LUCID
CONSULTING AUSTRALIA

THE WILLCOX APARTMENTS

~~–~~117 PROSPECT ROAD PROSPECT

Project No: LCE13523

Electrical Services Specification

For ~~Building Rules Consent~~Construction

~~Tender Issue~~

Revision ~~BRC~~A~~T1~~

SPECIFICATION ISSUE REGISTER

REVISION	DESCRIPTION	DATE ISSUED	AUTHOR	REVIEWED
T1BRCA	For Building Rules ConsentConstructionTender Issue	21/094/18	MD	PAC

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PROJECT DIRECTORY

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CLIENT	**Citify/Bert Farina Construction Pty Ltd**	Citify
ARCHITECT	**Ferrone Architects**	
BUILDING SERVICES	**Lucid Consulting Engineers (SA) Pty Ltd**	
STRUCTURAL AND CIVIL CONSULTING ENGINEERS	**TMK Consulting Engineers**	
CLIENT		
PROJECT MANAGER		BFC
ARCHITECT		Ferrone Architects
BUILDING SERVICES		Lucid Consulting Engineers
STRUCTURAL AND CIVIL CONSULTING ENGINEERS		TMK Consulting Engineers
ACOUSTIC ENGINEER		

CLIENT Citify/Bert Farina Construction Pty Ltd

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ARCHITECT	Ferrone Architects
BUILDING SERVICES	Lucid Consulting Engineers (SA) Pty Ltd
STRUCTURAL AND CIVIL CONSULTING ENGINEERS	TMK Consulting Engineers

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Contents

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1 GENERAL

1.1 CROSS REFERENCES

All work covered within this specification shall be read in conjunction with the following trade packages and contracts. Should any discrepancy occur between the references the larger/greater shall be assumed and referred to the Engineer prior to proceeding with any works.

- Preliminaries and General Contract Conditions
- ~~Principal's Project Requirements document~~
- Architectural Drawings and Specification
- Mechanical Services Specification for termination points
- Fire Services Specification for termination points
- Hydraulic Services Specification for termination points
- Civil and Structural Drawings for details of footings, piers, beams, columns or the like
- ~~...~~
- ~~Geotechnical soil report~~
- ~~Asbestos Register~~
- ~~Fire Engineering Report~~

The above documents shall be made available on request through the head contractor.

It is the electrical contractor's responsibility to ensure these documents and all sections of this specification are issued to its' sub-contractors, suppliers and the like, to ensure due allowance by the Electrical Contractor.

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1.2 PROJECT DETAILS

The works described within this specification pertain to the Electrical Services installation at The Willcox Apartments, 117 Prospect Road, Prospect, 5082.

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~~1.4 DESIGN AND CONSTRUCT~~

~~The works described in this specification and shown on the accompanying drawings were generally complete at the time of tender and illustrate the design intent of the works.~~

~~It is the responsibility of the Contractor to make all necessary allowances for the design, construct, supply and install of all components of the installation based on the before mentioned documents.~~

~~The Contractor shall undertake all necessary calculations, measurements, assessments and the like of all components of the installation and shall incorporate all necessary allowances within the tender offer. Where there exists a discrepancy from the information provided, the greater value shall be incorporated within the tender offer.~~

~~The Contractor shall accept all responsibility for the design, construction, supply and installation of the proposed works.~~

~~1.9~~1.3 DEFINITION OF TERMS

Proprietor/Principal	-	Client or end user of the proposed building
Head Contractor	-	Building Contractor appointed to carry out the construction of the building. Electrical Contractor shall enter contact to undertake the Electrical Services installation with the successful builder.
Electrical Supply Authority and Project Officer	-	~~xxx~~SA Power Networks ~~– Frank Greco~~
Telecommunications Supply Authority and Application Reference	-	~~xxx~~NBN Co. ~~– Jodie Lunn??~~
Contractor	-	Installer undertaking the works.
Works	-	As described within this specification
Provide	-	Supply, install, commission and place into service
Equal Approved	-	Alternative product/method of installation which is presented to the Consulting Engineer and written approval is received.

Commented [PC2]: Optional to retain.

Commented [PC3]: Optional to retain.

Commented [PC4]: Add "design, construct…" at the beginning for DnC projects.

~~1.10~~1.4 DRAWINGS

Tender Drawings

Drawings associated with and forming part of this specification are scheduled below:

Drawing No.	Drawing Title	Revision
LCE13523 E01	Drawing Index, Legend of Symbols, General Notes, Location Plan and Roof ~~Plan~~Arrangement	~~BRCA~~T1
LCE13523 E02	Basement Power, Communications and Luminaire Arrangement	~~BRCA~~T1
LCE13523 E03	Ground Floor Power, Communications and Luminaire Arrangement	~~BRCA~~T1
LCE13523 E04	Level 1 Power, Communications and Luminaire Arrangement	~~BRCA~~T1
LCE13523 E05	Level 2 Power, Communications and Luminaire Arrangement	~~BRCA~~T1
LCE13523 E06	Level 3 Power, Communications and Luminaire Arrangement	~~BRCA~~T1
LCE13523 E07	Level 4 Power, Communications and Luminaire Arrangement	~~BRCA~~T1
LCE13523 E08	Single Line Diagram, ~~s~~schematics and Details	~~BRCA~~T1

Commented [MD5]: Ensure titles match documents - need to be updated.

The arrangements and details indicated on the above drawings are approximate only. Check all dimensions and building details prior to commencement of the work.

A contractor walk through will be arranged for the contractor to raise queries and provide comment during the tender period.

~~A 3 dimensional 'REVIT' Design Model shall be made available, via request, to the head contractor.~~

~~The REVIT Model shall be used as an interpretation tool only for scope clarity and co-ordination with structure and other services. Under no circumstances shall it remove the obligation from the contractor to produce a construction set of documents (workshop drawings) for the proposed installation as nominated within this specification. Accuracy of the model shall not be relied upon for preparation of construction drawings, fabrication or installation.~~

~~1.13~~1.5 SCOPE

Outline description

The work covered by this specification includes the following:

- The provision of an electrical installation that satisfies all statutory, legislative and code requirements and conforms with the general details herein.
- The planning, scheduling, procurement of components and their installation to meet the program. Completion of the works to meet the proposed and required staging, in coordination and liaison with other trade packages.
- Full responsibility for the execution of the complete installation in accordance with the project specification and all drawings.
- The installation, testing, commissioning, maintenance, service and warranty; and all sundry and material items whether mentioned in detail or not, required to complete the installation and put it into working order.

Variations to the Scope

Variations will not be accepted unless there is a genuine scope change corresponding to a formal instruction by the Principal.

Instructions may be issued throughout the project as a result of final design and coordination. Unless the engineer's instruction is supported with a formal instruction from the Principal, the engineer's instruction cannot be used as grounds for a Variation.

Where a claim is genuine, additional costs or credits for any such variations must be submitted with a complete breakdown of costs including quantities and rates for all labour, materials and equipment. Variation Claims submitted without breakdowns will be rejected.

Substitutions to the Scope

Where a substitution to the specification is proposed, the contractor shall submit each substitution, incorporating technical details and a cost breakdown, to the head contractor. The substitution shall be reviewed by the consulting engineer and the client for consideration. Unless approved by the consulting engineer and the client, the substitution will not be acceptable as an equal or approved approach to the specification.

Description of the Installation

The following works generally describe the Electrical Services installation and shall be carried out under this specification:

- ~~Demolition of all existing/redundant wiring systems including co-ordination with Authorities and Utilities.~~
- ~~Co-ordination with Electricity Supply Authority for the provision of a new pad-mounted transformer installation, including excavation and site preparation for the cable vault as required.~~
- Co-ordination with Electricity Supply Authority via the electricity retailer for the provision of a new import-export revenue meter within the site main switchboard.
- Co-ordination with the Electricity Supply Authority for timing of relocation of existing onsite transformer to adjacent allotment.
- Provision of low voltage Electricity Supply Authority Service Pit.
- Payment of Electricity Supply Authority standard fees and charges.
- Provision of new underground consumers mains, and site main switchboard including all switchgear, controlgear and auxiliary panels.
- ~~Provision of a power monitoring system including metering, instrumentation and equipment to main switchboard, rising mains, cabling, terminations and programming.~~
- Multiple submains and distribution boards throughout the installation, including cable trays, cable ladders, supports, conduits, switchgear and controlgear, auxiliary panels and enclosures and all ancillary equipment to complete the installation.
- ~~Power factor correction (PFC) unit and Harmonic Filtering units.~~
- Earthing systems to all accessories, outlets, equipment, luminaires, other services, building structure, switchboards and communications cabling systems including provision of equipotential earthing system to slab reinforcement in all wet areas in accordance with AS3000 and in co-ordination with the Builder.
- ~~Underground and underfloor access provisions within and between all buildings on the site including draw wires, pits, sweep bends, locks, floor ducts, cable trays and access panels.~~
- General power installation throughout including access provisions, ~~skirting ducts, floor ducts,~~ supports, cabling and outlets.
- ~~Soft-wired power installation to workstation furniture including supports, cabling, outlets and electrical certificate of compliance for the installation.~~
- RCD protection of all socket outlet circuits, lighting circuits and other circuits and equipment as nominated.
- ~~Body and cardiac protected installation including local RCD and load protection devices.~~
- Power supplies to Mechanical, Fire, Hydraulic and specialised services including provision of supplies, outlets or isolators as nominated.
- Fire rated power supplies and communications connections to ~~Lift Services Lift Motor Room and~~ lift equipment.

Commented [MD6]: Not required for standard ACC units

Commented [MD7]: Only one building, no under floor cabling required

Commented [MD8]: Not required - office tenancy fitout not within scope

- Provision of general and specialised lighting throughout the complex including luminaires, lamps and specialist controls to suit BCA power density and energy efficiency requirements.
- ~~Lamp recycling of all lamps removed from site.~~
- ~~Provision and installation of an automated lighting control system throughout common areas and apartments including lighting control panels, lighting control relay and dimmer modules, DSI/DALI control modules, network bridges, bus coupler devices,light switches, motion sensors, photoelectric cell and time clock devices, communications bus cabling, and interface requirements lift services controller units.~~
- ~~Provision of additional modules within base common area / apartment lighting control system for control of equipment provided by others including air-conditioning, and automated windows / blinds.~~
- ~~Interface requirements of lighting systems to Mechanical Services Building Management System Controls or building electronic security system.~~
- Exit and emergency lighting throughout the installation complying with the requirements of AS 2293 ~~and interface to existing base building DALI lighting system~~.
- Access conduits for communications systems including those for ~~Telstra,~~ NBN Co and internal voice and data copper, and optical fibre cables, inclusive of pits and draw wires.
- ~~New Emergency Power Off (EPO) systems including push-buttons, labelling, inter-link wiring, 230/24V transformers, relays, shunt-trip circuit breakers and all terminations.~~
- ~~Telecommunications backbone cabling including copper and optical fibre cabling, and terminations.~~
- Telecommunications facility cabling including support systems, accessories and terminations.
- ~~New wiring and lighting support systems for electrical and communications services including 'Wyr-Grid', cable ladder, cable tray, uni-strut suspended support grid, threaded rod supports, fixings, ancillary pieces and other works nominated on the technical drawings. Note: penetrations through the slab above shall not compromise building structural provisions, x-ray slab where required.~~
- ~~Communication cabinet/rack power supplies including outlets.~~
- ~~Telecommunications racking system including furniture, cable retaining and management equipment, patch panels, outlets, and patch leads.~~
- ~~Smoke and thermal detection system complying with AS 1670 including Fire Indicator panel, cabling, detectors, indicating equipment and alarms, interface to mechanical services and other plant.~~
- ~~Emergency Warden Intercommunication System complying with AS 2220 including interface to telephone and PA system.Provision and installation of smoke detection system complying with AS 1670 to apartments as indicated.~~
- ~~Combined electronic security and fire detection system including control panel, keypads, detection devices and audio and visual alarms.~~
- ~~Electronic security system including control panel, keypads and detection devices and interface to lighting controls and fire detection systems.~~
- Provision of reticulated MATV system to all Apartments for digital FTA ~~and Foxtel IQ~~ and Digital distribution including the ability for high definition digital TV distribution,

Commented [MS9]: Remove if not required.

Commented [MD10]: Does this include general comms/fibre retic, or is this more specialised?

Commented [MD11]: Unsure of specifics - deleted to match Belford Apts

Commented [MS12]: Remove if not an apartment building

including backbone cabling, outlet cabling, passive and active equipment, racking, ~~satellite dish,~~ aerial installation, head-end equipment auxiliary equipment and accessories to each apartment to complete the installation.

- Provision of access control systems to car park, common areas and lifts ~~including lift controllers and interface,~~ card readers, door hardware, proximity cards, door release buttons, emergency break glass door releases buttons, TCP/IP interface between systems, interface to the intercom system, control equipment and programming.
- Audio/visual intercom system to all apartments including audio/visual equipment, audio/visual Building entrance stations, audio/visual apartment monitoring stations, individual apartment door bells facility, video and bus control equipment, equipment enclosures, main entrance access controllers (including signal cabling to lighting control system for operation of all foyer area lighting upon release), main entrance push button release, cabling, supports, auxiliary equipment, interface to building access control systems and all other accessories to complete the installation.
- ~~Audio-visual cabling associated with the installation of school interactive whiteboard and data projection equipment with fixed ceiling recessed loud speakers, including co-ordination with school regarding final equipment selection and positioning.~~
- ~~Hearing and induction loop system consisting of induction cable, amplifier and power supplies.~~
- ~~Closed circuit television surveillance system including cabling to cameras, cabling, racking, recording device and auxiliary equipment.~~
- ~~Provision of one (1) off new xxxkW/xxxkVA modular Uninterruptible Power Supply (UPS) unit with additional future internal xxkW redundancy facilities and associated battery systems including wiring systems, terminations, enclosure, switchgear, labelling, SNMP interface and ancillary items.~~
- ~~Provision of one (1) off new UPS External Maintenance Bypass Switch cubicle including wiring systems, terminations, enclosure, switchgear, escutcheon, labelling, fixing and ancillary items.~~
- ~~Provision of stand-by diesel generation system, including base tank, acoustic enclosure, controls, pipework, penetrations, exhaust system and refuelling pipework.~~
- Provision of grid-connected 10kW photo-voltaic solar panel system including submains and final sub-circuit connections to inverters and distribution network.
- Relocation and re-installation of existing 10kW photo-voltaic panel system retained from existing site, including submains and final sub-circuit connections to inverters and distribution network~~.~~
- ~~Interface system to integrate PV solar generation and wind generation systems and the power monitoring system to record and display the electrical power produced and the electrical power used by the trade training centre in real time. System shall also record the accumulative energy produced by the PV solar and wind generation systems and that used by the trade training centre. These parameters are to be displayed on a video monitor located within the trade training centre to demonstrate the power/energy produced compared with the quantities used. Include all hardware, PC and monitor, connections, commissioning and programming required to put the system into working order to the satisfaction of the school.~~

Commented [MS13]: Remove if not an apartment building

Commented [MD14]: Card reader shown in lift currently - is this required?

Commented [MD15]: A/V or just Audio? Check 219 or Belford.

Commented [MS16]: Remove if not an apartment

Commented [MD17]: Comment re: PV system retained from previous building.

- ~~Extra low voltage DC power system to workbenches within the trade training centre including transformers, terminals and all wiring required to put the system into working order.~~
- ~~Lightning Protection System.~~
- ~~Seismic bracing of electrical installation.~~
- Provision of all hoisting and access equipment required to install all systems.
- Provision of training of management and maintenance staff for all systems.
- Make timely applications and liaise with electrical and telecommunication authorities and utilities for all infrastructure and connections associated with the project on behalf of the Proprietor/Principal to meet the construction program milestones.
- Testing and commissioning of the above systems.
- Maintenance and servicing, defects liability and warranty for 12 months from the date of practical completion.
- Bound volumes of Installation and Operating Manuals, and work-as-executed drawings.

Commented [MD18]: Seismic bracing required?

~~**Fire Services**~~

- ~~Refer 'Fire Services' section of this specification.~~

~~1.16~~1.6 SPECIFIC PROJECT REQUIREMENTS

~~**Power and Communications Shutdowns**~~

~~Obtain approval from the Superintendent 2 weeks in advance of any proposed shutdown. Include to carry out power shutdowns out of hours, in full coordination with Electricity Supply Authority or the Telecommunications Carrier as applicable and the Proprietor via the Superintendent.~~

~~To avoid overload or tripping of downstream breakers ensure that all main downstream isolators are in an open position prior to re-energisation and reconnect loads in a staged manner. Inspect all downstream loads upon completion to ensure all protection devices are returned to the state functioning prior to shutdown.~~

Solar Photovoltaic System

Existing 10kW Solar Photo-voltaic system located on existing site is to be retained as part of demolition ~~works, and~~works and re-installed by the electrical contractor~~eo.~~

Commented [MD19]: Is this note required??

Embedded Metering Network System

The site shall be provided with an embedded energy metering network operated by a third party engaged by the client. The Electrical Contractor shall liaise with the successful networks provided and coordinate final requirements for metering installation provisions to the site.

~~University xxxx Requirements~~

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~~All works to be carried out in accordance with [Insert Department] guidelines. Refer to Appendix [X] for University xxxx Design and Construction guidelines [or refer to University xxxx website for latest version of Design and Construction guidelines].~~

~~Heritage Requirements:~~

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~~Contractors shall note that parts of the installation are heritage certified. Wiring methods in these areas shall be approved prior to any installation.~~

~~The Electrical Sub-contractor is to minimise interference with the original building fabric and is to note original architectural details and locations and record as necessary to ensure accurate and complete reinstatement.~~

~~All wiring shall be concealed within existing wall cavities wherever possible. Where wall chases are unavoidable, proposed wall chases shall be marked and approval sought prior to proceeding.~~

~~Tenderers shall note in particular the following areas where the above requirements strictly apply:~~

- ~~Building ...~~

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~~Physical Containment~~

~~Contractors shall note that parts of the installation have been designed and shall be installed to achieve certification of a Physical Containment Level X (PCX) in accordance with AS/NZS 2243.3.~~

- ~~Provide 'Stauff' mounting blocks in lieu of double sided saddles. Mounting blocks to provide 25mm minimum clearance from the wall surface in accordance with AS/NZS 2982.~~

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- ~~Corrugated conduit is not permitted.~~

- ~~Luminaries shall be provided with sealed smooth diffusers. Seal to the ceiling to a 250 micron standard. Apply same approach for sealing lighting frame to ceiling.~~

- ~~All exposed cables, conduits and other exposed items are to be smooth, sealed to surfaces, easy to clean and impervious. Provide 250 micron standard of seal at penetrations including socket outlets and lighting fixtures.~~

- ~~All works shall be undertaken in accordance with AS/NZS 2982 and AS/NZS 2243 (set).~~

~~Hazardous Areas~~

~~Contractors shall note that parts of the installation shall be installed to achieve certification of a hazardous environment in accordance with AS/NZS 60079.10.~~

~~All works shall be undertaken in accordance with AS/NZS 60079.10 suitable for a classification Zone 1 area for Gas Equipment in inadequately ventilated locations.~~

~~Rock and Site Civil Works~~

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~~Bore surveys across the site have indicated significant portions of rock are present. Areas of deep excavation or significant rock identified on the Civil Drawings shall be excavated by the main Civil Contractor with minor trenching, bedding preparation and backfilling remaining the responsibility of the Electrical Contractor unless noted otherwise.~~

~~Underground installation along the eastern boundary of the site will be insufficient to achieve 600mm requirement for unprotected cover from AS/NZS 3000 following civil excavating / site preparation. The electrical contractor shall provide a continuous 75mm minimum concrete barrier protection above the underground installation for the entire length otherwise further excavate to achieve the minimum cover requirements. No additional costs will be accepted should further excavation be undertaken and rock encountered upon the site.~~

~~Prototype Hotel Room / Apartment~~

~~The Electrical Services contractor shall make due allowance to supply and install all equipment associated with a standard king suite, to enable the construction of a prototype hotel room for client review and approval. All equipment, including equipment above ceilings/bulkheads, must be allowed for to ensure review can be undertaken for:~~

- ~~Constructability / spatial confirmation~~
- ~~Finishes assessment~~
- ~~Maintenance and access assessment~~
- ~~Actual control of systems must be operational in a demonstration mode for review and approval~~

~~Client Nominated Sub-contractors~~

~~As part of these works the client has nominated specialised sub-contractors to undertake the works indicated below. These shall be engaged by the Electrical Contractor and all associated costing included within their final tender submission:~~

- ~~Nurse Call System Provider: xxxx~~
- ~~Security / Access Control Sub-contractor: xxxx~~
- ~~PABX/DECT System Provider: xxxx~~
- ~~....~~

~~1.29~~1.7 ASSOCIATED WORKS

The following works related to the Electrical Services installation shall be carried out under other trade packages at the direction of the head contractor unless otherwise indicated.

Coordinate all reticulation, termination locations and connection details. Ensure that information is provided to other trades to facilitate these works.

All trade contractors are required to submit Inspection Test Plans (ITP) to the Electrical trade prior to installation of works. This is required to ensure coordination is undertaken for continuity, quality and completeness of work. Upon completion of works, the associated works trade contractor shall undertake a full inspection of the installation, complete ITP's and submit them to the Electrical trade to verify the works have been undertaken in accordance with the specification and Electrical Contractor's requirements. Likewise, the Electrical contractor shall

be responsible for undertaking the same ITP process, where Electrical services have associated works with other trades.

Commented [MD20]: COMPLETE ASSOCIATED WORKS.

~~1.29.1~~1.7.1 RELATED WORKS

Commented [MS21]: Review this section carefully. All items to be made the responsibility of the electrical contractor unless agreed previously. Confirm ALL proposed builders works items with the architect (in writing) to ensure are covered under the correct trades packages.

The following work related to the Electrical Services installation shall be carried out under control of the Head Contractor. Provide any additional work required for the completion and full operation of the Electrical Services Works including the provision of access panels for the proper maintenance of all equipment.

- Trimmed openings within T-Bar and plasterboard ceilings for luminaires (By ceiling trade).
- Repair of wall and floor chases.
- Lateral supports and block-outs for floor ducts and grouting in of floor ducts.
- Saw-cutting of concrete and timber floors (including joints where applicable).
- Roof plant platforms including suitable access ~~(By Steelworker)~~.
- Formed block-outs and penetrations through walls, slabs, footings, columns and beams as detailed on the architectural plans. If not indicated the Electrical contractor will be responsible for arranging directly with the associated trade to form the penetration and allow for the associated cost in their tender. Any required minor penetration through concrete beams or floors shall be sleeved by the Electrical contractor. Should a penetration be required to be cored after construction, the Electrical contractor shall arrange for and bear all associated costs.
- All trenching and reinstatement of surfaces (By Civil trade).
- ~~Trimmed timber floor access hatches and floor hatches/access panels within concrete floors.~~
- Provision of door signage and associated danger notices.
- Provision of equipment indicated by other trades including installation with exception of electrical connections.
- Provision of temporary power, lighting and emergency lighting during construction in accordance with the requirements of AS3012, including minimum emergency lighting levels of 20 lux.
- Hoisting of all equipment.
- Space for site shed and storage of equipment delivered to site.

Commented [MS22]: New requirements for construction and demolition sites to be provided with emergency lighting with a minimum maintained illuminance of 20 lux

Commented [MD23]: Is this required?

~~1.29.2~~1.7.2 TERMINATION POINTS - SUB-CONTRACTORS

Termination points with other sub-contractors are as follows:

Mechanical Services Sub-Contractor:

- Wiring and final connection from isolators for air conditioning units ~~and cassette units~~ shall be provided by the Mechanical Services Contractor.
- ~~Final terminations of submains to general exhaust fan control panels and mechanical services switchboards shall be provided by the Mechanical Services Contractor.~~
- ~~Wiring and final connections from fire rated isolators to Smoke Spill Fans shall be provided by the Mechanical Services Contractor.~~

Commented [MD24]: Confirm with TR

Commented [MD25]: Do we have smoke spill fans?

- Flex and plug and final connection from controlled SSOs for toilet exhaust equipment shall be provided by the Mechanical Services Contractor.
- Wiring and final connection form isolators for general and car park exhaust fans located on roof shall be provided by the Mechanical Services contractor. The electrical contractor to provide dedicated local control switch on light switchplate in each location for control of toilet / laundry exhaust fan.
- When exhaust fans are being supplied via lighting movement sensorscircuit, the Electrical Contractor shall provide power to the fans via the 2nd pole, which will be programmed to run for an additional 10 minutes once the lighting has switched off.

Electrical contractor to provide 0-30minute adjustable run-on timer for each fan including all cabling and other equipment as required. Run-on timers to be set to 10 minutes initially. Interlock fans to operate with the lighting circuits for each room serviced by the fan such that the operation of any light switch will operate the fan. Provide double pole light switches as required. Co-ordinate exact requirements with mechanical trade prior to first fix.

Access to carpark via roller door to provide signal to carpark exhaust fans to operate.

Detection via lighting motion detectors within carpark, to provide signal to carpark exhaust fans to operate. Refer to Mechanical services specification for final arrangement detail.

- Provision of terminal strips within Mechanical Services Switchboards and ducted air conditioning units for receipt of fire-mode signal via controls and wiring as provided by the Electrical Sub-contractor.
- Provision of terminal strips and time-switched signals within BMS equipment for receipt of lighting control signal cabling as provided by the Electrical Sub-contractor. (Coordinate signal type).
- Wiring to terminal strips within MSB's for kWh meter pulsed outputs as provided by the Electrical Sub-Contractor.
- The Mechanical Services Contractor shall provide terminals within air-conditioning systems for receipt and termination of cabling to the automated lighting control system as provided by the Electrical Sub-contractor under this contract.
- The Mechanical Services Contractor shall provide terminals within air conditioning systems for receipt and termination of cabling to the security system as provided by the Electrical Sub-contractor under this contract.
- Circuit breakers, sub-circuit cabling, and weatherproof isolators for all air-cooled condensing conditioning units (commercial tenancies, apartments and townhouses) shall be provided within local distribution boards by the electrical contractor under this contract. Sub-circuit cabling, weatherproof isolators and fFinal connections to units shall be provided by the Mechanical Contractor.
- For all roof mounted and indoor plant the Electrical Contractor shall provide isolators installed to pedestals located adjacent plant equipment, and labelled to reference plant equipment. No isolators shall be installed directly on plant equipment.
- For all plant located within the ceiling space the Electrical Contractor shall provide isolators/socket outlets securely installed adjacent plant equipment, and labelled to

~~reference plant equipment. No isolators/socket outlets shall be installed directly on plant equipment.~~

Hydraulics Sub-contractor:

- Wiring and final connections from socket outlets and isolators to all Hydraulic Services Equipment to be provided by the Electrical Contractor under this contact.
- For all roof mounted and indoor plant the Electrical Contractor shall provide isolators installed to pedestals located adjacent plant equipment, and labelled to reference plant equipment. No isolators shall be installed directly on plant equipment.
- For all plant located within the ceiling space the Electrical Contractor shall provide isolators/socket outlets securely installed adjacent plant equipment, and labelled to reference plant equipment. No isolators/socket outlets shall be installed directly on plant equipment.

Fire Services Sub-Contractor:

- Final termination of dedicated circuit hard wired connection to building FIP (fire indicator panel) from circuit breaker off MSB shall be provided by the Electrical Contractor under this contract.
- ~~Final termination of fire rated telecommunications phone line from building MDF to the building FIP shall be provided by the Electrical Contractor under this contract.~~
- Wiring and termination of the fire alarm signal to the access control system main controller for release of required exit doors controlled by the access control system shall be provided by the Electrical Services Contractor under this contract.
- Final termination of dedicated circuit hard wired connection to Diesel Fire Pump control panel in Fire Pump Room shall be provided by the Electrical Contractor under this contract.
- ~~Coordinate locations of all surface mounted equipment with Fire Services subcontractor to ensure sprinkler coverage is not impacted by final equipment placements.~~
- Flex and plug and final connection from dedicated circuit and weather proof SSO for jacking pumps shall be provided by the Electrical Contractor under this contract.
- For all roof mounted and indoor plant the Electrical Contractor shall provide isolators installed to pedestals located adjacent plant equipment, and labelled to reference plant equipment. No isolators shall be installed directly on plant equipment.
- Supply and installation of weatherproof 10A 230V power supply to water metre location within fire hydrant booster cabinet. Final connection of the power supply to the meter is by the Fire Contractor.

Lift Sub-contractor:

- Final connections of all submains to Lift Services Switchboards shall be provided by the Electrical Contractor under this contract. Final locations to be co-ordinated with Lift Services Contractor.
- ~~Telecommunications backbone cabling from Building MDF to FDPs within or adjacent Lift shall be provided by the Electrical Contractor under this contract. Final locations to be co-ordinated with Lift Contractor.~~

- ~~Circuit breaker within the Lift Services Switchboard (LSSB) for connection of power circuits shall be provided by the Electrical Contractor under this contract (Electrical Contractor to provide RCD to suit).~~
- ~~The Electrical Services Sub-contractor shall provide the smoke detectors with remote LED's at top of lift shafts, connected to separate zones.~~
- Installation of Access Control equipment as defined in the Access Control clause of this specification.

~~Integrated Building System Sub-contractor:~~

- ~~All lighting fixtures, wiring and switching devices including wall plates, motion detectors, light level sensors and DALI / C-Bus network interfaces shall be procured and installed by the Electrical Services contractor under this package. The local, standalone functionality of all DALI devices shall be programmed and commissioned by the Electrical Services Contractor in preparation for final system integration by the Integrated Building System Sub-contractor. Final connection and termination from DALI/C-Bus network interfaces shall be by the Integrated Building Systems Sub-contractor for transmission via the structured cabling system to lighting controllers provided in Integrated Building Systems scope. Provision of ethernet ports adjacent all equipment to allow connection via the client's ICT network shall be provided by the Integrated Building System Subcontractor. Any other network devices required will be provided by Integrated Building Systems Sub-contractor as part of the client's ICT network.~~
- ~~Provision of RJ45 communications network points at all required locations complete with fly-leads shall be provided for final termination to equipment by the Electrical Services Contractor.~~
- ~~All communications cable tray as designated on the Electrical Services documentation shall be provided by the Electrical Services contractor.~~
- ~~All floorboxes to be provided by the electrical contractor and installation of cast in conduits to these locations where required. Electrical contractor to coordinate and confirm all final provisions for cast in conduits and floorboxes with the IBS contractor prior to installation.~~
- ~~Wiring and final connection form socket outlets located with ceiling space for GPON units shall be provided by the Integrated Building Systems contractor.~~
- ~~Wiring and final connection from socket outlets located within ceiling space for Hotel Room Technology Controllers units shall be provided by the Integrated Building Systems contractor.~~
- ~~The Electrical Services contractor shall provide a BACNet high level interface at the Diesel Generator Control Panel for final termination of control interface cabling by the Integrated Building System contractor.~~
- ~~The Electrical Services contractor shall provide a BACNet high level interface at the Un-Interruptible Power Supply for final termination of control interface cabling by the Integrated Building System contractor.~~
- ~~Wiring and final connection from captive socket outlets within all Communications rooms shall be provided by the IBS contractor.~~
- ~~Wiring of emergency fire shut-off signal cabling from building IBS for Gas Solenoid Valves Control Panel within each kitchen and plantroom area shall be by the IBS Contractor for final termination by the Electrical Services contractor. Electrical Services contractor to~~

~~provide all controls equipment to take receipt of signals from local emergency stop buttons, Fire Indicator Panel and IBS to isolate supply of gas. If any one of these signals are received the gas supply shall be interrupted by the gas solenoid valve.~~

~~Food and Beverage Sub-contractor:~~

- ~~Wiring and final connection from isolators and socket outlets to kitchen equipment shall be provided by the Food and Beverage Contractor.~~
- ~~Provision of droppers and metal ducting as noted on the Food and Beverage drawings shall be provided by the Food and Beverage contractor for installation of cabling by the Electrical Contractor.~~
- ~~Installation of all tray/ladder support systems for beer, post-mix and associated refrigeration pipework shall be provided by the Electrical Contractor. Electrical Contractor shall coordinate with Food and Beverage Sub-contractor for final locations of all plant equipment, routes for all support systems and expected weight requirements for each pathway and incorporate into combined shop drawings.~~

~~Refrigeration Sub-Contractor:~~

- ~~Final terminations of submains to refrigeration switchboards shall be provided by the Refrigeration Contractor.~~

~~Irrigation Sub-contractor:~~

- ~~Wiring and final connections from socket outlets and isolators to all Irrigation Equipment to be provided by the Irrigation Contractor under this contact.~~

~~Automatic Door Sub-contractor:~~

- ~~The automatic door sub-contractor shall provide terminals within automatic doors for receipt and termination of cabling to the security system controller as provided by the Electrical Sub-contractor under this contract.~~

Automatic Roller Door Sub-contractor:

- The automatic roller door sub-contractor shall provide terminals within roller doors for receipt and termination of cabling to the security system controller as provided by the Electrical Sub-contractor under this contract.

~~Automatic Window Sub-contractor:~~

- ~~Terminal strip for receipt of fire mode signal for window opening, cabling as provided by the Electrical Sub-contractor.~~
- ~~Provision of wiring from SSO's located adjacent controlled windows as provided by the Electrical Services Sub-contractor.~~

~~Automatic Blinds Sub-contractor:~~

- ~~The automatic blinds sub-contractor shall provide terminals within blind controllers for receipt and termination of cabling to the automated lighting control system as provided by the Electrical Sub-contractor under this contract.~~

~~Workstation Sub-contractor:~~

- ~~The Workstation contractor shall supply starter socket and soft wiring for installation by the electrical services contractor.~~
- ~~Coordination with Electrical Contractor to determine size and type of umbilical's for reticulation of power and communications cabling to workstations.~~
- ~~Coordination with Electrical Contractor for installation of communications outlets to workstations.~~

~~Town Clock/Bell Sub-contractor:~~

- ~~Provision of terminal strips within controllers (Communications Room) and at Bell/Clock locations for termination of control cabling provided by the Electrical Sub-contractor.~~

Structural Steel / Concreter

Commented [MS26]: Remove/amend as applicable

- Provision of formed openings within structural steel to allow for the passage of electrical cabling in areas as nominated on the electrical services drawings.
- Coordination with Concreter/Steelworker for casting-in of conduits by the Electrical Contractor through concrete floor or structural concrete beams within the car park areas.

~~1.29.3~~1.7.3 TERMINATION POINTS/ASSOCIATED WORKS - AUTHORITIES

Termination points and associated works with utilities and authorities are as follows:

~~Energy Safe Victoria:~~

- ~~The Electrical Contractor shall engage the services of an approved electrical inspection authority as nominated by the respective Electricity Supply Authority and/or Energy Safe Victoria.~~
- ~~The Electrical Contractor shall lodge all necessary applications in a timely manner to meet the project programme, to the relevant inspection authority, and arrange for periodic inspections.~~
- ~~It is the Electrical Contractor's responsibility to ensure that the electrical installation is certified by the inspection authority prior to practical completion, and prior to any new or existing electricity supply being connected or re-energised.~~
- ~~The Electrical Contractor shall provide a Certificate of Electrical Safety for both prescribed and non-prescribed work in accordance with Energy Safe Victoria's requirements.~~
- ~~The Electrical Contractor shall pay all associated fees with the above works.~~

Electricity Supply Authority:

- Termination point for consumers mains cabling is the consumer terminals of the new pad-mounted transformer.
- The Electrical Contractor is to provide and supervise fully all excavation and ground works preparation for a new transformer cable vault and pad-mounted transformer.
- The Electrical Contractor shall co-ordinate with Electricity Supply Authority for the provision of a new supply to site.
- The Electrical Contractor shall co-ordinate with the Electricity Supply Authority for the removal and/or relocation of existing redundant services and equipment on site.

- The Electrical Contractor shall pay all associated fees with the above works, and lodge all necessary applications prior to completion of first fix.

Telstra:

- Point of termination is the new Telstra lead-in pits. The Electrical Sub-contractor shall provide all new lead-in conduits, coordinate with Telstra for provision of lead-in cables and termination and pay all associated fees.
- The electrical sub-contractor shall co-ordinate with Telstra and pay all fees associated with removal or relocation of existing redundant Telstra equipment or that scheduled to be reused from or within the sites.
- The electrical sub-contractor shall co-ordinate with Telstra to make all necessary applications for Lift, Security, FIP and other nominated phone lines on behalf of the developer, including payment of all associated fees.

Commented [MD27]: Is this required if the previous site is demo'd?

NBN Co:

- The Electrical Contractor shall provide all access provisions in the form of conduits and cable supports for all NBN Co cabling in accordance with NBN Co requirements.
- The Electrical Contractor shall co-ordinate with NBN Co for the preparation and approval of Workshop Drawings, approval of cable pathways during construction, and handover of cable pathways to NBN Co.
- The Electrical Contractor shall produce and provide all NBN Co. drawings and pathway drawings for final approval.
- The Electrical Contractor shall co-ordinate with NBN Co for the provision of a fibre optic lead-in and associated active equipment to site.
- The electrical sub-contractor shall co-ordinate with NBN Co and clients nominated Internet Service Provider (ISP) to make all necessary applications for Lift, Security, FIP and other nominated services in a timely manner, including payment of all associated fees.

Commented [MD28]: Taken from 219 PR - are our docs sufficient or will they require further drawings?

1.30.0 TERMINATION POINTS - PROPRIETOR

Termination points with the Proprietor are as follows:

- Provision of telephone handsets, telephone fly-leads, provision, installation and reprogramming of the PABX will be by the Proprietor. Termination of tie cables at the PABX end (only) will be by the Proprietor.
- Provision of active data networking communications equipment to be located within racking equipment, as provided by the Electrical Sub-contractor will be by the Proprietor.
- Provision of Environmental Monitoring Station and underfloor moisture detector for the Computer Room. The electrical sub-contractor shall arrange for removal of this equipment from the existing Council Broadview (Hampstead Road, Broadview) office installation at a time in co-ordination with the Superintendent (after hours).
- Provision of UPS units 1 and 2 to site for wiring and connection as provided by the Electrical Sub-contractor.
- Provision of CCTV cameras and recording equipment to site for installation, mounting and connection to cabling by the Electrical Sub-contractor.

~~**1.30.0** Provision of roof mounted external communications equipment and associated cabling to the Communications Room via access conduits as provided by the Electrical Sub-contractor.~~

~~1.38~~1.8 STANDARDS

Referenced documents: The following standards are referred by and/or form part of this Specification:

Code	Year	Description
~~AS/NZS 1158 Set~~	~~2010~~	~~Lighting for roads and Public Spaces~~
AS/NZS 1170.4	2007	Structural design actions - Earthquake actions in Australia
AS/NZS 1345	1995	Identification of the contents of piping, conduits and ducts
AS/NZS 1367	2016	Coaxial cable and optical fibre systems for the RF distribution of digital television, radio and in-house analog television signals in single and multiple dwelling installations
AS/NZS 1627 Set	1997	Metal Finishing - Preparation and pretreatment of surfaces
~~AS/NZS 1670 Set~~	~~2015~~	~~Fire detection, warning, control and intercom systems - Systems design, installation and commissioning~~
AS/NZS 1680 Set	2009	Interior Lighting
AS 1882	2002	Earth and bonding clamps
AS/NZS 1939 Set	1990	Degrees of protection provided by enclosure for electrical equipment (IP Code)
AS/NZS 2053 Set	2001	Conduit and fittings for electrical installations set
~~AS 2067~~	~~2016~~	~~Substations and high voltage installations exceeding 1 kV a.c.~~
AS/NZS 2201 Set	2008	Intruder alarm systems set
~~AS/NZS 2243 Set~~	~~2005~~	~~Safety in laboratories set~~
AS/NZS 2293 Set	2005	Emergency escape lighting and exit signs for buildings
AS/NZS 2700	2011	Colour standards for general purposes
AS 2946	1991	Suspended ceilings, recessed luminaires and air diffusers - Interface requirements for physical compatibility
~~AS/NZS 2982~~	~~2010~~	~~Laboratory design and construction~~
AS/NZS 3000	2018~~07~~	Electrical Installations (known as the Australian/New Zealand Wiring Rules)
~~AS/NZS 3003~~	~~2015~~	~~Electrical Installations – Patient Areas~~

Formatted Table

Commented [MS29]: Remove if no laboratories part of project

Commented [MS30]: Remove if no laboratories part of project

Commented [MD31]: Updated for this years new version

AS/NZS 3008	2017	Electrical Installations – Selection of Cables
~~AS/NZS 3010~~	~~2005~~	~~Electrical Installations – Generating Sets~~
AS/NZS 3012	2010	Electrical Installations – Construction and Demolition Sites
AS/NZS 3080	2013	Information technology - Generic cabling for customer premises
AS/NZS 3084	2003	Telecommunications Pathways and Spaces
AS/NZS 3111	2009	Approval and test specification - Miniature overcurrent circuit-breakers
AS/NZS 3117	2015	Approval and test specification - Bayonet lampholders
AS/NZS 3140	2014	Approval and test specification - Edison screw lampholders
AS 3786	2014	Smoke alarms using scattered light, transmitted light or ionization
~~AS 3811~~	~~1998~~	~~Hard-wired patient alarm systems~~
AS/NZS 3820	2009	Essential safety requirements for electrical equipment
AS 4282	1997	Control of the obtrusive effects of outdoor lighting
~~AS/NZS 4428 Set~~	~~1997~~	~~Fire detection, warning, control and intercom systems set~~
~~AS 4607~~	~~1999~~	~~Personal response systems~~
AS/NZS 4680	2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 4777 Set	2016	Grid Connection of Energy Systems via Inverters set
AS/NZS 4792	2006	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
AS/NZS 5000 Set	2005	Electric cables - Polymeric insulated set
AS/NZS 5033	2014	Installation and safety requirements for photovoltaic (PV) arrays
~~AS/NZS 60079 Set~~	~~2012~~	~~Electrical apparatus for explosive gas atmospheres set~~
AS/NZS 60598 Set	2013	Luminaires set
AS/NZS 60921	2002	Ballasts for tubular fluorescent lamps - Performance requirements
AS/NZS 60922	1998	Auxiliaries for lamps - Ballasts for discharge lamps (excluding tubular fluorescent lamps) - General and safety requirements

AS/NZS 60923	1998	Auxiliaries for lamps - Ballasts for discharge lamps (excluding tubular fluorescent lamps) - Performance requirements
AS/NZS 60925	2005	D.C. supplied electronic ballasts for tubular fluorescent lamps -Performance requirements
AS/NZS 60947 Set	2015	Low-voltage switchgear and controlgear
AS/NZS 61000 Set	2000	Electromagnetic Compatibility (EMC) set
AS/NZS 61048	2002	Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General safety requirements Capacitors for use in discharge lamp circuits
AS/NZS 61439 Set	2016	Low-voltage switchgear and controlgear assemblies
AS/CA S008	2010	Requirements for customer cabling products
AS/CA S009	2013	Installation requirements for customer cabling (Wiring rules)
AS/NZS CISPR Set		Electromagnetic Compatibility

Comply fully with all relevant Standards and Regulatory Codes published and in force at the time of construction, including the following:

- The local and national Electricity Acts and Regulations
- Occupational Health Safety & Welfare Act and Regulations
- National Construction Code (NCC)
- Standards Australia
- Electricity Supply Authority Service Rules and Conditions of Supply
- AEMO (Australian Energy Market Operator) Guidelines
- ACMA Regulations
- ~~Telstra Standards and Guidelines~~
- NBN Corporation Technical Guidelines
- Federal, State and Local Government Building Acts and Regulations
- State Fire Services Conditions of Connection
- ~~Energy Safe Victoria Regulations and Legislation~~
- ~~Foxtel Standards~~
- SA 76 – Ministers Specification – testing and maintenance of essential safety provisions

Commented [MS32]: Only applicable to projects exporting electricity (PV, Co-Gen etc)

Commented [MS33]: Amend to suit optical fibre provider ie Opticomm etc

Commented [MS34]: Remove for non South Australia projects

2 CONTRACT SUBMISSIONS / REQUIREMENTS

2.1 HOLD POINTS

The following is a summary of Hold Points referenced for completion prior to progression:

Clause Ref.	Submission Stage	Hold Point	Response Time
2.2	Tender	Technical Data	5 Working Days
~~2.3~~	~~Pre-Construction~~	~~Samples~~	~~10 Working Days~~
2.3	Pre-Construction	Technical Datasheets	10 Working Days
		Workshop Drawings	5 Working Days
		Calculations	5 Working Days
		Functional Controls Specification	5 Working Days
		Construction Approvals	5 Working Days
2.4	Construction	Inspections	2 Working Days
		Commissioning & Witnessing Plans	10 Working Days
		Testing and Commissioning Results	5 Working Days
		User Training	10 Working Days
		Prototype copies of Operation and Maintenance Manuals (including As-constructed Drawings)	5 Working Days
2.5	Post Construction	Operation Maintenance	10 Working Days

Commented [MD35]: "samples" hold point not included in 219 PR

2.2 TENDER DRAWINGS

Commented [PC36]: Clause to be included for DnC projects only. (Melbourne)

The Tender Issue drawings accompanying this specification illustrate the design intent of the proposed works. It is the responsibility of the Electrical Contractor to design and construct the installation based on the Tender Issue drawings provided.

Where sizes, ratings, loads and the like have been identified on the Tender Issue drawings, they are to be considered as the minimum values. The Electrical Contractor is to confirm all sizes, ratings, loads and the like and provide an installation that meets or exceeds the values shown.

The Electrical Contractor shall accept all responsibility for the proposed works, and shall present any deviations or exclusions from the design intent identified in the Tender Issue drawings within their tender offer. Prior to submitting the tender offer the Electrical Contractor

shall become fully acquainted with the nature and extent of the Contractor Works. If any doubt exists as to the meaning of any part of the tender documents, clarification must be obtained 7 days prior to the tender closing date.

2.3 TENDER SUBMISSONS

The submissions required at Tender shall incorporate, as a minimum, all information defined within the Appendices of this Specification. Any appendices not completely filled out will be rejected.

In addition to the Appendices the Manufacturer's selections data shall be provided incorporating the following:

- Electrical full load amps, voltage and phase data
- Performance data relevant to the equipment specification clause
- Acoustic data measured in Sound Power as per the equipment specification clause
- Size and weight information including maintenance clearance

Identical equipment to that approved by the consulting engineer must be installed on site. Equipment will only be considered "equal approved" if it has been approved by the consulting engineer.

Select manufacturers with local representation, technical support and expertise, proven local long-term performance and readily-available spare parts. The consultant shall reserve the right to thoroughly assess the validity of technical data submitted where the submitted equipment manufacture differs to that outlined in this specification.

Review and approval of the technical data does not remove from the contractor the responsibility to comply with the requirements of the tender documentation (all documents that for part of the head contract, refer section 1.1).

Commented [MS37]: Recently added into specification. Review thoroughly to ensure all are applicable to the project

Conduct of the Tender Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

2.4 PRE-CONSTRUCTION SUBMISSIONS

~~2.4.1~~ ~~SAMPLES~~

~~Requirement: Submit samples for approval and permission. All subsequent materials and workmanship are to match the sample.~~

~~Conduct of the Sample Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.~~

~~Storage: Once approved, the samples may be used within the work, subject to approval status and condition. Until required within the project the samples shall be stored in a locked location, with access allowed for any approved inspection authority.~~

~~Delay: Bear total responsibility for the consequences of delay resulting from failure to allow adequate time for assessment and approval of samples, including rejection of samples that are not approved for whatever reason.~~

~~2.4.1 Required samples: Submit samples of the following:~~

- ~~Accessories including SSOs, switches and isolators~~
- ~~Lighting Control Panel style sample~~
- ~~Luminaires and Lamps (labelled with project designations and all in working order with 3 pin plug and 3 core flex to allow assessment)~~
- ~~Lighting control equipment including reset switches~~

~~Deliver the samples to site office at least 14 days before approval is required and notify the Head Contractor of their arrival. Make due allowance to courier samples to and from the consulting engineers office for all required sample reviews (including re-submitted samples). Brochures may be acceptable where agreed with the consulting engineer.~~

~~Do not commence work affected by the samples until approval for the sample has been obtained.~~

~~Conduct of the Construction Samples shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.~~

Commented [MD38]: Are samples required? Removed from 219 PR

~~2.4.14~~2.4.1 TECHNICAL DATASHEETS

Requirement: Submit technical datasheets for approval and permission. All subsequent materials and workmanship are to match the approved technical datasheets.

Conduct of the Technical Datasheet Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

Delay: Bear total responsibility for the consequences of delay resulting from failure to allow adequate time for assessment and approval of technical datasheets, including rejection of technical datasheets that are not approved for whatever reason.

Required technical datasheets: Submit technical datasheets of the following:

- ~~Skirting Duct~~
- ~~Floor Duct,~~ Access Panels ~~and Floor Outlet Enclosures~~
- ~~Floor boxes~~
- ~~Power Pole, Power Blade, Umbilicals~~
- ~~Pedestal boxes~~
- Cable Trays and Ladder
- ~~Cable Pits~~
- ~~Marker Strip and Location Markers~~
- Conduits (Power and Communications)
- Communications Cables
- Communications outlets
- Communications racking equipment and patch panels (brochures acceptable)
- ~~Clipsal Starserve Enclosures.~~

- Smoke ~~and thermal detector~~alarms.
- ~~VESDA pipe~~
- ~~EWIS Speakers~~
- ~~EWIS WIP's~~
- ~~Ceiling speakers~~
- ~~Optical Fibre~~
- ~~LED Indicators~~
- ~~Audible/visual alarms~~
- ~~Manual call point/break glass alarms~~
- ~~PIR detectors~~
- Access Control Card Readers and Cards
- Reed Switches
- Electro-magnetic locks
- Electric Strikes / Electrical Mortise Locks
- Push Button Release switches
- Break Glass Release Switches
- MATV aerial and outlets
- ~~CCTV Cameras~~
- ~~CCTV Recording Equipment~~
- Security control panel
- Security alarms
- ~~Emergency Power Off (EPO) button and enclosure~~
- Apartment Load Centres
- Intercoms (1 of each station type).

~~Hearing Loop Audio Equipment~~

Conduct of the Construction Technical Datasheet review shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

~~2.4.15~~2.4.2 WORKSHOP DRAWINGS

Diagrammatic layouts

Tender Drawings forming part of this Specification are diagrammatic for tender only and shall not be used for installation purposes. Before commencing work, determine the exact positions of all electrical equipment in conjunction with and to the approval of the Consulting Engineer having regard to interior design, building features, other services, and the requirements of regulatory authorities and standards indicated above.

Commented [MS39]: Remove if provided on Fire Services Docs

Construction Workshop Drawings for Review

Requirement: Supply construction workshop drawings coordinated fully with other trades and the main contractor detailing the following items:

- Main Switchboards and all Distribution Boards including:
  - General plans, elevations and sections, construction and weights.
  - Circuit diagrams, busbar and cable sizes
  - Current carrying capacity, current and fault ratings
  - Equipment types and models, labelling and finishes
  - Additionally, provide documentary evidence of fault withstand type tests relevant to the applicable enclosure(s)
- Fire rating and fire barrier reinstatement proposals
- ~~Bus-duct trunking system including rating, route, supports and method of installation.~~
- Details of all associated works including wall, floor and ceiling penetrations, floor chases and wall chase locations including proposed depths and widths. Note that in general penetrations are not shown in detail on the Drawings accompanying the Specification.
- Co-ordinate final lighting, power and communications layouts (and all other provisions detailed herein) with other services and to suit final furniture locations including wardrobes. Provide shop drawings showing fully co-ordinated floor and ceiling plans complete with dimensions.

Commented [MS40]: Remove if no wardrobes.

- Details of all trenching including routes, depths, backfill, reinstatement and distances from other services.
- ~~Floor ducting including proposed locations, floor (concrete and timber) details, floor boxes and floor access panels, indicating routes, fixings, materials of construction, mounting and termination details.~~
- Details of equipment and cable support brackets and fixings including luminaire mountings and clearance to in-ceiling obstructions for all recessed equipment including mechanical services ductwork.
- Earthing and bonding:
  - General plans, elevations and sections, construction and weights
  - Product selections
  - Schematic diagrams
  - Mounting and fixing details including fixing to racks
- Telecommunication NBN backbone and facility cabling schematic diagrams including routes of all backbone and facility cables, proposed supports, cable tray routes and locations and labelling details for all cables.
- Telecommunications racking details and elevations showing disposition of all equipment, including space allocations for active equipment to be supplied by the proprietor in coordination with the Proprietor.
- Cable supports and pathways for NBN Co cabling as described in the NBN Co technical guidelines.
- Access control system and electronic security system showing the location and mounting details of system equipment and all associated power supplies (SSOs).

- ~~Combined electronic security and fire detection system showing the location and mounting details of system equipment and all associated power supplies (SSOs).~~
- Cable tray proposed routes in full coordination with Mechanical Services workshop drawings detailing submain quantities, locations, penetrations and support details.
- MATV schematic drawings showing locations of all active and passive equipment (including SSOs) and all outlets, and estimated signal strength at each outlet.
- ~~Clipsal Starserve schematic drawings showing locations of all active and passive equipment.~~
- ~~Hearing loops showing locations of in-floor conduits and tape, amplification equipment and design calculations for cable size and type.~~
- ~~Lighting control panels showing labelling and disposition/type of equipment.~~
- ~~Detailed design of lighting control system showing labelling and disposition/type of equipment.~~
- ~~Smoke & Thermal detection and EWIS systems reflected ceiling plans showing proposed locations of equipment, zoning and circuiting arrangements.~~
- Smoke and thermal alarms ~~and occupant warning devices~~ within apartments on reflected ceiling plans showing proposed locations of equipment and circuiting arrangements.
- ~~Equipment layouts within the Communications Room.~~
- ~~Fire Indicator Panel and EWIS panel general arrangement showing general plans and elevations, and disposition of all internal equipment.~~
- ~~VESDA systems showing the location of all equipment, design calculations and interface points to all other equipment.~~
- ~~Provide workshop drawings for standby diesel generator including acoustic enclosure, exhaust system construction, fuel tank, plinth construction details, bunding, weight, installation clearance requirements, traffic bollards, control systems, mimic panels and indicator lamp details and interface to building electrical systems including auxiliary power supplies to canopy lighting, block heaters, battery chargers, etc.~~
- ~~Provide workshop drawings for the UPS including weights, elevations, mounting and equipment details with manufacturers' data and schematic diagrams showing all components, wiring, protection, control and capacities.~~
- Detailed design of PV Systems including final selection and layout of Solar Panel array, inverter selection and locations building power system connections and all system calculations demonstrating compliance with all performance requirements of the system.
- ~~Detailed design of Wind Turbine Generation Systems including final selection and layout of wind turbine, inverter selection and locations building power system connections and all system calculations demonstrating compliance with all performance requirements of the system.~~
- Termination points with all other trades.
- Details of all proposed labelling and engraving.
- Earthing layouts and bonding connection locations and details.

~~Lightning protection arrangement including bonding to structure and earth.~~

Conduct of the Workshop Drawings Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

Number of copies: 3 off print copies or 1 off electronic copy.

Preparation: Prepare all drawings to AS 1100, AS 1102, AS 1103 and AS 3702 to the same scales and on the same size standard sheets as the Contract Drawings (Size A1 sheets).

Work-As-Executed Drawings

Requirement: Before the Date of Practical Completion and as a pre-condition to Practical Completion supply work-as-executed drawings based on the Contract Drawings.

Include the following minimum information:

- Actual locations of installed equipment
- Interface points with other trades
- Circuit numbers and phase for all final sub-circuits
- Actual cable tray and communication cable routes
- NBN Co cable pathways and supports.
- Location depths of all underground conduits and pits dimensioned from permanent landmarks

Commented [MS41]: Remove if not an NBN project

Include these drawings once approved in the Electrical Services Installation Manuals.

Provide a laminated copy of the main switchboard single line diagram to the approval of the Principal and Consulting Engineer; mount adjacent the Main Switchboard.

~~Provide a laminated copy of the voice and data cabling schematic diagram and mount within the Communications Room. Provide a bound set of communication floor plans indicating labelling and wiring routes and locate within the Communications Room.~~

AutoCAD version 2007 files in DWG format of the tender drawings are available from Lucid Consulting. (One single coordinated electronic transfer will be issued).

Commented [AD42]: Remove if Revit or Bluebeam documentation being provided

Work-as-executed drawings are to be provided by the Electrical Sub-contractor in both electronic and hard copies within each Installation Manual.

~~**2.4.16 CALCULATIONS**~~

~~Submit the following sample calculations based on the equipment as shown on the workshop drawings:~~

- ~~Earth loop impedance calculations of consumers' mains and submain cables based on the final route length and proposed cable requirements.~~
- ~~Earth fault-loop impedance calculations for all socket-outlet circuits not protected by an RCD (as required by AS3000).~~

~~All the above information shall be submitted for review prior to any order being placed on equipment.~~

~~**2.4.16** Conduct of the Calculations Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.~~

~~**2.4.22** FUNCTIONAL CONTROLS SPECIFICATION~~

~~For all equipment requiring a project specific control or operation strategy, the relevant sub-contractor shall submit via the Electrical Services Contractor a comprehensive Functional Specification for sign-off by the Consulting Engineers. The specification shall detail the controls strategy for each item of equipment and associated system, including all interfaces with other trades including Mechanical Services, Fire Services, Vertical Transportation, Automated Doors and Window trades and other specialised services trades as relevant. The Functional Specification is also to provide details on the BMS front end graphics package for review.~~

~~Ensure involvement of specialist equipment manufacturers during the commissioning phase and during the development of the Functional Specification. For example, the generator manufacturer shall be present and provide input to the generator control and staging strategy during the commissioning and testing process.~~

~~Conduct of the Functional Controls Specifications Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.~~

~~Systems for which the above requirement applies include but are not limited to the following systems:~~

- ~~Automated Lighting Control System~~
- ~~Electronic Security and Access Control Systems~~
- ~~Fire Detection Systems~~
- ~~Audio-visual Systems~~
- ~~Standby Generation~~
- ~~Power Factor Correction~~
- ~~Un-interruptible Power Supply and Generator Changeover~~
- ~~...~~

Commented [MD43]: Removed from 219 PR - are sample calculations required here?

~~2.4.35~~2.4.3 AUTHORITIES, PERMITS, FEES, CERTIFICATES AND APPROVALS

Tariffs and installation of meters

Make applications for the timely works of all relevant authorities and utilities. Pay all associated fees and costs.

Complete all forms and applications and arrange for signing by the Proprietor as appropriate.

Provide documents evidencing approval of regulatory authorities, before and as a pre-condition to Practical Completion or other specified dates, including the State Fire Service.

Provide Certificates of Compliance indicating self-certification of all aspects of the project as required by the Electricity Act.

