

# Electrical Services Specification

## Assisi Centre Existing Aged Care Building & New Retirement Accommodation

230 Rosanna Road, Rosanna

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Construction Issue

Project No.: 4906

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*Note: Revision to the text of this specification are indicated with border mark on right.*

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## **1. SCOPE**

### **1.1 THE OBJECTIVES OF THIS SPECIFICATION**

This Specification has been prepared, together with the associated drawings, to achieve the following:

- To define the scope and intent of the services as well as the minimum standards required of the contractor in respect to each of the items of equipment and the systems to be installed;
- To provide a basis upon which competitive tendering can be assessed;
- To generally define the technical quality required of the installation;
- To define the Quality Assurance requirements for the Contractor;
- To quantify capacities and sizes of plant;
- To define general operation or function of the plant and systems.

This Specification has been prepared on the understanding that the specialist tenderer possesses the trade expertise necessary to complete the works.

The Contractor shall be deemed to have thoroughly reviewed all project documents and identified, at the time of submitting the tender, the following:

- Issues that require design input or clarification from the Consulting Engineer. These will include the clarification of any issues raised by the tenderer's suppliers or Sub-contractors in respect of the equipment proposed or the proposed method of operation of any of the proposed equipment;
- Clauses within the Specification or information on the drawings, which require interpretation;
- Omissions from either the Specification or the drawings;
- Inconsistencies or discrepancies in the scale or definition of drawings;
- Specification or drawing items, which may be in conflict. Seek direction from the Consulting Engineer as to the item to take precedence;
- Deviations or alternatives proposed by the Contractor. In identifying proposed deviations the Contractor shall factor into his financial analysis the fees that may be claimed by the Consulting Engineer for the analysis of the proposed alternative. The Contractor shall provide a comprehensive report on any alternative in support of the proposal.

### **1.2 EXPECTATIONS OF THE CONSULTING ENGINEER**

The Consulting Engineer will not be undertaking full-time on-site attendance and will not act in a supervisory role. Formal advice, on a monthly basis, from the Contractor that the installation is installed in accordance with all relevant regulations and the intent of the Specification, will therefore be required.

It can be expected that the Consulting Engineer will undertake the following services during the Construction Phase Activities:

- Review shop drawings;
- Review samples nominated within this Specification;
- Respond to Requests for Information (RFIs). It is expected that prior to making a request for information the Contractor has used their best endeavours to obtain the information;
- Undertake random reviews of the installation. These reviews will be based upon a walk-through of the project with the outcome being a listing of any noted non-compliance matters;
- Issue Engineer Advices to the Superintendent to vary the scope of the works;
- Provide advice in respect of contract values as requested by the Superintendent;
- Undertake random reviews of items subject to test records or commissioning activities;
- Provide comment on whether the installation has achieved Practical Completion in respect of the Contract;
- Review 'As-installed' drawings and Operating and Maintenance Manuals;
- Review the works at the end of the Defects Liability Period.

It will not be the Consulting Engineer's role to review maintenance procedures during the Defects Liability Period and the responsibility for adequate maintenance, including Essential Services maintenance, will rest entirely with the Contractor.

### 1.3 CONTRACTORS DESIGN RESPONSIBILITY

The following is a list of design responsibilities in addition to the co-ordination and construction responsibilities to be undertaken by the Contractor:

- The Contractor shall liaise with respective utility companies to confirm the location, capacity and method of connection of all supplies between the property and such utilities. This shall include providing the Supply Authority with confirmation of all loads that the development will impose on the Authorities infrastructure;
- The Contractor shall provide the other trade contractors with all information necessary for interface co-ordination as well as to accurately assess and size each of the respective sub-systems. Examples include:
  - electrical load information shall be provided by the mechanical, fire, lift and hydraulic contractors to the electrical contractor, in order to allow the electrical contractor to check the size of all the required submains and circuit protection;
  - the water consumption for the mechanical services shall be provided to the hydraulic contractor to enable the hydraulics contractor to check the size of the water reticulation and the cold water demand;
- Prior to ordering equipment, plant, switchboards, etc. the Contractor shall ensure that sufficient space is available, by reference to the Architectural drawings or by site measurement, to accommodate the actual size of the equipment being offered;
- The design and performance of all systems shall be confirmed after the final design and selection of the components. This will include functional design, spatial allowances, equipment supports and servicing access requirements;
- Comprehensive checking of plant, systems, piping, cabling, etc. capacities and performance against the final arrangement of equipment, e.g. checking fan static pressures against the final ducting and equipment arrangement, checking submains, checking capacity of utility connections, checking working hydraulic pressures, checking for system interfaces and interference in electrical and BAS systems, etc.;
- The final design shall incorporate the requirements of thermal expansion, anchorage and restraint;
- Acoustic design or modification of equipment to meet the noise criteria specified. This shall be based on all equipment running in normal operating mode;
- The location of all plant access requirements shall be identified on the shop drawings;
- The location of all sensors, detectors, thermostats, etc. shall be identified on the shop drawings. It shall be the Contractor's responsibility to assess the location of each sensing device and to confirm their most appropriate location taking into account functional equipment and architectural requirements;
- The Contractor shall be responsible for the comprehensive co-ordination of the works, between all other trades, prior to installation, and shall satisfy himself that any alterations within the Contract do not adversely affect other Contractors. An example of this would be the electrical contractor choosing an alternative route that would change the available voltage at a mechanical switchboard;
- Detailed design of earthing and bonding system for each of the engineering services. These services shall be designed to comply with the relevant codes, and the requirements of the Architect, where exposed.

As part of this design review allow to undertake a physical review of all space in which mechanical plant is to be installed to ensure that the intended equipment can be accommodated.

### 1.4 SCOPE OF WORK

Allow for all work, including minor and ancillary work, ensure no omissions of necessary work and allow for appropriate interfaces between the various trades, as necessary, for the complete and satisfactory installation, commissioning, operation and maintenance of the electrical services in accordance with the intent of the drawings and this Specification.

The Contract drawings are intended to depict the installation in a diagrammatic and/or schematic manner.

Where an item, system, or any aspect of the services is not indicated on the drawings and/or included in the Specification, but is obviously required, provide such work within the Contract sum.

Lodge all necessary applications to authorities and pay all fees and charges.

All materials, fittings, accessories and apparatus shall be new and of first grade design and manufacture, and shall comply with the latest issue of relevant Australian Standards.

The work shall include, but not be limited to the design, supply, installation, commissioning and certification of the following:

- Disconnection and removal of existing redundant electrical services and wiring at the appropriate stage of the works as specified.
- Relocation of existing electrical services at the appropriate stage of the works as specified.
- Staging of the works in accordance with the architects staging plans, written staging document and this specification.
- Provision of temporary power supplies via a portable hired generator to supply the existing Aged Care Facility including essential services during power supply disruptions and disconnections and to suit the staging program.
- Underground lead-in conduits between the site boundary and substation installed in accordance with Jemena requirements, specifications and drawings.
- Co-ordination with Jemena for the provision and connection of a new 1500KVA kiosk type substation.
- Underground lead-in conduits for the Telecommunications Utility/Company incoming lead-in cables.
- Coordination with the Telecommunications Utility/Company for the provision and connection of new incoming lead-in cables.
- Co-ordination with Crown Castle Australia Pty Ltd (Mobile Tower Lessee) for the provision and connection of a new unmetered submain cable to their mobile communications switchboard.
- Coordination with the Builder for the provision of a substation easement in accordance with Jemena specifications and requirements.
- Electricity Retailer revenue metering and Proprietor sub-metering.
- Electrical and communications earthing systems.
- Electrical protection discrimination study and report.
- Systems and strategies for reducing electromagnetic radiation (EMF) to acceptable levels.
- Lightning surge protection.
- Site main switchboard SMSB.
- Main distribution switchboard MDBI.
- Light and power distribution boards.
- Upgrade of existing light and power distribution board DB3.
- Underground consumer mains as scheduled.
- Underground and overhead submain cables as scheduled.
- Underground conduits for consumer mains and submain cables including electrical cable pits.
- All civil works for underground conduits including trenching, backfill and reinstatement of trenches.
- Light and power sub-circuit wiring.
- Light and power fit out of the existing laundry.
- In-slab conduits, wiring ducts and conduit links.
- Overhead supporting systems for submain cables, sub-circuit wiring and wiring for other services.
- Final terminations and connections of consumer mains, submain cables and sub-circuit wiring unless specified otherwise.
- Sealing of all electrical services penetrations for fire, acoustic and water resistance as appropriate, including compliance with BCA.
- General and special purpose power systems including power outlets, isolators, direct wired connections and electrical accessories.
- Power supplies to electrical items and accessories supplied by other trades.
- Power supplies and connections to appliances and electrical items included on the architectural plans.
- Internal lighting systems including 24 hours security lighting.
- Building external lighting and security lighting systems

- External courtyards and landscape lighting systems.
- Monitored emergency evacuation lighting and exit signs system.
- Manual and automatic lighting control systems.
- Integrated Cat 6 structured communication cabling system for voice and data communications.
- New MDF, telephone distribution frames, communications equipment racks, voice and data outlets.
- Dedicated telephone lines for lifts, FIP and security including terminations.
- Power and data for nurse call, audio visual, wireless access points and DECT phone systems.
- MATV system including distribution cabling and outlets suitable for digital free-to-air TV, Foxtel Pay TV and the RAI Italian International channel.
- Basic integrated electronic security system comprising access controls, intruder detection, CCTV surveillance and intercom.
- Public address system.
- New nurse call and assistance call systems including dementia systems.
- Wanderer's alert system interfaced with the access controls and nurse call system
- DECT phone system interfaced with the nurse call system
- Painting as required.
- Submissions including samples and shop drawings.
- Provision of "testing and tagging" of the installed electrical services equipment.
- Complete testing, commissioning and certification of the electrical services installation including provision of test results and certificates.
- Labelling of all outlets, switches, isolators, panels, switchboards and submain cables.
- Provision of certified test certificates including certificates of electrical safety.
- Attendance at briefings with the Principal's representatives including regular on-going site co-ordination and safety meetings.
- Training and instructions to Assisi staff on the operation of the electrical services systems.
- Preparation of as-installed drawings. All as -installed drawings shall be prepared on AutoCAD 2000 and shall be made available to the Principal at the end of the project. Allow to discuss the proposed layering system prior to commencement of documentation. Allow to provide four sets of prints as well as a copy of the drawings in AutoCAD format.
- Preparation of Installation, Operating and Maintenance Manuals incorporating "As Installed" drawings, testing and commissioning results. Allow to provide four sets of manuals.
- 52 weeks maintenance and Defects Liability Period.
- Comprehensive testing and maintenance of all installed electrical systems and services throughout the defects liability period.
- Manufacturers guarantees, warranties and spare parts.
- Miscellaneous works as required to complete the electrical services installation correctly and in a proper and safe manner which could reasonably be expected to be provided in accordance with good trade practice, whether such works are specifically mentioned or not.

## **1.5 SITE VISIT**

The contractor shall be deemed to have thoroughly inspected the site, reviewed all existing documentation and has become conversant with all existing items and conditions prior to tendering and to take into account any conditions likely to affect the extent or performance of the contract.

No claims or discussions will be entered into from the neglect of the forgoing on the ground of ignorance of the amount of work involved and the conditions under which the works will be executed.

## **1.6 OCCUPATIONAL HEALTH AND SAFETY REQUIREMENTS**

The Contractor's works, the use of materials and site operation facilities shall meet all requirements of the Occupational Health and Safety Guidelines for Victoria. Plant access, platforms, etc., shall meet the requirement of OH&S.

## **1.7 SUB-DIVISION OF WORKS**

The Contractor is generally responsible for the sub-division of works between Sub-contractors.

#### 1.7.1 SUB-DIVISION OF THE WORKS OF THIS CONTRACT

The following documents and information is available from the Builder to assist with the integration of the services works.

- Jemena substation drawings and specifications.
- Architectural drawings, room data sheets and specification.
- Architects staging plan and written staging document.
- Mechanical services specification and drawings.
- Fire services specification and drawings.
- Hydraulics services specification and drawings.
- Vertical transportation services specification and drawings.
- Structural specification and drawings.
- Civil specification and drawings.
- Landscape drawings and specification.
- As installed electrical services drawings
- Acoustic report.
- Building surveyor report.
- Fire engineering report.
- Site based Environmental Management Plan.

The Builder shall make available the above documents to the Contractor.

The contractor shall liaise with sub-contractors to determine the exact scope of works within each sub-contract.

#### 1.7.2 WORKS BY THE PROPRIETOR/PRINCIPAL

The following works and/or items of equipment will be provided or carried out by the Proprietor/Principal. The Contractor shall work with the Proprietor/ Principal to ensure smooth integration of these works:

- Arrange with the Telecommunications Utility/Company the provision of the incoming lead-in cables.
- Arrange with Crown Castle Australia Pty Ltd the provision of a submain cable and associated connections to their mobile communication tower switchboard.
- Pay all associated head works charges to Jemena, Telstra and Crown Castle Australia Pty Ltd.
- Provision of PABX equipment, telephone handsets, software and programming.
- Provision of computer systems including active data network hardware, software, data switches, routers, modems etc. Contractor to provide power supplies and connections as required.
- Fit out of server rack CR2 including the provision and connection of tie cabling to data rack CR1.
- Provision of UPS backup for communications equipment racks excluding rack CR3.
- Provision of wireless access points. Contractor to provide data outlet and cabling
- Provision of MATV monitors and screens.
- Provision of audio visual equipment including wiring and connections.
- Provision of communication fly leads.
- Provision of wall mounted digital battery operated clocks.

#### 1.8 DRAWINGS

The following drawings are to be read in conjunction with this Specification:

Job No.	Dwg. No.	Title
4906	E001	Legend of symbols, schedule of drawings and general notes.
4906	E002	Site and external services demolition plan.
4906	E003	Site main switchboard SMSB and main distribution board MDBI schematics.
4906	E004	Nurse call system and lighting controls schematics.
4906	E005	Voice/data and MATV schematics.
4906	E006	CCTV, access controls and public address schematics.
4906	E007	Main switch room and conduits layout.



<b>Job No.</b>	<b>Dwg. No.</b>	<b>Title</b>
4906	E008	Distribution boards schematics
4906	E101	Ground floor – sheet 1- Lighting and public address layout
4906	E102	Ground floor – sheet 2 – Lighting and public address layout.
4906	E103	Ground floor – sheet 3 – Lighting and public address layout.
4906	E104	Ground floor – sheet 1 – Power, communications and access controls layout.
4906	E105	Ground floor – sheet 2 – Power, communications and access controls layout.
4906	E106	Ground Floor – sheet 3 - Power, communications and access controls layout.
4906	E201	First floor – Lighting and public address layout.
4906	E202	First floor – Power, communications and access controls layout.

## 1.9 DRAWINGS FOR INFORMATION

Electrical services drawings of the existing installation are available from the Builder or Architect for information. These drawings should be obtained and read for familiarization with the existing installation and to determine the demolition scope.

## 1.10 DEFECTS LIABILITY PERIOD

The defects liability period for the work of this Contract shall be 12 months.

## 1.11 ELECTRICAL DESIGN CRITERIA

<b>Item</b>	<b>Design Rating</b>	<b>Spare Capacity</b>
Incoming mains from substation	Full rated output of the transformers or maximum negotiated supply capacity.	
Submain from main switchboard	Maximum demand to AS 3000. Sized to AS 3008.	20%
Submain to lifts	Maximum demand as set out in AS 3000.	15%
Essential services	Fire rated to WS53W AS 3013 and full size neutral (ESR not acceptable).	20%
Distribution boards (Essential, Non-essential)	Sized for full number of outlets shown, based on table below, plus spares/spaces	10% spare (fitted) 25% space = total 35%
Standby generator	Lighting and power based on essential allocation shown on drawings.	20%
Cable trays/ladder	Sized for all lighting, power, and submain cables in accordance with AS 3008.	30%
Final sub-circuits	Minimum cable size of 2.5 mm <sup>2</sup> Spare capacity	20%
Distribution system design	Maximum volt drop 5%.	
Lighting	In accordance with AS 1680.	<ul style="list-style-type: none"> <li>– Loading not more than 2,500 W initial.</li> <li>– Maximum 16 points/cct.</li> <li>– 20 Amp C/B.</li> </ul>
Emergency lighting	DESIGNED IN ACCORDANCE WITH	<ul style="list-style-type: none"> <li>– System design to cater for 20% additional points</li> </ul>

Item	Design Rating	Spare Capacity
systems	AS 2293.	connected.
Lightning protection	Designed in accordance with AS 1768.	
Power sub-circuits	Designed to suit type of loads connected.	<ul style="list-style-type: none"> <li>– Circuit allocation</li> <li>– A/C area - 6 DGPOs</li> <li>– No. A/C - 4 DGPOs</li> <li>– Maximum 80% utilisation</li> <li>– 20 Amp C/B minimum.</li> </ul>

All submains and final sub-circuit sizes shall be confirmed with the respective trade connected load prior to installation.

## 1.12 DISRUPTION TO EXISTING SERVICES

It shall be appreciated that the various existing electrical and communication systems, etc., which serve the area to be refurbished, also serve adjacent areas which are to remain functioning throughout the work of this Contract.

The works of this Contract shall proceed without disruption to existing services and the use of adjacent buildings.

All works associated with the disruption to existing services shall be fully coordinated to be undertaken at the appropriate stage of the works program and as directed and approved in writing by the Principal or Proprietor.

The Contractor shall provide a works program for approval by the Principal or Proprietor detailing the date(s) and time(s) of all proposed disruptions to existing services including the duration of the disruptions.

Any unexpected expenses, damage or losses incurred by the Principal or Proprietor, as a result of undertaking work on existing services, shall be included as part of the work of the Contract, at no additional cost to the Proprietor or Principal.

Provide at least 48 hours notice to the Principal or Proprietor and gain approval, in writing, from the Principal or Proprietor, where it is necessary to interrupt or close down existing services for alterations, connections or diversions as required. Carry out such works at 'off-peak' times as approved in writing by the Principal or Proprietor and reinstate the services as soon as practicable to minimise inconvenience.

The Contractor shall allow in the Tender for all costs associated with additional penalty rates and overtime payments to cover these works.

Allow in the Tender for the provision and connection of temporary power supplies and generators to maintain the above services and buildings functioning during power supply disruptions and disconnections.

Allow in the tender for the provision and connection of a 300 KVA generator to supply the existing site main switchboard during change over from the existing Assisi Centre supply to the new Jemena substation supply .

All services which are encountered or interfered with as a result of the works of this Contract shall be fully investigated, and, where necessary, diverted or altered or adapted in a manner which shall be suitable for the new installations. Existing services which are required to remain shall be protected, supported and maintained as the exigencies of the case may require.

Maintenance staff will require access to plantrooms, and such access shall not be withheld.

Procedure of operation for work in existing areas shall be maintained.

#### **1.13 SITE SERVICES**

Contact all utility companies prior to commencing work, to ascertain the precise location of all in ground and above ground services in the vicinity of any proposed excavation or building works. Ensure protection of the services, as necessary, during the progress of the work at all times. In the case of work in close proximity to in ground services, particularly electrical cables or gas piping, hand digging may be necessary in order to determine the exact location of such services. Electronic tracing of in ground services may be required. Any damage to existing services shall be made good as part of the work of the Contract, at no additional cost to the Proprietor or Principal.

#### **1.14 EXISTING PLANT TO BE REMOVED**

Become fully informed of the scope for the existing electrical plant and services to be disconnected and removed by inspection of the site and by other means considered necessary prior to submitting the Tender. Refer to Section 1.5 "site Visit".

All existing electrical services and equipment to be disconnected and removed shall be completed in accordance with the staging and construction program, ensuring that disruptions to existing functions are kept to an acceptable level.

Unless specified otherwise, disconnect and remove the following existing electrical services at the appropriate stage of the works as detailed on the drawings and specifications:

- Underground consumer mains.
- Retailer metering from the existing site main switchboard
- Light and power distribution boards and associated submain cables and sub-circuit wiring
- Redundant electrical and communications services including associated wiring from the existing facility
- Redundant security and MATV services including associated wiring from the existing facility
- Redundant nurse call and public address services including associated wiring from the existing facility
- Redundant wiring support systems.

Prior to removal of existing plant the Principal or Proprietor's representative shall nominate which plant is to be retained by the Principal or Proprietor. All plant noted as such shall be decommissioned and made safe and delivered to a store within the site as nominated by the Principal or Proprietor. Plant shall be suitably sealed and protected from damage during hoisting, delivery and storage.

Existing plant which is required to be removed, but not required to be re-used or stored, shall be taken from the site and disposed of.

#### **1.15 EXISTING PLANT TO BE RELOCATED**

Where shown to be relocated, existing plant shall be shut down, made safe and protected from all damage during relocation.

Allow for servicing of plant to ensure correct operation. Submit a report on any damage or malfunction of existing plant prior to relocation.

Co-ordinate the relocation work so that plant shutdown is minimised. All prefabrication of associated service connections, etc. shall be performed prior to plant shutdown.

All existing electrical services and equipment to be relocated shall be completed in accordance with the staging and construction program, ensuring that interruptions to existing functions are kept to an acceptable level.

Relocate the following existing electrical services at the appropriate stage of the works as detailed on the drawings and specifications:

- MATV, RAI satellite dish for the Italian International channel.

#### **1.16 STAGING OR SEQUENCING OF WORKS**

The proposed staging of works is outlined within the Architects staging plans, written staging document and staging schedules in Section 1.17 below.

Assess the impact of the staging or work sequence on the services involved, notwithstanding that the services documents may not identify such staging or sequencing. Make due allowances for staging and sequencing, including temporary works, staged commissioning, out-of-hours works, etc.

The Electrical Services works shall be staged as follows:

Stage 1 – New 45 beds aged care facility comprising ground level and level 1.

Stage 2 – Refurbishment of existing aged care facility area North.

Stage 3 – Refurbishment of existing aged care facility area South

The staging demarcation line is shown on drawing E002 and comprises the following:

- All existing electrical services for stages 2 and 3 shall be maintained operational during the stage 1 works.
- All new and existing electrical services for stages 1 and 3 respectively shall be maintained operational during the stage 2 works.
- All new electrical services for stages 1 and 2 shall be maintained operational during the stage 3 works.

