



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

The University of Newcastle
Infrastructure and Facilities
Services
Project Briefing Document
**Interior Lighting and Lighting
Control**

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THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

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1. Scope

This Specification covers the general requirements applicable to the design, manufacture, performance and delivery of Interior Lighting and Interior Lighting Control Systems.

It is not the intention to specify details of design and construction except where necessary to establish performance requirements, nor is it the intention to set forth those performance requirements which are adequately specified by the applicable Standards.

This specification shall be read in conjunction with Standard Specification UON-ESS-101 Electrical Design Criteria.

2. Standards, Specifications and Statutory Obligations

All aspects of design, manufacture, testing, supply, plant, equipment, accessories, materials, construction, erection, installation, operation and performance shall comply with this Specification and the current issue of the relevant Australian Standards, the relevant International Standards, the UON Standard Specifications and Proffered Equipment List, as well as all Statutory Acts, Codes, Regulations and Requirements of the relevant Authorities having jurisdiction over them unless specified otherwise within this Specification.

These shall include but not be limited to:

Australian/International Standards

AS 3000	Wiring Rules
AS 3008	Electrical installations - Selection of cables
AS 1201	Tubular fluorescent lamps for general lighting service
AS 1680.0	Interior lighting Part 0: Safe movement
AS 1680.1	Interior lighting Part 1: General principles and recommendations
AS 1680.2.1	Interior lighting Part 2.1: Circulation spaces and other general areas
AS 1680.2.2	Interior lighting Part 2.2: Office and screen based tasks
AS 1680.2.3	Interior lighting Part 2.3: Education and Training Facilities.
AS 1680.2.4	Interior lighting Part 2.4: Industrial tasks and processes
AS 1680.3	Interior lighting Part 3: Measurement, calculation and presentation
AS 1680.4	Interior lighting Part 4: Maintenance of electric lighting systems
AS 3017	Electrical installations – Testing and inspection guidelines
AS 3665	Simple definitions of lighting terms and quantities
AS 3827	Lighting system performance - Accuracies and tolerances
AS 4282	Control of the obtrusive effects of outdoor lighting

University of Newcastle Standards

UON-ESS-101	General Electrical Specification.
UON-ESS-105	Preferred Equipment List.

Authorities and Statutory Acts, Codes, Regulations and Requirements

BCA
NCC 2016 Volume One BCA Class 2 to Class 9 buildings.
NCC 2016 Volume Two BCA Class 1 and Class 10 buildings.
Worksafe NSW
NSW Electrical Licencing & Regulation
NSW Service and Installation rules.

Where the stipulations of this Specification, the data sheets and the drawings do not comply with the minimum requirements of the Australian Standards and Statutory Regulations, the latter shall prevail.

Where the stipulations of this Specification, the data sheets and the drawings are more exacting than the minimum requirements of the Australian Standards and Statutory Regulations, the former shall prevail in the following order:

- a) Data sheets and detail drawings
- b) Specification and standard drawings.

The objective of a lighting system in a given space (typically a room or specific part of a room) is to contribute to the provision of the following in relation to the intended users of the space:

- a) Safety.
- b) Performance of physical tasks.
- c) An appropriate visual environment.

The variation in the emphasis on each of these aspects will vary for different spaces and even within spaces.

3. Light Fittings

All Light fitting shall be approved by the UON prior to installations. All light fitting shall be covered by a 5 year on site warrantee that covers all costs associated with the repair of the light fitting, including but not limited to, the cost of all material, travel, access, lifting equipment and labour.

Light fittings shall be LED type fittings where LED fitting can achieve the required lighting outcomes. When LED fittings are not available for the proposed installation, the next most energy efficient available lighting technology shall be used, this will generally be a "H.I.D" type fitting. Incandesce lamps shall not be used unless they are specifically required for their lighting characteristics. Any ballasts that is required for a type of fitting shall be a high efficiency Electronic type ballast. All internal LED fittings shall be dimmable.