Allow to obtain approvals or connections from authorities and utilities in a staged manner to suit the program, construction and occupation of the project.

Upon request, submit for approval any item related to the installation, including data sheets on materials and equipment and licence certificates.

Conduct of the Construction Approvals Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

~~**2.5.0 DEMAND LOGGING**~~

~~Submit the electrical demand logging results to the Consulting Engineer. Logging shall include profiles for: -~~

- ~~Current for all three phases~~
- ~~Voltage levels for all three phases~~
- ~~Power factor~~

~~All the above information shall be submitted for review prior to first fix.~~

~~Conduct of the Calculations Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.~~

~~2.12~~2.5 CONSTRUCTION SUBMISSIONS

~~2.12.1~~2.5.1 CONSULTANT INSPECTIONS

Commented [MS44]: Relocated from old Workmanship & Materials section. Inspections to be added to Hold Points table.

General

The consultant will be undertaking the following inspections throughout the project:

- First Fix Installation
- Second Fix Installation
- Completed Installation, including witnessing commissioned systems compliant with this documentation.

Commented [MD45]: Do we need to inspect trenching or Transformer install?

It is the contractor's responsibility to ensure that the installation is complete to a sufficient level to enable the consultant to satisfactorily inspect the installation at each of the above listed inspections.

The Electrical contractor shall communicate with the consultant, to ensure suitable awareness of the installation progress is provided to the consultant. A minimum one (1) month notification to the consultant must be given prior to commencement of inspection / witnessing of a specific area / level.

The first fix installation inspections must be undertaken prior to covering or concealing of underground or enclosed work.

When the installation is complete, commission the plant by putting it into working order and operate to prove all control methodologies, outlined within this specification, are achieved.

Witnessing of commissioning shall commence only when the contractor submits preliminary test results and the results are deemed acceptable by the consultant. The results must demonstrate the plant is operating in accordance with the construction design documents and is ready for test (i.e. building form complete and sealed, interior design generally complete

and electrical power with full control, operating in auto mode, installed). The final witnessing inspection will only occur once the consultant review comments have been rectified.

The contractor shall make due allowance for the (time and cost) in the commissioning phase of the project for final consultant witnessing of all plant in operation. Client inspection of witnessing is not substitutable for consultant witnessing, however the client has right to inspect with the contractor's presence, in addition to consultant witnessing/inspecting.

~~Any additional inspections or witnessing required by the consultant, due to incomplete works, unplanned or inadequate information provided or defective commissioning shall be at the cost at the Mechanical electrical contractor and shall be charged from the consultant to the electrical contractor at $160+GST per hour.~~

Upon request, provide all necessary certification and documentation required by current Statutory regulations.

Give sufficient notice so that inspection may be made at the following minimum stages:

- Trenching: Approval of routes, common trench arrangements (where proposed) and depths;
- Cabling: Commencement of cabling installation (including that of any sub-contractor);
- Connection: Connection of cabling and wiring;
- Earthing: Installation and connection of earthing system;
- Acceptance: Installation ready for acceptance;
- Testing of systems
- Commissioning of systems

Handover

The Principal shall only accept handover upon verification all the below has been satisfactorily completed:

- The consultant verifies all above inspections / witnessing has been undertaken, and
- The builder and mechanical contractor demonstrate all defects have been rectified.

Remedial Work

If a tested item fails to meet the performance requirements before Practical Completion, remedial or replacement must be rectified prior to practical completion. Under no circumstances shall failed tests remain un-rectified before entering the Defects Liability Period.

Completion

After satisfactory completion, leave the service in full operational condition.

~~2.12.2~~2.5.2 COMMISSIONING & WITNESSING PLANS

The contractor shall submit for approval a detailed commissioning plan indicating step by step testing strategy for all equipment. The commissioning plan shall be developed in conjunction with other trades and shall be required to be submitted to the head contractor and Consulting Engineer for review prior to any commencement of commissioning. The electrical services

contractor shall be responsible for providing commissioning duration period to head contractor for inclusion in the construction programme.

Any witnessing of commissioning required by the Consulting Engineer, prior to practical completion, shall be allowed for within the commissioning plan.

Conduct of the Commissioning & Witnessing Plans Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

~~2.12.3~~2.5.3 TESTING AND COMMISSIONING RESULTS

Provide testing and commissioning results in accordance with the Testing and Commissioning section of this specification as a pre-condition of Practical Completion.

Submission of satisfactory testing and commissioning results shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

~~2.12.4~~2.5.4 USER TRAINING

Carry out training on systems as nominated within this specification with user groups and other parties as nominated by the Superintendent. Provide a program for user training for approval by the Superintendent and Building Services Consulting Engineer.

Completion of user training shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

~~Operating Instruction Summary~~

~~Provide a brief summary of operating instructions including project specific features and control procedures on a single laminated card to be handed to the client's representative. Submit a draft of the Operating Instruction summary within the Operation and Installation Manual.~~

~~Asset Register~~

~~The contractor shall provide a digital record of all supplier warranties uploaded to the clients Asset Register. This excel format register shall form part of the handover document and be included in the Operation and Maintenance manual. These warranties shall be added against the appropriate line item contained in the register as developed by the contractor. The equipment designation should be the same as the Asset Register naming convention.~~

~~2.12.9~~2.5.5 INSTALLATION MANUALS

Requirement: Before commencement of operational maintenance and prior to Practical Completion, provide the specified number of copies of a combined operating and maintenance manual, written in clear concise English, containing a title page listing suppliers' names, addresses and telephone numbers, a table of contents, and the following sections:

- Front cover including Project Name, Location, Builder and Electrical Contractor
- Index
- Contractor's Name, Address, Telephone number and emergency telephone numbers

- General description of the installation, written as briefly as possible, consistent with providing a general understanding of its features and operation.
- Schedule of Technical Data
- List of Equipment Suppliers' and Manufacturers' catalogues and descriptive matter to provide a complete source of information. (All manufacturers' literature shall be original copies.)
- A copy of "Work-As-Executed Drawings" showing all circuiting, circuit numbers, phase annotation and communications outlets designations. All underground cable routes shall be dimensioned from permanent landmarks. Photographic and video records of concealed works.
- A copy of switchboard workshop drawings and all other construction drawings.
- A copy of all final distribution board legend cards.
- Maintenance Instructions
  - Routine
  - Preventative
- Test results taken during acceptable tests and Authority Certificates including:
  - RCD Test results
  - Exit and Emergency lighting discharge results
  - Communications cabling including calibration certificate for testing equipment
  - Electrical COCs
  - TCA1 form
  - Compaction test results certificates
- List of guarantees and warrantees of Equipment Suppliers.

Commented [AD46]: Remove if no underground compaction testing required

Form: A4 size, printed or typed on durable printing paper, with each page consecutively numbered, and neatly bound in durable vinyl or similar hard covers with embossed covers. Provide multiple volumes as required.

Number of copies: 3

Installation manuals are to be provided by the Electrical Sub-contractor in both hard copies and electronic form (USB drive within each Installation Manual).

Prototype copy: Provide a prototype copy for approval before proceeding with final copies. Co-ordinate the manuals with all other trades.

Final approval copies are to be received before and as a pre-condition to Practical Completion.

Submission of prototype copies of Operation and Maintenance Manuals shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

Apartment Owner Information

In addition to the Installation Manual provided for the builder owner and/or facilities management, provide an abbreviated Information Manual for each apartment owner.

Initially one copy shall be prepared and submitted to the Consulting Engineer for approval.

The Apartment Owner Information Manual shall contain the following documents:

- General Description of Plant and systems
- Original copy of the Manufacturer's Literature
- Maintenance Instructions (Routine and Preventative)
- List of Equipment Suppliers

The manual shall be professionally prepared and bound in a vinyl hard-back folder with insert sleeves on the front to an approved format.

Final approval copies are to be received before and as a pre-condition to Practical Completion.

Submission of prototype copies of Operation and Maintenance Manuals shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

Commented [AD47]: Remove from non-residential projects or if not required

~~2.12.10 MAINTENANCE AND TESTING OF SAFETY INSTALLATION MANUALS~~

~~Requirement: Prior to Practical Completion provide the specified number of copies of a Maintenance and Testing of Safety Installation Manual, written in clear, concise English. Co-ordinate with the Head Contractor and all other trades for submission of the Manuals.~~

~~Include the following sections:~~

- ~~Index~~
- ~~Contractor's and all sub-contractor's names, address, telephone numbers.~~
- ~~Schedule of included equipment, with testing frequencies.~~
- ~~Maintenance and testing of NBN Co NTU's servicing essential communications systems including fire and lift lines.~~
- ~~Structural protection and egress details.~~
- ~~Signage including exit and emergency signage details, including locations and testing requirements.~~
- ~~Fire Protection systems including hydrant and hosereel details.~~
- ~~Mechanical Service fire mode operation details.~~
- ~~Fire detection systems including automatic fire detection and EWIS system details.~~

~~The manual shall comply with AS 1851 - Maintenance of Fire Protection Equipment.~~

~~Form: A4 size, type written-on durable printing paper, with consecutively numbered pages, neatly bound in red vinyl hard-covers with embossed covers.~~

~~Number of Copies: 3.~~

~~Submission of prototype copies of Maintenance and Testing of Safety Installation Manuals shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.~~

~~2.12.26~~2.5.6 MAINTENANCE AND TESTING OF SAFETY INSTALLATION MANUAL INSERTS

Requirement: Prior to Practical Completion provide the specified number of copies of inserts into Maintenance and Testing of Safety Installation Manual as provided by the Fire Services

Contractor, written in clear, concise English. Co-ordinate with the Head Contractor and all other trades for submission of the inserts.

Include the following inserts:

- Signage including exit and emergency lighting details, including locations and testing requirements.
- General description of the exit and emergency lighting system.
- Maintenance and testing of NBN Co NTU's servicing essential communications systems including fire and lift lines.

The manual shall comply with AS 1851 - Maintenance of Fire Protection Equipment.

Form: A4 size, type written-on durable printing paper, with consecutively numbered pages, neatly bound in red vinyl hard-covers with embossed covers.

Number of Copies: 3.

Submission of prototype copies of Maintenance and Testing of Safety Installation Manual inserts shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

~~2.13~~2.6 POST-CONSTRUCTION SUBMISSIONS

~~2.13.1~~2.6.1 OPERATIONAL MAINTENANCE

Maintenance period: 12 months from the date of Practical Completion.

Requirement: Provide 24 hour emergency call-out services and arrive on site to rectify defective items within 2 hours of notification of a defective item. During the maintenance period:

- Carry out monthly inspections and perform maintenance work at the frequencies and following the procedures recommended by the manufacturers of the supplied equipment;
- Check all terminations and connections within switchboards, identify and correct any overheating.
- Promptly rectify faults. Replace faulty materials and equipment, including all luminaire lamps, and accessories.
- Check the operation of evacuation lights and exit signs at three monthly intervals. Provide logbook and log all tests.
- Test the operation of FIP circuits and the EWIS system on a monthly basis.
- Clean off dust and corrosion build-up to all plant and equipment.

Provide maintenance check sheets and arrange for signing of these by the nominated site representation. Provide a copy of the check sheets to the Consulting Engineer on a monthly basis.

Certification: At the end of the maintenance period make a final service visit and, upon satisfactory completion of the above procedures, certify in writing that the installation is operating correctly.

Approval for the release of retention monies will not be granted until 12 consecutive monthly check sheets have been received by both the Proprietor and the Consulting Engineer.

Conduct of the Operational Maintenance Submissions shall constitute a HOLD POINT. The Principal is responsible for release of this hold point.

Operational instruction: Coinciding with Commissioning and routine inspection visits, at times to be agreed with the Superintendent, instruct the Principal's operational maintenance staff in the recommended methods of operation and maintenance of the systems.

In addition provide a time allowance of 16 hours for the initial instruction in the operation of all systems.

3 MATERIALS & WORKMANSHIP

3.1 GENERAL

The following clauses set out the general requirements for the works. These requirements are not intended to cover all aspects of the installation and must be read in conjunction with all other sections of the Specification and the drawings.

Workmanship shall be of a high standard and each section of the work shall be properly and neatly executed to the best trade practice.

The tender drawings indicate the sizes of cables and the approved cable routes throughout the building. They do not, however, purport to show all minor cable offsets, hangers, method of fixing and clearances, all of which must be coordinated with other trades, measured on site and in accordance with AS 3000. All cable arrangements shall be coordinated with architectural, structural and other services on site prior to commencement of installation.

3.2 QUALITY ASSURANCE

Implement a Quality Assurance System for the works in accordance with the following Australian Standards:

- AS/NZS ISO 9000
- AS/NZS ISO 9001

The Quality Assurance System shall cover the following minimum aspects:

- Detailed plan setting out supervision, quality control and checking (witness point) procedures.
- Details of the Electrical Contractor's Quality Assurance Plan shall be submitted to the Superintendent upon request.

3.3 EXISTING SITE CONDITIONS

The contractor shall visit the site to familiarise himself with the extent of work. No extras shall be considered from neglect of this provision.

Minimum notice required for all required inspections; 10 working days

Commented [MS48]: Amend as required

The Electrical Contractor shall check with all relevant authorities as to possible locations of any underground services on site and in adjacent footpaths/roadways and locate before commencing excavation.

The Electrical Contractor shall allow to terminate all redundant services as necessary to allow demolition to commence.

3.4 COMPLETED SITE CONDITION

Thoroughly clean all fixtures and fittings and leave the installation in a first class working condition.

Untidy work whether exposed to view or concealed will not be accepted and rectified at nil cost.

3.5 UNIFORMITY AND QUALITY

Obtain approval for and maintain uniformity of the manufacturer and type of all materials and equipment. Use only new, current manufacture, first quality materials and equipment.

Comply with the manufacturer's recommendations in respect to installation techniques and the requirements for associated materials, access clearances, equipment, components and devices.

Ensure compatibility of materials and equipment with the installed environment in respect of ambient temperatures, utilities supplies and vibration.

Support all Electrical services equipment including cabling and the like, independently of other services and/or non-structural building elements.

3.6 WARRANTIES

All equipment and workmanship are required to be provided with a warranty. Warranty periods shall be for the manufacturer's standard period only, unless extension offers become available at no cost in the purchase of the equipment.

Warranties must commence at date of practical completion, not the date of installation. Ensure due allowance for this is made within tender price.

All warranties however must have a minimum period of 12 months from the date of Practical Completion.

Details for all products with extended manufacturers warranties shall be provided within final Operating and Maintenance manuals.

3.7 INSTALLATION COORDINATION

Check on site at regular intervals the building working dimensions, tolerances and the setting out of the associated works. Immediately report any discrepancy.

General Requirements

The positions of outlets, switches, luminaires and equipment shown on Drawings accompanying the Specification are for Tender purposes and are diagrammatic only. Check on site for positions and obtain approval and verification of all locations with the Principal and mounting heights prior to first fixing. When any relocating is required to conform to the above, undertake such relocation without additional costs to the Principal. Allow relocation of accessories and equipment a distance of 3m before and during first fix without variation to the contract.

Verify locations of all outlets, switches and equipment to ensure:

- Co-ordination with final furniture arrangements and interior design;
- Co-ordination with other trades construction workshop drawings;
- The work of any other trade does not interfere with the electrical installation;
- They are not shrouded by door swings and tracks, furniture or equipment;
- Conformity with any pattern formed by ceilings, panels, tiles beams and the like;

- Full compliance with AS 3000 and Electricity Act requirements.

Anomalies

Promptly report any anomalies, for consideration and instructions. Work proceeding without obtaining approval, and subsequently rejected by the Superintendent shall be made good at nil additional expense to the Principal.

Co-ordination

Provide sizes and depths of recessed equipment including Switchboard cubicles and luminaires to other trades in writing for coordination before placing orders and before commencement of the relevant trade's construction workshop drawings.

All in-ceiling services shall be coordinated with all applicable trade contractors to determine the best path of reticulation, and allow for all rise and falls as necessary. In instances where the installation has an exposed ceiling, services shall be installed in a neat and concise manner, while maintaining required clearance heights and remaining readily accessible. Submit final proposal and seek approval from consulting engineer prior to installation.

Segregation

Physically mechanically segregate and separate circuits or services at common coverplates using approved isolating barriers.

Physically segregate the Electrical Wiring Systems from all other wiring and sub-wiring systems and equipment using physical isolation or approved isolating barriers.

Cable routes: The routes shown on the Drawings accompanying the specification are diagrammatic only and will require onsite coordination. Determine the final routes to suit the building structure, site conditions and penetration locations.

Approval: Obtain approval for the final routes prior to installing consumers mains, major sub mains and submains.

Concealment: Unless otherwise specified, conceal and protect cables and conduits.

Arrangement: Arrange cables and conduits parallel with walls, ceilings, floors and other building elements.

Separate conduits: Run circuits originating at different distribution boards in separate conduits or enclosures.

Derating: Unless otherwise stated, all cables shown on drawings or specified are based on nominal derating factors. Where the cable installation method chosen involves a derating factor of less than unity upgrade the cables so that the current carrying capacity of the new cable, multiplied by the derating factor, is at least equal to the current carrying capacity of the minimum specified cable.

Cutting and making good: Unless included as associated works, cut all openings and penetrations, and install all sleeves required for the electrical installation. Maintain fire ratings in all instances.

Segregation: Maintain physical barrier segregation and separation between the electrical system and all other wiring systems and services. Liaise with all other services and trades where required to maintain this segregation.

3.8 SALVAGED EQUIPMENT AND DEMOLITION

All salvaged equipment remains the property of the Principal unless classified as redundant. Obtain approval for the definition of redundant equipment. Remove all redundant equipment from the site.

Remove PCB capacitors and equipment from the site wherever encountered.

Undertake procedures in accordance with WHS requirements to ensure timely removal of redundant PCB capacitors. Provide documentation evidencing the correct removal of this equipment.

Disconnect and remove asbestos containing equipment and panel boards where scheduled for replacement or as required by demolition. Remove from site in compliance with WHS requirements. Provide documentation evidencing the correct removal of this equipment.

Disconnect and remove entirely all wiring systems and associated equipment made redundant by the works. Where existing equipment is scheduled for re-use take delivery of same upon occupation of the site, store and protect on site and provide audit and dilapidation information of equipment on site. Take full responsibility for all such equipment stored on site.

~~Lamp Recycling~~

~~Engage the services of a Lamp Recycler for the recycling of all existing lamps removed from site.~~

~~The nominated Lamp Recycler shall be approved by "FluoroCycle" and "EcoSmartElectricans".~~

~~The Electrical Contractor shall obtain a recycling certificate for the recycling works for inclusion within the Installation Manual.~~

~~3.13~~3.9 PENETRATIONS

Generally

Provide treatment to the penetrations as follows. Refer to architectural drawings for indication of all fire walls, floors ceilings, and the like, for allowance required to fire rated penetrations throughout:

Fire walls, ceilings and structural members: Do not penetrate without approval. Restore the fire rating of all fireproof building members at barriers where penetrated by electrical services once cable installation is complete using an approved method. Provide approved proprietary fire-rated wall-boxes for accessories to be installed on fire rated walls. Seal to approval of Consulting Engineer and Authority.

Acoustic walls and ceilings: Do not penetrate without approval. Restore the acoustic rating of barriers where penetrated by electrical services once cable installation is complete using an approved method. Provide approved proprietary acoustic-rated wall-boxes for accessories to

be installed on acoustically rated walls. Seal to approval of Consulting Engineer and acoustic engineer.

Commented [MS49]: Remove if not required

Damp courses: Do not penetrate.

Floor slab: Run conduits entering a building at ground level under the waterproof membrane and vertically penetrate the membrane and the floor slab.

Existing structures: Obtain approval from a Structural Engineer for any penetrations through existing structures. Pay all associated costs for structural engineering advice.

Penetration size: Provide penetrations of diameter 10 mm greater than the cable or sleeve diameter for conduit and sleeves penetrating existing external walls, ground slab, or ground floor beams.

Sealing: Seal penetrations around conduits and sleeves with a weak sand/cement mix, or similar sealing compound. Seal the space between cables within sleeves with a pliable waterproof compound or intumescent fire rating material as required.

Fire Stopping Penetrations

Where services penetrate fire walls, floors or other fire rated barrier, sealant for those penetrations shall be sealed to the approval of the relevant Authorities.

Tenderers shall note the specific requirements to fire stop all cable penetrations through each floor and fire rated wall.

Submit details of proposed fire resistant sealants for approval prior to installations.

Fire Proofing: Fire proof each penetration through fire proof building members, irrespective of size, upon completion of installation of cables. Ensure fireproofing complies with all Building Code, Local Authority and Supply Authority requirements, utilising fire barrier pillows and mastic.

Sleeves

Fit a UPVC sleeve for each penetration through floor slabs, ground floor beams and external walls for cables not enclosed in conduit. In addition, for MIMS cables fit a sleeve for each masonry penetration.

Final location shall be accurately determined and installed to the approval of the Structural Engineer during construction. Provide shop drawings indicating location and size of all service penetrations for approval by the Structural Engineer.

Major External Penetrations (greater than 250mm)

Install weatherproof overflashings to upstand and complete with appropriate silicone sealant to prevent water ingress through penetration. Provide trimmer beams or other reinforcement necessary to support equipment, conduits and cabling passing through the penetration.

The over flashing shall be of the same material as the conduit passing through the roof and shall be securely fixed to it.

On completion the contractor shall test all penetrations for leaks to the satisfaction of the Architect.

Minor External Penetrations (Less than 250mm)

Utilise "Dektite" or "Rooftite" seal or equal approved and silicon sealant. Utilise a single seal for each conduit where not concealed under flashings. Utilise a multiple seal where seal is protected under sheetmetal flashing, not exceeding three (3) services through the Seal. Appropriately size all seals, silicone around the top of each seal and install clamps.

Exposed Penetrations

In addition to the above, flash penetrations where exposed to view with sheet metal escutcheon plates. Paint sheet metal to the architects approved colour

Acoustic Barrier and Plant Room Penetrations

Pack penetrations with acoustic insulation (70kg/m3 fibreglass or rockwool) and seal airtight with flashing angles and mastic. Ensure cable trays do not come into contact with the barriers/walls.

Upon completion of the project, provide written confirmation to the Superintendent that the above requirement has been complied with.

~~3.14~~3.10 CONCEALED SERVICES

Conceal all services in areas other than plant or utility areas. Install services as follows:

Cavity walls, hollow block and dry walls – install services concealed within cavity.

Single leaf brickwork, concrete – surface mounted conduit or "mini-duct" and seek approval prior to installation.

Do not chase walls.

Consumers Mains/Submains protection: Provide HDPE conduit protection to all consumers mains, submains and other non-RCD protected cabling reticulating within close proximity to the surface of walls, floors, ceilings and roofs.

Cable protection: Provide non-metallic conduit protection to TPS cables installed in poured concrete members, concrete blockwork, partitions and the like. Size such conduits to accommodate the TPS cables with sheath intact.

Load Centre Protection: Provide 3mm thick steel plate behind load centres when installed within cavity walls.

~~Body and Cardiac Protected Areas: Provide HDPE conduit protection to all cabling between local distribution board and field Leakage Protection Devices (LPDs) within body and cardiac protected areas.~~

Installation methods

Wall construction:	Installation and cabling facilities:
Rendered partition:	Flush wall box - Heavy duty conduit chased into wall.

Face partition:	Flush wall box - Heavy duty conduit concealed in cut or cored brick-work.
Face brick /block external cavity wall:	Flush wall box - Unless otherwise specified, cable run in cavity and tied against inner leaf of brickwork.
Stud partition:	Fixed clip - cable run in cavity. Provide shrouds as required to preserve segregation requirements.

~~3.15~~3.11 TRENCH EXCAVATION, BACKFILLING AND COMPACTION

General: Underground submains cabling and communications access provisions shall be carried out by the Electrical Sub-contractor including the supervision of all associated trenching and backfilling and coordination with other trades for provision of common trenches where proposed or required.

Underground power conduits shall be of the heavy duty (orange) type. Underground conduits for Communications services shall be class B (white) type as approved by ACMA. All conduits shall be complete with suitable expansion couplers and suitable care shall be taken where conduits enter buildings to allow for earth/building movements.

Conduits located in hazardous areas shall be resistant against hydrocarbons and of type heavy duty fuel resistant 'Nupi Smart Conduit' or equivalent.

Commented [MS50]: Required for hazardous areas only.

Conduits shall be installed with suitable falls to allow for drainage and installed to the following minimum depths:

- Electrical Conduits (HV) - 750 mm minimum
- Electrical Conduits (LV) - 600 mm minimum
- Communications Conduits - 600 mm minimum

Conduit segregation distances shall exceed the requirements of ACMA Regulations.

After installation of cables all conduits shall be sealed to prevent ingress of dirt and moisture. Spare conduits shall be capped for future use.

Cable pits: Cable pits shall be installed where indicated on drawings or as necessary for a satisfactory installation and as required by appropriate Authorities.

Construction: Load Class C pits shall be provided in accordance with AS 3996 as a minimum (unless specified otherwise). All pits shall be constructed of polymer concrete, cement concrete or glass reinforced concrete or reinforced plastic.

All pits shall be provided with gaskets below the lids to prevent water ingress, and shall be provided with termite protection.

The pits shall be of minimum dimensions 600 mm x 600 mm minimum (greater where shown) to enable cables to be easily inserted and withdrawn.

The pits shall be fitted with efficient means of drainage and be of a proprietary type. The Contractor shall ensure that sufficient drainage is provided to all pits, and to prevent water drainage through the conduits.

Provide embossed lids to all pits stating purpose i.e. "ELECTRICAL", "COMMUNICATIONS, "SECURITY" and the like. All lids are to be provided such that they are flush with the surrounding path area.

Provide lockable concrete lids for Communications and Security Pits (or where shown). Provide locking details for approval, and approved heavy-duty padlocks for each pit. Note 'Barry Bolts' shall be used as a minimum.

Where pits are shown in areas where there is to be paving or tiles, provide 'paver inlay' lids to accommodate pavers.

All pit lids shall be provided in accordance with AS/NZS 4586 with respect to slip resistance.

Pit locations shall be co-ordinated with paving locations and types.

Where 'gatic' type pits are required, the contractor shall provide 1off minimum pit lid lifter suitable for lifting and rolling the pit lid away from the open pit.

Marker strips & location markers: Proprietary marker strips and location markers shall be installed above all runs of new underground cabling and conduits.

Marker Strips shall be polymeric batts and shall:

- Be formed from polythene sheet, not less than 200mm wide.
- Have black block letters 150mm high on an orange background printed "DANGER - ELECTRICAL CABLE' or "DANGER - COMMUNICATIONS" indicating the service buried beneath.
- Be of proprietary manufacture and incorporate an insulated tracer wire within.
- Be laid continuously 230mm below the surface of the ground and above each conduit.
- Be laid continuously at 50% of depth of cover for each electrical conduit and at least 150mm above each communications conduit.

Location markers shall:

- Consist of 200mm square or round flush aluminium warning plate complete with direction arrows and service designation set into concrete.
- Be of proprietary manufacture.
- Be located every 30m in straight runs and at junctions or changes of direction for all underground conduits.
- Be located wherever services enter a building.

Trenching, Backfilling and Reinstatement: Include the supervision of all trenching, backfilling and reinstatement. Mark out for approval all proposed routes before commencement of any excavation. Obtain Council approval for all trenching outside the extent of the site and pay all associated fees.

Maintain a digital photographic record of all trenching. Include records within the Installation Manuals.

Make due consideration for prevailing weather conditions and allow for de-watering of trenches as required.

Locations and the extent of existing and new underground or underconcrete routes as shown on the drawings accompanying the specification are indicative only. Obtain from all relevant authorities and the Superintendent all known details of underground services in the vicinity of proposed trenches.

Trace and mark and allow for all costs for relevant authorities to trace and mark the locations of existing underground services where in the vicinity of proposed trenching as follows:

- Power - trace cables electronically using detector or tracer and mark.
- Telecommunications and audio-visual - as above.
- Water - as above (metallic pipes).
- Sewer - provide internal metallic tracer for detection.
- Stormwater - provide internal metallic tracer for detection.
- Gas - as for power above.

Allow within the tender submission to hand dig new trenches within the vicinity of existing underground services and modify conduit installation as required and as directed on site.

Where solid rock is encountered, obtain approval for conduit invert levels and sand/slab as required in accordance with AS 3000 without variation to the work. Shale rock shall be removed without variation to the work.

Select trenching routes so as to avoid tree roots. Where tree roots are encountered, allow to remove as part of the work. For larger root systems install conduits beneath. Avoid trenching near large tree specimens.

Bear total responsibility and cost for the repair of underground services damaged in all cases without variation to the work.

Provide barriers to all trenching routes left open and temporary night lighting where this is deemed a requirement by the Superintendent and in all cases where trenching is left open after hours. The barriers shall not be removed until completion of all work.

Trenches must be kept clear of water at all times and timbered where necessary to prevent collapse. They shall be excavated only sufficiently in advance of laying to allow that work to proceed without delay.

Where necessary and/or required by the Authorities for safe and efficient completion of the work, supply, erect shoring, timbering, planking, etc. of sufficient strength and quality to prevent earth and other materials entering the excavations, tunnels, etc.

Work shall be carried out in accordance with Work SA requirements.

Remove all shoring and timbering in an approved manner on completion of the work and after the inspections have taken place.

Ensure trenches are excavated to a depth 150mm lower than that required for final installation and provide a bed of clean, washed sand. Install new services within trenches and arrange for inspection before backfill.

Excess excavation below the required level shall be backfilled at the Contractor's expense with sand, gravel or other material as directed by the Superintendent, and thoroughly compacted. Any soft or yielding material shall be removed and replaced with sound material and compacted to the satisfaction of the Superintendent.

Ensure trenches are backfilled using quarry sand under pavements and excavated material in landscaped areas after removal of all sharp stones and vegetation. Place the backfill in maximum of 150mm layers and consolidate to 98% modified maximum dry density in paved areas and 85% modified maximum dry density in landscaped areas. Bear responsibility for future subsidence. Note: Contractor shall engage independent engineer to perform compaction testing of trenches on completion. Test results shall confirm 98% compaction has been achieved. A minimum of 4 compaction tests are required with test sheets inserted within manuals for review.

After completion of backfilling remove excess material from the site immediately. All cartage costs and tipping fees shall be paid by the Contractor.

Reinstate all surfaces to match existing. Saw-cut and remove 100mm to either side of trenches through bitumen. Provide fine crushed rock pavement material to match existing depth and compact to 95% of the modified maximum dry density. Provide a minimum of 30mm of 10mm Hotmix Surface Course. Ensure no high or low areas are produced.

Reinstate concrete surfaces to match existing using concrete of strength 20 Mpa or greater. Provide reinforcement to match existing where applicable and dowel into existing. Match existing concrete finishes in all respects.

Reinstate unit-paved or other paved surfaces to match existing after preparing the surface as above, with the addition of 50mm sand bed. Replace any damaged pavers with a type to match that damaged.

Reinstate existing lawn and garden surfaces to match those prior to trenching in terms of planning, compaction and levels.

Replace damaged plant specimens with approved plant types.

Reseed all damaged grassed areas.

~~3.16~~3.12 PAINTING

All concealed metal surfaces, excepting galvanised surfaces, shall be supplied with one coat of red zinc chromate primer applied. The paint shall be undiluted and in accordance with the appropriate SAA Code. All surfaces to be painted shall be thoroughly dry, cleaned down, free from weld splatter, burrs, dust, rust, cement and grease and the like.

Include painting of all equipment supplied including the applicable supports and fixings.

Do not paint surfaces pre-prepared by the respective manufacturer or equipment not recommended by the manufacturer to be painted.

Paint system: Unless otherwise specified paint all equipment as follows:

- Indoor locations: A system not inferior to full gloss - solvent borne.
- Outdoor locations: A system not inferior to full gloss - solvent borne.

Provide protection to all painted surfaces and make good any damage prior to practical completion. If damage is extensive totally repaint damaged equipment surfaces.

All switchboards, control panels and the like shall be cleaned down and polished with automotive polish prior to practical completion.

Paint colours are to be approved by the Consulting Engineer in each case.

Exposed conduits, wiring ducts, cable trays, brackets, frames, covers, etc. shall be painted with at least two coats of best quality oil paint of a colour nominated by the consulting engineer.

Galvanised surfaces shall be etch primed before painting.

Metal surfaces shall be painted, where scheduled, with one prep coat and two finishing gloss coats to selected colours. Carry out any other treatment (e.g. etch priming for galvanised surfaces, degreasing) to ensure a satisfactory result.

Damaged or unsatisfactory painting shall be made good.

~~3.17~~3.13 IDENTIFICATION

Switchboards: Number all circuit breakers within each switchboard and on the appropriate escutcheon; Number every hole on earth and neutral bars; Note these numbers on the switchboard circuit schedule. Label main switches. Identify all circuits with exit and emergency lighting.

All lift supplies to have an engraved Traffolyte label adjacent isolator reading "LIFT SUPPLY - DO NOT SWITCH OFF".

Outlets: Where applicable, identify all isolators, outlets, lighting control switches and power outlets with 2 IPA studs indicating the number and phase of the circuit and distribution board

to which it is connected. Locate IPA studs in accordance with the manufacturer's recommendation. For socket outlets with ID windows use the ID tags in lieu of IPA studs.

Provide engraved Traffolyte labelling for all isolators, outlets, lighting switches and equipment indicating:

- Distribution board supply
- Circuit reference

Use engraved and filled stainless steel labels for external areas. Brother labelling (or the like) will not be accepted.

Indicators: Where the circuit number has two numerals, provide an indicator with two numerals on the stud.

Additional marking: Provide marking as follows in addition to that required by AS 3000:

- Each Switchboard component.
- Each circuit breaker on the switchboard escutcheon, and with escutcheon removed.
- Complete circuit schedule (machine printed) at each switchboard
- Each fuse - fuse rating - visible without deadening circuit.
- Circuit number and switchboard on each light switch, power outlet and isolating switch.
- Each Main Switch

Label types: Unless otherwise specified, provide the following label types:

- For interior use: Engraved two-colour laminated plastic.
- For exterior use: Engraved and filled stainless steel.
- For interior general purpose outlets and switches: Push-in I.P.A. type studs.

Label edges: Round or bevel the edges of labels exceeding 1.5 mm thickness.

Colours:

-	Warning notices:	White letters on a red background.
-	Essential & fire equipment circuits:	Red letters on a white background.
-	Other labels:	Black letters on white background.

Fixing: Fix each label by not less than two chrome plated screws. Where adjacent to terminations, locate the label so that the installed wiring does not mask the label.

Generally not less than the following:

Isolating switches:	10 mm
Other equipment:	4 mm
Warning notices:	4 mm

Inside enclosures: 3 mm

3.183.14 IDENTIFICATION OF MAIN SWITCHBOARD

The electrical contractor shall provide signage in compliance with the AS/NZS 3000: 'Wiring Rules'.

- The main switchboard shall be legibly and permanently marked 'MAIN SWITCHBOARD'.
- The location of the main switchboard shall be legibly and permanently indicated by a conspicuous notice at each entry to the building that may be used by emergency services personnel.
- Notices indicating the location of the main switchboard shall be of permanent construction and shall incorporate 'MAIN SWITCHBOARD' in contrasting colours.
- The location of the main switchboard need not be marked where the location can be readily determined, e.g. where it is clearly visible from the main entry to the electrical installation.
- The location of the main switchboard need not be marked at the entry to a building where the location is clearly indicated at a Fire Indicator Panel.

The electrical contractor shall liaise with the builder to confirm final locations.

3.193.15 ELECTRICAL INTERFERENCE

Design and use electrical equipment which will not cause interference with electronic and electrical equipment in the vicinity. In the event that the inherent characteristics of equipment make interference possible, fit effective suppressors to eliminate the interference.

Maintain radio and television interference level within the limits set out in AS/NZS CISPR 14.1:2013.

Maintain electrical disturbances within the limits set out in AS/NZS 61000.3.7. Comply with AS/NZS 61000.6.1.

3.203.16 DISSIMILAR METALS

Where clips, brackets, and enclosure supports are of dissimilar metal to the actual enclosure used, completely insulate the enclosure at all fixing points with at least four layers of 50mm wide black polyethylene tape wrapped around the enclosure prior to fixing in position.

3.213.17 BREAK OF GAUGE CABLE BOXES

For installation where the incoming cable size exceeds the size permitted at the terminals, the electrical contractor shall supply and install a change of gauge junction box. Liaise with other subcontractors to ensure that terminals are able to accommodate the final cable selection prior to installation.

Ensure that the outgoing cable is adequately protected by the upstream circuit protection.

3.223.18 SUPPORT OF EQUIPMENT MOUNTED INTO CEILING TILES

Commented [MS51]: Required by DPTI and ceiling tile manufacturers.

Equipment such as downlight fittings, emergency lights, security sensors, speakers, must meet the requirements of the ceiling tile manufacturer. Generally, light-weight ceiling tiles are not

able to support anything other themselves and so no accessories are to be mounted into them without additional support. As a minimum, light-weight items are to be fixed to a sheet of 12mm plasterboard or 3mm ply-wood above the ceiling tile, spanning the full width of the tile, as additional bracing. Heavier items will need to be suspended from a concrete slab above or fixed directly into the ceiling structural supports. The Contractor is to seek advice from a qualified Structural Engineer to determine the appropriate mounting methods.

~~**3.23** CONCRETE PLINTHS~~

~~Construction~~

~~General: Provide concrete plinths under all floor mounted equipment located outside floor slabs extents as follows:~~

- ~~For all floor-mounted equipment with construction of hot dipped or galvanised.~~
- ~~Concrete: Grade N25~~
- ~~Finish: Steel float flush with the surround.~~
- ~~Reinforcement: Single layer of F72 fabric.~~
- ~~Surround: Provide galvanized steel surround at least 100 mm high and 1.6 mm thick. Fix to the floor with masonry anchors. Fill with concrete.~~
- ~~Minimum height: 100mm for main switchboard.~~

Commented [MD52]: Not required for service fuse enclosure - wall mounted/off-ground

~~3.32~~3.19 PLANT AND EQUIPMENT ACCESS

The provision of adequate access for maintenance is mandatory under BCA Part J8.

Ensure intended access is shown on the drawings and that the plant is arranged to permit inspection, maintenance and removal. This is particularly true of high level equipment and roof mounted equipment. See AS 1470, AS 1657, AS/NZS 1892.1 and AS/NZS 2865 for relevant requirements.

General

Services and equipment: Locate and arrange all services and equipment so that:

- They comply with the relevant requirements of the appropriate Occupational Health and Safety regulations.
- Failure of plant and equipment (including leaks) does not create a hazard for the building occupants.
- Failure of plant and equipment (including leaks) cause a minimum or no damage to the building, its finishes and contents.
- Inspection and maintenance operations can be arranged to minimise inconvenience and disruption to building occupants or damage to the building structure or finishes.
- Services and equipment are readily accessible for inspection and maintenance and arranged so that inspection and maintenance can be carried out in a safe and efficient manner. Include the following:
    - Conform to the relevant requirements of AS 1470, AS 1657, AS/NZS 1892.1 and AS/NZS 2865.

- If parts of the plant require regular inspection and maintenance either locate plant so it is safely accessible from floor level or provide permanent access platforms and ladders.
- In false ceilings locate items of equipment that require inspection and maintenance above tiled parts where possible. If this is not possible (for example if above set plaster or other inaccessible ceilings) provide access panels. Arrange services and plant locations to reduce the number of access panels. Coordinate with other trades to use common access panels where feasible.
- Modify manufacturer's standard equipment when necessary to provide the plant access in the contract documents.

- Securely fix/mount ancillary equipment (remote transformers, ballasts, control gear, battery boxes, etc) clear of ceilings, lighting equipment sitting on top of t-bar type ceiling tiles is not acceptable.
  - Ensure additional structural support is provided for any accessories installed on or in mineral fibre acoustic ceiling tiles. 10mm plaster board laminated to the mineral fibre acoustic ceiling tile would be deemed suitable.

~~3.33~~3.20 METALLIC SUPPORT SYSTEMS AND FIXINGS

Fabrication: Provide brackets, racks, hangers and other supports sized to adequately support the installed system and equipment, fabricated from structural steel sections or from other materials in sections of equivalent strength.

Minimum thickness of structural steel sections:

- Angles and bars: 6.5mm.
- Rods: 10mm diameter.

Fixing to building structure: Fix the supports by surface fixing to ceilings and walls, or suspension hangers from ceilings, or angle brackets or racks from walls, using the following methods, as appropriate:

- Masonry or concrete walls: Embedded Fixings
- Concrete slab ceilings: Embedded Fixings
- Structural steel: Bolts and nuts through clearance holes

Spacing: Space the supports at intervals of not more than 1 m and provide a support at each joint in the tray or ladder system.

Fixing of tray or ladder: Bolt the tray or ladder to the brackets, racks and other supports.

Galvanising: To AS 1650. Galvanise steel conduits and support systems exposed to the weather or installed in damp locations. Conduits and support systems where exposed to view shall be painted.

~~3.34~~3.21 EARTHQUAKE FIXINGS AND SUPPORTS

All plant, equipment and conduits shall comply with the requirements of the following standards:

- AS/NZS 1170.4 – Structural design actions - Earthquake actions in Australia

- AS 2670 – Evaluation of human exposure to whole-body vibration - General requirements
- ISO 20816 – Mechanical Vibration
- ISO 21940 – Mechanical Vibration

Where greater incorporate the Design, Selection and Installation with requirements of ASHRAE Handbook 2011, Applications Chapter 48.

For further information regarding earthquake restraining, refer to following:

- Gripple Seismic Installation Manual
- Tyco flow control, 2002,unistrut seismic bracing systems
- Fema e-74, January 2011, reducing the risks of non-structural earthquake damage - a practical guide.
- S.M.A.C.N.A seismic restraint manual, guidelines for mechanical systems, 1998, S.M.A.C.N.A, sheet metal and air conditioning contractors' national association.

Provide restraints and supports designed and certified by a structural engineer, to all plant, equipment, conduits and cable trays in accordance with AS/NZS 1170.4 Section 8, incorporating the following:

Criteria	Unit	Factor
Importance Level	I	~~(INSERT)~~2
Annual Probability of Exceedance	yr	~~(INSERT)~~1:500
Soil Classification		~~(INSERT)~~De
Hazard Factor	Z	~~(INSERT)~~0.10
Probability Factor	Kp	~~(INSERT)~~1.0
Structural Classification	EDC	~~(INSERT)~~2

Commented [MD53]: Taken from Hyd spec

All restraints and supports shall be issued to the structural engineer to review the adequacy of the structure to support the services loads, including seismic forces. Proof of formal review and approval by structural engineer shall be provided as part of the shop drawing review process.

Where internal expertise is not available to the contractor, formal engagement of a registered structural engineer shall be sought for design of earthquake restraints. Cost of engagement shall be included in Tender pricing and listed as a separate item when applicable.

Commented [MS54]: Values to be requested from structural engineer at beginning of the project.

The following do not require seismic bracing:

- All electrical conduit less than 64mm internal diameter

Transverse bracing for cable trays to be at 6.00m maximum centres and at section ends.

Longitudinal bracing for cable trays to be at 12.00m maximum centres and at section ends.

Transverse bracing on adjacent runs may be considered the longitudinal bracing for the adjacent section.

Spacing of the bracing may need to be reduced for example:

- Brace both sides of conduit or cable trays at flexible connections
- Brace to avoid collision between conduit or cable trays and other non-structural components
- Brace within 600mm of changes in direction, whether it be horizontal or vertical changes
- Brace where components penetrate floors or ceilings
- Brace in both directions at the top of all risers where risers exceed 900mm

The spacing of bracing along a run of conduit or cable tray should not vary greatly in order to ensure uniform deflection and loading.

Each unit of equipment connected to a run of conduit or cable tray shall be individually and independently braced. Thermal expansion and contraction forces, where present, must be considered in the layout of transverse and longitudinal braces. Flexibility should be provided where conduits pass through seismic or expansion joints or connect to equipment with vibration isolators.

Services braced in accordance with AS 1170.1-2007 section 8 shall have a minimum of 50mm clearance from all ceiling hangers and the ceiling grid.

Do not core through, cut through or otherwise damage steel reinforcement in concrete slabs, beams or columns when installing seismic bracing.

Seismic Bracing Selection Table

Category	Selection	Installation	Necessary Seismic Bracing
Switchboard & Distribution Boards	Main Switchboard (serving essential or non-essential loads)	Floor mounted, backed against a wall	Fix to floor and to the wall at least twice near the top of the switchboard
		Free standing	Fix to floor and provide steel 'A' frame support
	Load Centre and Local DB	Wall mounted	Seismic bracing not required
Light Fittings	<4kg	Installed in suspended ceiling (plasterboard or grid)	1 slack safety wire
	4 to 20kg	Installed in suspended ceiling (plasterboard or grid)	2 slack hangers
	>20kg	Installed in suspended ceiling (plasterboard or grid)	4 taut hangers
	Troffer fitting	Installed in suspended ceiling (plasterboard or grid)	2 slack hangers
	Pendants	Meeting requirements a), b) and c) in section G	Seismic bracing not required

Category	Selection	Installation	Necessary Seismic Bracing
		Able to make contact with other equipment	4 taut diagonal wires
		Installed adjacent to suspended ceiling (plasterboard or grid)	As per recessed luminaires depending on weight, above
Cable Trays	Power or communications cable tray	Suspended less than 300mm from structure	Seismic bracing not required
		Suspended greater than 300mm from structure	Bracing required
Conduits	Power or communications conduits	Internal diameter less than 64mm	Seismic bracing not required
		Internal diameter greater than 64mm	Bracing required
Large Equipment		Floor standing	Bracing required in accordance with manufacturers recommendations
Other equipment	Emergency lights, smoke detectors, speakers, motion sensors etc.	Installed on a ceiling tile	Seismic bracing not required but to be fixed to plywood backing board to prevent falling when tile is removed
		Installed on plasterboard ceiling	Seismic bracing not required

~~3.35~~3.22 EARTHING SYSTEMS

Earthing system: The following earthing system is to be provided for each supply in accordance with AS 3000.

- Type: MEN system (New) ~~(Existing)~~
- Maximum earth resistance: In accordance with AS 3000.
- Electrodes: Copper Clad Stainless Steel - 2.4m length.
- Pits: Proprietary earthing pit (300 mm x 300 mm).

Earth all metallic structure and equipment where this relates to the Electrical Services or Telecommunications installation.

The location of the earth stake shall be identified at the Main Switchboard.

Connections: For the connection of the main earthing conductor and interconnecting bonding use clamps to AS 1882.

Additional earthing and bonding: Provide additional bonding between the earthing system and all piped services within each building, at the closest practical point to where the piped services enter the building. Include all piped services, including Hot Water, Cold Water and the like, where applicable.

Provide dedicated earthing conductors to each raised floor and bond to the structure at appropriate locations. Insulate support equipment brackets to suit.

Earth all cable supports including by not limited to cable trays, ladders and catenaries.

Telecommunications Earthing: Provide a protective earthing system for the Communications cabling systems in accordance with ACMA regulations. Provide a dedicated 16 mm2 earth cable to each Communications Rack Enclosure, MDF or TPF. The earth cable shall be an uninterrupted link from the nearest Distribution Board. For Communications Racks the earth cable shall be terminated on an earth stud located on a face plate adjacent the enclosure between 900 and 1100 AFFL.

Do not allow the earthing conductor of any rack equipment frame or any earth connection between the communications raised floor and equipment earth. Insulate support equipment brackets to suit.

Showers and Bathrooms: Provide additional bonding to conductive reinforcement within a concrete floors and/or walls forming part of a shower or bathroom construction. The equipotential bonding conductor shall have a cross sectional area not less than 4mm2 and shall be bonded to the nearest adjacent earthing system of the electrical installation.

Provide additional earth stakes where required by the Supply Authority or to achieve the earth resistance stated in AS 3000.

Submains: Provide an earth wire with each group of submains sized to meet the minimum requirements outlined in AS/NZS 3000.

Final subcircuits: Provide a separate earth wire to each final subcircuit. Within each respective switchboard connect each earth wire to an earth bar. Ensure that earth bar numbers correspond with circuit breaker and neutral bar numbers.

~~3.36~~3.23 WIRING TO AND CONNECTION OF EQUIPMENT

Equipment status: Unless indicated equipment will be supplied internally wired.

Connection: Wire to the equipment through an isolating switch mounted adjacent, unless a plug top is provided.

Three-phase wiring: Provide a neutral cable equal in size to active conductors with all three phase wiring unless nominated otherwise.

Final connection: Provide all final connections unless advised otherwise.

Within 600mm of wall: Enclose the final connection in flexible PVC conduit, with approved type flexible conduit terminators.

More than 600mm from wall: Wire through conduit cast into or secured to slab. Final connection using flexible PVC conduit with approved terminators.

Flexible conduit type: Use galvanised steel flexible conduit for equipment requiring heavy duty protection or within plant rooms.

4 TESTING AND COMMISSIONING

4.1 TESTING

General: All testing and commissioning shall be undertaken in accordance with regulatory requirements, manufacturers requirements, and the requirements listed below.

Notice: Give sufficient notice so that all Testing may be witnessed by the Building Services Consulting Engineer.

Inspection / Testing Schedule: Provide a comprehensive Inspection and Testing Schedule a minimum of 10 working weeks prior to first inspection/test.

Minimum notice required: Provide 10 working days notice for exact time and date of each test/inspection.

Testing certificates: Provide test certificates and Certificates of Compliance for approval. Include copies within Installation Manuals.

Approval for energising: Obtain approval before energising newly installed or reconnected wiring or equipment.

Faulty installation: During testing, replace fuses and all equipment damaged as a result of incorrect installation work.

Testing and Tagging: Undertake all testing in accordance with AS/NZS 3760 for all electrical equipment and accessories installed under this contract. Provide tags on the flex cable (if fixed) or on the chassis (if flex cable is removable).

Provide a schedule of equipment that has been tested and tagged under this contract in the Installation Manuals, and confirm whether or not the appliance has passed or failed, date of test, and schedule for next test.

4.2 COMMISSIONING

Notice: Give sufficient notice that commissioning of the electrical services is to commence.

Minimum notice required: 5 working days

Phase sequence: Test phase sequence prior to commencement of works and ensure the correct phase sequence is maintained throughout the installation.

Balancing of load: Balance the load as evenly as practicable at Practical Completion. Recheck and, where necessary, rebalance the load at completion of the Defects Liability Period. Arrange all circuits so that balance is obtained at maximum demand as well as normal operating conditions, in accordance with AS/NZS 3000.

Site commissioning: Include the following:

Reticulation, Switchboards and Accessories:

- Test and provide Certificates of Compliance for the installation in accordance with the requirements of the Electricity Act.

- Insulation resistance measurements.
- Provide full functional and operational checks on energised control equipment and circuits, including adjustments for the correct operation of safety devices.
- Provide full functional and operational checks for all SSOs and RCDs. Log all RCD test results.
- Provide full functional and operational checks for all RCD/LPD devices within Body Protected Areas. Log all RCD/LPD test results including number of times tested, trip time and equipment used, including calibration certificates.
- Labelling of all switches and outlets.
- Earth resistance measurement: To AS 3000.
- Earthing: Confirmation of effective earthing of the exposed metal of electrical equipment.

Multi-Function and Check Meters:

- Check and verify operation, calibration and correct output of all meters. Provide calibration certificate and test results.

Circuit protection:

- Confirm that circuit protective devices are sized altered and adjusted, wherever necessary, to protect the installed circuits.

Luminaires:

- Clean luminaire reflectors, mirrors and diffusers. Replace faulty components including lamps. Check for correct switching and demonstrate.

Exit and Emergency Evacuation Lighting:

- Discharge test in accordance with AS 2293 and the Building Code of Australia.

~~Standby Diesel Generator:~~

- ~~Test the operation of the generator systems as specified under the Generator Section of this specification.~~

~~Uninterruptible Power Supply (UPS) System:~~

- ~~Test the operation of the UPS systems as specified under the UPS Section of this specification.~~

MATV:

- Test the operation of each outlet as specified under the MATV Section of this specification.

~~Fire Detection/EWIS: (also refer Specification section)~~

- ~~Test the operation of 30% of thermal detectors and all smoke detectors in accordance with AS 1670.~~
- ~~Test fire mode interface of all systems.~~
- ~~Confirm operation of alarms and shutdowns.~~
- ~~Confirm alarm signal transmission to the State Fire Service.~~

~~Demonstrate the correct operation of the entire EWIS system.~~

~~Lighting Control System:~~

- ~~Test and commission the operation as specified under the Lighting Control System of this specification.~~
- ~~Refer Lighting Control System Section of this specification.~~

Communications Cabling:

- Provide TCA 1 form compliance for communication system.
- Refer Communications Cabling Section of this specification.

Movement Detection:

- Test and commission each lighting movement sensor in accordance with the manufacturers requirements to ensure a fully operational system.
- Undertake a walkthrough of each control zone to ensure functionality is as specified.
- Engage the services of the manufacturer as required.

NBN Corporation Cable Pathways:

- Refer to NBN Corporation technical guidelines and the NBN Corporation section of this specification.

~~Clipsal Starserve System:~~

- ~~Undertake all necessary testing and commissioning as required by the manufacturer to ensure a fully certified system.~~
- ~~Refer Clipsal Starserve Section of this specification.~~

Access Control System:

- Test and demonstrate the operation of each door lock, reed switch and card reader.
- Demonstrate the operation of colour graphics.
- Programme time groups, schedules and key-tags in accordance with the requirements of the proprietor.

~~Electronic Security System:~~

- ~~Test and demonstrate the operation of each motion detection device, reed switch, duress button and the like.~~
- ~~Demonstrate the operation of the remote arming stations.~~
- ~~Demonstrate the successful operation of the remote monitoring facility.~~
- ~~Programme time groups, schedules, zones and the like in accordance with the requirements of the proprietor.~~

Intercom:

- Test the operation of each station as specified under the Intercom Section of this specification.

~~Audio Visual:~~

- ~~Test the operation of audio visual system as specified under the Audio Visual section of this specification.~~

Photo-voltaic Generation:

- Test the operation of photovoltaic generation system as specified under the Photovoltaic Generation section of this specification.

Defects:

- Rectify all defects upon notification. Provide written notice to the Project Manager of completion of defects. Retention monies will not be released until completion and rectification to the Proprietors approval of all defects.

5 ACCESSORIES & EQUIPMENT

5.1 LIGHT SWITCHES ~~& LIGHTING CONTROL PANELS~~

Rating and Type: 230 V, 15 A. All mechanisms shall be of heavy duty type suitable for inductive loads, of manufacture 'Clipsal 30 USM' (or equal approved). Mount to accessory plates of 'Clipsal C2000~~ID~~' Series (or equal approved) high impact polycarbonate.

Commented [PC55]: Or Clipsal 30PBL (with LED-ON indicator when power is available)

~~For aged care facilities where large format switches are required utilise Clipsal "P2000 Prestige" series or equal approved with associated P20 series mechanism.~~ Where switches are nominated as weatherproof they shall be of "Clipsal 56" Series manufacture (or equal approved) with locking provisions. Switches shall be UV stabilised where installed in external areas.

~~Where switches are nominated as chemical resistant they shall be of "Clipsal 56" Series manufacture (or equal approved).~~

Limit light switch and lighting circuit loadings to 75% of sub-circuit capacity maximum, irrespective of circuiting arrangements indicated. Provide interposing relays where the load of any equipment exceeds 75% of the switchgear or circuit protection manufacturer's recommendation.

Mechanism: On face plates secure the mechanism with retaining screws, so that it cannot be displaced during normal operation.

Mounting: Provide all switches and lighting control panels as flush mounting type, generally matching, in flush mounting standard pattern or proprietary wall-boxes. Mount all accessories in flush wall boxes except where mounted on duct or surface mounted to approval. Where switches are located on fire rated, inter-tenancy or acoustic walls they shall be provided with fire rated and acoustic wall boxes to maintain the integrity of the wall. Group switches together on one face plate where possible. Architrave switchplates will not be accepted unless approved. Do not install circuits from differing phases behind a single plate without provision of approved mechanical shrouds or barriers. Switches within disabled areas and access paths of travel shall be mounted at a height to the approval of the Architect, but generally all switches are to be mounted between 900 to 1100 AFFL and no closer than 500mm to any internal corners. Leave 10mm free space between adjacent faceplates.

Colour: Provide light switches and mechanisms of colour to the Architect's approval. Generally faceplate colours shall be provided as follows:

- General – White

~~Computer Dedicated – Blue~~

~~• Essential (Generator) – Red~~

~~• UPS – Black~~

Location: Check the exact location of each water container, door swings and other services for adequate clearance in compliance with AS/NZS 3000 before locating switches and outlets.

5.2 ISOLATING SWITCHES

Minimum rating: 415V, 20A minimum, or to exceed the connected load. All isolators shall be of heavy duty type suitable for inductive loads. IP Rating shall 56 minimum, fully complying with AS 3000.

Where isolators are nominated as weatherproof they shall be of "Clipsal 56" Series (or equal approved) high impact polycarbonate with locking provisions. Clipsal "Weathershield WHB IP66" Series (or equal approved) is acceptable in general external areas except in plant rooms, roofs or for specialist requirements.

Enclose the isolating switches to suit their operating environment. Label each isolating switch with the item of plant served with Traffolyte labelling.

Carry out all final connections to all equipment fitted with isolating switches.

Mechanisms: Isolating switches are to be provided with a rotating toggle with external locking facilities both in the 'on' and 'off' position.

The mechanism is to be rated in excess of the connected equipment.

Provide upstands and associated flashings as required for isolators. Do not mount isolators directly to equipment.

Colour: To the Consulting Engineers approval.

Location: Check the location of the isolator in respect to the connected plant and locate as close as practicable and within 600 mm.

5.3 SWITCHED SOCKET OUTLETS (SSO)

Rating and Type: 230V, 10A rated. Mount the outlet with the earth pin at the 6 o'clock position. Mount to accessory plates of "Clipsal C2000~~ID~~" series (or equal approved) high impact polycarbonate.

Commented [PC56]: DPTI projects call for Clipsal Standard Series

Mounting: Where SSOs are located on fire rated, inter-tenancy or acoustic walls they shall be provided with fire rated and acoustic wall boxes to maintain the integrity of the wall. SSOs shall be typically mounted at 300 AFFL. In areas where occupants may be of limited mobility install the SSOs no closer than 500mm to any internal corner.

Auto switched socket outlets shall not be provided without prior approval from architect and consulting engineer.

~~Where SSOs are pendant mounted they shall be of approved type suspended by means of a multi strand plastic coated stainless steel strain cable secured to building fabric (not ceiling system). Pendant outlets shall have a ceiling rose that matches the colour of the flex cable.~~

Where SSO's are nominated as weatherproof they shall be of "Clipsal 56" Series (or equal approved) manufacture. Clipsal "Weathershield IP53" Series (or equal approved) is acceptable in general external areas except in plant rooms, roofs or where IP66 rating is a requirement.

