminaires are de-lamped.

5.4.4 “Other” Lamp Types

If a lamp/ballast type is discovered that does not appear in Table 1, the lamp type should be classed as “Other”. In this case the following details will be required:

- The type of lamp present, e.g. LED.
- The Total Luminaire Power (rather than Lamp Nominal Wattage).

For “Other” lamp types, the value for Total Luminaire Power must include the power draw of the lamp plus the losses of any control gear present (whether internal or external to the luminaire). This should be determined from the nameplate or alternatively may be measured using a plug in power meter. An electrician may be required to conduct the power measurement.

These requirements also apply to T5 retrofit adaptors.

5.5 Identifying the ballast

The ballast type will affect the total power drawn by the luminaire. Ballasts which are not integral to the lamp will draw power in addition to the lamp's nominal power rating. Note that the nominal power rating of a compact fluorescent lamp with integral ballast (CFLi) includes the power losses of its integral ballast.

5.5.1 Ballasts for fluorescent lamps

There is a significant difference in the circuit power of fluorescent luminaires between those using (wire wound) magnetic ballasts and those using electronic ballasts.

For fluorescent lamps with a separate ballast, the ballast type shall be determined as follows:

- By using a frequency meter (in its simplest form, obtainable as a "ballast discriminator") aimed at the luminaire by the assessor (the preferred method)
- By physical evidence such as sighting a lamp starter (magnetic ballasts need a lamp starter) or by sighting T5 lamps which are only capable of operating on an electronic ballast
- By documented evidence such as as-installed equipment lists.

If observation and documented evidence are not available for the existing lighting system, a default evaluation of 'magnetic ballast' must be recorded with reasons for using the default.

Note that some ballasts will drive more than one lamp in the luminaire and some luminaires will contain more than one ballast. This is not relevant to the Assessment Form. It is not necessary to identify how many ballasts are present in the luminaire, just what type of ballast is present and how many lamps are present.

5.5.2 Ballasts for metal halide and mercury vapour lamps

Mercury vapour lamps will normally operate with magnetic ballasts (the default assumption).

Metal halide lamps can use either magnetic or electronic ballasts and the difference in power consumption is significant.

For metal halide lamps with separate ballast, the ballast type shall be determined as follows:

- By physical evidence such as sighting the ballast – preferably in a spare luminaire
- By documented evidence such as as-installed equipment lists

If observation and documented evidence are not available for the existing lighting system, a default evaluation of 'magnetic ballast' must be recorded with reasons for using the default.

5.5.3 Transformers for ELV halogen lamps

Extra low voltage (ELV) halogen lamps will be supplied by a magnetic or electronic transformer.

Magnetic transformers are significantly heavier and bulkier than electronic units (see Figure 1 and Figure 2 below).

Figure 1 – Electronic transformer (top) and magnetic transformer (bottom)

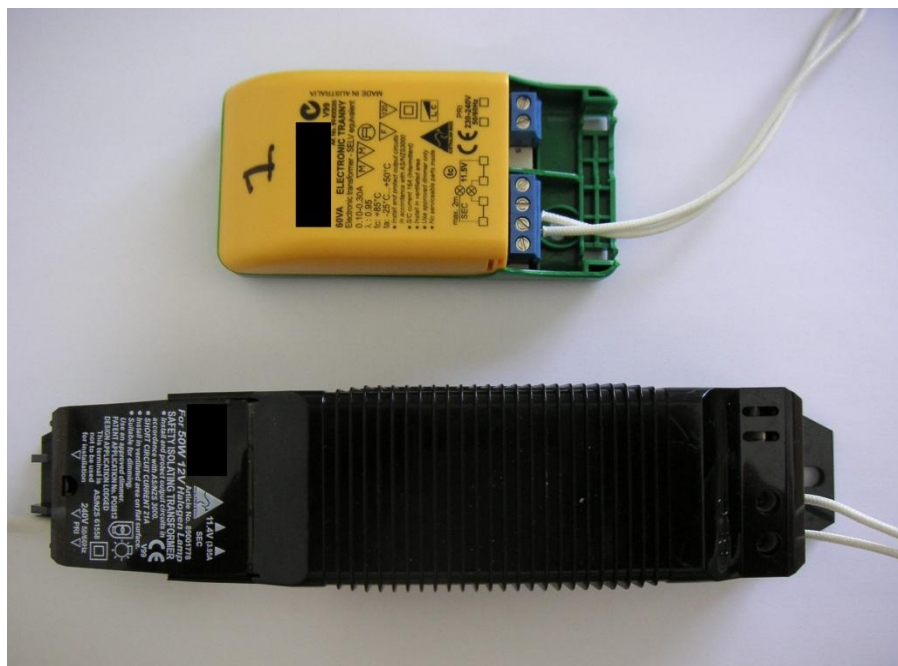
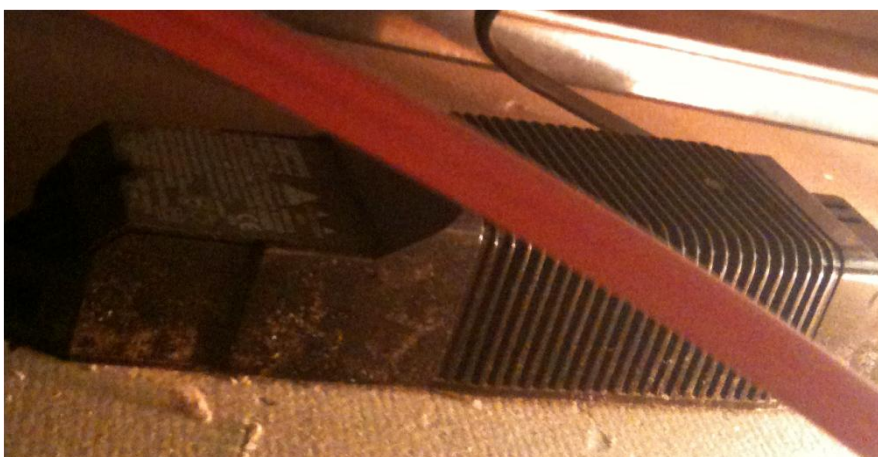


