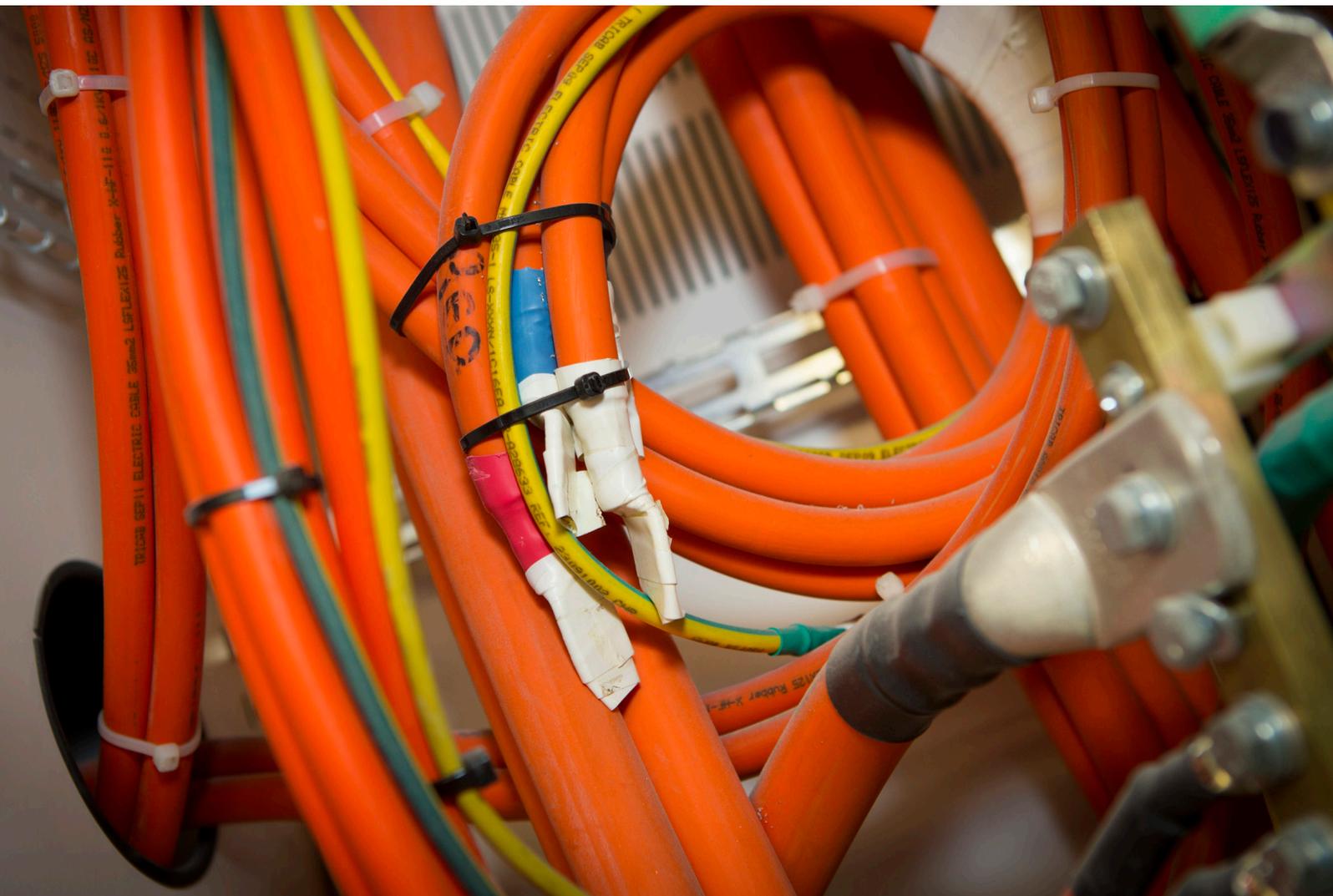


Section 8 Electrical.



