

**HYDE PARK PLACE**

**248 UNLEY ROAD, HYDE PARK**

Project No: LCE14462

## **Electrical Services Specification**

**Tender Issue**

**Revision T1**

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## 1 GENERAL

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### 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
- Architectural Drawings and Specification
- Mechanical Services Specification for termination points
- Fire Services Specification for termination points
- Hydraulic Services Specification for termination points
- Structural Drawings for details of footings, piers, beams, columns or the like
- 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.

### 1.2 PROJECT DETAILS

The works described within this specification pertain to the Electrical Services installation at 248 Unley Road, Hyde Park.

### 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	-	SA Power Networks Luke Georgeff
Embedded Energy Provider	-	TBA
Telecommunications Supply Authority and Project Officer	-	OptiComm Paul Carney
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.

## 1.4        **DRAWINGS**

### **Tender Drawings**

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

Drawing No.	Drawing Title
LCE14462-E000	COVER SHEET AND DRAWING INDEX
LCE14462-E001	GENERAL NOTES AND LEGEND OF SYMBOLS
LCE14462-E100	SITE PLAN
LCE14462-E101	TOWNHOUSE SERVICES ARRANGEMENT
LCE14462-E200	BASEMENT POWER, COMMUNICATIONS AND SECURITY ARRANGEMENT
LCE14462-E201	GROUND FLOOR POWER, COMMUNICATIONS AND SECURITY ARRANGEMENT
LCE14462-E202	1ST FLOOR POWER, COMMUNICATIONS AND SECURITY ARRANGEMENT
LCE14462-E203	2ND FLOOR POWER, COMMUNICATIONS AND SECURITY ARRANGEMENT
LCE14462-E204	3RD FLOOR POWER, COMMUNICATIONS AND SECURITY ARRANGEMENT
LCE14462-E205	4TH FLOOR POWER, COMMUNICATIONS AND SECURITY ARRANGEMENT
LCE14462-E206	5TH FLOOR POWER, COMMUNICATIONS AND SECURITY ARRANGEMENT
LCE14462-E207	6TH FLOOR POWER, COMMUNICATIONS AND SECURITY ARRANGEMENT
LCE14462-E208	BASEMENT LUMINAIRE ARRANGEMENT
LCE14462-E209	GROUND FLOOR LUMINAIRE ARRANGEMENT
LCE14462-E210	1ST FLOOR LUMINAIRE ARRANGEMENT
LCE14462-E211	2ND FLOOR LUMINAIRE ARRANGEMENT
LCE14462-E212	3RD FLOOR LUMINAIRE ARRANGEMENT
LCE14462-E213	4TH FLOOR LUMINAIRE ARRANGEMENT
LCE14462-E214	5TH FLOOR LUMINAIRE ARRANGEMENT
LCE14462-E215	6TH FLOOR LUMINAIRE ARRANGEMENT
LCE14462-E216	ROOF ARRANGEMENT
LCE14462-E300	SCHEMATICS AND DETAILS
LCE14462-E301	COMMUNICATIONS SCHEMATIC
LCE14462-E302	SINGLE LINE DIAGRAM

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.

## **1.5 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:

- Co-ordination with Electricity Supply Authority for the provision of a new internal substation transformer installation, including site preparation for the cable vault as required.
- Co-ordination with Electricity Supply Authority via the embedded electricity retailer for the provision of a new import-export revenue meter within the site main switchboard.
- Payment of Electricity Supply Authority standard fees and charges.
- Provision of new underground consumers mains, and site main switchboard including all switchgear, control gear and auxiliary panels.
- Multiple submains and distribution boards throughout the installation, within apartment complex and townhouses, including cable trays, cable ladders, supports, conduits, switchgear and control gear, auxiliary panels and enclosures and all ancillary equipment to complete the installation.
- 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.
- General power installation throughout including access provisions, supports, cabling and outlets.
- Electrical installation within apartments and townhouses according to architectural set-out.
- RCD protection of all socket outlet circuits, lighting circuits and other circuits and equipment per AS3000 requirements.
- Power supplies to Mechanical, Fire, Hydraulic and specialised services including provision of supplies, outlets or isolators as nominated.
- Fire rated power supplies to Lift Services Switchboard and lift equipment.
- Fire rated power supply to Diesel Pump Room.
- Provision of general and specialised lighting throughout the complex including luminaires, lamps and specialist controls to suit BCA power density and energy efficiency requirements.
- Exit and emergency lighting throughout the installation complying with the requirements of AS 2293.
- Access conduits for communications systems including those for Opticom and internal voice and data copper, and optical fibre cables, inclusive of pits and draw wires.
- Telecommunications facility cabling including support systems, accessories and terminations.
- Communication cabinet/rack power supplies including outlets.
- Telecommunications racking system including furniture, cable retaining and management equipment, patch panels, outlets, and patch leads.