Mechanism: Provide all SSO's with safety shutters operating via the neutral pin connection.

Commented [PC57]: Not required. But can be used in some installations.

Provide SSO's with neon indicators where indicated.

Provide 15 Amp or 20 Amp SSO's in locations nominated, being equal to other accessories.

Colour: To the Consulting Engineers approval.

Location: Check the exact location of water containers, inspection points, shower heads, eye wash outlets, door swings and other equipment for compliance with AS 3000 before locating SSO's.

~~Workstation Furniture: Where outlets are shown to be located on workstation furniture, allow to co-ordinate fully with the supplier of this furniture for wiring access and outlet locations. Note that workstation furniture will be provided under a separate fit-out contract.~~

~~5.5 INTEGRAL SURGE PROTECTED OUTLETS~~

~~General: Provide surge protected/overvoltage outlets for all socket outlets dedicated for NBN Corporation equipment, and or otherwise specified.~~

~~Rating, Type, Arrangement and Construction: As per general purpose outlets but with integral surge protection. Provide indicator light on each outlet to identify surge protection is available eg. "SURGE PROTECTED WHEN LIT". The light shall be removable for future replacement.~~

~~Labelling~~

~~Ensure that all labelling is in compliance with AS3003. The labelling shall identify the associated circuit breaker in the distribution board and the unique identifies within the area (ie. RCD X).~~

~~Ensure that all cleaners outlets are appropriately labelled "CLEANERS".~~

~~Lettering heights shall be in accordance with AS3003~~

~~5.12 THREE PHASE OUTLETS~~

~~Minimum rating: 415 V phase to phase, 20 Amp rating minimum.~~

~~Pin arrangement: Five round pins mounted with the earth pin at the 6 o'clock position, the neutral pin in the centre, and the red, white and blue phases in a clockwise sequence when viewed from the front of the socket.~~

~~Plug: Provide a matching plug top with a captive screw ring for each outlet.~~

~~Construction: Surface mounting type of high impact polycarbonate or metal clad, with spring loaded flap lid on the socket, equal to "Clipsal 56" Series (or equal approved).~~

~~5.17 EARTHING TERMINATION POINTS~~

~~Installation: Unless specified otherwise, the outlet shall be installed at 300mm AFFL.~~

~~Selection: Clipsal 'Medilec ML2031R01' Series or equal approved~~

~~Colour: Generally faceplate colours shall be white~~

~~HAND DRIERS~~

~~Installation: Mount the hand drier at 1050mm AFFL to the base in general areas, and 900mm AFFL in disabled areas, or as shown on Architectural elevations. The unit is to be circuited to an isolator installed at 2100 AFFL directly above the hand drier, and is to be of "Clipsal 2000V66" Series (or equal approved).~~

~~Selection: Supply and install hand-driers of "JD MacDonald Auto Beam" "Dyson Air Blade" manufacture.~~

~~5.24~~5.4 ACCESS PANELS

Provide access panels of quantities at least as shown on the drawings to provide a fully accessible wiring system. Access panel construction is to match floor outlet enclosure construction as above.

Access panels shall have heavy duty galvanised steel hinged lids. Refer to the architectural drawings for details relating to access panels.

~~5.25 DIMMERS~~

~~Provide dimmers rated to suit the connected load with 30% spare capacity. Minimum capacity shall be 450W. Dimmers shall be of rotary type (unless shown otherwise). Utilise high power dimmers equal to "Clipsal UDM" Series. Control equipment shall be located at or adjacent the first luminaire. The dimmers shall be suitably selected to suit the equipment load and type.~~

~~5.27 HEARING LOOPS AND EQUIPMENT~~

~~Design, supply and install fully concealed hearing loops to the following rooms:~~

- ~~AG27 Civic Function Room (Building A)~~
- ~~BG 12 Conference Room (Building A)~~
- ~~Reception Room (Building D)~~
- ~~Reception Room - 3 off separate systems, with interface ties (Building D)~~
- ~~Public Gallery (Building D)~~

~~Design each system in accordance with the guidelines produced by Better Hearing Australia. Submit proposed designs for approval prior to proceeding.~~

~~Provide all conduits, cables, connections, terminations and active equipment including amplifiers for the complete and operational system in each nominated area.~~

~~Design each system to provide a field strength of 0.4 Amp/metre (maximum) based on a frequency range of 100 - 5000 Hz (± 3dB relative to the level at 1000 Hz).~~

~~Provide a loop amplifier suitable for each system and locate to approval. Provide inputs so that the loop amplifier may be used in conjunction with other audio equipment.~~

~~Provide all cabling as required, of gauge to match the loop and amplifier impedance.~~

~~**5.25 ENVIRONMENTAL MONITORING OF COMPUTER ROOM**~~

~~The electrical sub-contractor shall arrange for, remove and take delivery of an existing "Sentinel" manufacture environmental monitoring station from the existing Port Adelaide Enfield Council Offices Computer Room (Broadview Offices, Hampstead Road), including control station and moisture detector. Delivery and removal by the Electrical Sub-Contractor will be effected at the discretion of the Superintendent (after hours).~~

~~Provide power supply, security cabling and cabling between the monitoring station and underfloor moisture detector. Mount, connect, test and commission all equipment. (Refer also Access Control/Security Section).~~

~~5.42~~5.5 PHOTO-ELECTRIC (PE) CELLS – DIN RAIL

Provide IP57 Photo-Electric (PE) cells equal to "Clipsal 4LSS" series for circuit group control where nominated. The photocell shall be capable of light level detection between 2 lux and 10,000 lux, and have a minimum 24VA rating. Locate photo-electric cells in accessible positions as approved by the Consulting Engineer and so as to avoid spurious operation. Provide auxiliary relays and contactors as necessary to switch the required quantity of circuits.

The PE-Cell module is to be installed within the nominated switchboard such that it can be adjusted without the removal of the switchboard escutcheon.

When a circuit is nominated as "PE-Cell and Time Switch Controlled" the PE-Cell shall be installed in series with the Time Switch.

~~**5.43 DAYLIGHT SENSORS**~~

~~Provide daylight (photocell) sensors equal to "Senor Switch PC" series for circuit group control where nominated. The photocell shall be capable of light level detection between 2 lux and 10,000 lux, and have a minimum 1,200W rating. Locate daylight sensors in accessible positions generally as shown, and so as to avoid spurious operation. Provide auxiliary relays and contactors as necessary to switch the required quantity of circuits.~~

~~All day light sensors shall have the following minimum requirements:~~

- ~~White in colour~~
- ~~LED status indicators~~
- ~~Ceiling/soffit surface mounted~~
- ~~Low temperature/humidity resistant in external and wet areas~~
- ~~Dual pole to all areas~~
- ~~Daylight switching set to switch lighting off at 600 lux at 0.75m AFFL~~
- ~~Default delay of 1 minute~~
- ~~Self-calibrating functionality is preferred~~

~~The Contractor shall liaise with the manufacturer during installation and commissioning as required ensure the system functions as scoped.~~

~~5.43~~ TIME SWITCH – DIN RAIL

Provide DIN rail mounted time switches of "Schneider 15270" series or equal, for nominated time switch controlled circuits as shown on the drawings accompanying this specification.

All time switches shall have the following minimum requirements:

- LCD display
- 365 day setting
- 4 channel
- 5 year reserve
- 10 Amp rating (min)
- Shall be installed through escutcheon such that time settings can be adjusted without escutcheon removal.

Provide auxiliary relays as required based on the total connected load of the timer.

~~5.56 TIME SWITCH – WALL MOUNTED~~

~~Provide wall mounted digital time switches of "PDL 646E7" series or equal, for nominated time switched circuits as shown on the drawings accompanying this specification.~~

~~All switches shall have the following minimum requirements:~~

- ~~White in colour~~
- ~~LED status indicators~~
- ~~LCD screen~~
- ~~Mounted on a flush face plate~~
- ~~7 day/24 hour timing facility~~
- ~~Manual override~~

~~Provide auxiliary relays as required based on the total connected load of the timer.~~

~~5.66~~5.7 MOVEMENT SENSORS

Provide ceiling mounted movement sensors equal to "~~Sensor Switch~~Clipsal 753", for control of nominated lighting circuits as shown on the drawings accompanying this specification.

Commented [MS58]: Or Clipsal "Infrascan"

All sensors shall have the following minimum requirements:

- White in colour
- LED status indicators
- Ceiling/soffit surface mounted
- Low temperature/humidity resistant in external and wet areas
- Dual pole to all areas
- PIR and microphonic detection

- Daylight switching to areas nominated and set to switch lighting off at 600 lux at 0.75m AFFL.
- Default setting at 10 mins (adjustable from 0 – 30 minutes)

The Contractor shall liaise with the manufacturer during installation and commissioning as required ensure the system functions as scoped.

~~5.67 CEILING SWEEP FANS~~

~~General: Provide ceiling sweep fans to locations as nominated on the drawings, complete with wall mounted speed controllers mounted at the same height as the light switches within the area.~~

~~Provide a speed controller to match the faceplate of the light switches and socket outlets in the area.~~

~~Provide electronic continuous speed controllers where multiple fans are connected to a single control point. Provide multiple controllers as required to ensure the design load of is not exceeded.~~

~~Ceiling sweep fans shall be installed in accordance with the manufacturer's requirements.~~

~~Selection: "Beacon Lighting Futura 122cm" or equal~~

~~Colour: White~~

~~5.74 OUTDOOR HEATER PANELS~~

~~Provide commercially manufactured 230V supplied outdoor electric radiant heater panels to locations as nominated equal to "Celmec Heatray ERH G4 1800" series.~~

~~Provide hub mounting trays and inbuilt electrical termination boxes.~~

~~Provide all controls modules for interfacing with Electrical supply and signalling from IBS contractor.~~

~~Accessories: Provide all mounting supports, adjustable angled brackets and recessing kits to suit final installation environment/location. Final trim colour for all recessing kits and supports to be confirmed with architect prior to manufacture.~~

~~5.80~~5.8 SMOKE ALARMS

Commented [MS59]: Remove if smoke alarms are not provided under electrical package

Standard: AS 3786

Provide smoke alarms to each nominated location. The alarms shall be mains powered from the unswitched active of the lighting circuit, and shall include the following performance characteristics:

9V DC battery backup (replaceable batter)

85dB at 3 metres alarm

Low battery indication (audible and visual)

Built-in test facility

CSIRO and ActivFire certified.

Photoelectric detection.

Flush mounted

Where multiple smoke alarms are required within individual apartments they shall be interlinked to provide a common alarm within the space.

Commented [AD60]: Remove requirement for interlinking of detectors if not required

Where smoke alarms are connected to a security / access control type system for monitoring they shall be connected such that each individual detector is a separate zone.

Commented [AD61]: Remove is smoke alarms are not being monitored bia the security / access control system

Selection: Alarms shall be of "Clipsal FireTek" series of equal approved.

~~7.0 ELECTROMAGNETIC SHIELDING~~

~~In locations as nominated on the drawings accompanying the Specification, provide magnetic shielding material for the shielding of all transformer, main switchboard room, submain or consumers mains cabling through the nominated area.~~

~~Engage an appropriate EMI Engineer to design and construct electromagnetic in accordance the World Health recommendations and Energy Networks Association Shielding shall consist of laminated high permeability magnetic steel around the relevant cable tray or group of conductors.~~

~~Make due allowance for derating of cables due to enclosure. Shielding enclosures shall be removable throughout their entire length.~~

SPARE PARTS

Allow within the tender submission the following spare parts, to be provided to site at the time of practical completion in original packaging:

lamps	-	24 of each type and wattage used
SSO's &	-	10 off of each type utilised on the project
switches	-	reset switches
	-	15 off (within luminaire type)
luminaires	-	6 off type 'A'
	-	3 off type "EX" and "EM"
fuses	-	3 off of each type utilised within the project, located within the relevant distribution board
circuit breakers	-	6 off of each rating and type utilised.
smoke & thermal detectors	-	6 off each type utilised

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CABLES & ENCLOSURE

~~47.~~16.1 CABLE SELECTION

Standards: Select cables in accordance with AS/NZS 3000 and AS/NZS 3008.1.

Ratings: Use AS/NZS 3008.1 for the determination of current ratings, voltage drop and cable size.

Voltage Drop: The maximum voltage drop to each final sub-circuit is not to exceed 2.5% unless specified otherwise.

Conductors: Unless otherwise specified, use multi-stranded copper conductors. Aluminium cabling will not be accepted.

Minimum Sub-Circuit size: 2.5mm2 for power and 1.5mm2 for lighting circuits.

Minimum Sub-Main and Consumers Mains size: As shown on the drawings accompanying this specification. In any case, they shall be sized to the maximum circuit protection device rating on the circuit, and shall not be sized any less to those shown on the drawings.

Sub-Circuit cable types: Unless otherwise specified use cabling with V-90 (PVC) insulation and PVC sheath, or R-HF-110 (Elastomer) insulation and HFS-110-TP (Elastomer) sheath for fire and life safety services.

~~VSD equipment (for Chilled Water Pumps, Condenser Water Pumps and Cooling Tower): Olex Varolex VSD/EMC from VSD to equipment.~~

Sub-Main/Consumers Mains cable types: Unless otherwise specified use X-90 (XLPE) insulation and PVC sheath, or R-HF-110 (Elastomer) insulation and HFS-110-TP (Elastomer) sheath for fire and life safety services.

Underground cables: Use X-90 (XLPE) insulation and PVC sheath cable in underground enclosures unless specified otherwise.

~~47.~~26.2 CABLE INSTALLATION

Standard: To AS 3000.

Manufacturers' recommendations: Unless otherwise specified, install, terminate and joint cables in accordance with manufacturers' recommendations.

Terminations: Terminate each circular multicore cable, and each single core TPS cable of greater cross section than 35mm2, using a nonferrous gland at each end of each cable. Provide non-ferrous gland plates for all single core cables.

Handling cables: Handle cables so as to avoid damage to insulation and serving or sheathing. Report all damage and replace or repair damaged cable as directed.

Straight-through joints: Unless unavoidable due to length or difficult installation conditions, run cables for their entire route length without intermediate straight-through joints. Locate and carry out approved joints as directed. Cable joints and junctions shall not be accepted unless approved by the Engineer prior to installation.

Commented [PC62]: Section will need to be amended for a non-PVC installation

Commented [PC63]: Lighting circuits can be 1.5mm2 in residential applications

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Commented [MS64]: Cable specifications may need to be modified in installations where there non-PVC cabling is required.

Installation: Install and adequately support fixed wiring as specified throughout the installation. For cabling routes not specified in detail, submit a proposed route layout and gain approval prior to ordering cables or support equipment. All multi-phase circuits with single conductors shall be installed in trefoil configuration, strictly in accordance with the requirements of AS 3008.

All underground cables that form part of different electrical installations (such as separately metered installations) to be installed in separate conduits.

Should cabling require to be painted for concealment, the cabling shall be installed within a suitably sized conduit, with only the conduit painted in the desired colour. Under no circumstances shall cabling be painted.

Conductors:

Identification: For fixed wiring colour the conductor insulation as follows:

- Active conductors in single phase circuits: RED.
- Active conductors in polyphase circuits:
  - A PHASE - RED
  - B PHASE - WHITE
  - C PHASE - BLUE
- Neutral conductors - BLACK
- Earth conductors - GREEN with YELLOW stripe
- Switched active conductors to and between fittings: WHITE
- Other conductors: To AS 3000.
- Sheathing: White for single phase and orange for 3-phase.

Tagging: Identify multicore cables and trefoil groups at each end and at crowded intermediate points by means of stamped, non-ferrous tags, clipped around each cable, or trefoil group. Tagging shall identify circuit details, equipment serviced and cable specification.

~~47.3~~6.3 DOUBLE INSULATED WIRING

Conceal all cabling, and utilise the loop-in, loop-out system with all joints being effected at outlets only. Obtain approval for the location of any junction boxes and joint cables in an approved manner and in an accessible location.

~~47.4 MIMS CABLES~~

~~Requirement: Install the cable in accordance with the manufacturer's recommendations using tradesmen trained in the particular technique. Maintain the manufacturer's seals until the joint or termination is about to be made.~~

~~Seal Type: Approved proprietary heat-shrink seals.~~

~~Temporary seal: Fit a temporary seal to the open end of any cable cut and not immediately terminated.~~

~~**47.4** Terminations: Fit a termination seal at each end of the cable run as soon as the cable has been cut to length, stripped back, and the moisture driven out.~~

~~Through joints: Do not use through joints unless approved. Approved joints shall be in accessible locations.~~

~~Sheath earthing: Where MIMS cables enter metal enclosures, eg. switchboards, earth the sheath to a non-ferrous plate secured to the enclosure. Where the sheath terminates at the plate, fully insulate, properly colour code, and cleat the conductors to the enclosures.~~

~~Bonding: Bond the metal sheaths of single core cables in a multi-phase circuit using proprietary earth bonding clips or clamps. Check circulating currents at full load and fit additional earth bonds where necessary.~~

~~Separation: Separate served MIMS cables by a minimum of 25 mm from TPS cables and PVC conduits. Separate unserved MIMS cable from TPS cables, conduits and ducts by a minimum of 50mm.~~

~~Dissimilar metals: Do not allow metals, other than those similar to the metal sheath, to touch the cable sheath. Where other metals are likely to touch the metallic sheath use a protective barrier of paint, PVC or similar material between them.~~

~~PVC serving: PVC serve MIMS cables unless otherwise specified.~~

~~Eddy currents: Arrange single core cable entries into ferrous metal enclosures using brass gland plates to minimise eddy currents.~~

~~Testing: Test the insulation resistance at the time of termination, and 24 hours later; the resistance at either of these tests shall not be less than infinity.~~

~~Three phase arrangements: Run three phase single core conductors in trefoil arrangement. Limit the effects of electromagnetic radiation.~~

~~Vibration: Where cables are to be connected to any item of equipment which vibrates, loop the cables adjacent to the point of connection.~~

~~Supports: Use only non-magnetic metallic supports for MIMS cables. Do not use PVC or plastic supports under any circumstances.~~

~~47.2~~06.4 COPPER CONDUCTOR TERMINATIONS

Requirement: Unless otherwise approved, terminate copper conductors to equipment, other than small accessory and luminaire terminals, by means of compression-type lugs of the correct size for the conductor, compressed only by the correct tool.

Within switchboards and equipment: Install all conductors within slotted ducts. Neatly bend each conductor to enter directly into the terminal tunnel or terminal stud section, allowing sufficient slack for easy disconnection and reconnection.

Identification ferrules: Where core identification is required, fit to each core durable numbered ferrules permanently engraved with numbers and/or letters to suit the specified connection diagrams.

Spare cores: Terminate and identify any spare cores into spare terminals.

~~47.2~~16.5 CHASING

Chasing is not permitted as part of these works.

Commented [PC65]: Generally included for all new projects, with the remainder of this section removed.

~~Carry out all chasing as necessary.~~

~~Chases shall be saw-cut, hand chasing will not be permitted.~~

~~Do not chase horizontally.~~

~~Do not chase structural beams or columns, or face work.~~

~~Obtain approval for the location of all chases before commencement.~~

~~Minimise chasing depth to allow a maximum render and set coat of 15mm. Obtain the structural engineer's approval for any chases of depth exceeding 40mm.~~

~~Contractors shall note that chasing may not be permitted in some heritage listed areas. This does not relieve the contractor's responsibility to provide a fully concealed cabling installation unless prior approval is obtained. Utilise underfloor spaces or reverse sides of walls in these instances.~~

~~Chase locations shown on the drawings accompanying the specification, show minor access requirements only and do not indicate the entire chasing requirements for the project.~~

~~Heavy duty conduit: Enclose all wiring in chases in continuous heavy-duty conduit to allow for future re-wiring.~~

~~47.3~~16.6 CONDUITS GENERALLY

Minimum sizes: Metallic and non-metallic conduits: 25mm.

Galvanised water pipe: Medium or heavy tube to AS 1074, 25mm nominal minimum bore.

Fixings: Utilise dual fixing conduit saddles. Single fixing conduit saddles are not acceptable. Maintain fire rating of all wall surfaces.

Do not use explosive-powered or similar fixing equipment unless approved.

To woodwork: Conduit matching saddles and round head plated steel wood screws.

To masonry: Galvanised saddles and round head plated steel screws screwed into approved metallic expansion devices. Wooden plugs, explosive powered fixings and adhesive fastenings are not permitted.

To steelwork: Plated steel metal-thread screws. Drill and tap the steelwork for each saddle.

Support: Unless otherwise specified, fix conduit saddles at a maximum of 1 m intervals in both horizontal and vertical runs. Ensure that installed conduits are fully supported during construction.

Lengths: Up to the commercially obtainable conduit lengths of run, install conduits without joints. Remove all rags, burrs, and sharp edges from each length before completing each conduit joint. Fit moulded plastic screwed bushes to the free ends of metallic conduit runs before installing the conductors.

Inspection fittings: Inspection fittings and the like shall be accessible.

Draw-in boxes: Provide draw-in boxes at suitable intervals not exceeding 30 m in straight runs, and at intervals not exceeding 25 m in other runs including directional changes.

Underground boxes: Fit draw-in boxes installed underground with gasketted covers and seal them against entry of moisture.

~~47.32~~6.7 CONCEALED CONDUITS

Route of run: Provide conduits in all concealed in wall chases, embedded in floor slabs and installed in inaccessible locations, direct between points of termination with a minimum number of sets. Do not conceal conduit fittings. Install conduits so as to allow future rewiring of the cabling system.

Location: Locate conduits run in concrete slabs entirely within the structural slab. Do not run conduits in concrete toppings.

Steel conduit: Steel conduit shall be galvanised if run in concrete slabs.

Fixing: Fix conduits directly to the reinforcing where the conduits pass above a single layer of reinforcing, or fix midway between double layers of reinforcing. Route the conduits in slabs so as to avoid crossovers and to keep the number of conduits in any one location to a minimum. Space conduits 75 mm apart in slabs.

Attendance at pours: Ensure that conduits are not displaced, broken, or damaged during concrete pours.

~~47.33~~6.8 NON-METALLIC CONDUITS AND FITTINGS

Type: Unless otherwise specified, use heavy duty conduits. Associated fittings shall be of the same material as specified for the conduit.

Joints: Use cemented joints. Adopt the manufacturer's recommended procedure for making joints.

Fittings: Use inspection-type fittings in accessible and exposed locations.

Conduit setting: At site, apply heat to form sets in UPVC conduit. Bends shall be of large radii and, after setting, shall maintain effective diameter and shape. Conduit sets distorted by kinks, wrinkles, flats or heating will be rejected.

Expansion joints: Install flexible couplings where structural expansion joints occur in buildings and in straight runs not embedded in wall chases or floor slabs. Install conduit saddles close to the flexible coupling in a manner which allows free movement for expansion and contraction.

Mechanical damage: In situations where the conduit is exposed to mechanical damage and external to buildings, provide mechanical protection to UPVC conduit for a height of not less than 3 m above ground or platform level.

47.346.9 FLEXIBLE CONDUIT

Type: Use PVC flexible heavy-duty conduit with protective outer sheath with associated fittings unless otherwise specified.

Use: In addition to its use on expansion joints, fit flexible conduit to equipment and plant subjected to vibration or where necessary for adjustment or ease of maintenance.

Length: The maximum length of a flexible conduit connection shall be 600 mm. Obtain approval for lengths greater than 600mm.

47.356.10 OTHER WIRING ENCLOSURES

Ducting:

Type: Powder coated Galvanised steel minimum 1.0mm thick with firmly fitting screw fixed cover.

Entries: Round off sharp edges and provide PVC bushes or the like for cable entries into metallic ducting.

Support: Rigidly support the duct in all locations (minimum 300mm intervals).

Surface Mounted PVC Ducting:

Type: White rectangular mini-duct with firmly fitting slide on cover type 'Clipsal' or equivalent. Provide end caps as required and ensure all cabling is completely concealed. Paint ducting to match surrounding surfaces and make good any visible surface penetrations.

Support: Rigidly support using double sided tape and screws with screw intervals no greater than 150mm apart.

47.366.11 CABLE TRAYS AND LADDERS

Support system: Bends, connectors, trays, ladders, brackets, and other supports necessary to make a complete cable or conduit support system shall be of the same manufacture, sized to adequately support the installed cabling.

General: All cables greater than 50mm2 cross sectional conductor area, shall be supported via cable tray. All cable runs that require greater than 2 catenaries in a single run shall be supported via cable tray.

Steel trays: Perforated pre-galvanised.

Minimum steel thickness:

- Trays up to 150mm wide: 1.0mm
- Trays from 150mm to 300mm wide: 1.2mm

- Trays over 300mm wide: 1.6mm

Folded edge: Minimum height 20 mm, radiused.

Slotting: Normal or reverse with no burrs or sharp edges on the side to which cables are attached.

Construction: Manufacture cable ladder trays and cable ladder from two folded steel or extruded structural grade aluminium side rails with cable support rungs between the two rails spaced at intervals of not more than 300mm (ladder) and 100mm (ladder trays).

Small cable: Do not run cables smaller than 13mm outside diameter on the cable ladder unless continuously supported.

Cable fixing: Slots or ladder rails shall be suitable for fixing cable ties, strapping or saddles. Communications cabling shall be fixed with Velcro cable ties.

Bend radius: Bends shall have a minimum inside radius of not less than twelve times the outside diameter of the largest diameter cable carried. Bends shall be manufactured by the supplier. The contractor shall not modify trays or ladders to provide bends.

Spare capacity: Provide sufficient space on the tray or ladder for not less than 20% more cables or conduits than specified, irrespective of sizes indicated on the drawings. The sizes and quantities nominated on the drawings are indicative, and are to be confirmed by the Electrical Contractor based on final cable quantities, sizes and locations.

Route: Cable tray routes shown on the drawings accompanying this specification are shown indicatively, and are to be confirmed by the Electrical with reference to conditions on site and the Structural Engineers drawings. In any case, cable trays shall be run parallel and perpendicular to the building structure.

Access: Position the support system to give adequate access for inspecting, replacing, or adding cable.

Support: Provide support brackets of the cantilever type (ie. one side of the bracket left open), cold galvanised after fabrication. Mount brackets to manufacturer's recommendations, with no appreciable sag between supports.

Cable strapping: Fix cable to the support system by proprietary nylon ties, straps or saddles, at 500 mm centres for vertical runs and 1000mm centres for horizontal runs. Use nylon ties for smaller cables (up to 15mm diameter single core cables, 25mm multicore cables), non-magnetic saddles or strapping for larger cables. All data cabling shall be fixed to cable trays with Velcro cable ties.

Cable protection: Provide a slightly curved support surface under cables leaving the tray or cable ladder to protect the cable sheath from impingement by the tray or ladder edge.

Mechanical Protection: Where cables are installed in such a manner that they may be vulnerable to impact provide cable tray lids.

Clearance: Maintain at least 200 mm clearance from hot water pipes 500 mm clearance from boilers or furnaces, and 100 mm clearance (minimum) from all other services.

Segregation: Segregation from electrical, communications, security etc. cabling shall be maintained in accordance with the relevant standards. Cabling can be reticulated on the same cable trays, provided a fixed partition (barrier) is installed to the cable tray.

Earthing: Earth all cable trays, ladder trays and ladders in accordance with the requirements of AS/NZS 3000 and ACMA technical standards.

47.376.12 CATENARIES

Construction: Provide commercial manufactured catenaries as follows:

Properly rated for the weight of the cabling to be installed.

Provide uniform support throughout cable length.

Be fixed at each end.

Capable of withstanding any mechanical stresses within the environment installed.

Consist of material equally resistant to corrosion and deterioration.

2.7mm minimum diameter.

1.5kN minimum break force.

Zinc coated.

Cables themselves shall not be used as catenaries.

Installation: Install catenaries as follows:

Provide no more than 3 groups of 5 bundles cables to each catenary.

Provide hangers at 1000mm intervals.

Shall be supported off the Building structure, and not off other plant and/or equipment.

Installed so as to run parallel and/or perpendicular to building structure.

Cable fixing: Nylon cables ties shall be provided for fixing electric cabling, and Velcro cable ties shall be provided for communications cabling at 500mm intervals.

Clearance: Locate cabling 100mm from moving parts of any equipment operating at elevated temperature.

Earthing: Earth all catenaries in accordance with the requirements of AS/NZS 3000 and ACMA technical standards.

49.0 FIRE RATED CABLING AND SUPPORTS

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Standard: To AS 3000 and AS/NZS 3013.

General: Provide supports for fire rated cabling as follows:

Comply with the requirements outlined in AS/NZS 3000 Appendix A and Appendix H.

Shall be certified and tested in accordance with AS/NZS 3013.

Cables shall be installed in accordance with the requirements outlined in AS/NZS 3013 in order to ensure a fully certified cable support system is provided.

Cables shall be fixed at maximum 1200mm centres using certified steel clips. Nylon cable ties will not be accepted.

Arrange in single layer or trefoil groups for side entry or exit. Protect cables from damage at entries.

Avoid unnecessary cable crossovers and maintain minimum 30% spare support width.

Where cabling is not able to achieve the required fire rating provide additional fire rated enclosure to achieve the require FRL.

Commented [MD66]: No fire rated cabling indicated on docs

SWITCHGEAR & CONTROLGEAR ASSEMBLIES (SCA)

~~60.17~~.1 SCOPE

Outline description: The work covered by this section of the specification includes the following:

Provision of new main switch board and distribution boards and auxiliary panels throughout the installation including enclosures and internal switching and control equipment.

~~60.27~~.2 DESIGN CRITERIA

Design SCA to comply with the following minimum criteria:

Main Switch Board No(s)		
Designation(s)	–	MSB
Maximum Dimensions	–	~~(insert)~~2200 mm Wide x ~~(insert)~~400 mm Deep x ~~(insert)~~2000 mm High
Rating	–	~~(insert)~~400 Amps, 3 phase, 415 Volts
Degree of Protection	–	IP56~~(insert)~~ Non-combustible material in accordance with BCA requirements
Installation	–	~~(select)~~ Indoor ~~or Outdoor~~, Free-standing ~~or Wall Mounted~~within cupboard.
Fault Rating	–	~~(insert)10~~ 20 kA for 1 second
Form Factor	–	~~(select)~~ Form ~~1 or~~ 2 ~~or 3bih or with metal barriers~~
Chassis Size	–	As shown
Connection	–	~~(select)~~ Front ~~or Rear~~ connected
Incoming Cable Entry	–	~~(select) Above or~~ Below via gland plate
~~Incoming Cable Reticulation~~	~~–~~	~~Below via gland plateSurface mounted on vertical cable tray, and enclosed in metallic top hat cover from switchboard opening to 100mm above ceiling level.~~
		~~Duct cover shall be powder coated to match switchboard, and shall maintain switchboard IP rating for the full extent of its length.~~
		~~Constructed to AS/NZS 3013 WS Classification – WS- xxxxx~~
Outgoing Cable Exit	–	~~(select)~~ Above and~~/or~~ b~~B~~elow via gland plates
~~Outgoing Cable Reticulation~~	~~–~~	~~Underground via conduit.~~Above and below via cable tray.
Plinth	–	Painted galvanised 75mm steel channel
~~DIN Rail~~	~~–~~	~~Required to suit CBus Lighting Control Hardware + 30% Spare~~
Accessories	–	Internal time clock
	–	Exit/Emergency Lighting push-button test facility

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Commented [MS67]: Rename as applicable

Commented [MS68]: Provide maximum switchboard dimensions

Commented [PC69]: Generally IP42, IP54 minimum in fire egress paths, IP56 in plant room areas or wet areas.

Commented [MS70]:

Commented [PCH71]: Amend notes to reflect specific installation requirements.

Commented [MS72]: Remove if not required within MSB

		Gate meter provisions for inset metering network on incoming supply
Paint Colour	–	~~(select) or T~~to approval of Architect
Rating/ Nameplates	–	To front door of Main Switchboard(s)
Doors	–	~~(select)~~ Required ~~or Not required~~, ensure minimum 600mm clearance around door swing in accordance with AS3000 requirements and SAPN Service and Installation Rules section A.4.3.4.7. ~~Provide barn door arrangement as required.~~

Commented [AD73]: Remove if not using an inset metering network

Commented [MS74]: Remove / Modify to suit non-South Australian projects

Distribution Board(s)

Designation(s)	–	~~DB.1~~MPB
Maximum Dimensions	–	~~(insert)~~1800 mm Wide x ~~(insert)~~500 mm Deep x ~~(insert)~~2000 mm High or to suit available accommodation
Rating	–	~~(insert)~~250 Amps, 3 phase, 415 Volts
Degree of Protection	–	~~Generally IP42, IP52 minimum in fire egress paths,~~ IP56 ~~- in plant room areas or wet areas.~~ Non-combustible material in accordance with BCA requirements
Installation	–	~~(select)~~ Indoor, ~~or Outdoor, Free-standing or Wall Mounted as indicated on the contract drawings, provide flushing frame,~~free-standing colour to match switchboard as required.
Fault Rating	–	~~(insert)~~20 kA for 1 second
Form Factor	–	Form 1
Chassis Size	–	Sized to accommodate all circuits shown plus 30% spare space
Connection	–	Front connected
Cable Entry / Exit	–	Above and below via gland plates and cable bushes
~~Cable Reticulation Above Switchboard~~	~~–~~	~~Surface mounted on vertical cable tray, and enclosed in metallic top hat cover from switchboard opening to 100mm above ceiling level.~~
		~~Duct cover shall be powder coated to match switchboard.~~
		~~Cabling is to be reticulated within wall cavity, with suitable mechanical protection.~~
		~~Constructed to AS/NZS 3013 WS Classification – WS- xxxxx~~
~~Cable Reticulation Below Switchboard~~	~~–~~	~~Surface mounted on vertical cable tray, and enclosed in metallic top hat cover from switchboard opening to floor level.~~
		~~Duct cover shall be powder coated to match switchboard, and shall maintain switchboard IP rating for the full extent of its length.~~
		~~Cabling is to be reticulated within wall cavity, with suitable mechanical protection.~~
		~~Constructed to AS/NZS 3013 WS Classification – WS- xxxxx~~
~~DIN Rail~~	~~–~~	~~Required to suit CBus Lighting Control Hardware + 30% Spare~~
Accessories	–	Internal time clock
	–	Exit/Emergency Lighting push-button test facility
Paint Colour	–	~~(select) or t~~To approval of Architect
Rating/ Nameplates	–	To front door of all distribution boards

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Commented [PCH76]: Amend notes to reflect specific installation requirements.

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Doors	–	Over all operational sections, ensure 600mm clearance around door swing in accordance with AS3000 requirements. Provide barn door arrangement as required.

Load Centre(s)

Designation(s)	–	LC.1
Maximum Dimensions	–	to suit available accommodation
Make	–	Clipsal '4FC' series or equal approved.
Rating	–	To match upstream circuit breaker unit rating and/or isolator (whichever the greater)
Degree of Protection	–	IP33 internally
Installation	–	Recessed with flushing frame. Provide 3mm thick steel plate behind enclosure.
Fault Rating	–	6 kA RMS Symmetrical (conditional)
Form of Segregation	–	Form 1
Connection	–	Front connected
Chassis Size	–	Sized to accommodate all circuits shown plus 30% spare space
Cable Entry / Exit	–	Above and below
Cable Reticulation	–	Cabling shall be reticulated within wall cavity with suitable mechanical protection.
		Constructed to AS/NZS 3013 WS Classification – WS- xxxxx
Colour	–	White
Doors	–	Required

Commented [PCH78]: Amend notes to reflect specific installation requirements.

~~60.3~~7.3 EXTERNAL DESIGN

REQUIREMENT: Provide an enclosure comprising panels, doors and the like, giving the specified enclosure, segregation and degree of protection as specified.

- Design and Construction: To AS/NZS 61439.
- Degree of Protection: To AS/NZS 1939 & AS/NZS 60529

Supporting Structure: Fabricate supporting frames from rolled, cold formed or extruded metal sections, with joints fully welded and ground smooth. Provide concealed fixing or brackets located to allow the assembly to be mounted and fixed in the specified location without removal of equipment.

Panels: Machine fold sheet metal angles, corners and edges with a minimum return of 25mm around the edges of front and rear panels, and 13mm minimum return edge around doors. Provide stiffening to panels and doors where necessary to prevent distortion or drumming.

Equipment Fixing: Provide equipment mounting panels fixed to threaded metal inserts located inside the enclosure at the rear of the mounting panels.

Lifting Provisions: Provide fixings in the supporting structure, and removable attachments, for lifting switchboard assemblies where floor-mounted. Provide switchboards in sections as required to enable installation in their final location.

Floor-Mounting: Provide a galvanised steel plinth channel, not less than 75mm high, for mounting the complete switchboard assembly on site. Drill sufficient clearance holes for 12mm diameter bolts, in the switchboard and the plinth, to rigidly fix the switchboard assembly to the plinth and the plinth to the floor.

Wall-Mounting: For flush or semi-flush switchboards: Provide a facing flange, of the same material and finish as the enclosure, and of a section which incorporates a return allowing the outside edge to fit neatly against the wall. For switchboards located on external walls, provide angled top to prevent water from pooling.

Minimum flange width: 32mm

Cable Entries

Provide sufficient clear space within each enclosure, adjacent to the cable entries, to allow the incoming cables and wiring to be neatly run and terminated, without overcrowding.

For cable entry and internal distribution, provide cable entries of not less than 100mm depth by the full width of cubicle space which is unrestricted by equipment or internal wiring.

Provide to each entry a removable gland plate fitted with a gasket to maintain the specified degree of protection.

Cable bushes for all entering and exiting cables (bunches of cables) to provide a close fit around cabling in accordance with the requirements of AS/NZS 3000. Seal cable entries to provide a close fit in all instances and to maintain the switchboard protection rating.

Doors

Maximum Width: To suit accommodation or as specified

Maintain 600mm clearance around distribution boards with equipment racked out and doors open. Provide barn door arrangement and/or bi-folding doors to enclosures as required to achieve this requirement. Alternative door construction shall not compromise the fit and finish or degree of protection of the switchboard.

Minimum Door Swing: Through 135□ minimum or 180□ where located in corridors.

Hang doors on heavy-duty chromium-plated block hinges which allow easy removal of the door when in the open position.

Ensure all doors operate smoothly and without sticking or creaking and close/latch with nominal clearances.

Provide a chromium plated lever-type handle to each door, operating a latching system with latching bar and guides. Key to 604 code.

Commented [MS79]: Amend if client has particular locking requirements

Provide roller rods to all boards incorporating a 3-point locking system.

Number of keys required: 3 with engraved identification labels

Smoke Seals: Provide a resilient strip seal, of foamed neoprene or the like, around each door, housed in a suitable channel or housing and fixed with an approved industrial adhesive.

Seal contact: Positive contact with a flat surface of the enclosure at least as wide as the seal strip.

Provide door stiffeners to each door with diagonal length greater than 900mm.

Escutcheon Plates

Requirement: Provide hinged removable escutcheon plates with the front of the circuit breakers protruding through neat cut-outs. Provide cut-outs for all spare space allowances. Fit insulated clip-in infill panels to each spare pole space. This escutcheon plate shall provide a flush surface between the edges of the distribution board case. Fit chromium plated lifting handles to each escutcheon plate.

Rigidity: The escutcheon panel shall be not less than 1.6mm thick and must be rigid. Stiffen or brace the panel as necessary to achieve this rigidity.

Frame: Provide a continuous 12 mm wide support frame for the fixing of each escutcheon plate, including additional support where necessary to prevent panel distortion.

Fixing: Fix each plate to the frame with metal fixings held captive in the plate and spaced uniformly.

Maximum Height: To suit accommodation or as specified.

Hanging: Hang escutcheon plates on hinges which allow opening through a minimum of 120□ and permit the removal of the escutcheon when in the open position.

Cable Duct

Requirement: Provide internal cable ducting sufficient to house cables for maximum board capacity without restricting closure to duct cover.

Minimum size: Cable duct to be a minimum of 70mm wide for all boards and minimum of 100mm for boards with a total capacity greater than 60 poles.

~~60.4~~7.4 BUSBARS

Requirement: Provide a three (3) phase busbar assembly with high conductivity electro tinned copper busbars designed for a maximum current density of 1.5 A/sq.mm from the termination of the incoming unit to the line side of the protective equipment for outgoing circuits.

Provide each distribution switchboard segment with a busbar assembly suitable for a minimum 100A take-off at any point.

Future Extensions: Pre-drill the main busbar assembly for future extension and extend busbar droppers to spare locations. Drill each dropper to suit connection of future equipment of the same type as that specified.

Cross Section: Radius edges and corners to prevent damage to insulation.

Support: Provide support sufficient to withstand without damage the maximum prospective fault currents. Do not support busbars from circuit breaker terminals.

Jointing: Make busbar joints with high tensile bolts and nuts, locked in position with lock nuts or locking tabs. Tighten bolts to the manufacturer's recommendation with a tension wrench. Do not use tapped holes and studs or the like for jointing current-carrying sections.

Insulation: Insulate busbars as follows:

Active and neutral busbars: Fully insulate the busbars with suitable plastic insulation of appropriate colours to designate phases. Busbar assemblies shall be red, white, blue phases from left to right when viewed from the front of the switchboard. Maintain phase colours (and rotation) throughout the installation.

Joints: Insulate either by taping or plastic coating, as follows:

Taped joints: Apply a non-adhesive stop-off type tape, coloured to match the specified colour coding, half lapped to achieve a thickness of not less than that of the solid insulation.

Plastic-coated joints: Apply, in accordance with the manufacturer's recommendations, and to a minimum thickness equal to that of the solid insulation, an air-drying plastic coating material which achieves a tensile strength in excess of 17MPa, and a minimum elongation of 300%.

Colour Coding: Colour the insulation as follows:

Active busbars: Red, white or blue.

Neutral busbars: Black where applicable.

Earth busbar: Green and yellow where applicable.

Neutral Busbar: Extend the neutral busbar into each switchboard compartment containing outgoing circuits with neutral connections. Provide terminals or drill the busbar for neutral connections.

Identification: Clearly mark and number terminal connections.

~~60.5~~7.5 NEUTRAL AND EARTH LINKS

Location: Locate neutral and earth links within 600mm of each cable entry unless written approval of greater spacing is obtained.

Connections: Provide stud connections for cables of cross section 16mm2 or larger.

Identification: Clearly mark and number terminals. Numbers on circuit breakers, neutral link and earth link for each circuit shall correspond.

Terminals: Provide a separate dual screw neutral terminal and earth terminal for each circuit breaker pole or fuse on each switchboard section. Provide additional terminals for future circuits.

Clearances: Provide 100mm (minimum) wiring channel between neutral and earth links and switchboard sheetmetal enclosure. Provide adequate clearance or insulating barrier between links and all live conductors.

~~60.6~~7.6 FINISHES

Surface Preparation: Where metal surfaces are to be painted, prepare them appropriately to avoid corrosion, and to withstand the relevant environmental conditions.

Paint Systems: For indoor locations use system not inferior to FULL GLOSS, SOLVENT-BORNE: INTERIOR - PAINTING. Colours are to be provided to AS 2700, to the approval of the Architect.

PAINT COLOURS: To AS 2700, to be approved.

~~60.7~~7.7 SWITCHGEAR

Requirement: Provide mains switching, outgoing circuit switching, motor and equipment controls and starters, protection, setting and auxiliary equipment as shown on the Drawings.

~~60.7.1~~7.7.1 MOULDED CASE CIRCUIT BREAKERS (MCCBS)

General

Moulded Case Circuit Breakers shall comply with AS3947-2 and IEC947-2. The breaking capacity performance certificates shall be available for category B to the above mentioned standard where applicable. The test shall be carried out under the breaking performance during operation (Ics) and under the admissible short time withstand.

The ultimate breaking capacity of the circuit breakers shall be at least equal to the prospective fault level at the point of the distribution system where the breakers are installed, unless the limitation capacity of an upstream breaker allows cascading.

The rated service breaking capacity (Ics) shall be a minimum of 50% of the ultimate breaking capacity (Icu). The rated withstand of the breaker shall be equal to the rated service capacity.

For MCCBs up to 630Amps, the service breaking capacity (Ics) shall be 100% of the ultimate breaking capacity (Icu).

All Moulded Case Circuit Breakers shall be designed for horizontal or vertical mounting without any adverse effect on electrical performance.

It shall be possible to reverse feed the breaker without reduction performance.

Moulded Case Circuit Breakers shall be fixed, plug-in or withdrawable models and in 3 pole or 4 pole versions as nominated.

The breakers shall have a rated operational voltage of 690V AC (50/60Hz) and rated insulation voltage of the circuit breakers shall be 750V AC (50/60Hz).

The Moulded Case Circuit Breakers shall provide Class II insulation (to IEC 664) between the front and internal power circuits.

Select circuit breaker trip curve types to suit the connected equipment, including coordinating with the Mechanical Trade for motors, pumps, fans and the like instantaneous and running load current characteristics.

Setting

All adjustable circuit breakers are to be set at the values shown on the drawings accompanying this specification. The Electrical contractor is responsible for setting of MCCB on site to specified values as shown on the accompanying drawings.

Cascading and Discrimination

All protection devices shall be selected to enhance discrimination and avoid cascading between upstream and downstream devices. It shall be arranged so that only the protection device immediately upstream of the fault shall operate to clear the fault.

Construction

Operating mechanism shall be of the quick make, quick break type, with the speed of operation independent of the operator, and mechanically trip free from the operating handle so as to prevent the contacts from being held closed against short circuit and overload conditions. The operating mechanism shall be constructed to operate all poles in a multi pole breaker simultaneously during opening, closing and tripped conditions.

The breakers shall be operated by a toggle or handle which shall clearly indicate the three fundamental positions ON, OFF and TRIPPED.

If required, rotary handles shall be fitted to the breaker.

Moulded Case Circuit Breakers shall be available in normal, high and limiting ranges.

Moulded Case Circuit Breakers of the same range shall have a common depth.

The standard operating mechanism shall provide positive break indication ie: -

- The operating mechanism shall be designed such that the toggle or handle can only be in OFF position if the power contacts are all actually separated.
- Isolation shall be provided by a double break on the main circuit.

The breakers shall provide double insulation from the front face allowing field installable auxiliaries without isolating the unit.

It shall be possible to lock the circuit breaker in the “isolated” position only with the use of a locking device and padlocks.

Protection units

All MCCBs shall be fitted with RMS sensing electronic trip units.

The trip units of MCCBs shall be easily interchanged with standard tools.

All electronic components shall withstand temperatures up to 125oC.

All settings on trip units shall have provision for sealing. Where circuit breakers as nominated to be sealed, the adjustable controls shall be concealed behind an escutcheon sealed with authority tags or otherwise.

Universal electronic trip units shall provide:

- Long time protection with adjustable time delay
- Short time protection with adjustable time delay
- Instantaneous protection
- All with adjustable thresholds

All universal trip units will incorporate a load monitoring function.

It shall be possible to install the following options without increasing the circuit breaker volume:

- high threshold earth-fault protection
- load monitoring with adjustable threshold
- LEDs to indicate the cause of tripping
- data transmission via a BUS

~~All breakers from 1250A to 3200A shall be fitted with trip units of the solid state interchangeable type.~~

Characteristics

The solid state protection unit shall have as required: -

- Long time protection adjustable from 0.4 to 1 times sensor rating (In).
- Short time protection adjustable from 3 to 6 times the setting made on the long time protection: time delay (when required) adjustable for discrimination with downstream MCCBs.
- Instantaneous threshold set at 35kA.
- Earth fault protection (when required) adjustable from 0.2 to 0.5 times the long time protection setting; adjustable time delay from instantaneous to 0.3s.

The circuit breaker shall provide positive break indication.

When required, motor operated mechanism with or without fault lockout, shunt trip, undervoltage release, auxiliary switches (up to four changeover contacts) and a tripped signal contact shall be provided. Each of these units shall incorporate a pre-wired terminal strip which is accessible from the front of the breaker without removing the cover.

Operation

All circuit breakers shall be provided with the facility for padlocking or keylocking in the open position.

It shall be capable of being used in conjunction with a visible break isolation switch to become one integral unit.

Electronic Trip MCCBs shall be possible to field test the trip units utilizing a secondary injection test kit.

Circuit breakers shall have clearly accessible from the front face:

- Markings of rating
- Marked as suitable for isolation
- "Push to trip" test button to test operation of poles.
- Contact position indication

Auxiliaries and Accessories

All accessories and electrical auxiliaries shall be manufactured in such a way that they can be easily field fitted without adjustment.

The breakers will have a double insulation of the front face allowing field installable auxiliaries without isolating the unit.

All electrical auxiliaries shall be equipped with built-in control terminals. All internal electrical auxiliaries shall be of snap-in type.

It shall be possible to fit the Moulded Case Circuit Breaker with a motor mechanism without affecting the circuit breaker characteristics.

All electrical auxiliaries shall be separated from power circuits and their addition shall not increase the volume of the circuit breaker.

It shall be possible to retrofit a residual current device (RCD) directly to the existing circuit breaker enclosure.

It shall be possible to equip the circuit breakers with devices indicating faults without tripping the circuit breaker.

Miniature Circuit Breakers

Standards: To AS 60974.2 for fault capacities of 10 kA or more. To AS/NZS 3111 for miniature overcurrent circuit breakers up to 1000 A current rating and less than 10 kA fault capacity.

Type: Provide circuit breakers which are true DIN rail mounted of "Schneider Electric" manufacture (or equal approved).

Provide non-standard curve type circuit breakers for all mechanical or refrigerative plant. Alternatively increase the size of circuit breakers and sub-circuit cabling to allow starting currents in accordance with AS/NZS 3000. Provide combined MACB/RCD circuit breakers where nominated, having a tripping current imbalance of 30mA within 300ms complying with AS/NZS 3190. MACB/RCD circuit breakers shall utilise a single pole space (alternatively increase pole spaces within distribution boards to suit).

~~60.7.2 AIR BREAK SWITCHES~~

~~Standard: To AS/NZS 3133 and AS/NZS 3100.~~

~~Category: 1 to AS/NZS 3100.~~

~~60.7.5~~7.7.2 CONTROL, TEST SWITCHES AND EQUIPMENT - SCA

Standard: To AS 60947

Rated operational current: Not less than 6 A at 230 V a.c. at utilisation category AC-11.

Degree of protection: Not less than the degree of protection specified for the switchboard.

~~60.7.6~~7.7.3 CONTACTORS

Standard: To AS 60947

Type: Block type, air break, DIN rail mounted and labelled.

Rated operational current: Not less than the full load current of the load controlled.

Rated duty: Uninterrupted (continuous).

Minimum size: 20 A at 415 V a.c.

Utilisation category: Not less than AC-3 or DC-3 as applicable.

Mounting: Mount the contactor with sufficient clearance to other equipment and to its enclosure to allow full access for maintenance, removal and replacement of coils and contacts, without the need to disconnect wiring or remove other equipment.

Interconnection: Do not connect contactors in series or parallel to achieve the specified ratings.

~~60.7.7~~7.7.4 FUSES WITH ENCLOSED FUSE LINKS

Standard: To AS 6029

Manufacture: Provide fuse-holders and fuse-links or equal to GEC Red Spot manufacture.

Fuse-holder: Mount the fuse-holders so that the fuse carrier may be withdrawn directly towards the operator and away from live parts, and provide fixed insulation which shrouds all live metal when the fuse carrier is withdrawn.

Fuse-links: Enclosed, high rupturing capacity (HRC) type mounted in a fuse carrier. Provide a 'fuse blown' indication which is visible when the link is fitted to its carrier. Where necessary for safe removal and insertion of the fuse carrier, provide extraction handles and mount them on clips within the spares cabinet.

Spares: Provide a minimum of 3 spare fuse-links for each size of fuse-link on each switchboard. Mount the spares on clips within the relevant switchboard.

~~60.8.0 SWITCH-ISOLATOR AND COMBINATION FUSE-SWITCH UNITS~~

~~Standard: To AS 60947.1 and AS/NZS 3947.3.~~

~~Operation: Independent manual operation including positive ON/OFF indicator and with interlocked door and retractable handle. Provide a facility to lock the unit in the OFF position.~~

~~Shrouding: Effective over range of switch positions.~~

~~Design: Totally enclosed unit incorporating arc control devices and shrouded stationary contacts. Double make and break, silver-plated contacts and plated copper terminals.~~

~~Auxiliary Contacts: As shown or required.~~

~~Labelling: Provide engraved labelling on front of fuse-switch units to indicate actual fuse cartridge rating, the maximum rating and the load they supply.~~

~~Fault make/fault break switch-isolators~~

~~Rated breaking capacity: To AS/NZS 3947.3 Table 3.~~

~~Rated short-time withstand current: To AS 60947.1 clause 4.3.6 and the manufacturer's recommendation to meet the prospective fault current conditions applying.~~

~~Rated short-circuit making capacity: To AS 60947.1 clause 4.3.6 and the manufacturer's recommendation to meet the prospective fault current conditions applying.~~

~~Rated short-circuit breaking capacity: To AS 60947.1 clause 4.3.6 and the manufacturer's recommendation to meet the prospective fault current conditions applying.~~

~~Load make/load break switch-isolators~~

~~Rated breaking capacity: To AS/NZS 3947.3 Table 3.~~

~~Rated short time withstand current: To AS 60947.1 clause 4.3.5 and the manufacturer's recommendation to meet the current conditions applying.~~

~~Rated making capacity: To AS 60947.1 clause 4.3.5 and the manufacturer's recommendation to meet the current conditions applying.~~

~~Rated breaking capacity: To AS 60947.1 clause 4.3.5 and the manufacturer's recommendation to meet the current conditions applying.~~

~~Fuse links: Isolate when switch contacts are open. Provide 3 phase sets of high rupturing capacity (HRC) fuse links.~~

~~60.26.0 SURGE REDUCTION FILTER~~

~~Standard: To IEC 61643-11~~

~~General: Provide surge reduction filters to distribution boards as shown on the accompanying drawings, and incorporating the following characteristics:~~

~~Nominal Voltage: 22-230V (single phase)~~

	~~380V (three phase)~~
~~Maximum Continuous Operating Voltage:~~	~~275VAC, 350VDC (single phase)~~
	~~440VAC, 580VDC (three phase)~~
~~Maximum Discharge Current:~~	~~As shown on accompanying drawings at 8/20µS~~
~~Status Indicator:~~	~~Mechanical Flag and auxiliary.~~
	~~LED indicator with buzzer to exterior of enclosure.~~
	~~Surge counter.~~
	~~Contact for BMS connection~~
~~Upstream Protection:~~	~~Provide 100A circuit breaker upstream, or as recommended by manufacturer~~
~~Installation:~~	~~DIN Rail~~
~~Manufacture:~~	~~Erico or equal approved~~
~~Make/Type:~~	~~TSG Series equal approved~~

~~60.62.0 SURGE DIVERTERS~~

~~Standard: To IEC 61643-11~~

~~General: Provide surge diversion to distribution boards as shown on the accompanying drawings, and incorporating the following characteristics:~~

~~Nominal Voltage:~~	~~22-230V (single phase)~~
	~~380V (three phase)~~
~~Maximum Continuous Operating Voltage:~~	~~275VAC, 350VDC (single phase)~~
	~~440VAC, 580VDC (three phase)~~
~~Maximum Discharge Current:~~	~~As shown on accompanying drawings at 8/20µS~~
~~Status Indicator:~~	~~Mechanical Flag and auxiliary.~~
	~~LED indicator with buzzer to exterior of enclosure.~~
	~~Surge counter.~~
	~~Contact for BMS connection~~
~~Upstream Protection:~~	~~Provide 100A circuit breaker upstream, or as recommended by manufacturer~~
~~Installation:~~	~~DIN Rail~~
~~Manufacture:~~	~~Erico or equal approved~~
~~Make/Type:~~	~~TDX100m Series equal approved~~

~~60.98.0 AUTOMATIC TRANSFER SWITCH (ATS)~~

~~General~~

~~The automatic transfer switch shall be of the mechanically held type, mechanically and electrically interlocked to exclude any possibility of paralleling the normal and emergency sources. The manual operation shall be controlled by user interface and key operation as a minimum.~~

~~To ensure continuity of service both circuit breakers shall have two stable positions, CLOSED and OPEN. It shall be possible to manually operate each circuit breaker in event of the absence of control voltage.~~

~~For maintenance purposes, the transfer switch shall have a neutral position with both breakers in the OPEN position. It shall also be possible to lock each circuit breakers in the OPEN position.~~

~~Each breaker of the transfer switch shall be equipped with auxiliary contacts and alarm contacts, if required. Electrical interlocking for lockout after fault shall be provided. A ready-to-close contact shall also be provided to ensure that a close signal is not given to the standby breaker unless the following conditions are present:~~

- ~~the breaker is open~~
- ~~the stored energy mechanism is charged~~
- ~~the mechanism is correctly reset~~
- ~~the breaker is not locked off~~
- ~~no opening order is present~~

~~The automatic transfer switch shall normally be 3 pole/3 pole type unless otherwise specified.~~

~~Construction~~

~~The following items shall be included in the ATS as standard:~~

- ~~Time delay for emergency to normal~~
- ~~Engine start signal on normal supply failure~~
- ~~Voltage sensing on normal supply (3-phase)~~
- ~~Control logic protective devices~~
- ~~Five position selector switch~~

~~The ATS shall include two motor operated circuit breakers up to 1,250 Amps.~~

~~The ATS shall include 2 (or 3) basic air circuit breakers, of fixed or drawout versions up to 6,300 Amps. All operations of the air circuit breakers shall be by a stored energy mechanism. It shall be possible to fit and maintain the mechanical interlock on site, and to have access to all components from the front. The interlocking shall be achieved with either rigid rods (vertical interlocking) or by Bowden cable (horizontal interlocking).~~

~~60.98.0~~ ACCESSORIES, INSTRUMENTS, METERS

Electricity Metering Equipment

Standards: To AS 62053.22

Test links: Provide test links for the connection of calibration instruments and meters and for the shorting of current transformer secondaries. Energy meters, maximum demand meters and ammeters, where specified, shall each be provided with a set of links comprising screw-clamped slide links and an earth link.

Current transformers

Standards: AS 60044.1

Accuracy classification and class: To be provided as follows:

- Energy measurements: 0.5M.
- Indicating and recording instruments: 2M.
- With 5A Secondary.

Rated short-time current: Not less than the short-time current equivalent of the potential fault capacity of the circuit in which the current transformer is installed.

Current transformers shall not be installed over MIMS cabling.

Retailer Meters

Provide retailer meters to meet the requirements of the Electricity Supply Authority and AEMO (Australian Energy Market Operator). Retailer meters shall be installed in accordance with the Victorian Electricity Service and Installation Rules.

The Electrical Contractor shall liaise with the Electricity Supply Authority to determine the correct meter type required to site.

