20.00 Electrical Services

Installation of luminaires with a T5 lamp shall only occur with the express agreement of the

conductive material support system such as 'Ezi-Fix'. Supporting off other services or ceiling hangers is unacceptable.

Downlights shall not be used for general illumination unless they are of the compact fluorescent type and then only with the express agreement of the Superintendent. Incandescent downlights may only be used where required for specific tasks, with the approval of the Superintendent. Downlights are not to be used in external areas unless specifically approved.

All luminaires other than those for street and pathway lighting shall be installed at a maximum of 3000 mm above f.f.l. Installation shall provide easy access for maintenance, and locations such as ceilings to voids or over stairs shall be avoided.

Light fittings in ceilings shall be mounted in accordance with the requirements of **Section 14.00 Ceilings.**

Artworks Display - The public areas of buildings may be used to display the University's Art Collection. Liaison should occur at an early date in the development of the plans with the Director, Griffith Artworks and the Superintendent to designate 'Gallery' areas.

The following guidelines are indicated for such gallery areas;

Designated walls in gallery areas should receive no direct sunlight.
Lighting in designated gallery areas should provide an even illumination of the wall.

Where fluorescent lighting (generally preferred method) is used, such lighting shall use low UV fluorescent lamps or have lamps fitted with UV absorbing polyester sleeves.

Where incandescent lighting, such as spotlights or wall washers are used, they should be dimmable to allow adjustment of the lighting level between 50 lux for works on paper and 150 lux for works on canvas. Where spotlights are used, they shall be at least 2 metres from the wall, mounted on' Eurotrack' type lighting track.

'Gallery' areas or walls are to be kept free of services outlets and equipment e.g. clocks, GPO's, data/voice outlets, EAC card readers etc.

Signage - Illumination of Signs and General Displays shall be provided with a maintenance illuminance in the order of 200 – 300 lux. Lighting shall be placed so that unwanted reflections shall not occur on the sign. The luminance factor of the surface of numbers, letters or symbols shall be not less than 0.3 (30 percent) different from their background.

Auditoria, Lecture Theatres, Seminar Rooms, Teaching Spaces – These spaces or the like shall be provided with illumination complying with AS 1680.2.3.

Lighting shall also comply with AS 1428.1.

In addition to the requirements of this Standard, adequate focussed lighting, without excess shadows, shall be provided on both the face of the presenter for lip reading and on the interpreter for sign language interpretation. The proposed lighting solution for this requirement is to be approved by LES.

Lecture Theatre lighting shall comprise a lowerable 'lighting beam' system along the principles used in Buildings GH1, Medicine & Oral Health Centre and G30, Arts & Education 1. Details of these systems are available from OFM.

Videoconferencing Rooms - The illumination to these spaces shall comply with the recommendations of AS 1680.2.3 – 1994 clause 10.15. The minimum illumination level in the room shall be 360 lux.

Luminaires within such rooms shall employ linear 4000^{o}K fluorescent lamps and Y5 diffusers with a lighting control system interfaced to the AMX audiovisual system. The lighting design shall achieve uniform and diffuse lighting in the vertical plane to eliminate facial shadows.

Stairs and Ramps - Within stairwells, luminaires shall be mounted on the walls or to the soffit of the landings.

An electronic copy of the lighting program, and any software required to modify the program, shall be included in the '*As Constructed*' documentation. All rights, intellectual or otherwise, to the programming shall be vested in the Principal. Any special devices or equipment required for

Table 2 : Typical Lighting Programs *continued*

Prog	Area	Control	Operation	
G	Lecture Theatres and Auditoriums fitted with AMX systems	Dimtek - AMX control panel	Scene Selection as per AMX program.	
		2 Push Button 'Dynalite' panel at each Entry/Exit - *(see diagram in Appendix A to this Section)*	Top Button (Entry) Bottom Button (Exit)	Preset 5 Preset 6
		8 Push Button/Switch 'Dynalite' panel on teaching wall or lecturn - *(see diagram in Appendix A to this Section)* + At least two movement detectors	Button 1 - Channels 1,2,4,6,8 (100% IL) Button 2 – Channels 2,4,6,8 (50% IL) Button 3 – Channels 2,4,5,6,8 (25% IL) Button 4 – Channels 5,6,8 (25% IL) Switch 5 – Channel 1 Switch 6 – Channel 2 Switch 7 – Channel 3 Switch 8 – Channel 4	Preset 1 Preset 2 Preset 3 Preset 4 White board (On/Off) FOH lights (On/Off) Spot lights(On/Off)