- Provision of reticulated MATV system to all Apartments and Townhouses for digital FTA and Foxtel IQ reticulated from Opticom Optical Network Terminal within apartments.
- 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.
- Closed circuit television surveillance system including cabling to cameras, cabling, racking, recording device and auxiliary equipment.
- Provision of grid-connected photo-voltaic solar panel system including submains and final sub-circuit connections to micro-inverters and distribution network.
- 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.

## **1.6 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.

### **1.6.1 RELATED WORKS**

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.

- 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.
- 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.

#### 1.6.2 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.
- Circuit breakers for all air conditioning units (commercial tenancies and apartments) shall be provided within local distribution boards for the areas served by the electrical contractor under this contract.
- Flex and plug and final connection from controlled SSOs for toilet exhaust equipment shall be provided by the Mechanical Services Contractor.
- Fans within apartments to be operated by separate switch on local light switch plate. Provide multi-gang plates as required. Co-ordinate exact requirements with mechanical trade prior to first fix.
- 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:**

- 415 volt 3 phase power supply and connection to Drinkable Cold Water Pressure Pump set controller located on Basement Level to be provided by Electrical Contractor under this contract.

- 240V single phase power supply to Central Gas Fired Domestic Hot Water Plant and connection to pre-wired assembly to be provided by Electrical Contractor under this contract.
- Power supply and connection to Drinkable Hot Water Return Pump set controller located within Ground Floor Plantroom to be provided by Electrical Contractor under this contract.
- 415 volt 3 phase power supply and connection to Basement Sewer Ejector Pit controller located in lower basement to be provided by Electrical Contractor under this contract.
- 240 volt GPO located adjacent to each dishwasher within cupboard space adjacent dishwasher recess, within each apartment to be provided by Electrical Contractor under this contract.
- 240 volt GPO located under gas hot plate within each apartment to be provided by 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.
- 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.
- 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.

**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.
- Installation of Access Control equipment as defined in the Access Control clause of this specification.

**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.

**Pool Sub-contractor:**

- Wiring of submains cabling to Pool Distribution Board location shall be provided by the Electrical Services contractor for final termination by the Pool Services contractor.

**Coordinate with Pool Trade for final earthing requirements to pool structure and equipment. Embedded Network Provider- TBA:**

- The Electrical Contractor shall provide all provisions within switchboards and meter panel boards for installation of embedded metering network meters by the network provider. Liaise with the Embedded Network Provider to coordinate the timing and installation of the meters.

### 1.6.3 TERMINATION POINTS/ASSOCIATED WORKS - AUTHORITIES

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

**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 internal transformer.
- The Electrical Contractor shall co-ordinate with Electricity Supply Authority for the provision of a new supply to site.

**Opticomm:**

- The Electrical Contractor shall provide all access provisions in the form of conduits and cable supports for all Opticomm cabling in accordance with Opticomm requirements.
- The Electrical Contractor shall co-ordinate with Opticomm for the provision of a fibre optic lead-in and associated active equipment to site.
- The electrical sub-contractor shall co-ordinate with Opticomm and clients nominated Internet Service Provider (ISP) to make all necessary applications for Security, FIP and other nominated services in a timely manner, including payment of all associated fees.

### 1.7 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 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 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 3000	2018	Electrical Installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008	2017	Electrical Installations – Selection of Cables
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 3786	2014	Smoke alarms using scattered light, transmitted light or ionization
AS/NZS 3820	2009	Essential safety requirements for electrical equipment

AS 4282	1997	Control of the obtrusive effects of outdoor lighting
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 60947 Set	2015	Low-voltage switchgear and control gear
AS/NZS 61000 Set	2000	Electromagnetic Compatibility (EMC) set
AS/NZS 61439 Set	2016	Low-voltage switchgear and control gear 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
- Opticomm Technical Guidelines
- Federal, State and Local Government Building Acts and Regulations
- State Fire Services Conditions of Connection

- Foxtel Standards
- SA 76 – Ministers Specification – testing and maintenance of essential safety provisions

## 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
		Technical Datasheets	10 Working Days
		Workshop Drawings	5 Working Days
		Calculations	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
		Prototype copies of Operation and Maintenance Manuals (including As-constructed Drawings)	5 Working Days
2.5	Post Construction	Operation Maintenance	10 Working Days

### 2.2 TENDER SUBMISSIONS

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
- 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).

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

## **2.3 PRE-CONSTRUCTION SUBMISSIONS**

### **2.3.1 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:

- Cable Trays and Ladder
- Cable Pits
- Communications Cables
- Communications outlets
- Communications racking equipment and patch panels (brochures acceptable)
- Smoke and thermal detectors.
- Access Control Card Readers and Cards
- Access Control Keypads
- Reed Switches
- Electro-magnetic locks
- Electric Strikes / Electrical Mortise Locks
- Push Button Release switches
- Break Glass Release Switches
- CCTV Cameras
- CCTV Recording Equipment

- Security alarms
- Apartment and Tenancy Load Centres
- Intercoms (1 of each station type).