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Document Control

Revision History

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Current Document Acceptance

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Key Updates from Previous Issue

Revision Item	Details
<i>8.2.2.2 Lighting Control</i>	<i>New Section</i>
<i>8.2.5 External Lighting</i>	<i>New content</i>
<i>8.3.1.2 Switchboard isolation</i>	<i>New content</i>
<i>8.3.2.1 Lamp and Poles</i>	<i>New content</i>
<i>8.3.3 Power Plug Placements</i>	<i>New content</i>
<i>8.4.1 Seismic Restraint</i>	<i>New content</i>

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8.1 Overview

8.1.1 Purpose

The University aims to provide a high level of quality and service while balancing capital and operating costs throughout the lifetime of a building.

Electrical services design is to consider this overall aim while thinking to the future adaptability and maintainability of the space.

This section of the Design Guidelines is intended to be read and implemented in design in conjunction with **Section 01 – General** and any project specific brief and agreements.

8.1.2 Future Services Installation

Allowance shall be made in the documentation of all projects for access to accommodate future services installation from the services tunnels to all areas within the buildings.

8.1.3 Buildings Under Refurbishment

For electrical services associated with buildings under refurbishment, the plant and equipment (where replaced) will be selected to meet the optimum design performance parameters.

8.1.4 Maintenance Considerations

Maintenance is a key consideration for the University and shall be given due attention during design.

Access hatches must be provided to all equipment mounted in ceiling spaces to allow suitable access for maintenance, testing or servicing. In all instances adequate space shall be allocated for effective and unhindered maintenance. Unrestricted access from tunnels to ceiling spaces via vertical shafts shall be incorporated in the design.

The consultant shall co-ordinate and rationalise plant and equipment types to permit interchangeability of spares and simplify maintenance and operation across the University. Only readily available models of plant and equipment shall be accepted in order to facilitate ease of timely repair.



8.3 Systems and Equipment

8.2 Design Concepts

8.2.1 Power

8.2.1.1 11kV Network and Interface

This section of this Design Guideline is included within the [Infrastructure section 13 of this guideline](#). Consultants are to discuss the 11kV network and the interface with existing and new University infrastructure on a case-by-case basis with University.

8.2.1.2 Filtering

Where equipment including fittings, apparatus, appliances, wiring and the like is likely to be incompatible with emission levels, harmonics, and power quality for other areas of the building, all such equipment shall be provided with suitable filtering to ensure correct operation.

8.2.1.3 Surge Protection

Surge protection is required in main switchboards, general power outlets, and communication rooms/data cabinets. Surge diverters shall also be provided at all main switchboards.

8.2.1.4 Hardwired Equipment

Isolating switches shall be provided for each permanently wired item of equipment. Each isolating switch shall be labelled to identify the equipment supplied.

8.2.1.5 Cabling

All cabling shall be stranded copper conductors and in all instances a full size neutral shall be installed.

Extra low voltage cabling shall not be exempt from AS/NZS 3000 regulations and shall comply in every respect with the regulations covering higher voltage cabling.

8.2.2 Lighting

8.2.2.1 Luminaires and Diffusers

Luminaires considered in the design shall be energy efficient, robust in construction and be installed in locations that are easy to maintain without the need for sophisticated access equipment.

Where diffusers are used they shall be tight fitting and be appropriately Internal Protection (IP) Rated to prevent the ingress of dust and insects.

8.2.2.2 AV Lighting Control

Lighting control via TRA Backbone should be used only in tiered lecture spaces or in spaces with a specific AV requirement.

8.2.2.3 Teaching Spaces

The lighting design of all teaching spaces must have the following objectives:

- Control all ambient light
- Provide note taking light
- Properly illuminate the presenter whenever they are in the presentation area
- Properly illuminate any demonstration and presenter work spaces (i.e fixed whiteboards etc)

All teaching spaces must provide a 2-way split system for separate light switching for Front of House/Presentation Wall and audience area lighting.