Allow for the provision of temporary services including back feeding existing services from new services to comply with the above staging requirements.

#### **1.17 STAGING SCHEDULES**

The following staging schedules have been prepared by Waterman AHW based upon their assessment of the works that will be required within each of the stages advised and without the input of the builder.

The works noted are only a suggestion of the items that should be considered and it does not purport to be a complete list of all the works that are required to be undertaken in each stage.

It shall be each sub-contractors responsibility to discuss the proposed staging of the works with the builder and to ensure that their respective submissions to the builder incorporates all works that are necessary to achieve the goals of the project as defined within the architectural documents.

No variations shall be approved for additional works that may be as a result of the final agreement of the staging of the works.

##### **STAGE 1**

The following main electrical services infrastructure will be installed and connected during Stage 1:

- Jemena substation
- New site main switchboard SMSB which will supply the total site light and power including the mobile communications tower.
- Main distribution switchboard MDB1 which will supply the new and existing Aged Care facility in Stages 1, 2 and 3
- Distribution boards and mechanical services switchboards for Stage 1

- Communications and Nurse Call equipment racks for Stage 1 interfaced with the head end equipment in the main Communications room
- Electrical submain connection from new SMSB to the existing site main switchboard required to maintain the supply to the Convent and Nurses home when the existing Jemena supply is transferred to the new Jemena substation. A temporary generator will be connected to the existing site main switchboard between the change-over of supplies to reduce down time.
- Submains, communications and security cabling supported on cable trays installed in the ceiling spaces.
- Connection of safety services including lift and fire indicator panel FIP. FIP located in Stage 3 area
- New telephone main distribution frame MDF including the connection of new Telstra lead-in cables. The new MDF will be connected to the existing MDF which will be retained to provide telephone services for the Convent and Nurses Home. The existing Telstra lead-in cables can be disconnected and removed after the new cabling has been connected at the appropriate time during Stage 1 or 2.
- Fit out of the new Communications room for the connection of Voice/Data, MATV, Security, CCTV, PA and Nurse Call. PABX and Server rack fit out by Client.
- Electrical and communications cable trays linking MDB1 and MDF with the new main communications room and run in the Stage 1 and 3 ceiling spaces.
- Roof mounted MATV free-to-air antenna, Foxtel satellite dish including the relocation and re-connection of the RAI satellite dish for the Italian International channel. The new free-to-air antenna and relocated satellite dish will be re-connected to the existing MATV head end which will be retained to provide MATV services for Stages 2 and 3 including the Convent and Nurses Home.
- PA zone controls and paging microphone to be temporarily located in the existing reception or office.
- The existing nurse call system shall be interfaced with the new system to maintain normal operation of the existing system during Stages 2 and 3 change over.
- Light and power fit out including new distribution board DB10 and connections for the existing laundry.

## **STAGE 2**

The following main electrical services infrastructure will be installed and connected during Stage 2:

- Distribution boards and mechanical services switchboards for Stage 2
- Communications and Nurse Call equipment racks for Stage 2 interfaced with the head end equipment in the main Communications room
- Submains, communications and security cabling supported on cable trays installed in the ceiling spaces.
- The existing distribution board DB2 shall remain connected during Stage 2 to supply existing light and power sub-circuits in Stage 3 including the store, carpark and plant room located below Stages 2 and 3.
- The existing light and power sub-circuits from DB1A, (located in Stage 3) which extend into Stage 2, can be disconnected and removed during Stage 2.
- New distribution board DB2 and communications equipment rack CR5 both located in Stage 3.
- Electrical and communications cable trays to new distribution boards DB2, DB6 and communications equipment rack CR5
- The existing telephone intermediate distribution frames IDF2 and IDF3 shall be disconnected and removed during Stage 2. Any existing telephone services that extend into Stage 3 from these IDF's shall be temporarily connected to IDF1 and/or IDF4.

## **STAGE 3**

The following main electrical services infrastructure will be installed and connected during Stage 3:

- Distribution boards and mechanical services switchboards for Stage 3
- Communications and Nurse Call equipment racks for Stage 3 interfaced with the head end equipment in the main Communications room
- Submains, communications and security cabling supported on cable trays installed in the ceiling space.

- The existing distribution boards DBIA can be disconnected and removed during Stage 3.
- The existing IDF's 1 and 4 can be disconnected and removed.
- Relocation and installation of the new PA zone controls and paging microphone into the new reception area
- Distribution board DB3 for the kitchen shall be upgraded and connected to MDB1 with a new submain cable
- Decommission the existing nurse call and PA systems.

#### **1.18 PROVISIONAL SUMS**

Allow for the Provisional Sum amounts as scheduled. The amounts shall be expended as may be instructed in writing and any portion thereof remaining unexpended at the completion of the Contract shall be deducted from the Contract Sum.

Allowances for any Provisional Sums included in the Contract documentation, relating to services works, shall not be duplicated or omitted.

#### **1.19 ASBESTOS**

Where asbestos is encountered, during the demolition works, the Contractor shall engage a qualified asbestos removalist to remove and dispose of any materials containing asbestos from the site.

#### **1.20 SUBMISSION**

On request from the Superintendent, submit for approval all required items relates to the installation, including shop drawings, data sheets for luminaries and electrical equipment, plans, samples of luminaries and products, license certificates, warranties, guarantees and obtain written approval of each requested item.

The Tenderers shall sign and submit the completed Tender forms attached to this specification.

A Tender may be rejected if the competed and signed Tender Forms are not submitted with the original tender.

Include with the tender the following Tender Forms and Schedules:

- Tender form
- Tender price break up schedule
- Schedule of Technical Data
- Schedule of Unit Rates
- Schedule of Deviations from Specification
- Schedule of Personnel

Submit with the tender a program indicating proposed power supply disruptions and the duration of disruptions for review and approval by the Principal or Proprietor.

## **2. GENERAL REQUIREMENTS**

### **2.1 CODES AND AUTHORITIES**

The works shall comply in every way with the requirements of any Authority having jurisdiction over them. Work not covered by the requirements of Statutory Authorities shall comply with the appropriate publication from the latest edition of Standards Association of Australia.

Allow for the payment of all associated Authority charges.

### **2.2 MANUFACTURER'S REQUIREMENTS**

All equipment and systems shall be installed in accordance with the specific recommendations of the manufacturer, including the provision of ancillary, safety and maintenance devices or facilities deemed necessary.

Failure to observe such recommendations may result in equipment or systems being rejected.

The Contractor may be requested to arrange for the manufacturer to visit the site for the purpose of confirming compliance with the manufacturer's requirements.

### **2.3 SAMPLES**

Samples of all fittings, accessories and apparatus proposed for use in the works shall be submitted for acceptance prior to construction. Only such items which are to the standard of the accepted sample shall be installed. Failure to comply with this provision may result in the unconditional rejection of such items when inspected on site. The accepted sample shall be marked with a designating sticker or marker for future comparison. Any rejected material, accessories, fittings or apparatus shall be removed from the site within 24 hours of such rejection.

Samples shall be:

- Complete in detail to enable determination of whether they comply with the requirements of the documents and whether they are suitable for their intended use and location;
- Submitted for ALL equipment, accessories and systems for inspection prior to installation;
- Labelled to identify their intended use and relation to these documents.

Samples will be

- Held on site after inspection and used as a standard for acceptance or rejection of subsequent production units;
- Returned.

Samples to be provided shall include but not be limited to:

- Light fittings;
- Outlets and accessories;
- Cable support systems;
- Intercoms/handsets and devices open to view.

### **2.4 EQUIPMENT PERFORMANCE GUARANTEE**

Guarantee that all equipment items installed under the Contract, when installed in accordance with the manufacturer's instructions shall operate as specified.

It shall be the Contractor's responsibility, in cases where design conditions are not met, to check and establish that all components meet the specified performance ratings.

## **2.5 CO-ORDINATION**

Comprehensive co-ordination of all services and associated building work shall be the Contractor's responsibility.

These responsibilities shall include:

- Co-ordination with Jemena for the provision and connection of a new 1500 KVA kiosk type substation.
- Co-ordination with the Telecommunications Utility/Company for the provision and connection of the incoming lead-in cables.
- Co-ordination with Crown Castle Australia Pty Ltd for the provision and connection of a submain cable to their switchboard for the mobile communications tower.
- Co-ordination of the works within each Sub-Contract;
- Management of the advance procurement of equipment to meet programme;
- Co-ordination of in-ground and in-ceiling services routes, including trenching, trays and pipework;
- Management of the preparation and approval of fully co-ordinated shop drawings including penetration drawings;
- Management of services testing and commissioning;
- Ensuring provision of all test results and required certifications to obtain Certificate of Occupancy from the Consulting Building Surveyor.

The Contractor shall be responsible for the proper direction, supervision, control and co-ordination of the work and shall assist all other trades in every way possible in meeting this responsibility.

All services shall be thoroughly co-ordinated prior to installation. Should work proceed without co-ordination being undertaken and authorisation by those with such responsibility and should other trades subsequently not be able to effectively proceed with their respective installation, the work initially undertaken shall be removed and reinstalled at the expense of the Contractor involved.

Any claims for additional costs or delays due to the lack of effective co-ordination by the various trades shall be rejected.

The Contractor shall arrange and co-ordinate all interconnection testing with other services systems, e.g. fire mode tests.

Where the works are to be installed in close proximity to the work of other Contracts, every effort shall be made to co-ordinate with the Contractors concerned to avoid interference.

## **2.6 PROTECTION**

During the progress of the work, all parts shall be covered up and protected to avoid injury by exposure to the weather, as a precaution against accidental damage, or damage due to any other cause.

## **2.7 SERVICES PENETRATIONS**

The Contractor shall be responsible to ensure that the penetration of services through walls, floors and roofs is undertaken in a manner consistent with maintaining fire ratings, achieving acoustic performance and achieving weather-proofing, as necessary.

## **2.8 CORROSION PROTECTION**

Ensure that all metal exposed to the atmosphere and ground is protected from atmospheric and soil corrosion.

Refer to AS 2312 (1994) *"Guide to the Protection of Iron and Steel Against Exterior Corrosion"*.



Whilst this standard refers mainly to the protection of structural steel, the principles noted shall be applied to all exposed metal work.

## **2.9 SEISMIC RESTRAINT**

Provide seismic restraints on plant and equipment in compliance with the Building Code of Australia and AS 1170.4.

Restraint shall be provided on all items listed in Table 5.1.5(b) of AS 1170.4, including main switchboards, generators, but excluding luminaires and sub-circuit cabling.

The design parameters to be used in designing to AS 1170.4 are:

- Site Factor  $S = 1.0$
- Acceleration Co-efficient  $a = 0.08$
- Importance Factor  $I = 1.0$
- Height Factors  $h_x$  = height to component from base of building  
 $h_n = 25m$
- Structural Period More Flexible E-W Direction Fundamental Period  $T = 0.54 \text{ sec.}$   
More Rigid N-S Period for Orthogonal Direction  $T = 0.43 \text{ sec.}$

## **2.10 TERMITE TREATMENT**

The work shall be in accordance with AS 3660 Protection of Buildings from Subterranean Termites.

## **2.11 WORKMANSHIP**

All workmanship shall be of a high standard throughout as accepted by the respective specialist trades.

Only suitably licensed tradesmen experienced in the type of work required by this project shall be employed on work which any Authority having jurisdiction requires to be carried out by licensed tradesmen.

Where the workmanship is not consistent with good trade practice, or standards or that any plant is inferior in quality or deficient in quantity to that specified, the work shall be made good. Rejected work or materials shall be removed from the site within 24 hours of such rejection. Defective work shall be reconstructed to conform to the specified requirements.

## **2.12 WORKSHOP DRAWINGS**

Provide a schedule of proposed workshop drawings for review. The schedule shall include drawing title, drawing scale, and the submission date. Additional shop drawings may be nominated as required by the client representative.

Drawings shall have all relevant information sufficient for all particulars to be examined. Provide plant layouts, ductwork layouts, pipework layouts, electrical layouts, switchboard construction, electrical power and control wiring schematics, piping schematics, air schematics, and any other work shop drawings specially specified elsewhere.

Provide drawings to accurately indicate the size and location of openings in walls, roofs, floors and for all plinths, bases and any other building type work.

Drawings shall be submitted for review. Where required, the amendments shall be made and the drawings re-submitted promptly.

No on-site work manufacturing shall be undertaken until the drawings have been reviewed.

The Contractor shall not assume that background disks will be provided to them free-of-charge by the system designers. A minimum charge of \$200 per transfer will be charged to Contractor's for services design drawings in AutoCAD 2000 in electronic format.

### **2.13 AS-INSTALLED DRAWINGS**

Provide comprehensive 'as-installed' drawings. The drawings shall be to scale not less than 1:50 for equipment areas and 1:100 for other areas. They shall clearly indicate the position and sizes of luminaires, switches, GPOs, outlets, switchboards, equipment, racks, cable routes, etc. and shall show no less details than the design drawings. The control and functional diagrams shall show instruments, valves and equipment items and shall list the set-point and operating differential of each control element.

As-installed drawings shall reflect the as-installed condition on site (i.e. they shall include all variations and changes to the design that occur during construction).

Drawings shall be prepared on AutoCAD 2000. Disk files of the shop drawings shall be provided for the Principal or Proprietor's use.

The as-installed drawings shall include, but not be confined to:

- Plant layouts (minimum scale 1:50);
- Cable tray/ladder rack layouts;
- Electrical light and power layout diagrams;
- Accurate in-ground cable conduit routes;
- Switchboard and control panel diagrams;
- Wiring and control diagrams;
- Electronic equipment schematics;
- Security system cable diagrams;
- Audio/visual services cable diagrams;
- 'As-installed' drawings shall be incorporated in the Operating and Maintenance Manuals;
- Fire rated penetrations;
- Manufacturer's requirements.

### **2.14 OPERATING AND MAINTENANCE MANUALS**

The contractor is required to use WEBFM OMTrak System for the purpose of producing the services Operating and Maintenance Manuals. Refer to Appendix E4 for details. Where there is a discrepancy between the Operating & Maintenance Manuals outlined within this specification and Appendix E4, then Appendix E4 takes precedence.

The instructions for operating and maintaining the services shall detail:

- Scope of work carried out;
- The installed services and describe the inter-related operation and purpose of the systems in the various parts of the building. Descriptions shall refer to equipment numbers given in the tender drawings and Specification;
- Procedures for normal starting and stopping, for restarting after power interruption and for emergency shutdown;
- Safety features of equipment and controls;
- Fire mode operation/isolation of the plant;
- Details of the systems design criteria;
- An inventory of installed equipment listing: type, manufacture, capacity and operating parameters, size and serial number, and supplier's name, address and phone number;
- Operating procedures of all installed equipment;
- An inspection, testing and maintenance program in tabular form showing the frequency and the level of routine attention required throughout the life of the equipment;
- Spare parts and manufacturer's sectionalised diagrams for parts identification;
- Maintenance for each item of equipment as recommended in manufacturer's installation and maintenance pamphlets;

- Manufacturer's Warranty Certificates and Test Report data;
- 'As-installed' drawings photographically reduced to binder size;
- Record drawings shall be 'as-installed' full size prints folded to binder size and heavily reinforced at the retaining posts.

The manual shall also include the following:

- A schedule of installed equipment on a floor-by-floor basis;
- Manufacturers literature on all equipment provided;
- Full set of commissioning test sheets;
- Listing of designer, Contractor and major Sub-contractors giving addresses and phone numbers.

The manuals shall also provide a separate section highlighting all maintenance requirements for essential services and the codes and standards to which these services are to be maintained. They shall also contain any list of essential services provided by the Building Certifier or Building Surveyor issued under the Building Code of Australia. The following is a list of codes which maybe applicable, the list shall not be taken to be absolutely complete or correct, and is provided as a guide only.

<b>Essential Service</b>	<b>Installation Standards/ Level of Performance</b>	<b>Nature of Inspection or Test, Frequency</b>
Emergency Lighting System	AS 2293	6 monthly to AS 2293

Operating and Maintenance manuals shall also cover the requirements of AS/NZS 3666 Parts 2 and 3, as well as the most up-to-date Government Regulations, in respect to microbial control, including provision of:

- Risk Management Plan;
- Physical details of applicable plant;
- Details of water treatment maintenance and management;
- Recommended cleaning, disinfection and emergency decontamination procedures;
- Start-up and shutdown procedures.

## **2.15 WARRANTY AND MAINTENANCE**

The complete works shall be warranted against defective workmanship and materials and against non-compliance of equipment or systems with specified performance of operation.

During the whole of the warranty period (12 months after Practical Completion) warranty, breakdown, preventative and essential services maintenance shall be performed.

Preventative maintenance shall be carried out on at least a monthly basis, as required by regulations and as required by manufacturers and in accordance with the instructions contained in the Operating and Maintenance manuals.

Essential services maintenance shall be performed in accordance to the requirements of AS 1851.

## **2.16 COMPLIANCE CERTIFICATES**

The following certificates of compliance shall be provided:

### **Installation Compliance Certificate**

This certificate shall be issued in the form of the draft herein this specification before the date of Practical Completion. The Building Surveyor will rely upon this Certificate in issuing a Certificate of Occupancy.

### **Independent Essential Services Certificate**

The Contractor shall engage the services of a suitably qualified organisation or person to independently verify that all aspects of the Essential Services installation comply with the relevant regulations, including the operation and performance of such services.

This certificate shall be issued before the date of Practical Completion. The Building Surveyor will reply upon this Certificate in issuing a Certificate of Occupancy.

**Essential Services Report**

Prior to the expiration of the 12 month defects liability period, the Contractor shall issue a form, as required by the building regulations, confirming that the Essential Services have been appropriately maintained during the defect period.

<b>(Draft of) INSTALLATION COMPLIANCE CERTIFICATE — ELECTRICAL SERVICES</b> (Signed letter in this form to be provided on electrical contractors letterhead prior to practical completion.)	
To:	<i>(Building Surveyor)</i>
Address:	
Reference:	
.....	<i>(Project Name)</i>
.....	<i>(Project Number)</i>
From: .....	<i>(Contractor)</i>
Address: .....	
<p>We hereby certify that the completed electrical installation fully complies with all the requirements and intent of the Specification and drawings prepared by Waterman AHW (Vic) Pty Ltd, as well as all relevant Australian Standards and Regulations which apply to the installation.</p> <p>These Australian Standards and Regulations include, but are not limited to: AS 1670, AS 1680, AS 1768, AS 2220, AS 2293, AS 3000, AS 3003, AS 3009, Building Code of Australia.</p> <p>We certify that all fire, smoke control and life-safe systems installed as part of this Contract have been fully inspected, tested and commissioned in conjunction with other service contracts and that the whole operates in accordance with the relevant codes and requirements.</p> <p>We also attach a copy of the independent certification of Essential Services.</p> <p><b>Contractor's Name:</b> .....</p> <p><b>Signature :</b> ..... <b>Date:</b> .....</p> <p><b>Witness:</b> ..... <b>Date:</b> .....</p>	

**2.17 SUBSTITUTIONS AND ALTERNATIVES**

Should the Contractor consider that any part of the work could be done quicker, better or more effectively by substitution of materials or methods other than those specified, the details of such substitutions or alternatives shall be included in the Tender, including a comprehensive Report in support of the proposals.

Where the words 'or equal approved' are used in this Specification, the Contractor may request permission to use a substitute for what is specified, provided they certify in writing that the substitute is of equal, or better quality and effectiveness than that specified.

## **2.18 TAKEOVER TESTS**

From time to time as portions of the installation are completed and before the Notice of Practical Completion is issued and the works taken over, the installation shall pass such tests specified or as deemed necessary to provide satisfaction that the installation conforms to the Contract requirements.

Carry out all such tests and shall be responsible for all labour, materials and instruments, appliances and other expenses associated with such tests.

Costs of all testing, including fuel, electricity, etc., to be paid by the Contractor.

## **2.19 INSTRUCTIONS TO PRINCIPAL'S/PROPRIETOR'S AND TRAINING**

In addition to the instructions contained in the 'Operating and Maintenance Manual', furnish the services of suitably qualified personnel to thoroughly instruct the Proprietor's/Principal's representative as to the proper operation and care of each and every aspect of the installation. Such instructions shall be provided as soon as possible after Practical Completion, to the convenience of the Proprietor's/Principal's.

Training shall be provided to the Building Operator/Engineer or the Client's representative on the following:

### **General**

Operation and Maintenance Manuals: Use items and procedures listed in the final draft operation and Maintenance Manuals as the basis for instruction. Review contents with the Proprietor's/Principal's staff in detail.

Format: Conduct training at agreed time, at system or equipment location.

### **Operation**

Immediately after Practical Completion, explain and demonstrate to the Proprietor's/Principal's staff the purpose, function and operation of the installations.

### **Maintenance**

Immediately after Practical Completion, explain and demonstrate to the Proprietor's/Principal's staff the purpose, function and maintenance of the installations.

### **Demonstrators**

Use qualified manufacturer's representatives who are knowledgeable about the installations.

### **Seasonal operation**

For equipment requiring seasonal operation, demonstrate during the appropriate season and within six (6) months.

## **2.20 TESTS AND INSPECTIONS**

Give sufficient notice so that tests and inspections may be made for work in progress or erected.

Provide all labour, test equipment and instruments required for carrying out the tests.

Notice shall be provided to allow inspection as necessary of:

- Samples;
- Cable reticulation standard (before ceilings/walls enclosed);
- Services being provided into inaccessible places.

Site testing shall include the following:

- Earthing medium;
- Circuit integrity;
- Lighting functionality;
- Instrumentation and control circuit functionality;
- Residual current devices
- Emergency lighting and exit signs
- Communications cable testing;
- Audio and visual system functionality
- Nurse call system functionality
- All electrical and communication systems functionality.
- Operation of switchgear and instrumentation on all switchboards
- Sound level of all installed equipment;
- Mobile generator operation and performance;
- UPS operation and performance;

The Contractor shall undertake their own testing to ascertain compliance with documents, codes and regulations applicable, prior to notifying the Consulting Engineer for final witness testing. Any retesting required after the final witness test shall be at the Contractor's cost including the Consulting Engineer's costs for time and travel.