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

### 2.3.2 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.

#### 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
- 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.
- Details of all trenching including routes, depths, backfill, reinstatement and distances from other services.
- 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
- Cable supports and pathways for Opticomm cabling as described in the Opticomm technical guidelines.
- Access control system and electronic security 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.
- Equipment layouts within the Communications Room.
- Provide workshop drawings for standby diesel generator including acoustic enclosure,
- Termination points with all other trades.
- Details of all proposed labelling and engraving.
- Earthing layouts and bonding connection locations and details.

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
- Opticomm cable pathways and supports.
- Location depths of all underground conduits and pits dimensioned from permanent landmarks

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).

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

### **2.3.3 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.

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

### **2.3.4 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.

## **2.4 CONSTRUCTION SUBMISSIONS**

### **2.4.1 CONSULTANT INSPECTIONS**

#### **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.

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 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.

### **2.4.2 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.

### **2.4.3 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.

#### 2.4.4 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 warranties of Equipment Suppliers.

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.

#### **2.4.5 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.

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.

## **2.5 POST-CONSTRUCTION SUBMISSIONS**

### **2.5.1 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.
- 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**

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#### **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

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 supply 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 cover plates 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 were required to maintain this segregation.

### 3.8 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.

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 over flashings 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 "Rooflite" 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 encounter the barriers/walls.

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

## **3.9 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.

### **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.

### 3.10 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 etched 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.

### 3.11 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

### **3.12 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.

### **3.13 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.

### **3.14 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.

### **3.15 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.

### 3.16 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.

### 3.17 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.

### **3.18 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	3
Annual Probability of Exceedance	yr	1:5000
Soil Classification		De
Hazard Factor	Z	0.1
Probability Factor	Kp	1.3
Structural Classification	EDC	II

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.

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
		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

Category	Selection	Installation	Necessary Seismic Bracing 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

### 3.19 EARTHING SYSTEMS

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

- Type: MEN system (New)
- 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 mm<sup>2</sup> 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 4mm<sup>2</sup> 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 sub circuits: Provide a separate earth wire to each final sub circuit. 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.

### **3.20 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**

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### **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 the appliance has passed or failed, date of test, and schedule for next test.

## **4.2 COMMISSIONING**

Notice: Give enough 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.

MATV:

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

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.

Intercom:

- Test the operation of each station as specified under the Intercom 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

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### 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' Series (or equal approved) high impact polycarbonate.

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.

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 switch plates 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 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

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 minimums, 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 "Weather shield 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" series (or equal approved) high impact polycarbonate.

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 "Weather shield 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.

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.

### **5.4 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).

## **5.5 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.

## **5.6 DAYLIGHT SENSORS**

Provide daylight (photocell) sensors equal to "Sensor 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.

## **5.7 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.

## **5.8 MOVEMENT SENSORS**

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

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.

## **5.9 SMOKE ALARMS**

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 battery)

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.

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

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## **6 CABLES & ENCLOSURE**

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### **6.1 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: 2.5mm<sup>2</sup> for power and 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.

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.

### **6.2 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 35mm<sup>2</sup>, 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.

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.

### **6.3 DOUBLE INSULATED WIRING**

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

### **6.4 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.

## **6.5 CHASING**

Chasing is not permitted as part of these works.

## **6.6 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 gasketed covers and seal them against entry of moisture.

## **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.

## **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.

## **6.9 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.

## **6.10 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.

## 6.11 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 50mm<sup>2</sup> 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.

## **6.12 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.

### **6.13 FIRE RATED CABLING AND SUPPORTS**

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.

## 7 SWITCHGEAR & CONTROLGEAR ASSEMBLIES (SCA)

### 7.1 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.

### 7.2 DESIGN CRITERIA

Design SCA to comply with the following minimum criteria:

#### Main Switch Board No(s)

Designation(s)	–	MSB / DB.C
Maximum Dimensions	–	3200 mm Wide x 550 mm Deep x 2100 mm High
Rating	–	1000 Amps, 3 phase, 415 Volts
Degree of Protection	–	IP54 Non-combustible material in accordance with BCA requirements
Installation	–	Indoor, floor-mounted, backed against wall as indicated on contract drawings. Provide flushing frame, colour to match switchboard as required.
Fault Rating	–	30 kA for 1 second
Form Factor	–	3bih or with metal barriers
Chassis Size	–	As shown
Connection	–	Front or Rear connected
Incoming Cable Entry	–	Above via gland plate
Incoming Cable Reticulation	–	Mounted on cable tray.
Outgoing Cable Exit	–	Above via gland plates
Outgoing Cable Reticulation	–	Mounted on cable tray.
Plinth	–	Painted galvanised 75mm steel channel
DIN Rail	–	Required to suit Lighting Control Hardware + 30% Spare
Accessories	–	Internal time clock  Gate meter provisions for inset metering network on incoming supply  Tenancy kWh meters as indicated.
Paint Colour	–	To approval of Architect
Rating/ Nameplates	–	To front door of Main Switchboard(s)
Doors	–	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.