20.03.06 Fire Alarm Interface

Lecture Theatre lighting and control systems shall be interfaced to the FIP to turn all lighting in corridors, stairwells and rooms with AMX systems to 100% in the event of a fire alarm. All other areas shall continue to operate in their present state and switch as per normal program.

20.04 Particular Lighting Requirements for Lecture Theatres

Controls - All lighting control in lecture theatres is to be interfaced to the AMX System. The lighting control system shall also be fully functional when the AMX system is not in use or in case of failure.

Switching controls shall be standard stainless steel push button panels, unless agreed otherwise by Griffith University and shall be provided at each of the following locations;

the entry to the lecture theatre, on/off only;
on the wall in close proximity to the lecturer's position – all modes;
the Bio Box at the rear of the lecture theatre or in the projection room where one is provided, full control – all modes.

General Lighting - General illumination in Lecture Theatres shall be supplied by means of dimmable fluorescent luminaires with K19 diffuser.

Care must be taken to avoid direct light spilling onto the projection screen.

Similarly, total lighting black-out above the lecturer's position must be available (projection mode) to enable use of an electronic projector or document camera (e.g. Visualiser).

Lighting must also be in accordance with AS 1428.1 applicable to all lecture theatres, Seminar Rooms, Teaching Rooms and Meeting Rooms. Personal lighting of the lecturer and an assistant should be via spot lights forward and to the sides of the selected locations.

The lectern shall be fitted with a flexible LED reading lamp installed in the joinery of lectern. ('Littlite' Flexible Gooseneck Lamp L-12 or similar).

Bio Box Room Lighting - Lighting within the projection room shall comprise dimmer controlled fluorescent and task specific luminaires, locally controlled.

Whiteboard Lighting - Uniform lighting of whiteboards shall be provided in all cases and shall be switched by the AMX system via the lighting control system from the lecturer's position, and projection room (where provided). Luminaires shall have asymmetric reflector or directional diffusers. Recessed luminaires are preferred.

20.05 Particular Lighting Requirements for Other Teaching Spaces

The following requirements apply to seminar and tutorial rooms, computer teaching rooms and any other specialist teaching spaces.

General Lighting - General illumination shall be provided by means of dimmable fluorescent lighting fitted with on-off control at doorways and at the front of the room and movement

20.07.02 Access Control

1 No. in the ceiling space within 300mm of the data projector mounting
1 No. for each computer position
2 No. on the wall adjacent to the control console at 600mm above f.f.l.

Provide a separate power circuit for the AV equipment as for Lecture Theatres.

20.07.09 Video Conferencing Rooms

Provide the following GPOs;

4 No. behind the equipment rack.
4 No. on wall adjacent to control console as previously described in Clause 20.07.08.
1 No. for each monitor (single only required).
1 No. on wall opposite viewing wall.
1 No. on wall behind control console.

20.07.10 Learning Centres

Open Access Computer Area – One (1) GPO per computer, printer or photocopier position plus other outlets as nominated in the SDF.

Help Desk – One (1) GPO to work station, two (2) GPOs to security cupboard.

Group Study Rooms – Two (2) GPOs per room.

Computer Teaching Rooms – One (1) GPO per computer position plus outlets for the console and data projector as previously described.

Seminar Rooms – As previously described.

20.07.11 Laboratory & Other Special Equipment

Provide power to laboratory equipment as required by the SDFs including the following;

Glass Washer – A three phase five pin 'Wilco' power outlet sized to suit the load of the dishwasher.
Ice Maker – Power supply in accordance with the manufacturers requirements.

In cases where a UPS is required, the wiring of the load centre shall allow continuous power supply to the TER via a bypass switch when the UPS is undergoing maintenance.

Lighting circuits within the TER shall be fed from a distribution board outside of the TER.