All detectors that are used to control internal lighting shall be integral to the fitting if this option is available. If the fitting contain a breakable bulb or tube it shall be covered to prevent glass from being released from the fitting upon breakage of the bulb or Tube. Fittings installed in areas susceptible to damage such as loading docks and utility rooms shall have a minimum Impact rating of IK10.

The lamp be it bulb, tube, LED or other shall be behind a light diffusing cover that prevent area user from looking directly at the light emitting element of the fitting.

When a light grid or grill is being used it shall ensure no more than a 90 degree spread of direct light is emitted from the light element to protect area users from the glare from the lighting element. See Figure 1 below,

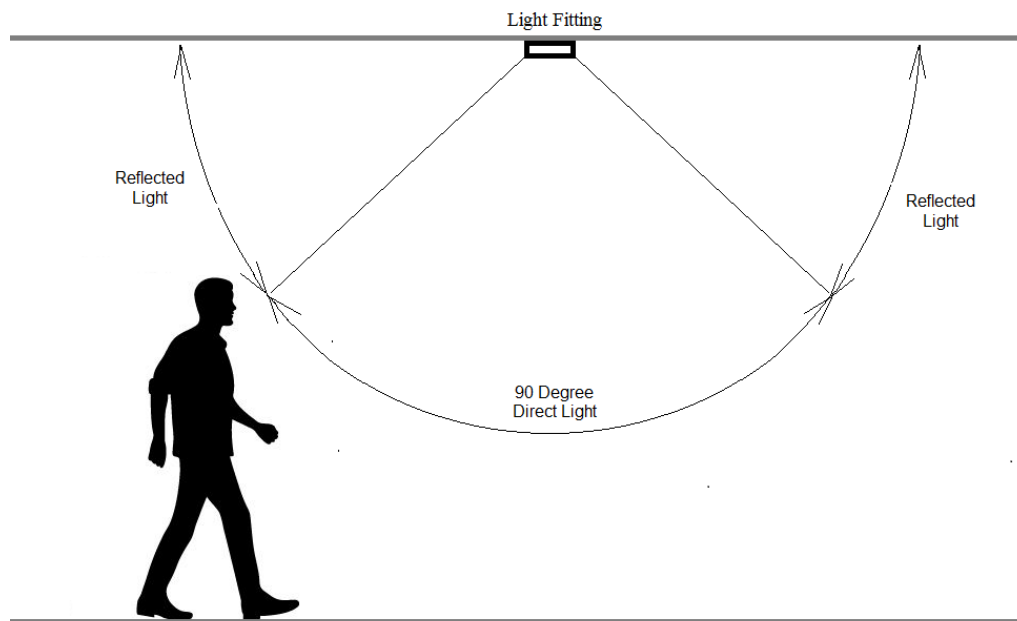


Figure 1

4. Design

The lighting characteristics shall be as per the table 1 shown below. The “Type of Area” shall be agreed with the UON prior to design. All lights within a given area must have a single common colour, light colour shall only change if the two areas are separated by a wall, partition or Door. New installation match the existing lights lamps per circuit. Dimming and efficiency. Dimming shall only be used for effect or to achieve temporary light levels, dimmers shall not be used to achieve a final required light level. The design must achieve the correct light level when the lights are at 100%. Lighting design in all Theatres will be completed by a third party designer that does lighting design as the core business.

Care should be taken during design to reduce glare from light fittings. Light fitting should where possible and placed in a location or that will not be in the direct line of site of the building users. Fitting within the direct line of site of area users should have reflector, grid or barrier to reduce the glare from with the light element.

All installations involving new lighting in a new location shall have a photometric diagram completed and approved by the UON prior to installation. On retrofit installations new fitting can be used in existing locations providing the new fittings have equivalent or higher light output than the existing fittings.

All common areas shall include at least one “Night Light”. The night lights in a given area shall generally maintain a light level in that area equivalent to the level required for escape path lighting. There shall be at least one nightlight inside each entrance door to a building and one light in ten in any common area hallway.

Some installation will require lighting that is more than purely functional, in these areas where lighting is to add to the aesthetic of the installation a lighting designer shall be used. Below is a list of required light levels for associated areas, light levels are permitted to be 10% below or 30% above the levels listed below, light levels outside these parameters will not be accepted. Light levels listed below are to be achieved with the fitting at 100%, dimming is not to be used to achieve required light levels.