## **2.21 AVAILABILITY OF SPARE PARTS**

Spare parts shall be readily purchasable and deliverable within a reasonable period of time for all equipment supplied under this Contract. This requirement applies to all components and in the case of small items such as valves, contactors and the like, complete replacement assemblies. Suppliers shall have been supplying the make and type of equipment continuously for a period of not less than five years prior to the date of tendering. Equipment for which suppliers have only recently obtained agencies or for which full spare parts are not held in stock in Australia shall be detailed in the tender offer. Equipment not complying with this clause, which is not highlighted at the time of tender, may be rejected.

## **2.22 CONCEALED SPACES**

The Contractor shall make all required allowances for working, installing and future maintenance of plant and equipment associated with this Contract with regard to concealed spaces, in accordance with the relevant Australian Standards.

### **3. GENERAL ELECTRICAL SERVICES REQUIREMENTS**

#### **3.1 GENERAL**

##### **Precedence**

Requirements of individual technical sections of the specification override conflicting requirements in this section.

#### **3.2 REFERENCED DOCUMENTS**

##### **Current editions**

Use referenced documents which are editions, with amendments, current three months before the closing date for tenders, except where other editions or amendments are required by statutory authorities.

##### **Contractual relationships**

Responsibilities and duties of the Principal, Contractor and Superintendent are not altered by requirements in referenced documents.

##### **General standards**

Part 3 of the Electrical Safety Act 1998

Electrical Safety (Installations) Regulations 1999

Electrical work: To AS 3000.

Degree of electrical protection: To AS 1939.

Fixed access ways: To AS 1657.

Communications cabling: To AS 3080.

Lighting: To AS 1680.

Emergency lighting: To AS 2293.

Emergency evacuation warning: To AS 2220.

Fire detection system: To AS 1670.

Microbial control: To AS 3666.

Radio frequency interference: To AS/NZS 1044.

Australian Communications Authority's — Electromagnetic Compatibility Framework comprising:

AS/NZS 4251

AS/NZS 1044

AS/NZS 1053

AS/NZS 2064.1/2

AS/NZS 2557

AS/NZS 3548

AS/NZS 4051

AS/NZS 4052

Units of measurement: To AS ISO 1000.

#### **3.3 INTERPRETATIONS**

##### **General**

Unless the context otherwise requires, the following definitions apply:

- Supply: "Supply", "furnish" and similar expressions mean "supply only";
- Install: "Install", "fix" and similar expressions mean "install only";
- Provide: "Provide" and similar expressions mean "supply and install";
- Approved: "Approved", "reviewed", "directed", "rejected", "endorsed" and similar expressions mean "approved (reviewed, directed, rejected, endorsed) in writing by the superintendent";
- Give notice: "Give notice", "submit", "advise", "inform" and similar expressions mean "give notice (submit, advise, inform) in writing to the superintendent";
- Obtain: "Obtain", "seek" and similar expressions mean "obtain (seek) in writing from the superintendent";
- Proprietary: "Proprietary" means identifiable by naming manufacturer, supplier, installer, trade name, brand name, catalogue or reference number;
- Samples: Includes samples, prototypes and sample panels.

#### **Technical**

Zinc-coated steel: Includes zinc-coated steel, zinc/iron alloy-coated steel, and aluminium/zinc-coated steel.

Pipe: Includes pipe and tube.

#### **Tests**

Except where otherwise defined in referenced documents, the following definitions apply:

- Pre-completion tests: Tests carried out before completion tests:
  - Type tests: Tests carried out on an item identical with a production item, before delivery to the site;
  - Production tests: Tests carried out on the purchased equipment, before delivery to the site;
  - Site tests: Tests carried out on site.
- Completion tests: Acceptance tests and final tests:
  - Acceptance tests: Tests carried out on completed installations or systems and, except for final tests, before the date for practical completion, to demonstrate that the installation or system, including components, controls and equipment, operates correctly, safely and efficiently, and meets performance and other requirements;
  - Final tests: Acceptance tests carried out before completion of the maintenance period.

#### **Maintenance period**

Co-extensive with the defects liability period.

### **3.4 CONTRACT DOCUMENTS**

#### **General**

Diagrammatic layouts: Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable. Before commencing work, obtain measurements and other necessary information.

Levels: Spot levels take precedence over contour lines and ground profile lines.

### **3.5 DESIGN**

#### **Space requirements**

Check space requirements of equipment and services indicated diagrammatically in the contract documents and submit a report on consequent variations to the design.

#### **Electrical supply system**

400 V, 3-phase, 4-wire, 50 Hz.

#### **Electromagnetic compatibility**

Use equipment and installation practices complying with the Australian Communications Authority — Electromagnetic Compatibility Framework and the Australian Standards recommendations.

#### **Radio frequency interference**

Use equipment which generates interference within limits set by AS/NZS 1044. If necessary, provide suppression devices. If appropriate, shield equipment to AS/NZS 1044.

#### **Fault level protection**

To withstand the fault level of the incoming supply at the equipment location.

#### **Rotating and reciprocating machinery noise and vibration**

Vibration severity: At least satisfactory, to AS 2625.3 or AS 2625.4.



### **3.6 QUALITY**

#### **3.6.1 INSPECTION**

##### **Notice**

General: If notice of inspection is to be given in respect of parts of the works, do not conceal those parts without approval.

Minimum notice for inspections to be made: four working days for on-site inspectors, otherwise two working days.

#### **3.6.2 TESTS**

##### **Notice**

General: Give sufficient notice so that designated tests may be witnessed. Do not carry out designated tests without approval.

Minimum notice for tests to be witnessed:

- 5 working days for site tests; and
- 10 working days for local pre-delivery tests.

##### **Testing authorities**

General: Except for site tests, have tests carried out by authorities accredited by NATA to test in the relevant field, or an organisation outside Australia recognised by NATA through a mutual recognition agreement. Co-operate as required with testing authorities.

Site tests: Use instruments calibrated by authorities accredited by NATA.

##### **Reports**

General: Submit copies of test reports, including certificates for type tests, showing the observations and results of tests and compliance or non-compliance with requirements.

##### **Endorsement**

If tests are to be carried out on parts of the works, do not conceal those parts and do not commence further work on those parts until the tests have been satisfactorily completed and compliance verified.

#### **3.6.3 PRE-COMPLETION TESTS**

##### **Motor rotation**

Check correct motor rotation while maintaining correct phase sequence at the switchgear and controlgear assembly, and if necessary alter connections.

#### **3.6.4 SAMPLES**

##### **Timing**

Delays: Coordinate submissions of related samples. Do not cause delays by making late submissions or submitting inadequate samples.

##### **Quantity**

General: Submit a sample of each designated item and two (2) copies of supporting documentation. Include ancillary items such as fasteners, flashings and seals.

##### **Identification**

Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include pertinent contract document references. Include service connection requirements and product certification. Identify non-compliances with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

##### **Approval**

General: Do not commence work affected by samples until the samples have been approved. Submit further samples as necessary.

**Retention**

Keep approved samples in good condition on site, until Practical Completion.

**Incorporation**

Incorporate in the works samples which have been approved for incorporation. Do not incorporate other samples.

**Criteria**

Match approved samples throughout the works.

**3.7 MATERIALS AND COMPONENTS**

**3.7.1 GENERAL**

**Proprietary items**

Implication: Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified, but indicates the necessary properties of the item.

Alternatives: If alternatives are proposed, submit proposed alternatives and include samples, available technical information, reasons for proposed substitutions and cost. If necessary, provide an English translation. State if use of proposed alternatives will necessitate alteration to other parts of the works and advise consequent costs.

**Manufacturers' or suppliers' recommendations**

General: Select, if no selection is given, and transport, deliver, store, handle, protect, finish, adjust, prepare for use, and use manufactured items in accordance with the current written recommendations and instructions of the manufacturer or supplier.

Instructions: Submit the recommendations and instructions, and advise of conflicts with other requirements.

Project modifications: Advise of activities that supplement, or are contrary to, manufacturer's or suppliers' written recommendations and instructions.

Product certification: If products must comply with product certification schemes, use them in accordance with the certification requirements.

**Sealed containers**

If materials or products are supplied by the manufacturer in closed or sealed containers or packages, bring the materials or products to point of use in the original containers or packages.

**Consistency**

For the whole quantity of each material or product use the same manufacturer or source and provide consistent type, size, quality and appearance.

**3.7.2 STANDARDS**

**Steel**

Structural hollow section: To AS 1163.

Structural bars and sections: To AS 3679.1.

Sheet: To AS 1595.

**Steel for factory finishes**

Electric resistance welded pipe: To AS 1450 "bright".

Cold rolled bar: To AS 1443 "bright".

Cold rolled sheet: To AS 1595/CA2S-E.

**Coated steel**

Galvanized structural hollow sections: To AS 1163.  
Zinc-coated sheet: To AS 1397.  
Coating class for sheet: Comply with the recommendations of AS 1397 Appendix B.  
Prepainted sheet: To AS 2728 Category 1.  
Thickness: Metal thicknesses specified are base metal thicknesses.

**Stainless steel**

Plate, sheet and strip: To AS 1449.  
Bars: To AS 2837.  
Welded pipe: To AS 1769.  
Grade: 304.

**Aluminium and aluminium alloys**

Drawn rods and bars: To AS 1865.  
Extrusions: To AS 1866.  
Drawn pipe: To AS 1867.  
Plate and sheets: To AS 1734.

**Copper and copper alloys**

Casting: To AS 1565.  
Plate, sheet and strip: To AS 1566.  
Rods, bars and sections: To AS 1567.

**Fasteners**

Bolts and screws: To AS 1111.  
Hexagon nuts: To AS 1112.  
Metal washers: To AS 1237.  
Machine screws: To AS 1427.  
Pressed nuts: To AS 1474.  
Self-drilling screws: To AS 3566.  
Tapping and metallic drive screws: To AS B194.  
Electroplating: To AS 1897.  
Galvanizing: To AS 1214.

**Ready mixed concrete**

To AS 1379.

**Steel fabric reinforcement**

To AS 1304.

**3.7.3 FACTORY FINISHES****Joint finishing**

Finish visible joints made by welding, brazing or soldering using methods appropriate to the class of work (including grinding or buffing) before further treatment such as painting, galvanizing or electroplating.

**Preparation for coating**

General: Before applying coatings to metalwork, complete cutting, drilling and other fabrication, and prepare surfaces to AS 1627.

**Paint finishes**

General: Use only paints in accordance with the Government Paint Code (GPC).

**Galvanizing**

General: To AS 1650.  
Minimum coating class: Z200.  
Coating type for wire: Type A.

**Electroplating**

Zinc: AS 1789.

Nickel and chromium: To AS 1192.

Service condition number: At least 2.

**Anodizing**

To AS 1231, at least class AA10.

**Thermoset powder coating**

Preparation: Use chemical pretreatments. If recommended, provide conversion coatings.

Internal use: To GPC P-155/1 or 4.

External use: To GPC P-155/2 or 5.

Finish: Full gloss.

**Equipment paint system**

Brush or spray application using paint to GPC specifications as follows:

- Prime coat to metal surfaces generally: P-32 or P-162;
- Prime coat to zinc-coated steel: P-13/4 or P-13/5;
- Undercoat: U-23;
- Full gloss enamel finish coats, oil and petrol resistant: E-24, two coats.

**Two-pack liquid coating**

Primer: Two-pack epoxy primer to GPC C-29/7.

Topcoat:

- Internal use: Proprietary polyurethane or epoxy acrylic system;
- External use: Proprietary polyurethane system.

Application: Spray.

Finish: Full gloss.

**Air-drying enamel**

Internal use:

- Primer: Two-pack epoxy primer to GPC C-29/7;
- Topcoats: 2 coats to GPC E-15/3.

Application: Spray or brush.

Finish: Full gloss.

**Stoving enamel**

Internal use:

- Primer: To GPC P-65.
- Topcoat: To GPC E-66/3.

Application: Spray or dip.

### **3.8 INSTALLATION**

#### **3.8.1 GENERAL Installation**

General: Install equipment and services plumb, fix securely and organise reticulated services neatly. Provide for movement in both structure and services.

Arrangement: Arrange services so that services running together are parallel with each other and with adjacent building elements. Under suspended ground floors, keep services at least 150 mm clear above ground surface, additional to insulation, and ensure access is not impeded.

Lifting: Provide permanent fixtures attached to the equipment, for lifting heavy items of equipment, as recommended by the manufacturer.

### **3.8.2 SERVICES CONNECTIONS**

#### **Statutory authorities' requirements**

If the authorities elect to perform or supply part of the works, make the necessary arrangements. Install equipment supplied, but not installed, by the authorities.

#### **Connections**

Connect to statutory authorities' services or service points. Excavate to locate and expose connection points. On completion reinstate the surfaces and facilities which have been disturbed.

### **3.8.3 SYSTEM INTEGRATION**

#### **General**

Interconnect system elements so that the installations perform their designated functions.

### **3.8.4 WIRING**

#### **General**

Concealed wiring: Conceal wiring runs, except within plant rooms. Install concealed wiring so that it can be rewired easily and without damage to finishes or materials.

### **3.8.5 BUILDING PENETRATIONS**

#### **Piping sleeves**

General: Provide metal or UPVC sleeves formed from pipe sections, for piping penetrations through non-fire rated building elements.

Sleeve diameter (for non fire-rated building elements): Sufficient to provide an annular space around the pipe, conduit or cable of at least 12 mm.

Minimum sleeve thickness:

- Metal: 1 mm;
- UPVC: 3 mm.

Sleeve terminations:

- If cover plates are fitted: Flush with the finished building surface;
- In floors draining to floor wastes: 50 mm above finished floor;
- In fire-rated and acoustic-rated building elements: 50 mm beyond finished building surface;
- Elsewhere: 5 mm beyond finished building surface.

Finish: Prime paint ferrous surfaces.

#### **Cable sleeves**

Provide UPVC sleeves formed from pipe sections, for penetrations through ground floor slabs and beams and external walls by cables not enclosed in conduit. In addition, for MIMS cables, provide sleeves for penetrations through masonry.

#### **Fire rated building elements**

Seal penetrations using a system of fire pillows or panels to AS 4072.1 and installed in such a manner as to permit future removal and reinstatement.

#### **Non-fire rated building elements**

Seal penetrations around conduits and sleeves. Seal around cables within sleeves. If the building element is acoustic rated, maintain the rating.

### **Limitations**

General: Do not penetrate or fix to the following without approval:

- Structural building elements including external walls, fire walls, floor slabs and beams;
- Membrane elements including damp-proof courses, waterproofing membranes and roof coverings.

Membranes: If approval is given to penetrate membranes, provide a waterproof seal between the membrane and the penetrating component.

### **3.8.6 FIXING**

#### **General**

If equipment and services are not suitable for fixing to non-structural building elements, fix directly to structure and trim around holes or penetrations in non-structural elements.

#### **Fasteners**

Use proprietary fasteners capable of transmitting the loads imposed and sufficient to ensure the rigidity of the assembly.

### **3.8.7 UNDERGROUND SERVICES**

#### **3.8.7.1 CABLES IN TRENCHES**

##### **Sand bed and surround**

Provide clean sharp sand around cables and conduits installed underground.

##### **Sealing ducts and conduits**

Seal buried entries to ducts and conduits using waterproof seals. Seal spare ducts and conduits immediately after installation. Seal other ducts and conduits after cable installation.

#### **3.8.7.2 CABLE PITS**

##### **General**

Draw-in pits: Sizes given are internal dimensions.

##### **Proprietary cable pits**

For pits < 1.2 x 1.2 m, provide proprietary concrete or polymer moulded pits.

##### **In-situ construction**

For pits > 1.2 x 1.2 m, select from the following:

- Proprietary cable pits;
- Construct walls and bottoms using rendered brickwork or 75 mm thick reinforced concrete. Incorporate a waterproofing agent in the render or concrete.

##### **Pit covers**

General: Provide pit covers to suit expected loads. Fit flush with the top of the pit.

Standard: To AS 3996.

Maximum weight: 40 kg for any section of the cover.

Lifting handles: Provide a lifting handle for each size of cover section.

##### **Drainage**

General: Provide drainage from the bottom of cable pits, either to absorption trenches filled with rubble or to the stormwater drainage system.

Absorption trenches: Minimum size 300 x 300 x 2000 mm.

#### **3.8.7.3 UNDERGROUND CABLE ROUTES**

##### **Survey**

Accurately record the routes of underground cables before backfilling.

### **Location marking**

General: Accurately mark the location of underground cables using route markers consisting of a marker plate set flush in a concrete base.

Location: Place markers at each joint, route junction, change of direction, termination and building entry point and in straight runs at intervals of not more than 100 m.

Concrete bases: 200 mm diameter x 200 mm deep, minimum.

Direction marking: Show the direction of the cable run using direction arrows on the marker plate. Indicate distance to the next marker.

Plates: Brass, minimum size 75 x 75 x 1 mm thick.

Plate fixing: Waterproof adhesive and four (4) brass or stainless steel countersunk screws.

Marker height: Set the marker plate flush with paved surfaces, and 25 mm above other surfaces.

### **Marker tape**

Where electric bricks or covers are not provided over underground wiring, provide a 150 mm wide yellow or orange marker tape bearing the words "WARNING - electric cable buried below", laid in the trench 150 mm below ground level.

## **3.8.8 SERVICE TRENCHING**

### **3.8.8.1 GENERAL**

#### **3.8.8.1A CROSS REFERENCES**

##### **General**

Refer to the General requirements section.

##### **Related sections**

Refer to the following sections.

### **3.8.8.2 QUALITY**

#### **3.8.8.2A INSPECTION**

##### **Witness points**

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

- Service trenches excavated before laying the service;
- Services laid in trenches and ready for backfilling.

##### **Hold points**

### **3.8.8.3 TESTS**

#### **Bedding density tests**

Testing authority: Have density tests of bedding carried out by an authority accredited by NATA.

Test methods:

- Field dry density: AS 1289.5.3.2 or AS 1289.5.3.5;
- Maximum dry density: AS 1289.5.1.1;
- Dry density ratio: AS 1289.5.4.1;
- Density index: AS 1289.5.6.1.

### **3.8.9 SERVICE TRENCHES**

#### **3.8.9.1 EXCAVATING**

##### **Existing surfaces**

Before excavating trenches, saw-cut existing concrete and bituminous surfaces on each side of the trench to provide a straight even joint. Lift and store unit paving for later reinstatement.

##### **Excavation**

Excavate for underground services, to required lines, levels and grades. Generally make the trenches straight between personnel access ways, inspection points and junctions, with vertical sides and uniform grades.

##### **Trench widths**

Keep trench widths to the minimum consistent with the laying and bedding of the relevant service and construction of personnel access ways and pits.

##### **Trench lengths**

Excavate trenches in sections of suitable length.

##### **Trench depths**

General: As required by the relevant service and its bedding method.

Notice: If excavation is necessary below the level of adjacent footings, give notice, and provide necessary support for the footings.

##### **Obstructions**

Clear trenches of sharp projections. Cut back roots encountered in trenches to at least 600 mm clear of services. Remove other obstructions including stumps and boulders which may interfere with services or bedding.

##### **Dewatering**

Keep trenches free of water. Place bedding material, services and backfilling on firm ground free of surface water.

##### **Excess excavation**

If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or grade N20 concrete.

#### **3.8.9.2 BORING**

##### **Subcontractor**

If under road boring is required in lieu of trenches, engage a suitably qualified subcontractor to do the work.

##### **Process**

Ensure a tight fit to the service pipes. If voids are encountered, fill by pressure grouting.

#### **3.8.9.3 BACKFILLING**

##### **General**

Backfill service trenches as soon as possible after the service has been laid and bedded, if possible on the same working day. Place the backfill in layers ( 150 mm thick and compact to the density, which applies to the location of the trenches to minimise settlement, and so that pipes are buttressed by the trench walls.

##### **Marking services**

Underground marking tape: To AS/NZS 2648.1.



**Backfill material**

General: General fill with no stones greater than 25 mm occurring within 150 mm of the service, or other materials as required for particular services or locations. Well graded, inorganic, non-perishable material, maximum size 75 mm, plasticity index ( 55%.

Under roads and paved areas and within 4 m of buildings: Coarse sand, controlled low strength material or fine crushed rock.

In topsoil areas: Complete the backfilling with topsoil for at least the top 50 mm.

In reactive clay: In sites classified M, H or E to AS 2870, provide an impervious material where trenches fall towards footings.

**3.8.9.4 REINSTATEMENT OF SURFACES****General**

Reinstate existing surfaces removed or disturbed by trench excavations to match existing and adjacent work.

**Lawn areas**

Provide 150 mm of loam and resow the lawn over the trench and other disturbed areas.

**Paving and roads**

Reinstate to match adjacent work, paved surfaces and assets disturbed or removed during excavation of trenching.

**Concrete surfaces**

Reinstate concrete surfaces to the original level. If necessary, provide steel reinforcement keyed to the adjacent concrete and laid to prevent the reinstalled concrete from subsiding and cracking.

**Bituminous surfaces**

General: Provide crushed rock base and sub-base to match the existing pavement. Prime coat the edges of the existing surfacing with bitumen. Lay and compact hot-mix asphalt so that the edges are flush and the centre is cambered 10 mm above the existing pavement. If hot pre-mix is not available, cold pre-mix may be used.

Minimum asphalt thickness: 50 mm or the adjacent pavement thickness, whichever is thicker.

**Unit paving**

Provide sand bedding and, if necessary, compacted crushed rock base. Reinstate the paving units.

**3.8.10 UNDERGROUND METAL PIPING****Corrosion protection**

General: Provide corrosion protection for:

- Underground ferrous piping;
- Underground non-ferrous metal piping in corrosive areas.

Protection methods: Select from the following:

- Impermeable flexible plastic coating;
- Sealed polyethylene sleeve;
- Continuous wrapping using proprietary petroleum taping material;
- Cathodic protection: Use sacrificial anodes or impressed current. Incorporate a facility for periodic testing;
- Standard: Comply with the recommendations of AS 2832.1.