The room shall also have one (1) dual outlet GPO mounted 800mm above f.f.l., on a separate circuit to that used for the equipment racks. This GPO shall have a red rocker switch and face plate, and labelled 'Telecommunication Equipment Only'.

The design of the electrical wiring within the TER shall be carried out in close consultation with ICTS and CLF.

All racks and cable trays shall be earthed as per Section 4.5 ofthd nsuni5titSectfneare

each of the main building services emanating from the board, including but not limited to air-conditioning, mechanical ventilation and services, hydraulics plant, hot water plant and any 'Commercial' tenancy.

The main kWhr meter for the building shall be;

For buildings with max. demand < 150kW,	'Electrex Micro 3M' or' Cutler Hammer IQ220';
or	
For buildings with max. demand > 150kW,	'Electrex Flash' or 'Cutler Hammer IQ DP-4000'

Other kWhr meters shall be standard polyphase meters complete with the multiplication factor clearly displayed and pulsed output to CCMS. The CCMS shall display electricity consumption on an electrical graphic page in kWh, ampere and kW units.

CT's associated with these meters shall be multi tapped type to allow for correct metering once the building is fully operational. CT's shall be located to allow easy reading of the ratios printed on the face plate.

A 'Metering Installation Record' as per Appendix B of this Section shall be competed and included in the Operations & Maintenance Manual for the project.

An A1 size non-fading laminated single line circuit diagram shall be provided for each DB and shall be hung on the internal face of the board door using an eye lid mechanism.

20.08.08 Circuit Breakers

Circuit breakers to final sub-circuits shall be 'Clipsal 4 Series Power Range' or 'Merlin Gerin DIN Range' miniature circuit breakers or better, subject to approval.

'Eaton Quicklag' circuit breakers shall be installed in existing electrical distribution boards where necessary subject to approval by the CLF Electrical Engineer.

Residual Current Device (RCD) protection shall be provided to all power sub-circuits supplying light fittings and power socket outlets, unless otherwise stated. Each circuit shall be individually protected. Where power outlets are not RCD protected, they shall be round pin socket outlets and prominently labelled '*OUTLET NOT RCD PROTECTED*'.

The number of circuit breakers required shall be limited by ensuring that a minimum of five (5) single occupancy staff offices/workstations shall be supplied from a single power circuit except where specialised equipment may be present in which case the circuit shall be designed to suit the electrical load.

If a refurbishment project results in more than 35% of the circuits on an existing switchboard being replaced or modified, then all lighting and power circuits on that switchboard shall be fitted with RCDs if they are not currently installed as required by AS 2000-2007.

20.08.09 Cable Numbering

All neutrals, earths and active cables shall be number ferruled to correspond to the circuit breaker number.

All circuit breakers shall be numbered consecutively on the fascia from top to bottom on the left hand side then top to bottom on the right hand side, and also on the circuit breaker mounting bracket for ease of identification once the fascia has been removed.

All active cables entering circuit breakers shall be installed as per manufacture's recommendations.

20.08.12 Workshop Drawings

Detailed construction drawings of the proposed switchboards shall be submitted to OFM for approval prior to construction. They shall be drawn to a minimum scale of 1:20 and shall show plan, front elevation, rear elevation in the cases of rear access switchboards, sectional views through plan and elevation sections showing each variation of cubicle layout, segregation and bus-bar arrangements.

Drawings shall also include schedules of all equipment, with manufacturer and model nominated, and a line diagram reflecting the actual configuration of the busbars, nominating size and rating of each section.

20.09 Electrical Riser Cupboard

The electrical riser cupboard as described in **Section 2.00 Planning & Design Controls**, shall

Cables shall not be installed within the ceiling space of the floor below that it is to service, except for between the Main Switchroom and the electrical services riser. Cables shall not be installed in floor slabs unless approved by the Superintendent.

20.10.08 Cable Penetrations

All cable penetrations shall be reinstated to original rating of the penetrated barrier (fire, acoustic, moisture).

20.11 Special Requirements for Laboratories (Wet or Dry)

20.11. 01 Distribution Boards

Each Laboratory shall have its own distribution board complete with surge arrestor.