There must be no direct light upon presentation surfaces. The positioning of luminaires and their grilles, directional spotlight diffusers and/or barn-doors (blinkers) shall be chosen and adjusted so that no light shines directly onto presentation surfaces.

For larger teaching spaces, a dimming capability and lighting scene capability shall be provided. Additional light circuits may be provisioned as required by the circumstances.

Spotlights should be used to illuminate the presenter and lectern desk to allow for good quality video recording for lecture capture, as well as providing dedicated lighting flexibility in lighting scenes.

Light fittings in computer areas shall be provided with low brightness glare control diffusers to prevent discomfort to computer operators.

Lighting in seminar rooms shall be step switched to provide a minimum of three levels of illumination. Lighting must be capable of lowering to 30% levels without flickering.

8.2.2.4 Illumination Levels

Illumination levels for various applications such as offices, educational, workshops and laboratories shall follow best practice. Glare and veiling reflections, where considered a problem, shall also be accommodated in the design.

The table below gives an example of what typical lighting scenes should be in larger teaching spaces:

Lighting Scene	Lighting Levels
All off	Aisle Lighting only – 0%
Projection Mode	70 Lux + Aisle Lighting On – 40%
Lecture Mode	300 Lux + Aisle Lighting On – 40%
All On	400 Lux + Aisle Lighting Off – 100%

8.2.3 Lighting Control

Sufficient controls, both automatic and manual, shall be provided so that energy can be saved when spaces are not in use or when systems require modification. The general requirement for lighting control is to turn off the lights when not in use.

All lighting systems must have switching and control capabilities to turn off lights when not needed. Light output and power consumption must be reduced when full light output is not needed. Mandatory requirements include:

- DALI Lighting control shall be via Desigo TRA PXC3 controllers.
- Light switches / controls must be provided in each room.
- Daylighting controls must be provided where sufficient daylight illumination can be provided to a space.
- Automatic shut-off switch and occupancy sensor must be provided to ensure lights are off after business hours.
- Separate switching of any display lighting and general lighting must be provided.
- Independent lighting switches must be provided for each area enclosed by ceiling height partitions.
- Automatic controls must still allow an occupant to manually turn off all of the lights in a room using the switch.

8.3 Systems and Equipment

Each room must have its own light switches and each switch must be limited to lighting a zone of maximum of 100m². For larger areas, different switches for lighting different zones must be placed in a control panel. Light switches must be configured to manual “on” operation or, if automatic “on” is desired. This light switching approach must be used in dry and wet laboratories and workshops where there are significant safety hazards.

Two-way switching at entry/exit points must be provided for large spaces with two entry/exit points that are more than 10 metres apart. Switches should be placed at the exits from rooms and two-way switching used to encourage occupants to turn off lights when leaving the room. Wherever possible, locate switches on the door handle side of doors.

Gang switching of multiple rooms is unacceptable.

Manual switches must be used in lieu of occupancy sensors in sub-stations, electrical, mechanical and telecommunications rooms, and in rooms with less than four ceiling lights.

Rooms containing two or more light fittings and external windows (daylight) shall be provided with multiple switching.

8.2.3.1 Motion Detection

Motion detection is to be provided in all corridors and all rooms with more than four ceiling light fittings. They must not be used in dry and wet laboratories and workshops where there are significant safety hazards.

Motion detection sensors must offer 360° sensing for ceiling mounted applications and 180° sensing for wall mounted applications. They must have a minimum detection range of 4.0m diameter for floor to ceiling heights of up to 2.4m, 6.0m diameter for floor-to-ceiling heights between 2.4m and 3.0m diameter, and at least 4.0m for other applications.

Manual “on” and automatic “off” must be the standard settings for occupancy sensors and they must be adjustable to switch off controlled lighting up to at least 30 minutes after space is unoccupied. Workspace areas must not have dead band zones which are not detected by occupancy sensors. The occupancy sensors must be sensitive enough to detect a single individual in a workspace typing in front of a computer. Motion detection sensors in a room must not be activated by occupants outside the room.