**3.8.11 PIPING****Cleaning**

General: Before installation, remove loose scale, burrs, fins and obstructions.

**Protection:** During construction, prevent the entry of foreign matter into the piping system by temporarily sealing the open ends of pipes and valves using purpose-made covers of pressed steel or rigid plastic.

#### **Installation**

**General:** Install piping in straight lines at uniform grades with no sags. Arrange to prevent air locks. Provide sufficient unions, flanges and isolating valves to allow removal of piping and fittings for maintenance or replacement of plant.

**Arrangement:** Arrange and support piping so that it remains free from vibrations whilst permitting necessary movements. Minimise the number of joints.

**Spacing:** Provide at least 25 mm clear between pipes and between pipes and building elements, additional to insulation.

**Dissimilar metals:** Join dissimilar metals using fittings of electrolytically compatible material.

#### **Accessibility**

Provide access and clearance at fittings which require maintenance or servicing, including control valves and joints intended to permit pipe removal. Arrange piping so that it does not interfere with the removal or servicing of associated equipment or valves or block access or ventilation openings.

#### **Embedded piping**

**Expansion and contraction:** Sheath or sleeve metal piping chased into masonry or encased in concrete so that expansion or contraction can take place without damage to the pipe or to the material or surface finish of the surrounding element.

#### **Cover plates**

If piping emerges from exposed building surfaces, provide cover plates of non-ferrous metal, finished to match the pipe, or of stainless steel, close fitting and firmly fixed in place.

<b>Nominal pipe size, DN</b>	<b>Cover plate diameter</b>
< 20	65 mm
> 20, <50	100 mm
> 50	50 mm larger than pipe

#### **Support system**

**General:** Provide proprietary support systems of galvanized or zinc-coated steel construction.

**Vertical pipes:** Provide anchors and guides to maintain long pipes in position, and supports to balance the mass of the pipe and its contents.

### **3.8.12 CONCRETE PLINTHS**

#### **Construction**

**General:** Provide galvanized steel surround at least 75 mm high and 1.6 mm thick, fixed to floor with masonry anchors. Fill with concrete.

**Reinforcement:** Single layer of F62 fabric.

**Concrete:** Grade N20.

**Finish:** Steel float flush with the surround.

### **3.8.13 VIBRATION SUPPRESSION**

#### **General**

Minimise the transmission of vibration and noise from rotating or reciprocating equipment to other building elements.

#### **Equipment requiring vibration isolation mountings**

Except for external equipment which is not connected to the structure of any building, support rotating or reciprocating equipment on mountings as follows:

- For static deflections < 15 mm: Single or double deflection neoprene in-shear mountings incorporating steel top and base plates and a tapped hole for bolting to equipment;
- For static deflections  $\geq$  15 mm: Spring mountings.

#### **Selection of vibration isolation mountings**

Select mountings to achieve 95% isolation efficiency at the normal operating speeds of the equipment.

#### **Spring mountings**

Use free-standing laterally stable springs with at least 12 mm clearance between springs and other members such as bolts and housing. Provide the following:

- Ratio of mean coil diameter to compressed length at the designated minimum static deflection:  $\geq$  0.8:1;
- Minimum travel to solid of at least 150% of the designated minimum static deflection;
- Levelling bolts and lock nuts;
- 5 mm neoprene acoustic isolation pads between base-plate and support;
- Vertical resilient limit stops: To prevent spring extension when unloaded, to serve as blocking during erection, and which remain out of contact during normal operation;
- Snubbing: Snub the springs to prevent bounce at start-up.

#### **Installation**

Set and adjust vibration isolation mounting supports to give adequate clearance for free movement of the supports.

#### **Inertia bases**

General: Use inertia bases with mass at least that of the equipment supported.

Construction: Steel, or steel-framed reinforced concrete. Position foundation bolts for equipment before pouring concrete.

Supports: Support on vibration isolation mountings using height saving support brackets.

### **3.8.14 METALWORK**

#### **General**

General: Use metalwork capable of transmitting the loads imposed, and sufficient to ensure the rigidity of the assembly without causing deflection or distortion of finished surfaces. Construct to prevent rattle and resonance.

Metal separation: Prevent contact between electrolytically dissimilar metals, by using concealed insertion layers.

#### **Fabrication**

Edges and surfaces: Keep clean, neat and free from burrs and indentations. Remove sharp edges.

### **3.8.15 WELDING AND BRAZING**

#### **Welding**

Steel: To AS 1554.1.

Aluminium: To AS 1665.

Stainless steel: Follow the recommendations of WTIA Technical Note 16.

### **Brazing**

General: Ensure brazed joints have sufficient lap to provide a mechanically sound joint. Do not use butt joints relying on the filler metal fillet only.

Filler metal:

- General: To AS 1170.1 as follows:
  - Copper-to-copper: Minimum 15% silver content;
  - Copper-to-brass: Minimum 34% silver content;
- Application: Ensure the brazing alloy wets all surfaces and fills the clearance between the overlapping parts.

## **3.8.16 SITE PAINTING**

### **General**

If exposed to view, paint new services and equipment including in plant rooms, except chromium, anodised aluminium, UPVC, stainless steel, non-metallic flexible materials and normally lubricated machined surfaces. Repaint proprietary items only if damaged.

### **Standard**

General: Comply with the recommendations of AS 2311 Sections 3, 6 and 7, or AS/NZS 2312 Sections 5, 8 and 10, as applicable.

### **Combinations**

Do not combine paints from different manufacturers in a paint system.

### **Protection**

Remove fixtures before starting to paint, and refix in position undamaged on completion.

### **Paint application**

Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur. Ensure each coat of paint or clear finish is uniform in colour, gloss, thickness and texture, and free of runs, sags, blisters, or other discontinuities.

### **Repair of galvanizing**

If galvanized surfaces have been cut or welded after galvanizing, prime the affected area using zinc rich organic binder to GPC C-29/16.

### **Paint systems table**

<b>Substrate</b>	<b>1st coat</b>	<b>2nd coat</b>	<b>3rd coat</b>	<b>4th coat</b>
Concrete	L-28	L-28	-	-
Iron and steel	P-32	U-16/1	E-15/3	E-15/3
Aluminium	P-35/4	U-16/1	E-15/3	E-15/3
Copper	C-29/2	C-29/2	E-24	E-24
Zinc-coated steel	P-13/4	U-16/1	E-15/3	-
Timber	P-18/1	U-16/1	E-15/3	E-15/3
Organic or inorganic zinc primed metal	U-16/1	E-15/3	-	-

## **3.8.17 COLUMNS**

### **Definition**

Fabricated columns more than 2400 mm high, designed to support accessories outdoors.

### **Design**

General: Provide columns designed, manufactured and tested by a specialist manufacturer.

Dimensions: To AS 1798.

### **Construction**

General: Galvanise columns and fittings after fabrication.

Bases: Provide columns with mounting bases for fixing to reinforced concrete footings.

Accessory mountings: Provide adjustable mountings, to suit accessories, and with provision for rigidly clamping each item in position, once adjusted correctly.

Maintenance access: Provide pole stirrups secured to either side of the column for access to accessories. Locate the first stirrup at least 3 m above ground level.

Electrical connections: Provide a recess at the base of the column for access to cable connections and equipment, fitted with a flush mounted cover. For connections higher than 3 m provide a catenary wire cable support system.

### **3.8.18 MARKING**

#### **General**

General: Mark equipment, electrical wiring, piping, valves, conduits and ducts, to provide a ready means of identification.

Piping, conduits and ducts: To AS 1345, as applicable.

#### **Labels**

Type: Select from the following:

- For indoor applications only, engraved two-colour laminated plastic;
- Engraved and black filled lettering on stainless steel or brass, minimum thickness 1 mm;
- Cast metal.

Label edges: If labels exceed 1.5 mm thickness, use radiused or bevelled edges.

#### **Minimum lettering heights**

Equipment nameplates: 40 mm.

Valve and pump identification: 20 mm.

Warning notices: 7 mm.

Automatic controls and electrical equipment: 5 mm.

Isolating switches: 5 mm.

Inside electrical enclosures: 3.5 mm.

Other: 3 mm.

#### **Location**

General: Locate labels so that they are easily seen and are either attached to, below or next to the item being marked.

Exposed locations: Use durable materials.

#### **Fixing**

General: Use mechanical fixing. Do not penetrate vapour barriers.

Valves and pumps: Screw fix to body or attach by key ring to valve handwheels.

#### **Contents**

General: Match terminology of work-as-executed drawings.

Valves and pumps: Correlate pumps to starters and valves.

#### **Conduit and Piping**

Identify throughout its length, including in concealed spaces.

#### **Electrical**

Mark operable control devices, indicators, isolating switches and outlets to provide a ready means of identification.

### **3.8.19 SPARES**

#### **General**

Schedule: At least eight (8) weeks before the date for practical completion, submit a Schedule of Spare Parts necessary for maintenance of the installation. State against each item the recommended quantity, and the manufacturer's current price, including for:

- Packaging and delivery to site;
- Checking receipt, marking and numbering in accordance with the spare parts schedule;
- Referencing equipment schedules in the operation and maintenance manuals;
- Painting, greasing and packing to prevent deterioration during storage.

#### **Cables**

At each ceiling-mounted accessory, provide 2 m spare cable attached to the accessory.

### **3.8.20 TOOLS**

#### **General**

General: At practical completion, provide two complete sets of special tools and portable indicating instruments necessary for operation and maintenance of equipment together with suitable means of identifying, storing and securing the tools and instruments. Include instructions for use.

### **3.8.21 COMMISSIONING**

#### **Reports**

Submit reports indicating observations and results of tests and compliance or non-compliance with requirements.

#### **Notice**

Give sufficient notice for inspection to be made of the commissioning of the installation.

#### **Starting up**

General: Coordinate schedules for starting up of various systems and equipment. Give 5 working days notice before starting up each item.

Checks: Before starting, verify that each piece of equipment has been checked for proper lubrication, drive rotation, belt tension, control sequence, circuit protection or for other conditions which may cause damage.

Tests: Verify that tests, meter readings, and specified electrical characteristics agree with those required by the manufacturer.

Wiring: Verify wiring and support components for equipment are complete and tested.

Manufacturers' representatives: Have authorised manufacturers' representatives present on site to inspect, check, and approve equipment or system installation prior to starting up, and to supervise placing equipment and operation.

Starting up: Execute starting up under supervision of manufacturers' representative and appropriate contractors' personnel, in accordance with manufacturers' instructions.

Report: Submit a report demonstrating that equipment has been properly installed and is functioning correctly.

#### **Circuit protection**

Confirm that circuit protective devices are sized and adjusted to protect installed circuits.

#### **Controls**

Calibrate, set and adjust control instruments, control systems and safety controls.

### **3.8.22 CLEANING**

#### **General**

At practical completion, clean the following:

- Luminaires. Relamp luminaires used during construction;
- Insides of switchgear and controlgear assemblies;
- Switchgear and contactors, and other electrical contacts. Adjust as necessary.

### **3.8.23 MAINTENANCE**

#### **General**

General: During the maintenance period, carry out periodic inspections and maintenance work as recommended by manufacturers of supplied equipment, and promptly rectify faults.

Emergencies: Attend emergency calls promptly.

#### **Maintenance program**

Submit details of maintenance procedures and program, relating to installed plant and equipment, 6 weeks before the date for practical completion. Indicate dates of service visits. State contact telephone numbers of service operators and describe arrangements for emergency calls.

#### **Site control**

Report to the Principal's designated representative on arriving at and before leaving the site.

#### **Maintenance records**

General: Submit, in binders which match the manuals, loose leaf log book pages designed for recording completion activities including operational and maintenance procedures, materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed log book pages recording the operational and maintenance activities performed up to the time of practical completion.

Number of pages: The greater of 100 pages or enough pages for the maintenance period and a further 12 months.

Certificates: Include test and approval certificates.

Service visits: Record comments on the functioning of the systems, work carried out, items requiring corrective action, adjustments made and name of service operator. Obtain the signature of the Principal's designated representative.

Referenced documents: If referenced documents or technical sections require that log books or records be submitted, include this material in the maintenance records.

Certification: On satisfactory completion of the installation, submit certificates stating that each installation is operating correctly.

#### **4. SUPPLY AND METERING**

##### **4.1 GENERAL**

The electrical supply network for the Assisi Centre Redevelopment consists of a new Jemena high voltage kiosk type substation with incoming high voltage feeders originating from a Jemena high voltage pole in Rosanna road.

The Electrical supply for relocated Laseter House will be provided under a separate contract.

The Jemena head work charges will be paid by the Principle.

The requirements for the electrical metering consists of:

- Electricity Retailer Energy Metering;
- Proprietor Energy Consumption Metering.

##### **Electricity Retailer Energy Metering**

The final Electricity Retailer has not been ascertained. The Contractor shall allow to supply and install all metering equipment and pay all charges and costs relating to the provision and connection of the metering..

The supply tariffs will be ascertained with the Electricity Retailer and Jemena.

The Contractor shall allow for all interconnecting cabling for the metering connections.

The Contractor shall allow to install all electrical metering equipment (CT chambers, meter panels and CT's).

##### **Proprietor Energy Metering**

Proprietor energy metering (sub-metering) shall be provided as indicated on the schematics to provide power record of the demand usage for the installation.

##### **4.1.1 CROSS REFERENCES**

###### **General**

Comply with:

- 'General Requirements' and the 'General Electrical Services Requirements' section; and
- Victorian Service and Installation Rules.

##### **4.1.2 STANDARD**

###### **Meter panels**

To AS 1759.

###### **Meters**

To AS 1284 where applicable.

###### **Current transformers**

To AS 1675 where applicable.

###### **Interpretation**

Electricity Distribution Company: Franchise company responsible for the delivery of electricity to the site.

Electricity Retailer: Company nominated by the Principal for the retail supply of electricity (metering).

###### **Phase rotation**

Red/White/Blue and check with supply company.



## **4.2 SUPPLY**

### **4.2.1 SUPPLY SOURCE**

#### **Cable /Outdoor Substation**

Capacity: 1.5 MVA Initial, 2.0 MVA Future

Fault level: 40 KA Initial, 49 KA Future at 5.24% and 5.69% Impedance respectively

Supply system: 415/230V 3-phase, 4-wire 50Hz.

Point of attachment: Low voltage isolator in Jemena substation.

### **4.2.2 ELECTRICITY SUPPLY**

Jemena will reticulate and connect new HV and LV cabling to a new 1.5MVA kiosk type substation located as shown on the site plan.

The contractor shall provide the following:

- Underground lead-in conduits between the site boundary and substation installed in accordance with Jemena requirements, specifications and drawings available from the Builder.
- All associate civil works including trenching, backfill and reinstatement of trenches for the installation of the underground conduits.

The contractors shall co-ordinate the final location and alignment of the conduits with other in ground services and associated civil works, including with Jemena and the Superintendent.

### **4.2.3 SUBSTATION**

The contractor shall coordinate with Jemena for the provision and connection of a new 1.5MVA kiosk type substation located as shown on the site plan. The substation will supply the new and existing aged care facility including the existing convent, nurses home and mobile communications tower.

Jemena will make available from their LV switchboard in the substation one LV supply rated at 1.5MVA. 400volts, 50Hz.

The contractor shall coordinate with the Builder for the construction of a substation easement in accordance with Jemena drawings, specifications and requirements.

The contractor shall provide and connect a temporary hired 300KVA mobile generator to supply the existing site main switchboard during supply disruptions and supply changeover from the existing Assisi Centre supply to the Jemena substation supply.

The contractor shall take note of section 1.11 "Disruption to Existing Services" prior to disconnecting the existing Assisi Centre supply.

## **4.3 ELECTRICAL INSPECTIONS**

#### **General**

Both the prescribed and non-prescribed works shall be inspected and certified by an independent electrical inspector registered by the Office of the Chief Electrical Inspector for the class of works being undertaken.

The electrical inspector shall:

- Prepare and submit monthly reports throughout the construction period ensuring compliance of the electrical installation with all relevant Australian Standards;
- Review shop drawings prior to submission to the consultant;
- Witness testing of electrical plant, including switchboards, standby generators, UPS systems;
- Earth continuity and resistance tests;
- Circuit continuity and insulation resistance tests;
- Connections and polarity tests;

- Confirm circuit load and cable sizes;
- Confirm projection co-ordination.

**Inspector**

Obtain the services of and pay all associated fees and charges, one of the following electrical inspection companies.

- Electrical Inspection & Certification Pty Ltd (Phone: 9431 3148).

#### **4.4 METERING**

##### **4.4.1 ELECTRICITY SUPPLIER**

**General**

Arrange for the disconnection and removal of the existing Electricity Retailer energy meter from the existing site main switchboard at the appropriate stage of the works.

Coordinate with the Electricity Retailer for the provision and connection of a new electricity energy (smart) meter installed on a wall mounted meter panel within the new site main switch room. The meter shall be provided with a digital pulse output.

Provide a wall mounted meter panel, isolation facilities and connections.

Collect the metering CT's from Jemena and install them into the new site main switch board.

Provide and connect all necessary wiring enclosed in conduit between the CT's and the meter panel.

Final metering connections shall be coordinated with the Electricity Retailer.

The installation shall be in accordance with the Victorian Service and Installation Rules and the Electricity Retailer requirements.

Where remote meter reading by the electricity retailer is required. Provide a telephone outlet adjacent to each metering point for remote data transfer. Provide a conduit/cable interface between all metering points.

**Costs**

Pay all costs associated with the provision of electrical meters for the following services:

- Proprietor light and power meters.

**Meter panels**

Dimensions and locations: To suit the proposed metering configuration. Ensure adequate clear space in front of the panel to Distribution Company's requirements.

Special: Pre-drill hinged panels and pre-wire as required to suit the proposed Distribution Company's equipment.

##### **4.4.2 PROPRIETOR'S SUB-METERING**

**Main switchboards**

- Proprietors sub-meters shall be provided in the site main switchboard SMSB and main distribution board MDBI as detailed on the schematics;
- Sub-meters shall be NHP NEMO 72 LRS 485, or equal;
- The sub-meters shall be interfaced with a monitoring PC installed in the main communications room;

- The sub-meters shall be capable of providing both instantaneous and maximum demand figures for the following functions:
  - W, VA, VAR;
  - Voltage;
  - Current;
  - Phase Angle;
- The maximum demand shall be time dependent;
- A software management package capable of being installed on the PC shall be provided to manage the results.

## **5. EARTHING**

### **5.1 GENERAL**

The scope of the earthing works contained in this Contract shall be:

- Provision of earth stakes and connections;
- Earthing of all cable ways and accessories installed in this Contract;
- Provision of earthing cables with the submain cables as scheduled.

#### **5.1.1 CROSS REFERENCES**

##### **General**

Comply with the 'General Requirements' and the 'General Electrical Services Requirements' sections.

##### **Block cabling**

Refer to 'Telecommunications Wiring' section.

##### **Testing and Commissioning**

Requirement: Comply with 'General Requirements' section.

##### **Standards**

Power system earthing: Multiple Earth Neutral to AS 3000 and Victorian Service and Installation Rules.

### **5.2 MAIN EARTHS**

#### **5.2.1 EARTHING SYSTEMS**

##### **Configuration**

Clarify method of substation earthing with the Electricity Company and provide interconnections.

#### **5.2.2 GENERAL**

Construction: Driven electrode(s) connected to the earth terminal bar in the main switchboard by means of PVC insulated stranded copper earthing cable.

Earth stakes: 'Copperweld' or 'Acelex' copper clad steel stakes, generally 25 mm diameter x 2000 mm long. Do not use aluminium earth stakes.

(Note: In corrosive soil conditions use stainless steel. Check with Structural Engineer during design stage for soil report.)

Connection: Connect earth stakes using approved clamps to the earthing conducts. Make connections in pits, or as required by the Electricity Company.

Pit lids: Heavy duty steel engraved with red filled lettering 'Main Earth - Do Not Disconnect'.

Bonding: Connect incoming metallic mains water pipes for hydraulic and fire services and the incoming gas mains to the main earth bar in the main switchboard.

Separation: Separate HV and LV and space earth electrodes to the Electricity Company's approval.

#### **5.2.3 INSTALLATION**

Ensure earth stake(s) terminations are positioned in a permanently visible location.

In corrosive soils, place each earthing electrode in a 200 mm bore hole and backfill with vibrator compact conductive grouting compound (Non-porite Metalox, or equal). Determine whether soil is corrosive.

Where rock is encountered place each earthing electrode in a 200 mm bore hole and backfill with a vibrator compacted conductive grouting compound (Non-porite Metalox, or equal).

Record main earth stake location on as-built drawings.

### **5.3 TESTS**

Testing: Submit an earth resistance test report to the Consulting Engineer detailing the testing of the earth resistance and the results of that test. If the measured earth resistance is outside specification provide recommendations for additional earthing to reduce the resistance.

Test point: Measure earth resistance from main earth bar.

### **5.4 EARTHING TERMINAL BARS**

Provide earthing terminal bars. Braze all connections between the equipment and the bars.

### **5.5 SWITCHBOARDS**

Earth all switchboards by means of earthing cables or sheaths submain cable unless specified otherwise. Install an earth conductor with the respective cables where PVC/PVC cabling or PVC building wire is used.

Effectively earth all metal work in the vicinity of switchboards. Do not earth equipment via a neutral bus of the neutral earth connection.

### **5.6 CABLING ACCESSORIES AND APPLIANCES**

#### **5.6.1 EARTHING**

Earth light fittings, socket outlets and fixed wiring to appliances by means of the earth conductor which forms part of the respective circuit cabling.

Use a separate earthing conductor for each circuit.

Run earthing conductors back to the earth bar within the switchboard from where the supply originated.

Earth all exposed metal fittings, e.g. cable trays, ducts, etc. associated with the electrical services. Earth all metal to which electrical services outlets are fixed, e.g. metal wall studs, skirting wiring duct. Ensure earth continuity is maintained.

Earth exposed metallic pipes for gas or water within 2m of GPOs or electrical equipment. Conceal the earth wiring in partition walls or in conduits in rendered walls.