Multi-Function Meters

- Characteristics:
  - Provide multi-function meters capable of monitoring the following functions:
    - Voltage (line to line, line to neutral) per phase.
    - Current per phase.
    - Thermal demand current, 15 minute averaging.
    - kW, kVAr, kVA.
    - Power factor.
    - Frequency.
    - Sliding window demand for kW, kVA.
    - Individual and total harmonic distortion to 15th harmonic.
    - Total harmonic distortion (THD).

All above values shall be presented in real time, minimum and maximum.

- Protocols:

- Modbus RTU (RS485 interface 2-wire)

- BMS:
  - Provide all necessary interfaces to ensure full compatibility with the BMS.

Commented [PC80]: May need to be changed depending on BMS type.

Modbus IP, Lonworks, BACnet

Commented [PC81]: Remove when there is no BMS.

Kilowatt Hour Meters

- General:
  - Provide kWh meters having digital LCD display, with a 200ms/kWh (or less) remote signalling pulse. Meter shall be DIN rail mounted, and be of "Schneider Electric PowerLogic" series or equal approved. Electrical Contractor shall provide CT's as required by the manufacturer.
- Revenue Class:
  - Where nominated on the drawings, provide revenue class kWh check meters suitably selected for the on-selling of Electricity. Meters shall be capable of measuring the following functions:
    - Voltage (line to line, line to neutral) per phase.
    - Current per phase.
    - Thermal demand current, 15 minute averaging.
    - kW, kVAr, kVA.
    - Power factor.
    - Frequency.
    - Sliding window demand for kW, kVA.
    - Individual and total harmonic distortion to 15th harmonic.
    - Total harmonic distortion (THD).

All above values shall be presented in real time, minimum and maximum.

All revenue class meters shall be NMI approved under AEMO Rules and Regulations.

- Testing:
  - Check and verify operation, calibration and correct output of meters. Provide test results to the Engineer for approval prior to commissioning of the switchboard.
- Labelling
  - Marking: To AS/NZS 3000. Marking shall include labels for each switchboard control, circuit designations and ratings, fuses fitted to fuse holders, current-limiting fuses, warning notices for operational and maintenance personnel, and the like.
- Location:
  - Screw-fix each label adjacent to its relevant item of equipment, but not on the equipment.
- Material:
  - Two-colour laminated plastic Traffolyte.
  - Colours:
    - Warning notices: White letters on red background.
    - Other labels: Black letters on white background.
- Lettering height: Generally not less than the following:
  - Main switchboard designation: 25mm

- Main switches isolators: 20mm
- Submain control switches: 10mm
- Identifying labels: (outside of cubicle rear covers etc)4mm
- Equipment labels within cubicles: 3mm
- Warning notices: 4mm

- Schedule cards: For light and general power distribution provide schedule cards of minimum size A4 with text typewritten to show:
  - Sub-main designation size and rating;
  - Light and power circuit number, type and area supplied;
- Approval:
  - Submit the proposed schedule for approval.
- Mounting:
  - Mount the schedule card in a holder fixed to the inside of the enclosure door, adjacent to the distribution circuit switches, and protect the schedule with a hard plastic cover.

~~61 POWER FACTOR CORRECTION (PFC)~~

~~Standards: AS/NZS 61439, IEC 61921 Ed. 1.0 and IEC 60831-1~~

~~General: Design, construct, supply and install an automatic power factor correction unit including switchgear and controlgear. The equipment shall be capable of achieving no less than 0.98 lagging power factor under all load conditions.~~

~~Design Criteria: The system shall be designed in accordance with the following criteria:~~

- ~~Nominal Operator Voltage: 400V-415V, three phase~~
- ~~Rated insulation Voltage: 690V~~
- ~~Nominal Operating Frequency: 50Hz~~
- ~~Rated Insulation Voltage: 690V~~
- ~~Network Pollution Level: < 15% at 400V-415V~~
- ~~Capacitance Tolerance: 5% to 10%~~
- ~~Power Frequency Withstand Voltage: 2.5kV, 50Hz, 1 minute~~
- ~~Operating Temperature: -5 to 60C~~

~~Construction Criteria: The system shall be constructed with the following criteria:~~

~~Maximum Dimensions~~	~~–~~	~~(insert) mm Wide x (insert) mm Deep x (insert) mm High~~
~~kVAr Rating~~	~~–~~	~~As shown on drawings accompanying this specification~~
~~Number of Steps~~	~~–~~	~~As shown on drawings accompanying this specification~~
~~Degree of Protection~~	~~–~~	~~IP(insert)~~
~~Installation~~	~~–~~	~~(select) Indoor or Outdoor, Free-standing or Wall Mounted~~
~~Form Factor~~	~~–~~	~~(select) Form 1 or 2 or 3bih or with metal barriers~~
~~Connection~~	~~–~~	~~(select) Front or Rear connected~~
~~Incoming Cable Entry~~	~~–~~	~~(select) Above or Below via gland plate~~
~~Plinth~~	~~–~~	~~Painted galvanised 75mm steel channel~~
~~Paint Colour~~	~~–~~	~~(select) or to approval of Architect~~
~~Rating/ Nameplates~~	~~–~~	~~To front door of enclosure.~~
~~Doors~~	~~–~~	~~Required. Ensure 600mm clearance around door swing in accordance with AS/NZS 3000 requirements, provide barn door arrangement as required.~~

~~Gland Plates: Provide removable gland plates for all entries.~~

~~Main Isolator: Provide main isolator to match the maximum setting of the upstream circuit breaker.~~

~~Ventilation: Provide one or more thermostatically controlled fans designed to maintain thermal temperatures to manufacturers requirements. Each fan is to incorporate a removable and washable filter. Generally the fans shall be installed to the base of the unit, with the exhaust provided on top.~~

~~Fuses: Provide a set of HRC fuses for each group of capacitors. There shall be no more than 1 group of capacitors per fuse.~~

~~Harmonic Blocking Reactors: Provide harmonic blocking reactors in series with each step. The series resonant frequency of the circuit shall be design to 189Hz.~~

~~Earthing: Provide earthing of all modules utilising an earth bar within the enclosure.~~

~~Busbar: Provide fully shrouded busbars, which will be rated no less than the maximum circuit breaker rating upstream.~~

~~Contactors: Selected specifically for use with capacitor switching to avoid short circuits within the capacitors banks, and shall be of electromagnetic type. The contactors shall incorporate current limiting resistors to allow the reduction of transient overvoltage, and be capable of a minimum of 300,000 operations at 400V.~~

~~Current Transformers: Current transformers shall be installed in accordance with the manufacturer's requirements, and shall be installed to the location as nominated on the drawings accompanying this specification. Provide Traffolyte label on the relevant switchboards for identifying PFC Current Transformers behind.~~

~~Reactive Power Controller: The reactive power controller shall control the automatic switching of each capacitor step to achieve the desired power factor. The controller shall have the following features:~~

- ~~Minimum of 6 steps~~
- ~~Manual on/off control for capacitors.~~
- ~~Multi-function display indicating stages activated, actual power factor, reactive current, active current and apparent current.~~
- ~~Built in alarm indicator of faults including over current, equipment failure, incorrect power factor, harmonics.~~
- ~~Built in alarm indicator for over temperature, fan failure.~~
- ~~Balanced cyclic use of capacitor steps to ensure uniform usage.~~
- ~~Front panel mounted, and accessible without door removal.~~
- ~~RS485 Modbus outputs for remote monitoring via the BMS.~~
- ~~Shall be of "Schneider Varlogic" manufacture of equal approved.~~

~~Alarm Panel: Provide a power factor correction alarm panel installed outside the Main Switchroom (or an in alternative approved location) for audio-visual alarm in the event of a system failure. The alarm shall incorporate a mute button installed within reach, to disable the audible alarm. The panel shall be appropriately labelled to identify purpose.~~

~~INTER-TRIP UNIT (ITU) SYSTEM~~

~~144.0 GENERAL~~

~~The electrical contractor shall design, construct and install an inter-trip unit system including active equipment and devices, enclosures, electrical and communications cabling, switchgear, controlgear, device licenses, ancillary hardware and software, testing, programming, commissioning, user training and all power supplies as required.~~

~~The new ITU system and supporting electrical infrastructure and controls shall conform to all requirements of the Electrical Supply Authority. The requirements of the Electrical Supply Authority will supersede any requirements of this specification to ensure embedded generation within the network with export facilities is achieved.~~

~~The ITU system shall facilitate and control in coordination with the Electrical Supply Authorities requirements the suitable disconnection of the reciprocating co-generation unit from the Utility network within the required time/cycles due to a network fault occurring or Utility request.~~

~~The receipt of an "inter-trip" signal and permission requests shall control the network operation of the co-generation unit and solar system as requested via the vector shift and ROCOF relay devices as required.~~

~~The electrical contractor shall directly coordinate with the Electrical Supply Authority as required for factory acceptance testing, SCADA communications, system connections, testing and commissioning and all other ancillary works to complete the installation. Solid state microprocessor active equipment is preferred.~~

~~Coordinate with the Electrical Supply Authority for all ITU requirements and arrange testing and commissioning of SCADA communication and protection functions.~~

~~The ITU contactor shall ensure all active equipment and devices for connection to Electrical Supply Authority comprises SCADA Interface as required.~~

~~The Electrical contractor shall coordinate with the electrical and mechanical contractors and ensure the appropriate circuit breaker/load break switch devices are incorporated within the co-generation systems complete with the required communications facilities.~~

~~The Electrical contractor shall coordinate with the mechanical contractor and provide all equipment and control requirements to ensure embedded import/export generation to the Electrical Supply Authorities requirements.~~

~~154.0 FACTORY ACCEPTANCE TESTING~~

~~Prior to the Electricity Supply Authority commencing connections to the project systems, the Electrical contractor shall submit the active equipment for factory acceptance testing. The Electrical contractor will coordinate with the Electrical Supply Authority for undertaking the testing to ensure confirmation and approval the active equipment communicates correctly with the Electrical Supply Authorities equipment.~~

~~FUNCTIONAL DESCRIPTION~~

~~The Electrical contractor shall submit a functional description report as part of the switchboard/schematic approval comprising description not limited to the below as a minimum:~~

- ~~Inter-trip signal received~~
- ~~Inter-trip signal reset~~
- ~~Permission signal granted~~
- ~~Permission signal denied~~
- ~~Manual and auxiliary contactor operation of generator circuit breaker or DB.Generator load break switch~~
- ~~Automatic operation of generator circuit breaker due to overload or fault~~
- ~~Loss of 'Mains' supply~~
- ~~Instatement of 'Essential' supply provided by base building stand-by diesel generator~~
- ~~Reinstatement of 'Mains' supply~~
- ~~Site requirement to operate generator during extended period of 'mains' outage~~

~~168.0 INTERFACE POINTS~~

~~Electrical Supply Authority: Shall be at a terminal strip within the switchroom for the termination of SCADA communications and inter-trip signals. The interface shall be Distributed Network Protocol (DNP3) to be compatible with the Electrical Supply Authority SCADA RTU as the master.~~

~~The inter-trip signal interface shall be adjacent the SCADA communications termination to identify a single point of demarcation of inter-trip and SCADA systems. The electrical contractor shall provide a marshalling panel to contain all interface equipment. External grade optical fibre shall be provided to inter-connect the switchroom marshalling panel to the ITU panel.~~

~~Mechanical Contractor: The mechanical contractor shall coordinate with the electrical and Electrical contractor to ensure the generator comprises the necessary control devices, controller communications and circuit breaker equipment required to connect the generator to the Electrical Supply Authorities distribution network. The coordination shall ensure the generator is synchronised at a location suitable to complete the project works.~~

~~Co-generator Unit Controller: Shall be at the Co-Generation Unit control panel.~~

~~The ITU shall provide and reticulate all cabling and terminations for the above items. Coordinate with the necessary trades for provision of hardware interfaces, timing and location of final terminations.~~

~~174.0 GENERATOR CONTROL~~

~~The generator shall disconnect from the Electrical Supply Authority network during the event of a 'mains' failure and ensure normal operation of the base building stand-by diesel generator and automatic transfer switch is instated.~~

~~The Electrical contractor shall coordinate with the mechanical/generator contractor to ensure that in the event of an 'inter-trip' signal requiring the generator to be instantly isolated from the Electrical Supply Authority, the generator controller limits the generator from over/under speed issues.~~

~~177.0 METERING REQUIREMENTS~~

~~Critical~~

~~The ITU system shall provide the following critical operation data as a minimum to the Electrical Supply Authority SCADA system:~~

- ~~Permission to Connect – Granted/Denied~~
- ~~Generator Circuit Breaker Status~~
- ~~Customer Circuit Breaker~~
- ~~Generator Connected~~
- ~~Alarms as applicable~~

~~Critical signalling I/O shall be a hard wired interface of discrete voltage free signals for digital signals and 0-5mA for analogue signals.~~

~~Non-Critical~~

~~The ITU system shall provide the following non-critical instantaneous generator data as a minimum to the Electrical Supply Authority SCADA system:~~

- ~~Voltage (V)~~
- ~~Current (Amps)~~
- ~~Apparent Power (kVA)~~
- ~~Real Power (kW)~~
- ~~Reactive Power (kVAR)~~
- ~~Power Factor~~

~~Monitoring of solar generation system via a high-level interface to the BMS shall provide the above information on the HLI display. Status of the Vector control and ROCOF relays shall also be represented on the display.~~

~~195.0 NETWORK PROTECTION~~

~~The ITU system shall be capable of receiving an inter-trip signal from the Electrical Supply Authority SCADA system and disconnect the generator from the network within the required duration.~~

~~The ITU system shall control the connection of the solar system to the network via vector shift and ROCOF relay devices.~~

~~The inter-trip signal from the Electrical Supply Authority shall be via a normally open (N.O.) voltage free contact from the Electrical Supply Authority inter-trip relay located within the 11kV Authorities substation.~~

~~The Electrical contractor shall provide the source voltage for activating the contact from the switchroom emergency distribution board.~~

~~200.0 CUSTOMER CONTROLS~~

~~The ITU system shall provide the ability to trip/disconnect the generator or customer circuit breaker. The trip/disconnect shall be via manual operation and/or via an auxiliary protection relay to a motorised circuit breaker devices. The Electrical contractor shall provide the necessary equipment to facilitate both operating methods.~~

~~Trip/disconnect shall not be facilitated by the active equipment.~~

~~203.0 LOCATION OF ITU EQUIPMENT~~

~~The ITU equipment shall be located within a dedicated section/tier of DB.Generation at Ambulatory level within the lift services motor room. The Electrical contractor shall coordinate with the electrical contractor to define the requirement of area required.~~

~~Some termination equipment is required by the Electrical Supply Authority to be located within the Gresham Street car park for a discrete demarcation point between the Authority and project works. The terminations shall be provided within a lockable wall mounted enclosure to suit.~~

~~206.0 STATUS INDICATION~~

~~The ITU system shall provide LED status indicators mounted on the ITU/DB.Generation door to indicate status of function description items in Section 8.4 and critical metering items in Section 8.6.~~

~~An operable HMI interface shall be provided adjacent the LED status indicators complete with operable buttons or touch screen functionality. The HMI interface shall provide manual control facilities for adjusting system set points. Password access shall be required for all manual operations and data set-point adjustments.~~

~~The HMI shall provide access to all high level data available from the co-generator control panel, stand-by diesel generator, Electrical Supply Authority communications networks, solar system and status of necessary circuit breaker/load break switch devices.~~

~~210.0 BMS COMMUNICATIONS~~

~~The Electrical contractor shall coordinate with the BMS contractor and provide a high level interface and associated communications cabling to the BMS (Modbus/Ethernet preferred). The BMS shall display the status of items indicated in Section 8.10 for site monitoring purposes.~~

~~Control of the ITU system from the BMS is not required.~~

~~213.0 BACKUP POWER SYSTEM~~

~~The ITU system shall comprise an uninterruptable backup power system capable of supporting the required systems including the HMI for a minimum of 8hours. The uninterruptable backup power system shall include a 'mains' battery charger for full reinstatement of battery availability within 4 hours of 'mains' reinstatement.~~

~~The backup power system shall be capable of notifying the HMI/BMS of any system faults of alarms.~~

~~216.0 USER TRANING~~

~~The Electrical contractor shall provide a 1off user training session for building management and site maintenance personnel. The user training shall cover an overview of the system, the function, operating requirements and support details as a minimum.~~

~~218.0 MAINTENANCE AND OPERATING MANUAL~~

~~The ITU shall complete a full detailed description of all components, maintenance requirements and operational instructions within a dedicated ITU system Maintenance and Operation Manual. Provide copies of all test results, as-built drawings, electrical COCs, Electrical Supply Authority compliance and connection certificates and other applicable information.~~

~~A draft manual shall be submitted 3 weeks prior to practical completion for review and upon receipt of review comments, the manuals shall be finalised and 3off copies to be provided by practical completion stage.~~

~~ENERGY MONITORING SYSTEM (EMS)~~

~~225.0 GENERAL~~

~~The EMS contractor shall provide a new energy monitoring system (EMS) and power monitoring devices including current transformers, monitoring devices, wiring systems terminations, ethernet gateways, device licences, software packages, coordination with the BMS trade for access and installation of new software platforms, reporting and logging, preparation of graphical displays, user training and testing, programming and commissioning of the EMS systems.~~

~~Provide all cabling, termination, distribution board equipment including shorting links and terminations for all services including but not limited to electrical, mechanical and hydraulic services.~~

~~228.0 COORDINATION AND ASSOCIATED WORKS~~

~~In addition to the works nominated in the Electrical Documentation, the EMS contractor shall include the following:~~

- ~~Wiring and final connection at all monitoring devices including electrical power meters, mechanical VSDs, hydraulic gas meter and all other associated devices and equipment to complete the installation~~
- ~~Provision of device licences, software packages, coordination with the BMS contractor for access and installation of new software platforms, reporting and logging, preparation of graphical displays, user training and testing, programming and commissioning of the EMS systems~~

~~232.0 EMS SYSTEM~~

~~The energy monitoring system shall be equal to 'Schneider ION Enterprise' series.~~

~~The power monitoring devices shall be equal to 'Schneider ION or PM' series meters as nominated in the tender documentation capable of communication with the EMS software platform. Provide all Ethernet gateways, I/O equipment and power supplies to complete the installation.~~

~~235.0 BMS CONNECTION~~

~~Connection of the EMS system to the BMS is required for system and user access.~~

~~The EMS contractor shall coordinate with the BMS contractor to provide access and I/O equipment and other equipment as required to complete the installation.~~

~~238.0 MULTI-FUNCTION METERS~~

~~Characteristics: Provide multi-function meters capable of monitoring the following functions:~~

- ~~Voltage (line to line, line to neutral) per phase.~~
- ~~Current per phase.~~
- ~~Thermal demand current, 15 minute averaging.~~
- ~~kW, kVAr, kVA.~~

~~Power factor.~~

- ~~Frequency.~~
- ~~Sliding window demand for kW, kVA.~~
- ~~Individual and total harmonic distortion to 15th harmonic.~~
- ~~Total harmonic distortion (THD).~~

~~All above values shall be presented in real time, minimum and maximum.~~

~~Protocols: Modbus RTU (RS485 interface 2-wire) or Ethernet~~

~~BMS: Provide all necessary interfaces to ensure full compatibility with the BMS.~~

~~Testing: Check and verify operation, calibration and correct output of meters. Provide test results to the Engineer for approval prior to commissioning of the switchboard.~~

~~253.0 ELECTRICAL SERVICES METERS~~

~~The EMS contractor shall provide and install meters, cabling, terminations and all ancillary devices and equipment to complete the electrical scope of works.~~

~~The EMS contractor shall provide cabling, terminations and all ancillary devices and equipment to complete the scope of works to connect to mechanical and hydraulic meters and other hardware devices.~~

~~A schedule of power monitoring meters and equipment required for the all services is as follows:~~

~~Power Monitoring Unit (PMU) Designation~~	~~Equipment Served~~	~~Location~~	~~Type~~	~~Meter installed by~~	~~Termination at BMS panel by BMS contractor~~
~~PMU-1~~	~~LV Feeder 1~~	~~MSB.1~~	~~ION7350~~	~~EMS Contractor~~	~~Yes~~
~~PMU-2~~	~~LV Feeder 2~~	~~MSB.1~~	~~ION7550~~	~~EMS Contractor~~	~~Yes~~
~~PMU-3~~	~~Tenant Riser 1 (Lvl 3,4,5,6,LR)~~	~~MSB.1~~	~~PM5350~~	~~EMS Contractor~~	~~Yes~~

~~286.0 MECHANICAL AND HYDRAULIC SERVICES DEVICES~~

~~The EMS contractor shall provide cabling, terminations and all ancillary devices and equipment to complete the scope of works to connect to mechanical and other hardware devices.~~

~~A schedule of mechanical variable speed drives (VSDs) and other equipment required for the mechanical services is as follows:~~

~~Designation~~	~~Equipment Served~~	~~Location~~	~~Motor rating (kW)~~

~~PCHWP-3~~	~~Chilled water pump serving chiller 3~~	~~Sub-basement plantroom~~	
~~SCHWP-2~~	~~Secondary chilled water pump serving induction units (L1 to L13)~~	~~Level 17 plantroom~~	~~15~~

~~Gas Monitoring Unit (GMU) Designation~~	~~Equipment Served~~	~~Location~~	~~Type~~	~~Meter installed by~~	~~Termination at BMS panel by BMS contractor~~
~~GMU-1~~	~~Incoming Natural Gas~~	~~Ground External Enclosure~~	~~Gas Meter~~	~~Mechanical Contractor~~	~~Yes~~
~~GMU-2~~	~~CGU-1~~	~~Roof Level~~	~~Gas Meter~~	~~Mechanical Contractor~~	~~Yes~~

~~Thermal Monitoring Unit (TMU) Designation~~	~~Equipment Served~~	~~Location~~	~~Type~~	~~Meter installed by~~	~~Termination at BMS panel by BMS contractor~~
~~TMU-1~~	~~Supplementary FCUs~~	~~Level 2~~	~~Thermal~~	~~Separate Contract~~	~~Yes~~
~~TMU-2~~	~~Supplementary FCUs~~	~~Level 3~~	~~Thermal~~	~~Separate Contract~~	~~Yes~~

~~348.0 REPORTING~~

~~The EMS Software shall be capable of delivering the following information instantaneously on command by the operator:~~

~~All available metrics from metering devices including but not limited to:~~

- ~~PMUs - kWh, kVA, kWe, kVAR, PF, Amps, Volts~~
- ~~TEMs - kWh, T1, T2, Flow (L/s)~~
- ~~GMUs - MJ~~
- ~~VSDs - kWh, kVA, kWe, PF, Amps, Volts~~
- ~~Log and record all data associated with metering devices on a 60 second interval minimum or as provided by the metering unit, whichever is less~~
- ~~Onboard storage for a minimum 36 months including the ability to download data for long term storage~~
- ~~User defined time period (eg. minutes, hours, days, months, years)~~
- ~~User defined date range with calendar selection~~
- ~~User defined selection of each metering device~~
- ~~User defined selection of each metric~~

348.0 ~~Generate reports in excel file based on the specific user selections (including a new column for each metric selected, time and date)~~

- ~~Generate graphs with time on horizontal axis and metrics on vertical axis based on the specific user selections~~

~~The EMS contractor shall provide all necessary reporting to suit the requirements of building management and NABERS/sustainability systems engineer.~~

~~348.0 UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM~~

~~366.0 GENERAL~~

~~Design, manufacture, supply and installation of a three-phase continuous duty, on-line, double conversion, solid state Uninterruptible Power Supply (UPS) system incorporating the following items and systems:~~

- ~~UPS frame containing rectifier(s), inverter(s), battery charger(s), static by-pass, and associated control and monitor panel.~~
- ~~Battery string(s), external cabinets.~~
- ~~Integrated passive/active cooling system.~~
- ~~Instrumentation including warning lights and alarms, electrical interlocks and earthing.~~
- ~~Operating Maintenance Manuals.~~
- ~~Testing and Commissioning.~~

~~Include all supports, fixings and the like to suit the operational system.~~

~~375.0 OPERATIONAL DESCRIPTION~~

~~UPS Modes of Operation: The UPS shall operate as an on-line, fully automatic system in the following modes:~~

~~Normal~~

~~Utilising commercial AC power, the critical load shall be continuously supplied by the Inverter. The Inverter shall power the load while regulating both voltage and frequency. The Rectifier shall derive power from the commercial AC source and shall supply DC power to the Inverter. Simultaneously, the Battery Charger shall charge the battery.~~

~~Battery~~

~~Upon failure of the commercial AC power, the critical load shall continue to be supplied by the Inverter, which shall obtain power from the batteries without any operator intervention. There shall be no interruption to the critical load upon failure or restoration of the commercial AC source.~~

~~Recharge~~

~~Upon restoration of the AC source, the Charger shall recharge the batteries and simultaneously the Rectifier shall provide power to the Inverter. This shall be an automatic function and shall cause no interruption to the critical load.~~

~~Bypass~~

~~If the UPS must be taken out of the Normal mode for overload, load fault, or internal failures, the static bypass switch shall automatically transfer the critical load to the commercial AC power. Return from Bypass mode to Normal mode of operation shall be automatic. No-break transfer to and from Bypass mode shall be capable of being initiated manually from the front panel.~~

~~Energy Saver~~

~~The UPS shall continuously monitor the voltage and frequency of the bypass source. When the source parameters are within acceptable limits, the UPS will utilise a minimal/optimal combination of its internal subsystems to ensure acceptable power is always delivered to the critical load, at a system efficiency of 99% or greater, over the range of 50% to 100% load. The Energy Saver System shall be enabled by the user, and shall be adjustable. It shall incorporate a "High Alert Mode" to automatically (without user intervention) provide maximum power conditioning any time bypass source variation levels exceed pre-set, adjustable limits. When Energy Saver System is utilised, the UPS must attenuate ANSI C62.41 type line transients to within IEC and ITIC limits. The Energy Saver System shall be able to distinguish between upstream (utility) faults and downstream (load) faults, and react appropriately to protect and support the critical load, without interruption.~~

~~Manual Bypass~~

~~The UPS shall include an internal/external manual maintenance bypass switch that shall enable safe access to internal major assemblies whilst the load is supplied by mains power.~~

~~389.0 CODES AND STANDARDS~~

~~The installation shall comply with all relevant codes and standards to the approval of the Principal, including the following:~~

- ~~AS 3000 — Wiring Rules~~
- ~~AS 3008 — Electrical Installations – Selection of cables~~
- ~~AS 3011 Set — Electrical Installations – Secondary batteries installed in buildings~~
- ~~AS 3731 Set — Stationary batteries – Nickel-cadmium~~
- ~~AS 4029 Set — Stationary batteries – Lead Acid~~
- ~~AS 60146 Set — Semiconductor converters~~
- ~~AS 61000 Set — Electromagnetic compatibility (EMC)~~
- ~~AS 62040 Set — Uninterruptable power systems (UPS)~~
- ~~CE-Mark~~

~~400.0 PERFORMANCE CRITERIA~~

~~Modular, scalable and hot swap critical power system. The system can be set internal 0,1,2 redundant UPM. UPM can be added into the system on line mode. UPS Continuous Ratings. The UPS shall be rated as per table below:~~

~~UPS Frame rating~~	~~200kW~~
~~UPS Static Bypass Rati++ng~~	~~200kW~~

~~UPM rating~~	~~25kW~~
~~UPM number (selection)~~	~~1-8~~

~~Output power ratings are based on 25 kW rated uninterruptible power modules (UPMs). A single UPS cabinet can house different UPM modules to get ratings of 25-200 kW.~~

~~The UPS shall feature internal redundancy if the load is less than the rating of N-1 power modules of 25kVA/25kW each.~~

~~UPS frame Rating (max) is the maximum output possible from the UPS (for a load power factor range of 0.8 lagging to 0.8 leading). The UPS shall not require de-rating when supporting a leading power factor load of 0.8 or greater.~~

~~Rectifier / Charger Input:~~

~~Nominal three-phase input voltage: 400 Vac (380Vac/400Vac and 415Vac selectable): 4-wire plus ground~~

~~Operating input voltage range: +20%, -15% of average nominal input voltage at full load and +20%, -40% of average nominal input voltage at half load without battery discharge.~~

~~For 50Hz systems, operating input frequency range shall be 46 to 54Hz.~~

~~Input power factor 0.99 lagging.~~

~~Normal input current limit: The UPS shall have the following programmable input current limit settings while operating in normal mode:~~

- ~~Rectifier/charger input current limit shall be adjustable from 100 to 115% of full-load input current.~~
- ~~Battery input current limit shall be adjustable from 5% to 20% of the UPS full load input current.~~

~~On generator input current limit: The UPS shall have the following programmable input current limit settings while operating in normal mode on generator:~~

- ~~Rectifier/charger input current limit shall be adjustable from 100% to 115% of full load input current.~~
- ~~Battery recharge input current limit shall be adjustable from 5% to 20% of the UPS full load input current.~~

~~Input current total harmonic distortion (THD) shall be less than 3% at nominal line voltage and 5% nominal source impedance.~~

~~Power walk-in: Ramp-up to full utility load adjustable from 10 amps per second to 1 amp per second.~~

~~Bypass Input~~

~~Synchronising bypass voltage range shall be +10, -15% of average nominal input voltage.~~

~~Synchronising bypass frequency range is +/- 0.5hz to +/- 4hz, user adjustable, and is centred on the nominal frequency. Default setting is +/- 4hz.~~

~~Slew rate: 1 Hz per second, maximum.~~

~~Input surge withstand capability: The UPS shall be in compliance with IEEE 587 (ANSI C62.41), category A & B (6kV).~~

~~Rectifier / Charger Output:~~

~~Nominal DC voltage shall be adjustable from 540VDC (480 VDC open circuit battery voltage) to 486VDC (432 VDC open circuit battery voltage).~~

~~Steady state voltage regulation shall be +/- 0.5%.~~

~~Voltage ripple shall be less that 0.5% (peak-to-peak).~~

~~Capacity: The rectifier/charger shall support a fully loaded inverter and recharge the battery to 90% of its full capacity within 10 times the discharge when input current limit is set at maximum.~~

~~Low line operation: The rectifier/charger shall be capable of sharing the DC load with the battery when the input voltage falls below the specified operation input voltage range, the On Battery indicator shall enunciate operation in this mode.~~

~~DC sensing: Redundant DC voltage sensing methods shall be incorporated for providing battery over-voltage protection.~~

~~Battery charger characteristics: The UPS battery charging system shall have the following characteristics:~~

- ~~The charger shall be capable of being configured for several charge modes including:~~
  - ~~A charging mode that increases battery life by allowing the battery to rest, reducing positive plate corrosion~~
  - ~~A charging mode floating the battery at a set level, which can be adjusted via software, used for flooded cell applications~~
    - ~~Nominal Float Voltage: 2.31 V per cell.~~
    - ~~Equalising Voltage: 2.35 V maximum per cell (adjustable).~~
- ~~UPS will automatically adjust battery shutdown based upon loading and battery capacity.~~
  - ~~The UPS shall automatically adjust the final discharge voltage between 1.67 and 1.75 Volts per cell based on the existing load and the rate and length of discharge.~~
  - ~~The absolute minimum operational voltage is 1.67 V per cell (adjustable).~~

~~UPS Output in Normal Mode~~

~~Nominal output voltage 380/400/415V, 3 phase, 4 wire plus ground at the UPS output terminals.~~

~~Steady-state voltage regulation (in inverter) shall be within +/- <1% average from nominal output voltage.~~

~~Transient voltage response shall be per EN62040-3, Class 1, (< +/- 5% from nominal voltage for 100% load step, full load re-transfers and full load drop on battery).~~

~~Transient voltage recovery shall be compliant to CBEMA/ITIC Class 1.~~

~~Linear load harmonic distortion capability: Output voltage THD of less than 1% for 100% linear load.~~

~~Non-linear load harmonic distortion capability: Output voltage THD of less than 5% for 100% non-linear load when tested using the non-linear load described in IEC 62040-3 connected line to neutral.~~

~~Line synchronisation range shall be +/- 4Hz, adjustable to+/-0,5 Hz.~~

~~Frequency regulation shall be +/- 0,01Hz free running.~~

~~Frequency Convention, 50Hz to 60Hz, vice versa~~

~~Frequency slew rate shall be 1 Hz/second maximum (adjustable).~~

~~Phase angle control:~~

- ~~Balanced linear load shall be <1 degree from nominal 120 degrees~~

~~Phase voltage control:~~

- ~~Balanced linear loads shall be +/- 1% from average phase voltage~~
- ~~Unbalanced linear loads shall be less than <2% from average phase voltage for 100% load unbalanced~~

~~Overload current capability (with nominal line and fully charged battery):~~

- ~~Double Conversion mode: The unit shall maintain voltage regulation for 102% to 110% of resistive/inductive load for 10 minutes, 111% to 125% for 60 seconds, and 126% to 150% for 10 seconds, >150% for 300ms~~
- ~~Stored energy mode (typically on battery): The unit shall maintain voltage regulation for 102% to 110% of resistive/inductive load for 10 minutes, 111% to 125% for 60 seconds, and >125% for 300ms~~
- ~~Energy Saver System operation: Continuous = 110%. Transient = 1000% peak current for 10ms.~~
- ~~On bypass: Continuous = 125%. Transient = 1000% peak current for 10ms.~~

~~Short-circuit capability: 2.5x In for 400ms, derated models 2.5 x In for 400ms~~

~~Fault clearing current capability: see section 13 above.~~

~~Static transfer time, inverter to bypass: No break, completed in less than 4ms.~~

~~Static transfer time, Energy Saver to inverter: No break, completed in less than 4ms maximum, typically <2ms.~~

~~Acoustical noise: Noise generated by the UPS under normal operation shall not exceed 60dbA at one metre from any operator surface, measured at +25 degrees Celsius and full load, per ISO 7779 standard.~~

~~EMI Suppression: IEC 62040-2 C3~~

~~Electrostatic discharge (ESD): The UPS shall meet IEC61000-4-2 level 3; 4kV contact/8kV air discharge.~~

~~Efficiency: The UPS incorporate 3-level power converter design for highest possible efficiency. Efficiency shall be greater than 96%.~~

~~Environmental Requirements~~

~~The UPS shall withstand any combination of the following external environmental conditions without operational degradation:~~

- ~~Operating Temperature: +5 degrees C to +40 degrees C continuous without de-rating (excluding batteries).~~
- ~~Storage Temperature: - 25 degrees C to + 55 degrees C. Prolonged storage above +40 degrees C will cause rapid battery self-discharge.~~
- ~~Relative Humidity (operating and storage): 5-95% non-condensing.~~

~~Elevation:~~

- ~~Operational: 1000m maximum without de-rating. De-rate by 1% for every 100m above 1000m, to a maximum of 2000m.~~
- ~~Transportation Capable of air transport, up to 15,000m. excluding batteries~~

~~489.0 FEATURES~~

~~The UPS shall consist of the following standard components:~~

~~491.0.0 UNINTERRUPTIBLE POWER MODULE (UPM)~~

~~The modular design of the UPS shall permit safe and fast removal, incremental and replacement of the UPM, while in on-line or bypass mode. Mean time to repair (MTTR) for the module shall be no more than 10 minutes in order to return UPS to normal mode.~~

~~Rectifier/Charger~~

~~The rectifier/charger shall convert incoming AC power to regulated DC output for supplying the inverter and for charging the battery. The rectifier/charger module shall also provide the following:~~

- ~~The rectifier shall be capable of drawing power from the utility with a power factor of 0.99 under nominal conditions.~~
- ~~The rectifier shall feature protection circuitry that prevents the IGBTs from sourcing current in excess of their published ratings.~~

~~Inverter~~

~~The inverter shall feature an IGBT pulse-width-modulation (PWM) design with high speed switching. The inverter shall also have the following features:~~

- ~~The inverter shall be capable of providing the specified quality output power while operating from any DC source voltage (rectifier or battery) within the specified DC operating range.~~
- ~~The inverter shall feature protection circuitry that prevents the IGBTs from sourcing current in excess of their published ratings.~~

~~501.0.0 PARALLEL SYSTEM CONFIGURATION~~

~~System Configuration~~

~~The system redundancy shall be configurable on UPS level and on UPM level.~~

~~The parallel system shall consist of same system cabinet rating.~~

~~Different power rating can be external paralleled, for redundancy or upgradable objectives.~~

~~The outputs of the XX parallel UPS cabinets shall be connected to the critical bus within the UPS output distribution switchboard or an optional Parallel Tie Cabinet.~~

~~An external maintenance bypass switch shall be located either in a separate enclosure or shall be incorporated in the UPS Output distribution board or System Parallel Module.~~

~~Module Interconnections~~

~~No inter-UPS module signals or control connections shall be required for balanced UPM load sharing.~~

~~No inter-UPS module signals or control connections shall be required for UPS module selective tripping.~~

~~This wireless paralleling method shall not rely on information to be shared between the UPS cabinets or between the UPM's, thereby eliminating the need for inter-UPS communications.~~

~~This wireless selective tripping method shall not rely on information to be shared between the UPS modules.~~

~~The external maintenance bypass switch shall include an interlock arrangement with auxiliary contacts for each UPS to ensure that each UPS is operating on static bypass before the external maintenance bypass switch is closed.~~

~~UPS Performance During Normal Operation~~

~~The UPS cabinets in the parallel UPS system shall not have a master/slave relationship.~~

~~Wireless selective tripping and load sharing shall eliminate a controls single point of failure.~~

~~All UPM's in the parallel system shall share load equally to within <5% when operating normally.~~

~~The UPS shall feature constraints which do not permit it to be continuously operated in a configuration where one UPS is in bypass mode while other UPS's are in inverter mode and all UPS's are connected to the critical bus.~~

~~It shall be possible to continuously load all the UPM's at 100% of the individual UPM power rating. UPS system redundancy shall be lost when the load exceeds the rating of N-1 modules.~~

~~UPS Performance with a Faulty UPM~~

~~In the event of a UPM failure, the failed UPM shall remove itself from the critical bus. The remaining UPM's shall immediately assume the entire critical load or transfer to bypass mode.~~

~~The UPS shall not interrupt the flow of conditioned power to the critical load, if one UPM fails.~~

~~The UPS shall not interrupt the supply of power to the critical load, if a fuse in the bypass circuit blows.~~

~~Load Sharing~~

~~The UPS shall share the critical load between the UPM's equally so that each module's load is always within 5% of the others.~~

~~The UPS shall be capable of providing balanced load sharing without any inter- module connections.~~

~~Each UPM shall need to monitor only its own input and output power in order to remain phase locked with the other UPM's. This wireless paralleling method shall not rely on information to be shared between the modules.~~

~~Selective Tripping~~

~~The UPS shall be able to selectively trip a failed UPM off-line without any inter- module connections.~~

~~Each UPS shall look only at itself to determine if a UPM failure has occurred. If a UPM failure does occur, the faulty UPM shall identify its own internal failure and subsequently remove itself from the critical bus by instantaneously shutting off the inverter and subsequently opening an output relay internal to the UPM. This wireless selective tripping method shall not rely on information to be shared between the parallel UPS's.~~

~~The selective trip method each UPM employs to identify an internal failure, shall require the module to look for changes in module output voltage and output current data relative to recent output current and voltage data.~~

~~If a UPM does isolate itself from the critical bus, due to an identified internal failure, the module shall try three times to restart. If the module successfully restarts and its output is stable and remains within specification limits, it shall resynchronise with the critical bus and automatically reconnect itself to the critical bus. The reconnected UPM shall resume load sharing with the other UPMs and UPM level redundancy shall once again be available.~~

~~The selective trip controls within each UPM shall be independent of the inverter controls. The inverter controls within each module shall also provide selective tripping capability for removing a faulty module from the critical bus.~~

~~The selective trip controls within each UPM shall be continuously monitored to assure they are functioning properly. Failure of a UPM's selective trip controls shall not impair its ability to parallel its output and share the critical load with the other modules. A UPM shall alarm if it determines its selective trip controls have failed.~~

~~535.0.0 STATIC BYPASS~~

~~The bypass shall serve as an alternative source of power for the critical load when an abnormal condition prevents operation in normal mode. The bypass shall consist of a fully rated, continuous duty, naturally commutated static switch for high-speed transfers. Mean time to repair (MTTR) for the module shall be no more than 30 minutes in order to return UPS to normal mode.~~

~~The bypass shall feature the following transfer and operational characteristics. Transfers to bypass shall be automatically initiated for the following conditions:~~

- ~~Output overload period expired.~~
- ~~Critical bus voltage out of limits.~~
- ~~Internal over temperature period expired.~~
- ~~Total battery discharge.~~
- ~~UPS failure.~~

~~Uninterrupted automatic re-transfer shall take place whenever the inverter is capable of assuming the critical load.~~

~~Uninterrupted automatic re-transfers shall be inhibited for the following conditions:~~

- ~~When transfer to bypass is activated manually or remotely.~~
- ~~In the event of multiple transfers/re-transfer operations the control circuitry shall limit "cycling" to three operations in any ten minute period. The third transfer shall lock the critical load on the bypass source, for 60 minutes.~~
- ~~UPS failure.~~

~~Uninterrupted manual transfers shall be initiated from the control panel. Uninterrupted manual transfers to bypass and from bypass shall be possible with the inverter logic. During manual transfers to bypass mode, the inverter must verify proper bypass operations before transferring the critical load to the bypass.~~

~~All transfers to bypass shall be inhibited for the following conditions:~~

- ~~Bypass voltage out of limits (+10%, to -15% of nominal),~~
- ~~Bypass frequency out of limits (+/- 4 Hz, adjustable, factory set)~~
- ~~Bypass out of synchronisation~~
- ~~Bypass phase rotation / installation error~~

~~Static transfer time: No break, typical 2ms, complete in less than 4ms.~~

~~The bypass shall be manually energised using the control panel or remotely through a building alarm input.~~

MONITORING AND CONTROL COMPONENTS

The following components shall provide monitor and control capability:

- Control panel: 7' colour LCD, touch sensitive, with LED status indicators.
- Alarm and metering display.
- Building alarm monitoring.
- Communication ports: RS-232 and USB.

562.0.0 BATTERY MANAGEMENT SYSTEM

The UPS shall contain a battery management system which has the following features:

Charging

The battery management system shall charge the batteries using an intermittent charging cycle. The active battery charger states are constant-current (charge mode), constant-voltage (float mode) and no-charge (rest mode). The charge mode shall equalise and charge the batteries to near full capacity before entering into float mode. In float mode, a constant voltage float charge shall charge the batteries for a minimum of 48 hours or until the batteries are fully charged. The batteries are then put into rest mode.

The battery shall be monitored whilst in rest mode and the charge cycle shall automatically re-start should the battery voltage drop below pre-determined levels. The charging control system shall activate an alarm should the battery capacity drop below the pre-determined levels. The charge cycle will automatically restart after a utility disturbance. The batteries shall not be physically disconnected from the UPS DC bus during the charge cycle and shall be available at all times to supply the inverter.

Self-Testing

The battery management system shall automatically test the battery string(s) to ensure that the battery is capable of providing greater that 80% of its rated capacity. Testing the batteries shall not jeopardise the operation of the critical load. Upon detection of the battery string(s) not capable of providing 80%, the UPS system will alarm that the battery needs attention/replacement. The battery test shall be able to detect the following:

- Open battery string
- Shorted battery string
- Battery capacity (runtime) less than 80% of "new" battery capacity

572.0.0 WIRING TERMINALS

The UPS shall contain terminals (adequately sized to accommodate 90°C wiring) for securing user wiring to the following locations:

- Rectifier/charger input connections (4-wire plus ground)
- Bypass input connections (4-wire plus ground, 400Vac)
- DC link connections for battery cabinets (positive and negative plus ground).
- AC output connections (4 wire plus ground)

~~CABINET OPTIONS AND ACCESSORIES~~

~~The UPS system shall consist of the following options and accessories as required:~~

~~Field upgrades~~

~~Manufacturer shall offer the ability to upgrade the capacity or redundancy of the UPS system on-line in the field. Manufacturer shall offer integrated UPM's that can be added in the field, to increase the capacity or redundancy of a scalable, multi-modular UPS frame. Each scalable, multi-modular UPS frame shall allow upgrading the UPS system to match the power rating of the static bypass using integrated UPM's added in the field.~~

~~Network Adapter and UPS Power Monitoring Software~~

~~Optional PX Gateway card adapter shall provide a communications interface between the UPS and the following network management systems.~~

- ~~SNMP v.1, v.3~~
- ~~Modbus TCP~~
- ~~IPv6~~

~~This capability shall allow the unit to be monitored remotely over an Ethernet network using a standard web browser.~~

~~UPS Power Monitoring Software~~

~~This system shall continuously monitor critical power elements associated with the UPS, using the communications port on each module and a customer furnished PC. The system shall automatically alarm if any problems arise and notify local or remote personnel of the alarm condition via email, page, or text message.~~

~~Relay Card~~

~~Serial dry contact card providing 5 isolated dry output contacts, 1 isolated input.~~

~~592.0 CONSTRUCTION~~

~~Enclosures~~

~~The UPS shall be housed in a free-standing double front enclosure (safety shields behind door) equipped with wheels and levelling feet. The enclosure shall be designed for computer room applications. The front door shall have a lock to prevent unauthorised entry.~~

~~The UPS enclosure dimensions shall not exceed:~~

- ~~Standard 19" 42U IT server rack~~
- ~~3U high/UPM~~

~~Modular construction~~

~~The UPS shall be comprised of:~~

~~25kVA/25kW Universal Power Modules (UPMs), each including the rectifier, inverter, and battery converter power and control circuitry. The UPM can be quickly exchanged or replaced as necessary.~~

- ~~Fan and capacitors can be maintained easily on site.~~

~~Ventilation~~

~~The UPS shall be designed for forced-air cooling. Air inlets shall be on the front of the unit. Air outlet configuration for the UPS shall be exhaust at the rear of the cabinet. 800/500mm of clearance shall be required for proper air circulation at the rear of the UPS.~~

~~Clearance / Access~~

~~Normal serviceable subassemblies shall be modular and capable of being replaced from the front of the UPS (front access only required).~~

~~The system shall require no more than 900mm of front service access room and shall not require side or rear access for service or installation.~~

~~No side clearance shall be required for the system working. The side enclosure covers shall be capable of being located directly adjacent to a wall.~~

~~Cable entry~~

~~Standard cable entry for the UPS cabinet shall be through the enclosure rear top/ bottom.~~

~~610.0~~ ~~CONTROLS AND INDICATORS~~

~~Microprocessor Controlled Circuitry~~

~~The UPS controls shall have the following design and operating characteristics:~~

- ~~Fully automatic operation of the UPS shall be provided through the use of microprocessor controlled Digital Signal Processing. DSP shall eliminate variances from component tolerance or drift, and provide consistent operational responses.~~
- ~~All operating and protection parameters shall be firmware controlled, thus eliminating a need for manual adjustments. The logic shall include system test capability to facilitate maintenance and troubleshooting. Periodic maintenance reminders shall be communicated to the User via the front panel display. Printed circuit board replacement shall be possible without requiring calibration.~~
- ~~Start-up and transfers shall be automatic functions.~~

~~Digital Front Panel Display~~

~~The UPS control panel shall be a 7" touch sensitive, backlit LCD front panel display that includes LED indicators for basic UPS status. Large, luminous, colour coded LED pillars (vertical bars) shall show the UPS status (green, amber, red), and be clearly visible up to 30m from the UPS. The LCD shall display:~~

- ~~UPS status (home screen): the LCD screen shall have a colour coded border (header) that turns red on alarm, and shows basic UPS status in the header of the display, visible at all times. The header shall alternately show UPS status output voltage and battery time remaining, and be visible constantly in all display screens. The home screen shall show~~

~~load level, average efficiency, and power consumption in kWh. The home screen shall show a system mimic diagram with a colour-highlighted power path, operating mode, and active events.~~

- ~~Controls tab: Single button controls for turning the UPS on and off, transfer to/from bypass, and enabling or disabling the battery charger, initiating a battery test, and enabling or disabling Energy Saver System (ESS).~~
- ~~Metering tab: The metering screen shall show voltages currents, temperatures, kW, kVA, and power factor (as applicable) for the UPS input, output, bypass source, and battery. Colour coded (green, amber, red) bar graph indicators will accompany power and temperature measurements~~
- ~~Logs tab: alarm/event queue, active alarms and alarm history, events, status changes and commands, all timed to the 1/1000th second for tracking and analysis.~~
- ~~Statistics tab: Numerically and graphically displays the savings afforded by ESS operation over time.~~
- ~~Settings tab: shall provide button access to user adjustable settings such as, but not limited to: date/time, building alarm designations, communications parameter setup, UPS name, user passwords, and display language.~~

~~Control Panel Lamp Indicators~~

~~The UPS control panel shall provide the following monitoring functions with indicator (icon) LED's:~~

- ~~NORMAL: This green LED shall indicate that the commercial AC utility or generator source is supplying power to the rectifier and the inverter is supporting the critical load.~~
- ~~BYPASS: This amber LED shall indicate that the UPS has transferred the load to the bypass circuit.~~
- ~~BATTERY: This amber LED shall indicate that the commercial AC utility or generator source has failed and the battery is supplying power to the inverter, which is supporting the load.~~
- ~~ALARM: This red LED and the accompanying audible alarm horn, shall indicate that the UPS detects an alarm condition, outlined in detail in the Logs tab from the home screen and in the operator's manual.~~

~~630.0~~ ~~COMMUNICATIONS~~

~~Communications Bay~~

~~The UPS shall be equipped with field configurable communications bays that will accommodate three (3) plug-in communication devices~~

~~Remote Monitoring~~

~~WEB/SNMP communication capabilities will be available for all systems as a standard.~~

~~The UPS shall be able to be monitored remotely via communications devices. UPS manufacturer shall provide optional communications devices capable of communicating via various industry standard protocols such as SNMP, and BACNet (TCP and RS485). Monitoring of UPS status may also be performed through isolated dry contact Form C relays.~~

~~The UPS communication capability should be able to integrate into any industry standard Building Management System (BMS) and/or Network Management System (NMS). The UPS must also be able to be monitored via any standard Internet browser.~~

~~Liaise with the IBS Contractor for connection of the UPS to the IBS for status, event and alarm monitoring.~~

~~All optional hardware interfaces shall be "Hot-swappable" (UPS maintains power to critical applications while changing interfaces).~~

~~Shutdown~~

~~There shall be a mechanism that provides graceful, orderly, unattended, sequential shutdown of one or multiple computers powered by one UPS. This shutdown shall be performed via in-network or out-of-network means. The order of shutdown shall be user-defined, allowing the maximisation of runtime on battery for more critical systems.~~

~~The UPS shall also be capable of interfacing with an operating system's built-in shutdown routine. This shall be done through a cable connection to the communication interface card.~~

~~Notification~~

~~There shall be a mechanism to send alerts to key personnel via email or SNMP traps. An alarm notification may also be sent by a network message.~~

~~644.0 UPS PROTRECTION AND SWITCHGEAR~~

~~25-200kW shall feature UPS rectifier input isolating switch as standard.~~

~~Rectifier/Charger protection shall be provided through individual fusing of each phase.~~

~~25-200kW scalable UPS: should feature the thermal-magnetic moulded-case circuit breaker within the UPS as standard. Battery protection shall be provided by fuses.~~

~~Electronic current limiting circuitry and fuses in the Inverter circuit shall provide output protection.~~

~~649.0 MANUFACTURERS~~

~~Provide a UPS system of manufacture Eaton, Emerson, APC or ABB.~~

~~651.0 TESTING AND COMMISSIONING~~

~~Engage the services of the manufacturer to test and commission the UPS system. As a minimum undertake the following tests:~~

- ~~Pre-energize visit to inspect installation and provide guidance to installers as required.~~
- ~~Post-start-up visit for alarm notification configuration, operator training etc.~~

~~The following procedures and tests shall be performed during the UPS start-up:~~

~~Visual Inspection~~

- ~~Visually inspect all equipment for signs of damage or foreign materials.~~

~~Observe the type of ventilation, the cleanliness of the room, the use of proper signs, and any other safety related factors.~~

~~Mechanical Inspection~~

- ~~Check all the power connections for tightness.~~
- ~~Check all the control wiring terminations and plugs for tightness or proper seating.~~

~~Electrical Pre-check~~

- ~~Check the DC bus for a possible short circuit.~~
- ~~Check input and Bypass power for proper voltages and phase rotation.~~
- ~~Check all lamp test functions.~~

~~Initial UPS Start-up~~

- ~~Verify that all the alarms are in a "go" condition.~~
- ~~Energize the UPS and verify the proper DC, walk-up, and AC phase on.~~
- ~~Check the DC link holding voltage, AC output voltages, and output waveforms.~~
- ~~Check the final DC link voltage and Inverter AC output. Adjust if required.~~
- ~~Check for the proper synchronization.~~
- ~~Check for the voltage difference between the Inverter output and the Bypass source.~~

~~Load Testing~~

- ~~100% resistive dummy load for 10 minutes~~
- ~~50% resistive dummy load for 10 minutes~~
- ~~Transient load test from 50% load to 100% load~~
- ~~Simulated mains power failure~~

~~Operational Training~~

~~Before leaving the site, the field service engineer shall familiarize responsible personnel with the operation of the UPS. The UPS equipment shall be available for demonstration of the modes of operation.~~

STAND-BY DIESEL GENERATOR

682.0 GENERAL

Design, manufacture, supply and install a stand-by diesel generator system incorporating the following items and systems:

- Skid-mounted diesel engine and alternator.
- Exhaust System.
- Acoustic enclosure with access doors.
- Fuel supply pipework to the existing bulk fuel tank. Modifications to the bulk tank to suit the project requirements.
- Automatic Electric starting system.
- Instrumentation including warning lights and alarms, electrical interlocks and earthing.
- Electric transfer controls and mechanical interlocks.
- Vibration isolation.
- Cabling between the engine, alternator and switchgear controls and all auxiliaries.
- Operating Maintenance Manuals.
- Testing and Commissioning.

Include all supports, fixings, penetrations and the like to suit the operational system.

696.0 CODES AND STANDARDS

The installation shall comply with all relevant codes and standards to the approval of the Superintendent, including the following:

Code	Year	Description
AS/NZS 3000	2007	Electrical Installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008	2017	Electrical Installations – Selection of Cables
AS/NZS 3010	2005	Electrical Installations – Generating Sets
AS/NZS 61000 Set	2000	Electromagnetic Compatibility (EMC) set
AS 4594	1999	Internal Combustion Engines
AS 1359	1998	General Requirements for Rotating Machines
AS 1940	2004	Flammable and Combustible Liquids
AS 1692	2006	Steel Tanks for the Storage of Flammable and Combustible Liquids
AS 1055	1997	Acoustics - Description and Measurement of Environmental Noise

738.0 PERFORMANCE CRITERIA

Performance criteria associated with the installation are as follows:

Nominal capacity: 530kVA stand-by

Power factor at site: 0.8

~~**738.0** Minimum capacity: 30% of nominal capacity for 12 hours without degradation of performance~~

~~- Voltage/Frequency:~~	~~415V, 3phase / 50Hz~~
~~- Voltage Regulation:~~	~~± 2.5% - any load over the site rated capacity range~~
~~- Speed:~~	~~Less than 5% of the rated voltage.~~
~~-~~	~~Maximum of any one harmonic of 3%.~~
~~- Governing:~~	~~Electronic governor with load sensing to provide Class A1 governing to AS 2789.4 to provide steady state frequency regulation of ± 2%.~~
~~- Radio Interference:~~	~~In accordance with AS 10044 (Equipment that does not inherently produce radio interference will be preferred).~~
~~- Starting Time:~~	~~Not exceeding 75 seconds.~~
~~- Load Acceptance:~~	~~50% rated load immediately and full rated load within 60 seconds, irrespective of ambient conditions.~~
~~- Fuel Storage:~~	~~Sufficient to allow 12 hours operation at full load.~~

~~**752.0** DIESEL ENGINE~~

~~The engine shall be direct injection diesel type sized to drive the alternator and auxiliaries in accordance with the specified performance criteria.~~

~~The engine shall be fitted with an automatic forced feed lubricating oil system with positive pressure to all working parts. There shall be no moving parts which require lubrication prior to the starting of the engine. The lubricating oil filter system shall incorporate a suction strainer and full flow replaceable element filter designed to remove any particles of size greater than 5 micron. Provide a galvanised drip tray 2.0mm steel) of sufficient capacity to contain all dump oil.~~

~~Provide a replaceable dry type element air filter suitable for minimum 240 hours operation.~~

~~Provide exhaust gas catalytic purification to limit emissions to levels acceptance to EPA.~~

~~Engine cooling shall be via closed loop cooling system utilising an air cooled radiator. The radiator fan shall be sized to ventilate the enclosure as well as provide radiator cooling. The jacket cooling water shall be circulated by a pump driven directly from the engine. Provide suitable coolant in line with manufacturer's recommendations.~~

~~738.0 ALTERNATOR~~

~~The set alternator shall be brushless, self-regulating screen protected type, having axial flow forced air-ventilation and rated to provide overload capacity of 10% for a1 hour.~~

~~Performance:~~

~~Overload:~~	~~1.5 x Full load current for 2 mins.~~
	~~1.1 x Full load current for 1 hour.~~
~~Load Imbalance:~~	~~Up to 20%~~

~~Construction:~~

~~Insulation:~~	~~Class F minimum~~
~~Temperature Rise:~~	~~Class F minimum~~
~~Rotor:~~	~~Salient pole type~~
~~Stator:~~	~~Star connected for 4 wire connection~~
~~Balance:~~	~~Statically, dynamically and electrically balanced for all speeds up to 125% rated speed.~~

~~770.0 ACOUSTIC ENCLOSURE~~

~~Provide a complete galvanised steel weatherproof acoustic enclosure, purpose designed for the specific installation to comply with the following criteria:~~

- ~~Maximum noise level of 70 dB (A) at 7m in any direction~~
- ~~Size and shape to suit this specific location, with access for all normal serving and maintenance.~~
- ~~Complete with internal emergency battery back-up fluorescent light and SSO.~~
- ~~Lifting facilities and manufacture to suit headroom restrictions of the installation.~~
- ~~Air inlet and outlet via acoustic attenuators with absorbent panels of galvanised sheet and sandwich filled with high density material.~~
- ~~Vermin proof.~~

~~778.0 EXHAUST~~

~~Provide an exhaust piping system including all supports, hangers and joints to complete the operational system.~~

~~Size all pipework based on the manufacturer's recommendations for back-pressure and to prevent resonance. Provide all components and pipework to suit the muffler/silencer assembly.~~

~~Provide a silencer system incorporating drain, stop cock and spark arrestor.~~

~~Exhaust pipework and silencer shall be lagged with thermal insulation and clad overall.~~

738.0 Lagging shall be clip-on pipe section pipe section insulation material, with mineral wool or similar, 50mm thick.

The exhaust stack shall be heat resistant grade stainless steel supported by suitably placed brackets with guide sleeves.