#### **Distribution Board(s) – Common Area Distribution Board**

Designation(s)	–	DB.C
Maximum Dimensions	–	Section of MSB.
Rating	–	160 Amps, 3 phase, 415 Volts
Fault Rating	–	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 via gland plates and cable bushes
Cable Reticulation Above Switchboard	–	Mounted on vertical cable tray. Duct cover shall be powder coated to match switchboard.
DIN Rail	–	Required to suit Lighting Control Hardware + 30% Spare
Accessories	–	Internal time clock Exit/Emergency Lighting push-button test facility Power Monitoring Units as indicated.
Rating/ Nameplates	–	To front door of all distribution boards
Doors	–	Over all operational sections, ensure 600mm clearance around door swing in accordance with AS3000 requirements. Provide barn door arrangement as required.

#### **Meter Panel Board(s)**

Designation(s)	–	MPB.L1 – MPB.L5
Maximum Dimensions	–	900 mm Wide x 450 mm Deep x 2100 mm High or to suit available accommodation
Rating	–	125 Amps, 3 phase, 415 Volts
Degree of Protection	–	IP52 minimum. Non-combustible material in accordance with BCA requirements
Installation	–	Indoor, floor-mounted, backed against wall as indicated on the contract drawings, provide flushing frame, colour to match switchboard as required.
Fault Rating	–	16 kA for 1 second
Form Factor	–	Form 1
Chassis Size	–	As required to suit number of meters indicated.
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 from switchboard opening to 100mm above ceiling level.
Cable Reticulation Below Switchboard	–	Surface mounted on vertical cable tray, and enclosed in metallic top hat cover from switchboard opening to floor level.
Paint Colour	–	To approval of Architect
Rating/ Nameplates	–	To front door of all distribution boards
Doors	–	Over all operational sections, ensure 600mm clearance around door swing in accordance with AS3000 requirements. Provide barn door arrangement as required.

#### **Distribution Board(s)**

Designation(s)	–	DB.POOL
Maximum Dimensions	–	800 mm Wide x 400 mm Deep x 1500 mm High or to suit available accommodation
Rating	–	100 Amps, 3 phase, 415 Volts
Degree of Protection	–	IP56. Non-combustible material in accordance with BCA requirements
Installation	–	Indoor, Wall Mounted as indicated on the contract drawings, provide flushing frame, colour to match switchboard as required.
Fault Rating	–	10 kA for 1 second
Form Factor	–	Form 1
Chassis Size	–	48 way
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.
Paint Colour	–	To approval of Architect
Rating/ Nameplates	–	To front door of all distribution boards
Doors	–	Over all operational sections, ensure 600mm clearance around door swing in accordance with AS3000 requirements. Provide barn door arrangement as required.

#### **Distribution Board(s) – Solar PV Array**

**Note: Final Requirements of Solar PV Distribution Board DB.Solar to be determined by Electrical Contractor to suit new 30kW PV Solar Array requirements.**

Designation(s)	–	DB.Solar
Maximum Dimensions	–	600 mm Wide x 400 mm Deep x 1500 mm High or to suit available accommodation
Rating	–	100 Amps, 3 phase, 415 Volts
Degree of Protection	–	IP54. Non-combustible material in accordance with BCA requirements. Smoke seals.
Installation	–	Indoor, Wall Mounted as indicated on the contract drawings, provide flushing frame, colour to match switchboard as required.
Fault Rating	–	16 kA for 1 second
Form Factor	–	Form 1
Chassis Size	–	48 Way
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 from switchboard opening to 100mm above ceiling level.
Cable Reticulation Below Switchboard	–	Surface mounted on vertical cable tray.
Accessories	–	As required to suit PV Solar system.
Paint Colour	–	To approval of Architect
Rating/ Nameplates	–	To front door of all distribution boards
Doors	–	Over all operational sections, ensure 600mm clearance around door swing in accordance with AS3000 requirements. Provide barn door arrangement as required.

#### **Apartment Load Centre(s)**

##### **Note:**

##### **Typical for Levels 1-5. Level 6 Apartments to have 3-phase supply.**

Designation(s)	–	LC-AX.XX
Maximum Dimensions	–	402 mm Wide x 98 mm Deep x 252 mm High or to suit available accommodation
Make	–	Clipsal 'RMXE118F' ResiMAX series or equal approved.
Rating	–	To match upstream circuit breaker unit rating and/or isolator (whichever the greater)
Degree of Protection	–	IP40 / IK07
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	–	18 ways minimum. Confirm final sub-circuit and chassis requirements to suit architectural set-out.
Cable Entry / Exit	–	Above and below
Cable Reticulation	–	Cabling shall be reticulated within wall cavity with suitable mechanical protection.
Colour	–	White
Doors	–	Required

### 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.

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.