Type of Area	Lux	Colour	Kelvin	Glare
AUDITORIUMS				
Assembly halls—General use	160	White	4000k-5000k	19
Social activity	80	White	4000k-5000k	19
Examinations	240	White	4000k-5000k	19
Theatre use	Specialized lighting designer and UON approval required. Aisle lighting as per AS1680.2.3 Clause 10.15)			
CLASSROOMS				
General use	240	White	4000k-5000k	19
Laboratories	320	White	4000k-5000k	19
Lecture rooms	240	White	4000k-5000k	19
Music rooms	320	White	4000k-5000k	19
Reading rooms	320	White	4000k-5000k	19
Seminar rooms	240	White	4000k-5000k	19
CONFERENCE ROOMS				
Conferring	240	White	4000k-5000k	19
Conference table	600	White	4000k-5000k	19
Rear wall	160	White	4000k-5000k	19
Auxiliary graphics	800	White	4000k-5000k	19
FOOD SERVICE FACILITIES DINING AREAS				
General	160	White	4000k-5000k	2
Counters	240	White	4000k-5000k	2
KITCHENS				
General	160	White	4000k-5000k	22
Food preparation ,cooking ,washing up	240	White	4000k-5000k	2
GRAPHIC DESIGN AND MATERIAL				
Colour selection	800	Cool White	5000k-6000k	19
Charting and mapping	800	Cool White	5000k-6000k	19
Graphs	800	Cool White	5000k-6000k	19
Key lining	800	Cool White	5000k-6000k	19
Layout and artwork	600	White	4000k-5000k	19
Photographs, moderate detail	400	White	4000k-5000k	19
LIBRARIES				
Audio listening areas	160	White	4000k-5000k	19
Audio-visual areas	240	Warm White	3000k-4000k	1B

Book repair and binding	320	White	4000k-5000k	19
Book stacks	240	White	4000k-5000k	19
Card files	320	White	4000k-5000k	19
Carrels, individual study areas	320	White	4000k-5000k	–
Cataloguing	320	White	4000k-5000k	19
Circulation desk	320	White	4000k-5000k	19
INDOOR SPORTS FACILITIES	As per AS2560			
WORKSHOPS				
Rough bench or machine work	240	White	4000k-5000k	22
Medium bench work or machine work	400	White	4000k-5000k	19
Fine bench or machine work	800	Cool White	5000k-6000k	19
Extra-fine bench or machine work	1 200	Cool White	5000k-6000k	19
COMPURT/SCREEN-BASED TASK AREAS				
Keyboards	160 (240)	White	4000k-5000k	19
Reference material:				
(a) Good, simple	240	White	4000k-5000k	2
(b) Average detail	320	White	4000k-5000k	2
(c) Poor, fine detail	600	White	4000k-5000k	2
Background/environment	160	White	4000k-5000k	2
Microform reading areas	20-40	White	4000k-5000k	2
Equipment rooms	320	White	4000k-5000k	22
DRAFTING OFFICES C.A.D.				
Drawing board	600	White	4000k-5000k	2
Reference material:				
(a) Good, simple	320	White	4000k-5000k	2
(b) Poor, fine detail	600	White	4000k-5000k	2
Background/environment in drafting office	240	White	4000k-5000k	2
OFFICE AREAS				
Reception Area	319	White	4000k-5000k	19
Meeting rooms	320	White	4000k-5000k	2, 19
Training rooms ,seminar rooms	240	White	4000k-5000k	2
Conference rooms, boardrooms	240(1 60)	White	4000k-5000k	2
General Office areas	300	Warm White	3000k-4000k	1, 19
PHOTOCOPYING AND PRINTING ROOMS				
Intermittent	160	White	4000k-5000k	25
Sustained, collating	240	White	4000k-5000k	19
Colour copying	240	Cool White	5000k-6000k	19