Allow for all pipework expansion vertically and horizontally.

Provide a hinged flap to prevent vain ingress.

Provide an accessible exhaust drain point.

788.0 FUEL SYSTEM CONTROLS

The fuel supply work shall include the following:

- Removal of redundant heating oil from the existing site bulk storage tank.
- Cleaning of the tank, suitably to be used as a bulk diesel storage tank.
- Overhaul of existing fuel supply pumping equipment, to be reused.
- New pipework to the new generator, nominally 25mm hard drawn copper to AS1432, type B.
- Provision of the supply and installation of required diesel fuel oil at completion of the commissioning works.
- Labelling, and relabelling of existing and new components.

Arrange and fix all pipework to provide heat appearance and grade for venting and draining to appropriate points.

Pressure test all completed pipework systems.

Provide expansion loops, flexible connections etc and install fitting which allow movement.

Paint pipework in accordance with AS1345. Provide function and flow labels.

800.0 BATTERY AND CHARGER

Provide starting battery of heavy duty sealed type, suitable to crank the set continuously for 30 seconds initially, and for a further similar period after 2 minutes.

Batteries shall be sealed lead-acid recombination type with a 3 year guarantee and 10 year warranty. Mount to a suitable corrosion proof stand.

The battery charger shall be connected to the essential services power supply. It shall be of constant potential type with built-in current protection.

Provide power supply on indicator, voltmeter and ammeter instrumentation.

805.0 VENTILATION DUCTWORK AND FITTINGS

Provide ventilation ductwork as indicated on the drawings.

Ductwork shall be of approval galvanised sheet steel with Pittsburgh type seams or similar.

~~**738.0** Sheetmetal thickness shall be of 1.00mm gauge minimum.~~

~~Fire Dampers: Provide fire dampers where indicated complying to AS1682. Control using thermally released links to AS1890.~~

~~Paint all ductwork and fittings after degreasing and cleaning.~~

~~**811.0** GENERATOR SET CONTROLS~~

~~The generator shall automatically provide stand by power for the essential services as nominated under mains failure conditions.~~

~~Controls shall be PLC based equipment.~~

~~The generator shall automatically start upon receipt of the appropriate start initiation signal(s), after a programmable delay of 3 seconds (adjustable to 30 seconds minimum).~~

~~The generator output circuit breaker shall be normally closed, tripping only in fault condition. Loads shall be connected to the generator by the Automatic Changeover Switchgear.~~

~~Upon restoration of the mains the load will be automatically switched back to mains supply and the generator shall run for a cool down period prior to shutting down.~~

~~Provide a generator set control panel easily accessible from the enclosure. The panel shall house all switchgear, protection, controls and indicators.~~

~~The following controls and alarms are required as a minimum:~~

- ~~Output Current (x3)~~
- ~~Output Voltage (x3)~~
- ~~Frequency~~
- ~~Oil Pressure~~
- ~~Coolant Temperature~~
- ~~Number of Starts~~
- ~~Indication of Alarms and Faults~~
- ~~Battery Volts/Amps~~

~~Alarms shall include:~~

- ~~Generator fault conditions~~
- ~~Battery charger fail~~
- ~~Output circuit breaker trip status~~
- ~~Low Fuel~~
- ~~Underspeed~~
- ~~Battery Low~~

~~Faults (shutdowns) shall include:~~

- ~~Fuel Empty~~

738.0 Overspeed

- Low Oil Pressure
- High Temperature

The contractor shall provide a schedule of available alarms to the Consulting Engineer to selection of the final control and alarm arrangement. The contractor shall render all assistance necessary to support this process.

Provide "mains available, "mains failure" and "stand-by" indications.

Provide a mode selector switch for auto/on/off operation.

842.0 REMOTE STATUS INDICATOR PANEL (MIMIC PANEL)

Provide a remote status indication panel within the Level 7 Computer Suite (or adjacent in an approved location) providing indication of the following:

- Mains Available
- Generator Stand-by
- Generator Operational
- Generator Fault
- Alarm

Provide workshop drawings of the Status Panel for Approval.

850.0 REMOTE REFUELLING POINT

Provide a remote refuelling point as per the location nominated on the drawings.

The remote refuelling point is to include the following:

- Indicator panel incorporating
  - an overflow alarm indicator
  - a base storage tank fuel level indicator
- 'Camlock' complete with lockable cap for fitting of a base building padlock.
- Isolation ball valve and inline non-return valve.
- 15L (minimum) overflow catch can.

Provide all refuelling pipework, supports and fixings from remote refuelling point to bulk storage tank.

860.0 BULK STORAGE TANK

Provide a 2000L (minimum) self bunded and 4 hour fire rated bulk fuel tank.

Storage tank to be of type Convault Australia Pty Ltd 'CVA-2' Series or equivalent.

Provide flow and return pipework (pipe sizing 32mm flow and 50mm return minimum) and automatic self-levelling refuelling pumping system between bulk storage tank and generator day tank.

738.0 Provide control cabling between refuelling pumping system, bulk storage tank and generator day tank for automatic fuel delivery and control.

Provide overflow safety mechanisms in the form of sensor(s) within the generator base fuel tank bund.

Provide local electronic level indicator to bulk storage tank of type 'Pulsar' or equivalent.

Provide remote level indicator to remote diesel refuelling point.

Provide interface for remote fuel level monitoring of tank via BMS.

869.0 GENERATOR CONTROL PHILOSOPHY

The generator shall start up and operate under the following conditions:

- Loss of mains supply
- Manual operation with changeover

Upon loss of mains supply, the following to occur:

- Generator start up after the defined time interval
- Generator control system to provide acknowledgement signal to the changeover switch for the generator to take up load
- Changeover switch to operate
- Changeover switch to provide an acknowledgement signal to the Lift Services switchboard(s) /controller(s) for the initiation of shedding in essential mode
- Changeover switch to provide an acknowledgment signal to the BMS for the initiation of mechanical services load shedding in essential mode

Upon manual operation of generator without changeover, the following items to occur:

- Generator start up after the defined time interval
- Changeover switch to provide acknowledgement signal to BMS

882.0 SPARES

Provide a complete set of recommended spare parts and any special tool required for the installation. Spare parts shall include spare filters and other consumables.

884.0 TESTING & COMMISSIONING

Notice: Give sufficient notice that commissioning of the electrical services is to commence.

Minimum notice required: 5 working days

Phase sequence: Ensure the correct phase sequence is maintained throughout the installation.

Balancing of load: Balance the load as evenly as practicable at Practical Completion. Recheck and, where necessary, rebalance the load at completion of the Defects Liability Period. Arrange all circuits so that balance is obtained at maximum demand as well as normal operating conditions.

738.0 Provide a temporary load bank (rated to full load) including all wiring and testing for final commissioning.

Site commissioning: Include the following:

Stand-by Diesel Generator System:

- Check and record start times
- Test and verify interface to transfer switchgear.
- Check and demonstrate correct operation of all controls, metering and protection.
- Verify sound levels.
- Load and endurance tests as follows:
  - Carry out a 4 hour load test at 100% load. Check and record water temperature, oil pressure, engine exhaust temperature, speed, fuel consumption, output voltage, current and power.
  - Carry out step load tests as follows:
    - 0 - 50% step
    - 50% - 100% step
    - 100% - 50% step
  - Record voltage, frequency and harmonic distortion.
- Check and verify fuel pump operation and controls, and flow rates.
- Check engine oil temperature
- Check operation of all alarms and faults.
- Test operation of generator/BMS interfaces for car park exhaust fans and stair well pressurisation fans.

On completion of testing and commissioning ensure that diesel, lubricating oils and coolants are filled.

Reticulation, Switchboards and Accessories:

- Test and provide Certificates of Compliance for the installation in accordance with the requirements of the Electricity Act.
- Insulation resistance measurements.
- Provide full functional and operational checks on energised control equipment and circuits, including adjustments for the correct operation of safety devices.
- Labelling of all switches and outlets.
- Earth resistance measurement: To AS 3000.
- Earthing: Confirmation of effective earthing of the exposed metal of electrical equipment.

Circuit protection: Confirm that circuit protective devices are sized altered and adjusted, wherever necessary, to protect the installed circuits.

Defects: Rectify all defects upon notification. Provide written notice to the Project Manager of completion of defects. Retention monies will not be released until completion and rectification to the Proprietors approval of all defects.

~~738.0 OPERATIONAL MAINTENANCE~~

~~Maintenance period: 12 months from the date of Practical Completion.~~

~~Requirement: Provide 24 hour emergency call-out services and arrive on site to rectify defective items within 2 hours of notification of a defective item. During the maintenance period:~~

~~Monthly Tests (12 off)~~

- ~~Visually check the equipment and its surroundings / enclosure for any signs of degradation, moisture, foreign objects, vermin etc.~~
- ~~Check fuel, lubricants and coolant levels.~~
- ~~Check visual indicators, gauges, warning lights etc.~~
- ~~Check starting equipment including batteries etc.~~
- ~~Check manual start operation and load transfer operation.~~
- ~~Where applicable check electrical transfer switchgear operation in conjunction with the ESP contractor during fire-mode testing of fire pumps.~~
- ~~Carry out Common Tasks as listed above.~~
- ~~Report sub-standard conditions.~~

~~Quarterly Tests (4 off)~~

~~The following tests to occur at 3 month intervals:~~

- ~~Check operation of mains failure / automatic start and load transfer equipment.~~
- ~~Check operation of automatic change-over switchgear.~~
- ~~Mechanically check all clamps, fixings and terminations.~~

~~Yearly Test (1 off)~~

~~The following servicing to occur prior to completion of the warrantee period:~~

~~ENGINE~~

- ~~Lubricating~~
  - ~~Change engine oil and filter(s)~~
- ~~Cooling~~
  - ~~Check coolant level~~
  - ~~Check for leaks~~
  - ~~Check for radiator restrictions~~
  - ~~Check hoses~~
  - ~~Check belts and pulleys~~
  - ~~Check block heater~~
  - ~~Check DCA level~~
- ~~Fuel~~
  - ~~Check fuel level~~
  - ~~Check for leaks~~

738.0 Check governor linkage & rail

- Check pump and valves
- Check tank breather
- Drain sediment from day tank
- Change fuel filters

- Air Exhaust
  - Check for leaks
  - Check condensate trap
  - Check for restrictions
  - Check breather
  - Check exhaust pan cap
  - Change air filters
  - Clean engine

GENERATOR

- Alternator
  - Check airflow
  - Check electrical connections
  - Blow out dust
  - Measure winding resistance
  - Carry out high voltage insulation test
- Controls
  - Check for correct operation
- General
  - Check battery electrolyte
  - Check charging volts
  - Check starting system
  - Clean battery terminals
- Testing
  - Test set with no changeover
  - Test set with no changeover
  - Check engine instruments
  - Check display panel
  - Check vibration level
  - Visual assessment of exhaust smoke

FULL LOAD TESTING

- Record run time & number of starts
- Record frequency at no load & full load
- Record phase voltages
- Record line currents
- Record engine oil pressure & temperature
- Record battery voltage
- Carry out Common Tasks listed above

~~738.0~~ ~~Record any sub-standard conditions~~

~~Note scheduled tasks and frequency shall be used for guidance only and represent the minimum requirements. It is not an exhaustive task list. The Maintenance Contractor shall maintain the item of equipment to the true intent of the manufacturer's recommendations, Code and Act requirements, and best standard industry practise in relation to the operation, inspection, testing & maintenance procedures.~~

~~Where it is necessary to shut down the equipment (and/or interconnecting systems) in order to perform the warrantee service and obtain approval prior to the shutdown.~~

~~Allow to provide a temporary load bank (rated to full load) and 4 hour test for the annual maintenance including all required diesel and lubricating oils.~~

~~All equipment must be reinstated to normal operating condition immediately after maintenance and at the end of each day unless agreed otherwise with the relevant Property Services Site Representative.~~

~~Ensure all switches and controls are returned to normal operating position after maintenance activities have been completed.~~

~~Records of test results and checks, together with any defects shall be passed to the relevant site Property Services Representative.~~

~~Provide a Certificate of Compliance for all works undertaken in compliance with the Electricity Act.~~

~~Provide maintenance check sheets and arrange for signing of these by the nominated site representation. Provide a copy of the check sheets to the Consulting Engineer on a monthly basis.~~

~~Certification: At the end of the maintenance period make a final service visit and, upon satisfactory completion of the above procedures, certify in writing that the installation is operating correctly.~~

~~Approval for the release of retention monies will not be granted until 12 consecutive monthly check sheets have been received by both the Proprietor and the Consulting Engineer.~~

~~Operational instruction: Coinciding with Commissioning and routine inspection visits, at times to be agreed with the Superintendent, instruct the Principal's operational maintenance staff in the recommended methods of operation and maintenance of the systems.~~

~~In addition provide a time allowance of 8 hours for the initial instruction in the operation of all systems.~~

~~738.0 LIGHTNING PROTECTION~~

~~1007.0 GENERAL~~

~~Provide air terminal and downconductor at rooftop level to a separate lighting earthing system at ground level.~~

~~Bond the lightning protection earth to the building protective earth within a labelled lightning protection earth bus bar enclosure.~~

~~The lightning protection system shall consist of the following parameters:~~

- ~~Dynasphere air terminal~~
- ~~Downconductor~~
- ~~Lightning event counter~~
- ~~Low impedance grounding system~~
- ~~Equipotential earth bonding~~

~~The AS 1768 standard shall be used as a guideline to installing the lightning protection system.~~

~~The lightning protection system shall be of type Erico 'Eritech System 3000' series.~~

~~1018.0 PROTECTION LEVELS AND DESIGN RULES~~

~~The risk assessment criteria as per Australian Standard, AS1768: 2007, has been used to carry out the risk analysis.~~

~~It has been determined that the total risk is greater than the tolerable value for one or more factors and therefore the structure shall require a protection measure against lightning.~~

~~The lightning protection system shall provide a minimum 97% level of protection as outlined in AS/NZS 1768.~~

~~1022.0 AIR TERMINALS~~

~~The air terminals shall be installed in the positions indicated in the drawings.~~

~~A base plate and aluminium mast shall be used to provide a minimum air terminal mounting height of 3 metres above any surrounding building structure.~~

~~Guy wires shall be provided to ensure sufficient structure integrity.~~

~~1026.0 AIR TERMINATIONS~~

~~The air terminations shall be carried out in accordance to the manufacturer's instructions to achieve the required bonding level.~~

~~The terminations shall be undertaken with all necessary accessories including coldshrink tube, coupling equipment, silicone tape, semi conductive tape, structure bonding braid and warning labels.~~

~~**738.0** The air termination method of attaching to the building should have adequate mechanical strength to withstand the expected wind loadings and natural harmonic resonance.~~

~~Guy wires shall be provided to ensure sufficient structure integrity.~~

~~**1031.0** DOWNCONDUCTOR~~

~~Where the steel within the building cannot be accessed for use as down conductors, a dedicated down conductor shall be used.~~

~~The down conductor shall follow the most direct path possible between the air termination and the lightning protection earth stake. Right angle bends should be avoided but may be used where necessary.~~

~~The downconductor shall be segregated from all other electrical services by 500mm minimum and therefore a pathway adjacent the mechanical services riser is required.~~

~~Any part of the down conductor system that is exposed to mechanical damage should be protected by covering it with a moulding or tubing of non-conductive material.~~

~~Provide all necessary down conductor fixings and mounting brackets.~~

~~**1037.0** EARTH ELECTRODE SYSTEM~~

~~A dedicated lightning protection earth electrode shall be provided. The earth electrode shall have a maximum resistance of 5Ω total system resistance.~~

~~Where a dedicated down conductor is used, a dedicated lightning earth bus bar and earth electrode shall be provided.~~

~~The lightning earth bus bar shall be provided in an enclosure complete with an Erico 'Eritech System 3000' series lightning event counter.~~

~~The lightning bus bar enclosure is to be located with the ground floor office waste and store room for inspection access during scheduled maintenance periods.~~

~~The down conductor shall be bonded to the lighting earth bus bar via the compression lug.~~

~~The downconductior shall be bonded to the primary lightning protection earth electrode.~~

~~The entire lower termination is to be bound in waterproofing mastic to ensure the termination is free of moisture.~~

~~In locations where achieving the require earth resistance is difficult, earth electrodes shall be deep driven copper bonded steel rods driven to a depth of 2.4 metres minimum.~~

~~Where the rods cannot be driven, they shall be installed in predrilled holes backfilled with Ground Enhancement Material, GEM. Provide additional rods until required earth resistance is achieved.~~

~~The type of rods used should have a metallurgical bond between the steel core and the copper skin. The minimum skin thickness should be 250 microns.~~

738.0 The earth electrodes shall each be provided with an earth pit. In the case where the earth pit is positioned in location where there is concrete, the concrete shall be cut and re-instated. The ground rods shall be bonded to the reinforcement steel in the concrete in places where the earth pit is installed in concrete.

Test Links shall be provided close to the earth electrodes to provide a disconnection point for testing of the earth electrodes.

1050.0 EQUIPOTENTIAL BONDING

The lightning protection system shall be bonded to the building protective earth systems including main switchboard MSB and any necessary communications earth systems at the lightning earth bus bar enclosure.

The bond between the lightning protection system and the electrical earth shall be carried out in accordance with the recommendations in AS/NZS 3000 standards.

The bond between the lightning protection system and any necessary communications earth shall be carried out in accordance with the recommendations in AS/CA S009.

Metal which is attached to the outer surface of the building should be bonded where practicable as directly as possible to the lightning protection system. Where such metal is of considerable length and run approximately parallel to a down conductor, it should be bonded at each end and at 10m intervals.

Any metal entering or leaving the building for gas, water and other systems should be bonded as directly as possible to the earth termination. At the point of entry or exit on the supply side.

1056.0 JOINTS

The lightning protection system shall have as few joints as possible. The joints should be mechanically and electrically effective.

Where overlapping joints are used, the length of overlap should not be less than 20 mm for all conductors. Contact surfaces should be cleaned and inhibited from oxidation with suitable corrosion inhibiting compound.

Particular notice should be placed on joints of dissimilar metals band where the risk of galvanic corrosion exist stainless steel bonds shall be provided.

Joints between down conductors and electrodes should be of adequate strength and current carrying capacity and be arranged to ensure that there will be no failure of the connection under conditions of use or exposure that can be reasonably expected. If mechanical connectors are used, they should be designed and constructed so that the connection will not slacken off in use.

All earth electrode terminations are to be CAD welded.

1062.0 FASTENERS

Conductors should be securely attached to the building using gunmetal saddles. The fasteners holding these saddles shall be substantial in construction and not subject to breakage and should be together with nails screws of stainless steel. Fasteners should be spaced so as to

~~give adequate support to the conductors and should not exceed 1000m spacing both on vertical and horizontal runs.~~

~~1064.0 WEATHERPROOFING~~

~~The installation of the lightning protection shall be carried out that so that the building and in particular roof is made weatherproof.~~

~~1066.0 TESTING AND CERTIFICATION~~

~~The lightning protection system shall be certified by the installer to have complied with this specification and other relevant standards.~~

~~Soil resistivity tests shall be undertaken before and after lightning protection works.~~

~~Earth resistance test shall be carried out on each earth electrode and a test certificate shall be provided. Witnessing of the tests and the visual inspection of the underground portion of the works may be required.~~

~~The earth resistance test shall be carried out using the fall of potential method as stipulated in the ASNZS 1768 standard.~~

~~Inspection and test reports shall be submitted to complete the certification of the system.~~

~~Results: Provide copies of the inspection and test reports and include in the Maintenance Manuals.~~

~~1073.0 REINSPECTION~~

~~The supplier shall develop a program of inspection and maintenance in association with the owner's representative to insure future integrity of the lightning protection system. This programme shall include inspection and test plan and method of carrying out maintenance.~~

~~A copy of the inspection and testing plan to be included in the Maintenance Manuals.~~

~~738.0~~ LUMINAIRES

~~1077.1~~8.1 SCOPE

Outline description: The work covered by this section includes the following:

Provision of luminaires satisfying all statutory, legislative and code requirements and conforming to the general details indicated herein.

The planning, scheduling and procurement of luminaire components and construction of luminaires to meet the agreed programme.

Full responsibility for packaging, delivery, and unloading on site, storage, maintenance, service and warranty; and all other items whether mentioned in detail or not to complete the luminaires supply and warranty in accordance with this specification.

~~1077.2~~8.2 PACKAGING

Pack luminaires and components in robust and sealed packages suitable for withstanding conditions between dispatch and installation. Store luminaires within original packaging until installation. Take all steps as necessary for the adequate protection of luminaires.

~~1077.3~~8.3 TESTING

Standard: To AS/NZS 4847, AS/NZS 4934, AS/NZS 60598.1, AS/NZS CISPR Set

Certification: All luminaire manufacturers shall be members and/or endorsed by the Lighting Council of Australia, and shall be tested at a NATA approved laboratory.

All test results shall be available on request for approval.

~~1077.4~~8.4 PERFORMANCE STANDARDS

Thermal characteristics: To AS/NZS 60598.1

Glare control: To AS/NZS 1680

Where lighting arrangements have not been indicated by Lucid, such as to tenancies and apartments, contractor shall ensure lighting arrangements comply with AS1680 (Interior and Workplace Lighting) and BCA Section J6 (Energy Efficiency of Artificial Lighting and Power) requirements.

~~1077.5~~8.5 PHOTOMETRIC DATA

Standard: To AS 1680.3

Requirement: Where requested, provide and obtain approval, full photometric data before delivering a standard product, or commencing to manufacture a non-standard product.

~~1077.6~~8.6 LAMP PERFORMANCE

Requirement: Ensure starter switches and igniters (where applicable), control gear and lampholders are suitable for use with the lamps supplied and when installed in the luminaire

body to be supplied will allow the lamps to achieve the performance given in the lamp manufacturer's published data sheets when operating on the power supply provided for the project.

1077.78.7 GENERAL CONSTRUCTION

Stiffness: The materials, body shape, and method of manufacture shall result in a luminaire of adequate stiffness to prevent warping or sagging when installed in position.

Body shape: Rectangular and square luminaires shall have straight parallel edges and square corners.

Surface mounting: For fixing of surface-mounted luminaires to ceilings or walls provide symmetrically placed fixing holes as follows:

- In square and rectangular luminaires: Not less than four holes.
- In circular luminaires: Not less than three holes.

Recessed mounting in suspended ceilings: To AS 2946.

Provide all recessed luminaires with 1.5m 3-core flex and plug type connection.

Ceiling trim: Where ceiling trim is specified attach it to the luminaires with concealed fixings.

Degree of Protection: Construct each luminaire to provide the protection appropriate to its final installed location.

Condensation: Where required provide a facility for draining condensation.

Metal bodies: Preparation: (Except for aluminium bodies which have been etched and anodised): Degrease to AS 1627 Part 1.

Finish: An approved factory applied finish.

Minimum paint thickness: 0.025 mm for each surface and edge.

Diffusers and Visors

Field Code Changed

Provide diffusers and visors manufactured from UV stabilised acrylic, polycarbonate or other approved material which achieves the specified glare control.

Position: Locate diffusers and visors so that the diffuser or visor temperature does not exceed 75□C.

Colour matching: Colour match diffusers and exposed metal painted surfaces of the same type.

1077.88.8 WIRING

Standard: To AS/NZS 60598.1

~~Fluorescent and~~ LED luminaires:

Cable: V105 250 V PVC insulated cable copper conductor, minimum size 24/0.2 mm (stranded), or 1/0.80 mm (solid).

Loom wiring: Neatly loom the wiring and install clear of ballasts. Fix the looms with soft metal, polythene or similar approved clips fastened to the luminaire body.

Internal Termination: Wiring within the fixture shall be terminated on suitable rated terminal blocks.

External Termination: Provide external terminations as follows:

- Luminaire installed within a suspended ceiling – flex and plug terminations are considered suitable
- Luminaire installed in exposed ceiling areas, and external areas – provide a junction box mounted on the top or side or within the luminaire body. Mount a fixed terminal block inside the junction box. Flex and plug connections will not be accepted.

Terminal blocks: Fix each terminal block to the body adjacent to the cable entry. Unless otherwise specified, provide suitably sized terminal blocks to accommodate the required cabling, equal to rapid earth terminal blocks.

Earthing: Provide an earthing connection point comprising an earth bolt or screw of not less than 5 mm diameter x 12 mm length located adjacent to the terminal block with solderless connection lug. Fix the bolt or screw to the luminaire metallic body or junction box by welding or double lock-nuts on to serrated washers.

~~Incandescent and discharge lamp luminaires:~~

~~Cable: Wire between the terminal block and lampholder in stranded 250 V teflon insulated cable, minimum size 24/0.2 mm.~~

~~Termination: Provide a junction box mounted on the top or side or within the luminaire body. Mount a fixed terminal block inside the junction box. Flex and plug connections will not be accepted.~~

~~DALI luminaires:~~

~~Cable: Each DALI universe shall be cabled in a 'daisy chain loop'. Alternative cabling methods shall be approved by the Lighting Control System manufacturer prior to installation.~~

~~The Electrical Contractor shall utilise a 5 core soft wired cable mechanism, certified for use with DALI controlgear. Each core shall be as follows:~~

~~Marking~~	~~Conductor Size~~	~~Wire Colour~~	~~Description~~
~~N~~	~~2.5 mm2~~	~~Blue~~	~~20A Neutral Conductor~~
~~Earth~~	~~2.5 mm2~~	~~Green/Yellow~~	~~Protective Earth~~
~~L~~	~~2.5 mm2~~	~~Brown~~	~~20A Active Conductor~~

~~DA-~~	~~1.5 mm2~~	~~Grey~~	~~DALI Control Wire~~
~~DA+~~	~~1.5mm2~~	~~Orange~~	~~DALI Control Wire~~

~~Cable systems shall be of "Clipsal DALI MSW5P" series or equal approved.~~

~~Termination: Cables shall be terminated directly onto the controlgear module.~~

~~1077.47~~8.9 ACCESSORIES AND CONTROL GEAR

~~1077.47.1~~8.9.1 ELECTRONIC BALLASTS

Requirement: Electronic controlgear shall be provided for all luminaires and shall be equal to "Tridonic Atco, Philips or Osram" manufacture and include the following features as a minimum:

Constant light output

- Output to be independent of fluctuating supply voltage
- Smart heating (fluorescent and HID luminaires)
- Cathode heating reduction after pre-heat time
- Defined lamp warm start within 0.5s (fluorescent) and 15s (HID)

Voltage Guard

- Overvoltage indication starting at input voltage 267-306 V AC
- Overvoltage protection 320 V AC, 1 h
- Undervoltage protection (shutdown) below 150 V AC/176 V DC
- AC voltage range 220-240 V
- DC voltage range 175-280 V

Other Features

- Power factor > 0.97
- Operating frequency ≥ 40 kHz
- Operating frequency ≥ 140Hz for discharge luminaires.
- Earth leakage current ≤ 0.5mA.
- Suitable for automatic and manual wiring with insulation displacement connector (IDC)
- Wide operating temperature range from -25°C to +50°C
- Service life of 50,000 hrs under reference conditions with failure probability of less than 0.2% for every 1000 hrs of operation
- Safe switch off of defective lamps
- Automatic re-start after lamp change
- For luminaries with or an in accordance with EN 60598
- Suitable for luminaries with protection class SK I and SK II
- Ingress protection IP 20

- Thermal protection according to AS/NZS 61347.1
- EMC compliance according AS/NZS CISPR Set
- Integral 2 Amp fuse.

Ballasts shall have ENEC and CE identification and certified to:

- EN 55015
- EN 55022
- EN 61347
- EN 60925
- EN 60929

Ballasts must meet harmonic requirements outlined in AS/NZS 61000.3.2.

Energy class CELMA A-2 Energy Efficiency Index (EEI) and A-1 for dimmable.

Ballasts shall be thermally protected and in compliance with IEC specifications 928 and 929 for safety and performance.

~~**1077.47.2** ELECTRONIC BALLASTS – DIMMABLE~~

~~Requirement: Dimmable ballasts shall be provided to luminaires as specified. Ballasts shall be analogue 0-10V dimmable, and capable of being dimmed by standard universal potentiometer dimmer.~~

~~**1077.47.4** ELECTRONIC BALLASTS – DIGITAL ADDRESSABLE LIGHTING INTERFACE (DALI)~~

~~Standard: IEC 62386 Set~~

~~Requirement: Digital Addressable Lighting Interface (DALI) ballasts shall be provided to luminaires as specified. The ballasts shall be of "Tridonic Atco, Philips or Osram" manufacture. No other manufacture ballasts will be accepted.~~

~~The selected ballasts shall match the performance characteristics of the conventional ballasts, and shall incorporate the following additional characteristics:~~

- ~~All DALI controlgear shall be capable of controlling exit and emergency lighting.~~
- ~~All DALI controlgear shall be capable of lamp monitoring.~~
- ~~All DALI controlgear shall be of the same manufacture, generation and have compatible firmware installed.~~

~~Installation: Coordinate with the lighting control system manufacturer and/or commissioning agent to ensure that all ballast selections are fully compatible with the lighting control system.~~

~~Addresses: Unless specifically requested otherwise each individual luminaire shall be provided with one (1) DALI address which is unique to that luminaire.~~

~~The Electrical Contractor shall ensure that all DALI luminaires are installed, programmed and commissioned to ensure a fully operational system in its entirety.~~

~~**1077.47.2** DALI training course, and shall provide evidence of such training within the tender submission.~~

~~1077.47.15~~8.9.2 MOUNTING OF ACCESSORIES

Location: Positively locate accessories, including ballasts, capacitors, connection blocks, lampholders and the like.

Fixings: Fix accessories to the luminaire body (or to separate enclosures where applicable) with plated metal-thread screws and nuts. Screws shall remain fixed in position when accessories and fixing nuts are removed.

Bayonet cap and Edison screw accessories: Lampholder and socket mountings: Fix lampholder to prevent rotation.

~~1077.48.0 FLUORESCENT ACCESSORIES~~

~~Lampholder mountings: Mount each lampholder on a rigid bracket, to the dimensions and tolerances specified in AS 1201.2. Space lampholders laterally at not less than 70 mm centres.~~

~~Starter switch mounting: Unless otherwise specified, mount each starter switch so that it is not less than 20 mm from other components in the gear tray, and is accessible without removing the gear tray cover.~~

~~Ballasts: Position ballasts to obtain maximum heat dissipation. Unless secured to the luminaire chassis, ballasts shall be supported via hangers or catenaries within the ceiling space. Ballasts shall not rest on the ceiling.~~

~~Spacing: Where two or more ballasts are installed in the one location provide separation between ballasts to allow adequate ventilation in accordance with manufacturers recommendations. Maintain 50mm spacing from capacitors.~~

~~1077.53.0 POLE MOUNTED LUMINAIRES~~

~~Standard: AS/NZS 1158.~~

~~General: Design, construct, supply and install manufacturer approved poles for all pole mounted luminaires nominated. Generally they shall be constructed as follows:~~

~~Concrete footings with anchor rods rated to withstand the weight and weather conditions within the area of installation.~~

~~Provide a removable gland plate with neoprene seal approximately 600 to 900 AFGL to accommodate a 2A circuit breaker.~~

~~Terminate the underground conduit supplying the pole at 150 AFGL within the pole.~~

~~All cabling entering and exiting the structure shall be weather sealed (IP65or greater) and shall be in weather resistant flexible conduit.~~

~~Where CCTV cabling is installed within the pole, arrange conduits and cabling to avoid interference.~~

~~1077.48.0~~ LAMPS

Requirement: Supply luminaires complete with lamps.

Single manufacturer: Lamps of the one type shall be of the same manufacture.

Lamp identification: Provide a legible label in each luminaire, fixed in a position convenient for reading at the luminaire installed position, which clearly identifies the lamp type to be installed in the luminaire.

~~Linear Fluorescent Lamps~~

~~Standard: AS/NZS 4782 and AS/NZS 4783.~~

~~Requirement: Provide lamps with low resistance cathodes and standard bi-pin caps.~~

~~Lamp data: Provide fluorescent lamps of identical manufacture equal to "Philips TLD 840 New Generation" complying with the following, unless specifically indicated otherwise:~~

~~- Colour Rendering Index (Ra) - Greater than 85~~

~~- Colour Temperature - 4000 K~~

~~Provide compact fluorescent lamps complying with the requirements above. (Colour temperature to approval).~~

~~Self Ballasted Lamps~~

~~Standard: AS/NZS 4847.~~

~~Lamp: Provide self-ballasted lamps of Philips or Osram manufacture, complying with the following, unless specifically indicated otherwise:~~

~~- Colour Rendering Index (Ra) - Greater than 85~~

~~- Colour Temperature - 4000 K (neutral white)~~

LED Lamps

Standard: IEC 62031 Ed 1.0

Lamp: Provide LED lamps of CREE, Philips, Osram, Luxeon, Rebel or Bridgelux manufacture, complying with the following, unless specifically indicated otherwise:

- Colour Rendering Index (Ra) - Greater than 85
- Colour Temperature - 4000 K (neutral white)

Commented [MS82]: Change the default colour temperature to suit project or remove if not applicable

Certification: Only LED lamps that have been tested in accordance with IESNA LM-70, IESNA TM-21 and IEC 62031 shall be accepted.

~~**Incandescent Lamps**~~

~~Standard: AS/NZS 4934 and AS 2325.~~

~~Performance: AS 4934.2~~

~~Type: Tungsten filament for general lighting purposes rated at 250 V. Tungsten halogen dichroic for extra low voltage.~~

~~- Lamp caps:~~

~~- Lamp rating:~~	~~Cap type:~~
~~- Up to 100 W:~~	~~Bayonet (BC)~~
~~- 100 - 200 W:~~	~~Medium Edison Screw (MES)~~
~~- Extra low voltage~~	~~MR16 bi-pin type, average life 5000 hours, Phillips "MASTERLine ES" or Osram "DECOSTAR IRC"~~

~~**Discharge Lamps**~~

~~Standard: IEC 61167 and IEC 62035.~~

~~Lamp: Provide discharge lamps of Sylvania, Philips or Osram mafnuacture, complying with the following, unless specifically indicated otherwise:~~

- ~~Colour Rendering Index (Ra) - Greater than 85~~
- ~~Colour Temperature - 4000 K (neutral white)~~

~~1077.76~~8.11 RECESSED LUMINAIRES – WARNING SIGNS

Standard: AS/NZ 3000

Requirement: Provide warning signage where recessed downlights are installed within an accessible roof space.

'WARNING: recessed lights have been installed in this roof space. To reduce the risk of fire DO NOT COVER the light fittings with thermal insulation or any other material unless in accordance with instructions provided by the lighting manufacturer,'

1077.778.12 EMERGENCY LIGHTING

Standard: AS/NZS 2293 and Building Code of Australia (BCA)

Outline description: The work covered by this section of the specification:

The installation of an emergency and evacuation lighting and exit sign system that satisfies all statutory, legislative and code requirements and conforms to the general details indicated herein.

The provision of discharge testing facilities for all emergency and exit luminaries in accordance with AS/NZS 2293 at local area distribution boards classified by the distribution board zoning of the Building.

Emergency and exit lighting shall generally be installed in accordance with AS/NZS 2293 and as shown on the accompanying drawings. However, when installed above doorways exit fittings shall be installed directly above on the transom.

Where cable between emergency light and remote battery / control gear exceeds 2m, the electrical contractor shall ensure the cabling is fire rated.

The planning, scheduling and procurement of components, installation to meet the programme, coordination and liaison with other trade packages.

Full responsibility for the execution of the complete installation in accordance with the specification and drawings.

Installation, testing, commissioning, maintenance, service and warranty all building act tests up to the end of the defects liability period; and all other items whether mentioned in detail or not to complete the installation and put it into working order in accordance with this specification.

TESTING

Manufacturers' tests:

Classification testing: To AS/NZS 2293.3 Appendix C.

Type testing: To AS/NZS 2293.3 Appendix D.

Certification: For each size and type of emergency lighting luminaire and exit sign supply copies of a certificate of tests stating the testing authority, manufacturer and details of parameters and results for each test.

Number of copies: Insert one copy of each certificate in each copy of "Operating and Maintenance Manual"

LABELLING

Requirement: To AS 2293.1.

For each distribution board device that will cause emergency or exit lighting to discharge provide the following label: -

'WARNING: INTRERRUPTING SUPPLY WILL DISCHARGE EMERGENCY LIGHTING BATTERIES'

The label shall be fixed securely immediately adjacent the device which will operate the discharge facility. Note adhesive labelling will not be accepted.

Provide labelling adjacent each individual circuit that supplies exit and emergency lighting.

MAINTENANCE RECORDS - EMERGENCY LIGHTING

Requirement: To AS 2293.2, the Building Code of Australia and South Australia Minister's Specification SA76.

Commented [MS83]: Remove for non-South Australian projects

Log book: A4 size, printed or typed on durable printing paper and neatly bound in durable vinyl or similar covers, coloured distinctly different from the colour of the operating and maintenance manual covers. Include the log book within the Maintenance and Testing of Safety Equipment Manuals.

SINGLE-POINT SYSTEMS

Battery: Indelibly stamp each battery with its date of manufacture. Provide the manufacturer's warranty on the battery life with the luminaire operating under normal conditions at an ambient temperature of 25oC. Batteries shall be of the high temperature Nickel-Metal Hydride (NiMH) type.

Commented [MS84]: Replace with Lithium Iron Phosphate (LiFePO4) for a greener alternative.

Battery charger: Two-rate, constant current, constant voltage, temperature compensated type with automatically selected boost and float charging rates.

Local Testing facilities: Provide a local test switch on each luminaire. Provide self-testing facilities for each luminaire.

Distribution Board Testing facilities: Provide test facility within each local distribution board that supplies exit and emergency lighting circuits. The test facility shall be constructed as described on the drawings accompanying this specification.

Inverter system: Protect the inverter system against damage whilst in operation in the event of failure, removal or replacement of a lamp.

Installation: To AS 2293.1 Section 2.

Circuiting: Unless shown otherwise all exit and emergency lighting shall be circuited from the un-switched active of the nearest adjacent general lighting circuit. Where essential circuits are available, circuit from the nearest essential general lighting circuit.

~~**MONITORED SYSTEMS**~~

~~General: Where specified provide a monitored exit and emergency lighting system of "Clevertronics Zoneworks" manufacture or equal approved. The system shall be provided with local single point test facilities within each distribution board.~~

~~Liaise with the manufacturer to design, construct, supply and install the exit and emergency monitoring system with all necessary power supplies, WAP's, routers and interfaces to ensure a fully operational system.~~

~~1077.81~~8.13 SCHEDULE OF LUMINAIRES

The schedule defining the type of luminaires with designations can be found on the drawings accompanying the specification.

Each luminaire has been selected in accordance with the following criteria:

- Compliance with relevant Australian and International Standards.
- Energy efficiency with respect to ongoing energy consumption.
- Appearance based on the requirements outlined by the End User and/or Architect.
- Known reliability of the proposed luminaire with respect to longevity, ongoing maintenance and the intended use.
- Relevant trade price of the luminaire.
- Quality of the fixture, including componentry.
- Recognition by the Lighting Council of Australia. Only manufacturers who are members or are endorsed by the Lighting Council of Australia will be accepted.
- Testing undertaken by NATA (National Association of Testing Authorities).
- Testing undertaken in accordance with relevant Australian Standards.
- Photometric data provided for computer lighting simulations.

Where alternative luminaires, lamps, controlgear and the like have been proposed by the Contractor, evidence shall be provided to ensure they are fully compliant with the above requirements. The Contractor shall then engage the services of Lucid Consulting Engineers on an hourly rate basis to undertake all necessary photometric calculations required to ensure the proposed alternatives will provide sufficient light levels within the nominated areas. On submission of the tender offer the Contractor acknowledges by default their acceptance of this requirement.

~~1078.0 LIGHTING PERFORMANCE~~

~~The installation of the lighting system must comply with all relevant statutory requirements in particular BCA Section J Power Density requirements, AS1680, AS2293 and AS3000. The proposed design criteria associated with the design and installation forms the basis of the design brief listed below:~~

~~Area~~	~~Maintained Illuminance~~	~~Power Density~~	~~Luminaire & Lamp Type~~	~~Controls~~
~~Trade Training Centre~~	~~320lx~~	~~8W/m2~~	~~Surface mount luminaire with T5 fluorescent lamps~~	~~Time clock and manual control with PE Cell daylight harvesting via lighting control system~~
~~Amenities~~	~~80lx~~	~~6W/m2~~	~~Surface mount weather proof luminaire with fluorescent lamps~~	~~Motion control with manual override~~
~~Indoor Car park Entrance~~	~~800lx (first 15m)~~ ~~160lx (next 4m)~~	~~25W/m2~~	~~Surface mount luminaire with Metal Halide lamps~~	~~PE Cell control for activation during the day via lighting control system~~
~~Car park (Aisles & Disable)~~	~~40lx~~	~~6W/m2~~	~~Surface mount weather proof luminaire with fluorescent lamps~~	~~Motion control and lift activation via lighting control system~~
~~Entry Lobby~~	~~320lx~~	~~15W/m2~~	~~Recessed luminaires with compact fluorescent lamps~~	~~Motion control activation via lighting control system~~
~~Plant Rooms~~	~~160lx~~	~~5W/m2~~	~~Chain suspended weather proof luminaire with fluorescent lamps~~	~~Local control with auto off (motion override) via lighting control system~~
~~Mall~~	~~600lx~~	~~16W/m2~~	~~Recessed luminaires, Wall mount direct/indirect luminaires and coffer/bulkhead indirect lighting~~	~~Time schedule with PE Cell control via lighting control system~~
~~Supermarket~~	~~Refer Appendix H – BMB Supermarket Design Brief~~			
~~Fire Stairs/ Corridors~~	~~80lx~~	~~8W/m2~~	~~Surface mount luminaires with fluorescent lamps~~	~~Motion control via lighting control system~~

~~Apartment Atrium/Corridor~~	~~160lx~~	~~8W/m2~~	~~Pole/wall mount direct/indirect luminaires with fluorescent lamps~~	~~Time schedule, PE Cell and motion control via lighting control system~~

~~Final luminaire type in all areas to be approved by Architect and Services Engineer. All lighting calculations together with luminaire samples/technical data to be provided for review.~~

~~LIGHTING CONTROL SYSTEM (LCS)~~

~~1149.0 SCOPE~~

~~Outline description: The work covered by this section includes the following:~~

- ~~Design, construct, supply and install a Lighting Control System (LCS), including all controllers, power supplies, interfaces and the like to ensure a fully operational system.~~
- ~~Provide functionality as described in this specification and on the accompanying drawings.~~
- ~~Testing and commissioning in accordance with the manufacturers requirements.~~

~~1154.0 GENERAL~~

~~This clause has been developed based on a generic LCS. Should there exist any discrepancies between this specification and the manufacturers' specification and/or requirements, the higher standard shall be adhered to.~~

~~1156.0 MANUFACTURE~~

~~The LCS shall be of 'Clipsal C-Bus' or 'Philips Dynalite' manufacture.~~

~~1158.0 PRE-QUALIFICATION~~

~~The Electrical Contractor shall be approved and certified to install the nominated LCS, and shall have demonstrated previous experience with installations of similar type and scale.~~

~~Where DALI controlgear is specified, the Contractor shall have undertaken an approved DALI training course, and shall provide evidence of such training within the tender submission.~~

~~1161.0 MODULES~~

~~All modules, relays, dimmers, interfaces, controllers and the like shall be installed within the relevant switchboard, and DIN rail mounted. The equipment shall be located in a fully separated section with screening as necessary to avoid interference and appropriately labelled to identify purpose.~~

~~Unless shown otherwise provide sufficient space to accommodate all equipment and 30% spare space for future additions to the network. Liaise with the nominated LCS manufacturer to ensure all spatial requirements are met.~~

~~1164.0 DALI~~

~~All DALI luminaires shall be installed to ensure a fully operational system is provided.~~

~~The Electrical Contractor shall supply and install DALI controlgear in accordance with the following minimum criteria:~~

- ~~All DALI controlgear shall be of the same make, manufacture and generation.~~
- ~~All DALI controlgear shall be installed in a daisy chain loop. Star configuration will not be accepted.~~

~~Should any doubt exist as to the compatibility of certain luminaires, controlgear and configurations, the Electrical Contractor shall engage the services of the LCS manufacturer to test the luminaires prior to installation, and pay all associated costs.~~

~~It is the Electrical Contractors responsibility to ensure that all DALI controlgear is selected and cabled in accordance with the LCS manufacturer's requirements, and to ensure a fully operational system.~~

~~1171.0 INTERFACES~~

~~The following interfaces shall be provided as a minimum:~~

- ~~USB interface within each enclosure, load centre, switchboard and the like, for local access and programming of the LCS software.~~
- ~~Network interface within each enclosure as necessary to allow for access to the LCS software over the LAN (Local Area Network).~~
- ~~LONworks, MODBUS or BACnet gateways for high level communication with the nominated BMS.~~
- ~~AMX interface for high level communication with the nominated AV (Audio Visual) system.~~
- ~~Ceiling sweep fan controller for control of ceiling sweep fans via the local input device.~~
- ~~Motorised blind, curtain and shutter controllers for control of motorised blinds and the like via the local input device. Provide an individual controller for each blind motor.~~
- ~~Security system interface, for interfacing with the nominated security system.~~

~~The Contractor shall coordinate with the relevant Sub-Contractor to determine final connection and communication requirements. It is the responsibility of the Electrical Contractor to ensure a fully operational system is provided.~~

~~1181.0 FAULT FINDING~~

~~The LCS shall be designed, programmed and constructed to provide an automatic fault finding facility, such that all faults are logged and reported.~~

~~When a fault is experienced which effects the ongoing operation of the LCS, the operation of the LCS shall be transferred to a pre-determined failsafe mode until the error has been rectified.~~

~~1184.0 METERING~~

~~Provide an interface with nominated metering units as shown on the drawings accompanying this specification. The meter readings shall be capable of being viewed on any touchscreen as determined by the Proprietor.~~

~~1186.0 CABLING~~

~~The Electrical Contractor shall provide all cabling as required to ensure the successful operation of the system. The cabling shall be uniquely coloured from all other cabling installed, and shall be segregated from all other cabling in accordance with the manufacturer's requirements. As a minimum all cabling shall be installed as follows:~~

- ~~Installed on cable trays, catenaries or conduit.~~
- ~~Where installed on cable trays they shall be located in a segregated section using barriers, and shall be fixed to the cable tray using Velcro cable ties.~~
- ~~Where installed on catenaries, they shall be installed on a completely separate catenary, or can be installed as a separate group on any other catenary.~~

~~1191.0 GENERAL LIGHTING CONTROL SYSTEM FUNCTIONS~~

~~Function~~

~~The general function of the lighting control system shall include but not be limited to the following general scenarios. Ensure each circuit is labelled with an appropriate description facilitate programming.~~

~~Open plan offices~~

- ~~Local switch On/Off, with daylight sensing.~~
- ~~Provide intelligent programmable light level sensors, to measure the natural day light levels at the nominated working plane (750mm AFFL) and according to a predetermined lux level (400 lux) to intelligently monitor and dim and/or switch various circuits depending on these factors.~~
- ~~360 deg Occupancy sensors to be located within these areas as depicted on plans and setup to automatically turn lighting off for after hours operation.~~
- ~~Corridor circulation zone linking to closed office occupancy sensors for after hours access.~~

~~Store rooms/ cleaner rooms~~

- ~~Local switch On/Off, with PIR time delayed occupancy sensor to be programmed as a re-trigger able timer to automatically switch lights On and OFF after 15 minutes, if no movement is detected.~~

~~Offices (adjacent windows)~~

- ~~Local switch On/Off, with PIR delayed occupancy sensors with daylight sensing set at 400 lux at 750mm AFFL to be programmed as a re-trigger able timer to switch lights off only after 15 – 30 minutes, if no movement is detected.~~
- ~~Alternately a PIR occupancy sensor only may be programmed as a re-trigger able timer to switch lights On/Off with a 15 - 30 minutes re-trigger time delay.~~

~~Offices~~

- ~~Local switch On/Off, with PIR time delayed occupancy sensor to be programmed as a re-trigger able timer to switch lights off only after 15 - 30 minutes, if no movement is detected.~~
- ~~Alternately a PIR occupancy sensor only may be programmed as a re-trigger able timer to switch lights On/Off with a 15 - 30 minutes re-trigger time delay.~~

~~Plant rooms and other general areas~~

- ~~Local switch.~~

~~Toilets~~

- ~~PIR time delayed occupancy sensor to be programmed as a re-trigger timer to switch lights On and Off after 15 – 60 minutes, if no movement is detected.~~

~~Perimeter lighting~~

- ~~The luminaries on the perimeter of the building shall generally be controlled such that in the event of there being sufficient natural light from the windows, the luminaries shall be switched in response to the available natural illumination by the LCS.~~

~~Supervisory control~~

- ~~It shall be possible to manually switch off all of the luminaries in the building from a central position, if required. This central position may be the system computer or other approved switching position. It shall be possible to determine and switch the following from the same position.~~
- ~~All luminaries on any selected floor~~
- ~~All luminaries in the building with the exception of those luminaries to which no switching is shown on the drawings.~~
- ~~All luminaries on any selected zone with the exception of those luminaries to which no switching is shown on the drawings.~~

~~Meeting / Function Rooms~~

- ~~The lighting control system to provide dimmed scenes from local light switch panels at the entry to each room, utilizing a multi- button switch panels.~~

~~Schedules & scene management~~

- ~~The lighting control system shall have the ability to implement multiple time schedules including On/Off control, scene activation, special day, public holiday, logical function schedule triggers and be configurable for at least 10 years in advance.~~
- ~~Schedules shall be managed via both central PC based control and local Touch Screen control modules.~~

~~Scenes~~

~~Typical scenes to be selected from these switch panels might be:~~

- ~~Scene 1~~
  - ~~Welcome: This scene is used for general use of the room, ideal for meetings and day-to-day use.~~
- ~~Scene 2~~
  - ~~Presentation: This button selects a preset scene for a presentation dimming lights appropriately to suit overheads and projector lights to a screen.~~
- ~~Scene 3~~
  - ~~Break: This button selects a scene for a lunch or break period.~~
- ~~Scene 4~~
  - ~~Off: This button selects an "Off" scene turning all the lights "Off" with a slow fade time to enable those in the room adequate time to leave.~~

~~Master Lighting Control Panel~~

- ~~Master Lighting Control Panel is to be provided as shown, and incorporate the following scenes:~~

~~Normal~~	~~Typically activated automatically on disarming of the security system.~~
~~After Hours~~	~~Typically activated via integral time switch pre-determined by the Proprietor.~~
~~Panic~~	~~Typically activated from keypads located in the bed room, kitchen and building entrance. All selected loads are switched on and the security system (if integrated) is triggered activating external sirens.~~
~~Holiday~~	~~Activated from the main control panel. Capable of replaying minimal building activity to demonstrate the building is still occupied.~~
~~Cleaning~~	~~Activated from a security keypad at the building entrance. Selected loads are switched on to 50% (or half lights are turned on) to provide the cleaner with sufficient brightness to clean the area.~~

~~1240.0 SPECIFIC LIGHTING CONTROL SYSTEM FUNCTIONS~~

~~The general function of the lighting control system shall include but not be limited to the following general scenarios:~~

Schedule of Lighting Control Zones		
Zone	Control device	Methodology
Ground Floor		
LZ.G1	MS.G1, MS.G2, SCP	On SCP disarm, turn on and before 8.00am utilise MS.G1 and MS.G2 and turn off after 10 min delay. Between 8.00am and 6.00pm – turn on. After 6.00pm – turn off with MS.G1 and MS.G2 override (10 min delay) On SCP arm – turn off.
LZ.G2	MS.G1, MS.G2, MS.G3, MS.G4, SCP	As per LZ.G1 but utilise MS.G1, MS.G2, MS.G3, MS.G4.
LZ.G3	MS.G5	Turn on with movement 10 min delay Turn off
LZ.G4	MS.G6, PB.G1, SCP	As per LZ.G3 but with PB.G1 override which switches off and resets on SCP arm.

LEGEND

- LZ.Gx – Lighting Zone 'x' on ground floor.
- MS.Gx – Movement Sensor 'x' on ground floor.
- PB.Gx – Pushbutton 'x' on ground floor.
- CTS.Gx – Colour touch screen 'x' on ground floor.
- TS.Gx – Black and white touch screen 'x' on ground floor.
- MCTS.Gx – Master colour touch screen 'x' on ground floor.

1278.0 INPUT PANELS

Input panels shall generally be of pushbutton type with LED indicators to indicate button selection. All panels selected shall be fully compatible with the nominated LCS. In general, input panel types shall be summarised as follows:

Area	Input Panel Type		
	Clipsal	Philips Dynalite	Colour/Finish
General Areas	503x series	DLP/DSP series	Stainless Steel
Back of House Areas	C2000 series	DLP series - standard	White
Small Meeting Rooms	DLT series	DR2P series	White Glass
Boardroom	CT series	DTP1xx series	White Glass

~~Plant, outdoor and other weatherproof areas.~~	~~56 series~~	~~N/A~~	~~Grey~~

~~1314.0 PRE-CONSTRUCTION SUBMISSIONS~~

~~The Electrical Contractor shall provide the following minimum information prior to commencing installation of the LCS, for approval by the Engineer and LCS manufacturer:~~

- ~~Layout drawings showing equipment locations, paths of reticulation and the like.~~
- ~~Zoning diagrams showing the lighting control zones, including zone designations.~~
- ~~Schedules identifying equipment type (make and model) corresponding to the layout drawings.~~
- ~~Schematic diagrams of the LCS.~~
- ~~Schedule of interfaces with all equipment and devices separate to the LCS e.g. BMS, security system etc.~~
- ~~Functional specification identifying the operation of the LCS, including description of each zone, and programmed scenes.~~
- ~~Switchboard shop drawings.~~

~~1323.0 PROGRAMMING, TESTING AND COMMISSIONING~~

~~The Electrical Contractor shall engage the services of an independent commissioning agent as nominated by the LCS manufacturer.~~

~~Testing and commissioning shall be undertaken in accordance with the LCS manufacturers' requirements. In any case, the following minimum requirements shall be met:~~

- ~~Shall be commissioned in accordance with CIBSE Commissioning Code M – "Commissioning Management".~~
- ~~Shall be commissioned in accordance with CIBSE Commissioning Code C – "Automatic Controls".~~
- ~~Shall be commissioned in accordance with CIBSE Commissioning Code L – "Commissioning Process for Lighting and NLCS".~~
- ~~Final programming requirements shall be coordinated with the Proprietor.~~
- ~~Testing reports in accordance with the LCS manufacturers requirements.~~

~~1331.0 LCS TUNING~~

~~The Electrical Contractor and the independent commissioning agent shall attend site quarterly for 12 months after Practical Completion to tune and check the operation of the LCS to ensure the programming requirements have been met. The Electrical Contractor shall liaise with the Proprietor.~~

~~1333.0 TRAINING~~

~~Coordinate with the Proprietor to arrange for a "Training Day" to train all end-users (as nominated by the Proprietor) in the use and operation of the LCS. The following minimum topics shall be discussed:~~

1314.0 Basic everyday use and operation of the system.

- After hours operation.
- Emergency operation.
- Recommended use for optimising energy efficiency.
- Maintenance requirements.
- Troubleshooting.

1341.0 AS-INSTALLED DOCUMENTATION

The Electrical Contractor shall provide all As-Installed information for inclusion within the Operating and Maintenance Manual as follows:

- As-Installed drawings showing the following minimum items:
  - Cable pathways and types.
  - Dimmer, controller, relays, interfaces locations and the like
  - Control panel types and locations.
  - Schematics and diagrams
- Technical Specification identifying the operation of the system to the Proprietor.
- Handover and training records
- Testing and commissioning reports

1351.0 WARRANTY

The system shall be warranted for a minimum 4 year period, which includes parts and installation.

1353 DALI CONTROL SYSTEM (DCS)

1354.0 SCOPE

Outline description: The work covered by this section includes the following:

- Design, construct, supply and install a DALI Control System (DCS), including all controllers, power supplies, interfaces and the like to ensure a fully operational system.
- Provide functionality as described in this specification and on the accompanying drawings.
- Testing and commissioning in accordance with the manufacturers requirements.

1359.0 GENERAL

This clause has been developed on a generic DCS. Should there exist any discrepancies between this specification and the manufacturers' specification and/or requirements, the higher standard shall be adhered to.

1361.0 MANUFACTURE

The DCS shall be a 'Clipsal DALI Control System'.