Sensors must be designed to operate in temperatures from 0-30°C and relative humidity of 0-90%, non-condensing. They must have an estimated design life cycle of 15 years.

The occupancy sensors must be located where line-of-sight to occupants is not inhibited by building structures e.g. beams, changes in ceiling height or other building elements such as surface mounted air conditioning ducts, cable trays and pipe work etc.

Corridor sensors should be located at each entry point to the corridor unless it is less than 5.0m long and can be covered by a single central sensor. Occupancy sensors must default to “on” in case of sensor failure. Generally, good quality passive infra-red (PIR) sensors with a high density of detection zones are preferred because they are sensitive to detecting small movements and do not consume energy to operate.

8.2.3.2 Teaching Spaces

Teaching spaces often require special lighting controls and need to ensure audio visual capability. This interface shall be via Designo TRA PXC3 controllers using an AMX-KNX gateway.

Consultants should refer also to **Section 03 - Audio Visual** and ensure the interface is suitably coordinated. Teaching spaces include:

- auditoriums
- lecture theatres
- classrooms
- seminar rooms
- computer rooms
- laboratories
- conference rooms
- moot rooms
- tutorial spaces
- all meeting rooms

Lighting controls for laboratories and all teaching spaces must include two wall mounted lighting switches - one at lecturer’s “Lectern” and one on wall panel near room entry / exit point.

Where dimming and light activation programming is used with light switch panels having more than one switch arrangement, i.e. numbered 1, 2, 3 4, etc., a clearly defined light switch sign is to be provided to indicate each switch function, i.e. 50% light levels, 100% light levels, front row off etc. The switch panel is to have a general all “off” switch.

Switches for every light in positions from which the controlled lights can be seen.

8.2.3.3 Tunnels and Corridors

Two way switching shall be provided in all tunnels and corridors as a minimum. Final switching requirements shall be determined by the extent of control - i.e. occupancy sensors.

8.2.4 Emergency Lighting

All buildings that contain monitored exit and emergency lighting shall be linked back to the University centralised monitoring system.

Emergency and exit lighting circuits shall be wired direct from distribution switchboards and shall be labelled with engraved plastic labels.

Emergency lighting shall be installed in every switchboard room / sub-station with lighting levels designed to provide adequate lighting to carry out operations under power failure conditions.

8.2.5 External lighting

Control should be via a photocell and manual/auto switch situated at main switchboard.

Fittings to be LED Roadway NXT Fittings.

Street lighting poles to be Spunlite Octagonal lighting over pathways or in communal areas to be Spunlite Urban range.

Catenary external Cable Support

At no time will any catenary type cable support be visible.

8.2.6 Security and Street Lighting

All external security and street lighting shall be LED and controlled by photo-cell switching. By-pass switches shall

8.3 Systems and Equipment

be provided on all circuits. Each street light pole shall be separately fused.

Internal security lighting shall be provided in the following areas of the buildings: balconies, verandas, corridors and all stairwells and exterior doors.

The lighting shall be controlled by an externally mounted photo electric cell and a bypass switch, located in the distribution switchboard cupboard.

8.2.7 Lightning Protection

Lightning protection shall be provided to all recommended buildings using risk assessment criteria specified by current codes.

Copper conductors shall be used.

Test points are to be provided at the lowest level of the building.



8.3 Systems and Equipment

8.3 Materials & Equipment

8.3.1 Electrical Equipment

8.3.1.1 Earthing

The earthing system shall be a multiple earthed neutral system and meet the approval of the local Supply Authority.

Where entering or leaving the main switchboard and along its route length, the earth cable shall be protected by means of PVC conduit.