Figure 2 – Magnetic transformer in ceiling space



For extra low voltage lamps, the transformer type shall be determined as follows:

- By physical evidence such as sighting the transformer
- By documented evidence such as as-installed equipment lists

If observation and documented evidence are not available for the existing lighting system, a default evaluation of 'magnetic transformer' must be recorded with reasons for using the default.

6 NLPD assessment

6.1 Background

This section deals with selecting an NLPD assessment methodology appropriate to the space being assessed.

In lighting systems in which luminaires of a single type are arranged in a regular array, the grid method is applied. The luminaire power is divided by the area that the luminaire covers.

In lighting systems in which there is an irregular layout of luminaires or where there are a number of different luminaire types installed, a representative area is chosen by the assessor. The total luminaire power within this representative area is calculated and divided by the floor area.

6.2 Identifying the general lighting system

The general lighting system is usually best represented in open plan general office space.

Spaces that have been extensively fitted out with small cellular offices, meeting rooms, or conference rooms are less likely to have an installed lighting system that represents the base system. These spaces are likely to have a higher luminaire density to compensate for the small room sizes or have significant architectural or feature lighting installed.

Where functional spaces have been fully fitted out with such cellular offices, it may not be possible to determine the NLPD of the general lighting system and the functional space may be determined as Not Assessable.

6.3 Selecting the method

6.3.1 Grid Method

The grid method should be used when a single luminaire type is installed in a regular array within the functional space.

Luminaires do not need to be at exactly the same spacing for this method to apply. Rows of luminaires may be spaced alternately at 1.8m and 2.4m centres. This is equivalent to a uniform spacing of 2.1m centres and may be used accordingly.

6.3.2 Representative area method

The representative area method should be used when there is an irregular array of luminaires or where there is more than one luminaire type represented in the general lighting system within the functional space.

6.3.3 Not assessable

The Functional space shall be deemed NOT Assessable for the purposes of the CBD Program when:

- Spaces have been extensively fitted out with small cellular offices, meeting rooms, conference rooms etc as outlined in section 6.2, or
- Less than 50m² of floor area is accessible or visible, or
- There is no installed lighting system and no contractual agreement for a new system.

6.4 Applying the method

6.4.1 Grid method

Measure the spacing X and Y between luminaires as shown in Figure 3.