### **5.7 TELECOMMUNICATIONS SYSTEM EARTHS**

Install an independent earth for the telecommunications systems including an earthing electrode and pit, equivalent to the power earth and appropriately labelled.

Install a 50 mm<sup>2</sup> copper, stranded, PVC insulated earthing conductor from the pit to the data system control panel.

### **5.8 COMPUTER EQUIPMENT EARTH**

Install an independent earth for computer equipment including an earthing electrode and pit, equivalent to the power earth appropriately labelled.

### **5.9 INTERCONNECTION OF EARTH PITS**

Interconnect all independent earth pits, excluding those installed for high voltage or lightning protection systems with a 50mm<sup>2</sup> copper, stranded, PVC insulated conductor drawn into a 25 mm PVC conduit.

Terminate to the stake in each pit, in such a manner, that it can be disconnected without affecting the system earth, should the Electricity Company concerned permit.

Clearly, permanent and separately label the interconnecting conductor.

#### **5.10 MAINTENANCE**

Undertake inspections on the integrity of the earthing system on a 12-monthly basis.

## **6. SWITCHBOARDS**

### **6.1 GENERAL** **Scope of Works**

The main facilities for the provision of new switchboards are indicated on the drawings and schematics.

The scope includes:

- Supply, installation and connection of a new site main switchboard SMSB.
- Supply, installation and connection of a main distribution board MDBI.
- Supply, installation and connection of distribution boards DBI, DB2, DB4, DB5, DB6, DB7, DB8, DB9, DB10, DBCR and DBSR.
- Upgrade of existing distribution board DB3.
- Supply, installation and connection of a weatherproof (IP56) enclosure for the mobile generator isolator and connections.
- Supply, installation and connection of a weatherproof (IP56) enclosure for the mobile generator stop/start wiring terminals and connections.
- The layout plans for the electrical distribution system has been detailed. The Contractor shall verify whether the allowances are adequate and adjust the design until the spatial allowances can be attained.
- Submit full discrimination and protection curve details including Jemena HV and LV equipment setting requirements in the substation.

The functionality of the electrical distribution system is as follows:

- There is no permanent standby generation plant proposed.
- The facility for the connection of a manually operated temporary generator will be required
- Jemena metering facilities will be required.
- Surge diverter equipment shall be provided.
- Power factor correction monitoring CT shall be provided in SMSB.
- The contractor shall liaise with Jemena to achieve discrimination with the switchgear installed upstream of SMSB and all switchgear installed downstream of SMSB.

The site main switchboard SMSB has been designed and arranged for the connection of a temporary manually operated mobile generator to supply the essential services (safety services), general light and power including hydronic heating for the Assisi Centre upon failure of the normal mains supply. It is not proposed to connect the air conditioning to the generator.

When the generator is connected, manual load shedding and changeover from normal mains supply to generator supply and vice versa will be necessary upon failure and restoration of the mains supply respectively. Manual isolation and testing facilities shall also be provided.

The switchboards have been designed based on NHP Terasaki switchgear. The contractor shall co-ordinate with NHP Mark Daniell (Mobile: 0418 582 442) for the detailed technical requirements for the design of the switchboards.

#### **6.1.1 CROSS REFERENCES**

##### **General**

Comply with the 'General Requirements' and the 'General Electrical Services Requirements' sections.

#### **6.1.2 STANDARD**

##### **General**

To AS 3439.1.

### 6.1.3 INTERPRETATIONS

#### Definitions

Proprietary assemblies: Low voltage switchgear and control-gear assemblies available as a catalogue item, consisting of manufacturer's standard layouts and equipment.

Custom-built assemblies: Low voltage switchgear and control-gear assemblies manufactured to order.

Rated currents: Rated currents are continuous uninterrupted current ratings within the assembly environment under in-service operating conditions.

#### Abbreviations

TTA: Type tested assemblies.

NTTA: Non-type tested assemblies.

PTTA: Partially type tested assemblies.

### 6.1.4 DESIGN

#### Design Schedule

The attached schedule represents the design criteria for all switchboards.

<b>AS 3439 Requirements</b>			
<b>Clause</b>	<b>Item</b>	<b>Main Switchboards SMSB &amp; MDBI Requirements</b>	<b>Distribution Switchboards Requirements</b>
4.7	Rated diversity factor	In accordance with Table 1	In accordance with Table 1
6.2	Special Service Conditions	Nil	Nil
6.2.10	Electrical and radiated interference	Shall comply with AS 4251.1	Shall comply with AS 4251.1
7.2.1.1	Degree of protection	IP41 IP56 for outdoor use	IP41 for indoor use IP56 for outdoor use IP42 for plant rooms
7.4.2	Protective measure against direct contact with live parts	7.4.2.1, by insulation or 7.4.2.2, by barriers or enclosures as appropriate 7.4.3.1, by using protective circuits	7.4.2.1, by insulation or 7.4.2.2, by barriers or enclosures as appropriate 7.4.3.1, by using protective circuits
7.4.3	Protective measure against indirect contact with exposed conductive parts	7.4.3.1 by using protective circuits	7.4.3.1 by using protective circuits
7.4.6	Accessibility in service by authorised personnel	For all operations specified in clause 7.4.6.1	For all operations specified in clause 7.4.6.1
7.4.6.2	Accessibility for maintenance	Refer to 'Form' requirements	Refer to 'Form' requirements
7.5.2	Prospective short circuit current	50 kA for 1 second	18 kA for 1 second
7.5.4	Co-ordination of short circuit protective devices	In accordance with manufacturer's data. Fault current limiters	In accordance with manufacturer's data. Fault current limiters
7.7	Form of segregation	Form 3B	Form 1
7.9.1	Input voltage variations	As per clause 7.9.2	As per clause 7.9.1



#### AS 3439 Requirements

Clause	Item	Main Switchboards SMSB & MDBI Requirements	Distribution Switchboards Requirements
8.3.1	Repetition of electrical routine tests on site.	All routine tests (8.3.1 to 8.3.4) shall be performed at the manufacturer's premises prior to shipping and on site upon completion of installation and connection.	All routine tests (8.3.1 to 8.3.4) shall be performed at the manufacturer's premises prior to shipping and on site upon completion of installation and connection.

#### Site / Installation Details

No.	Item	Main Switchboards SMSB & MDBI Requirements	Distribution Boards Requirements
1	Location of enclosure	Indoors Indoor, refer to drawings	Indoors/outdoors refer to drawings
2	Mounting	Floor mounted free standing back connected SMSB. Front connected MDBI	Wall mounted front connected
3	Environmental conditions	Maximum ambient temperature 40°C	Maximum ambient temperature 40°C
4	Cable entry locations	Top entry. Top/bottom exit To suit site conditions	Top/bottom entry Top/bottom exit
5	Ventilation	Natural ventilated and switchboards located inside in ventilated or air-conditioned room	DSB located inside in poorly ventilated cupboards
6	Busbar temperature rise	50°C maximum	35°C maximum
7	Control devices and equipment	De-rate to manufactures recommendations to achieve specified performance criteria under design operating conditions.	

#### Layout

An indicative layout plan is detailed on the drawings. The Contractor shall verify at the time of tender, that the spatial allowances are adequate and make all due allowance to fit the switchboards into the space provided.

Position equipment in accordance with the manufacturer's recommendations to provide safe and easy access for operation and maintenance and to avoid imposing undue thermal effect on adjacent equipment. De-rate system componentary as necessary to suit method of installation and proximity to other equipment. Consider functional relationships between items of equipment in the laying out of equipment on the assembly.

#### Service conditions

Normal service conditions.

#### Rated currents

Rated currents: Minimum continuous uninterrupted rated currents within the assembly environment, under in-service operating conditions.

#### Fault levels

Rated short-circuit currents: Maximum prospective symmetrical rms current values at rated operational voltage, at each assembly incoming supply terminal, excluding effects of current limiting devices.

Assembly short-circuit capacity characteristic: Rate main circuit supply and functional units as follows:

- Back-up protective device not provided: Rated short-circuit current for 1 s;
- Back-up protective device provided: Rated short-circuit current for the maximum opening time of the associated protective device.

Tested levels: Do not use equipment at fault levels higher than tested levels, unless provided with fault current limiting back-up protection.

### **Separation**

The main switchboards shall be constructed to a Form 3B standard as modified below.

Each subsection of the main switchboard shall be compartmentalised from other subsections.

Subsections of the main switchboard are:

- Unmetered tenancies;
- Proprietor fire and lift services;
- Proprietor light and power.

Separate compartments shall be provided to all moulded case circuit breakers rated greater than 400 Amps.

For all other moulded case circuit breakers: Mount <4 functional units within a common separated subsection.

The temporary generator connection facility shall be installed within a separate compartment.

All outgoing cables shall be fully shrouded.

Moulded case or miniature overcurrent circuit breakers rated up to 100 A, connected to circuits for lighting, general purpose outlets and small single or multi-phase electrical accessories. Mount any number of circuit breakers within a Form 1 separated subsection, provided the circuit breakers are mounted on an approved multi-pole busbar chassis assembly, concealed with an escutcheon panel and removable door.

### **Spare facilities**

Provide spare equipment capacity including busbar assemblies and wiring accessories.

### **Mounting**

Floor mounted: Main switchboard and all assemblies with frontal area  $\geq 2\text{m}^2$ .

Wall mounted: Front access assemblies with frontal areas  $< 2\text{m}^2$ .

## **6.1.5 ELECTRICITY RETAILER**

### **Electricity Retailer's equipment**

General: Refer section 4.4 for requirements.

## **6.2 QUALITY**

### **6.2.1 INSPECTION**

#### **Notice**

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

- Fabrication and painting completed;
- Factory assembly completed, with busbars exposed and functional units assembled;
- Assembly ready for routine testing and dispatch;
- Assembly installed and connected;
- Acceptance.

## **6.2.2 PRE-COMPLETION TESTS**

### **Type tests**

To AS 3439.1.

Testing facility: Accredited by NATA or registered with the Association of Short-Circuit Testing Authorities (ASTA).

### **Production tests**

Carry out the following tests:

- Assemblies: Electrical and mechanical routine function tests at the factory using externally connected simulated circuits and equipment;
- Residual current devices: Test using apparatus which displays the trip current and trip time of each device;
- Dielectric testing:
  - NTTAs and PTTAs: 2.5 kV r.m.s. for 60 s;
- Functional testing: Operate mechanical devices, relays, programmable logic controllers and logic controls, protection, interlocking and alarm equipment;
- Protection relays: Primary current injection tests or, if approved, secondary current injection tests, to verify time/current characteristics and settings.

### **Site tests**

Carry out secondary current injection tests on adjustable trip circuit breakers after installation and before energisation, to verify time/current characteristics and settings.

## **6.2.3 CONTRACTOR'S SUBMISSIONS**

### **General**

Submit type test certificates for components, functional units and assemblies including internal arcing-fault tests and factory test data.

### **Calculations**

General: Submit detailed certified calculations verifying design characteristics.

Standard: To AS 3865 and IEC 890.

### **Type test data**

General: Verify that type tests and internal arcing-fault tests, if any, were carried out at not less than the designated fault currents at rated operational voltage.

Alterations to TTAs: Submit records of alterations made to assemblies since the tests.

### **Product data for proprietary assemblies**

Submit the following:

- Types and model numbers of items of equipment;
- Overall dimensions;
- Fault level;
- IP rating;
- Rated current of components;
- Number of poles and spare capacity;
- Mounting details;
- Door swings;
- Paint colours and finishes;
- Access details;
- Schedule of labels.

### **Shop drawings of custom-built assemblies**

Submit shop drawings showing:

- Types, model numbers and ratings of assemblies;
- Component details, functional units and transient protection;
- Detailed dimensions;
- Shipping sections, general arrangement, plan view, front elevations and cross-section of each compartment;
- Projections from the assembly that may affect clearances or inadvertent operation, such as handles, knobs, arcing-fault venting flaps and with drawable components;
- Fault level and rated short circuit capacity characteristics;
- IP rating;
- Fixing details for floor or wall mounting;
- Front and back equipment connections and top and bottom cable entries;
- Door swings;
- External and internal paint colours and paint systems;
- Quantity, brand name, type and rating of control and protection equipment;
- Construction and plinth details, ventilation openings, internal arcing-fault venting and gland plate details;
- Terminal block layouts and control circuit identification;
- Single line power and circuit diagrams;
- Details of mains and submain routes within assemblies;
- Busbar arrangements, links and supports, spacing between busbar phases, and spacing between assemblies, the enclosure and other equipment and clearances to earthed metals;
- Dimensions of busbars and interconnecting cables in sufficient detail for calculations to be performed to AS/NZS 3008.1.1, AS 3768 and AS 3865;
- Internal separation and form of separation and details of shrouding of terminals;
- Labels and engraving schedules.

## **6.3 PROPRIETARY ASSEMBLIES**

### **6.3.1 GENERAL Modifications**

Carry out to the original manufacturer's standards and methods of construction.

#### **Doors**

Provide lockable doors with a circuit card holder.

## **6.4 CUSTOM-BUILT ASSEMBLIES**

### **General**

Provide rigid, ventilated, insect-screened enclosures consisting of panels, doors, or both, giving the designated enclosure, separation and degree of protection.

### **TTAs and PTTAs**

Use construction methods verified by required tests to at least the nominated fault level and temperature-rise limits and internal arcing-fault containment and venting.

### **NTTAs**

Fabricate from sheet metal of rigid folded and welded construction. Obtain approval for non-welded forms of construction.

### **Layout**

Compartments: Separate shipping sections, subsections, cable and busbar zones, functional unit modules and low voltage equipment compartments using vertical and horizontal steel partitions which suit the layout and form of separation.

Form 1 enclosures: Separate into compartments using partitions at 1.8 m maximum centres.

Equipment mounting heights above floor to the centre line of the equipment:

- Toggles and handles of circuit breakers, fused switch units and isolators:
  - Wall mounted assemblies: 500 - 900 mm;
  - Floor mounted assemblies: 200 - 1900 mm;
- Control switches, indicating lights, meters and instruments on doors:
  - Wall mounted assemblies: 1 - 1.7 m;
  - Floor mounted assemblies: 200 - 1800 mm;
- Push-button emergency switching devices: 800 - 1600 mm.

Equipment on doors: Set out in a logical manner in functional unit groups, so it is accessible without the use of tools or keys.

### **Enclosures**

Steel enclosures:

- General: Minimum 1.6 mm thick zinc-coated sheet steel, coating class Z200.
- Outdoor assemblies: Coating class Z450.

### **Insect proofing**

Cover ventilation openings using non-combustible and non-corroding 1 mm mesh.

### **Equipment mounting panels**

General: Strong enough to support the weight of mounted equipment. Construct using minimum 3 mm thick metal or non-metallic board with heavy metal angle supports or plates bolted or welded to enclosure sides.

Non-metallic boards: To AS 1795.1.

Front accessible cable zones: 450 mm minimum width.

### **Equipment fixing**

Spacing: Provide sufficient thermal, mechanical and electrical clearance between equipment to ensure proper functioning. Provide 50 mm minimum clearance between:

- Busbars for lifts, fire services and building emergency services; and
- General installation services, busbars and equipment.

Mounting: Use bolts, set screws fitted into tapped holes in metal mounting panels, studs or proprietary attachment clips. Provide accessible equipment fixings which allow equipment changes after assembly commissioning.

Installation: For lightweight equipment, use combination rails and proprietary clips.

### **Earth continuity**

Effectively bond equipment and assembly cabinet metal frame to the protective earth conductor. Strip painted surfaces and coat with corrosion resistant material immediately before bolting to the earth bar. Provide serrated washers under bolt heads and nuts at painted, structural metal-to-metal joints.

### **Lifting provisions**

For assemblies with shipping dimensions exceeding 1.8 m high x 600 mm wide, provide fixings in the supporting structure and removable attachments for lifting.

### **Supporting structure**

Provide concealed fixings or brackets to allow assemblies to be mounted and fixed in position without removing equipment.

**Wall-mounting**

Reinforce at bolt holes. For flush or semi-flush assemblies, provide angle trims of the same material and finish as the enclosure.

**Floor-mounting**

Provide mild steel channel plinth, galvanized to class Z600, with toe-out profile, nominal 75 mm high x 40 mm wide x 6 mm thick, for mounting complete assemblies on site. Drill M12 clearance holes in assembly and channel and bolt assemblies to channel. Prime drilled holes using zinc rich organic binder to GPC-C-29/16.

**6.5 CABLE ENTRIES****General**

Provide cable entry facilities within assembly cable zones for incoming and outgoing power and control cabling. Provide sufficient clear space within each enclosure next to cable entries to allow incoming and outgoing cables and wiring to be neatly run and terminated, without undue bunching and sharp bends.

**Main switchboards**

All cables shall be supported via either cable trays or cable channels.

**Distribution boards**

Cables supported by PVC channel ducting. Locate earth/neutral busbars to minimise cable lengths in switchboards. Preferably at the top or bottom of the board, not alongside the circuit breakers.

**Cover and gland plates**

Cover plates: Provide 150 mm maximum width cover plates butted together and covering the continuous cable entry slot.

Gland plates: Provide removable gland plates fitted with gaskets to maintain the degree of protection.

Materials: 1.5 mm thick steel, 5 mm thick composite material or laminated phenolic. Use 6 mm thick brass for MIMS cables and cable glands.

**6.6 DOORS AND COVERS****Width**

Maximum: 900 mm.

**Door swing**

At least 90°.

**Door stays**

General: Provide stays to outdoor assembly doors.

Adjacent doors: Space adjacent doors to allow both to open to 90° at the same time.

**Construction**

Provide single right angle return on all sides and fit suitable resilient sealing rubber to provide the degree of protection and prevent damage to paintwork.

**Hanging**

Provide corrosion-resistant pintle hinges or integrally constructed hinges to support doors. For removable doors, provide staggered pin lengths to achieve progressive engagement as doors are fitted. Provide 3 hinges for doors higher than 1 m. Provide restraining devices and opposed hinges for non lift-off doors.

#### **Door hardware**

Provide the following:

- Corrosion-resistant lever-type handles, operating a latching system with latching bar and guides strong enough to withstand explosive force resulting from fault conditions within the assembly;
- Dual, edge mounted, corrosion-resistant "T" handles with provision for key locking cylinder;
- Captive, corrosion-resistant knurled thumb screws.

#### **Locking**

General: Incorporate cylinder locks in the latching system. Key alike.

Number of keys: 2 per assembly.

#### **Door mounted equipment**

Protect or shroud door mounted equipment and terminals to prevent inadvertent contact with live terminals, wiring, or both.

#### **Earthing**

Maintain earth continuity to door mounted indicating or control equipment using multi-stranded, flexible earth wire, or braid of equal cross-sectional area, bonded to the door.

#### **Covers**

Maximum dimensions: 900 mm wide and 1.2 m<sup>2</sup> surface area.

Fixing: Fix to frames using at least 4 fixings. Provide corrosion-resistant acorn nuts if the cover exceeds 600 mm in width. Rest cover edges on the cubicle body or on mullions. Do not use interlocked covers.

Handles: Provide corrosion-resistant "D" type handles.

#### **Escutcheons**

For doors enclosing circuit breakers, provide escutcheon plates as barriers between operating mechanisms and live parts.

#### **Escutcheon plates**

General: Provide plates or removable covers with neat circuit breaker toggle cut-outs allowing interchangeability of 1, 2 and 3 pole circuit breakers. Provide corrosion-resistant lifting handles or knobs. Provide unused circuit breaker toggle cut-outs with blanking in-fill pole covers.

Maximum dimensions: 900 mm wide and 1.2 m<sup>2</sup> surface area.

### **6.7 FACTORY FINISHES**

#### **Extent**

Apply protective coatings to internal and external metal surfaces of assembly cabinets including covers, except to stainless steel, galvanized, electroplated, or anodised surfaces and to ventilation mesh covers.

#### **Finish coats**

Thermoset powder coating or 2-pack liquid coating.

#### **Paint colours**

Standard: To AS 2700.

**Colours:**

- Indoor assemblies : Beige.
- For the main switchboard, the following additional colours shall be painted on the main switchboard cover doors to distinguish different sections of the switchboard:
  - Unmetered tenancies : Orange
  - Fire and essential mechanical ventilation : Red
- Outdoor assemblies: : Avocado green G34.
- Removable equipment panels: : Off white Y35.
- Assembly interior: : White.

## **6.8 BUSBARS**

**General**

Provide main circuit supply busbars within assemblies, extending from incoming supply terminals to the line side of protective equipment for outgoing functional units and for future functional units.

**Standards**

To AS 3768, AS 3865 and IEC 890.

**Definitions**

Incoming busbars: Busbars connecting incoming terminals to line side terminals of main switches.

Main circuit supply busbars: Busbars connecting incoming functional unit terminals, or incoming busbars where no main switches are included, to outgoing functional unit terminals or outgoing functional unit tee-offs.

Tee-off busbars: Busbars connecting main busbars to incoming terminals of outgoing functional units.

**Material**

Hard-drawn high-conductivity electrolytic tough pitched copper alloy bars, designation 110.

**Temperature rise limits - active and neutral conductors**

Maximum rated current temperature rise limits:  $50 \pm 1.5^{\circ}\text{C}$  by type test or calculation to AS 3768 or IEC 890.

Maximum short-circuit withstand current temperature rise limits:  $160^{\circ}\text{C}$  by calculation to AS 3865.

**Cross section**

Rectangular with radiused edges.

**Supports**

General: Sufficient to withstand thermal and magnetic stresses due to maximum prospective fault currents.

Material: Non-hygroscopic insulation capable of holding busbars at  $105^{\circ}\text{C}$ .

Provide insulating barriers, or busbar insulation to all busbars penetrating horizontal barriers.

**Phase sequence**

For main busbars and connections to switching devices, set-out phase sequence for phases A, B and C, from left-to-right, top-to-bottom and back-to-front when viewed from the front of the assembly.

**Colour coding**

General: Provide 25 mm minimum width colour bands permanently applied to busbars at 500 mm maximum intervals with at least one colour band for each busbar section within each compartment.

Active busbars: Red, white and blue respectively for the A, B and C phase.

Neutral busbar: Black

MEN link: Green-yellow and black.