Earthing electrodes shall be provided with covered and removable inspection pits. The connection of the earthing conductor to the earth electrodes shall be by 'cad-weld' or equal approved. Gatic lids shall be fitted with an approved brass engraved label reading – "Earth Stake Cover".

8.3.1.2 Switchboard Isolation

The aim is to have isolation of pan assemblies external to the affected assembly. This will enable electricians to work on completely isolated panels.

Also allow provision for all modules to be seated at top and bottom. Access to panel via sides. This is to prevent exposure to live parts below.

8.3.1.3 Switchboards and Sub-boards

Main switchboards and mechanical services switchboards shall be fitted with Schneider ION 7650 type multi-function energy power meter capable of measuring voltage, current, maximum demand kW (current and maximum recorded) kWh, kVA, kVAr, power factor.

All submain circuits from the MSB shall be metered via dedicated ION type meters or V.I.A Schneider NSX breakers equipped with Micrologic S.2e integrated metering overloads

Electricity retailer kWh meter cubicles are to be fabricated from minimum 2mm mild steel with fully welded corners.

The voltage protection level up shall be less than 800V at 3kA 8/20s and 6kA 1.2/50s.

The maximum discharge current shall be 100kA 8/20s per phase. The nominal discharge current shall be 70kA 8/20s per phase. The impulse current shall be 20kA 10/350s per phase.

Main switchboards shall have circuit breaker and current transformer space provisions for the installation of power factor correction equipment.

Indicating lights shall be neon lamps - Lumolie FP4 or equivalent, or LED cluster type.

Main switches shall be suitable for on-load switching.

Time clocks shall be multi programmable electronic type with one day battery backup. All wiring within switchboards shall be enclosed in PVC cable ducts with removable lids. Duct lids shall be labelled to indicate which cable duct they are fitted to.

8.3.1.4 Switchboard Colours

All switchboards are to be a cream colour of approved type.

All conduits are to be orange.

8.3.1.5 Electric motors

The following are preferred for use in plant rooms, fume cupboards etc.:

- Fractional H.P. - "G.M.F." Brook Crompton™.
- Ball bearing 3 phase - up to 12 kW "Crompton Parkinson", ASEA™.
- Ball bearing 3 phase - 12 kW to 40 kW - ASEA™

8.3.2 Lighting Equipment

8.3.2.1 Lamps and Poles

LED lighting shall be used throughout the buildings. Lamps shall have a colour temperature of 4000K with a colour rendering index (CRI) of 85 (light fittings with a colour rendering index <85 require specific assessment and approval by UC prior to specification and use).

Refer to Section 1 Appendix A for preferred suppliers and further information.

Street lighting shall be Betacom GL520 LED Road and Area Lighting Luminaire™.

Light poles shall be Spunlite™ manufacture 6 metre high octagon poles.

The emergency and exit lighting shall be Nexus™ type connected to an area controller.

LED Warranty

All drivers and fittings should have a minimum warranty of 5 years.

All drivers must be available locally.

LED

LED fitting should have a minimum efficiency rating of L70 of 50000 B 30.

Internal fittings should have a minimum rating of 40.

Industrial fitting (I.e. High Bays Shove) have a rating of L80 of 125000 B20. IP rating of 40

8.3.2.2 Light Switches

Light switches in tunnels shall be the protected type 56 series.

8.3.3 Power Plugs Placements

Placement of outlets should be designed so as not to create obvious and potential trip hazards when users have power devices connected to them.

SSOs (Single Socket Outlets) in meeting rooms with tables for users should ideally be placed in a floor box under the desk with a tabletop plug solution, rather than placing the majority of power sockets around the perimeter walls.

While some examples of 'soft power' options are available, use of these must be approved prior to selection and purchase by both LTS & FM for standards compliance and to ensure the product is fit for intended purpose.

Switched sockets for fridges/dishwashers etc. should be placed in the module to the side of the appliance.

8.3.4 Wall Clocks

Power over internet (POI) wall clocks are to be used in lecture theatres, all teaching spaces and receptions areas. This is not a centralised system.