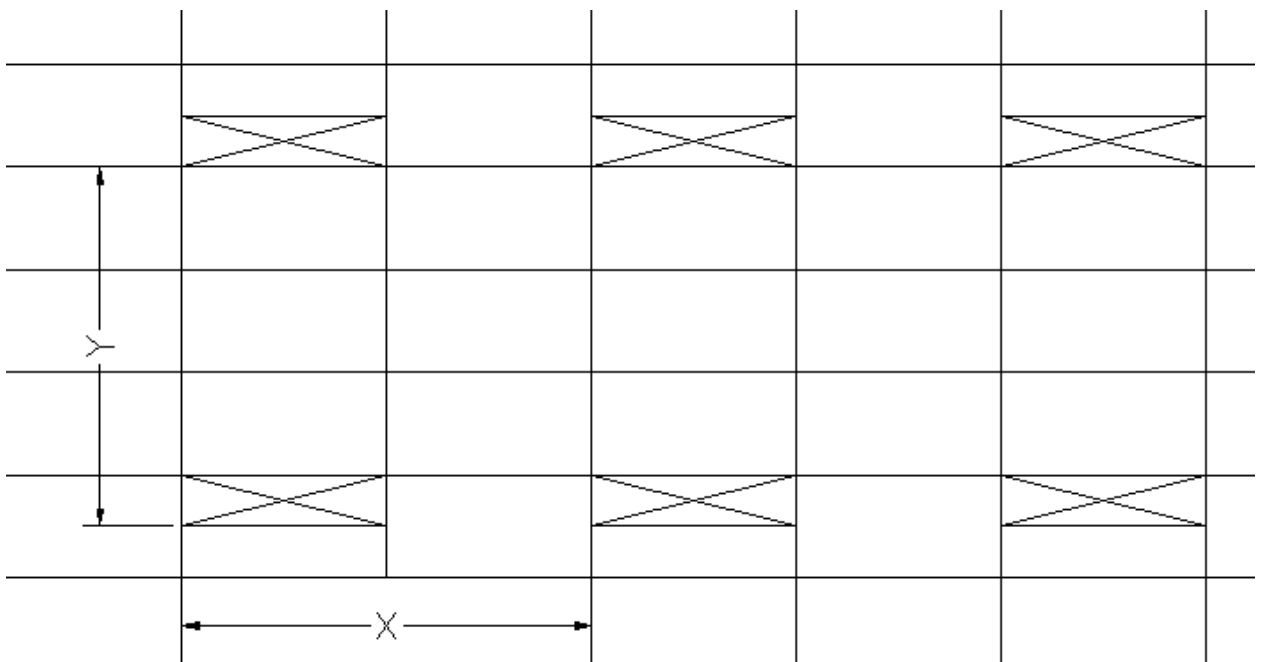
The spacing between luminaires must be measured because ceiling grid sizes do vary and it is easy to make a mistake by simply looking at the grid and assuming its dimensions.

Note that the measurement is taken from one side of the luminaire to the same side of the adjacent luminaire. It is the luminaire centre distance and NOT the distance between luminaires.

Calculate the area per luminaire - X (m) multiplied by Y (m)

Divide the luminaire power by the area per luminaire to get the NLPD in W/m²

Figure 3: Luminaire spacing in a regular array



6.4.2 **Representative Area method**

The assessor shall choose a representative area that best represents the general lighting system and has a lighting installation similar to that which applies across the entire functional space.

The minimum representative area shall be 15% of the functional space NLA or 50m² whichever is greater. If the functional space area is less than 50m², the representative area shall be the whole of the functional space.

It is preferred that the representative area is contiguous but, if not possible, it may be built up from smaller non contiguous sample areas within the functional space.

Representative areas and sample areas may include enclosed spaces when it is clear that the luminaire arrangement has not been changed in those spaces. This may be of assistance when assessing a number of similar functional spaces.

All representative areas and any sample areas that they comprise must lie within the functional space, be clearly marked on floor plans and the NLA of each measured accurately to within $\pm 5\%$.

If the assessor is unsure of the appropriate locations of the sample or representative areas then they should seek advice from the CBD Administrator.

The Assessment Form will calculate the NLPD by dividing the total power of all base lighting luminaires within the representative area by the NLA of the representative area.

7 Lighting control assessment

7.1 Background

The energy efficiency of a lighting system is heavily influenced by the power density of the installation. Lighting control systems operate to reduce the operating power by switching or dimming the lighting and, therefore can have a significant impact on the overall performance of the lighting system.

However, it is not practical to assess the effectiveness of installed lighting control system, because of the possibility that the systems are not operating as intended or at all. For this reason, the assessment process is designed to identify and report on the capacity of the installed lighting control system(s) installed in each functional space, rather than including the lighting controls in the NLPD calculation. This is an assessment of the potential for the lighting control system to manage the lighting operation.

An explanatory note in the Building Energy Efficiency Certificate will indicate the potential benefits of the lighting control systems that have been identified.

7.2 Identifying lighting control system capacity

The assessor shall make an assessment of the capacity of the installed lighting control system; a measure of its potential to closely match the operation of the functional space lights with the needs of the occupants.

Lighting control capacity shall be assessed as Basic, Average and Sophisticated as detailed below.

Sophisticated:

- At least 50% by area of the lighting within the functional space is managed by an occupancy based control system that ensures that lights only operate when the space is occupied; and
- Rooms are individually controlled; and
- The largest switching zone is less than 100m².