### **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.

## **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 16mm<sup>2</sup> 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.

## **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.

## **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.

### **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 key locking 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 refrigerate 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).

### **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.

### **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.

### **7.7.4 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 8/20 $\mu$ S
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

## 7.8 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). 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.

### **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:
    - 9.5
    -

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.

## **8 LUMINAIRES**

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### **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.

### **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.

### **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.

### **8.4 PERFORMANCE STANDARDS**

Thermal characteristics: To AS/NZS 60598.1

Glare control: To AS/NZS 1680

### **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.

### **8.6 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**

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.

### **8.7 WIRING**

Standard: To AS/NZS 60598.1

#### **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.

## **8.8 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,'

## **8.9 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 luminaires 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 defect's 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: INTERRUPTING 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.

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 Lithium Iron Phosphate (LiFePO4) type.

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.

#### **8.10 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, control gear 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.

## **9 STRUCTURED CABLING SYSTEMS (SCS)**

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### **9.1 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/Class E compliant Structured Cabling System (SCS) incorporating backbone and horizontal cabling and all cable terminations.
- Fitting out of Communications Cupboard and risers 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.

### **9.2 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**

- 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.

### **9.3 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 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

## **9.4 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 6/Class E 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 Product/Labour Warranty that will have a valid minimum warranty of 5 years and is to be a fully manufacturer certified system.

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.

## **9.5 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

## **9.6 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.

## **9.7 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.

## 9.8 TESTING

### Copper

All cables shall be tested and approved for Category 6/Class E 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 all cabling with compliance to Category 6/Class E 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.

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)

#### **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.

### **9.9 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/Class E, 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.

### **9.10 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/Class E 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.

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.

### **9.11 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.

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)

## **9.12 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 600mm wide by 600mm deep;
- 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 gasketed 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.

## **9.13 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/Class E 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/Class E 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.

#### 9.14 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

**Copper Patch Panels:**

- Minimum 24 outlets per panel (1 RU)
- Fitted with Category 6/Class E complaint RJ45 type shuttered sockets complying with AS/NZS 3080
- Capability of supporting a removable rear cable management tray.
- Approved labelling system utilising the engraved labelling adjacent each outlet, or utilising the panel's proprietary labelling system.

**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.

#### **9.15 COPPER BACKBONE AND HORIZONTAL CABLING**

Provide Category 6A/Class EA 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.

##### **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.

## 9.16 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/Class E UTP.
- 2m of Category 6/Class E 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 enough 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, patch panels and the socket outlets. Provide one fly lead for each workstation as follows:

- Category 6/ Class E 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.

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## 10 SECURITY SYSTEM

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### 10.1 GENERAL

#### **Standard: AS/NZS 2201 Set**

#### **Scope**

Provide a security system comprising:

- Access control system including entry cards/keys as required
- Car park vehicle access 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.

#### **System Structure**

The system shall be a distributive system with electronic equipment connected via network communications links.

### 10.2 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 lead acid cells.

**10.3 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.

**10.4 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.
- Schematic diagrams for the security system.
- Schedule of interfaces with all equipment and devices separate to the security system e.g. Mechanical controller, FIP etc.
- Functional specification identifying the operation of the security system, including description of each zone, and programming.

**10.5 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.

## **10.6 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.

## **10.7 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

## **10.8 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.

## **10.9 WARRANTY**

The system shall be warranted for a minimum 5-year period, which includes parts and installation.

## **10.10 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.

To be installed within Communications Cupboard in Basement.

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.

#### **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.

#### **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.

## **10.11 ACCESS CONTROL**

### **Make and Model**

Access Control System shall be of "Inner Range Integrity" manufacture or equal approved.

### **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.

### **System Features:**

- Independent operation
- Routine reporting to system controller via networking link
- Battery backup for 8 hours
- Communications via telephone line (PSTN) and Ethernet (IP).
- 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 trail.
- Anti-pass back 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.

### **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 or via activation of the card reader.

### **Vehicle Exit**

Vehicle exit from the secure car park area shall be available to all vehicles via induction loop located at carpark exit.

### **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.

Access control system to be programmed to allow egress from internal fire stairs to:

- Levels 3-6: to tenants of those levels only.
- Levels 1-2: to all building tenants.
- Ground floor and any required fire exits: always accessible to all building occupants.

### **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.

### **Access Keys**

Type: Keyring fob with pushbuttons for auto door control

Quantity: Provide 150 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**

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 single-leaf access-controlled doors.

Installation: Supply electric door strike to 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.

#### **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.

#### **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.

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## **11 CCTV SURVEILLANCE SYSTEM**

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### **11.1 SCOPE**

**Standard: AS 4806 Set**

#### **Outline Description**

The system shall provide a digital Closed-Circuit Television System (CCTV) of type 'Hikvision' 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.
- Power over Ethernet (PoE) switches.
- 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 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.