FILING AREAS				
Sorting:				
(a) Simple, clear detail	240	White	4000k-5000k	19
(b) Difficult, fine detail	320	White	4000k-5000k	19
ENTRANCES				
Entrance halls, lobbies, foyers	160	White	4000k-5000k	—
Waiting rooms	160	White	4000k-5000k	19
Enquiry desks	320	White	4000k-5000k	19
Gatehouses	160	White	4000k-5000k	19
Loading bays	80	White	4000k-5000k	—
CIRCULATION/COMMON AREAS				
Corridors, passageways, ramps	40	White	4000k-5000k	—
Stairs (internal)	80	White	4000k-5000k	—
Lift, escalators, moving, walks (See Australian Standard 1735)	AS 1735	White	4000k-5000k	2, 3
Toilets	80	White	4000k-5000k	—
STAFF ROOMS				
Changing rooms, locker rooms	80	White	4000k-5000k	
Cleaners' rooms	80	White	4000k-5000k	—
Cloakrooms	80	White	4000k-5000k	—
Rest rooms	40	White	4000k-5000k	—
FIRST AID CENTRES				
Rest rooms	40	White	4000k-5000k	—
Treatment rooms	320	White	4000k-5000k	19
appropriate				
STOREROOMS				
Rough bulky material:				
(a) Dead storage	40	White	4000k-5000k	3
(b) Live storage	80	White	4000k-5000k	3
Medium or fine material requiring care:				
(a) Dead storage	80	White	4000k-5000k	—
(b) Live storage	160	White	4000k-5000k	25
Counters:				
(a) Intermittent tasks	240	White	4000k-5000k	—
(b) Sustained tasks	320	White	4000k-5000k	2
PLANT ROOMS				
General	80	White	4000k-5000k	25
Control panels, switchboards	160	White	4000k-5000k	—

CONTROL AND MONITORING ROOMS:				
(a) Intermittently monitored	240	White	4000k-5000k	2
(b) Continuously monitored	320	White	4000k-5000k	2
CARPARKS (INDOORS)				
Entrances:				
(a) During daytime				
—first m	800	Warm White	3000k-4000k	—
—next m	160	Warm White	3000k-4000k	—
(b) During night-time				
automatically reduced at night				
Aisles, ramps, circulating roads, pedestrian crossings	40	Warm White	3000k-4000k	—
Normal parking spaces	40	Warm White	3000k-4000k	—
Parking spaces for disabled	40	Warm White	3000k-4000k	—
Accessed				
WAREHOUSES				
Storage of goods of one kind of large unit size	40	White	4000k-5000k	N/A
Storage of goods of different kinds and search and retrieval tasks	80	White	4000k-5000k	28
Storage routinely involving reading tasks or See Clause				
Automatic high-bay storage				
(a) Aisles and gangways	20	White	4000k-5000k	N/A
WELDING AND SOLDERING				
Gas and arc welding and brazing	160	White	4000k-5000k	28
Ordinary soldering and spot welding	400	White	4000k-5000k	22
Fine soldering and spot welding	600	White	4000k-5000k	N/A
Extra-fine soldering and spot welding	800	Cool White	5000k-6000k	N/A
WOODWORKING				
Rough sawing and bench work	240	White	4000k-5000k	25
Sizing, planning, rough sanding, medium machine and bench work, gluing	400	Cool White	5000k-6000k	22
Fine bench and machine work, fine sanding, finishing, veneering	600	Cool White	5000k-6000k	1B
ASSEMBLY SHOPS AND MANUFACTURING PROCESSES				
Rough work, e.g. large scale assembly, frame assembly, assembly of heavy machinery	160/240	White	4000k-5000k	25 ⁺
Medium work, e.g. machined parts, main engine assembly, vehicle body assembly	400	White	4000k-5000k	22
Fine work, e.g. small parts, electronic equipment, sub-assemblies (engine components)	600	White	4000k-5000k	19
Extra-fine work, e.g. very small or intricate parts, precision mechanisms, instruments	1 200	Cool White/Daylight	> 5000k	N/A

If the areas being lit is not shown above, use the guidelines in Table 2 below to establish required light levels.