Average:

- The space does not qualify for “sophisticated” lighting control capacity; and
- At least 50% by area of the lighting within the functional space is managed by a time or occupancy based lighting control system that ensures that lights are turned off outside of normal working hours; and
- The largest switching zone is less than 250m².

Basic:

- The space does not qualify for either “sophisticated” or “average” lighting control capacity.

Lighting control capacity must be identified for all functional spaces.

- Where there is more than one control system installed within each functional space, assess the capacity of the system covering most of the functional space (more than 50% by area).
- The preferred method for identification of lighting controls is by visual inspection of the installed lighting system and electrical cupboards as required.
- Inputs shall be in accordance with *Section 2.4.1 Standard for acceptable data*. Verifiable supporting documentation may be used to assist in identification of the type of lighting controls installed.
- If no lighting controls are identified through observation and documented evidence, a default evaluation of “Basic” must be recorded.

8 Performance comments

8.1 Background

The CBD Tenancy Lighting Assessment allows for a single comment to be placed against each functional space to describe any additional features of the lighting system that may affect its energy or functional performance.

8.2 Performance comments

Only a single “performance comment” may be applied to each functional space and that is limited to the list available in the Assessment Form. If several comments apply the assessor should select the one that appears to be having most impact on the energy consumption.

These features are detailed in Table 2.

Table 2: Performance comments list

Performance comments

Luminaires delamped
Voltage reduction devices used
T5 adapters used
Desktop task lighting used
Check illuminance levels

9 Proposed systems

9.1 Background

There may be cases where the building owner intends to upgrade the lighting system of the functional spaces to be assessed soon after the assessment has been done. Or there may be a make-good clause in the lease agreement that requires the incumbent tenant to return the lighting system to its original state when vacating the tenancy.

Providing that there is a contractual commitment to proceed with the proposed installation which includes detailed design drawings and equipment specifications, the proposed lighting system may be assessed based on the available documentation.

In this case, both the installed lighting system and the proposed lighting system are assessed and reported in the Building Energy Efficiency Certificate.

9.2 Eligibility of proposed systems

Where building owners expects that the existing lighting system will change soon after the assessment, they may request an additional assessment of the proposed lighting system. The upgrade may be as a result of an owner initiative or because existing tenants need to meet the make good provisions of their lease.

The assessment of the proposed system can only be done in addition to the assessment of the existing system and strict eligibility criteria must be met.

To be eligible for assessment, building owner proposed upgrades must meet the following criteria:

- A signed contract committing the building owner to the upgrade,
- A contract completion date within 3 months of the assessment date,
- Detailed design documentation that provides all the information required for the assessment. This shall include reflected ceiling plans, lighting circuits, control strategies, equipment schedules and technical specifications.

To be eligible for assessment, upgrades resulting from make good provisions must meet the following criteria:

- An enforceable clause in the lease agreement requiring the tenant to return the lighting system to its original state,
- An agreed make-good completion date falling within 3 months of the assessment date,
- Detailed design documentation that provides all the information required for the assessment. This shall include reflected ceiling plans, lighting circuits, control strategies, equipment schedules and technical specifications.

9.3 Assessing proposed systems

The assessment process is identical to the process used to assess the installed lighting system except that it is completed from the contractual design information.

10 Appendices

10.1 Appendix A – Information checklist for assessments

The following information may be required for an assessment.

This checklist covers most of the information needed, but individual assessments may require additional information or documentation depending on the individual circumstances of the premises.

Information checklist

Obtain this information prior to site visit	<ul style="list-style-type: none"> <input type="checkbox"/> Required scope of assessment including floors and tenants to be included in the assessment <input type="checkbox"/> Floor plans showing tenant locations and fitout - if unavailable or incomplete assessor will need to mark-up the floor plan where it impacts the assessment. (Assessor will need to determine any impact on costs and negotiate with building owner accordingly) <input type="checkbox"/> Net lettable area of each floor and tenancy <input type="checkbox"/> Contact name, phone number and email at each tenant organisation <input type="checkbox"/> Confirmation that the building owner has advised the tenant of the impending assessment <input type="checkbox"/> Any available as-installed manuals relating to the lighting and controls installation including luminaire schedules complete with supporting manufacturer's data that details the installed luminaires and reflected ceiling plans.
Complete these tasks prior to the site visit	<ul style="list-style-type: none"> <input type="checkbox"/> Contact each tenant and arrange for a date and time on which the assessment is to be conducted. <ul style="list-style-type: none"> • As a guide to the tenants, they can be advised that the assessment of each functional space will take less than one hour. • Also advise the tenants that there may be a need for a follow up inspection by a specialist tradesperson if the required information is not accessible to the assessor <input type="checkbox"/> Obtain details of any site inductions or site safety requirements and address these as far as possible <input type="checkbox"/> Setup the assessment form with all available information
Complete these tasks at the beginning of the site visit	<ul style="list-style-type: none"> <input type="checkbox"/> Undertake any site inductions required by the building owner or tenant <input type="checkbox"/> Carry out the assessors own site specific job safety analysis and produce any safe work method procedures that this assessment might require
Complete these tasks in each functional space	<ul style="list-style-type: none"> <input type="checkbox"/> Make any amendments to the floor plan where this might affect the assessment