~~1314.0 PRE-QUALIFICATION~~

~~The Electrical Contractor shall be approved and certified to install the nominated DCS, and shall have demonstrated previous experience with installations of similar type and scale.~~

~~The Contractor shall have undertaken an approved DALI training course, and shall provide evidence of such training within the tender submission.~~

~~1366.0 MODULES~~

~~All modules, relays, dimmers, interfaces, controllers and the like shall be installed within the relevant switchboard, and DIN rail mounted. The equipment shall be located in a fully separated section with screening as necessary to avoid interference and appropriately labelled to identify purpose.~~

~~Unless shown otherwise provide sufficient space to accommodate all equipment and 30% spare space for future additions to the network. Liaise with the nominated LCS manufacturer to ensure all spatial requirements are met.~~

~~1369.0 DALI~~

~~All DALI luminaires shall be installed to ensure a fully operational system is provided.~~

~~The Electrical Contractor shall supply and install DALI controlgear in accordance with the following minimum criteria:~~

- ~~All DALI controlgear shall be of the same make, manufacture and generation.~~
- ~~All DALI controlgear shall be installed in a daisy chain loop. Star configuration will not be accepted.~~

~~Should any doubt exist as to the compatibility of certain luminaires, controlgear and configurations, the Electrical Contractor shall engage the services of the DCS manufacturer to test the luminaires prior to installation, and pay all associated costs.~~

~~It is the Electrical Contractors responsibility to ensure that all DALI controlgear is selected and cabled in accordance with the DCS manufacturer's requirements, and to ensure a fully operational system.~~

~~1376.0 INTERFACES~~

~~The following interfaces shall be provided as a minimum:~~

- ~~USB interface within each enclosure, load centre, switchboard and the like, for local access and programming of the DCS software.~~
- ~~Network interface within each enclosure as necessary to allow for access to the DCS software over the LAN (Local Area Network).~~
- ~~AMX interface for high level communication with the nominated AV (Audio Visual) system.~~
- ~~Ceiling sweep fan controller: for control of ceiling sweep fans via the local input device.~~
- ~~Motorised blind controller: curtain and shutter controllers for control of motorised blinds and the like via the local input device.~~
- ~~Security system interface, for interfacing with the nominated security system.~~

~~**1314.0** The Contractor shall coordinate with the relevant Sub-Contractor to determine final connection and communication requirements. It is the responsibility of the Electrical Contractor to ensure a fully operational system is provided.~~

~~**1385.0** FAULT FINDING~~

~~The DCS shall be designed, programmed and constructed to provide an automatic fault finding facility, such that all faults are logged and reported.~~

~~The DCS shall incorporate Line Controllers for monitoring of the connected DALI lines. The controllers shall provide status and error information for DALI lines, controlgear and lamps.~~

~~The Line Controller shall also be capable of displaying status and error information via LAN.~~

~~When a fault is experienced which effects the ongoing operation of the DCS, the operation of the DCS shall be transferred to a pre-determined failsafe mode until the error has been rectified.~~

~~**1390.0** CABLING~~

~~The Electrical Contractor shall provide all cabling as required to ensure the successful operation of the system. The cabling shall be uniquely coloured from all other cabling installed. And shall be segregated from all other cabling in accordance with the manufacturers requirements. As a minimum all cabling shall be installed as follows:~~

- ~~Installed on cable trays, catenaries or conduit.~~
- ~~Where installed on cable trays they shall be located in a segregated section using barriers, and shall be fixed to the cable tray using Velcro cable ties.~~
- ~~Where installed on catenaries, they shall be installed on a completely separate catenary, or can be installed as a separate group on any other catenary.~~
- ~~In all instances DALI Cabling shall be double insulated.~~

~~**1396.0** FAULT FINDING~~

~~The DCS shall incorporate Line Controllers for monitoring of the connected DALI lines. The controllers shall provide status and error information for DALI lines, controlgear and lamps.~~

~~The Line Controller shall also be capable of displaying status and error information via LAN.~~

~~**1399.0** GENERAL CONTROL SYSTEM FUNCTIONS~~

~~Function~~

~~The general function of the DCS shall include but not be limited to the following general scenarios:~~

~~Open plan offices~~

- ~~Local switch On/Off, with daylight sensing.~~
- ~~Provide intelligent programmable light level sensors, to measure the natural day light levels at the nominated working plane (750mm AFFL) and according to a predetermined~~

~~lux level (400 lux) to intelligently monitor and dim and/or switch various circuits depending on these factors.~~

- ~~360 deg Occupancy sensors to be located within these areas as depicted on plans and setup to automatically turn lighting off for after hour operation.~~
- ~~Corridor circulation zone linking to closed office occupancy sensors for after hours access.~~

~~Offices (adjacent windows)~~

- ~~Local switch On/Off, with PIR and microphonic time delayed occupancy sensors with daylight sensing set at 400 lux at 750mm AFFL to be programmed as a re-trigger able timer to switch lights off only after 15 – 30 minutes, if no movement is detected.~~
- ~~Alternately a PIR occupancy sensor only may be programmed as a re-trigger able timer to switch lights On/Off with a 15 - 30 minutes re-trigger time delay.~~

~~Offices~~

- ~~Local switch On/Off, with PIR and microphonic time delayed occupancy sensor to be programmed as a re-trigger able timer to switch lights off only after 15 – 30 minutes, if no movement is detected.~~
- ~~Alternately a PIR occupancy sensor only may be programmed as a re-trigger able timer to switch lights On/Off with a 15 – 30 minutes re-trigger time delay.~~

~~Meeting / Function Rooms~~

- ~~The lighting control system to provide dimmed scenes from local light switch panels at the entry to each room, utilizing a multi- button switch panels.~~

~~Scenes~~

~~Typical scenes to be selected from these switch panels might be:~~

~~Scene 1 Welcome: This scene is used for general use of the room, ideal for meetings and day-to day-use.~~

~~Scene 2 Presentation: This button selects a preset scene for a presentation dimming lights appropriately to suit overheads and projector lights to a screen.~~

~~Scene 3 Break: This button selects a scene for a lunch or break period.~~

~~Scene 4 Off: This button selects an "Off" scene turning all the lights "Off" with a slow fade time to enable those in the room adequate time to leave.~~

~~1421.0 SPECIFIC CONTROL SYSTEM FUNCTIONS~~

~~The general function of the DCS shall include but not be limited to the following general scenarios:~~

Schedule of Lighting Control Zones		
Zone	Control device	Methodology
Ground Floor		
LZ.G1	MS.G1, MS.G2, SCP	On SCP disarm, turn on and before 8.00am utilise MS.G1 and MS.G2 and turn off after 10 min delay. Between 8.00am and 6.00pm – turn on. After 6.00pm – turn off with MS.G1 and MS.G2 override (10 min delay) On SCP arm – turn off.
LZ.G2	MS.G1, MS.G2, MS.G3, MS.G4, SCP	As per LZ.G1 but utilise MS.G1, MS.G2, MS.G3, MS.G4.
LZ.G3	MS.G5	Turn on with movement 10 min delay Turn off
LZ.G4	MS.G6, PB.G1, SCP	As per LZ.G3 but with PB.G1 override which switches off and resets on SCP arm.

LEGEND

- LZ.Gx – Lighting Zone 'x' on ground floor.
- MS.Gx – Movement Sensor 'x' on ground floor.
- PB.Gx – Pushbutton 'x' on ground floor.
- CTS.Gx – Colour touch screen 'x' on ground floor.
- TS.Gx – Black and white touch screen 'x' on ground floor.
- MCTS.Gx – Master colour touch screen 'x' on ground floor.

1459.0 INPUT PANELS

Input panels shall generally be of pushbutton type with LED indicators to indicate button selection. All panels selected shall be fully compatible with the nominated DCS. In general, input panel types shall be summarised as follows:

Area	Model	Colour/Finish
General Areas	DCDAL31M series	White
Small Meeting Rooms	DCLCD35 series	White
Boardroom	DCLCD70 series	White

1477.0 PRE-CONSTRUCTION SUBMISSIONS

The Electrical Contractor shall provide the following minimum information prior to commencing installation of the DCS, for approval by the Engineer and DCS manufacturer:

1477.0 Layout drawings showing equipment locations, paths of reticulation and the like.

- Zoning diagrams showing the lighting control zones, including zone designations.
- Schedules identifying equipment type (make and model) corresponding to the layout drawings.
- Schematic diagrams of the DCS.
- Schedule of interfaces with all equipment and devices separate to the DCS eg. BMS, security system etc.
- Functional specification identifying the operation of the DCS, including description of each zone, and programmed scenes.
- Switchboard shop drawings.

1486.0 PROGRAMMING, TESTING AND COMMISSIONING

The Electrical Contractor shall engage the services of an independent commissioning agent as nominated by the DCS manufacturer.

Testing and commissioning shall be undertaken in accordance with the LCS manufacturers' requirements. In any case, the following minimum requirements shall be met:

- Shall be commissioned in accordance with CIBSE Commissioning Code M – "Commissioning Management".
- Shall be commissioned in accordance with CIBSE Commissioning Code C – "Automatic Controls".
- Shall be commissioned in accordance with CIBSE Commissioning Code L – "Commissioning Process for Lighting and NLCS".
- Final programming requirements shall be coordinated with the Proprietor.

1493.0 DCS TUNING

The Electrical Contractor and the independent commissioning agent shall attend site quarterly for 12 months after Practical Completion to tune and check the operation of the DCS to ensure the programming requirements have been met. The Electrical Contractor shall liaise with the Proprietor.

1495.0 TRAINING

Coordinate with the Proprietor to arrange for a "Training Day" to train all end-users (as nominated by the Proprietor) in the use and operation of the DCS. The following minimum topics shall be discussed:

- Basic everyday use and operation of the system.
- After hours operation.
- Emergency operation.
- Recommended use for optimising energy efficiency.
- Maintenance requirements.
- Troubleshooting.

~~1477.0 AS-INSTALLED DOCUMENTATION~~

~~The Electrical Contractor shall provide all As-Installed information for inclusion within the Operating and Maintenance Manual as follows:~~

- ~~As-Installed drawings showing the following minimum items:~~
  - ~~Cable pathways and types.~~
  - ~~Dimmer, controller, relays, interfaces locations and the like~~
  - ~~Control panel types and locations.~~
  - ~~Schematics and diagrams~~
- ~~Technical Specification identifying the operation of the system to the Proprietor.~~
- ~~Handover and training records~~

~~1512.0 WARRANTY~~

~~The system shall be warranted for a minimum 4 year period, which includes parts and installation.~~

~~1477.0~~ NATIONAL BROADBAND NETWORK (NBN) CORPORATION CABLING SYSTEMS

~~1515.1~~9.1 SCOPE

Outline Description: The work covered by this section includes the following:

- Preparation and approval of NBN Co Workshop Drawings in accordance with NBN Co guidelines.
- Access provisions for NBN Co cabling to site.
- Access provisions for NBN Co Network Termination Units (NTU), Power Supply Units (PSU) and Fibre Wall Outlets (FWO).
- Provision of cable supports and pathways in accordance with NBN Co requirements.
- Coordination and arrangement of inspections with NBN Co via the NBN Co Project Officer.
- Coordination with NBN Co for transfer of ownership of all NBN Co cable pathways.
- Application to the clients nominated Internet Service Provider (ISP) for ~~Lift,~~ Security~~, FIP~~ and other nominated services in a timely manner, including payment of all associated fees.
- Testing and commissioning of all systems installed and connected.
- Labelling of systems.
- Other items, whether mentioned in detail or not to complete the installation and put it into working order.

~~1515.2~~9.2 STANDARDS AND PRACTICE

Conformity to Standards

All materials and practice shall comply with the following standards unless otherwise specified:

Code	Description
AS/CA S008	Requirements for Authorised Cabling Products
AS/CA S009	Installation Requirements for Customer Cabling (Wiring Rules)
AS/NZS 1477	PVC Pipes and Fittings for Pressure Applications
AS/NZS 2032	Installation of PVC Pipe Systems
AS/NZS 3000	Electrical Installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3084	Commercial Building Standards for Telecommunications Pathways and Spaces
AS/NZS 3085.1	Administration of Communications Cabling Systems – Basic Requirements
AS/NZS 3086	Telecommunications Cabling Systems for Small Office/Home Office Premises
AS/NZS 3087	Testing of Balanced Communications Cabling
AS 3996	Access Covers and Grates
AS/NZS 4117	Surge Protection Devices for Telecommunications Cabling
AS/NZS 4129	Fittings for Polyethylene Pipes and Pressure Applications

AS/NZS 4130	Polyethylene Pipes for Pressure Applications
AS/NZS 4586	Slip Resistance Classification of New Pedestrian Surface Materials
AS/CA C524	External Telecommunications Cable Networks
AS/CA G591	Telecommunications in Road Reserves – Operational Guidelines for Installations
SAA HB29	Communications cabling manual

NBN Corporation Technical Guidelines

In addition the entire works shall be carried out by ACMA Open Cabling Registration cabling installers. All materials and equipment supplied shall hold relevant ACMA approvals.

The system shall generally be installed in accordance with the above standards; however, reference shall also be made to the manufacturers' requirements. Where there is a discrepancy, the standard which exceeds the requirements of the other shall be adhered too.

~~1515.3~~9.3 SYSTEM CERTIFICATION

Requirement

It is the Electrical Contractor's responsibility to supply, install, design and construct the cable support mechanisms for all NBN Co cabling based on the drawings accompanying this Specification. The cable support system and pit and pipe installation shall be fully certified by NBN Co prior to handover. Any NBN Co cable supports shown on the accompanying drawings are shown indicatively and are to be amended by the Electrical Contractor in consultation with the Electrical Engineer and NBN Co to suit the specific site requirements.

Submission

The Electrical Contractor shall submit all information necessary to NBN Co as required, to ensure a fully certified system is provided.

It is the Electrical Contractor's responsibility to ensure NBN Co sign-off and provide acceptance of the installation.

~~1515.4~~9.4 WORKSHOP DRAWINGS

Diagrammatic layouts: Tender Drawings forming part of this Specification are diagrammatic for tender only and shall not be used for installation purposes. Before commencing work, determine the exact positions of all equipment in conjunction with and to the approval of the Architect, Consulting Engineer and NBN Corporation having regard to interior design, building features, other services, and the requirements of regulatory authorities and standards indicated above.

Requirement: The Electrical Contractor shall submit Workshop Drawings in accordance with NBN Co guidelines to NBN Co for review and sign-off prior to commencement of work on site.

It is the Electrical Contractor's responsibility to obtain NBN Co approval of the drawings in a timely manner.

~~15.5~~9.5 INSPECTIONS

Arrange for, and give sufficient notice for inspection to the NBN Co Project Officer as follows:

- Installation of all underground works including conduits and pits.
- Installation of internal cabling cable supports before closing of ceilings.
- Completion of installation prior to handover to NBN Co.

Minimum notice required: 10 Working days

Coordinate with the NBN Co Project Officer to arrange for all necessary inspections required by the Authority. It shall be the Electrical Contractors responsibility to rectify all defects indicated by NBN Co, which shall be rectified without any addition to the construction programme, and at no additional cost to the project.

~~15.6~~9.6 GENERAL

Supply and install all trays, ducts, pits, hangers, brackets and the like to suit.

All metallic cable support mechanisms shall be connected to the building protective earth as specified for each case in AS/CA S009 or local equivalent, whichever is greater. It shall be the Electrical Contractors responsibility to ensure earth continuity is maintained for the full extent of all cable support mechanisms.

All conduits shall be installed in accordance with NBN Co Pit and Pipe requirements. The system shall be capable of supporting NBN Co cabling, and certified in accordance with NBN Co requirements.

~~15.7~~9.7 CABLE SUPPORT SYSTEM

Supports generally:

Shall comply with AS/NZS 3084, manufacturers requirements and NBN Co requirements.

Segregation:

Segregation shall be provided in accordance with NBN Co requirements. However, the following shall be incorporated within the installation:

- Cable pathways are to be generally run parallel and/or perpendicular to the Building structure.
- Cable pathways shall generally be installed below other services to allow ease of access by NBN Co during cabling installation.
- Conduits shall be labelled in accordance with NBN Co requirements.
- Draw wires shall be labelled with tags at both ends to identify

~~15.8~~9.8 EXTERNAL WORKS

Provide NBN Co approved P100mm (unless shown otherwise) communications conduits and pits as shown on the drawings, accompanying the Specification. Conduit runs shall generally be straight, however where bends exist they shall not exceed the bend radius requirements outlined in the NBN Co Technical Guidelines.

Refer to the drawings accompanying the specification for approximate locations of pits. Final locations are to be approved on site.

Provide 10mm nylon draw cords within all conduits, with ID tags provided to both ends.

Underground works shall be carried out in accordance with the "Cables & Enclosure" section of this specification, and NBN Co guidelines.

All conduits shall be installed in accordance with NBN Co Pit and Pipe requirements. The system shall be capable of reticulating NBN Co cabling, and certified in accordance with NBN Co requirements.

~~1515.9~~9.9 POWER SUPPLY

Requirements:

Provide 230 volt AC mains power supply to all active equipment as required by NBN Co Technical Standards.

Dedicated Circuit:

The supply shall; be provided by a dedicated circuit and the circuit breaker shall be labelled "NBN CO EQUIPMENT SUPPLY – DO NOT SWITCH OFF".

~~1515.10~~9.10 TESTING

Undertake all testing as required in the NBN Co technical guidelines.

Results:

Results are to be presented to NBN Co as required to achieve sign-off.

1516 TELECOMMUNICATIONS BLOCK CABLING SYSTEMS

1517.0 SCOPE

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OUTLINE DESCRIPTION:

THE WORK COVERED BY THIS SECTION INCLUDES THE FOLLOWING:

- **PROVISION OF A MAIN DISTRIBUTION FRAME (MDF)**
- **PROVISION OF A TELSTRA LEAD-IN**
- **APPLICATIONS TO TELSTRA, INCLUDING PAYMENT OF ALL ASSOCIATED FEES.**
- **THE PROVISION OF NEW EXTERNAL BUILDING UNDERGROUND CONDUIT ACCESS AND CABLE DRAW-IN PITS.**
- **BACKBONE EXTERIOR AND INTERIOR COPPER CABLING INCLUDING ALL TERMINATIONS.**
- **PROVISION OF A CATEGORY 3/CLASS C COMPLIANT BLOCK CABLING SYSTEM INCORPORATING BACKBONE AND HORIZONTAL CABLING AND ALL CABLE TERMINATIONS.**
- **PROVISION OF WALL-MOUNT FRAMES AND DISCONNECTION MODULES.**
- **PROVISION OF CABLE SUPPORTS, DUCTS, TRAYS, CATENARIES AND THE LIKE.**
- **TESTING AND COMMISSIONING OF ALL SYSTEMS INSTALLED AND CONNECTED.**
- **LABELLING OF SYSTEMS.**
- **OTHER ITEMS, WHETHER MENTIONED IN DETAIL OR NOT TO COMPLETE THE INSTALLATION AND PUT IT INTO WORKING ORDER.**

1531.0 STANDARDS AND PRACTICE

CONFORMITY TO STANDARDS

ALL MATERIALS AND PRACTICE SHALL COMPLY WITH THE FOLLOWING STANDARDS UNLESS OTHERWISE SPECIFIED:

AS/CA S008

REQUIREMENTS FOR AUTHORISED CABLING PRODUCTS

AS/CA S009

- **INSTALLATION REQUIREMENTS FOR CUSTOMER CABLING (WIRING RULES)**

AS/NZS 3000

- **SAA ELECTRICAL WIRING RULES**

~~**1516** AS/NZS 3080 – CLASS C~~

- ~~**INTEGRATED TELECOMMUNICATIONS CABLING FOR COMMERCIAL PURPOSES**~~

~~AS/NZS 3084~~

- ~~**COMMERCIAL BUILDING STANDARDS FOR TELECOMMUNICATIONS PATHWAYS AND SPACES**~~

~~AS/NZS 3085.1~~

- ~~**ADMINISTRATION OF COMMUNICATIONS CABLING SYSTEMS – BASIC REQUIREMENTS**~~

~~AS/NZS 3086~~

- ~~**TELECOMMUNICATIONS CABLING SYSTEMS FOR SMALL OFFICE/HOME OFFICE PREMISES**~~

~~AS/NZS 3087~~

- ~~**TESTING OF BALANCED COMMUNICATIONS CABLING**~~

~~AS/NZS 4117~~

- ~~**SURGE PROTECTION DEVICES FOR TELECOMMUNICATIONS CABLING**~~

~~SAA HB29~~

- ~~**COMMUNICATIONS CABLING MANUAL**~~

- ~~**TELSTRA CORPORATION RULES AND REGULATIONS**~~

- ~~**NBN CORPORATION PIT AND PIPE INSTALLATION GUIDELINES**~~

~~**IN ADDITION THE ENTIRE WORKS SHALL BE CARRIED OUT BY ACMA OPEN CABLING REGISTRATION CABLING INSTALLERS. ALL MATERIALS AND EQUIPMENT SUPPLIED SHALL HOLD RELEVANT ACMA APPROVALS.**~~

~~**THE SYSTEM SHALL GENERALLY BE INSTALLED IN ACCORDANCE WITH THE ABOVE STANDARDS; HOWEVER REFERENCE SHALL ALSO BE MADE TO THE MANUFACTURERS**~~

REQUIREMENTS. WHERE THERE IS A DISCREPANCY THE STANDARD WHICH EXCEEDS THE REQUIREMENTS OF THE OTHER SHALL BE ADHERED TOO.

1558.0 PROTOCOLS AND STANDARDS

THE SCS SHALL BE CAPABLE OF SUPPORTING THE FOLLOWING MINIMUM PROTOCOLS AND STANDARDS:

- **ETHERNET STANDARDS:**
  - **10 BASE T**
  - **TOKEN RING**
  - **ATM25**
  - **PSTN**
- **VOICE COMMUNICATIONS**
  - **ANALOGUE AND DIGITAL PABX SYSTEMS**
  - **ANALOGUE AND DIGITAL VIDEO APPLICATIONS**
  - **VIDEO CONFERENCING**
  - **BROADBAND VIDEO**
  - **BROADCAST TELEVISION**
  - **VOICE OVER IP (VOIP).**
- **POWER OVER ETHERNET**
  - **POE IN ACCORDANCE WITH IEEE 802.3AF POE**

1574.0 SYSTEM CERTIFICATION AND WARRANTY

REQUIREMENT

THE INSTALLER OF THE CABLING INSTALLATION IS TO PROVIDE THE PRINCIPAL WITH IMPEDANCE MATCHED END TO END SOLUTION. THE PREFERRED END TO END MANUFACTURES OF PRODUCT SHALL BE TE CONNECTIVITY, SIEMON, CLIPSAL ACTASSI, MOLEX SCS SYSTEMS. ALL PRODUCTS SHALL EXCEED CATEGORY 3/CLASS C CHANNEL AND COMPONENTS REQUIREMENTS. THE INSTALLATION SHALL BE CAPABLE OF MEETING OR EXCEEDING AS/NZS 3080 CERTIFICATION AND WARRANTY REQUIREMENTS. THE WARRANTY IS TO COMPRISE OF AN APPLICATIONS ASSURANCE

AND EXTENDED PRODUCT WARRANTY THAT WILL BE VALID FOR A MINIMUM OF A 20 YEAR PERIOD, AND IS TO BE A FULLY MANUFACTURER CERTIFIED SYSTEM.

THE TENDERING CONTRACTOR SHALL BE AN APPROVED INSTALLER OF THE BLOCK CABLING SYSTEM.

SUBMISSION

PROVIDE WITH THE TENDER A CLEAR STATEMENT OF THE APPLICATIONS ASSURANCE AND EXTENDED PRODUCT WARRANTY OFFERED ON THE COMMUNICATIONS INSTALLATION.

1580.0 INSPECTIONS

ARRANGE FOR, AND GIVE SUFFICIENT NOTICE FOR INSPECTION OF THE INSTALLATION AS FOLLOWS:

- INSTALLATION OF ALL UNDERGROUND WORKS INCLUDING CONDUITS AND PITS.
- INSTALLATION OF CABLING.
- INSTALLATION OF INTERNAL CABLING BEFORE CLOSING OF CEILINGS.
- COMPLETION OF INSTALLATION READY FOR TERMINATION.
- MINIMUM NOTICE REQUIRED: 10 WORKING DAYS

COORDINATE WITH TELSTRA CORPORATION TO ARRANGE FOR ALL NECESSARY INSPECTIONS REQUIRED BY THE AUTHORITY.

1588.0 GENERAL

SUPPLY AND INSTALL ALL TRAYS, CABLES, DUCTS, PITS, AND MOUNTING BLOCKS/BRACKETS TO SUIT. ALL DATA PLATES TO MATCH OTHER ACCESSORIES.

ALL DISTRIBUTION FRAMES, CABLE TRAYS AND CATENARY WIRES SHALL BE CONNECTED TO THE BUILDING PROTECTIVE EARTH AS, SPECIFIED FOR EACH CASE IN AS/CA S009 OR LOCAL EQUIVALENT, WHICHEVER IS GREATER.

UNDERGROUND WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE "CABLES & ENCLOSURE" SECTION OF THIS SPECIFICATION.

ALL CONDUITS SHALL BE INSTALLED IN ACCORDANCE WITH TELSTRA AND NBN CO PIT AND PIPE REQUIREMENTS. THE SYSTEM SHALL BE CAPABLE OF SUPPORTING NBN CO CABLING, AND CERTIFIED IN ACCORDANCE WITH NBN CO REQUIREMENTS. ENGAGE THE SERVICES OF TELSTRA TO PROVIDE ALL PIT AND PIPES IN ACCORDANCE WITH NBN CO REQUIREMENTS FOR THE FUTURE INSTALLATION OF NBN CO CABLING.

1593.0 EXTERNAL WORKS

PROVIDE ACMA APPROVED P100MM COMMUNICATIONS CONDUITS AND PITS AS SHOWN ON THE DRAWINGS, ACCOMPANYING THE SPECIFICATION. CONDUIT RUNS SHALL GENERALLY BE STRAIGHT, HOWEVER WHERE BENDS EXIST THEY SHALL NOT

EXCEED THE BEND RADIUS REQUIREMENTS OF THE CABLING TO BE INSTALLED WITHIN. PLAN AND GAIN APPROVAL FOR ALL ROUTES BEFORE EXCAVATION.

REFER TO THE DRAWINGS ACCOMPANYING THE SPECIFICATION FOR APPROXIMATE LOCATIONS OF PITS. FINAL LOCATIONS ARE TO BE APPROVED ON SITE.

PROVIDE 10MM NYLON DRAW CORDS WITHIN ALL CONDUITS.

UNDERGROUND WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE "CABLES & ENCLOSURE" SECTION OF THIS SPECIFICATION.

1598.0 TESTING

ALL CABLES SHALL BE TESTED AND APPROVED FOR CATEGORY 3/CLASS C COMPLIANCE UTILISING CERTIFIED TEST EQUIPMENT AS PROVIDED BY THE SUB-CONTRACTOR. PROVIDE CERTIFYING EVIDENCE OF THE CALIBRATION ACCURACY OF ALL TEST EQUIPMENT.

THE FOLLOWING SHALL BE THE MINIMUM TESTING REQUIREMENTS FOR COPPER CABLING:

- 100% TESTING OF ALL RUNS FOR CONTINUITY AND POLARITY.
- 100% TESTING OF HORIZONTAL CABLING WITH COMPLIANCE TO CATEGORY 3/CLASS C REQUIREMENTS.
- A WRITTEN TEST REPORT FOR EVERY TEST (1 PER PAGE) AND A SOFT COPY SHALL BE SUBMITTED AND INCLUDED WITH THE AS-BUILT DOCUMENTATION. ALTERNATIVELY, IF REQUESTED IN THE SCOPE OF WORK, TEST RESULTS TO BE

~~SUBMITTED IN .CSV FORMAT, TO ALLOW GENERATION OF SUMMARY TEST INFORMATION IN LIEU OF INDIVIDUAL TEST PAGES.~~

- ~~TESTING SHALL BE CARRIED OUT WITH A LEVEL TESTER AS RECOMMENDED BY THE MANUFACTURER. THE CONTRACTOR PRIOR TO PERFORMING ANY TESTING MUST SEEK APPROVAL FROM PRINCIPAL IF ANY OTHER CABLE TESTER IS TO BE USED.~~

~~THE FOLLOWING PARAMETERS SHALL BE TESTED ACCORDING TO AS 3080 AND EIA/TIA-568B.2~~

- ~~NEAR-END CROSSTALK (NEXT) (BOTH DIRECTIONS)~~
- ~~POWER SUM NEAR-END CROSSTALK (PSNEXT) (BOTH DIRECTIONS)~~
- ~~FAR-END CROSSTALK (FEXT) (BOTH DIRECTIONS)~~
- ~~POWER SUM FAR-END CROSSTALK (PSFEXT) (BOTH DIRECTIONS)~~
- ~~POWER SUM EQUAL LEVEL FAR-END CROSSTALK (PS ELFEXT) (BOTH DIRECTIONS)~~
- ~~ATTENUATION~~
- ~~RETURN LOSS (BOTH DIRECTIONS)~~
- ~~DELAY SKEW~~
- ~~CONTINUITY~~
- ~~WIRE MAP~~
- ~~LENGTH~~
- ~~DC LOOP RESISTANCE~~
- ~~ATTENUATION TO CROSSTALK RATIO (ACR)~~
- ~~ACR @ REMOTE~~
- ~~POWER SUM ACR~~
- ~~PROPAGATION DELAY (BOTH DIRECTIONS)~~

~~A COMPLETE SET OF TEST RESULTS SHALL BE PROVIDED AS PART OF THE INSTALLATION MANUALS. INSPECTION AND TESTING OF THESE PARAMETERS DOES NOT RELIEVE THE CONTRACTOR OF THEIR RESPONSIBILITY TO PROVIDE AND~~

MAINTAIN AN OPERATIONAL SYSTEM. REPLACE ANY CABLES NOT PERFORMING WITHIN THE SPECIFIED REQUIREMENTS.

PROVIDE COMPLETED AND SIGNED TCA1 FORM FOR ENTIRE COMMUNICATIONS SYSTEM INSTALLATION.

RESULTS: PROVIDE COPIES OF THE TEST RESULTS AND TCA1 FORM AND INCLUDE WITHIN MAINTENANCE MANUALS.

1625.0 COMMUNICATIONS OUTLETS

PROVIDE OUTLETS TO EACH LOCATION NOMINATED ON THE DRAWINGS ACCOMPANYING THIS SPECIFICATION, WHICH SHALL GENERALLY BE PROVIDED AS FOLLOWS:

- FITTED WITH MINIMUM CATEGORY 5E/CLASS D, 8 WAY RJ45 OUTLETS WITH "IDC" TYPE TERMINATIONS. MAKE OF RJ45 OUTLETS SHALL MATCH THAT OF THE CABLE.
- MOUNTED ON FACE PLATES OF IDENTICAL MANUFACTURE TO POWER OUTLETS.
- PROVIDED WITH SHUTTERS.

1630.0 LABELLING - COMMUNICATIONS CABLING

ALL LABELLING WILL BE IN ACCORDANCE WITH AS/NZS 3085.1.

FACEPLATES TO MATCH SOCKET OUTLET FACEPLATES AND ARE TO BE SUPPLIED AND INSTALLED BY THE CONTRACTOR. RJ45 CATEGORY 5E/CLASS D SOCKETS SHALL MOUNT INTO FACEPLATE, WHICH WILL BE FLUSH MOUNTED AND SHALL BE PERMANENTLY LABELLED USING AN APPROVED METHOD WITH UNIQUE ALPHANUMERIC CHARACTER IDENTIFICATION CODE TO IDENTIFY THE FRAME, MODULE AND PAIR NUMBERS. PROVIDE SAMPLES FOR APPROVAL PRIOR TO INSTALLATION.

IN ADDITION, PROVIDE LABELS FOR ALL CABLES CONSISTING OF WRAP-AROUND MARKERS, BEHIND FACE-PLATES AND AT COMMUNICATIONS ENCLOSURES. HAND WRITTEN LABELLING DIRECTLY ON CABLES WILL NOT BE ACCEPTED.

ALL LABELS, REGARDLESS OF THEIR LOCATION, SHALL PROVIDE FOR CLEAR AND CONCISE EASE OF IDENTIFICATION OF ITS RESPECTIVE POINT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE AND INSTALL THESE PRE-PRINTED LABELS SIZED APPROPRIATELY TO ITS LOCATION.

ALL DISCONNECTION MODULES SHALL BE LABELLED USING TE CONNECTIVITY HIGHBAND LABEL HOLDERS TO SUIT. IN ADDITION, EACH FRAME SHALL BE LABELLED AND EACH GROUP OF CABLES CORRESPONDING TO EACH ACTIVE EQUIPMENT

~~CABLING GROUP, OR GROUP/AREA OF THE INSTALLATION. ALLOW A SEPARATE LABEL FOR EACH GROUP OF 6 VERTICAL MODULES FOR THIS PURPOSE.~~

~~LABELLING REQUIREMENTS SHALL BE DEFINED IN CONJUNCTION WITH THE PROPRIETOR AFTER SUBMISSION OF COMMUNICATIONS ROOM WORKSHOP DRAWINGS.~~

~~1637.0 CABLE SUPPORT SYSTEM~~

~~SUPPORTS GENERALLY: SHALL COMPLY WITH AS/NZS 3084, AND WITH MANUFACTURERS REQUIREMENTS.~~

~~RISER CABLE SUPPORTS:~~

~~HORIZONTAL RUNS: SUITABLE SIZED CABLE TRAYS AND LADDERS WITH PAINTED TOP-HAT SECTIONS FROM FLOOR TO CEILING WITHIN EACH CUPBOARD OR AT EACH PENETRATION.~~

~~VERTICAL RUNS: CABLE TRAY OR OTHER APPROVED METHODS OF SUPPORT.~~

~~DISTRIBUTION CABLE SUPPORTS:~~

~~CONCEAL ALL CABLES. SUPPORT CABLES RUN IN FALSE CEILING SPACE OR WITHIN BUILDING STRUCTURE BY ONE OF THE FOLLOWING METHODS:~~

- ~~CATENARY WIRE SUPPORT.~~
- ~~SURFACE MOUNTED CONDUIT.~~
- ~~CABLE TRAY ON CANTILEVER SUPPORTS.~~

~~INSTALL DUCTS AND CONDUITS WHERE REQUIRED.~~

~~PROVIDE CABLE TRAY SUPPORTS FOR ALL INTERNAL FIBRE CABLES THROUGHOUT THEIR ENTIRE LENGTH.~~

~~SEGREGATION:~~

~~PROVIDE PHYSICAL BARRIER SEGREGATION BETWEEN THE COMMUNICATIONS CABLING SYSTEM AND ALL OTHER WIRING SYSTEMS AS LAID OUT IN AS/CA S009. COMMUNICATIONS CABLES ARE NOT TO RUN PARALLEL WITH POWER CABLES AND SHALL BE INSTALLED TO AVOID LUMINAIRES. CROSSOVERS, WHERE UNAVOIDABLE, SHALL BE PERPENDICULAR TO POWER CABLES AND OTHER EQUIPMENT.~~

~~REDUCING NOISE COUPLING: IN ORDER TO FURTHER REDUCE NOISE COUPLING FROM SOURCES SUCH AS ELECTRICAL POWER WIRING, RADIO FREQUENCY (RF) SOURCES,~~

~~LARGE MOTORS AND GENERATORS, INDUCTION HEATERS AND ARC WELDERS, THE FOLLOWING ADDITIONAL PRECAUTIONS SHOULD BE CONSIDERED;~~

- ~~INCREASE PHYSICAL SEPARATION, TAKING ADVANTAGE OF THE "INVERSE SQUARE LAW"~~
- ~~MAINTAINING PROXIMITY OF ELECTRICAL BRANCH CIRCUIT LINE, NEUTRAL AND GROUNDING CONDUCTORS BY TWISTING, SHEATHING, TAPING OR BUNDLING TOGETHER, TO MINIMIZE INDUCTIVE COUPLING INTO TELECOMMUNICATIONS CABLING.~~
- ~~USING SURGE PROTECTORS IN BRANCH CIRCUITS, WHICH CAN FURTHER LIMIT THE PROPAGATION OF ELECTRICAL SURGES.~~
- ~~USING FULLY ENCLOSED, GROUNDED METALLIC DUCTING, OR GROUNDED CONDUIT, OR USING CABLE INSTALLED CLOSE TO A GROUNDED METALLIC SURFACE, WHICH WILL LIMIT INDUCTIVE NOISE COUPLING.~~

~~CAPACITIVELY AND INDUCTIVELY COUPLED ELECTRICAL NOISE SOURCES:~~

~~CLOSED METAL PATHWAYS (E.G. CONDUITS) GENERALLY PROVIDE ADEQUATE PROTECTION FROM NEARBY CAPACITIVELY COUPLED (RAPID CHANGES IN LARGE VOLTAGES) NOISE SOURCES TYPICALLY FOUND IN COMMERCIAL BUILDINGS, HOWEVER CAN CAUSE CROSSTALK BETWEEN THE CABLES WITHIN THE ENCLOSURE. IN CASES WHERE INDUCTIVELY COUPLED (RAPID CHANGES IN LARGE CURRENTS) NOISE SOURCES ARE A PROBLEM, THE CLOSED METAL PATHWAY SECTION IN PROXIMITY TO THE SOURCE SHOULD BE OF FERROUS (OR EQUIVALENT) INDUCTION SUPPRESSION MATERIAL.~~

~~ROUTING OF UNSHIELDED PATHWAYS:~~

~~OPEN OR NON-METAL PATHWAYS (EG. OPEN TRAY OR PLASTIC DUCT) SHALL BE PLACED WITH SUFFICIENT SEPARATION FROM NOISE SOURCES TO ELIMINATE ANY~~

~~POTENTIAL COUPLING PROBLEMS. THESE PATHWAYS SHALL BE ROUTED A MINIMUM OF 300 MM AWAY FROM FLUORESCENT LIGHTING FIXTURES.~~

~~SPECIAL ATTENTION SHALL BE GIVEN TO THE ROUTING OF SUCH PATHWAYS AWAY FROM BALLASTS AND HIGH INTENSITY DISCHARGE DEVICES.~~

~~SHIELDING:~~

~~SHOULD ANY DOUBT EXIST WITH RESPECT TO INTERFERENCE, CROSSTALK AND THE LIKE, PROVIDE SHIELDED CABLING ALTERNATIVES. APPROVED ALTERNATIVES ARE AS FOLLOWS:~~

- ~~SHIELDED TWISTED PAIR (STP)~~
- ~~SCREENED CABLE WITH FOILED TWISTED PAIR (S/FTP)~~
- ~~SCREENED TWISTED PAIR (SCTP)~~

~~1666.0 INCOMING TELSTRA CABLING AND MAIN DISTRIBTION FRAME (MDF)~~

~~PROVIDE CONDUIT FACILITIES FOR ALL TELSTRA CORPORATION LEAD-IN CABLING AS REQUIRED FOR TELSTRA. INCLUDE LEAD-IN CONDUITS, DRAW-WIRE, CABLE TRAYS AND BACK-MOUNT CHANNELS.~~

~~PROVIDE AN MDF AS INDICATED ON THE DRAWINGS ACCOMPANYING THE SPECIFICATION, AND COMPRISING THE FOLLOWING CHARACTERISTICS:~~

~~EXTERNAL:~~

- ~~EXTERNAL ENCLOSURES ARE TO BE OF IP54 MINIMUM.~~
- ~~WALL SURFACE MOUNTED.~~
- ~~KEY LOCKABLE.~~
- ~~COLOURED WHITE.~~
- ~~POLYCARBONATE OR METAL CONSTRUCTION.~~
- ~~LABELLED "MAIN DISTRIBUTION FRAME" (OR AS SHOWN ON THE ACCOMPANYING DRAWINGS) WITH TRAFFOLYTE LABELLING.~~

~~INTERNAL:~~

- ~~ENCLOSED IN POLYCARBONATE OR METAL CONSTRUCTION.~~
- ~~WALL SURFACE OR RECESSED AS SHOWN.~~
- ~~KEY LOCKABLE.~~
- ~~COLOURED WHITE.~~
- ~~LABELLED "MAIN DISTRIBUTION FRAME" (OR AS SHOWN ON THE ACCOMPANYING DRAWINGS) WITH TRAFFOLYTE LABELLING.~~

~~**1516 JUMPER WIRES:**~~

- ~~**0.5MM PLAIN COPPER CONDUCTORS.**~~
- ~~**TWISTED.**~~
- ~~**PVC INSULATED.**~~

~~**PROVIDE BACK-MOUNT CHANNELS SIZED AS INDICATED ON THE DRAWINGS ACCOMPANYING THE SPECIFICATION AND ALL TERMINATION FACILITIES AS REQUIRED FOR TELSTRA. WALL-MOUNT DISTRIBUTION FRAMES SHALL BE EQUAL TO "TE CONNECTIVITY PROFILE" EQUIPMENT.**~~

~~**PROVIDE DISCONNECTION MODULES AS REQUIRED FOR ALL INTERNAL CABLING INCLUDING AN EARTHING MODULE AT EACH FRAME. MODULES SHALL BE "TE CONNECTIVITY LSA-PLUS" OR EQUIVALENT. REFER TO 'EARTHING' SECTION DETAILING EARTHING REQUIREMENTS.**~~

~~**ARRANGE WITH TELSTRA CORPORATION FOR THE PROVISION OF ALL INCOMING CABLING AND ITS TERMINATION IN COORDINATION WITH THE PROJECT PROGRAMME. PAY ALL ASSOCIATED TELSTRA FEES. ARRANGE FOR CONNECTION VIA**~~

THE TELSTRA SMART COMMUNITY WEBSITE (HTTP://WWW.TELSTRA.COM.AU/SMARTCOMMUNITY).

PROVIDE ALL FINAL DISTRIBUTION FRAMES AS INDICATED ON THE DRAWINGS ACCOMPANYING THE SPECIFICATION. COORDINATE LOCATIONS ON SITE. FDP'S SHALL BE RECESSED AND LOCKABLE.

1690.0 INTERMEDIATE DISTRIBUTION FRAMES (IDF) AND FINAL DISTRIBUTION POINTS (FDP)

PROVIDE IDF'S AND FDP'S AS INDICATED ON THE DRAWINGS ACCOMPANYING THE SPECIFICATION, AND COMPRISING THE FOLLOWING CHARACTERISTICS:

EXTERNAL:

- EXTERNAL ENCLOSURES ARE TO BE OF IP54 MINIMUM.
- WALL SURFACE MOUNTED.
- KEY LOCKABLE.
- COLOURED WHITE.
- POLYCARBONATE OR METAL CONSTRUCTION.
- LABELLED "MAIN DISTRIBUTION FRAME" (OR AS SHOWN ON THE ACCOMPANYING DRAWINGS) WITH TRAFFOLYTE LABELLING.

INTERNAL:

- ENCLOSED IN POLYCARBONATE OR METAL CONSTRUCTION.
- WALL SURFACE OR RECESSED AS SHOWN.
- KEY LOCKABLE.
- COLOURED WHITE.
- LABELLED "MAIN DISTRIBUTION FRAME" (OR AS SHOWN ON THE ACCOMPANYING DRAWINGS) WITH TRAFFOLYTE LABELLING.

JUMPER WIRES:

- 0.5MM PLAIN COPPER CONDUCTORS.
- TWISTED.
- PVC INSULATED.

PROVIDE BACK-MOUNT CHANNELS SIZED AS INDICATED ON THE DRAWINGS ACCOMPANYING THE SPECIFICATION AND ALL TERMINATION FACILITIES. WALL-

~~**MOUNT DISTRIBUTION FRAMES SHALL BE EQUAL TO "TE CONNECTIVITY PROFILE" EQUIPMENT.**~~

~~**PROVIDE DISCONNECTION MODULES AS REQUIRED FOR ALL INTERNAL CABLING INCLUDING AN EARTHING MODULE AT EACH FRAME. MODULES SHALL BE "TE**~~

CONNECTIVITY LSA-PLUS" OR EQUIVALENT. REFER TO 'EARTHING' SECTION DETAILING EARTHING REQUIREMENTS.

1711.0 SUBSCRIBER LINE PROTECTION (SLP)

GENERAL:

PROVIDE SUBSCRIBER LINE PROTECTION TO ALL MDF'S SIZED TO MATCH THE TELSTRA LEAD-IN CABLE, AND INCORPORATING THE FOLLOWING CHARACTERISTICS:

MAXIMUM CONTINUOUS OPERATING VOLTAGE:	190VDC
MAXIMUM DISCHARGE CURRENT:	20KA AT 8/20µS
MAXIMUM LINE CURRENT:	150MA
FREQUENCY:	12MHZ; 8MBITS
INSTALLATION:	TE CONNECTIVITY-LSA DISCONNECTION BLOCK
MANUFACTURE:	ERICO OR EQUAL APPROVED

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1732.0 UNSHIELDED TWISTED PAIR (UTP) CABLING

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TYPE:

PROVIDE CATEGORY 3/CLASS C COMPLIANT SOLID CORE 4 PAIR UTP AS SHOWN ON THE ACCOMPANYING DRAWINGS.

CONDUCTOR:

PROVIDE SOLID BARE COPPER SIZED ACCORDINGLY. STRANDED CABLING WILL NOT BE ACCEPTED.

INTERNAL CABLING INSULATION AND JACKET:

PROVIDE POLYETHYLENE INSULATION AND POLYETHYLENE JACKET.

EXTERNAL CABLING INSULATION AND JACKET:

PROVIDE UV STABILISED POLYETHYLENE INSULATION AND NYLON JACKET, WITH JELLY FILLED INTERSTICES.

FIRE AND LIFE SAFETY:

WHERE CABLING IS BEING PROVIDED FOR FIRE AND LIFE SAFETY EQUIPMENT I.E. LIFTS, FIRE INDICATOR PANELS (FIP) AND THE LIKE, AS SHOWN ON THE

~~ACCOMPANYING DRAWINGS, THE CONTRACTOR SHALL PROVIDE CABLING TO MEET THE FOLLOWING MINIMUM REQUIREMENTS:~~

- ~~1.5MM2 SOLID COPPER CONDUCTORS~~
- ~~R-HF-110 (ELASTOMER) INSULATION~~
- ~~HFS-110-TP (ELASTOMER) SHEATH~~

~~TERMINATIONS:~~

- ~~TERMINATE ALL CABLE PAIRS AND ALL CABLES.~~
- ~~TERMINATE WITH CONNECTOR PIN ASSIGNMENT IN ACCORDANCE WITH AS/NZS 3080, OPTION T568A.~~
- ~~MAINTAIN CABLE TWISTS AS FAR AS POSSIBLE UP TO THE POINT OF TERMINATION AND NO MORE THAN 8MM FROM THE POINT OF TERMINATION.~~
- ~~CUT BACK CABLE SHEATHS NEATLY AND SUPPORT ADEQUATELY.~~
- ~~PROVIDE ADEQUATE AND POSITIVE STRAIN RELIEF.~~

~~HORIZONTAL CABLING:~~

- ~~CABLE LENGTH OF UTP CABLES SHALL NOT TO EXCEED 2,000M. PLAN ALL ROUTES SO AS TO ACHIEVE THIS REQUIREMENT~~
- ~~PROVIDE UTP HORIZONTAL CABLES FROM THE APPROPRIATE FRAME TO INFORMATION OUTLET LOCATIONS AS SHOWN~~
- ~~UTILISE 2 CABLE PAIRS GENERALLY FOR EACH OUTLET~~

~~BACKBONE CABLING:~~

~~PROVIDE CATEGORY 3 COMPLIANT UNSHIELDED TWISTED PAIR (UTP) BACKBONE CABLING AS INDICATED ON THE DRAWINGS ACCOMPANYING THE SPECIFICATION AS FOLLOWS:~~

- ~~OUTDOOR CABLES WITH POLYETHYLENE SHEATH, GEL FILLED~~
- ~~SPLICE FROM OUTDOOR TO INDOOR CABLES WHEN ENTERING A BUILDING.~~
- ~~GEL FILLED CABLING SHALL BE INSTALLED AT LEVEL GRADE IN ORDER TO PREVENT THE GEL FROM SEEPING AND POURING OUT OF THE CABLE OVER AN EXTENDED PERIOD OF TIME.~~

~~PERFORM TEST ON EACH CABLE IN ACCORDANCE TO MANUFACTURER'S TESTING RECOMMENDATIONS AND IN ACCORDANCE WITH AS 3080. REPLACE ANY DAMAGED OR FAILED COMPONENTS.~~

~~1732.0~~ STRUCTURED CABLING SYSTEMS (SCS)

Commented [PC85]: Section is constructed around a Category 6A SCS.

~~1763.1~~10.1 SCOPE

Outline Description: The work covered by this section includes the following:

- ~~The provision of new external building underground conduit access and cable draw-in pits.~~
- ~~Backbone exterior and interior optical fibre and copper cabling including all terminations.~~
- Provision of Category 6~~A~~/Class E~~A~~ compliant Structured Cabling System (SCS) incorporating backbone and horizontal cabling and all cable terminations.
- Fitting out of Communications rooms for cable-trays, vertical ducts and equipment.
- Testing and commissioning of all systems installed and connected.
- Labelling of systems.
- Other items, whether mentioned in detail or not to complete the installation and put it into working order.

Commented [MS86]: Change if 6 or 5E required

~~1763.2~~10.2 STANDARDS AND PRACTICE

- Conformity to Standards

All materials and practice shall comply with the following standards unless otherwise specified:

AS/CA S008

- Requirements for Authorised Cabling Products

AS/CA S009

- Installation Requirements for Customer Cabling (Wiring Rules)

AS/NZS 3000

- SAA Electrical Wiring Rules

AS/NZS 3080 – Class E~~A~~

Commented [PC87]: If cable type is changed from Cat 6A, reference to Class will require to be changed to correspond.

- Integrated Telecommunications Cabling for Commercial Purposes

AS/NZS 3084

- Commercial Building Standards for Telecommunications Pathways and Spaces

AS/NZS 3085.1

- Administration of Communications Cabling Systems – Basic Requirements

AS/NZS 3086

- Telecommunications Cabling Systems for Small Office/Home Office Premises

AS/NZS 3087

- Testing of Balanced Communications Cabling

AS/NZS 4117

- Surge Protection Devices for Telecommunications Cabling

SAA HB29

- Telecommunications Cabling Handbook

ISO/IEC 11801

- Information Technology – Generic cabling for customer premises

In addition, the entire works shall be carried out by ACMA Open Cabling Registration cabling installers. All materials and equipment supplied shall hold relevant ACMA approvals.

The system shall generally be installed in accordance with the above standards; however, reference shall also be made to the manufacturers requirements. Where there is a discrepancy the standard which exceeds the requirements of the other shall be adhered too.

Refer to 'Earthing' Section detailing earthing requirements.

~~1763.3~~10.3 PROTOCOLS AND STANDARDS

The SCS shall be capable of supporting the following minimum protocols and standards:

- Ethernet Standards:
  - 10 Base T, 100 Base TX, 1000 Base T
  - 10 Base T, 100 Base TX, 1000 Base TX, 10G Base T
  - ATM25
  - ISDN
  - PSTN
- Voice Communications
  - Analogue and digital PABX systems
  - Analogue and digital video applications
  - Video conferencing
  - Broadband video
  - Broadcast television
  - Voice over IP (VoIP).
- Power Over Ethernet
  - PoE in accordance with IEEE 802.3af PoE
  - PoE+ in accordance with IEEE 802.3at PoE

Commented [PC88]: Keep for Category 5e solution

Commented [PC89]: Keep for Category 6, 6A, 7 or 7A solution

~~1763.4~~10.4 SYSTEM CERTIFICATION AND WARRANTY

Requirement

The cabling installation shall be provided as an impedance matched end to end solution. The end to end system shall be from one of the following preferred manufacturers TE Connectivity, Siemon, CommScope Systimax, Clipsal Actassi, Molex SCS and Panduit systems. All products shall exceed requirements for Category 6A/Class EA channel and components.

The installation shall be capable of meeting or exceeding AS/NZS 3080 certification and warranty requirements. The warranty is to comprise of an Applications Assurance and Extended

Commented [MS90]: Remove if a specific system is required.
SA Health requires Systimax

Commented [MS91]: Change if 6 or 5E required

Product/Labour Warranty that will have a valid minimum warranty of 55 years and is to be a fully manufacturer certified system.

Commented [MS92]: Change validity period of warranty to suit installation:

20/25 year period – High end client with leased space for 10 years+

10 year period – Medium client with 5-7 year lease

5 year period – Short lease low tech client

1 year period – Short term temporary fitout

The tendering contractor shall be an approved installer of the SCS system.

Submission

Provide with the tender a clear statement of the Applications Assurance and extended product warranty offered on the communications installation.

~~1763.5~~10.5 INSPECTIONS

Arrange for, and give sufficient notice for inspection of the installation as follows:

- Installation of all underground works including conduits and pits.
- Installation of cabling.
- Installation of internal cabling before closing of ceilings.
- Completion of installation ready for termination.
- Minimum notice required: 10 Working days

~~1763.6~~10.6 GENERAL

Supply and install all trays, cables, ducts, pits, and mounting blocks/brackets to suit. All data plates to match other accessories.

All distribution frames, cabinets, cable trays and catenary wires shall be connected to the building protective earth as, specified for each case in AS/CA S009 or local equivalent, whichever is greater.

Underground works shall be carried out in accordance with the "Cables & Enclosure" section of this specification.

~~1763.7~~10.7 EXTERNAL WORKS

Provide ACMA approved P50mm and/or P100mm communications conduits and pits as shown on the drawings, accompanying the Specification. Conduit runs shall generally be straight, however where bends exist they shall not exceed the bend radius requirements of the cabling to be installed within. Plan and gain approval for all routes before excavation.

Refer to the drawings accompanying the specification for approximate locations of pits. Final locations are to be approved on site.

Provide 10mm nylon draw cords within all conduits.

Underground works shall be carried out in accordance with the "Cables & Enclosure" section of this specification.

~~1763.8~~10.8 TESTING

Copper

All cables shall be tested and approved for Category 6~~A~~/Class E~~A~~ compliance utilising certified test equipment as provided by the Sub-Contractor. Provide certifying evidence of the calibration accuracy of all test equipment.

Commented [MS93]: Change if 6 or 5E required

The following shall be the minimum testing requirements for copper cabling:

- 100% testing of all runs for continuity and polarity.
- 100% testing of all cabling with compliance to Category 6~~A~~/Class E~~A~~ requirements.
- ~~100% testing of all fibre cabling with compliance to OS2 and OM4 requirements.~~
- A written test report for every test (1 per page) and a soft copy shall be submitted and included with the as-built documentation. Alternatively, if requested in the Scope of Work, test results to be submitted in .FLW and .PDF format, to allow generation of summary test information in lieu of individual test pages.
- Testing shall be carried out with a minimum of a Level IV tester. The contractor prior to performing any testing must seek approval from Principal if any other cable tester is to be used.

Commented [MS94]: Change if 6 or 5E required

Commented [PC95]: Level II – Cat 5
Level III – Cat 5e/Cat 6
Level IV – Cat 6A/7A

The following parameters shall be tested according to AS 3080:

- Near-End Crosstalk (NEXT) (Both directions)
- Power sum Near-End Crosstalk (PSNEXT) (Both directions)
- Far-End Crosstalk (FEXT) (Both directions)
- Power sum Far-End Crosstalk (PSFEXT) (Both directions)
- Power sum Equal Level Far-End Crosstalk (PS ELFEXT) (Both directions)
- Attenuation
- Return Loss (Both directions)
- Delay Skew
- Continuity
- Wire Map
- Length
- DC Loop resistance
- Attenuation to Crosstalk Ratio (ACR)
- ACR @ remote
- Power sum ACR
- Propagation Delay (Both directions)

~~Optical Fibre~~

~~All optical fibre backbone/horizontal cables are to be tested in accordance with AS/NZS 3080 and ISO/IEC 11801 Tier 2 or Extended Test program utilised ITDR. Provide evidence of the calibration accuracy of the OTDR.~~

~~The fibre optic testing is to include bi-directional two-fibre dual wavelength 850/1300nm or 1310/1550nm insertion loss, grading of connector face.~~

General

A complete set of test results shall be provided as part of the Installation Manuals. Inspection and testing of these parameters does not relieve the Contractor of their responsibility to provide and maintain an operational system. Replace any cables not performing within the specified requirements.

Marginal passes will not be accepted.

Provide completed and signed TCA1 form for entire communications system installation.

Results: Provide copies of the test results and TCA1 form and include within Maintenance Manuals.

~~1763.9~~10.9 COMMUNICATIONS OUTLETS

Provide outlets to each location nominated on the drawings accompanying this specification, which shall generally be provided as follows:

- Fitted with Category 6~~A~~/Class E~~A~~, 8 way RJ45 outlets with "IDC" type terminations. Manufacturer and make of outlets shall match that of the cable.
- Mounted on face plates of identical manufacture to power outlets.
- Where shielded cabling is provided in lieu of UTP, provide the equivalent shielded outlet type.
- Provided with shutters.

Commented [MS96]: Change if 6 or 5E required

Commented [PC97]: Outlet type is to be changed to 'GG45' for Category 7, 'ARJ45' for Category 7A.

Commented [MS98]: Required for DECD projects (SA). Generally not required except in floor/table boxes or where outlets are installed vertically.

~~Where soft-wired workstations are provided, only the following approved methods for cable reticulation shall be accepted:~~

- ~~Provide a MUTO (Multi-User Telecommunications Outlet) at each workstation group location, with fly leads from the MUTO to each workstation outlet, or;~~
- ~~Provide a blank face plate with 50mm core holes. Each core hole shall have a neoprene or rubber gasket. The communications cabling shall be enclosed in corrugated conduit from the face plate to the workstation, or;~~
- ~~Provide a "Clipsal 3105 series" bull nose wall plate, or;~~
- ~~Where umbilicals are used for cable reticulation, provide cabling to each workstation outlet location. Provide segregation behind power and communications cabling within umbilicals.~~

~~1763.15~~10.10 LABELLING - COMMUNICATIONS CABLING

All labelling will be in accordance with AS/NZS 3085.1.

Faceplates to match socket outlet Faceplates and are to be supplied and installed by the Contractor. RJ45 Category 6~~A~~/Class E~~A~~ sockets shall mount into faceplate, which will be flush mounted and shall be permanently labelled using an approved method with unique alphanumeric character identification code. Provide samples for approval prior to installation.

Commented [MS99]: Change if 6 or 5E required

In addition, provide labels for all cables consisting of wrap-around markers, behind face-plates and at communications enclosures. Hand written labelling directly on cables will not be accepted.

All labels, regardless of their location, shall provide for clear and concise ease of identification of its respective point. It is the Contractor's responsibility to provide and install these pre-printed labels sized appropriately to its location.

Labelling requirements shall be defined in conjunction with the Proprietor after submission of Communications Room workshop drawings.

~~1763.16~~10.11 CABLE SUPPORT SYSTEM

Supports generally: Shall comply with AS/NZS 3084, and with manufacturers requirements.

Riser cable supports:

Horizontal runs: Suitable sized Cable Trays and ladders with painted top-hat sections from floor to ceiling within each cupboard or at each penetration.

Vertical runs: Cable Tray or other approved methods of support.

Cable ties: Support all cabling with Velcro cable ties. Nylon ties will not be accepted.

Distribution cable supports: Conceal all cables. Support cables run in false ceiling space or within building structure by one of the following methods:

- Catenary wire support.
- Surface mounted conduit.
- Cable tray on cantilever supports.

Install ducts and conduits where required.

Provide cable tray supports for all internal fibre cables throughout their entire length.

Segregation: Provide physical barrier segregation between the communications cabling system and all other wiring systems as laid out in AS/CA S009. Communications cables are not to run parallel with power cables and shall be installed to avoid luminaires. Crossovers, where unavoidable, shall be perpendicular to power cables and other equipment.

Reducing noise coupling: In order to further reduce noise coupling from sources such as electrical power wiring, radio frequency (RF) sources, large motors and generators, induction heaters and arc welders, the following additional precautions should be considered;

- Increase physical separation, taking advantage of the “inverse square law”
- Maintaining proximity of electrical branch circuit line, neutral and grounding conductors by twisting, sheathing, taping or bundling together, to minimize inductive coupling into telecommunications cabling.
- Using surge protectors in branch circuits, which can further limit the propagation of electrical surges.
- Using fully enclosed, grounded metallic ducting, or grounded conduit, or using cable installed close to a grounded metallic surface, which will limit inductive noise coupling.