### **11.2 CCTV CAMERAS**

Provide CCTV cameras as shown or scheduled.

### **Camera types**

#### **Internal Fixed Vandal Resistant:**

- Colour
- 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: Internal Ground Entries, Main Lobby, Pool Area.

Internal vandal resistant cameras to be in-ceiling or surface mounted of type Hikvision or equivalent.

#### **External Vandal Resistant:**

- Colour
- 3 Megapixel resolution
- IP66 rated
- 30 images per second
- Day/night mode capabilities
- Automatic back focus
- 2 simultaneous vidoestreams
- Integrated memory backup
- PoE

Locations: Ground and Basement Car Park

External vandal resistant cameras to be surface or pendant mounted of type Hikvision 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.

## **11.3 NETWORK VIDEO RECORDER (NVR)**

Provide network video recording unit with a minimum of 14 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.

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 Hikvision or equivalent.

### **Mounting**

Rack mounted

## **11.4 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

### **11.5 UNINTERRUPTABLE 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

### **11.6 EQUIPMENT CABINETS**

Equipment to be mounted in the Main Communication Cabinet (CC).

### **11.7 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.

### **11.8 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.

### **11.9 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.

### **11.10 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.

#### **11.11 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.

#### **11.12 MANUALS AND DRAWINGS**

##### **Requirements**

Provide equipment information and as-installed drawings for the system for inclusion in the operating and maintenance manuals.

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## **12 MATV SYSTEM**

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### **12.1 SCOPE**

Outline Description: Provide MATV cabling and outlets to distribute FTA Television and Foxtel signalling within apartments utilising backbone signal provided from Opticomm Optical Network Termination within apartments. Provide outlets as shown on architectural drawings.

### **12.2 STANDARDS**

Standards: AS/NZS 1367, AS 1417, IEC 60966 Set.

### **12.3 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.

### **12.4 CABLES**

Type: Single core coaxial cable with a nominal impedance of 75 ohms.

Screen: Copper tape and wire braid.

Dielectric: Polythene 5 cell extrusion.

### **12.5 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.

## **12.6 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.

## **12.7 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.

## **12.8 FOXTEL**

Standards: Foxtel installation standards.

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.

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## **13 INTERCOM SYSTEM**

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### **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.

The system shall be designed, constructed, supplied and installed by an installer certified by the manufacturer.

The system shall utilise the Opticomm optical fibre network within the building to transmit backbone trunk signalling between the server equipment and monitoring equipment.

The install system shall be of commercial manufacture and of '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).

#### **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.

### 13.2 ENTRANCE STATIONS

The entrance stations shall have the minimum features and provide:

- Audio/visual (colour) communications to all Apartments.
- Digital apartment call panel including digital name scrolling facility.
- Interface with main entry door(s) release facilities.
- Vandal resistant and IP rated for external conditions.
- Options for hearing impaired persons.

Entrance stations shall be "Urmet Domus Elekta" manufacture or equal approved.

### 13.3 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.
- Integrated help facility.
- Adjustable volume control.
- Integrated hearing aid setup.

Monitoring stations shall be "Urmet Domus Signo" manufacture or equal approved.

Monitoring stations shall be connected directly from apartment Opticomm Optical Network Termination device via Category 6 communications cabling.

### 13.4 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.

### 13.5 WIRING, POWER AND EQUIPMENT

#### Requirements

The intercom system shall be an IP based system utilising Category 5 UTP (minimum) cabling, and Opticomm optical fibre cabling for backbone cabling.

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.

Provide all wiring, equipment and accessories to complete the installation.

Provide all cable segregation requirements between power and communications bus cabling.

### **13.6 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.

## 14 PHOTOVOLTAIC GENERATION SYSTEMS

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### 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 PV System Installation including PV arrays and roof mounting system, weatherproof inverters, DC and AC wiring to connect to building distribution system.
- Walkway for maintenance access to all panels in array, minimum 600mm wide.
- 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.
- Total aggregate inverter system capacity of 30kW
- Micro-inverter system (one inverter for each PV panel). Micro inverters shall be connected in strings to chassis of DB-Solar located in Level 6 Electrical Riser cupboard. IP66 minimum.
- All DC cabling between panel and micro-inverter.
- All AC cabling between inverters and DB-Solar Chassis in electrical riser cupboard. Note that a maximum of 13 micro inverters shall be connected to a 20Amp AC circuit. Micro inverters to be compatible with 72 cell panels. For all roof mounted cabling, utilise quick connect cabling / sockets.
- High efficiency panel (<18%) to achieve total system capacity to be limited to 30kW aggregate via micro-inverters. Layout drawings based upon 104 panels each with an output of 330W measuring 1.6m x 1m. Minimum clearance from building edge of 1.5m including walkway. Final arrangement to be determined by Electrical Contractor and coordinated with all roof services and structure.
- All panels to be mounted to roof with appropriate framing. Coordinate structural framing and walkway requirements with structural engineer.
- PV system retailer to maintain STC rebate credits to ensure lowest cost to the client.
- Panel warranty – 25yrs to 80% output
- Inverter warranty – 10yrs minimum