Protective earth busbar: Green-yellow.

Restrictions: Do not use adhesive type colour bands.



### **Busbar systems**

Use multi-pole proprietary busbar assemblies or busbar systems, which have been verified for short circuit capacity and temperature rise-limits by type tests.

Use 4-pole busbar systems for all main busbar zones with neutral busbars of an equivalent size to the phase busbars. Phase and neutral busbars shall be housed in the same metallic enclosure.

Neutral bars shall follow the outgoing circuit protective devices to minimise eddy currents.

### **Current carrying capacity**

Active conductors: Take into account thermal stresses due to short circuit current, assuming magnetic material enclosures located indoors in well-ventilated rooms and 90°C final temperature.

Neutral conductors: Size to match incoming neutral conductor current carrying capacity.

Protective earth conductors: Size for at least 50% of the rated short circuit withstand current for 100% of the time duration.

### **Tee-off busbars current rating**

For individual outgoing functional units: Equal to maximum frame size rating of the functional unit.

For multiple functional units: Equal to the diversity factors of AS 3439.1, based on frame size rating.

### **MEN links**

MEN links > 10 mm<sup>2</sup> in section: Bolted removable busbar links stamped "MEN LINK", located in the incoming compartment, between neutral and earth busbars.

### **Fault current limiters**

Rate busbars connected to fault current limiters to 100% of the indicated fault current limiter circuit breaker frame size or fuse base rating.

### **Busbar links**

For current transformers, provide removable busbar links ≤ 450 mm long.

### **Cable connection flags**

General: Provide and support busbar flags for equipment with main terminals too small for cable lugs. Use flags sized to suit cable lug termination, with current rating of at least the maximum equipment frame size.

Phase isolation: Provide phase isolation between flags where the minimum clearance distances phase-to-phase and phase-to-earth are below the component terminal spacing.

### **Future extensions**

Pre-drill the main circuit supply busbar for future extensions and extend busbar droppers into future functional unit locations.

### **Jointing**

Use high tensile steel bolts, washers and nuts, with lock nuts or locking tabs. Do not use tapped holes and studs or the like for jointing current carrying sections.

### **Busbar insulation**

Active and neutral busbars and joints: Select from the following:

- Polyethylene: At least 0.4 mm thick with dielectric strength of 2.5 kV rms for 1 min, applied by a fluidised bed process in which the material is phase coloured and directly cured onto the bars;
- Close fitting busbar insulation mouldings at least 1 mm thick;
- Heat shrink material: Use only on rounded edge busbars.

Taped joints: Apply non-adhesive stop-off type tape, coloured to match adjacent insulation and half lapped to achieve a thickness at least that of the solid insulation.

Damaged insulation: Repair damaged insulation before energising.

## **6.9 MAIN SWITCHES**

### **6.9.1 SWITCH-ISOLATOR AND COMBINATION FUSE-SWITCH UNITS**

#### **Standard**

To AS 3947.3.

#### **Type**

Poles: 3.

Rated current: To suit unit installed in enclosure.

#### **Rated fault capacity**

Short circuit making capacity: At least the fault level at assembly incoming terminals.

Breaking capacity: At least the rated full load current.

#### **Utilisation category**

Circuits consisting of motors or other highly inductive loads: At least AC-23.

Other circuits: At least AC-22.

#### **Rated duty**

Uninterrupted in non-ventilated enclosure.

#### **Operation**

Independent manual operation including positive "ON/OFF" indicator.

#### **Locking**

Provide for padlocking in the "OFF" position.

#### **Handles**

Removable only when switch is in open position.

#### **Construction**

General: Either

- Totally enclosed; or
- With full and direct shrouding to fixed live parts of switches and fuses, so that insertion of a screwdriver does not cause faults between phases.

Shrouding: Effective over range of air break switch positions.

Incorporate the following:

- Earthing terminal;
- Neutral link mounted within unit;
- Contact position clearly indicated whether cover is in place or not. For fuses mounted in withdrawable carriage ensuring isolation from supply before access to fuses is possible, secondary indication may be omitted.

#### **Fuse-switch units**

General: Provide an extended operating handle, at least 100 mm above the floor, which remains clear of other equipment over the range of positions.

Fuse links: Isolated when switch contacts are open. Provide 3-phase sets of high rupturing capacity (HRC) fuse links.

#### **Label**

Label the CFS to indicate fuse and frame sizes.

## **6.10 AUTO-TRANSFER SWITCHES**

### **Standard**

To AS 3639.1.

### **Type**

3-pole automatic type with supervisory circuits which initiate and restore the changeover transfer operation. Control power source to be served from active line side operation. Provide full indication lights to details control status and power available. Provide AOM control switch.

### **Load side connections**

Segregate from incoming side.

### **Classification**

Contactors: PC.

Circuits: CB.

### **Circuit breakers**

Comply with moulded case and miniature circuit breakers, in the circuit breakers subsection. Do not use non-auto circuit breakers.

### **Contactors**

Comply with Contactors in the Controlgear subsection.

### **Interlocks**

Provide electrical and mechanical interlocks.

## **6.11 CIRCUIT BREAKERS**

### **6.11.1 AIR CIRCUIT BREAKERS**

#### **Standard**

To AS 3858.

#### **Type**

Open construction, withdrawable 3-pole, back connected, trip free.

#### **Rated duty**

Based on uninterrupted duty in a non-ventilated enclosure.

#### **Utilisation category**

Type B for partial and full discrimination.

#### **Rated service short-circuit breaking capacity**

At least the fault level at incoming terminals of the assembly.

#### **Closing operation**

Provide trip free closing mechanisms for operation, with positive mechanically operated "ON/OFF" indications.

#### **Opening operation**

Provide mechanically operated release for opening.

#### **Auxiliary switch contacts**

Provide contacts with minimum rated operational current of 6 A at 240 V, 50 Hz. Provide at least one spare normally-open and one spare normally-closed contact. Provide shunt trip release coil circuits with an early-make/late-break series connected auxiliary contact.

#### **Protection system**

Integral to the circuit breaker, incorporating a solid state protection relay.

### **Compartment**

House each circuit breaker in a separated self-contained enclosed subsection module within the assembly.

### **Locking**

Provide for circuit breakers to be padlocked in the open position.

### **Interlocking**

Electrical: Interlock control circuitry of functional units using normally-opened and normally-closed auxiliary contacts.

Mechanical: Required.

- Coded key: Captive type with squared face key with alphabetical or numerical coded operating face.

### **Door interlock**

Except for compartment doors serving only as covers, provide interlocks preventing compartment doors being open while circuit breakers are closed.

### **Abnormal operations**

Provide breakers which cannot be used in the following operations:

- Slow closing or opening of contacts;
- Manual independent hand closure, if springs fail;
- Release of charged springs while contacts are closed.

### **Withdrawable type**

Mounting: Mount circuit breaker on a withdrawable carriage with racking gear for racking in or withdrawing, and for positively fixing the unit into any of the three following positions:

- Connected;
- Test/isolated;
- Disconnected.

Auxiliary contacts: Use contacts which remain connected in the test/isolated position.

Interlocking: Provide interlocking which prevents circuit breaker being racked in or withdrawn unless it is in a tripped condition and prevents the circuit breaker being closed unless located in either the connected or test/isolated position. Provide stored energy devices which are automatically discharged by any racking operation.

Shutters: Provide automatic shutters, which can be padlocked, covering busbar and incoming/outgoing circuit connections and labelled "BUSBARS" and "CIRCUIT" respectively.

Earthing: Provide earthing connection between withdrawable carriage and assembly earth busbar which makes before, and breaks after, other contacts on the circuit breaker carriage.

### **Maintenance**

Provide for slow closing of the circuit breaker and for adjustment when disconnected.

### **Lift truck**

Provide purpose-built ACB lift truck to facilitate maintenance removal of ACB's.

Provide one lift truck for each separate switchboard or room containing ACB's.

## **6.11.2 MOULDED CASE AND MINIATURE CIRCUIT BREAKERS**

### **Standard**

Fault capacity  $\geq 10$  kA: To AS 3858.

**Miniature circuit breakers**

Fault capacity < 10 kA, current rating < 100 A: Use miniature overcurrent circuit breakers.

**Mounting**

Mount circuit breakers so that the "ON/OFF" and current rating indications are clearly visible with covers or escutcheons in position. Align operating toggles of each circuit breaker in the same plane.

**Utilisation category**

Non-discrimination: Type A.

Partial or full discrimination: Type B.

**Adjustable current settings**

General: If trip current adjustment control is exposed with covers in position, provide for sealing to prevent tampering.

Labels: Provide labels indicating trip settings.

**Trip settings**

Adjustable short circuit trip settings: Set to the low position.

**Trip units**

Circuit breakers with interchangeable and integrally fused trip units: Connect so that trip units are not live when circuit breaker contacts are open.

**Locking**

Provide for locking circuit breakers in the open position.

**Clip tray chassis**

For miniature overcurrent circuit breakers provide clip tray assemblies capable of accepting single, double, or triple circuit breakers, and related busbars. Provide moulded clip-on pole fillers for unused portions.

**Accessories**

Rotary handle: Provide "ON/OFF" indication, and override release to open door padlocking facility.

Motor operators: Provide selector switches, controls and indicators.

Auxiliary contacts: Minimum rating 5 A.

**6.12 LINKS****6.12.1 NEUTRAL AND EARTH LINKS****Terminals**

Provide terminals for future circuits.

**Links**

Assembly capacity > 36 poles: Provide neutral and earth links at the top and bottom of the circuit breaker section.

Assembly capacity ≤ 36 poles: Provide links at the point of entry of incoming supply cables.

Mounting: Mount neutral links on an insulated base.

Control circuits: Provide separate neutral and earth links.

Labels: Provide labels for neutral and earth terminals.

**Cables > 10 mm<sup>2</sup>**

Provide bolts or studs.

## **6.13 INTERNAL WIRING**

### **6.13.1 WIRING**

#### **Cable type**

Provide 0.6/1 kV copper cables. Use V-90HT insulation where directly connected to active and neutral busbars.

#### **Cable interconnections**

General: For the main circuit supply, provide cable interconnections as follows:

- Use 1.5 mm<sup>2</sup> (minimum) internal cables, with minimum V75 insulation rating with stranded copper conductors rated to AS 3008.1. Use cables with current ratings suitable for the internal assembly ambient air temperature and for temperature rise limits of equipment within the assembly;
- Run cables clear of busbars and metal edges;
- Provide cables capable of withstanding maximum thermal and magnetic stresses associated with relevant fault level and duration;
- Run cables neatly. Provide slotted trunking sized for future cables or tie at 150 mm maximum intervals using ties strong enough to withstand magnetic stresses created at the specified fault current. Do not use adhesive supports;
- Ensure wiring for future equipment can be installed without removal of existing equipment.

Identify power and control cables at both ends using neat fitting ring type ferrules agreeing with work-as-executed circuit diagrams. Mark to AS 1103.

Terminate control cables and motor control circuits in tunnel terminals or, if necessary, use suitable palm type lugs and correct crimp tool.

For equipment mounted on hinged doors run cables on the hinge side to avoid restricting the door opening. Bundle cables using spiral wrap PVC.

If recommended by device manufacturers, provide shielded wiring.

Adjacent circuit breakers: If suitable proprietary multi-pole busbar assemblies are available to link adjacent circuit breakers, do not use cable interconnections.

#### **Cables > 6mm<sup>2</sup>**

Terminations:

Tunnel terminals: Single cables.

Other connection points or terminals: ≤ 2 cables.

Doors: Do not run cables to hinged doors or removable panels.

Supports:

Spacing at enclosure: ≤ 200 mm from a termination.

Spacing generally: ≤ 400 mm.

Strength: Capable of withstanding forces exerted during fault conditions.

Single core cables rated ≥ 300 A: Do not use ferrous type metal cable saddles.

Marking: Terminate marked cables for connection to external controls in correspondingly marked terminals within the assembly.

#### **Control and indication circuits**

General: Provide conductors sized to suit the current carrying capacity of the particular circuit.

Minimum size: 1 mm<sup>2</sup> with 32/0.2 stranding.

#### **Cable colours**

Colour code wiring as follows:

- A phase: Red;
- B phase: White;
- C phase: Blue;
- Neutral: Black;
- Earthing: Green-yellow.

### **6.13.2 TERMINATIONS**

#### **Submains, light and power circuits**

Connect direct to the circuit breaker terminals.

#### **Other circuits**

Connection to circuits  $\leq 16 \text{ mm}^2$ : Provide DIN-type tunnel terminal blocks.

Connection to circuits  $> 16 \text{ mm}^2$ : Provide stud-type terminals  $\geq 5 \text{ mm}$  diameter, sized to continuously carry the load.

Cables  $> 70 \text{ mm}^2$ : Stud type terminals, fixed to a DIN-type or G rail.

Tunnel terminals: Provide insulated sleeve ferrules to flexible cables terminated in tunnel terminals.

Identification: Identify cables at both ends using neat ring-type ferrules.

Type: Screw-tightened, clip-on, 35 mm DIN-type, flexible, non-flammable and, as a minimum, suitable for the insertion of a screwdriver blade.

#### **Shrouded terminations:**

Form 4 separation : Cut and shaped polycarbonate solid sheet rigidly fixed into position, with cable cut-outs to underside.

Degree of protection: IP2X minimum.

Location: Locate terminals to provide ready access to outgoing terminations.

Mounting rails: Screw or rivet mounting rails to assembly not greater than 500 mm centres. Provide sufficient length to accept a further 20% terminals or 3 terminals, whichever is the greater.

Arrangement: Terminate internal wiring to one side of the terminal block, leaving the other side for outgoing circuits.

Grouping: Provide separate terminal groups for final subcircuit and control wiring. Provide oversized barriers between each group of terminals having different voltages and terminal size.

Terminals for power wiring: 3 phases or single phase and neutral.

Control terminals: In alphabetical or numerical order of wire identification, with the lowest number or letter next to the power terminals.

Shipping breaks: Provide terminal blocks for interconnecting wiring on each side of shipping breaks.

### **6.14 MEASUREMENT ACCESSORIES**

#### **6.14.1 CURRENT TRANSFORMERS (METERING)**

##### **Standard**

Measurement current transformers: To AS 1675.

##### **Test links**

Provide test links for connection of calibration instruments and meters and for shorting of current transformer secondaries. Provide energy meters, maximum demand meters, ammeters and protection relays, with sets of rail-mounted links consisting of screw-clamped slide links and an earth link.

**Test studs**

For energy and demand meters provide rail-mounted potential test studs or plug connections next to associated current transformer links. Provide at least one set of test studs for each compartment.

**Accuracy classification**

Energy measurements: Class 0.5M.

Indicating instruments: Class 2M.

**Ratings**

Rated short time current: At least the short time withstand current equivalent of the circuit in which the transformer is installed.

Rated primary current: At least equal to the current rating of the functional unit.

Secondary windings: Rated at 5 A, burden of 0.4 W (10 VA) with star point earthed.

**Type**

If practicable, use cast resin encapsulated window-type with busbar clamping devices. Otherwise use wound-primary type with mounting feet.

**Installation**

General: Install transformers to permit easy removal.

Removable links: Provide removable links of minimum lengths for transformers fitted on busbar systems.

**6.14.2 INSTRUMENTS AND METERS****Standards**

Indicating instruments: To AS 1042.

Electricity meters: To AS 1284 Parts 1, 3 and 4.

Transducers: To AS 1384.

**Digital meter scales**

Electronic self-illuminated LCD display, with provisions to indicate peak recording levels. A common display may be provided for a multiple of meter types. Adjustment pushbuttons to reset the recordings shall be provided behind a locked panel. Clear operating instructions shall be provided adjacent to the meter.

**Transducers**

If necessary for transducer operation, provide auxiliary supply. Connect outputs to dedicated rail-mounted isolating type terminals.

**Accuracy**

Indicating instruments and accessories: Accuracy class 1.5 or lower class index number except Class 3 for thermal maximum demand indicators.

Electricity meters: Class 0.5.

Power factor meters, phase angle meters and synchrosopes: 2 electrical degrees maximum error.

Transducers: Class 0.5.

**Accessories**

General: Mount next to associated instruments, inside cabinets.

**Mounting**

Flush mount meters on hinged panels. Wire with multi stranded flexible cables.

**Protection devices**

Meter potential protection devices: Group together behind associated meter cover or hinged door, preferably next to current transformer test links.

**Labels**

If associated exclusively with one phase, label meters "RED", "WHITE", or "BLUE" as applicable.



### **6.14.3 INDICATOR LIGHTS**

#### **Standard**

To AS 1431.2.

#### **Degree of protection**

At least that of the assembly/operating face.

#### **LED indicators**

12 or 24 V as necessary, in corrosion-resistant bezel, nominal 5 mm diameter.

#### **Press-to-test**

Compartments/subsections with < 5 indicating lights: Provide each indicating light with a fitted integral press-to-test lamp actuator.

Compartments/subsections with  $\geq 5$  indicating lights: Provide a common press-to-test lamp push-button.

### **6.15 SWITCHGEAR ACCESSORIES**

#### **6.15.1 CIRCUIT BREAKER INTEGRAL PROTECTIVE RELAYS**

##### **General**

Provide integral protective relays which provide for tripping in the event of relay operation, and for manually resetting. Provide operation indicators with a set of change over voltage free alarm contacts, for connection to an alarm circuit.

##### **Mounting**

Integral type: Readily accessible for viewing and adjustment with doors and covers in position.

External type: Flush.

#### **6.15.2 CURRENT TRANSFORMERS (PROTECTION)**

##### **Standard**

To AS 1675.

##### **Type**

Cast resin encapsulated window type with busbar clamping devices.

##### **Rated short time current**

At least the short time current equivalent to the assembly fault level.

##### **Rated short-time**

At least the maximum time setting of the related protective relay. Minimum 1 s.

##### **Rated primary current**

Equal to assigned current rating of the associated functional unit.

##### **Rated secondary current**

5 A. Connect star point to earth.

##### **Interposing transformers**

As recommended by the protective relay manufacturer.

##### **Characteristics**

As recommended by the protective relay manufacturer.

##### **Test links**

Provide test terminals and current transformer secondary shorting links in accessible positions within instrument panels. Provide a set of DIN-type rail mounted test links, consisting of screw clamped slide links and earth links, for each current transformer group.

### **Installation**

General: Install transformers to permit easy removal.

Removable links: Provide removable links of minimum lengths for transformers fitted on busbar systems.

Markings: Mount transformers in the assembly enclosure, so that polarity markings and nameplate details are readily viewed right side up without removing the transformers.

## **6.15.3 RESIDUAL CURRENT DEVICES**

### **Integral type**

General: Incorporate earth leakage in circuit breaker protection operation.

Mounting: Comply with moulded case and miniature circuit breakers, in the circuit breakers subsection.

### **Tripping**

Residual current classification: Type II.

Maximum tripping current: 30 mA.

## **6.15.4 FUSES WITH ENCLOSED FUSE LINKS**

### **Standards**

To AS 2005 Parts 21.1, 21.2, 29 and 40.

### **General**

General: Provide fuses suitable for the fault level at the assembly, and which discriminate with other protective equipment.

Let-through energy and peak cut-off current: To suit protected equipment.

### **Utilisation category**

Motor circuits: gG, gM or aM.

Back-up protection: gG.

Distribution/general purpose: gG.

### **Fuse-holders**

Mount fuse-holders so that fuse carriers may be withdrawn directly towards the operator and away from live parts. Provide fixed insulation which shrouds live metal when the fuse carrier is withdrawn.

### **Unenclosed fuses**

Provide barriers on both sides of each fuse link, preventing inadvertent electrical contact between phases by the insertion of screwdriver.

### **Fuse links**

Type: Enclosed, high rupturing capacity type mounted in a fuse carrier. If necessary for safe removal and insertion of the fuse carrier, provide extraction handles. Mount on clips within the spares cabinet.

Identification: Clearly indicate Australian manufacturer or distributor.

### **Busbar mounted fuse holders**

Provide fuse carriers with retaining clips, minimum fuse holder 32 A.

### **Spares**

Provide 3 spare fuse links for each rating of fuse link on each assembly. Mount spares on clips within the spares cabinet.

## **6.16 CONTROLGEAR**

### **6.16.1 CONTACTORS**

#### **Standard**

A.c. and d.c. contactors: To AS 1029.1.

#### **Type**

Block type, air break, electro-magnetic.

### **Poles**

3.

### **Minimum rated values**

Rated operational current: Full load current of the load controlled.

Rated duty:

- Motors: Intermittent class 0.1;
- Heater banks: Intermittent class 1;
- Discharge lighting.

Rating: 16 A.

Mechanical endurance: 10.

Utilisation category:

- Motors: AC-3 or DC-3;
- Heater banks: AC-1 or DC-1;
- Discharge lighting: AC-11.

Contacts life: 1 million operations at AC-3, AC-11 or DC-3.

### **Auxiliary contacts**

General: Provide auxiliary contacts with at least one normally-open and one normally-closed separate contacts with rating of 6 A at 240 V ac.

Utilisation category: AC-1.

Slave relay: If the number of auxiliary contacts exceeds the number which can be accommodated, provide a separate slave relay.

### **Mounting**

Mount with sufficient clearance 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 ratings.

## **6.17 CONTROLGEAR ACCESSORIES**

### **6.17.1 CONTROL AND TEST SWITCHES**

#### **Standards**

To AS 3947.1 and AS 3947.5.1.

#### **Rated operational current**

Utilisation category: AC-22 to AS 3947.1.

#### **Degree of protection**

At least the degree of protection for the assembly.

#### **Push-buttons**

Type: Oil-tight, minimum 22 mm diameter, or 22 x 22 mm.

Rated operational current: At least 4 A at 240 V a.c.

Marking: Identify functions of each push-button. For latched "STOP" or "EMERGENCY STOP" push-buttons, state instructions for releasing latches.

Colour code: To AS 1431.2.

Illuminated push-buttons: Comply with Indicator lights, in the Measurement accessories subsection.

#### **Rotary switches**

General: Cam operated type with switch positions arranged with displacement of 60°.

Off position: Locate at the 12 o'clock position. Test positions must spring return to off position.