- In furniture and workstations, provide non-metallic ducting or a physical barrier for separation of power and communications.
- The following minimum clearances shall be incorporated for all installations for unshielded systems:

kVA	≤ 3	3 ≤ 6	6 +
Amp	≤ 10	10 ≤ 25	25 +
Cable (m)	0.05	1.5	3
Termination (m)	0.05	3	6

- The following minimum clearances shall be incorporated for all installations for shielded systems:

kVA	≤ 3	3 ≤ 6	6 +
Amp	≤ 10	10 ≤ 25	25 +
Cable (m)	0	0.6	1
Termination (m)	0	0.6	1

Capacitively and inductively coupled electrical noise sources: Closed metal pathways (e.g. conduits) generally provide adequate protection from nearby capacitively coupled (rapid changes in large voltages) noise sources typically found in commercial buildings, however can cause crosstalk between the cables within the enclosure. In cases where inductively coupled (rapid changes in large currents) noise sources are a problem, the closed metal pathway section in proximity to the source should be of ferrous (or equivalent) induction suppression material.

Routing of unshielded pathways: Open or non-metal pathways (eg. open tray or plastic duct) shall be placed with sufficient separation from noise sources to eliminate any potential coupling problems. These pathways shall be routed a minimum of 300 mm away from fluorescent lighting fixtures.

Special attention shall be given to the routing of such pathways away from ballasts and high intensity discharge devices.

Shielding: Should any doubt exist with respect to interference, crosstalk and the like, provided shielded cabling alternatives. Approved alternatives are as follows:

- Shielded Twisted Pair (STP)
- Screened Cable with Foiled Twisted Pair (S/FTP)
- Screened Twisted Pair (ScTP)

~~1763.17 EQUIPMENT CABINETS LAYOUTS~~

~~Provide equipment cabinets complying with the following criteria:~~

- ~~Standard 19" mounting;~~
- ~~RU accommodation and mounting provisions as indicated on the drawings accompanying the specification, at least 600mm clear equipment depth;~~
- ~~Minimum dimensions of 800mm wide by 1000mm deep;~~

~~**1763.17** Self-supporting powder-coated steel cabinet, with framed glass lockable double door over where indicated. Front rack mount surface to be set back 150-175mm from outer surface of the front frame members. Rear mounting rails to be provided and to be set forward 90-110mm from outer surface of rear frame members.~~

- ~~Fitted with 230V power distribution in the form of:~~
  - ~~12 minimum vertical SSO's~~
  - ~~an isolating switch in the incoming supply;~~
  - ~~Two (2) shelves 400mm deep shall be provided within each rack;~~
  - ~~Provide Rackmount sets (nuts, screws and washers), keys and castors for enclosed mounting cabinets. Open racks shall be bolted to access floors;~~
  - ~~Fitted with cable management tidies, 1 off for each patch panel (minimum as indicated);~~
  - ~~Fitted with vertical cable management to extend the rack height;~~
  - ~~Fitted with 24 port RJ45 patch panels;~~
  - ~~Fitted with 12 port fibre optic breakout trays;~~
  - ~~Neoprene gasketted cable entry;~~
  - ~~Provided with Traffolyte label to identify designation.~~

~~Plan the disposition of racking equipment, including active equipment in full coordination with the Proprietor. Submit proposed rack layouts for approval prior to ordering equipment.~~

~~1763.35~~10.12 OUTLETS

Each outlet shall be provided with:

- Faceplate with a socket mounting cutout, of colour to match other accessories;
- Faceplate socket inserts consisting of Category 6~~A~~/Class E~~A~~ RJ-45 connectors. This connector shall have the following characteristics:
  - A minimum contact coating of 50 microns (1.27 micro meters) of gold over 50+ microns Nickel
  - 8 pin cable connector of insulation displacement type compliant with the Category 6~~A~~/Class E~~A~~ transmission performance.
- Cable termination, pin assignments, pair allocation, colour coding and performance shall conform to AS /NZS 3080, option T568A.
- Mount designated dual and triple outlets on a single plate matching other accessories where shown on the contract drawings.
- Approved labelling system utilising the engraved labelling adjacent each outlet, or alternatively utilising the outlets proprietary labelling system.
- Mount designated dual outlets on a single plate matching other accessories where shown on the contract drawings.

Commented [MS100]: Change if 6 or 5E required

Commented [MS101]: Change if 6 or 5E required

Commented [MS102]: Change for Dental to T568B

~~**1763.36** CONSOLIDATION POINTS (CP)~~

~~Provide consolidation points to locations as nominated on the drawings as follows:~~

- ~~Locate within a lockable enclosure either above or below ceiling as nominated.~~
- ~~When located within the ceiling, provide Traffolyte label beneath ceiling corresponding to the designation of the consolidation point.~~
- ~~Consolidation points shall utilise shuttered RJ45 outlets.~~

~~**1763.36** Shall generally be 12 points wide.~~

- ~~Shall be appropriately selected for UTP and shielded cabling.~~

~~**1763.43 TERMINATION PANELS AND TERMINATION FACILITIES**~~

~~Provide suitable termination panels as indicated and within the floor distribution racks/equipment cabinet and terminate all cabling systems.~~

~~Provide termination panels and terminations as follows:~~

~~**General:**~~

- ~~Strain relief for each cable and each cable pair~~
- ~~Provide panel quantities to give a minimum of 30% spare capacity on the termination capacity of each cabling system.~~
- ~~Labelling system with engraved Traffolyte labelling adjacent each outlet and panel complying with AS/NZS 3085-1~~

~~**Fibre Panels:**~~

- ~~Minimum 6 outlets per panel (1 RU)~~
- ~~Slide out tray with hinged lid.~~
- ~~Each fibre cable shall be tight buffered with colour coded jacket for identification fibre cable type:~~
  - ~~Multimode - Orange~~
  - ~~Singlemode – Yellow~~
- ~~Rack mounted termination units shall provide cross-connection, interconnected or splicing capabilities.~~
- ~~Rack mounted fibre termination unit shall consist of frame mountable housing for termination and/or splicing fibre optical cables and allow for organisation of fibre optic interconnects. The assembly shall have rear slots for cable entry, with grommet fibre retainers for holding buffered fibre in place and fibre storage guide for maintaining bend radius~~
- ~~Acceptable connector types are as follows:~~
  - ~~SC Simplex and Duplex~~
  - ~~LC Simplex and Duplex~~
- ~~Adapter plates suitable for SC and LC (Simplex and Duplex) couplings shall be installed to angled through adaptors to the left or to the right of the panel to improve the patch cord management and provide protection from accidental exposure of active fibres.~~
- ~~Provide dust caps for all terminations.~~

~~**Copper Patch Panels:**~~

- ~~Minimum 24 outlets per panel (1 RU)~~
- ~~Fitted with Category 6A/Class EA complaint RJ45 type shuttered sockets complying with AS/NZS 3080~~
- ~~Capability of supporting a removable rear cable management tray.~~

~~1763.36 Approved labelling system utilising the engraved labelling adjacent each outlet, or utilising the panel's proprietary labelling system.~~

- ~~Provide separate dedicated patch panels for cabling associated with CCTV / IP security devices, nurse call system, Wi-Fi networking equipment and digitally distributed MATV systems. Coordinate final quantities of additional patch panels required with other trades.~~

~~**Cable Management:**~~

- ~~Provide vertical cable management within all Cabinets for the height of the enclosure.~~
- ~~Provide horizontal cable management as shown on the accompanying drawings. In general, 1 off wire minder shall be provided for every 1 off patch panel.~~
- ~~Cable management shall be provided in the form of flexible rings, manufactured of non-metallic material.~~

~~1763.73~~10.13 COPPER BACKBONE AND HORIZONTAL CABLING

Provide Category 6~~A~~/Class E~~A~~ compliant solid core 4 pair UTP cabling.

Conductor:

Provide solid bare copper sized accordingly. Stranded cabling will not be accepted.

Insulation and Jacket:

Provide polyethylene insulation and PVC jacket or LSZH.

Terminations:

Terminations shall be provided as follows:

- Terminate all cable pairs and all cables.
- Terminate with connector pin assignment in accordance with AS/NZS 3080, option T568A.
- Maintain cable twists as far as possible up to the point of termination and no more than 8mm from the point of termination.
- Cut back cable sheaths neatly and support adequately.
- Provide adequate and positive strain relief.

Commented [MS103]: Change to T568B for Dental

Copper Backbone and Horizontal Cabling:

Copper backbone and horizontal cabling shall be provided as follows:

- Cable length of UTP cables, including patch leads shall not to exceed 100 m, and be greater than 15m. Plan all routes so as to achieve this requirement
- Provide copper horizontal cables from the appropriate cable centre to information outlet locations as shown
- Terminate the copper cables at each outlet location and on the relevant vertical/ patch panel within the Communications Room. Provide a 1m loop within the ceiling space at each end. (loop must be installed in figure eight design)

General:

All cable installation shall observe the manufacturers recommendations regarding the installation methods and techniques, particularly bending radius.

All cables shall generally be laid at random within cable trays to avoid alien crosstalk.

Perform test on each cable in accordance to manufacturer's testing recommendations and in accordance with AS 3080. Replace any damaged or failed components.

~~**1763.74** FIBRE BACKBONE CABLING~~

~~Type:~~

~~Provide the following cable types as shown on the accompanying drawings:~~

- ~~Single Mode (SMOF) – OS2 – 9/125µm~~
- ~~Multi Mode (SMOF) – OM4 – 50/125µm~~

~~Sheath:~~

~~Provide Low Smoke Zero Halogen outer sheath.~~

~~Terminations:~~

~~Terminations shall be provided as follows:~~

- ~~Terminate all cabling.~~
- ~~Terminate at both ends with appropriate connector type.~~
- ~~Cable in star topology.~~
- ~~Cut back cable sheaths neatly and support adequately.~~
- ~~Provide adequate and positive strain relief.~~

~~Exterior Optical Fibre Backbone Cabling:~~

~~Exterior optical fibre cables used for all underground applications shall be provided as follows:~~

- ~~Acrylate coated optical fibres~~
- ~~Water block loose tubes~~
- ~~High absorption water-swellable yarns to cable core.~~
- ~~Polyethylene sheath and jacket with bounded nylon jacket.~~

~~Interior Optical Fibre Backbone Cabling:~~

~~Interior optical fibre cables used for all interior applications shall be provided as follows:~~

- ~~High absorption water-swellable yarns to cable core.~~
- ~~Low Smoke Zero Halogen (LSZH) sheath.~~

~~General:~~

~~All cable installation shall observe the manufacturers recommendations regarding the installation methods and techniques, particularly bending radius.~~

~~Perform test on each cable in accordance to manufacturer's testing recommendations and in accordance with AS 3080. Replace any damaged or failed components.~~

~~1763.101~~10.14 COPPER PATCH CABLES AND FLY LEADS

Patch Cables:

Patch cables shall be provided for interconnection between patch panels and active equipment in the communications cabinet. Patch cables shall be made by the same manufacture of the UTP cable, patch panels and the socket outlets. Patch cabling complying with the equipment manufacturers requirements shall be provided for all communications outlets and active equipment tie cables as indicated on the drawings accompanying the specification Patch cables shall comprise:

- Category 6~~A~~/Class E~~A~~ UTP.
- 2m of Category 6~~A~~/Class E~~A~~ RJ45 UTP Patch lead
- Connector pin assignment shall be in accordance with AS/NZS 3080, option T568A.
- A label showing compliance to the ACMA Telecommunications Labelling Notice.

Quantities of cables to be provided by the Contractor shall be sufficient to allow for at least one voice and one data service at each workstation and sufficient RJ45 to suit the entire installation.

Fly Leads:

Shall be provided for interconnection of outlets and equipment in the field. Fly lead cables shall be made by the same manufacture of the UTP cable, patchpanels and the socket outlets. Provide one fly lead for each workstation as follows:

- Category 6A/ Class EA RJ45/RJ45 UTP fly lead
- Connector pin assignment shall be in accordance with AS/NZS 3080, option T568A
- Nominal length 3m, with maximum length 5m
- A label showing compliance to the ACMA Telecommunications Labelling Notice.
- Fly leads for telephone handsets, will be provided by the Principal.

Commented [MS104]: Change if 6 or 5E required

Commented [MS105]: Change if 6 or 5E required

Commented [MS106]: Change if 6 or 5E required

1764~~11~~ ~~SECURITY SYSTEM~~ACCESS CONTROL SYSTEM

1764.1~~11~~.1 GENERAL

Standard: AS/NZS 2201 Set

Scope

Provide a security system comprising:

- Access control system including entry cards/keys as required
- ~~Intruder detection system~~
- ~~Air conditioning after hours control~~
- ~~Lighting control relays/interfaces~~
- ~~Duress alarms~~
- Car park vehicle access control
- ~~Alarm signal transmission to remote control security station~~
- ~~Central supervisory system for monitoring and control~~
- Power supply
- Wiring, conduit and all minor works associated with system.

Work

The work shall include:

- Detailed system design
- Manufacture, supply, installation and wiring
- Testing and commissioning
- Operation and maintenance manuals
- Maintenance during defects liability period
- Liaison with other contractors responsible for door hardware, air conditioning, lifts, etc, as applicable

~~Specialist Licensed Sub-Contractors~~

~~The Contractor shall be certified and registered for installation of the nominated security system, and shall be a SCEC (Security Construction and Equipment Committee) endorsed Contractor.~~

Alarm Operation

The system shall be self-contained. An alarm condition shall initiate local audible and visual external alarm device.

Central Station Interface: The system shall include an interface suitable for connection to a central security station.

System Structure

The system shall be a distributive system with electronic equipment connected via network communications links.

Commented [MD107]: UPDATE FUNCTIONAL DESCRIPTION.

~~1764.2~~11.2 POWER SUPPLY

Requirements:

Provide 230 volt AC mains power supply to central supervisory system controller/control panel and other devices as required. Incorporate transient voltage protection in all devices.

The Contractor shall provide all necessary power supplies for all equipment and appliances that shall warrant a fully operational system.

Dedicated Circuit:

The supply shall; be provided by a dedicated circuit and the circuit breaker shall be labelled "SECURITY SYSTEM – DO NOT SWITCH OFF".

Back-up Supply:

Provide 12 Volt DC battery back-up with minimum capacity in accordance with AS/NZS 2201 Set. The battery shall consist of maintenance free sealed led acid cells.

~~1764.3 WIRING~~

~~General~~

~~Cabling shall be reticulated utilising any of the following methods:~~

- ~~Cast in situ concrete when installed on concrete walls and the like.~~
- ~~Reticulated along cable trays in a segregated section using partitions. Cables are to be strapped to the cable trays using nylon cable ties.~~
- ~~Installed within heavy duty conduit when installed in areas with exposed ceilings, including in areas with cable tray.~~

~~Communications Network~~

~~Twisted 2 pair screened cable or other as required in conduit linking all controllers. The network shall be supervised.~~

~~Cabling shall not exceed 1.5km in length.~~

~~1764.12 PRE-CONSTRUCTION SUBMISSIONS~~

~~The Electrical Contractor shall provide the following minimum information prior to commencing installation of the security system, for approval by the Engineer:~~

- ~~Layout drawings showing equipment locations, paths of reticulation and the like.~~
- ~~Zoning diagrams showing the security zones, including zone designations.~~
- ~~Schedules identifying equipment type (make and model) corresponding to the layout drawings.~~

~~**1764.3** Schematic diagrams for the security system.~~

- ~~Schedule of interfaces with all equipment and devices separate to the security system e.g. BMS, lighting control system etc.~~
- ~~Functional specification identifying the operation of the security system, including description of each zone, and programming.~~

~~**1764.20** TESTING~~

~~Testing and commissioning shall be undertaken in accordance with the security system manufacturers' requirements.~~

~~Testing and commissioning shall be coordinated with a representative of the manufacturer. Upon completion the security system shall be warranted and approved by the manufacturer.~~

~~**1764.23** MAINTENANCE~~

~~Requirement~~

~~Maintain system during Defects Liability Period in accordance to AS/NZS 2201 Set.~~

~~Site Visits:~~

~~Visit site and carry out maintenance procedures at not less than 3 month intervals and whenever advised of a fault.~~

~~**1764.28** MANUALS AND DRAWINGS~~

~~The Electrical Contractor shall provide all As-Installed information for inclusion within the Operating and Maintenance Manual as follows:~~

- ~~As-Installed drawings showing the following minimum items:~~
  - ~~Cable pathways and types.~~
  - ~~Controllers, detectors, accessories, interfaces locations and the like~~
  - ~~Control panel types and locations.~~
  - ~~Schematics and diagrams~~
- ~~Technical Specification identifying the operation of the system to the Proprietor.~~
- ~~Handover and training records~~

~~**1764.37** STAFF TRAINING~~

~~Coordinate with the Proprietor to arrange for a "Training Day" to train all end-users (as nominated by the Proprietor) in the use and operation of the security system. The following minimum topics shall be discussed:~~

- ~~Basic everyday use and operation of the system.~~
- ~~After hours operation.~~
- ~~Emergency operation.~~
- ~~Maintenance requirements.~~
- ~~Troubleshooting.~~

~~1764.3~~ WARRANTY

The system shall be warranted for a minimum 5 year period, which includes parts and installation.

~~1764.45~~ ~~CENTRAL SECURITY SYSTEM CONTROLLER~~

~~Requirements~~

~~Provide all equipment for a fully functional computer based security system including software, specific hardware and interconnecting cabling to local controllers and security system devices generally. The system controller shall offer programmable control, monitoring and event logging by means of a keyboard, VDU and printer.~~

~~Location~~

~~As shown on drawings.~~

~~System Controller Features~~

~~Provide a computer manufactured to the recommended requirements of the software manufacturer.~~

~~System Software Features~~

- ~~Menu driven machine prompt and operator response~~
- ~~Allocation of user access times and areas~~
- ~~Data base storing all user information in sorted files for ease of operator use~~
- ~~Capacity of at least 1000 key users/10 access levels with addition/deletion facility for all individual cards~~
- ~~Password entry facility for operators, at least 3 levels of entry and audit trail from log-on to log-off~~
- ~~Door hold open alarms, software timed~~
- ~~Time clock for automatic security time zone control~~
- ~~Archiving of all transactions~~
- ~~Verification of key user coded information~~
- ~~Menu-driven logging of historical data from alarm only, historical trial by door or card, card allocation listing, and the like~~
- ~~Initiation of alarm signal for selected events for connection to modem or operation of audible alarm as required~~

~~Operation~~

~~Alarm Annunciation: Activation of alarm condition shall:~~

- ~~Display message on VDU~~
- ~~Print message and associated acknowledgement and cancellation on printer~~
- ~~Initiate audible and visual alarms~~

~~**1764.45** Response Time: 5 sec~~

~~Access Control: Provide facilities for operator to permit or deny access at any selected time or permanently to any individual card/key.~~

~~Programming~~

~~Program system in consultation with user. Modify program as required by user during the Defects Liability Period.~~

~~1764.73~~11.4 SECURITY SYSTEM CONTROL PANEL

Requirement

Provide a wall mounted control panel for monitoring and control of the security system comprising a programmable access control processor and control switches, visual indicators, relays, etc. Provide an LCD display with English text to indicate any abnormal condition and to facilitate programming.

Enclosure

Control panel enclosure shall be of sheet steel with acrylic enamel paint finish, stainless steel or impact resistant plastic. Layout and labelling shall facilitate use by operator.

Provide vandal resistant screws on all enclosures.

Location

Enclosure(s) shall be installed between 1500 to 1800 AFFL, and shall be installed over the relevant power and communications outlets.

Locations shown on the drawings accompanying this specification are indicative, and are to be confirmed on site.

Capacity

The controller shall have provision for at least 8 independent alarm systems with up to 256 programmable inputs.

Programming

The controller shall permit system configuration and options to be programmed by an operator using selected access key/code. Programming shall also be performed by dialling in from a remote computer.

Commented [PC108]: Confirm if this requirements will be suitable.

Access Control

The control panel shall provide programming of all access control functions.

Time Clock

System shall incorporate a 365 day real time clock with battery backup.

Memory

System shall have a built in memory which allows recall and display of all transactions. Provide a printer to give English text record of all transactions.

Operation

Activation of alarm device when control panel is in secure mode shall:

- Initiate audible/visual alarm on panel
- Initiate external audible/visual alarm if required
- Illuminate appropriate sector indicator on control panel
- Transmit alarm to control station

Mute Button: Provide facility to silence audible alarm while retaining visual indication until alarm is cleared and device is reset.

Reset: Private Code activated facility.

Time Delay: Provide adjustable time delay (30 sec to 3 mins) on motion alarm signals in sectors between control panel and entry/exit doors.

Status

The status of each sector shall be displayed on the control panel.

Entry and Exit Alarm Delay

Provide facility for entry and exit sector intruder alarms on path to control panel to be delayed.

Time Delay: Adjustable from 30 sec to 240 sec.

1764.7411.5 ACCESS CONTROL

Make and Model

Access Control System shall be of "Inner Range Integriti" manufacture or equal approved.

Commented [PC109]: Should be checked for every project. And confirm with "or equal approved" shall be suitable.

Others to consider:
-Tecom Challenger
-Gallagher Cardax
-Protégée GX

Scope

The access control system shall control and monitor selected doors and the movement of lifts cars detailed on the drawings utilising access keys, key pads, key readers, door locks, and door monitoring switches. After Hours Air Conditioning (AHAC) controls shall be provided.

System Features:

- Independent operation (200 card users/10 access levels)
- Routine reporting to system controller via networking link
- Battery backup for 8 hours
- Communications via telephone line (PSTN) and Ethernet (IP).

Commented [MD110]: NBN??

- Monitoring and control by each local control unit of 2 doors each with an entry key reader, PIN reader and exit key reader as required.
- Interface to fire alarm system for automatic door release on fire alarm.
- Memory for audit trial.
- Anti-passback support.
- Card status indicator via red/green LED indicators on reader.
- Response time from presentation of a key to operation of the interface contacts shall be less than one second.

Pedestrian Entry

Entry to the building, outside normal working hours when the building is secured, shall only be available to persons who are holders of authorised access keys or via release signal from building intercom system.

Commented [MS111]: Remove if not applicable

Pedestrian Exit

Exit from the building be available at all times, including at controlled access points, by push-button control, local movement detector or by operation of internal door handles.

Vehicle Entry

Vehicle entry to the secure car park area shall only be available to persons who are holders of authorised remote transmitters.

Vehicle Exit

Vehicle exit from the secure car park area shall only be available to persons who are holders of authorised remote transmitters.

Authorisation

Entry via access controlled door shall be available to key holders only at entry points authorised to the particular keys. Entry points shall be individually assigned to keys.

Time

Access controlled doors shall remain unlocked for an adjustable period initially set at 30 seconds. On expiry of selected time, doors shall relock.

System Controller

System shall incorporate a programmable controller wired to local control units for central monitoring and control. Programming shall be available to operators with required access code/key.

Local Control Units

Access control devices (key readers, door locks, etc) shall be connected to distributed local micro-processor based control units located within equipment rooms, cupboards or within the ceiling space in approved locations.

Control System: Connect to Security System Controller via communications network.

Wireless Input Expanders

Provide Wireless Input Expanders (Wireless Data Gathering Panels) for extension of the Access Control System using wireless interfaces for remote controls and the like.

Access Keys

Commented [PC112]: Will need to be amended for each project. Confirm quantities with client.

Type: Proximity type with passive RF code

Keyring fob with pushbuttons for autodoor control

Magnetic stripe type, credit card size

Barcode type for optical scanner, credit card size

Magnetic insert key type, MIL, DKS or similar

Marlock alloy key with encoded holes for optical scanner

Quantity: Provide 200 access card/keys with initial system.

Card Readers

Type: Provide proximity card readers to locations as nominated on the accompanying drawings.

Card readers shall be compatible with all types of cards, fobs and the like specified as part of these works.

Readers shall have distinct LED indicators for "LOCKED" and "UNLOCKED".

Enclosures: Reader head enclosures shall be of minimum protection classifications:

External: IP 66D to AS 1939

Internal: IP 54 to AS 1939

Tamper Switches: Reader enclosures and wiring terminations enclosures shall be fitted with tamper switches. Operation of the tamper switch shall cause the system to ignore any further information from the reader and any associated request to exit buttons. Tamper shall be reported to the security system controller and must be reset manually.

RF Car Park Roller Door Reader

Commented [MS113]: Remove if not required

Type: 30070 MicroLatch REC-20 4 Channel Wiegand RF Receiver.

Indicators: On Keeloq™ Reception – Red LED, On Wiegand Transmission – Green LED

Current consumption @ 12VDC 10mA maximum

Physical Dimensions 85mm (L) x 65mm (W) x 32mm (H)

ABS plastic case material

4 Output Channels

Output Options: INT Shunt selectable, REMOVED 10K pull-ups to 5 volt DC, EXT Open collector +5 volt out terminal active for user selectable external pull-ups

433.92MHz RF Operating Frequency

Code Hopping (Keeloq™) AM ASK Superheterodyne for RF Signal Type

Conform to wiegand standard

Electric Door Strikes

Type: Fail safe, power on to secure. Strike shall engage door latch.

Requirement: Provide electric door strikes for all access controlled doors.

Installation: Supply electric door strike too responsible door hardware trade for installation within door frames. Wire to and commission. Provide concealed conduits for all wiring.

Operation: Secure mode – controlled by access control system. Non-secure mode – access and egress shall be permitted. Provide interface with building fire system for automatic release of all controlled doors on receipt of a fire signal.

Sensors: Provide complete with "door open too long" and "Door forced open" tongue sensors.

Fire Doors: Electric door latch release units fitted to fire rated door frames shall be designed and installed to avoid any loss of the fire rating.

Double Doors: Provide wiring hinge and wiring through fixed leaf door strike position.

~~Electric Solenoid Lock~~

~~Requirements: Provide electric solenoid locks for access control of doors with automatic operators. Doors as shown will be fitted with automatic operators.~~

~~Installation: Supply electric solenoid locks to responsible other trade for building into door frames. Wire to and commission. Provide concealed conduits for all wiring.~~

~~Operation: Secure mode – controlled by access control system. Non-secure mode – access and egress shall be permitted and controlled by movement detectors at doors.~~

Door Release

Provide door release push-button adjacent each nominated controlled door. Push-button is to be mounted on a face plate to match the surrounding power outlets, and labelled accordingly.

Break Glass Release

Provide Break Glass Release adjacent each nominated controlled door. Releases shall be sufficiently labelled, and shall generally be coloured green.

~~After Hours Air Conditioning Control~~

~~Provide key reader unit on each floor in locations shown for the operation of after hours air conditioning. Duration of after hours air conditioning shall be adjustable 0 to 6 hours. Set initially for two hours. Provide cabling between security system controller and the Building control and monitoring system or air conditioning control system to activate after hours air conditioning.~~

~~Intruder Detection Interface~~

~~Provide interface with the intruder detection system for monitoring of all controlled doors, and arming of the security system.~~

~~The Access Control system shall be capable of being armed from any perimeter card reader by swiping a proximity card 3 times (or as predetermined by the Proprietor).~~

Automatic Doors

Provide interface with automatic doors, roller doors, roller shutters and the like.

Coordinate with the relevant sub-contractor to determine termination and communication requirements.

~~Lighting Control System~~

~~Provide interface with the nominated lighting control system for monitoring of each security zone when armed and disarmed. A signal shall also be provided for alarm mode.~~

~~Door Monitoring~~

~~Provide position monitoring of access controlled doors and others as shown on drawings.~~

~~Switches: Polarised magnetic proximity type or other approved. Where door construction permits, conceal within door frame and door. Wire to local control unit security system controller as appropriate.~~

Lift Interface

Coordinate with the Vertical Transportation Services Contractor for the installation of access control within nominated lifts. Access Control shall generally be provided as follows:

Supply and install Data Gathering Panels (Lift Controllers) within each lift shaft. Coordinate with the Vertical Transportation Services Contractor to determine final locations.

Deliver proximity card readers and cabling of sufficient length to the Vertical Transportation Contractor for installation by the Contractor.

Allow to terminate all cabling within the card readers and Data Gathering Panels.

Liaise with the Vertical Transportation Contractor to determine final programming requirements.

~~1766.0 INTRUDER DETECTION SYSTEM~~

~~Standard: AS/NZS 2201Set~~

~~Make and Model~~

~~Intruder detection system shall be of "Inner Range Integriti" manufacture or equal approved.~~

~~Controller~~

~~Connect all alarm devices to security system control panel/controller.~~

~~Keypads~~

~~Provide keypads suited for remote arming stations as shown on the accompanying drawings. Keypads shall be provided as follows:~~

- ~~Installed between 900 to 1100 AFFL~~
- ~~Backlit keypad with hinged protective cover~~
- ~~Multi-lingual~~
- ~~Zone indicators~~
- ~~LCD screen~~
- ~~Indicators for area status, door function, alarms and/or other conditions (can be customised via programming)~~
- ~~Shall be suitably selected when installed in external areas.~~

~~Movement Detectors~~

~~Passive infra-red (PIR) beam type. Detection beam shape and range be selected to suit location. Range shall not exceed 75% of manufacturer's recommended maximum. Provide masks to optimise detection as necessary.~~

~~Detectors shall be ceiling surface mounted unless shown otherwise. Provide suitable rated weather protected sensors to external areas, plant rooms and the like.~~

~~Reed Switches~~

~~Reed switches shall generally be installed within door frames, and recessed such that they are concealed and not visible.~~

~~When installed for roller shutters, roller doors etc, reed switches shall be recessed within the slab and covered with epoxy resin such that they are flush with floor level. Surface mounted reed switches will not be accepted.~~

~~Duress Alarm~~

~~Provide duress alarms where shown.~~

~~Type: Mechanically latched hand operated pushbutton with key reset.~~

~~Location: Mount to approval in unobtrusive location for easy operation.~~

~~Disconnection: A break in wiring to alarm device shall cause an alarm.~~

~~Zoning~~

~~Coordinate with the proprietor to determine final security zoning requirements.~~

~~Any zones shown on the accompanying drawings are indicative and require to be confirmed prior to final programming on site.~~

~~The system shall be capable of accommodating 16 zones.~~

~~Wireless Input Expanders~~

~~Provide Wireless Input Expanders (Wireless Data Gathering Panels) for extension of the Access Control System using wireless interfaces for remote controls, panic pendants, wireless sensors and the like.~~

~~Modules: Provide the following additional wireless modules for delivery to the Proprietor:~~

- ~~___ off wireless panic pendants~~

~~Screamers~~

~~Provide internal piezo-sirens where nominated on the drawings. Sirens are to incorporate visual LED alarm, and shall be surface ceiling mounted.~~

~~External Audible and Visual Alarms~~

~~Provide external weatherproof enclosure with siren and flashing blue light which shall operate in event of any selected alarm.~~

~~1804.0 REMOTE MONITORING STATION FACILITY~~

~~Requirements~~

~~Connect system to an established, approved, remote central station with continuous monitoring facilities. Provide facility and terminals for connection by others to a central station.~~

~~Transmission Medium~~

~~The remote alarm shall be transmitted via:~~

- ~~A dedicated direct telephone line~~
- ~~A digital dialler utilising a Telstra voice line~~
- ~~The Telstra Security Network~~
- ~~A telephone modem link for computer based monitoring~~

~~Pay all associated fees for the remote connection.~~

~~Monitored Conditions~~

~~The following condition shall be separately monitored at the central station.~~

- ~~System status~~
- ~~Common intruder alarm~~
- ~~Common duress alarm~~
- ~~Tamper alarm~~
- ~~Mains power supply failure~~
- ~~Line fault~~

~~CCTV SURVEILLANCE SYSTEM~~

~~1824.0 SCOPE~~

~~Standard: AS 4806 Set~~

~~Outline Description~~

~~The system shall provide a digital Closed Circuit Television System (CCTV) of type 'Pelco EnduraXpress' series or equivalent comprising the following:~~

- ~~Colour digital CCTV cameras to specified locations.~~
- ~~Category 6 Class E communications cabling to all camera locations.~~
- ~~Computer based network video recording system (NVR) c/w backup storage.~~
- ~~NVR to be configured to operate all cameras.~~
- ~~Workstation to decode and display video streams.~~
- ~~"KVM" device consisting of LCD screen and keyboard interface.~~
- ~~Power over Ethernet (PoE) switches.~~
- ~~UPS providing back-up based on final system design.~~
- ~~Cabinet equipment including patch panels, cable management and all accessories.~~
- ~~TCP/IP interface to local area network to allow network access for viewing purposes.~~
- ~~Network software to allow viewing access to system on site and from a remote connection.~~
- ~~Software, programming, commissioning and testing to the proprietor's requirements.~~
- ~~Proprietor training~~

~~System equipment to be rack/desk mounted in main communications cabinet.~~

~~Work~~

~~The works shall include the following:~~

- ~~Detail system design.~~
- ~~Supply and installation.~~
- ~~Programming of system.~~
- ~~Testing and commissioning of system.~~
- ~~Staff training of system.~~
- ~~Operation and maintenance manuals.~~
- ~~Maintenance during the liability period.~~

~~1851.0 CCTV CAMERAS~~

~~Provide CCTV cameras as shown or scheduled.~~

~~Camera types~~

~~Internal Fixed:~~

- ~~Colour~~
- ~~1.3 Megapixel resolution~~
- ~~30 images per second~~
- ~~Day/night mode capabilities~~
- ~~Automatic back focus~~
- ~~2 simultaneous vidoestreams~~
- ~~Integrated memory backup~~
- ~~Power supply: 12/24V to suit application via PoE~~

~~Locations: Lifts and Small Office Lobbies~~

~~Internal cameras to be in-ceiling of type 'Pelco Sarix IDE10' series or equivalent.~~

~~Internal Fixed Vandal Resistant:~~

- ~~Colour~~
- ~~1.3 Megapixel resolution~~
- ~~30 images per second~~
- ~~Day/night mode capabilities~~
- ~~Automatic back focus~~
- ~~2 simultaneous vidoestreams~~
- ~~Integrated memory backup~~
- ~~Power supply: 12/24V to suit application via PoE~~

~~Locations: Car park, Ground Entries and Main Lobbies~~

~~Internal vandal resistant cameras to be in-ceiling or surface mounted of type 'Pelco Sarix IM10-V' series or equivalent.~~

~~External Vandal Resistant:~~

- ~~Colour~~
- ~~2.1 Megapixel resolution~~
- ~~IP66 rated~~
- ~~30 images per second~~
- ~~Day/night mode capabilities~~
- ~~Automatic back focus~~
- ~~2 simultaneous vidoestreams~~
- ~~Integrated memory backup~~
- ~~Power supply: 12/24V to suit application via PoE~~

~~Locations: External areas~~

~~External vandal resistant cameras to be surface or pendant mounted of type 'Pelco Sarix IEE20' series or equivalent.~~

~~Pan Tilt Zoom (PTZ):~~

- ~~Colour~~
- ~~1.3 Megapixel resolution~~
- ~~IP66 rated~~
- ~~30 images per second~~
- ~~Day/night mode capabilities~~
- ~~Automatic back focus~~
- ~~2 simultaneous vidoestreams~~
- ~~Integrated memory backup~~
- ~~Power supply: 12/24V to suit application via PoE~~

~~Locations: Nominated locations~~

~~External vandal resistant cameras to be surface or pendant mounted of type 'Pelco Spectra HD' series or equivalent.~~

~~Camera Locations~~

~~Coordinate final camera locations with all other services and building structure.~~

~~Provide workshop drawings for review and approval by the Proprietor and Consulting Engineer prior to first fix. Workshop drawings to be submitted in accordance with the 'Drawings' section of the Specification.~~

~~Mounting, Housings and Enclosures~~

~~Mounting: Provide mounting bracket to suit location. Brackets shall be of durable, non-corrodible material.~~

~~Housings: Provide a durable polycarbonate non-corrodible housing for internal cameras.~~

~~Weatherproof Enclosure: Camera mounted in external or exposed locations shall be provided with a durable, non-corrodible enclosure to protect against sun, rain and damage. Enclosures shall be constructed of high impact vandal resistant polycarbonate.~~

~~Camera Lens~~

~~Select each camera lens to suit required field of view. Lens to include standard, wide angle or telephoto types, etc.~~

~~Remote Control~~

~~Provide control panel at monitor for remote control of pan/tilt/zoom where specified.~~

NETWORK VIDEO RECORDER (NVR)

Provide network video recording unit with a minimum of 28 day recording space based on final system design.

Network video recording unit to have a minimum input capacity of final system plus a minimum of 25% spare capacity for future expansion.

Hard drive to have a minimum capacity of 12 Terabytes of storage with 100% backup storage using RAID protocols or equal approved.

Network video recording unit to have a minimum of 64 channels.

Network video recording unit to have the ability to serve 32 simultaneous playback streams.

Network video recorder unit to be of type Pelco 'EE500 EuduraXpress' series or equivalent.

Mounting

Rack mounted

1920.0 WORKSTATION

Provide the ability to view and configure CCTV surveillance system.

Workstation to be provided with removable storage (SD or USB) and CDRW device to allow the transfer and copy of recorded information.

To be provided with a TCP/IP network interface.

Workstation to be of type Pelco 'WS5070 EuduraXpress' series or equivalent.

Mounting

Rack mounted

1927.0 ACTIVE NETWORK SWITCHES

Provide active network switching equipment compatible with final CCTV system equipment and complying with the following minimum criteria:

- 24 port 10/100/1000 Gigabit Ethernet Ports
- Power of Ethernet (PoE)
- Network stackable
- Fully rack mountable (1 RU per 24 port)
- AC power cord
- Rack mounting kit

Network switches to have the ability to be configured and monitored from a standard web browser via the internal network.

Active network switches shall be equal to Cisco 'Catalyst 3750' series or equivalent.

~~Network switches to be compatible to final system design.~~

~~Mounting~~

~~Rack mounted~~

~~1940.0 UNITERRUPTABLE POWER SUPPLY (UPS)~~

~~Provide uninterrupted power supply/supplies to all active equipment and switches to ensure critical operation of system during a mains power failure.~~

~~Provide a minimum of 2 hours continuous operation of the entire system during a mains power failure.~~

~~Uninterrupted power supplies to be provided with maintenance bypass facilities.~~

~~Mounting~~

~~Rack mounted~~

~~1946.0 EQUIPMENT CABINETS~~

~~Provide equipment cabinets complying with the following minimum criteria:~~

- ~~1000mm rack depth~~
- ~~800mm rack width~~
- ~~2100mm rack height~~
- ~~45 RU accommodation or as indicated on the drawings~~
- ~~Fitted with 230V power distribution in the form of:~~
  - ~~1x10 minimum vertical SSO's~~
  - ~~an isolating switch in the incoming supply~~
- ~~Fitted with 24 port RJ45 patch panels.~~
- ~~Fitted with vertical and horizontal cable management tidies, 1 off for each patch panel (minimum as indicated);~~
- ~~Rackmount sets (nuts, screws and washers), keys and levelling kit.~~
- ~~Fitted with fixed cable chimney to ceiling~~
- ~~Fitted with internal cable trays 1 off per side (i.e. 2 off per cabinet)~~
- ~~Fitted with two (2) sliding shelves~~
- ~~Fitted with two (2) fixed shelves~~
- ~~2 fan unit kit~~

~~Enclosed cabinets shall be equal to Rack Technologies '26" File Sever Rack series or equivalent with vented top and rear, solid side panels and ventilated acrylic door.~~

~~1964.0 CABLING~~

~~The system cabling to be installed in accordance with AS/NZS3080 and the cable manufacturers requirements.~~

~~System cabling to be installed in accordance with 'Communication Cabling' section of the Specification.~~

~~1967.0 COMMISSIONING~~

~~The system shall be commissioned by companies and individuals trained and approved to carry out such works by the system manufacturer. System installer and programmer shall be a Certified and Approved Installer. No other Installers will be permitted.~~

~~1969.0 TESTING~~

~~After the installation is completed, tests to be carried out to demonstrate that the installation is in a satisfactory working order to all camera locations.~~

~~1971.0 STAFF TRAINING~~

~~Requirements~~

~~Allow training nominated site staff in the use and operation of the system. Allow for at least 3 separate visits for this purpose. Duration of staff training periods shall be adequate for scope and complexity of the system.~~

~~1974.0 MAINTENANCE AND WARRANTY~~

~~Requirement~~

~~The system shall be provided with a 12 month manufacturer and installation warranty.~~

~~Maintain system during the Defects Liability Period.~~

~~Site Visits: Visit site and carry out maintenance procedures at not less than 3 month intervals and whenever advised of a fault.~~

~~1979.0 MANUALS AND DRAWINGS~~

~~Requirements~~

~~Provide equipment information and as-installed drawings for the system for inclusion in the operating and maintenance manuals.~~

MATV SYSTEM

1984.112.1 SCOPE

Outline Description: The system is to reticulate Digital Video Broadcasting – Terrestrial (DVB-T) services from within the metropolitan area~~, and satellite signals from Foxtel pay-television services~~ to outlet locations nominated.

1984.212.2 STANDARDS

Standards: AS/NZS 1367, AS 1417, IEC 60966 Set.

1984.312.3 SYSTEM DESIGN

Distribution Technique: Radiating main trunk cable from the main antenna position. Outlets are to be supplied from distribution cable using splitters and/or tee units.

On-Site Measurements: Before completing the final design, measure the on-site signal levels of the nominated services, and note the existence and direction of any ghosting sources, and sources causing increased Bit Error Rates (BER). Establish the required aerial height and submit workshop drawings for approval, including mounting proposals.

Final Design: Before commencing the installation submit details of the proposed final design, including expected signal levels at all outlets, and showing the configuration of equipment required to meet the specified performance.

1984.412.4 PERFORMANCE

Picture Quality: At each outlet, the picture received on a domestic TV receiver shall not be noticeably inferior to the picture received when the receiver is connected directly to the antenna, and shall be free from discernible cross-modulation, intermodulation, ringing, noise or other distortion.

Signal Levels:

At any outlet:

- Maximum: 10 mV - Minimum: 2 mV.

Differential signals: To AS 1367.

Sound Carrier Level: At least 9 db less than the vision carrier.

Maximum Voltage Level: 120db(uV) at any point on the distribution system.

1984.512.5 TESTING

Requirement: Carry out tests to demonstrate compliance with the performance and other requirements of the Specification, in the presence of the Superintendent.

Equipment: Provide the equipment, apparatus and materials necessary to perform the tests, including field strength meter and portable TV receiver.

Rectification: Correct the system, and replace components without extra cost, as necessary to achieve compliance.

~~1984.6~~12.6 CABLES

Type: Single core coaxial cable with a nominal impedance of 75 ohms.

Screen: Copper tape and wire braid.

Dielectric: Polythene 5 cell extrusion.

~~1984.7~~12.7 CABLE INSTALLATION

Cable Routes: Install cable using the most direct route. Run cables in false ceiling spaces, wall cavities, conduits and ducts, keeping clear of other services. Do not embed in plaster, mortar, cement, or the like, nor run in cracks or joints in walls, ceilings, floor slabs and the like.

Surface Cables: Do not run cables on surfaces without approval.

Continuity: Run cables continuously from the originating point to the terminating point without intermediate joints or connections unless otherwise approved.

Fixing: Fix coaxial cable with plastic clips at 600mm maximum centres.

Bending Radius: Not less than the cable manufacturer's recommended minimum.

Sealing: Seal the ends of cables exposed during the installation with tape or caps to minimise moisture take-up.

Tails: Leave 150mm tails for cut-off before terminating.

Terminations: Prepare cable ends for termination using the 'hot wire' stripping technique. Do not use cutting tools.

~~1984.8~~12.8 ANTENNA SYSTEM - MATV

Requirement: Provide an antenna system which gives adequate gain, directional characteristics and polarisation for the nominated services.

Balun: Supply, and install in a weathertight enclosure, a balun matching each antenna to the 75 ohm co-axial lead-in cable.

Insertion loss: Less than 0.5 db.

Frequency response: 0.5 db over the channel or band.

~~1984.9~~12.9 ANTENNA INSTALLATION

Standard: AS 1417.

Locations: Locate antennae upon the roof plant platforms to obtain suitable signals. Obtain prior approval from the Superintendent for the proposed locations before commencement.

Orientation: Orient the antennae to minimise reception of reflected signals.

Lead-In-Cable: Run lead-in cable inside the mast.

Fixing: Attach the antenna to a pipe support, sealed at the top but open at the bottom, fixed to the building and flashed where required.

Weather Proofing: Spray signal receiving parts with silicone or an equivalent weather damage inhibiting spray.

~~1984.10~~12.10 ANTENNA AMPLIFIERS

Standard: To AS 1367.

Requirement: Install a pre-amplifier at the masthead if the signal level at the distribution amplifier is less than 46 db(uV).

Power Source: Provide low voltage a.c. power to the pre-amplifier via the co-axial feeder cable. Install the power source in an easily accessible location. Include associated costs for power supplies, and power to power supplies within the tender submission. (MATV amplifiers and SSO's for this equipment are not shown on the drawings accompanying the specification). Obtain prior approval to the proposed location.

Frequency Response: Flat to within 1 db across the desired band.

Impedance: Match input and output to provide RLR of at least 15 db for 75 ohm co-axial cable.

Gain: Sufficient to achieve minimum signal level of 46 db(uV) at the distribution amplifiers.

Rating: Continuous use.

~~1984.11~~12.11 PASSIVE ELEMENTS

Standard: To AS 1367.

Type: Taps, splitters, and the like, shall be of the transformer or directionally coupled type. Components shall be mounted on fibre-glass boards. All connections shall be permanently labelled on the outside of the enclosure to allow fast identification. Cable saddle clamps are to be correctly sized to suit the diameter of the cable.

Frequency Response: Flat to within 2 db over the range 45 MHz – 820 MHz.

Screening: Screen passive elements to minimise the effect of radiation and/or reception of interfering signals.

Plugs and Sockets:

Construction: To be 75 ohm co-axial push-on type, machined from either beryllium-copper, or brass with nickel or silver plating. Where crimp connections are used they shall be performed using the correct crimping tools. All crimping sleeves used shall exceed 5 mm in length. Plugs using the centre conductor of the coaxial cable as the centre pin are not permissible.

Termination Impedance: Install termination impedances on unused splitter and tap-off outlets and at the end of each line.

1984.1212.12 OUTLET PLATES AND QUANTITIES

Requirement: Install outlets where shown on the Drawings. Provide outlet plates to match other accessories.

Type: Co-axial cable sockets flush-mounted on high-impact plastic plate. Fix components on a printed board assembly fitted with a clamp and screw for the co-axial cable termination.

~~1986.0 FOXTEL~~

~~Standards: Foxtel installation standards.~~

~~General: Engage the services of Foxtel for the design, construction, supply and installation of a fully certified Foxtel system. Any design details provided on the drawings are shown indicatively and require to be confirmed by Foxtel prior to installation.~~

~~Type: Co-axial cable sockets flush-mounted on high-impact plastic plate. Fix components on a printed board assembly fitted with a clamp and screw for the co-axial cable termination.~~

STARSERVE SYSTEM

1993.0 SCOPE

Outline Description: Provide a "Clipsal Starserve" system to provide the following operational features:

- Reticulation of Digital Video Broadcasting – Terrestrial (DVB-T) services from within the metropolitan area.
- Reticulation of telecommunications backbone cabling (Category 3/Class C) and communications horizontal cabling (Category 5e).
- Active equipment, power supplies and Video Distribution Units (VDU) for a fully operational system.
- "Clipsal Starserve" proprietary enclosures.

1999.0 STANDARDS

Standards: As referenced in the "Communications Cabling Systems" and "MATV Systems" clauses.

2001.0 SYSTEM DESIGN

General: Any schematics and design documentation accompanying this specification is provided indicatively. Engage the services of Clipsal to undertake a full design of the Clipsal Starserve system based on the information provided.

On Site Measurements: Liaise with Clipsal to measure on site signal levels of the nominated services, and ensure adequate cable pathways are provided.

Final Design: Before commencing the installation submit details of the proposed final design, including expected signal levels at all outlets, and showing the configuration of equipment required to meet the specified performance.

2005.0 ENCLOSURE

Construction: Provide a "Clipsal Starserve" enclosure to meet the following minimum requirements:

- Wall recessed with dimensions of 380mm high x 270mm wide x 90mm deep.
- Suitable for recessing within 63mm stud walls.
- Polycarbonate construction, with low profile swing door and key lock.
- Enclosure shall be capable of accommodating a wireless broadband router of minimum dimensions 175mm high x 120mm wide x 30mm deep.
- Enclosure shall be capable of accommodating an NBN Co Network Termination Unit (NTU) in future.

2012.0 TESTING

General: Undertake all testing as referenced in the "Communications Cabling Systems" and "MATV Systems" clauses of this specification. In addition, engage the services of "Clipsal" to

~~during the testing and commissioning process to undertake any further testing as required by "Clipsal".~~

~~Warranty: The system shall be warranted in its entirety by "Clipsal" for a minimum period of 15 years. Liaise with "Clipsal" as required, and provide all necessary information to "Clipsal". Warranty certificates are to be provided within the Operating and Maintenance Manual.~~

~~MUSIC / PUBLIC ADDRESS SYSTEM~~

~~2018.0 SCOPE~~

~~Design and provide a music / public address system incorporating the following provisions:~~

- ~~Zoned music system. Zones according to functional building areas and assembly / production areas~~
- ~~Public Address System, zoned as above~~
- ~~Source material systems (radio, CD system, tape system, microphones)~~
- ~~Multiple microphone positions~~
- ~~Interface to the fire services system. Coordination with the fire system for generation of evacuation tones complying fully with the requirements of AS 2220.~~
- ~~All cabling and support systems~~
- ~~Amplification equipment~~
- ~~Speaker systems~~
- ~~Testing, commissioning, warranty and maintenance.~~

~~Include all racking, power supplies, interconnections, brackets, fixings and other sundry items for the complete operation of the system.~~

~~Provide all cabling between the PA rack position and the speaker locations. Include termination of these cables to the speakers and at the PA rack.~~

~~2031.0 SCHEDULE OF PERFORMANCE~~

~~Design and install the system to comply with the following performance criteria:~~

~~Performance Description~~	~~Criteria~~
~~Output Sound Level~~	~~85 dBA +/- 3 dB at 1500mm AFL~~
~~Intelligibility Range~~	~~100 Hz to 10,000 Hz~~
~~Spare Capacity~~	~~25% on any zone~~

~~Assume on acoustic treatment of ceilings, walls, floors or other surfaces.~~

SCHEDULE OF ZONES

Provide separate speaker zones as follows:

Zone	Area
1	Seating
2	HVAC / Radiator
3	Carpets
4	Canteen
5	Office

2047.0 PA SELECTOR PANEL

Provide a PA selector panel for the zoned selection and distribution of either general PA announcements of Music. Install the panel in the Office area. Provide interface facilities to the PABX.

Provide the following facilities on the panel:

- Music On / Off selector
- Zone selector for each specified zone
- All-call selector
- Master volume control

Provide selectors with coloured LED indicators. Logically arrange all selectors and indicators to mimic, as far as possible, the physical layout of the building.

Design the panel to operate as follows:

Music	select On and select combination of zones (or all call)

Select Off – resets zone selectors off

PA	select combination of zones (or all) and push-to-talk

Push-to-talk interrupts Music when active.

2060.0 PABX SYSTEM INTERFACE

Provide facilities such that each individual PA system zone or a general 'all calls' zone may be accessed via incoming extensions from the PABX system.

2062.0 SPEAKER SYSTEMS

Select transformer power tapping to meet required sound power levels.

~~Maintain correct polarity in all distribution circuits.~~

~~Provide ceiling recessed loudspeakers as follows:~~

~~Designation~~	~~Criteria~~
~~Diffuser~~	~~Paintable white PVC or mesh wire grille~~
~~Dimensions~~	~~100mm nominal diameter~~
~~Minimum Rated Capacity~~	~~5 W~~
~~Frequency Response~~	~~70 Hz – 17 kHz~~
~~Sound Output level~~	~~90 dB @ 1m / 1 W @ 1 kHz~~

~~Provide high quality transformers for each loudspeaker of horn with at least the following power taps:~~

~~Designation~~	~~Criteria~~
~~Loudspeakers~~	~~.33, .66, 1.25, 2.5 and 5 W~~
~~Horns~~	~~2, 5, 10 and 15 W~~

~~Provide reflex horns to all plant and external areas constructed or rigid spun aluminium, cast fibreglass, or one-piece moulded high impact resistant polycarbonate, free from mechanical resonances in the range 300 Hz – 2 kHz as follows:~~

~~Designation~~	~~Criteria~~
~~Dimension~~	~~200 mm minimum~~
~~Minimum Rated Capacity~~	~~15 W~~
~~Frequency Response~~	~~20 Hz – 2.5 kHz or better~~
~~Sound Output Level~~	~~110 dB @ 1m / 1 W @ 1 kHz on axis.~~

~~Provide transformers with high impedance at low frequency to ensure reliable amplifier and system operation on low frequency switching transients.~~

~~AMPLIFIERS~~

~~Provide solid state power amplifiers sufficient to accommodate zoned speaker load requirements with an RMS power rating 25% higher than the connected load. Provide amplifies with the following features:~~

~~Standard amplifier equipment to allow for interchangeability~~

- ~~Suitable for both 250 volt ac, 50 Hz single phase SSO operation~~
- ~~Output regulation – 3 dB no load to full load~~
- ~~Noise level – 80 dB below rated output~~
- ~~Harmonic Distortion at full load – 2%~~
- ~~Output line voltages – 50/70/100 selectable with overload and short circuit protection~~
- ~~Frequency response – 50 to 15,000 Hz +- 3 dB~~
- ~~Input Sensitivity – 1 volt (0 dBV) for rated output~~
- ~~Suitable for 19 inch rack mounting.~~

~~Install all amplifiers in a 19 inch rack within the PABX room.~~

~~2096.0 NETWORK MEDIA PLAYERS~~

~~Mount the player within the PA system 19 inch rack.~~

HEARING LOOP/AUGMENTATION SYSTEM

2100.0 SCOPE

Design, supply and install fully concealed hearing loops to the following rooms:

- AG27 Civic Function Room (Building A)
- BG 12 Conference Room (Building A)
- Reception Room (Building D)
- Reception Room - 3 off separate systems, with interface ties (Building D)
- Public Gallery (Building D)

Design each system in accordance with the guidelines produced by Better Hearing Australia. Submit proposed designs for approval prior to proceeding.

Provide all conduits, cables, connections, terminations and active equipment including amplifiers for the complete and operational system in each nominated area.

Work

The works shall include the following:

- Detail system design.
- Supply and installation.
- Programming of system.
- Testing and commissioning of system.
- Operation and maintenance manuals.
- Maintenance during the liability period.

Design each system to provide a field strength of 0.4 Amp/metre (maximum) based on a frequency range of 100 - 5000 Hz (@ 3dB relative to the level at 1000 Hz).

Provide a loop amplifier suitable for each system and locate to approval. Provide inputs so that the loop amplifier may be used in conjunction with other audio equipment.

Provide all cabling as required, of gauge to match the loop and amplifier impedance.

~~WIRING, POWER AND EQUIPMENT~~

~~Requirements~~

~~Provide all necessary power supplies as required to ensure a fully operational system.~~

~~2124.0 TESTING~~

~~After the installation is completed, tests to be carried out to demonstrate that the installation is in a satisfactory working order to all required areas.~~

~~Provide system details, testing and commissioning results within the Installation Manuals.~~

INTERCOM SYSTEM

~~2129.1~~13.1 SCOPE

Outline Description

The system shall provide audio~~/visual~~ communications and main building entry door(s) and control as detailed on the electrical services drawings and schematics to individual apartments.

Commented [MS114]: Amend scope to be project specific.

The system shall be designed, constructed, supplied and installed by an installer certified by the manufacturer.

The install system shall be of commercial manufacture and of 'Bticino~~Urmet Domus IPervoice~~' or equal approved, and shall generally provide the following minimum facilities and operation:

- Audio~~/visual~~ intercom ~~(colour)~~ facilities from main building entry door(s) entrance station to individual monitoring stations to allow for controlled visitor entry to the building main entry door(s) and foyer area.
- Interface to building access control system to allow for release of the main entry door(s) locking mechanism(s) and or door controller(s).
- Interface to building lift controller to call lift cart and allow access to selected level upon release of the main entry door(s).
- Door bell facility to individual Apartment main entry doors.
- ~~The selected system shall operate the foyer area/lobby area lighting upon release of main entry door(s). (Coordinate signal and cabling requirements with Building Lighting Management System).~~

Commented [MS115]: Revise scope to suit project

Work

The works shall include the following:

- Detail system design.
- Supply and installation.
- Programming of system.
- Testing and commissioning of system.
- Operation and maintenance manuals.
- Maintenance during the liability period.
- Liaison with other contractors including door hardware, etc as applicable.

~~2129.2~~13.3 ENTRANCE STATIONS

The entrance stations shall have the minimum features and provide:

- Audio~~/visual (colour/black and white)~~ communications to all Apartments.
- Digital apartment call panel including digital name scrolling facility.
- Door release via integrated RFID tag reader or tenants unique password.
- Map indicator for directions to living unit on doors release.
- Interface with main entry door(s) release facilities.
- Vandal resistant and IP rated for external conditions.
- ~~Allow operation of Apartment entry/foyer/lobby and corridor area lighting upon main entry door release.~~
- Options for hearing impaired persons.

Entrance stations shall be "~~Urmet Domus Elekta~~Bticino" manufacture or equal approved.

Commented [MS116]: Remove if not an apartment building

~~2129.3~~13.4 MONITORING STATIONS

The monitoring station shall have the minimum features and provide:

- Audio~~/visual (colour/black and white)~~ communications to main building entrance station(s).
- Door release facility to building main entry door(s) including adjustable time delay facility.
- Additional function button for user programmed option.
- Door bell facility to individual Apartments.
- Integrated help facility.
- Adjustable volume control.
- Integrated hearing aid setup.

Monitoring stations shall be "~~Urmet Domus Signo~~Bticino" manufacture or equal approved.

Commented [PC117]: Signo for basic functionality with handset, or Imago for upperrange.
For high end equivalent use
Aiphone GT-1M

~~2129.4~~13.5 LIFT CONTROLLER INTERFACE

Provide interface with vertical transportation system.

When door release button is pressed, the activated door strike shall simultaneously transmit a signal to the lift controller, which only allows access to the visiting floor of the communicated tenant station.

~~2129.5~~13.6 WIRING, POWER AND EQUIPMENT

Requirements

The intercom system shall be an IP based system utilising Category 5 UTP (minimum) cabling, and optical fibre cabling for runs greater than 90 metres.

Provide all necessary power supplies as required to ensure a fully operational system.

Dedicated Circuit: the supply shall be provided by a dedicated circuit and the circuit breaker shall be labelled "INTERCOM SYSTEM – DO NOT SWITCH OFF" at the relevant area distribution boards throughout the building.

Audio and visual bus wiring types to suit the final system and manufacturers requirements.

Provide all wiring, equipment and accessories to complete the installation.

Provide all cable segregation requirements between power and communications bus cabling.