Information checklist

- Take photographs of the ceiling grid that clearly show luminaire spacing and type

 - Identify the general lighting system

 - Identify all luminaires in the general lighting system and add them to the site luminaire schedule
 - Luminaire identification shall include lamp power and quantity and ballast type
 - Where luminaire power cannot be determined, include the name and description of the luminaires in the site luminaire schedule and flag for further investigation (will require specialist tradesperson if the Assessor does not have the appropriate qualifications to undertake this work themselves)
 - Take close up photographs of luminaires and lamps to aid further investigation and assessment review.

 - Decide on the appropriate assessment method
 - If using the grid method, measure the spacing between luminaires – do not assume the grid spacing
 - If using the representative area method, identify the representative area, mark it up on the floor plan and measure the area.

 - Determine the lighting control strategy of the space. This may require switching some lights and/or discussion with the tenant contact.

 - Fill in the assessment calculator for the space




 - Walk around the space and ensure that it has been left as found

 - Advise the tenant contact that you are leaving and return any security passes provided
 - If further investigation is required, advise the tenant contact
-


It will be necessary for a site inspection to confirm that the information provided is accurate, current and complete. A site visit is compulsory to count luminaires, establish the assessment method and measure representative areas where applicable.

10.2 Appendix B – Common lamp types

Table 3 – Common lamp types

Lamp Type	Description	Typical Lamp Nominal Sizes and Wattages	Notes and Examples
T8 or T12	<p>Linear fluorescent with diameter 8/8 inch (26mm) or 12/8 inch (38mm).</p> <p>Can be halophosphate, triphosphor or quad phosphor.</p> <p>Can operate on magnetic or electronic ballast.</p>	<p>T8 600mm = 18W T8 900mm = 30W T8 1200mm = 36W T8 1500mm = 58W T8 1800mm = 70W T12 600mm = 20W T12 900mm = 30W T12 1200mm = 40W T12 1500mm = 65W T12 1800mm = 77.5W</p>	
T5	<p>Linear fluorescent with diameter 5/8 inch (16mm).</p> <p>Only operates on electronic ballast.</p>	<p>T5 550mm = 14, 24W T5 850mm = 21, 39W T5 1150mm = 28, 54W T5 1450mm = 35, 49, 80W</p>	 <p>T5 lamps are noticeable narrower than T8 lamps. See section 0 for discussion of retrofit T5 adaptors.</p>
CFLn	<p>A single-ended compact fluorescent lamp with non-integral ballast (i.e. ballast is separate from lamp).</p> <p>Can operate on magnetic or electronic ballast.</p>	<p>Length ~150mm typical Can vary 120 – 570mm Various wattages</p>	

Lamp Type	Description	Typical Lamp Nominal Sizes and Wattages	Notes and Examples
CFLi	A single-ended compact fluorescent lamp with integral ballast.	Length ~150mm typical Various wattages	
Circular fluorescent	A fluorescent lamp in a circular shape Can operate on magnetic or electronic ballast.	Diameter ~300mm 22W, 32W, 40W	
Incandescent / halogen-low voltage	Lighting systems operating on 12 Volts with magnetic or electronic transformer	50W, 35W, 20W	
Incandescent / halogen-mains voltage	Mains voltage general purpose lamps and down lights with no ballast or transformer	Various sizes and wattages	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Incandescent</p>  </div> <div style="text-align: center;"> <p>Halogen</p>  </div> </div>
Metal halide	Becoming more popular as down lights and spotlights Can operate on magnetic or electronic ballast.	Reflector diameter ~100mm 20W, 35W, 50W, 70W (office applications)	

Lamp Type	Description	Typical Lamp Nominal Sizes and Wattages	Notes and Examples
Mercury Vapour	Becoming less common in office applications Usually operates with magnetic ballast	Various sizes and wattages	
Other lamp types	Lamp types not listed above, including LED and lamps with T5 retrofit adaptors. Discussed in section.5.4.4		

10.3 Appendix C – Details of luminaire power calculations

The luminaire power for each luminaire is determined by looking up a series of equations, which are based on the lamp type and ballast or transformer type. These equations are reproduced in Table 4. Note that the number of lamps present in each luminaire will also affect the luminaire power.