Rated operational current: At least 6 A at 240 V a.c.

Escutcheon plates: Provide rectangular plates securely fixed to the assembly panel. Identify switch position and function.

#### **Time switches - dial type**

Operation: 7-day with synchronous motor or electronically controlled drive from 240 V 50 Hz supply. Provide day omit and manual override facilities.

Mains failure operation: Either by

- 24 hour spring; or
- battery with 100 hour minimum operating capacity and guaranteed 10 year minimum life.

Contact rating: 16 A at 240 V a.c.

Construction: Provide readily accessible means of adjustment. Provide operational settings which are clearly visible when switch cover is fitted.

Dial: Either analogue with 2 hands, or digital with hour and minute display.

### **6.17.2 CONTROL RELAYS**

#### **Standards**

To AS 1431.1 and AS 2481.

#### **Operation**

Suitable for continuous operation. Select relays in compliance with the **Control relay** section table.

**Control relay selection table**

Relay type	Minimum mech. Life (million operations)	Base	Minimum contact rating	Inter-changeable	Minimum no. of contact elements
1	5	Plug-in	1.25 L	Yes	2
2	10	Plug-in	5A at 240V	Yes	2
3	10	Fixed mounting	5A at 240V	Yes	4

#### **Construction**

Latch plug-in types to receptacle bases using captive clips which can be applied and released without using tools.

#### **Contact elements**

Type: Electrically separate, double break, silver alloy, non-welding contacts.

Configuration: For standard relays, provide assemblies with at least 2 sets of contacts and expandable to eight (8) sets of contacts in the same assembly. Provide at least one normally-open and one normally-closed contact.

On site conversion: Provide contact blocks readily convertible to either normally-open or normally-closed contacts.

#### **Time delay relays**

Adjustable over the full timing range with timing repeatability within  $\pm 12.5\%$  of nominal setting.

**Electronic relays**

Incorporate light emitting diodes indicating energisation states of relays.

**Pneumatic relays**

Provide sealed chamber type with internal circulating air with linear calibrated time adjustment.

**Synchronous relays**

Provide synchronous motor drive type relay fitted with anti-stalling device which protects gearing during normal operation.

**Phase failure relays**

General: Provide separate solid state phase failure relays which release at:

- 85% of normal voltage;
- single phase failure; or
- reverse phase sequence after an appropriate time delay.

Sensing circuit: Rejects induced voltage spikes, and disturbances with frequencies other than 50 Hz.

Back-up protection: Provide high rupturing capacity fuses to each phase.

**6.17.3 PROGRAMMABLE LOGIC CONTROLLERS****General**

Provide complete programmable logic controllers including central processing unit, input/output modules and mounting hardware, and which:

- Are modular in construction and of the same manufacture, with interchangeable peripherals and software;
- Have an integral power supply of sufficient capacity to satisfy the requirements of the central processing unit and input/ output module combinations which can be located within the mounting hardware;
- Are designed and constructed to operate in electrically noisy environments; and
- Are located in the low voltage control section of the associated functional unit.

**Central processing units**

General: Provide the following:

- Separate run, monitor and program functions;
- Operating system: Stored in non-volatile memory;
- Programmed software: Stored so that loss of power to the unit for a period up to 1 year will not cause corruption of data and will allow automatic restarting and correct operation immediately on power restoration.

Inputs and outputs (minimum):

- External inputs: 24;
- External outputs: 16;
- Internal relays: 128.

**Input/output modules**

Status: Clearly identified and indicated by a light emitting diode.

Diodes: Not obscured by assembly wiring.

Analogue input: 4 - 20 mA or 0 - 10 V d.c., opto-isolated.

Analogue output: 4 - 20 mA or 0 - 10 V d.c., into a burden of  $\geq 600$  W.

Digital input: 24 V d.c., opto-isolated.

Digital output: Volt-free relay contacts or opto-isolated solid state switches for switching an output load of at least 2 A at 24 V a.c. or d.c.

**Programmer**

Operation: Using ladder logic, allowing for editing without the need to re-enter the whole program. Include test and monitoring functions which facilitate testing, running and debugging of software and provide for input/output number check.

Hand-held programmers: Provide moulded connectors and 2 m connection cable.

**6.17.4 EXTRA-LOW VOLTAGE TRANSFORMERS**

**General**

Provide the following:

- Centre tap on secondary winding;
- Primary and secondary windings wired out on opposite sides of transformer case;
- Primary and secondary windings separated using an earthed screen wired out to an insulated terminal;
- Output loading ( 80% of transformer continuous rating, taking account of degree of ventilation and ambient temperature within assembly, and supplied load.

**6.18 ANCILLARY EQUIPMENT**

**6.18.1 BATTERIES AND CHARGERS**

**Standards**

Valve regulated sealed lead-acid batteries: To AS 4029.2.

Vented nickel-cadmium batteries: To AS 3731.1.

Chargers: To AS 4044 Type 2.

**General**

Provide a battery and charger system for circuit breaker tripping, closing and automatic changeover switch operation. Locate within the switchroom.

**Circuit breaker operation**

Provide a d.c. supply for circuit breaker operation from battery system and charger.

**Performance**

General: Capable of 10 consecutive air-circuit breaker or moulded case circuit breaker operations for the designated quantity of circuit breakers. Each operation consists of open-close of main contacts for 0.5 s duration, with 1 s intervals between operations, and minimum discharge current of 4 A, with batteries in 50% discharge condition. Maintain a minimum terminal voltage of 80% of rated voltage at the completion of the 10 operations.

System voltage: 110 V d.c.

**Battery chargers**

Type: Free standing, floor mounted, ventilated cabinet type with separate charger and battery subsections.

Degree of protection: IP42.

Tapping: Provide tapings on the transformer to permit adjustment over a range of 95% - 105% of secondary winding voltage on open circuit.

Circuitry: Solid state, micro-processor type, constant voltage, fully automatic, incorporating a smoothing network to give an output wave form at least as smooth as that of a 3-phase bridge system, and automatic boost and float charge functions adequate to ensure maximum battery life and rated performance. Provide facilities for manual boost and test.

Maximum design transient: 70% of the component manufacturer's peak inverse ratings.

Instruments, controls and indicators: Group for ease of operation. Provide analogue or digital instruments for the following:

- Charger output current;
- System voltage;
- Load current.

A.C. input protection: Miniature circuit breakers. Protect outgoing tripping supply using 2 pole d.c. miniature circuit breaker.

Provide alarm indication to monitor the following:

- A.C. supply;
- Boost charge on;
- Charge fail;
- Low battery voltage;
- High battery voltage;
- Low electrolyte for vented cells;
- Earth fault, secondary side.

Provide facility for remote alarm indicator.

#### **Safety signs and labels**

Standard: To AS 2676.1.

Safety signs: Provide cautionary, regulatory and emergency safety signs to charger enclosure and switchroom.

### **6.18.2 ANTI-CONDENSATION HEATERS**

#### **General**

Rating: Provide heaters rated at not less than 20 W/m<sup>2</sup> of total external area including top of weatherproof enclosure.

Type: Black heat type which may be touched without injury, mechanically protected and thermostatically controlled.

### **6.18.3 TRANSIENT PROTECTION**

#### **Standards**

Main assemblies connected to the MEN earthing system: To AS 4070 Category II.

Main assemblies not connected to the MEN earthing system: To AS/NZS 1768 Category C.

Distribution boards: To AS/NZS 1768 Category B.

#### **Primary protection**

Provide shunt connected metal oxide varistors at assembly incoming supply terminals, on the line side of incoming functional units.

#### **Secondary protection**

Provide metal oxide varistors or zener diode surge protection to assembly in-built equipment and semiconductor components which are not able to withstand transient overvoltages exceeding primary protection let-through residual levels.

#### **Components**

Short-circuit protective devices and isolators: Back-up each arrestor active supply with a live side 32 A totally enclosed fault current limiting fuse. Provide 32 A multi-pole automatic miniature circuit breaker on load side of fuses, as an arrestor isolator.

**Cables:**

- Maximum length between main circuit supply active and associated fuse, isolator, arrester, neutral and earth conductor connections including MEN link: 1 m;
- Maximum length between earth conductor and earth grid/electrode system: 5 m;
- Installation: Keep cables as short and straight as practicable with line and load side separately bunched 300 mm apart.

Minimum cable size: 6 mm<sup>2</sup> copper.

Surge arrester enclosures: Totally ventilated sheet metal wall boxes with hinged covers, mounted within or on the wall next to designated assemblies, containing grouped surge arrestors.

Surge protection devices shall be provided with status indicators (or lights) exposed through the switchboard escutcheon. Where a DDC system is installed, provide remote terminals to monitor status.

Marking: Label each group of primary arrestors, stating their purpose and the necessary characteristics.

**Performance**

- Voltage surge divertors shall be compatible with the electrical distribution network;
- Divertor shall be rated to operate at a minimum discharge current of not less than 10 kA;
- The transient overvoltage let through value shall be 240V rated components - 600V;
- Protection shall be provided between phase-to-phase and phase-to-neutral;
- Remote pre-failure indicators shall be provided and provided with an output linked to the Building Automation System.

**6.18.4 SPARES CABINET**

**General**

General: Provide a spares cabinet with main name plate, labelled shelves and non-lockable door. Size for storing racking handles, special tools, spare lamps, spare fuse links and other equipment necessary for satisfactory assembly operation.

Location: Either

- Incorporated into assembly enclosure; or
- Wall mounted in main switchroom.

Finish: To match assembly.

**6.19 INSTALLATION**

**6.19.1 ASSEMBLY INSTALLATION**

**Fixing**

Before making interpanel connections, fix assemblies and metering equipment enclosures into position, level and plumb.

**6.19.2 ASSEMBLY ENTRIES**

**Cable entries**

General: Neatly adapt one or more cable entry plates, if fitted, to accept incoming cable enclosure. Use the minimum number of entry plates to leave spare capacity for future cable entries. Do not run cables into the top of weatherproof assemblies.

Single core cables rated > 300 A: Pass separately through non-ferrous gland plates. Do not use metal saddles.

**Cable enclosures**

Continue cable enclosures to or into assemblies and fit cable entry plates so that the IP rating of the assembly and the fire rating of the cable are maintained.



### **Cable supports**

Support or tie mains and submains cables within 200 mm of terminations. Provide cable supports suitable for stresses resulting from short circuit conditions.

### **Bus trunking system entry**

Provide entry plates with close tolerance cut-out to accommodate busbars, fitted with a flange bolted and sealed to assembly enclosure to maintain assembly IP rating. Earth busway enclosure to assembly protective earth conductor. Fit busway flanges at assembly manufacturer's premises and retain for transportation.

## **6.20 MARKING**

### **General**

Provide labels including control and circuit equipment ratings, functional units, notices for operational and maintenance personnel, incoming and outgoing circuit rating, sizes and origin of supply and kW ratings of motor starters.

### **Identifying labels**

Provide labels fixed to access panels, doors, covers and escutcheon panels and internal equipment, indicating the relevant section and component.

### **Minimum lettering heights**

Main assembly designation: 25 mm.

Distribution assembly designations: 15 mm.

Small proprietary distribution boards: 10 mm.

Main switches: 10 mm.

Outgoing functional units: 8 mm.

Identifying labels (on outside of cabinet rear covers): 4 mm.

Danger, warning and caution notices: 10 mm for main heading, 5 mm for remainder.

Other labels including equipment labels within cabinets: 3 mm.

### **Label colours**

Generally: Black lettering on white background.

Main switch and caution labels: Red lettering on white background.

Danger, warning labels: White lettering on red background.

### **Fixing**

General: Fix labels securely.

Method: Select from the following:

- Screws and double-sided adhesive (double-sided adhesive only is unacceptable);
- Fixed in extruded aluminium sections fixed to panels using rivets or countersunk screws.

Aluminium labels: Use aluminium or monel rivets.

Restrictions: Do not use self-tapping or thread-cutting screws.

### **Set-out**

Align horizontally and vertically with adjacent labels.

### **Labels on assembly exteriors**

Manufacturer's name: Required.

Assemblies: Label with essential markings.

Designation labels: For other than main assemblies, provide designation label stating source of electrical supply. Identify separate sections of enclosures.

Assembly controls: Label controls and fault current limiters, including the following:

- Circuit designation for main switches, main controls and submains controls;
- Details of consumers mains and submains;
- Incoming busbar or cable rating to first tee-off;
- Fuse link size.

#### **Labels on assembly interiors**

General: Provide labels for equipment within assemblies. Locate so that it is clear which equipment is referred to, and lettering is not obscured by equipment or wiring.

Moulded case circuit breakers: If circuit breaker manufacturer's markings are obscured by operating handle mechanisms or motor operators, provide additional markings open to view on or next to the circuit breaker.

#### **Danger, warning and caution notices**

Busbars: If polymer membrane coating is used without further insulation, provide warning notices on the front cover near the main switch or local main switch, and on rear covers, indicating that busbars are not insulated.

Fault current limiters: In assembly sections containing fault current limiter fuses provide caution notices fixed next to the fault current limiters, stating that replacement fuse links are to match as-installed fuse link ratings, make and characteristics. Provide separate label stating fault current limiting fuse ratings.

Externally controlled equipment: To prevent accidental contact with live parts, provide warning notices for equipment on assemblies not isolated by main switch or local main switch.

Stand-by power: Provide warning notices stating that assemblies may be energised from the stand-by supply at any time.

Anti-condensation heaters: To prevent accidental switching off, provide caution notices for anti-condensation heaters.

Custom-built assemblies: For insulation or shrouding requiring removal during normal assembly maintenance, provide danger notices with appropriate wording for replacement of insulation shrouding before re-energising assemblies.

Positioning: Locate notices so that they can be readily seen, next to or, if impracticable, on busbar chamber covers of functional units, and behind the front cover of functional units. Provide circuit identification labels in the cabling chamber of each functional unit, located next to external terminations.

### **6.20.1 CIRCUIT SCHEDULE**

#### **Schedule cards**

General: For general light and power distribution boards, provide schedule cards of minimum size 200 x 150 mm, with typewritten text showing the following as-installed information:

- Submain designation, rating and short-circuit protective device;
- Light and power circuit numbers and current ratings, cable sizes and type and areas supplied.

Mounting: Mount schedule cards in a holder fixed to the inside of the assembly or cupboard door, next to the distribution circuit switches. Protect with hard plastic transparent covers.

#### **Single-line diagrams**

Custom-built assemblies: Provide single-line diagrams.

Format: Non-fading print, at least A3 size, showing the as-installed situation.

Mounting: Enclose in a non-reflective glazed metal frame and wall mount close to assembly.

**6.21 COMPLETION**

**6.21.1 TRAINING**

**General**

Provide training of Client Representatives in the complete operation and maintenance of all switchboards.

**Programmable logic controllers**

Provide one programmer and submit associated instruction manual 5 days before start of operator training.

**6.21.2 SPARES**

**Tools**

Accessories: Provide one set of racking tools for circuit breakers, and special installation, operation and servicing tools.

Indicator lights: Provide 3 spare lamps and one lamp extractor per 10 indicating lights. Locate in spares cabinet.

Alarm annunciators: Provide 3 spare lamps, lamp remover, screen remover (if applicable), mounted on clips in the assembly enclosure or in spares cabinet.

**6.21.3 COMPLETION TESTS**

**General**

Carry out the following tests:

- Electrical operation;
- Dielectric.

**6.21.4 MAINTENANCE**

**General**

General: Carry out the following:

- Monthly inspections and maintenance work to maintain the assembly, including battery systems;
- Rectify faults, make adjustments, and replace consumable and faulty materials and equipment within 24 hours of notification;
- Check the operation of all electrical switchgear prior to the end of maintenance period or at a 12 monthly interval;
- Undertake electrical injection tests on all switchgear prior to the end of maintenance period or at a 12 monthly interval;
- Undertake electrical conductivity tests on all electrical switchgear prior to the end of maintenance period.

Standard: To AS 2467.

## **7. WIRING AND ACCESSORIES**

### **7.1 GENERAL**

#### **Scope of Works**

The Contractor shall supply, install and connect consumer mains and submain cables as scheduled and as detailed on the drawings including:

- Consumer mains cables from the Jemena substation to the new site main switchboard SMSB.
- Generator supply submain cables from wall mounted isolator to SMSB
- Submain cables from SMSB to main distribution board MDBI and existing site main switchboard.
- Submain cables to light and power distribution boards.
- Submain cables to mechanical services switchboards.
- Fire rated submain cables to lifts and fire indicator panel.
- Termination of mains and submain cables into the switchboards;
- Electrical metering enclosures as detailed including C/T chamber;
- Light and power sub-circuit wiring;
- Cable support systems as detailed on the plans for power, communication and security services;
- Cable support brackets as detailed;
- Commissioning.

#### **Consumer Mains**

Provide cable lugs including supports and co-ordinate with Jemena for the final connections of the consumer mains cables to the point of supply isolator in the substation at a mutually agreeable time with Jemena and the Principal.

Include in the tender the payment of any applicable connection fees and charges to Jemena.

#### **Submain Cables**

Submain cables shall be supported on cable ladder systems throughout the complex in all plant room and service corridor areas.

For horizontal cable runs, the cables shall be physically spaced by one cable group diameter, in accordance with AS 3008. This is the typical installation format

For vertical cable runs, the cables shall be spaced by one cable group diameters in accordance with AS 3008.

In plantroom areas where a specific cable route deviate from the main reticulation network, the cable shall be supported either via cable ladders or cable tray surface mounted.

In concealed spaced areas, where a specific cable route deviates from the main reticulation network, the cable shall be supported via either cable tray or catenary cable.

For vertical cable risers within riser shafts, the submain cables shall be clipped to unistruts located on the wall.

At each switchboard location, provide an additional 3m of cable for termination.

Where specified and as required, provide fire rated submains in accordance with the BCA, AS1668 and AS/NZS 3000.

Submain cable sizes and capacities shall cater for:

- Full current rating or sealed trip setting of the upstream protection device.
- The method of installation and separation from adjacent heat emitting services or insulating materials.
- A maximum voltage drop of 2.5% from the main switchboard at ultimate ratings to the distribution board or control panel.

- Neutrals conductor size to be the same size as the phase conductors.

Leave 2 metres coiled submain cable tails at switchboards and control panels provided by other services providers. Co-ordinate the final connections to these switchboards and control panels with the other services providers.

Co-ordinate and confirm final loads, spare capacity required and final submain cable routes with the other services providers prior to installing submain supporting systems.

Underground submain cables shall be enclosed in heavy duty rigid PVC Category “A” conduits in accordance with AS/NZS 3000.

Allow in the tender all associated civil works including boring under existing paving, trenching, bedding, backfill and reinstatement of trenches.

Co-ordinate the final location of underground conduit routes with other in-ground services and associated civil works with the Superintendent.

Provide cable markers at cable pits, switchboard entries, building entries and every 50 meters along the underground conduit runs.

Provide electrical and communications cable pits with trafficable lids to match existing presently installed on site.

#### **Cable Support Systems**

The electrical services contractor shall supply and install the following cable support systems:

- Power Cabling
  - cable ladders/trays
  - unistruts in riser shafts
  - conduits as detailed.
- Communication/Security Cabling
  - cable ducts/trays
  - conduits as detailed
  - the unistruts/cable trays in the riser shaft
- Telstra Conduits
  - incoming service conduits
- CitiPower Conduits
  - incoming service conduits

The cable bracketing system shall comprise:

- Plantrooms Service Corridors and main reticulation routes.
  - Purpose made ‘unistrut’ style channel sections.
  - The design of the brackets shall allow for the services to be ‘laid in’ wherever possible.
- Concealed in ceiling services.
  - Threaded rod with angle iron bracket.

The cable route and layout diagrams depict the main services routes. The sizes shown are approximate and the electrical contractor shall allow to configure the ladder/duct systems into modules of 150/300/450/600 mm, as required. The electrical services contractor shall:

- Co-ordinate the final location of all the cable route with the other trade contractors working in the area.
- Allow for all deviations and offsets required to achieve the intent of the installation.
- Provide the bending radius to suit the required service.
  - Submains — 10 times the maximum diameter of the cable.

- Communications/Security Services:
  - » incoming services — 2,000mm min.
  - » ducts — 800mm min.
- Incoming electrical supply: 2,000mm min.
- Co-ordinate incoming services with Telstra, Optus, United Energy Communications and CitiPower Pty.
- Assess the total sizes as detailed, and make due allowance for any additional requirement over and above the size as indicated.

#### **7.1.1 CROSS REFERENCES**

##### **General**

Comply with 'General Requirements' and 'General Electrical Services Requirements' sections.

#### **7.1.2 INTERPRETATIONS**

##### **Abbreviation**

MIMS: Mineral-insulated metal-sheathed.

TPI: Tough plastic insulated.

TPS: Tough plastic sheathed.

UPVC: Ultraviolet Polyvinyl chloride.

PVC/PVC: PVC insulated, PVC sheathed

XLPE: Cross linked polyethylene

#### **7.2 STANDARDS**

AS 3000.

AS 3080.

AS 3013.

AS 3008.1

#### **7.3 QUALITY**

##### **7.3.1 PRE-COMPLETION TESTS**

###### **Site tests**

MIMS cable systems: Test the insulation resistance:

- at the time of termination; and
- 24 hours later.

Other cable systems: Test the insulation resistance before the final connection of equipment and before energisation.

##### **7.3.2 CONTRACTOR'S SUBMISSIONS**

###### **Cable routes**

If not shown on the drawings in detail, submit details of the following:

- Submain cable tray routes and signs.
- Switchboard cupboard layouts including risers.
- Busduct systems including routes, dimensions and connection details.

###### **Power cable ratings calculations**

General: If cable sizes are not given, submit calculations of current ratings and voltage drop.

The cable sizes indicated for mechanical, lift, fire and hydraulic loads are based upon preliminary design data. The electrical Contractor shall confer with the Contractors responsible for those trades and obtain the nameplate data on the operating loads. Confer with the consultant on the diversity applied. No cables are to be ordered or switchboard drawings commenced prior to cable sizes being confirmed.

Unless noted otherwise all mains and submains shall be designed with a minimum 20% spare capacity.

Standard: To AS 3008.1.