2129.613.7 TESTING

After the installation is completed, tests to be carried out to demonstrate that the installation is in a satisfactory working order to all stations

Testing shall include the operation of each monitoring station communication to all entry stations and correct interface to access control and lighting control systems including door release and lift call functions.

Programming of system to suit the Proprietor's requirements.

Provide system details, testing and commissioning results within the Installation Manuals.

~~2130 NURSE CALL SYSTEM~~

~~2131.0 GENERAL PROVISIONS~~

~~Supply and install a "TCP/IP" server based nurse call system to provide nurse call facilities throughout the new ward area.~~

~~Include nurse call server, network switches, workstation software, controllers, annunciators panels, handsets, call points, power supplies, cabling, patch cables, fly leads, high level interfaces, relays, contactors and terminations required for the complete and operational system.~~

~~All nurse call communications shall be over IP based over Cat6 communications cabling with RJ45 connectors. Provide guarantee at tender time that communication system performance is error free and not compromised in any way utilising category 6 UTP cabling.~~

~~Provide all cabling necessary to complete operating system and shall be to the manufacturers specification. Submit cable types and sizes with the tender.~~

~~The design, planning, scheduling, procurement of components and installation to meet the programme, in reference to the proposed and required staging and in coordination and liaison with other trade packages.~~

~~Full responsibility for the provision of a fully operational and complete installation in accordance with the specification and drawings.~~

~~The installation, testing, commissioning, maintenance, service and warranty; and all sundry and material items whether mentioned in detail or not, required to complete the installation and put into working order.~~

~~2139.0 INTERFACE TO EXISTING~~

~~The existing nurse call systems in use in the hospital are to be maintained throughout the works. No disruption is to occur to the existing operation of the hospital.~~

~~The existing nurse call system is to be retained and will remain to be used for the areas of the ward not being upgraded.~~

~~All new nurse call annunciators shall be located in the corridor adjacent to the existing annunciators.~~

~~Until such time where the remaining wards are upgraded, two nurse call systems shall be in operation.~~

~~2144.0 MANUFACTURERS~~

~~The nurse call system shall be a full IP based system wired in star configuration as selected from one of the following suppliers:~~

- ~~Hills Health Solutions (Merlon)~~
- ~~Austco (Tacera)~~
- ~~Voda Communications (Advance Care IP)~~

~~2130 Alert Tech (CarePlus)~~

~~2150.0 GENERAL~~

- ~~The contractor shall supply and install a complete Nurse/Patient communication system. This includes all equipment, accessories and materials necessary for a complete operating IP Nurse Call system with VoIP based speech to each bed and staff position, integrated to the other sub-systems detailed in accordance with the specifications and applicable drawings, to provide the functions listed in the specification.~~
- ~~Provision of a new nurse call server including interface equipment, cabling, UPS facilities, connection to network, nurse call management software for computer network/system to enable the display of call activity and produce diagnostics and reports.~~
- ~~The Nurse Call equipment furnished under this specification shall be the standard product of one manufacturer as stated above; systems offered with third party manufactured power supplies, patient pendants, patient entertainment handsets and LED dot matrix corridor annunciators will not be accepted. Field wiring shall be CAT6 cable unless agreed otherwise, and all voice and data connections shall be by RJ-45 connectors.~~
- ~~Annunciator Panels and call/cancel buttons to be included as part of the submission.~~
- ~~Interface the nurse call system with the local patient TV's to allow control of TV channels and volume via the patient nurse call hand set.~~
- ~~High level interface, cabling, connection facilities and termination requirements to the building fire indicator panel (FIP) in full coordination with fire services trade.~~
- ~~Nurse call system server base equipment to be centrally located within communications racks located within the communications rooms. All field switches / data gathering panels to be located in the new local comms racks. All racking, network switches, patch panels and power supplies to be provided under this contract.~~
- ~~All cabling, support systems, outlets, connections, terminations, equipment, interface devices, and accessories to complete the operational system.~~
- ~~Allow to liaise and coordinate with management, proprietor and consulting engineer to confirm the exact system requirements prior to finalising the tender price.~~
- ~~Testing and commissioning of the system including programming to the building services engineer's, proprietor's and management requirements.~~
- ~~Allow for training of staff in the operation of system (minimum full 2 days)~~
- ~~Installation and operating literature for inclusion in the electrical services installation manuals including as installed drawings, system manuals and system equipment including identifiers, locations and descriptions.~~

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~~2130~~ PHOTOVOLTAIC GENERATION SYSTEMS

~~2164.1~~14.1 SCOPE

Outline description: The work covered by this specification includes the following:

The provision of a Photovoltaic (PV) Array installation that satisfies all statutory, legislative and code requirements and conforms with the general details herein.

Specific works: The following works generally describe the Electrical Services installation and shall be carried out under this specification:

- Grid Connected 10kW PV System Installation including PV arrays and roof mounting system, weatherproof inverters, DC and AC wiring to connect to building distribution system.
- Retain existing and re-installation of existing 10kW PV System retained from the building previously occupying the site, including PV arrays and roof mounting system, weatherproof inverters, DC and AC wiring to connect to building distribution system.
- Co-ordination with Electricity Supply Authority for the grid connection of the PV array.
- Co-ordination with Electricity Supply Authority for the establishment of the Network Connection Agreement.

Commented [MD118]: Is this adequate?

~~2164.2~~14.2 STANDARDS

The following standards are specific to the PV installation and are referred by and/or form part of this Specification:

- AS/NZS 1170.2 Structural design actions, Part 2: Wind actions
- AS 4777 Grid connection of energy systems via inverters
  - Part 1 - Installation requirements
  - Part 2 - Inverter requirements
  - Part 3 – Grid protection requirements
- AS 5033 Installation of photovoltaic - PV – arrays
- IEC 61215Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval
- IEC 61724Photovoltaic system performance
- Clean Energy Council, Grid-Connected Solar PC Systems, Install and Supervise Guidelines for Accredited Installers, December 2011
- Clean Energy Council, Grid-Connected Solar PC Systems, Design Guidelines for Accredited Designers, December 2011

~~2164.3~~14.3 TERMINATION POINTS

Co-ordinate Grid connection works with Electricity Supply Authority including the following:

- All Approvals
- Protection Requirements
- Commission schedule

- Witnessing testing

~~2164.4~~14.4 DESIGN BRIEF

The design and installation of the PV systems must meet the specified requirements of the Electricity Distribution Code and NER at the point of common coupling. The proposed design criteria associated with the design and installation forms the basis of the design brief listed below.

Item	Design Criteria	Comments
Extreme ambient conditions under which all solar panels shall operate	-10° C to +65° C	Equipment shall be suited for full and efficient operations in Adelaide climatic conditions
Extreme ambient conditions for inverter plant and string monitors shall operate	-10°C to +50°C	Equipment shall be suited for full and efficient operations in Adelaide climatic conditions
External rain/hail other conditions	Adelaide, Australia	Equipment shall be suitable for installation at location
Grid Connection	Required	Comply with Electricity Supply Authority requirements
Installed Capacity	Sufficient to provide 10~~9~~.0 kWp	The number of panels multiplied by the generation capacity of each panel (kW)
Peak Output	10~~9~~.0 kWp	The installed capacity multiplied by an efficiency factor based on orientation and panel efficiency in Adelaide
Power Generation over 25 years	Minimum 325 MWh/annum for 25 years	The installed capacity multiplied by the efficiency factors and average energy yield per panel per year
~~CO2 Emmission Abated over 25 years~~	~~Minimum 4.4 tonnes CO2-e/kWh based on 0.68kg CO2-e/kWh~~	~~Australian Government Department of Climate Change – NGA Factors October 2011~~
Available Roof Area	Refer Drawing LCE 3416.E11	Refer Structural / Other limitations – Liaise with structural engineer
Design Roof Plan Dimensions	Refer Drawing LCE 3416.E11	Refer Structural / Other limitations – Liaise with structural engineer

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Item	Design Criteria	Comments
Mounting Method	30degree angle frame mounted certified to AS/NZS 1170.2	Non-penetrative preferred on low pitch roof. Fixing details to eliminate leakage
Mounting	Removable/hinged for cleaning/inspection	Clearance of approximately 100mm required under panel arrays in fixed position for general access/cleaning/inspection
Accessibility Walkways	Minimum of 600mm wide walkways	Walkways between panel arrays for access/maintenance to be provided as part of works
Mass/Area (kg/m2) Inverter Panel Arrays	 <50kg/m2 <25kg/m2	 Based on a 3,000W IP65 Inverter Refer Structural Details
Inverters	230/400V +10% to -11% Compliant with AS4777 and Electricity Supply Authority requirements	Operating Voltage range in accordance with AS60038 & AS3000 Inverters must be tested and certified for use in Australia. Generation must shut down on loss of Network Supply
Electricity Supply Authority Harmonics Fault Current Over/Under Current Over/Under Voltage Frequency	Compliance with Electricity Supply Authority Requirements	Final requirements to be defined in accordance with Electricity Supply Authority Services & Installation Rules
Compliance with Electricity Supply Authority Customer Guide To Embedded	Required	Required for connection to the grid

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Item	Design Criteria	Comments
Generation Network Connection (Small)		
Electrical Wiring & Electrical Installation	To AS3000, AS5033	Refer electrical specification
Power Factor	Within 0.90 (Lagging) and 0.90 (Leading)	Required for connection to the grid
Harmonic Limits	Individual Odd Harmonics – 1.33% Individual Even Harmonics – 0.76% Total Harmonic Distortion – 1.67%	The permissible harmonic limits associated with the customer's electrical installation must not be exceeded.
Electromagnetic Interference	In accordance with AS2344	Any electromagnetic interference caused by the installation or any plant / equipment connected must be less than the limits set out in AS/NZ2344
Disturbing Loads	In accordance with the limits in AS61000	Voltage disturbance at the grid connection points for each site to be in accordance with AS61000
Photovoltaic Orientation	North facing, 35° inclination to approval or flat mounted on roof	To maximise efficiency depending on structural implication of additional support structures
Maintenance – General Equipment	12 months from completion	Monthly inspections Equipment adjustment, checking and cleaning Record outputs Provide monthly report
	Annually throughout equipment warranty period	Annual inspection Items as above Provide annual report
Maintenance – Photovoltaic Panels	12 months from completion	Inspection of all panels every 3 months Clean all panels every 3 months in accordance with manufacturer's recommendation
Testing and Commissioning	As per CEC Installation Guidelines	

Item	Design Criteria	Comments
Labelling	As per AS4777.1 and AS/NZS 5033	

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~~2164.5~~14.5 WARRANTY SCHEDULE

The installation of PV system must comply with all relevant Australian and International Standards including all relevant codes and legislative requirements. The manufacturers warranty required listed below.

Item	Warranty Period (minimum)	Comments
Panels	25 years	Minimum 80% power output @ 25 years
Interconnections	25 years	
Mounting frames	25 years	
Inverters	10 years	

~~FIRE SERVICES~~

~~2165.1 GENERAL~~

~~This section of the specification details the requirements for fire services associated with the project. This fire services section of the electrical services speciation does preclude any other sections of this specification. The electrical services contractor shall review this document and all the subsequent referenced documents in their entirety.~~

~~Generally the fire services works associated with the project involve the following:~~

- ~~A microprocessor based Fire Indicator Panel (FIP) configured with Analogue Addressable Loops to connect to addressable devices. The Fire Indicator Panel shall incorporate generic non-proprietary software.~~
- ~~Provision of 230V power for FIP.~~
- ~~FIP to incorporate AS1668.1 compliant fire fan control panel for Smoke Spill Fan, Mechanical Damper and Evaporative System controls including rotary switches/push button fire fan controls and LED status indication.~~
- ~~FIP shall be fitted with a high level interface to connect to the Master Evacuation Control Panel (MECP).~~
- ~~Provision of external fire alarm sounder strobe complete with statutory 'FIRE' signage. The final location is subject to approval by the project architect.~~
- ~~Provision of addressable fire detection system spaced in accordance with AS1670.1 including provision of addressable loop cabling.~~
- ~~Provision of magnetic door hold open devices configured to release in fire mode or loss of power including provision of smoke detectors within 1.5 m of the applicable fire/smoke doors.~~
- ~~Provision of sounder bases within apartment for notification of residents. (DELETE IF NOT APPLICABLE)~~
- ~~Addressable smoke detection system spaced in accordance with AS1668.1 outside lift shafts, outside/inside fire isolated stairways, supply air fans, lift shafts and along paths of smoke migration on an extended 20.4 m grid layout.~~
- ~~Analogue addressable input/output devices as necessary to allow all required fire systems interfaces and fire signals for fire hydrant/sprinkler system monitoring, sound system shutdowns and AS1668.1 controls.~~
- ~~Provision of audio visual alarms interfaced to operate in fire alarm to all occupied spaces providing sound levels to AS1670.4.~~
- ~~Casting in conduits into slab within fire isolated stairways for detection and cabling to sprinkler control valves.~~
- ~~Where fire cabling to be run exposed, install within conduit and fix hard to ceiling/structure.~~
- ~~Addressable analogue Manual Call Points located as indicated on drawings.~~
- ~~Smoke sampling devices within air conditioning outside air fans for non-latching shut down upon detection of smoke. Alarms raised from these detectors shall not notify the fire authority.~~

~~Smoke sampling devices within stairwell pressurisation fans for non-latching, shutdown upon detection of smoke. Alarms raised from these detectors shall not notify the fire authority.~~

- ~~Selex/Dymo labelling of all field devices, including input/output devices indicating exact address as per FIP programming and display and block plans.~~
- ~~Complete new set of fire alarm block plans, sleeved within clear plastic protectors and within bound folder (two off copies) located within the FIP, include index of all devices and corresponding addresses. Ensure fire alarm block plans are presented in accordance with local authority requirements.~~
- ~~Fire cabling and termination of cabling to mechanical services switchboards for fire mode operation.~~
- ~~Fire cabling to fire/smoke dampers for fire mode operation.~~
- ~~Fire cabling to access control/security system to release electronically controlled doors in fire mode. Final location and coordination is to be undertaken on site.~~
- ~~High Level Interface to ….~~
- ~~Alarm Signalling Equipment (ASE) located within FIP including assisting the client in making the application to Telstra for PSTN telephone line to the ASE. The Fire Services Trade shall purchase and install the GSM monitoring equipment and arrange with fire authority for line testing prior to hand-over.~~
- ~~Cabling associated with the above works as per cabling schematic and that required to achieve compliance with AS1670, AS1668.1, AS/NZS3000, AS/NZS3013 and AS/CA:S009.~~
- ~~Provision of four (4) additional detectors to account for coordination with other services within the ceiling space. Should these detectors not be utilised during project works, allow to handover to the client at practical completion in original packaging.~~
- ~~Statutory maintenance in accordance with Building Code of Australia requirements (including associated reference legislation). Generally undertake maintenance in accordance with AS1851 unless state/territory legislation requires otherwise.~~
- ~~Defects Liability Period of 12 months.~~
- ~~Provision of certificate of compliance in accordance with state legislation e.g. Form 2 (SA), Form 15A (NSW), etc.~~

~~Associated Works~~

~~Builders Related Trades~~

- ~~Provision of signage on fire hose reel cabinet doors to state 'FIRE INDICATOR PANEL' where applicable.~~

~~2165.2 AUTHORITIES AND APPROVALS~~

~~Prior to practical completion, the electrical services contractor shall provide a certificate of connection from the fire authority for any new fire detection systems. Allow for payment of all associated fees.~~

~~If the responsible authority is required to or, pursuant to the statutory powers vested in it, elects to perform or supply part of the works or to inspect or test the Works during~~

~~construction, make the necessary arrangements with the authority and pay and bear the fees payable in connection therewith.~~

~~2165.3 CONTRACTORS SUBMISSIONS~~

~~Prior to commencing works on site, allow to provide the following items:~~

- ~~Shop drawings detailing the proposed fire services installation~~
- ~~Fire Indicator Panel schematic and wiring diagrams~~
- ~~Battery calculations verifying that the batteries supplied are capable of achieving the requirements outlined within the relevant legislation~~

~~Do not proceed until shop drawings and battery calculations have been reviewed by the consulting engineer and are considered satisfactory.~~

~~Prior to practical completion allow to provide the following:~~

- ~~A section within the electrical services operating and maintenance manual detailing the scope of works, applicable Australian Standards and maintenance requirements~~
- ~~As-installed drawings and fire alarm block plans~~
- ~~Authority certificates and reports~~
- ~~Certificates of compliance.~~

~~For details on requirements on the completion of operating and maintenance manuals, refer to the relevant section of this specification.~~

~~STANDARDS – FIRE SERVICES~~

~~Australian Standard and Codes current at the date of tendering are applicable in respect of all workmanship except where they conflict with the provisions of this Specification.~~

~~The following codes which specifically form part of this specification insofar as they are appropriate together with such other codes as required by the Authorities having jurisdiction shall be complied with:~~

~~Fire Services~~

~~AS1345~~	~~Identification of the Contents of Piping, Conduits and Ducts~~
~~AS1530~~	~~Methods for Fire Tests on Building Material, Components and Structures~~
~~AS1603~~	~~Automatic Fire Protection and Alarm Systems~~
~~AS/NZS1668~~	~~The Use of Mechanical Ventilation and Air Conditioning in Buildings~~
~~AS1670~~	~~Automatic Fire Detection and Alarm Systems – System Design, Installation and Commissioning~~
~~AS/CA S009~~	~~Installation Requirement for Customer Cabling~~
~~AS1851~~	~~Maintenance of Fire Protection Equipment~~
~~AS/NZS2053~~	~~Conduits and Fittings for Electrical Installations~~
~~AS2220~~	~~Emergency Warning and Intercommunication Systems~~
~~AS2444~~	~~Portable Fire Extinguishers and Fire Blankets – Selection and Location~~
~~AS2700~~	~~Colour Standards for General Purposes~~
~~AS/NZS3000~~	~~Electrical Installations (SAA Wiring Rules)~~
~~AS/NZS3013~~	~~Electrical Installations – Classification of the Fire and Mechanical Performance of Wiring Systems~~
~~AS4428~~	~~Fire Detection, Warning, Control and Intercommunication Systems – Control and Indicating Equipment~~
~~AS7240~~	~~Fire Alarm Systems~~

STATUTORY PREVENTATIVE MAINTENANCE

The fire services installed as part of this contract shall be maintained in accordance with the relevant state legislation outlined in the Building Code of Australia section I1.1 (and referenced legislation).

Relevant maintenance certificates shall be submitted to the client at the end of the maintenance year detailing that the systems operate in accordance with the relevant Australian Standards to which they were originally installed.

Ensure that all maintenance tags are stamped in accordance with the requirements of the legislation and that log books are maintained. At the end of the defects liability period, allow to submit a certificate stating that the systems have been maintained and operate as per the original design standards applicable. Where applicable, the certificate shall take the form as specified within the relevant local state/territory legislation.

Report all defects to the client as soon as defects are identified.

Maintenance shall be undertaken by a suitably qualified fire contractor.

2165.6 PORTABLE FIRE EXTINGUISHERS

Install portable fire extinguishers and location signs as provided by the client and as required by AS2444- 2001.

Where extinguishers are installed in areas prone to vandalism or weathering, provide weatherproof break glass enclosures complying with AS1603.5.

Final approval shall be obtained by the Architect prior to installation.

Fire extinguishers shall be complete with all identification signage to AS2444 requirements.

2165.7 FIRE INDICATOR PANEL

The Fire Indicator Panel shall be a wall mounted cubicle with an internal hinged frame. All equipment shall be of modular plug in design, with the field terminations and power supply accessible by opening the internal frame.

A locked door keyed to 003 shall secure the control sections of the equipment. All controls and indicators shall remain visible with door closed.

The colour finish shall be manufacturer's standard finish.

2165.7.1 PANEL CONTROLS AND INDICATORS OPERATION

The FIP shall have membrane touch and front panel controls with audible feedback, LCD display featuring operator prompts and common system status indicators.

All essential controls shall be grouped together as per the Fire Fighters Facility layout in AS4428.3 irrespective of whether the panel is manufactured to comply with AS4428 or AS7240.

~~ESSENTIAL CONTROLS~~

~~Evacuate isolate: Shall isolate / de-isolate the evacuation output.~~

~~External bell isolate: Shall isolate / de-isolate the bell output.~~

~~Firefighter facility in accordance with AS4428.1~~

~~Zone indication in accordance with AS7240.2 (if applicable).~~

~~2165.7.3 ESSENTIAL INDICATORS~~

~~Common alarm indicator (RED led): Shall flash until all incoming alarm signals are acknowledged then shall become steady.~~

~~Common isolate/disable indicator (AMBER led): Steady indicator and shall remain on while any zone or device is isolated/disabled.~~

~~Common fault indicator (AMBER led): Steady indicator and shall remain on until all faults are removed from system.~~

~~Liquid crystal display: The LCD display shall be a 14 line X 40 character display with sections dedicated to displaying specific information or including the Fire Brigade Controls.~~

~~2165.7.4 SYSTEM CONTROLS~~

~~The front panel shall have a menu button, which is not password protected and allows access to the following system functions~~

~~No Password Protection~~

~~Alarms: Shall display all devices / zones in alarm.~~

~~Pre Alarms: Shall display all devices / zones in pre alarm.~~

~~Isolates/Disables: Shall display all devices / zones that are isolated.~~

~~Faults: Shall display all devices / zones in fault.~~

~~Password Protection Level 2~~

~~Status: Shall display the status of loops, modules, power supply, brigade outputs, all inputs, all outputs, the system and analogue values of individual devices.~~

~~Tests: Shall allow testing of alarms, faults, the system and panel indicators.~~

~~The front panel shall have a button, which has level 2 and 3 password protection and allows access to the following system functions~~

~~Date: Shall allow the date to be altered.~~

~~Time: Shall allow the time to be altered.~~

~~Day/Night: Shall allow the day / night sensitivity change over times to be altered.~~

~~Logs: Shall have five separate logs of 300 events for alarms, faults, isolates, system events and configuration changes.~~

~~Tests: Shall allow single person operation alarm testing of devices and detectors.~~

~~Inputs / Outputs: Shall allow the manual control of all inputs and outputs.~~

~~Access to allow alterations via the front panel keypad of descriptors, types, configuration, detector sensitivity, and default relay outputs.~~

~~Access to add or change passwords.~~

~~2165.7.5 ALARM OPERATION~~

~~On receipt of an alarm the common alarm indicator shall flash and ancillary equipment will activate as programmed.~~

~~The LCD shall display the exact location of the device in alarm, the type of device and the alarm sequence. All controls related to the LCD shall become inoperable except for the alarm acknowledged and the next / previous buttons, once acknowledge other system operations can proceed.~~

~~The LCD display shall always register the first alarm received with subsequent alarms cued in order of receipt, accessible by scrolling.~~

~~2165.7.6 FAULT INDICATOR~~

~~The common fault indicator and the LCD shall display the first open circuit fault on an analogue/addressable loop. The LCD shall display the exact section of cable where the fault has occurred by indicating the last two devices it is able to communicate with in each direction.~~

~~2165.7.7 COMMON OUTPUTS~~

~~Provide at least one of each of the following:~~

- ~~Common Alarm Output~~
- ~~Common Fault Output~~
- ~~Common Isolate Output~~
- ~~Common Bell Output (Monitor for line fault)~~
- ~~Common Ancillary Output (Monitor for line fault)~~
- ~~Common Sounder Output (For External beacon)~~

~~2165.7.8 CONFIGURATION~~

~~The FIP shall be configured as an analogue/addressable system with up to 200 analogue/addressable devices per loop. The installer shall determine the number of loops to suit the installation including a spare capacity of 20%.~~

~~A minimum of two (2) addressable loops shall be provided. Final configuration shall be agreed with Consulting Engineer.~~

~~The FIP shall be capable of displaying the identity of each device with groups of devices allocated to zones.~~

~~On power up the panel will perform a 'self learn' which reports back the type of device located at each address. If a panel has not been configured then the 'self learn' information will be automatically saved. Default descriptors and outputs will be provided for each device. If a configuration is loaded into the panel at power up the self learn will identify any discrepancies between the configuration, the field devices and the internal panel modules. These differences can be incorporated into the configuration or deleted.~~

~~Programming the system shall be carried out either on the manufacturer's premises, via a modem link, or on site via a portable computer. A functional brief shall be submitted for review and approval by the Consulting Engineer prior to programming.~~

~~2165.7.9 POWER SUPPLY~~

~~Standard: To AS1603.4 clauses 2.7 and 2.8.~~

~~Mains supply shall be 230V AC (+6% – 10%) at 50HZ and installed in accordance with AS/NZS 3000 and AS1670.~~

~~Sealed Batteries: Shall be capable of powering door hold open devices for a period of 24 hours in the event of power failure.~~

~~2165.7.10 FIRE FAN CONTROL PANEL~~

~~New fire indicator panel to incorporate new AS1668 fire fan control panel for all plant controls of air handling plant and equipment associated with the smoke hazard management system.~~

~~Smoke Spill fan controls to be individually key switched (three position – "auto", "on", "off") and provided with LED fan status indication for red – "run", green – "stop", amber "fault".~~

~~Motorised dampers, and all other air handling plant and equipment to be provided with key switched controls (three position – "auto", "on", "off").~~

~~All controls to be individually labelled, permanently engraved on the panel face adjacent the control for clear identification.~~

~~Provide shop drawing for approval prior to manufacture.~~

~~2165.7.11 FIELD DEVICES~~

~~All field devices shall:~~

- ~~Designed and installed in locations with a view to minimise the detrimental effects of moisture, dust, insects and other foreign materials.~~
- ~~Be installed in accordance with manufacturer's recommendations.~~
- ~~Ideally have in-built short unit isolators.~~

~~2165.7.12 DETECTORS~~

~~All detectors shall:~~

~~Be installed in accordance with AS1668 and AS1670 and in locations as detailed on drawings.~~

- ~~Be fully approved by an approved testing authority and be batch tested by CSIRO ActivFire.~~
- ~~Be Analogue photo optical, ionisation, carbon monoxide and heat as indicated on the drawings.~~
- ~~ideally have in-built short circuit isolation.~~

~~2165.7.13 ANALOGUE DETECTOR BASES~~

~~All detector bases shall:~~

- ~~Be no larger than 100mm in diameter.~~
- ~~Not have any electronics.~~
- ~~Signal Fire Indicator Panel if detectors removed.~~
- ~~Ability to be remotely tested at Fire Indicator Panel.~~
- ~~Ability for remote LED's to be connected.~~

~~2165.7.14 INPUT/OUTPUT DEVICES~~

~~All input/output devices shall:~~

- ~~Have a unique address programmed with DIP switches or be able to be addressed via the FIP.~~
- ~~Obtain and send information to equipment such as relays, solenoids, airflow, switches etc. The input shall monitor for a short or open circuit.~~
- ~~Provide loop outputs to mechanical plant, etc.~~
- ~~Ideally have in-built short circuit isolation.~~

~~2165.7.15 INPUT DEVICES~~

~~All input devices shall:~~

- ~~Have a unique address programmed with DIP switches.~~
- ~~Obtain change of condition from equipment such as pressure switches, monitored valves etc. The input shall monitor for a short or open circuit.~~

~~2165.7.16 MANUAL CALL POINT~~

~~'Break Glass' manual call points shall be incorporated as part of the Fire Indicator Panel and shall:~~

- ~~Be approved to AS1603 part 5.~~
- ~~Have a unique address programmed with DIP switches.~~
- ~~Be fully approved by an approved testing authority.~~

~~2165.7.17 SHORT CIRCUIT ISOLATORS~~

~~All short circuit isolators shall:~~

~~Be installed to protect the analogue/addressable loop against wire-to-wire short circuits.~~

- ~~In their normal state pass data as required for normal system operation. In the event of a short circuit the loop shall be disconnected between isolators.~~
- ~~Automatically reset when the wiring short circuit has been repaired.~~
- ~~Isolation bases shall be provided for every 20 detectors (maximum)~~

~~2165.7.18 FIRE ALARM WARNING BEACON~~

~~Comply with the following:~~

- ~~Warning beacons shall be 24V DC red low profile weatherproof type.~~
- ~~The alarm shall have a neat and unobtrusive appearance.~~
- ~~Strobe shall be mounted on a "FIRE" sign worded in letters no less than 25mm in height as per the requirements of AS1670.1.~~

~~2165.7.19 FIRE ALARM ZONING~~

~~Fire alarm zones to be as follows:~~

~~Fire Alarm Zone~~	~~Location~~
~~Zone 1~~	
~~Zone 2~~	
~~Zone 3~~	
~~Zone 4~~	
~~Zone 5~~	
~~Zone 6~~	
~~Zone 7~~	
~~Zone 8~~	
~~Zone 9~~	
~~Zone 10~~	
~~Zone 11~~	
~~Zone 12~~	
~~Zone 13~~	
~~Zone 14~~	
~~Zone 15~~	
~~Zone 16~~	

~~OCCUPANT WARNING SYSTEM~~

~~Provide a two zone occupant warning system incorporating audible visual field devices and isolation controls for each zone within the Fire Indicator Panel.~~

~~Alert and Evacuate tones shall be transmitted in accordance with AS1670.4 with the Alert tone timeout (adjustable) to be initially set to 60 seconds.~~

~~Zones to be as follows:~~

~~**Occupant Warning (evacuation) Zone**~~	~~**Location**~~
~~Evac Zone 1~~	~~Nightclub:~~ ~~Basement~~ ~~Ground Floor~~ ~~Ground Floor mezzanine~~ ~~Ground Floor Supermarket~~
~~Evac Zone 2~~	~~First Floor~~ ~~Second Floor~~ ~~Second Floor Mezzanine~~ ~~Roof level~~

~~AUDIO VISUAL ALARMS~~

~~Provide 24 volt DC powered and red base colour with integral red strobe. Sound level shall be set to "high" and all devices shall be surface mounted utilising shallow base.~~

~~Devices shall have in-built synchronising capability activated upon commissioning.~~

~~2165.7.22 ELECTRICAL WIRING INSTALLATION~~

~~Wiring Methods~~

~~Each wiring method shall comply with the requirements of the relevant clauses within this specification.~~

~~All cables shall:~~

- ~~Be adequately fixed and supported with appropriately sized purpose made clips, cleats, straps or saddles. Fire rated cables shall be fixed and supported by suitable fixings in accordance with local requirements.~~
- ~~Be installed in accordance with the manufacturer's recommendations.~~
- ~~Be installed between equipment without any joints.~~
- ~~Be installed so that it can be readily renewed, repaired and relocated without effecting building finishes and construction.~~
- ~~Be in accordance with an approved colour code, so that all wires are readily distinguishable.~~
- ~~Have adequate cross sectional area so that on particularly long wiring runs the integrity of system operation is not compromised by excessive voltage drops, and in any case these voltage drops shall not reduce the voltage across particular items of equipment to a level below the manufacturers recommended operating parameters. Confirm the relevant specifications with the manufacturer.~~

~~All detector wiring shall be completely separated from low voltagte wiring and where it crosses low voltage wiring a separating bridge of rigid non-conducting material shall be supplied and installed between the fire alarm and low voltage wiring (AS/NZS 3000:2000). In general, detector cables must be so spaced from all other wiring or otherwise protected, such that the magnitude of induced voltage in the detector circuit cannot cause a false alarm.~~

~~2165.7.23 ANALOGUE/ADDRESSABLE LOOPS~~

~~The analogue/addressable loop/s shall be cabled in red twisted TPS, unless detectors/devices are performing AS1668 functions. For AS 1668 functions, the loop shall be fire rated RADOX or approved equivalent. All loops are to have a maximum loop resistance of 50 ohms with a maximum distance of 2km when 2.5mm^2 cable is used.~~

~~Two core screened twisted pair cable originating from FIP extending through the protected areas and returning to the FIP shall be utilised for loops not requiring a fire rating.~~

~~Cable Specifications~~

- ~~Capacitance of 100 picofarads per metre or less~~
- ~~Resistance of 100 milliohms per metre or less~~
- ~~Impedance of loop typical 100 to 120 ohms~~

~~Maximum distances between modules 1km providing cable meets above specifications.~~

~~Recommended cable type~~

- ~~Hartland HC2335 (non fire rated)~~
- ~~Radox FR Communication 1.5mm 1 pair (fire rated)~~

~~The analogue/addressable loop/s shall consist of a two core cable originating from the FIP extending through the protected areas and returning to the FIP or remote addressable module. The use of multicore wiring containing both outgoing and incoming circuits is not acceptable.~~

~~A maximum number of 300 devices (comprising 150 detectors and 150 modules) shall be connected onto any one analogue/addressable loop. A minimum of 3 addressable loops shall nevertheless be allowed for in the tender and shall not be varied unless approved by Consulting Engineer.~~

~~Wiring between addressable devices and equipment such as pressure switches etc. shall be monitored for an open circuit.~~

~~2165.7.24 EXTERNAL FIRE ALARM BEACON CONNECTION~~

~~Supply and install a two core 1.5mm2 PVC sheathed MIMS from the FIP to the beacon location as shown on the drawings.~~

~~2165.7.25 DOOR ELECTRICAL STRIKES~~

~~Requirement: Provide signal cabling from the FIP to the building's Access Control Panel to enable release of doors in the event of a fire alarm. Door strikes shall be provided by door hardware supplier and wiring by the Electrical Sub-Contractor. Fire contractor to undertake terminations at the Fire Indicator Panel only.~~

~~Operation: Electric door strikes to release upon removal of power supply. Automatic doors are to drive open in the event of a fire alarm. Internal automatic doors are to be manually operated from the FIP via a rotary switch.~~

~~2165.7.26 HIGH LEVEL INTERFACE~~

~~Provide a RS232/RS485 High Level Interface (HLI) card within the FIP to facilitate connection to other equipment. The HLI shall use a recognised programming language, BACnet, Lonworks, MODBUS or similar.~~

APPENDIX A – SECTION COSTS & UNIT RATES - ELECTRICAL SERVICES

This schedule is to be completed and submitted with Tender submissions. The amounts indicated in the total tender price including administration costs and profit for sections of the work are as follows:

ITEM	AMOUNT TENDERED
~~Underground Survey~~	~~$ .....~~
Access Conduits & Pits	$ .....
Main Switchboard & Distribution Boards	$ .....
Earthing and Bonding	$ .....
Consumers Mains and Submains	$ .....
Cable Trays & Support Systems	$ .....
Power Subcircuits	$ .....
Lighting Subcircuits~~Gen Set and auto changeover facilities~~	$~~$~~ .....
Accessories & Outlets~~Lighting Subcircuits~~	$~~$~~ .....
Luminaires~~Accessories & Outlets~~	$~~$~~ .....
Exit & Emergency Luminaires~~Skirting Duct~~	$~~$~~ .....
Lighting Controls~~Floor Ducting~~	$~~$~~ .....
NBN Corporation Cable Pathways~~Luminaires~~	$~~$~~ .....
Structured Cabling System ~~Exit & Emergency Luminaires~~	$~~$~~ .....
MATV System~~Lighting Controls~~	$~~$~~ .....
Access Control~~NBN Corporation Cable Pathways~~	$~~$~~ .....
Intercom System~~Telecommunications Block Cabling~~	$~~$~~ .....
Relocation of existing 10kW Photo-voltaic system to new building~~Structured Cabling System~~	$~~$~~ .....
New 10kW Phot-voltaic system~~People Counter System~~	$~~$~~ .....
~~Fire Detection System/VESDA~~	~~$ .....~~
~~EWIS System~~	~~$ .....~~
~~Hearing Audio Loops~~	~~$ .....~~

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~~MATV System~~	~~$ .....~~
~~Foxtel System~~	~~$ .....~~
~~Clipsal Starserve System~~	~~$ .....~~
~~Security & Access Control~~	~~$ .....~~
~~PA/BGMS System~~	~~$ .....~~
~~AV System~~	~~$ .....~~
~~Intercom System~~	~~$ .....~~
~~Lightning Protection~~	~~$ .....~~
~~Fluorescent Lamp Recycling~~	~~$ .....~~
Labelling	$ .....
~~Civil Works~~	~~$ .....~~
~~Fire Detection and Alarm System~~	~~$ .....~~
~~Portable Fire Extinguishers~~	~~$ .....~~
~~Electrical Inspections and Certificate of Electrical Safety~~	~~$ .....~~
Testing & Commissioning	$ .....
Maintenance & Servicing	$ .....
~~Legislative Fire Services Maintenance~~	~~$ .....~~
For Approval/Workshop Drawings	$ .....
As-Constructed Drawings	$ .....
Operating and Maintenance Manual	$ .....
User Training	$ .....
Other (specify)	$ .....
SUBTOTAL	**$ .....**
GST	$ .....
	$ .....
TOTAL	

Tenderer ..... **Date** .....

~~Tenderers shall also provide a price breakdown of the mechanical component of their tender on a building by building basis as follows:~~

~~ITEM~~	~~AMOUNT TENDERED~~
~~Sitework Establishment and Preliminaries~~	~~$.....~~
~~Building A~~	~~$.....~~
~~Building B~~	~~$.....~~
~~Building C~~	~~$.....~~
~~Building D (Council Chamber)~~	~~$.....~~
	~~_____~~
~~TOTAL TENDER AMOUNT~~	~~$~~
	~~_____~~

~~ALTERNATIVE ITEM~~

~~Nominate the cost/credit to the tender sum for the following alternative installations:~~ ~~_____$~~

~~Provision of RJ45 based terminations, racks and all equipment as required in lieu of "TE Connectivity Highband" installation as specified.~~

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~~APPENDIX B – SCHEDULE - SUBCONTRACTORS AND PERSONNEL~~

~~Identify below Sub-Contractors included within the tender submission.~~

~~ITEM~~	~~SUB-CONTRACTOR~~
~~Lighting Control System~~	~~……………………………~~
~~SCA~~	~~……………………………~~
~~Communications Cabling~~	~~……………………………~~
~~Clipsal Starserve~~	~~……………………………~~
~~Fire Detection~~	~~……………………………~~
~~EWIS~~	~~……………………………~~
~~MATV~~	~~……………………………~~
~~Foxtel~~	~~……………………………~~
~~Lighting Controls~~	~~……………………………~~
~~Security & Access Control~~	~~……………………………~~
~~People Counter System~~	~~……………………………~~
~~PA/BGM System~~	~~……………………………~~
~~AV System~~	~~……………………………~~
~~Intercom System~~	~~……………………………~~
~~Lamp Recycling~~	~~……………………………~~
~~Electrical Inspection Authority~~	~~……………………………~~
~~Other~~	~~……………………………~~

Personnel	**Name**	**Years Experience**	**Years with Company**
Project Manager	…………………………………	…………………………	………………………………
Foreman	…………………………………	…………………………	………………………………

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SCHEDULE - HOURLY RATES

Identify below the following hourly rates that are applicable for the duration of this contract:

Occupation	**Normal Time Rate $/hr**	**Overtime Rate $/hr**	**Double Time Rate $/hr**
Foreman	.....	.....	.....
Electrical Mechanic	.....	.....	.....
Electrical Apprentice	.....	.....	.....
Communications Technician/ Installer	.....	.....	.....
Security Technician	.....	.....	.....
Intercom Technician	.....	.....	.....

INDICATIVE PROJECT HOURS ALLOWANCE

Identify the indicative number of working hours included in the Tender submission:

ITEM	Normal Time	After Hours	Total Hours
Project Manager	.....	.....	.....
Supervisor	.....	.....	.....
Electrical Mechanic	.....	.....	.....
Apprentice	.....	.....	.....
Total Hours	.....	.....	.....

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APPENDIX C – SCHEDULE OF RATES - LUMINAIRES

ITEM	**ADDITION**	**DELETION**	**DELETION**
Include labour and material, profit and overhead costs in each item.		**(Prior to Approval)**	**(After Approval)**
Luminaire Designations			
....	$....................	$....................	$....................
....	$....................	$....................	$....................
....	$....................	$....................	$....................
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~~APPENDIX D – SCHEDULE OF UNIT RATES~~

~~Include labour and material, profit and overhead costs in each item.~~

~~ITEM~~	~~ADDITION~~	~~DELETION~~
~~General Power~~		
~~One single-phase double SSO on existing circuit (with 15 metres of cable)~~	~~$.....~~	~~$.....~~
~~One single-phase 15A SSO on new circuit (with 15 metres of cable and 16A RCD/MCB)~~	~~$.....~~	~~$.....~~
~~One 20A 3-phase Isolator with 30m of 4c 4mm2 cable & 20A circuit breaker~~	~~$.....~~	~~$.....~~
~~Installation of wall switch and 10 metres of 2c 2.5mm2 switchwire and reset unit.~~	~~$.....~~	~~$.....~~
~~1000 VA dimmer unit installed~~	~~$.....~~	~~$.....~~
~~1800 VA dimmer unit installed~~	~~$.....~~	~~$.....~~
~~Price per metre 2.5mm2 2c+E installed anywhere in building~~	~~$.....~~	~~$.....~~
~~Price per metre 6.0mm2 4c+E installed anywhere in building~~	~~$.....~~	~~$.....~~
~~Price per metre 6.0mm2 2c+E installed anywhere in the Building~~	~~$.....~~	~~$.....~~
~~Price per metre 50mm2 4c+E Cu/PVC/PVC installed to tray~~	~~$.....~~	~~$.....~~
~~Skirting duct per length (3m) installed~~	~~$.....~~	~~$.....~~
~~Double SSO installed to skirting duct with 15 m cable to existing circuit~~	~~$.....~~	~~$.....~~
~~Floor duct installed within concrete per metre~~	~~$.....~~	~~$.....~~
~~Floor outlet enclosure with 1 off general power double SSO, 1 off computer power double SSO and 4 off RJ45 outlets~~	~~$.....~~	~~$.....~~
~~Cable tray~~	~~$.....~~	~~$.....~~
~~- 300 mm installed per metre~~	~~$.....~~	~~$.....~~
~~450 mm installed per metre~~	~~$.....~~	~~$.....~~
~~600 mm installed per metre~~	~~$.....~~	~~$.....~~
~~Price per metre installation of 100mm electrical conduit underground to a depth of 600mm cover, including all excavation works and reinstatement~~	~~$.....~~	~~$.....~~
~~Copper price at time of Tender~~	~~Price per tonne~~	~~$.....~~
~~TEM~~	~~ADDITION~~	~~DELETION~~
~~Communications~~		

Tenderer ..... **Date** .....

~~Floor distribution rack, (45 RU) supply and installed (unfurnished)~~	~~$.....~~	~~$.....~~
~~24 port patch panel installed, populated and terminated~~	~~$.....~~	~~$.....~~
~~Patch lead (2m)~~	~~$.....~~	~~$.....~~
~~One RJ 45 communications outlet, 50m category 3 cable and associated terminations at distribution panel~~	~~$.....~~	~~$.....~~
~~One RJ 45 communications outlet, 50 m Category 6A cable and associated terminations at communications enclosure complete with patch and fly leads~~	~~$.....~~	~~$.....~~
~~As above, but triple outlet~~	~~$.....~~	~~$.....~~
~~12 fibre optical fibre cable termination~~	~~$.....~~	~~$.....~~
~~Highband module installed and terminated~~	~~$.....~~	~~$.....~~
~~Fire Detection/EWIS~~		
~~Photo-optical smoke detector and 10 metres cabling~~	~~$.....~~	~~$.....~~
~~Ionisation smoke detector and 10 metre cabling~~	~~$.....~~	~~$.....~~
~~Thermal detector and 10 m cabling~~	~~$.....~~	~~$.....~~
~~Audible/visual alarm and 20m cabling~~	~~$.....~~	~~$.....~~
~~EWIS speaker and 20 m cabling (recessed)~~	~~$.....~~	~~$.....~~
~~Manual call point and 20 m cabling~~	~~$.....~~	~~$.....~~
~~WIP (installed)~~	~~$.....~~	~~$.....~~
~~Security/Access Control~~		
~~Key tag~~	~~$.....~~	~~$.....~~
~~Key tag detector~~	~~$.....~~	~~$.....~~

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Tenderer ..... **Date** .....

~~SCHEDULE OF UNIT RATES cont'd~~

~~PIR detector~~	~~$.....~~	~~$.....~~
~~Electro-magnetic lock~~	~~$.....~~	~~$.....~~
~~Electric Strike~~	~~$.....~~	~~$.....~~
~~Reed switch~~		
~~Release switch~~	~~$.....~~	~~$.....~~
~~Access controlled single door (excluding additional RPU) within 50m of SCU~~	~~$.....~~	~~$.....~~
~~CCTV Camera - Internal~~	~~$.....~~	~~$.....~~
~~CCTV Camera – External~~	~~$.....~~	~~$.....~~
~~CCTV Camera - PTZ~~	~~$.....~~	~~$.....~~

APPENDIX E – SCHEDULE OF TECHNICAL DETAILS - ELECTRICAL SERVICES

DETAIL – LUMINAIRES

Complete this schedule of material items proposed and include with tender documents. These items must comply with the specification unless the tenderer nominates and includes details of the nonconformity.

Luminaire Designation	Manufacturer	Cat. No.	Lamp Type & Manufacturer	Delivery from Approval

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Tenderer ..... **Date** .....

EQUIPMENT CONFORMITY

Itemise below all points where tendered items differ from the specification.

EQUIPMENT ACCOMMODATION

Itemise below any equipment offered that cannot be accommodated in the spaces shown on the drawings.

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Tenderer ..... **Date** .....

DETAIL - POWER & ACCESSORIES

Complete this schedule of material items proposed and include with Tender. All items shall comply with the specification unless the Tender nominates and includes details of the nonconformity.

~~1~~	Cables		
		Manufacturer	.....
		Cat. No.	.....
~~2~~	Conduits		
		Manufacturer	.....
		Cat. No.	.....
~~3~~	SSOs		
		Manufacturer	.....
		Cat. No.	.....
4	Lighting Reset Switches		
		Manufacturer	.....
		Cat. No.	.....
~~5A~~	Light Switches (snap action)		
		Manufacturer	.....
		Cat. No.	.....
~~5B~~	~~Light Switches (momentary)~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~6~~	Isolators		
		Manufacturer	.....
		Cat. No.	.....
~~7~~	~~Skirting Duct~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~8~~	Cable Trays/Ladders		
		Manufacturer	.....
		Cat. No.	.....
~~9~~	~~Hand Driers~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~10~~	~~Dimmer Switches~~		
		~~Manufacturer~~	~~.....~~

Tenderer ..... **Date** .....

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		~~Cat. No.~~	~~.....~~
~~11~~	~~Floor Ducts~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~12~~	~~Floor Boxes~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~13~~	~~Hearing Loop Cable~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~14~~	~~Hearing Loop Amplifiers~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~15~~	~~Manual Changeover Switches~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~16~~	PE Cell		
		Manufacturer	.....
		Cat. No.	.....
~~17~~	Internal Movement Sensors		
		Manufacturer	.....
		Cat. No.	.....
~~18~~	External Movement Sensors		
		Manufacturer	.....
		Cat. No.	.....
~~19~~	~~Daylight Sensors~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~

Tenderer ..... **Date** .....

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EQUIPMENT CONFORMITY

Itemise below all points where tendered items differ from the specification.

Tenderer ..... **Date** .....

DETAIL - SCA

Complete this section of material items proposed and include with the tender. These items must comply with the specification unless the Tender nominates and includes details of the nonconformity.

1 MAIN SWITCH BOARD

	Manufacturer	. . . . .
	Fault & Current rating	. . . . .
	Segregation	. . . . .
Main Switch		
	Manufacturer	. . . . .
	Type	. . . . .
Moulded Case Circuit Breakers		
	Manufacturer	. . . . .
	Type	. . . . .
Contactors		
	Manufacturer	. . . . .
	Type	. . . . .
~~Multi-Function Meters~~		
	~~Manufacturer~~	~~. . . . . .~~
	~~Type~~	~~. . . . . .~~
~~kWH Meters~~		
	~~Manufacturer~~	~~. . . . . .~~
	~~Type~~	~~. . . . . .~~
~~Selector Switches~~		
	~~Manufacturer~~	~~. . . . . .~~
	~~Type~~	~~. . . . . .~~

Tenderer ..... **Date** .....

~~Change-over Switch~~

~~Manufacturer~~ .....

~~Type~~ .....

Dimensions

W x H x D .....

Mass (kg) .....

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Tenderer ..... **Date** .....

2 DISTRIBUTION BOARD(S)

	Manufacturer	. . . . .
	Fault rating	. . . . .
Miniature Circuit Breakers		
	Manufacturer	. . . . .
	Type	. . . . .
Residual Current Devices		
	Manufacturer	. . . . .
	Type	. . . . .
~~Shunt Trip Circuit Breakers~~		
	~~Manufacturer~~	~~. . . . . .~~
	~~Type~~	~~. . . . . .~~
Time Clocks		
	Manufacturer	. . . . .
	Type	. . . . .
On/Auto/Off Switches		
	Manufacturer	. . . . .
	Type	. . . . .

Tenderer ..... **Date** .....

Contactors		
	Manufacturer	. . . . .
	Type	. . . . .
Dimensions		
~~DB.G1~~MPB	W x H x D	. . . . .
~~DB.G2~~	~~W x H x D~~	~~. . . . . .~~
~~DB.G3~~	~~W x H x D~~	~~. . . . . .~~
~~DB.G4~~	~~W x H x D~~	~~. . . . . .~~
~~DB.G5~~	~~W x H x D~~	~~. . . . . .~~
~~DB.F1~~	~~W x H x D~~	~~. . . . . .~~
~~DB.F2~~	~~W x H x D~~	~~. . . . . .~~
~~DB.F3~~	~~W x H x D~~	~~. . . . . .~~
~~DB.F4~~	~~W x H x D~~	~~. . . . . .~~
Authority Meter Panel Enclosure	W x H x D	. . . . .
~~Generator Input Enclosure~~	~~W x H x D~~	~~. . . . . .~~

EQUIPMENT CONFORMITY

Itemise below all points where tendered items differ from the specification.

Tenderer ..... **Date** .....

EQUIPMENT ACCOMMODATION

Itemise below any equipment offered that cannot be accommodated in the spaces shown on the drawings.

DETAIL - COMMUNICATIONS CABLING

Complete this schedule of material items proposed. These items must comply with the specification unless the Tender nominates and includes details of the nonconformity.

~~1~~ CABLE

Manufacturer .....

Cat. No. .....

~~2A~~ ~~FIBRE (internal)~~

~~Manufacturer~~ .....

~~Cat. No.~~ .....

~~2B~~ ~~FIBRE (external)~~

~~Manufacturer~~ .....

~~Cat. No.~~ .....

~~3A~~ ~~RACKS (enclosed)~~

~~Manufacturer~~ .....

~~Cat. No.~~ .....

~~3B~~ ~~RACKS (open)~~

~~Manufacturer~~ .....

~~Cat. No.~~ .....

~~4~~ PATCH PANELS

Manufacturer .....

Cat. No. .....

Tenderer ..... **Date** .....

~~5~~	OUTLETS		
		Manufacturer	.....
		Cat. No.	.....
~~6~~	PATCH LEADS		
		Manufacturer	.....
		Cat. No.	.....
~~7~~	~~Horizontal Cabling Terminations~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~8~~	~~Vertical Back-mount Channels~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~9~~	~~MDF~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~10~~	~~Jumper Cable~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~

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EQUIPMENT CONFORMITY

Itemise below all points where tendered items differ from the specification.

EQUIPMENT ACCOMMODATION

Itemise below any equipment offered that cannot be accommodated in the spaces shown on the drawings.

Tenderer ..... **Date** .....

DETAILS OF PROPOSED MANUFACTURER'S WARRANTY

(Attach separate sheets as required)

Tenderer ..... **Date** .....

~~DETAIL – CLIPSAL STARSERVE~~

~~Complete this schedule of material items proposed. These items must comply with the specification unless the Tender nominates and includes details of the nonconformity.~~

~~1~~	~~ENCLOSURE~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~2~~	~~COMMUNICATIONS CABLE (Horizontal)~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~3~~	~~MATV CABLE (Horizontal)~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~4~~	~~MATV CABLE (Vertical)~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~5~~	~~VIDEO DISTRIBUTION UNIT (VDU)~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~6~~	~~PATCH LEADS~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~7~~	~~Horizontal Cabling Terminations~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~8~~	~~Jumper Cable~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~

~~EQUIPMENT CONFORMITY~~

~~Itemise below all points where tendered items differ from the specification.~~

Tenderer ..... **Date** .....

EQUIPMENT ACCOMMODATION

Itemise below any equipment offered that cannot be accommodated in the spaces shown on the drawings.

DETAILS OF PROPOSED MANUFACTURER'S WARRANTY

(Attach separate sheets as required)

DETAIL - FIRE DETECTION/EWIS

1	FIRE INDICATOR PANEL		
		Manufacturer	.....
		Cat. No.	.....
2A	SMOKE DETECTORS (Photo-optical)		
		Manufacturer	.....
		Cat. No.	.....
2B	SMOKE DETECTORS (Ionisation)		
		Manufacturer	.....
		Cat. No.	.....
3	THERMAL DETECTORS		
		Manufacturer	.....
		Cat. No.	.....
4	FIBs		
		Manufacturer	.....
		Cat. No.	.....
5	CABLE		
		Manufacturer	.....
		Cat. No.	.....
6	MECP		
		Manufacturer	.....

Tenderer ..... **Date** .....

		~~Cat. No.~~	~~.....~~
		~~Line Voltage~~	~~.....~~
		~~Power Capacity~~	
		~~Spare %~~	~~.....~~
~~7~~	~~WIPs~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~8~~	~~MCPs~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~9~~	~~SPEAKERS~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
		~~Diameter~~	~~.....~~
~~10~~	~~SPEAKERS (horn)~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~11~~	~~VESDA SYSTEMS~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~

DETAIL - ACCESS CONTROL ~~AND SECURITY~~ SYSTEM

~~1~~	~~CMS~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~2A~~	~~SCREEN~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~2B~~	~~PRINTER~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~3~~	KEY-TAG READER		
		Manufacturer	.....

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Tenderer ..... **Date** .....

		Cat. No.	.....
		Read Distance	.....
4	PROXIMITY KEY-TAGS		
		Manufacturer	.....
		Cat. No.	.....
5	REED SWITCHES		
		Manufacturer	.....
		Cat. No.	.....
6	EMERGENCY BREAK GLASS		
		Manufacturer	.....
		Cat. No.	.....
		Line Voltage	.....
		Power Capacity	
		Spare %	.....

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Tenderer ..... **Date** .....

~~7~~ ELECTROMAGNETIC LOCKS

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Manufacturer .....

Cat. No. .....

Type .....

~~8~~ ~~PIR DETECTORS~~

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~~Manufacturer~~ .....

~~Cat. No.~~ .....

~~9~~ SECURITY PANEL

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Manufacturer .....

Cat. No. .....

Diameter .....

~~10~~ LIFT CONTROLLER

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Manufacturer .....

Cat. No. .....

~~11~~ ~~AUDIBLE ALARMS~~

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~~Manufacturer~~ .....

~~Cat. No.~~ .....

~~12~~ ~~AUDIBLE/VISUAL ALARMS~~

~~Manufacturer~~ .....

~~Cat. No.~~ .....

13 SOFTWARE

Manufacturer .....

Cat. No. .....

Tenderer ..... **Date** .....

DETAIL - INTERCOM SYSTEM

~~1~~	BUILDING ENTRANCE STATION		
		Manufacturer	.....
		Cat. No.	.....
~~2~~	MONITORING STATIONS		
		Manufacturer	.....
		Cat. No.	.....
~~3~~	AUDIO BUS EQUIPMENT		
		Manufacturer	.....
		Cat. No.	.....
~~4~~	~~VIDEO BUS EQUIPMENT~~		
		~~Manufacturer~~	~~.....~~
		~~Cat. No.~~	~~.....~~
~~5~~	DOOR BELLS		
		Manufacturer	.....
		Cat. No.	.....
~~6~~	LIFT CONTROLLER		
		Manufacturer	.....
		Cat. No.	.....
~~7~~	CABLE		
		Manufacturer	.....
		Cat. No.	.....

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Tenderer ..... **Date** .....

~~DETAIL – AUDIO VISUAL SYSTEM~~

~~1 INTERNAL SPEAKERS~~

~~Manufacturer .....~~

~~Cat. No. .....~~

~~2 OUTDOOR SPEAKERS~~

~~Manufacturer .....~~

~~Cat. No. .....~~

~~3 VOLUME CONTROL~~

~~Manufacturer .....~~

~~Cat. No. .....~~

~~4 PROJECTOR~~

~~Manufacturer .....~~

~~Cat. No. .....~~

~~5 MOTORISED SCREEN~~

~~Manufacturer .....~~

~~Cat. No. .....~~

~~DETAIL – PA/BGM SYSTEM~~

~~1 MEDIA MATRIX~~

~~Manufacturer .....~~

~~Cat. No. .....~~

~~Read Distance .....~~

~~2 INTERNAL SPEAKERS~~

~~Manufacturer .....~~

~~Cat. No. .....~~

~~3 WEATHERPROOF SPEAKERS~~

~~Manufacturer .....~~

~~Cat. No. .....~~

~~4 AMPLIFIER~~

~~Manufacturer .....~~

~~Cat. No. .....~~

~~5 MEDIA SWITCHER~~

Tenderer ..... **Date** .....

~~Manufacturer~~ .....

~~Cat. No.~~ .....

Tenderer ..... **Date** .....

APPENDIX F – ALTERNATIVE LUMINAIRE COMPARISON CHECKLIST

Luminaire reference:

All alternative luminaires to provide evidence of compliance with AS3820

Item	**Original Specified**	**Proposed Alternative**
Manufacturer / Model No.		
Lamp Type & Wattage		
Total Circuit Power		
Lumen Output		
Colour Render Index (Ra)		
Colour Temperature		
Mounting Type (Surface, Recessed etc.)		
Dimensions $L \times W \times D$ or Ø Dia		
Dimmable Y ☐/ N ☐. If Yes, state type		
Finish Type & Colour – Bezel, trim etc.		
Diffuser type		
Ballast / Driver Type & Life		
Lamp Life & Output e.g. L70		
IP Rating		
Lead Time (state no. of weeks)		
Warranty of Luminaire (state no. of years)		
Cost		

Tenderer ..... **Date** .....

Disclaimer:
By submitting this document the undersigned person and associated company is stating the alternative luminaire information is true and accurate. Furthermore, if this proposed alternative is approved, the undersigned takes design responsibility of the lighting installation and confirms the lighting levels and design intent is in accordance with applicable standards.

SIGNED:

COMPANY: DATE:

This form must accompany any proposed alternative luminaire samples / data sheets. Alternative fittings will not be considered without this form being filled in to the satisfaction of the consulting engineer. Should this form not be completed, the contractor must proceed with the purchase and installation of the originally specified fittings.

Tenderer ..... **Date** .....

~~APPENDIX G – ELECTRICAL SWITCHBOARDS CONTRACTOR CHECKLIST~~

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Tenderer ..... **Date** .....