Activity	Lux	Light colour	Kelvin	Comments	
Movement and orientation	40	White	4000k-5000k	Interiors rarely visited with visual tasks limited to movement and orientation	Corridors; cable tunnels; indoor storage tanks; walkways.
Rough intermittent	80	White	4000k-5000k	Interiors requiring intermittent use with visual tasks limited to movement, orientation and coarse detail.	Staff change rooms; live storage of bulky materials; dead storage of materials needing care; locker rooms; loading bays.
Simple	160	White	4000k-5000k	Any continuously occupied interior where there are no tasks requiring perception of other than coarse detail. Occasional reading of clearly printed documents for short periods.	Waiting rooms; staff canteens; rough checking of stock; rough bench and machine work; structural steel; casting concrete; automated process monitoring; entrance halls; general fabrication of turbine halls.
Ordinary or moderately easy	240	White	4000k-5000k	Continuously occupied interiors with moderately easy visual tasks with high contrasts or large detail (>10 min arc).	School chalkboards and charts; medium woodworking; food preparation; counters for transactions.
Moderately difficult	320/400	White	4000k-5000k	Areas where visual tasks are moderately difficult with moderate detail (5-10 min arc or tolerances to 125µm) or with low contrasts. e.g. reading, writing, typing, enquiry desks.	Inspection of medium work; fine woodwork; car assembly.

Difficult	600	Cool White	5000k-6000k	Areas where visual tasks are difficult with small detail (3-5 min arc or tolerances to 25µm) or with low contrast.	Drawing boards; most inspection tasks; proofreading; fine machine work; fine painting and finishing; colour matching.
Very difficult	800	Cool White	5000k-6000k	Areas where visual tasks are very difficult with very small detail (2-3 min arc) or with very low contrast.	Fine inspection; paint retouching; fine manufacture; grading of dark materials; colour matching of dyes.
Extremely difficult	1200	Cool White/Daylight	> 5000k	Areas where visual tasks are extremely difficult with extremely small detail (1-2 min arc or tolerances below 25µm) or of low contrast. Visual aids may assist.	Graphic arts inspection; hand tailoring; fine die sinking; inspection of dark goods; extra-fine bench work.
Exceptionally difficult	1600	Cool White/Daylight	> 5000k	Areas where visual tasks are exceptionally difficult with exceptionally small detail (<1 min arc) or with very low contrasts. Visual aids will be of advantage.	Finished fabric inspection; assembly of minute mechanisms, jewellery and watchmaking

Maximum Illumination Power Density shall be as per Table J6.2a contained in BCA Building Code Australia) Volume 1.

Because of the time taken for the human eye to adjust to changes in light levels, light in entryways shall be higher than lighting in the main areas. This is reflected in the table above.

4.1. Photo Metric Design

Once an installation is complete a light levels are to be checked against the levels on the design Photo Metric drawing. An UON approved photometric meter shall be used to check correct lighting levels have been achieved. This shall be demonstrated to the UON representative.

4.2. Light Levels

When installing new or modifying the location of existing Emergency Escape Lighting or Illuminated Exit Signage, Electrical Drawings will be updated to reflect the changes. Where the majority of fittings in a given area are to be relocated, a new drawing shall be produced.

When installing monitored fittings, a “Nexus Fitting Commissioning Data” sheet as per Appendix A shall be completed and submitted to the UON Project Manager or Representative. Dimmers are for affect only, they are not to be used to achieve normal operating light levels.

5. Safety

Internal light fitting shall be installed in such a way that it can be accessed using a platform ladder (Max 3 meter) and require no specialised equipment to access. In the event this is not possible, a method and location for the installation is to be approved by the University Representative.

In areas that contain rotating machine an Incandescent light shall be installed to light the rotating machine parts when they are running. This is to minimise the strobing effect from LED or HID lighting.

Glass tubes or globes with no
Mechanical protection.

6. Electrical

All lights and lighting control devices (Including Switches) shall be labelled with an engraved label indication the point of supply for that fitting/Device.

A plug and socket shall be used to connect light fittings the lighting circuit.