Table 4 – Calculation of Luminaire Power (per lamp)

Lamp Type	Luminaire Power (per lamp, in Watts)	
	Electronic Ballast	Magnetic Ballast
Linear fluorescent T8 or T12	$NLP + 1$	$NLP + 8$
Linear fluorescent T5	$1.1 \times NLP + 2$	N/A
CFLn	$NLP + 2$	$NLP + 8$
CFLi	NLP	
Incandescent / halogen – mains voltage	NLP	
Incandescent / halogen – low voltage	$NLP \div 93\%$	$NLP \div 80\%$
Metal halide	$1.1 \times NLP + 0.9$	$1.05 \times NLP + 14$
Mercury vapour		$1.1 \times NLP + 10$

NLP = nominal lamp power

Notes:

- Luminaire power does not deteriorate over time, although the power factor of fluorescent luminaires may deteriorate as the power factor correction capacitor deteriorates.
- Fixed dimming and fluorescent ballasts with a low ballast lumen factor (BLF) are not considered at this time.

Sources of information used to derive equations:

- Linear fluorescent T8, T12, T5 and CFLn: AS/NZS Performance of electrical lighting equipment – Ballasts for fluorescent lamps – Part 2: Energy labelling and minimum energy performance standards requirements. Curve fitted to lamp/ballast circuit power, best representing magnetic as well as electronic ballasts.
- Incandescent / halogen – low voltage: Analysis of the Potential for Minimum Energy Performance Standards for Power Supply Units For Extra Low Voltage Tungsten Halogen Lighting, Prepared for the Australian Greenhouse Office and NAEEEC under the National Appliance & Equipment Energy Efficiency Program by Mark Ellis & Associates, Steven Beletich Associates, April 2005.
- Metal halide and mercury vapour: curve fitted to data derived from:
 - NSW IPART Street Lighting Load Table
 - Supplier Ballast Catalogue
 - AS/NZS 1158.6 (2004) Lighting for roads and public spaces – Part 6: Luminaires.
- Note that all equations are similar to those used in the Commercial Lighting Method of the NSW Energy Savings Scheme, which uses ballast EEI classification rather than magnetic/electronic ballast classification.

10.4 Appendix D – NLPD calculation examples

The examples provided below are of nominal lighting power densities calculated by the grid method and the representative area method.

10.4.1 Grid method

The ceiling layout shown in Figure 4 depicts a series of luminaires installed in a suspended tiled ceiling and arranged in a regular array.

For this example, we will assume that the ceiling grid is 1200mm x 600mm and that the luminaires use two 36W T8 lamps operating on magnetic ballasts.

Using the equation from Table 4 the power of one lamp plus ballast is $36 + 8 = 44\text{W}$.

The total luminaire power (for two lamps) is $2 \times 44 = 88\text{W}$.

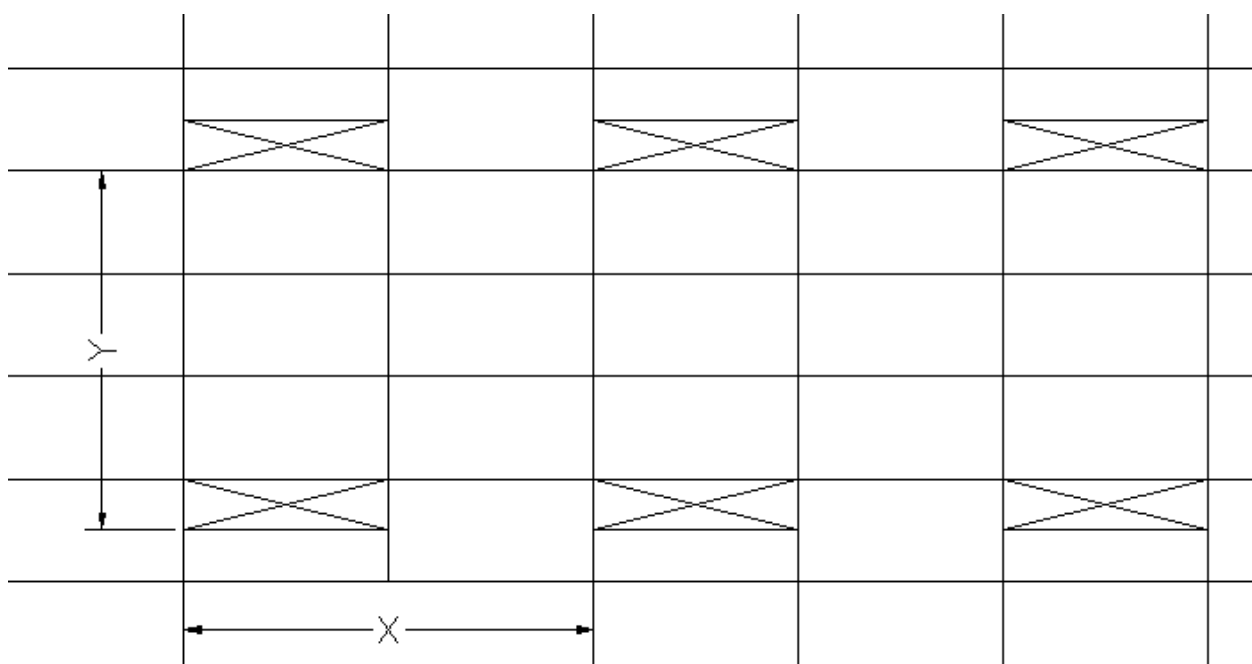
The luminaire centre distances are shown as X and Y. Distance X is $2 \times 1200 = 2400\text{mm}$ (2.4m) and distance Y is $3.5 \times 600 = 2100\text{mm}$ (2.1m)