### 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 61215 Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval
- IEC 61724 Photovoltaic 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
- TERMINATION POINTS

Co-ordinate Grid connection works with Electricity Supply Authority including the following:

- All Approvals
- Protection Requirements
- Commission schedule
- Witnessing testing

### 14.3 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 30.0 kWp	The number of panels multiplied by the generation capacity of each panel (kW)

Item	Design Criteria	Comments
Peak Output	30.0 kWp	The installed capacity multiplied by an efficiency factor based on orientation and panel efficiency in Adelaide
Available Roof Area	Refer Roof Drawing LCE14462-E216	Coordinate with Structural / Services / Other limitations – Liaise with structural engineer
Mounting Method	Roof 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	<50kg/m2	Based on a 3,000W IP65 Inverter
Panel Arrays	<25kg/m2	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	Compliance with Electricity Supply Authority Requirements	Final requirements to be defined in accordance with Electricity Supply

Item	Design Criteria	Comments
Fault Current Over/Under Current Over/Under Voltage Frequency		Authority Services & Installation Rules
Compliance with Electricity Supply Authority Customer Guide To Embedded Generation Network Connection (Small)	Required	Required for connection to the grid
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, flat-mounted on low-pitch roof	Provide any support structures required.
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

Item	Design Criteria	Comments
		Clean all panels every 3 months in accordance with manufacturer's recommendation
Testing and Commissioning	As per CEC Installation Guidelines	
Labelling	As per AS4777.1 and AS/NZS 5033	

#### 14.4 WARRANTY SCHEDULE

The installation of PV system must comply with all relevant Australian and International Standards including all relevant codes and legislative requirements. The manufacturer's 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	

## 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/Metering Boards	\$ .....
Earthing and Bonding	\$ .....
Consumers Mains and Submains	\$ .....
Cable Trays & Support Systems	\$ .....
Power Subcircuits	\$ .....
Lighting Subcircuits	\$ .....
Accessories & Outlets	\$ .....
Luminaires	\$ .....
Exit & Emergency Luminaires	\$ .....
Opticomm Cable Pathways	\$ .....
Structured Cabling System	\$ .....
CCTV System	\$ .....
Apartment MATV Cabling	\$ .....
Security & Access Control	\$ .....
Intercom System	\$ .....
Testing & Commissioning	\$ .....
Maintenance & Servicing	\$ .....
Legislative Fire Services Maintenance	\$ .....
For Approval/Workshop Drawings	\$ .....
As-Constructed Drawings	\$ .....
Operating and Maintenance Manual	\$ .....
User Training	\$ .....
Other (specify)	\$ .....
<b>SUBTOTAL</b>	<b>\$ .....</b>
GST	\$ .....
	<b>\$ .....</b>
<b>TOTAL</b>	<b>_____</b>

## APPENDIX B – SCHEDULE - SUBCONTRACTORS AND PERSONNEL

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Identify below Sub-Contractors included within the tender submission.

ITEM	SUB-CONTRACTOR
SCA	.....
Communications Cabling	.....
MATV	.....
Security & Access Control	.....
Intercom System	.....
Solar PV	.....
Other	.....

Personnel	Name	Years Experience	Years with Company
Project Manager	.....	.....	.....
Foreman	.....	.....	.....

### SCHEDULE - HOURLY RATES

Identify below the following hourly rates that are applicable for the duration of this contract:

<b>Occupation</b>	<b>Normal Time Rate \$/hr</b>	<b>Overtime Rate \$/hr</b>	<b>Double Time Rate \$/hr</b>
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:

<b>ITEM</b>	<b>Normal Time</b>	<b>After Hours</b>	<b>Total Hours</b>
Project Manager	.....	.....	.....
Supervisor	.....	.....	.....
Electrical Mechanic	.....	.....	.....
Apprentice	.....	.....	.....
Total Hours	.....	.....	.....

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## APPENDIX D – SCHEDULE OF UNIT RATES

Include labour and material, profit and overhead costs in each item.

ITEM	ADDITION	DELETION
<b>General Power</b>		
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.	\$.....	\$..... ..
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 16.0mm2 2c+E installed anywhere in the Building	\$.....	\$..... ..
Price per metre 50mm2 4c+E Cu/PVC/PVC installed to tray	\$.....	\$..... ..
Price per metre 240mm2 4c+E Cu/PVC/PVC installed to tray	\$.....	\$..... ..
300mm Cable Tray installed per metre	\$.....	\$..... ..
Copper price at time of tender	\$.....	\$..... ..
<b>Communications</b>		
Floor distribution rack, (24 RU) supply and installed (unfurnished)	\$.....	\$..... ..
24 port patch panel installed, populated and terminated	\$.....	\$..... ..
Patch lead (2m)	\$.....	\$..... ..
One RJ 45 communications outlet, 50 m Category 6 cable and associated terminations at communications enclosure complete with patch and fly leads	\$.....	\$..... ..
As above, but double outlet	\$.....	\$..... ..