20.11.02 Safety Isolators

Provide the relevant safety isolators for power, gas and other services as required by the relevant standards and regulations. Isolators shall be 'NHP D5' range or approved equal, colour

The master controller and communication network shall be a 'Clevertronics Zoneworks System' or a 'Stanilite Nexus (NCS) - Emergency Lighting Computerised Testing and Monitoring System'

Mt Gravatt - *Simplex Model 2320* situated in Room 2.01A, M10 Social Sciences Building.

Gold Coast - *Simplex Model 2351* situated in the Main Switchroom on Level 1 of the G01 Business 1 Building.

Queensland Conservatorium, South Bank - *Simplex Model 6400* situated in Switchroom 1.04. of the S01 Conservatorium Building.

Queensland College of Art, South Bank – *Simplex Model 6400* situated in Room 1.24 of the S03 Grey St Studios Building.

Logan - *Simplex Model 6205* situated in Room 1.11 of the L03 Information Services Building.

The Master Clock provides control impulses via a Type 2811-1004 Booster Relay to the clocks in a building via colour coded, 2 core, 4mm² shielded risers and 2.5mm² tap-off to each floor terminating in a 'Clipsal 408/3A' recessed plug base.

Clocks shall be 'Simplex Impulse' Type 0054-32 J-Dial (230mm diameter) or Type 0054-42 J-Dial (305mm diameter). Generally the standard clock shall be the 305mm dia. model.

Video Conferencing Rooms shall have a 24 hour LED digital clock suitably sized for the size of the room and located on the wall opposite the monitors.

In acoustically sensitive areas, provide a 24 hour LED digital clock.

Wiring for the clock system shall be black in colour.

20.14.03 Clocks in New Buildings

An Ethernet Clock system shall be installed in all new buildings. Refer to **Section 21.00 Communications & Data Services** for all details of the clocks and installation.

20.15 Underground Electrical Services

All underground electrical services shall be installed in conduit in accordance with the requirements of AS 3000 and shall be laid in sand with 75mm below and 150mm above and to sides. Conduits shall be laid side by side and ***not*** one above the other.

All underground cable shall be identified by laying an approved continuous PVC marker tape 300mm min. above the conduit.

Trenches shall be backfilled only with selected fill and compacted in layers not exceeding 200 mm to a relative density of 90%. The minimum cover shall be in accordance with AS 3000 and not less than 600mm to the top of conduit. Concrete cover to conduits at a lesser depth will be allowed only with the written approval of the Superintendent.

The minimum size of underground conduit shall be 25mm diameter. All spare in-ground conduits shall be fitted with a 2.5mm^2 TPI cable as a draw wire.

All underground cable shall be double insulated cable, not less than 2.5mm^2. Jointing of underground cables is ***not*** acceptable.

Maximum distance between pits on underground cable runs shall be 60m. All pits shall have their lids marked with a brass plate indicating the service installed and the route from the pit, and shall be adequately drained.

Brass marker plates with lettering not less than 10mm high shall be installed on the building external wall at entry/exit points, at kerbs and road crossings and any changes in direction. The plate shall also include an arrow showing the direction of the cable run. In unpaved areas, the marker shall be set in a concrete pad not less than 300mm square x 200mm deep.

Separation distances to other services in the same trench shall be in accordance with the requirements of AS 3000 and AS 3500.

20.18 Electrical Design Requirements

The electrical design submitted for review by the CLF Electrical Engineer shall, as a minimum requirement, include the following;

Maximum demand calculations for each switchboard, net and with spare capacity;
Voltage drop schematic, eg from substation to MSB to DB to load centre (where applicable) to socket outlet or permanent connection.
Line diagram schematic of the main switchboard with fault current withstand rating, size and ratings of switchgear and cables entering or leaving the board.
Details of distribution boards including number of poles, rating of busbar and mainswitch and number of spare poles.
Details of lightning protection, earthing schematic and fault loop impedances for non RCD circuits.
Layout of cable tray/ladder routes
Layouts of underground services
Schedule of luminaire types and outlets
Luminaire layouts and switching/control schematics
Locations, types and classifications of emergency lighting.