8.4 Installation Requirements

8.4 Installation Requirements

8.4.1 Seismic Restraint

All equipment shall be provided with seismic restraint.

All systems will be installed in accordance with seismic codes, component manufacturers and building construction standards. Whenever a conflict occurs between standards the most stringent will apply.

8.4.2 Lighting Fixtures

Each recessed luminaire is to be supplied with a 7.5 Amp 2.5m flexible cord and plug. Fixing brackets shall be retractable type so that the fittings can be readily removed. Flexible cables shall be locked into the light fittings.

Luminaires shall be bushed where wiring enters.

All recessed light fitting diffusers shall be prismatic hinged frame supported.

8.4.3 Cabling and Conduit

Mains and sub-main cables shall be circular, supported on continuous tray or rack. All circular cabling shall be terminated in cable glands with non-ferrous gland plates.

Cabling in conduits connecting any and all light fittings must be run to facilitate ease of light fitting maintenance or replacement and therefore must not be run through respective light fittings.

Underground cabling shall be enclosed in PVC heavy duty orange conduit with marker tape above. Approved cable markers shall be provided at every change of direction, each side of a roadway and at 30.0m intervals of a straight run. A drawing shall be provided showing the exact cable location with dimensions from permanent buildings, structures, footpaths or roadways.

Surface cabling in plant rooms and tunnels shall be enclosed in PVC heavy duty orange conduit.

Corrugated PVC conduit shall only be used to change direction in difficult areas. Corrugated PVC conduit will not be permitted to be used in straight runs or where solid PVC conduit could have been installed.

Cabling in accessible ceiling spaces shall be installed in cable ducts or supported on cable trays, sized to allow 30% future expansion. Cabling in other ceiling spaces shall be neatly clipped to battens or tied to catenary wires with nylon cable ties. Position the support system to give adequate access for inspecting, replacing or adding cable.

8.4.4 Switchboards and Sub-boards

The outer door to the switchboard shall be labelled "SWITCHBOARD" in 25mm high lettering, with black on white Traffolyte labels.

Bus bars shall be copper and colour coded. Full size neutral bars shall be installed. All bus bar joints shall be electro-tinned finish and shall have lock nuts fitted to all jointing bolts. Bolts shall be high tensile.

Bolts to switchboards and sub-boards shall be re-torqued to bolt manufacturer's recommendations at the end of the defects liability period. This work shall be carried out outside normal operating hours.

Bus bar links shall be provided for the replacement of current transformers.

A schedule in a hard-plastic covered frame shall be provided inside each switchboard door. The schedule shall indicate the fuse or circuit breaker number and details of the circuit protected.



8.5 Numbering & Labelling

8.5 Numbering & Labelling

8.5.1 Distribution Boards, Outlets & Switches

All distribution boards and circuits, general power outlets and control switches shall be identified with circuit identification numbers (CIN), both on the exterior and interior socket/s and switches.

Labelling shall be carried out with approved machine engraved Traffolyte labels. Labels shall be black lettering on a white background.

8.5.2 Mains and Sub-mains Cables

Mains and sub-mains cables shall be identified by securely attached tags at each end of the cable, indicating the number of cores, size and type of conductor and the origin and destination of the cable in relation to switchboard designations,

I.e. 4 - 95 sq. mm Cu XLPE MSB-DB2.

8.5.3 Cable Trays

Cable trays shall be labelled only outside of cable risers / switchrooms with white engraved labels with red lettering reading "Danger 440 Volts" at 6.0m centres and at each change of direction.



Compliance Checklist

Project Name:

Date:

Submitting Consultant:

Design Stage:

Section 08 – Electrical Compliance Checklist

Complies
Does Not Comply
Not Applicable
Comments:

1.0 Section 01 – General

All Clauses

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Date:

University Reviewer:

Signed:

Acceptable

Acceptable subject to comments

Resubmission required