7. Efficacy

When completing an installation involving 10 or more fittings the installer shall ensure a power factor of at least .96. Due to the dramatic affect dimming LED lights has on power factor, dimming shall not be used with LED lights to achieve normal operating light levels. Dimmers may be used for effect or for a certain function but the normal light level required in the area shall be achieved with fittings running at 100%.

Maximum Illumination Power Density shall be as per Table J6.2a contained in BCA Building Code Australia) Volume 1.

In larger areas where natural light could make up more than 30% of the light on a cloudless day, daylight harvesting shall be used to reduce energy consumption.

8. Control

The level of Automation or Lighting control in an area will depend upon the size of the area, the level of lighting required and the activity that takes place in that area. Generally, the lighting control strategy will be established and dictated in the general project specification. If the specification does not address lighting control, clarification should be sort from UON before proceeding with design. The table below is a guide only for UON lighting control strategies. CBUS is the UON preferred control bus.

Standard in line switches are only to be used to turn lights or lighting installations off. They may be used in conjunction with other motion detection, however shall not be used as the only means of controlling a light or lighting installation. Some method of detection or automation must be used on all installations to ensure that the light or lighting installation are not left energised when not required.

Size	Office, Non Public Areas ¹
<15 Meters Sq.	Single or Multiple PIR Motion detection or Timer.
15<80 Meters Sq.	Single or Multiple PIR Motion detection or Timer.
80<200 Meters Sq.	Multiple PIR motion detectors with controller
>200 Meters Sq.	Organic Response- Distributed Control
	Storage or Utility areas²
<100 Watts	PIR or motion detector (Dali controller).
>100 Watts	PIR or motion detector (Dali controller).
>80 Meters Sq.	Multiple PIR Motion detector
Stairways and Carparks	PIR or motion detector (Dali controller).
Theatres	Dali. Crestron (Design by UON AV department)
Labs	Dali. Crestron
Public areas	As required, safety shall be the primary consideration.

¹ Non-public area is an area where the public would not go unescorted by a UON person.

² These are generally areas with controlled access such as switch rooms of mechanical room.

All rooms shall have a device capable of turning the lights on or off at each entry. All areas that use lighting control to shut down lighting will do so in two stages. If no movement is detected for a UON predetermined time, the bulk of the lights will be shut off. Enough lights shall remain illuminated to ensure a light level equivalent to that required by Australian Standards for escape path lighting. After a

further UON predetermined time, the remainder of the lights will shut down. This is intended to reduce the risk of someone being plunged into darkness if they have not triggered the movement detectors for some time.

9. Installation

Any vertically installed fastener shall be directly attached to the building support structure and shall not use an interference fit device such as a wall plug, dowel or Gyproc anchor to complete the installation. In the event that no suitable structure is available in the required location and additional support for the fitting cannot be fabricated, a mechanically attached device such as a toggle bolt may be used. Fasteners installed horizontally may use an interference fit device providing the fastener and attachment device are capable of supporting the sheering load of the fitting.

Internal light fitting shall be installed in such a way that it can be accessed using a platform ladder (Max 3 meter) and require no specialised equipment to access. In the event this is not possible, a method and location for the installation is to be approved by the University Representative. Recessed fitting shall be used where possible.

10. Drawings and Data.

Check compliance with original photo metric drawing at the completion of the installation. Legend to be updated must show room number.

Handover documentation to be provided shall include:

- Light fitting layout drawings
- Light circuit arrangements
- Termination diagrams for and lighting automation
- GA for automation equipment
- Wiring diagram for all lighting automation equipment
- Luminaire schedule
- Photometric drawing of all installed lighting.

All drawing to be as per UON-DSS-001

11. Defect Liability Period

All light fitting shall be covered by a 5 year on site warrantee that covers all costs associated with the repair of the light fitting, including but not limited to, the cost of all material, travel, access, lifting equipment and labour.

12. Miscellaneous

Pay all fees to authorities in connection with applications, inspections and approvals.

Once the works is complete the area is to be cleaned to the point that there is no sign of the work having taken place.