Thus the area per luminaire is $2.4 \times 2.1 = 5.04\text{m}^2$

And the NLPD is $88\text{W} \div 5.04\text{m}^2 = 17.5\text{W/m}^2$

These calculations are done automatically in the assessment form but included her to illustrate the background process. In the assessment form only the quantity of lamps and the wattage of each need be entered.

Figure 4: Luminaire spacing in a regular array



10.4.2 Representative area method

Figure 5 depicts a whole floor of a building which is occupied by a single tenant. This makes the floor a single functional space for a CBD tenancy lighting assessment.

There is a mix of luminaires on this floor but the task lighting in enclosed offices and the feature lighting in the tea rooms do not form part of the general lighting system. Only the 2 x 36W troffers (the rectangles with the diagonal lines) and 2 x 18W down lights (the small dark circles) around the perimeter are part of the general lighting system, both with magnetic ballasts.

Because there is more than one luminaire type in the general lighting system, the representative area method must be used.

Total floor NLA is 1,800m² so the NLA of the representative area must be 15% of 1800m² (270m²) which is larger than the 50m² minimum.

Figure 5: Multiple luminaire types

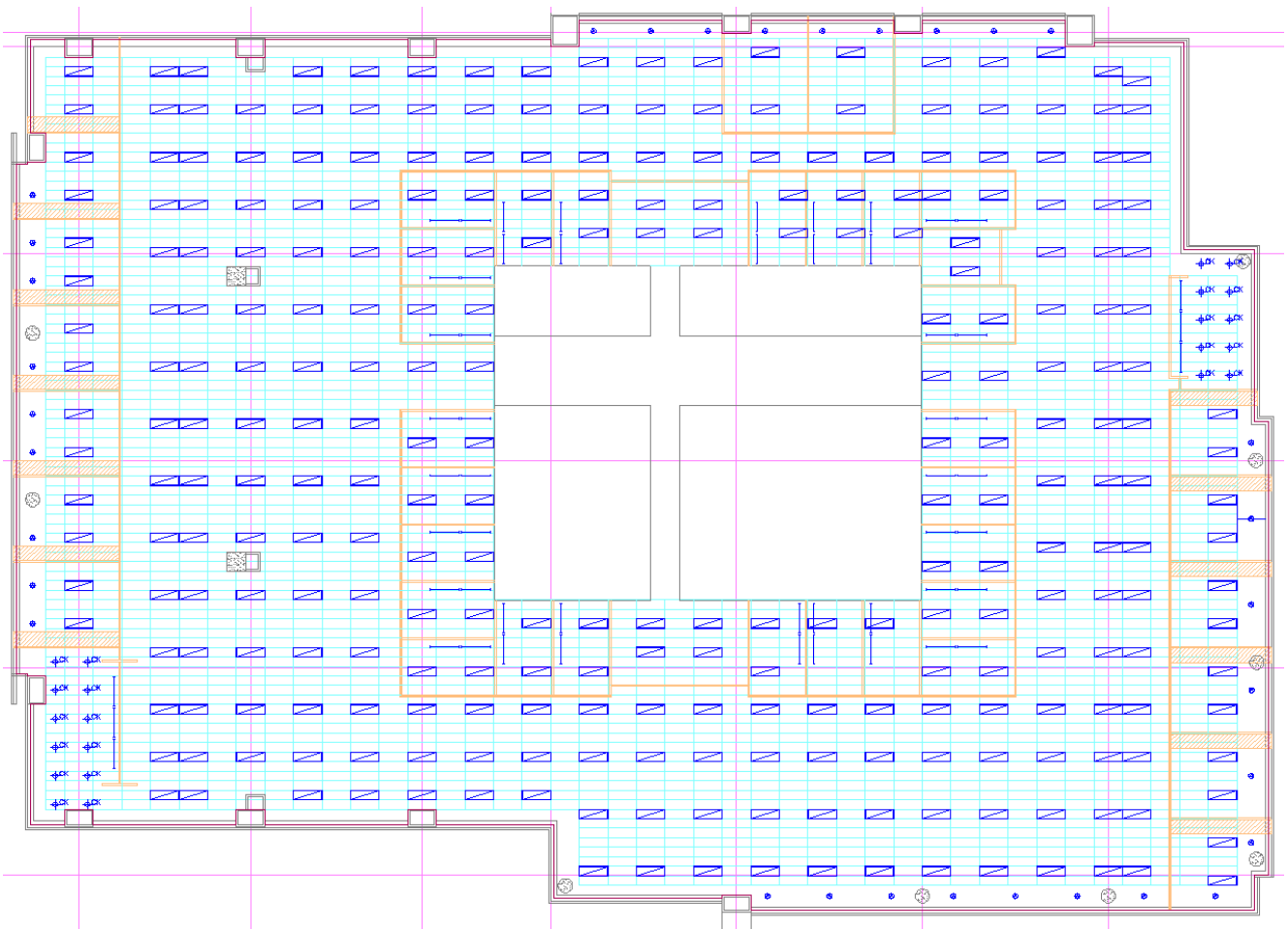
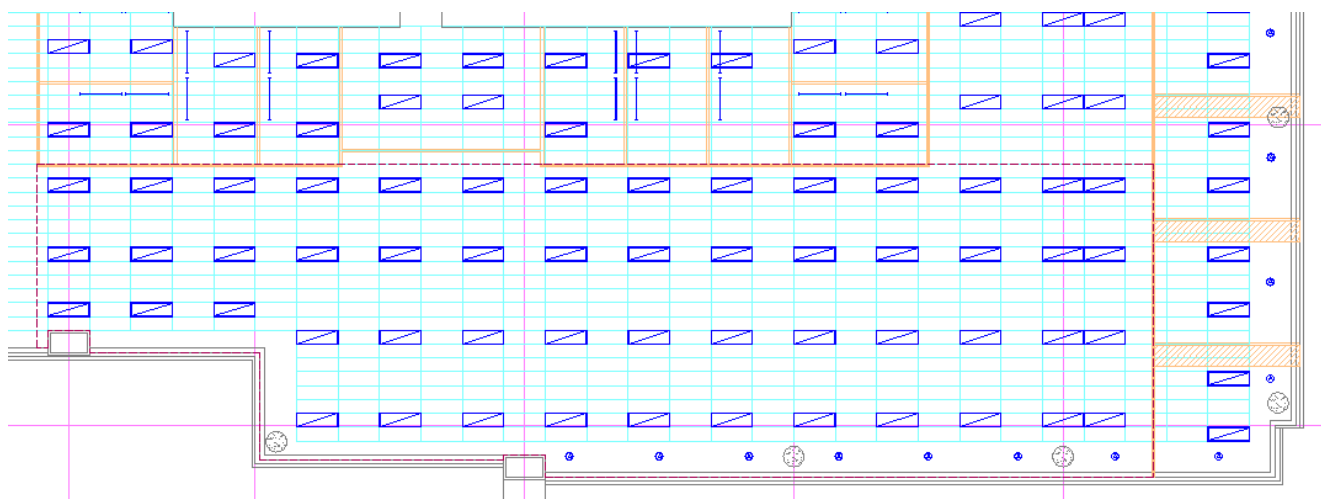


Figure 6 shows in dotted outline the representative area that was chosen, a section of open general office space at the bottom of Figure 5 that is bounded by office partitions and using the corner of an office as a convenient landmark.

Figure 6: Representative area



The NLA of the representative area is 264m² which is quite close to our target.

The power of each luminaire is calculated in the same manner as for the grid method and added to Table 5.

The quantity of each luminaire type within the representative area is counted and also added to Table 5.

The total power of all luminaires is added up and divided by the floor area to obtain the overall NLPD of 19.0W/m².

Table 5: Representative area calculation

Luminaire	Power (W)	Quantity	Total power(W)
2 x 36W troffer	88	53	4,664
2 x 18W down light	52	7	364
		Total	5,028
		Area	264
		NLPD	19.0 W/m²