<b>Fire Detection</b>		
Photo-optical smoke detector/alarm and 10 metres cabling	\$.....	\$..... ..
Ionisation smoke detector/alarm and 10 metre cabling	\$.....	\$..... ..
Thermal detector/alarm and 10 m cabling	\$.....	\$..... ..
<b>Security/Access Control</b>		
Key tag	\$.....	\$..... ..
Key tag detector	\$.....	\$..... ..
Electro-magnetic lock	\$.....	\$..... ..
Electric Strike	\$.....	\$..... ..
Access controlled single door (excluding additional RPU) within 50m of SCU	\$.....	\$..... ..
CCTV Camera	\$.....	\$..... ..

## 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

### **EQUIPMENT CONFORMITY**

Itemise below all points where tendered items differ from the specification.

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### **EQUIPMENT ACCOMMODATION**

Itemise below any equipment offered that cannot be accommodated in the spaces shown on the drawings.

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## 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.

Cables

Manufacturer .....

Cat. No. ....

SSOs

Manufacturer .....

Cat. No. ....

Light Switches

Manufacturer .....

Cat. No. ....

Isolators

Manufacturer .....

Cat. No. ....

Internal Movement Sensors

Manufacturer .....

Cat. No. ....

## EQUIPMENT CONFORMITY

Itemise below all points where tendered items differ from the specification.

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## 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	.....
Moulded Case Circuit Breakers		
	Manufacturer	.....
	Type	.....
Multi-Function Meters		
	Manufacturer	.....
	Type	.....
kWH Meters		
	Manufacturer	.....
	Type	.....
Dimensions		
	W x H x D	.....
	Mass (kg)	.....

### 2 DISTRIBUTION BOARD(S)

	Manufacturer	.....
	Fault rating	.....
Miniature Circuit Breakers		
	Manufacturer	.....
	Type	.....
Residual Current Devices		
	Manufacturer	.....
	Type	.....
Dimensions		
MPB.L1	W x H x D	.....
MPB.L2	W x H x D	.....
MPB.L3	W x H x D	.....
MPB.L4	W x H x D	.....
MPB.L5	W x H x D	.....
Apartment Load Centres	Manufacturer	.....
	Type	.....

Penthouse Load Centres	Manufacturer	.....
	Type	.....
DB.Pool	W x H x D	.....
DB.Solar	W x H x D	.....

#### **EQUIPMENT CONFORMITY**

Itemise below all points where tendered items differ from the specification.

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#### **EQUIPMENT ACCOMMODATION**

Itemise below any equipment offered that cannot be accommodated in the spaces shown on the drawings.

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## 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.

### CABLE

Manufacturer .....

Cat. No. ....

### RACKS

Manufacturer .....

Cat. No. ....

### PATCH PANELS

Manufacturer .....

Cat. No. ....

### OUTLETS

Manufacturer .....

Cat. No. ....

### PATCH LEADS

Manufacturer .....

Cat. No. ....

## EQUIPMENT CONFORMITY

Itemise below all points where tendered items differ from the specification.

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## EQUIPMENT ACCOMMODATION

Itemise below any equipment offered that cannot be accommodated in the spaces shown on the drawings.

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## DETAILS OF PROPOSED MANUFACTURER'S WARRANTY

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(Attach separate sheets as required)

**DETAIL - ACCESS CONTROL AND SECURITY SYSTEM**

PROXIMITY READER

Manufacturer	.....
Cat. No.	.....
Read Distance	.....

PROXIMITY KEY-TAGS

Manufacturer	.....
Cat. No.	.....

ELECTROMAGNETIC LOCKS

Manufacturer	.....
Cat. No.	.....
Type	.....

AUTODOOR CONTROLLER

Manufacturer	.....
Cat. No.	.....

SECURITY PANEL

Manufacturer	.....
Cat. No.	.....
Diameter	.....

ROLLER DOOR CONTROLLER

Manufacturer	.....
Cat. No.	.....

**DETAIL - INTERCOM SYSTEM**

BUILDING ENTRANCE STATION

Manufacturer .....

Cat. No. ....

MONITORING STATIONS

Manufacturer .....

Cat. No. ....

LIFT CONTROLLER

Manufacturer .....

Cat. No. ....

CABLE

Manufacturer .....

Cat. No. ....

## 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 <i>L × W × D or Ø Dia</i>		
Dimmable Y <input type="checkbox"/> / N <input type="checkbox"/> . 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		

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.