### **Shop drawings**

Submit shop drawings of all major cable routes and inground cables.

## **7.4 WIRING SYSTEMS**

### **7.4.1 SELECTION**

#### **General**

Use the following systems:

- Cast concrete slabs: Unsheathed cable in heavy duty UPVC conduit.
- Accessible spaces: Thermoplastic insulated and sheathed cables.
- Concealed spaces: Unsheathed cable in UPVC conduit.
- Plant rooms: Unsheathed cable in heavy duty UPVC conduit.
- Plastered or rendered surfaces: Cable in UPVC conduit.
- Stud walls without bulk insulation: Thermoplastic insulated and sheathed cables.
- Inground cabling: In accordance with AS 3000.

### **7.4.2 INSTALLATION**

#### **Standard**

Fire or mechanical damage: Classifications to AS 3013.

#### **Segregation**

Maintain minimum segregation requirements of AS 3000, AS 3008 and AS 3080.

Unless noted otherwise cable sizes nominated in the schedule are based on the method of installation not requiring de-rating of the cable current carrying capacity.

#### **Installation methods table**

Wall construction	–	Installation and concealed cabling facilities
Rendered masonry partition	–	Flush wall box – conduit chased into wall
Double sided face brick partition	–	Vertically mounted flush wall box with conduit concealed in cut bricks.
Face brick external cavity wall	–	Flush wall box with thermoplastic insulated cables in conduit run in cavity and tied against inner brick surface, or thermoplastic sheathed cables run in cavity.
Stud partition	–	Rewirable.
Suspended ceiling spaces	–	Catenary cable supports with cables clipped at maximum 1200 mm centres.
	–	Cable tray.
	–	Cables not to touch mechanical plant or light fittings.
Vertical cabling	–	Supported via galvanized channel supports spaced from wall.
	–	Fixed at centres to suit manufacturers recommendations (nominally min. of 1200 mm).
	–	Avoid force on terminations.
	–	Avoid strain or pinching of outer sheath.
Acoustic walls	–	Acoustic wall box sealed after cable installation (note, all boxes not to be installed back-to-back).
Fire rated walls	–	Brick: Ensure sufficient clearances, min. 100mm between wall boxes.
	–	Stud partition: Use proprietary fire rated wall boxes.

### **Sheath Colours**

- Power final subcircuits – black sheath.
- Lighting final subcircuits – white sheath.
- UPS final subcircuits - orange circular PVC/PVC.
- Power submains – black.
- Fire services – red sheath.

### **Handling cables**

Report damage to cable insulation, serving or sheathing.

### **Straight-through joints**

Unless unavoidable due to length or difficult installation conditions, run cables without intermediate straight-through joints.

### **Cable joints**

Locate in accessible positions in junction boxes.

### **Extra-low voltage circuits**

Individual wiring of extra-low voltage circuits: Tie together at regular intervals.

### **Conductor colours**

General: For fixed wiring, use coloured conductor insulation. If this is not practicable, slide at least 150 mm of close fitting coloured sleeving on to each conductor at the termination points.

Active conductors in single phase circuits: Red.

Active conductors in polyphase circuits:

- A phase: Red.
- B phase: White.
- C phase: Blue.

### **Tagging**

Identify multicore cables and trefoil groups at each end using stamped non-ferrous tags clipped around each cable or trefoil group.

### **Marking**

Identify the origin of all wiring using legible indelible marking.

## **7.5 POWER CABLES**

### **7.5.1 SELECTION**

#### **Cable**

General: Use multi-stranded copper cable generally, except for MIMS.

- Aluminium conductors are not to be used.

Minimum size:

- Lighting subcircuits: 2.5 mm<sup>2</sup>.
- Power subcircuits: 2.5 mm<sup>2</sup>.
- Control circuit: 1.5mm<sup>2</sup>.
- Flexible cords: 30/0-25mm<sup>2</sup> Cu.
- Submains: 6 mm<sup>2</sup>.
- All power subcircuit cables to be either 2C+E/4C+E.
- All lighting subcircuit cables to be 3C+E min. (4C+E for single point emergency lights). (2C+E cable to be used for looping between light fittings.)



#### **Cable materials**

PVC cables (insulated and sheathed): - 0.6/1 kV and V75 rating unless otherwise shown.

Environments exceeding 75°C: - V105°C rating.

XLPE cables: Use 0.6/1 kV and 90°C rating.

EPR cables: Where specified as flexible cable use 0.6/1 kV and 90°C rating.

### **7.5.2 UNSHEATHED - INSTALLATION**

#### **General**

Use permanently fixed conduit enclosures assembled before installing wiring. Use draw wires to pull in conductor groups from outlet to outlet, or use ducts with removable covers.

### **7.5.3 FIRE-RATED - INSTALLATION**

#### **General**

If exposed to mechanical damage, provide minimum WS53 protection to AS 3013.

## **7.6 TERMINATIONS**

### **7.6.1 COPPER CONDUCTORS**

#### **General**

Other than for small accessory and luminaire terminals, terminate copper conductors to equipment, using compression-type lugs of the correct size for the conductor. Compress using the correct tool or use soldering.

#### **Within assemblies and equipment**

General: Loom and tie together conductors from within the same cable or conduit from the terminal block to the point of cable sheath or conduit termination. Neatly bend each conductor to enter directly into the terminal tunnel or terminal stud section, allowing sufficient slack for easy disconnection and reconnection.

– Alternative: run cables in UPVC cable duct with fitted cover.

Identification ferrules: Provide durable numbered ferrules fitted to each core, and permanently marked with numbers, letters or both to suit the connection diagrams.

Spare cores: Identify spare cores and terminate into spare terminals, if available. Otherwise, neatly insulate and neatly bind the spare cores to the terminated cores. Edit Note.

## **7.7 WIRING ENCLOSURES AND CABLE SUPPORTS**

### **7.7.1 CONDUITS**

#### **Minimum sizes**

Metallic and non-metallic conduits: 20 mm.

Galvanised water pipe: Medium or heavy, to AS 1074.

#### **Rigid conduits**

Provide straight long runs, smooth and free from rags, burrs and sharp edges. Set conduits to minimise the number of fittings.

#### **Galvanising**

If installed in damp locations, galvanise mild steel wiring enclosures and support systems.

#### **Set out**

If exposed to view, install conduits in parallel runs with right angle changes of direction.

Note: Corrugated conduit shall be concealed from view unless specifically nominated on the drawings.

#### **Inspection fittings**

Locate in accessible positions.

**Draw cords**

General: Provide draw cords in conduits not in use. Leave 1 m of cord coiled at each end of the run.

Material: Polypropylene cord, or insulated stranded earth wire, 2.5 mm<sup>2</sup> minimum size.

**Draw-in boxes**

General: Provide draw-in boxes at intervals not exceeding 30 m in straight runs, and at changes of level or direction.

Underground draw-in boxes: Provide gasketed covers and seal against moisture.

**7.7.2 CONCEALED CONDUITS****Routes**

Conduits concealed in wall chases, embedded in floor slabs or installed in inaccessible locations: Run directly between points of termination, minimising the number of sets. Do not use inspection fittings.

**Conduits in concrete slabs**

Route: Do not run in concrete toppings. Do not run within pretensioning cable zones; cross pretensioning cable zones at right angles. Route to avoid crossovers and minimise the number of conduits in any location. Space parallel conduits at least 50 mm apart.

Minimum cover: Conduit diameter or 20 mm. Conduits shall be located in the middle third of in-situ concrete slabs between the upper and lower structural reinforcement.

Conduit size: 25 mm maximum diameter.

Fixing: Fix directly to top of the bottom layer of reinforcing where the conduits pass above a single layer of reinforcing.

**Prohibited floor slabs**

Do not run conduits in the floor slabs of boiler rooms, plant rooms and tank rooms.

**Hollow-block floors**

Locate conduits in the core-filled sections of precast hollow-block type floors.

**Columns**

General: Do not place more than four 25 mm (maximum) diameter conduits centrally in each column.

Bends: Enter columns via bends with minimum radius of 150 mm.

Chasing: Do not chase columns.

**7.7.3 METALLIC CONDUITS AND FITTINGS****Standard**

Metallic conduits and fittings: AS 2052.

**Type**

Screwed steel.

**Corrosion protection**

For steel conduits, paint ends and joint threads with zinc rich organic binder to GPC-C-29/16.

**Expansion joints**

General: Provide flexible couplings consisting of flexible conduit and fittings, at:

- structural expansion joints; and
- in long straight runs if the ambient temperature varies by more than 40°C.

Conductivity: Maintain electrical conductivity between the two ends of rigid metallic conduit.

Movement: Provide conduit support saddles close to flexible couplings to permit free movement for expansion and contraction.

#### **7.7.4 NON-METALLIC CONDUITS AND FITTINGS**

##### **Standard**

Non-metallic conduits and fittings: AS 2053.

##### **Conduits in roof spaces**

Locate below roof insulation and sarking. In accessible roof spaces, provide mechanical protection for light-duty conduits.

##### **Conduit in slabs**

Use high compression corrugated conduit and restrain at regular intervals to achieve a nominally straight run.

##### **Category A conduit**

For direct buried installations requiring the use of Category A conduit, use protective cover strips and corrugated conduit.

##### **Flexible conduit**

Use for equipment and plant subjected to vibration. If necessary, use for adjustment or ease of maintenance. Provide the minimum possible length.

##### **Corrugated conduits**

Corrugated conduit only to be used for difficult installations where numerous bends are required within a concrete pour in lieu of bending sets. Generally rigid conduit shall be used.

Corrugated conduit shall not be installed exposed to view without prior approval of the architect.

##### **Associated fittings**

General: Use fittings of the same type and material as the conduit.

Wall boxes on UPVC conduits: For special size wall boxes not available in UPVC, use prefabricated earthed metal boxes.

##### **Inspection fittings**

Use inspection-type fittings only in accessible locations and where exposed to view.

##### **Joints**

General: Use cemented or snap on joints.

Expansion couplings: If encased in concrete, do not use bellows type.

#### **7.7.5 DUCTED WIRING ENCLOSURES**

##### **Ducting**

Provide purpose-made ducts, skirting ducts and floor ducts, incorporating segregation where used for multiple services, and rigidly supported. Round off sharp edges and provide PVC bushes for cable entries into metallic ducting.

##### **Accessories**

General: Provide purpose-made accessories and covers to match the duct system. Use screw-fixed covers, or clip-on covers removable only with the use of tools.

Cable support: Except for horizontal runs where the covers are on top, support wiring using retaining clips at intervals of not more than 1 m.

#### **7.7.6 CABLE SUPPORTS**

##### **System**

Provide a complete cable support system consisting of trays or ladders and including brackets, fixings and accessories. Fabricate brackets, racks and hangers using structural steel sections or other materials in sections of equivalent strength.

##### **Manufacture**

Use proprietary trays, ladders and accessories from a single manufacturer in the same application.

### **Cable trays**

#### **Materials:**

- Interior: Zinc-coated steel, or steel with two-pack liquid coating, air-drying enamel or stoving enamel finish.
- Exterior: Hot dip galvanised steel.

#### **Minimum steel thickness:**

- Trays < 150 mm wide: 1 mm.
- Trays ≥ 150 mm, < 300 mm wide: 1.2 mm.
- Trays ≥ 300 mm wide: 1.6 mm.

Perforations: To Admiralty pattern, reverse stamping.

### **Cable ladders**

General: Use two-folded steel or extruded structural grade aluminium side rails with cable support rungs between the rails.

Steel ladders: Galvanised.

Rung spacing: 300 mm maximum.

Small cables: Run cables less than 13 mm diameter in cable trays or ducts.

#### **Structural sections:**

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

### **Catenary wires**

#### **Materials:**

- Galvanised stranded wire
- Eyelets and tensioning buckles and clamps.

#### **Installation:**

- Supported from building structure
- No wire sag
- Pretensioned.

### **Fixing to building structure**

General: Fix supports to the building structure or fabric using direct fixing, hangers or brackets.

Spacing: Space supports at maximum intervals of 1.5 m for trays and 3 m for ladders.

### **Access**

Provide a minimum of 150 mm free space above and 600 mm free space on one side of trays and ladders.

### **Cable fixing**

Provide slats or rails suitable for fixing cable ties, strapping or saddles.

### **Bend radius**

Provide bends with a minimum inside radius of 12 times the outside diameter of the largest diameter cable carried.

### **Cable protection**

Provide rounded support surfaces under cables where they leave trays or ladders.

### **Cable strapping**

Use steel straps on MIMS cables.

**Minimum clearances**

Hot water pipes: 200 mm.

Boilers or furnaces: 500 mm.

**7.8 MAINTENANCE**

The following maintenance works shall be undertaken:

- One month after energisation of the electrical system
  - Infrared thermal scan of all main cable and switchboard electrical termination.
- 12 monthly interval
  - Inspection of cable routes noting insulation temperature and condition.
  - Infra red thermal scan of all main cable and switchboard electrical terminations.
  - Integrity of all sealed conduit controls and inground cable pit facilities.

## **8. OUTLETS**

### **8.1 GENERAL**

Provide wire to and connect all socket outlets, isolators and electrical accessories located as shown on the drawings.

Outlets shall comply with AS 3112 and arranged with the earth pin in the 6 o'clock position.

Allow for the following:

- Flush mounted socket outlets in wall boxes.
- Surface mounted weatherproof IP65 socket outlets and isolators equal to Clipsal 56 series.
- Durable (traffolyte) circuit identification labels on all outlets, isolators and electrical accessories indicating circuit number and distribution board number.
- Conduits as required to enclose wiring and cabling including providing conduit links between ducts and cavity walls.
- Final power connections to work stations.
- Socket outlets installed in joinery as shown on the architectural plans.
- Combination RCD circuit breaker protection installed in the distribution boards for single phase socket outlets and lighting points.
- 3 Phase combination switched socket outlets with integral RCD protection where shown on the drawings.
- Captive type socket outlets for communications equipment racks (CER's).
- Outlets and electrical accessories as scheduled on the drawings.

All power socket outlets shall be switched type.

The style and trim colour of all visible outlets shall be confirmed with the Architect.

All outlets shall be labelled with distribution board or distributor identification and circuit number.

Outlets installed in wet areas such as kitchens, washrooms, etc., including external areas shall be weatherproof IP65 type rated to AS1939 and provided with RCD protection.

Outlets installed beneath counters or bench tops or behind equipment shall be installed complete with an accessible isolating switch located with other power accessories above the counter or bench tops etc., and shall be suitably labelled.

Where AV equipment is installed, the power supply circuit to the AV equipment and control panel shall be dedicated and not serve other socket outlets. It may be used for AV in an adjacent room provided the phase remains the same.

As the ceiling socket outlets for the projectors are adjacent to lighting circuits, the same phase as the lighting circuit shall also be maintained.

#### **Light Switches**

All light switched in bedrooms shall be Clipsal P2000 series to cater for operators with disabilities.

Light switches shall be 15A rocker type mounted under a moulded plastic flush plate.

Generally mount light switches 1050 mm above floor level unless specified otherwise.

Multi switch positions shall be ganged under one cover. Where six or more switches are located in the one position a stainless steel switch panel shall be installed.

Switches shall be mounted on the latch side of the doors.

Light switches shall generally be flush mounted using brackets or metal wall boxes in masonry walls and fitted to standard size flush plates. Provide large switch mechanisms unless otherwise specified.

Provide shrouds over switches terminals where fitted to metal framing.

Light switches in plant rooms shall be protected type.

Push button light switches which operate in conjunction with ECS presence detectors shall be bell press type, Clipsal 30PBBP or approved equivalent.

#### **Power Outlets**

Provide GPO's and other accessories generally from the same manufacturer and of the same manufacture for light switches.

All power outlets in bedrooms, ensuites and bathrooms shall be Clipsal P2000 series to cater for operators with disabilities.

Surface mounted outlets shall be mounted in a matching wall box secured in four locations. Flush mounted outlets shall be secured by means of metal wall boxes in masonry walls and standard fixing brackets in stud walls.

Shroud outlet terminals where appropriate or where required.

The final mounting height of all outlets, isolators and electrical accessories shall be confirmed with the Architect.

### **8.1.1 CROSS REFERENCES**

Comply with the 'General Requirements' and the 'General Electrical Services Requirements' sections.

### **8.1.2 STANDARDS**

Generally: To AS 3000.

Degrees of protection: To AS 1939.

Radio interference limits: To AS/NZS 4051.

### **8.1.3 INTERPRETATIONS**

#### **Definitions**

Rated currents: Rated currents are continuous uninterrupted current ratings within the accessory outlet or appliance under in service conditions. Current rating to consider harmonic load component.

Mounting height to centre of equipment from FFL.

#### **Abbreviations**

GPO: General purpose outlet.

SPO: Special purpose outlet.

FFL: Finished floor level.

### **8.1.4 DESIGN**

#### **Layout**

Exact locations of all accessories outlets and appliances to be referenced from architectural floor plans or architectural advice.

Architect to approve final colour and locations of all outlets.

## **8.2 QUALITY**

### **Samples**

Submit samples of all accessories outlets and appliances. Provide colour schedule palette with samples for approval.

### **Uniformity**

Use outlets of the same style and manufacture throughout the installation.

### **Labelling**

Label each outlet to indicate circuit number and origin.

Labels shall be permanent type of self-adhesive type or engrave plastic IPA stud.

## **8.3 APPLIANCES**

### **8.3.1 GENERAL**

#### **Accessories**

All electrical accessories shall be supplied from a comprehensive catalogue range for domestic/commercial applications.

### **8.3.2 LIGHTING AND SOCKET OUTLET SWITCHES**

#### **Minimum rating**

15 A, 240 V a.c.

#### **Mechanism**

General: Construct the face plate and mechanism so that the mechanism cannot be displaced during normal operation, using retaining screws.

Suitable for connected fluorescent or discharge lighting loads.

#### **Indicators**

Provide red indicators above switch toggles, to be visible with switches "on".

Provide neon indicators as detailed.

### **8.3.3 GENERAL PURPOSE OUTLETS**

#### **Minimum rating**

10A 240V AC.

#### **Floor outlets**

Wilco FO series.

#### **Indicators**

Provide neon indicators as detailed.

#### **Pin arrangement**

Mount outlets with the earth pins at the 6 o'clock position.

#### **Protected or Weatherproof Accessories**

Non-corroding metal or polycarbonate housing.

IP56 rated.

### **8.3.4 3-PHASE OUTLETS**

#### **Minimum rating**

20 A, 500 V a.c.

#### **Pin arrangement**

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



**Plug**

Provide a matching plug top for each outlet.

**Construction**

Surface mounted type of high-impact resistant plastic, with flap lid on the outlet.

**Protected or Weatherproof Accessories**

Non-corroding metal or polycarbonate housing.  
IP56 rated.

**8.3.5 LIGHTING OUTLETS**

**Pin arrangement**

Standard: 3 flat pin with looping terminal.

Emergency lighting: 4 flat pin if self-contained emergency lighting is to be connected.

**8.3.6 INSTALLATION**

**General**

Provide flush mounted accessories except in plant rooms.

Light switches located on latch side of doors; 70mm above lock mechanism.

Multigang switches/outlets under one switchplate.

More than 6 switches; use stainless steel cover.

Segregate and provide barriers in switch recess to limit voltage beneath 240 Volts.

Where stainless steel plates are used, flush screw heads and uniform material types are to be used.

Suspend outlets/pendant to 1800 FFL.

Align vertically and horizontally adjacent switches, GPOs and outlet flushplates.

**Surface mounting**

Use proprietary mounting blocks.

**Restricted location**

Do not install wall boxes across junctions of wall finishes.

**Marking**

Label isolating switches and outlets to identify circuit origin.

**8.4 APPLIANCES**

Where appliances are provided by other trades co-ordinate installation and location of isolators or outlets to suit.

**8.4.1 GENERAL**

Supply all appliances internally wired and complete with control switches, controllers or connecting links.

Provide an isolator adjacent to each directly connected appliance.

Connect each 3-phase appliance with a separate neutral and earth.

Enclose the final connection in flexible PVC conduit where equipment is within 600 mm of a wall or column.

Where equipment is greater than 600 mm from the wall, install cabling within concealed conduit, in-floor ducting cast into the slab or by service pole.

Check all equipment immediately upon arrival for electrical loading and phase connections.

#### **8.4.2 MOTORISED ROLLER SHUTTERS**

Provide a DOL reversing starter:

- In a metallic enclosure with 'RAISE', 'STOP' and 'PUSH TO LOWER' buttons in the cover.
- 'LOWER' button momentary contact type without a 'hold-in' connection. (Motor stops as button released.)
- A time delay relay set at five seconds to prevent immediate restarting.
- Eye beam protecting the opening from the door closing.
- Limit switches at the top and bottom of travel.
- Provide a manually operated isolator at high level adjacent to the motor.

#### **8.4.3 AUTOMATIC DOORS**

- Locate a GPO within the door pelmet.
- Provide a minimum length of 2000mm of 3-core flexible cable for future connection by the door supplier.
- A second GPO in the door pelmet for fail safe power supplies.
- Provide a switch for after hours isolation for door control.
- Provide two core 1.5mm<sup>2</sup> PVC/PVC wiring from the switch to the door pelmet and 2 metre tails left coiled for connection by the door supplier.

#### **8.4.4 CEILING SWEEP FANS**

##### **Mounting height**

Minimum height from blades to finished floor level: 2200 mm.

##### **Horizontal clearance**

Minimum 1200 mm from blade tip to wall cupboards or shelves that require access by ladder or steps.

##### **Speed regulators - inductive**

Surface mounted with adequate clearance for ventilation.

##### **Speed regulators - capacitive and electronic**

Flush mounted.

#### **8.4.5 CEILING MOUNTED APPLIANCES**

##### **Fixing**

For appliances which have unacceptable bending moments, or are heavy or vibrate, provide support brackets fixed through ceiling to the building structure. Brace to prevent horizontal movement.

##### **Connections**

Provide flush mounted 3 pin socket outlets on the ceiling next to support brackets.

#### **8.5 MAINTENANCE**

Examine the condition and functionality of the outlets and appliances at a 12 monthly interval or at the end of the Defects Liability period.

## **9. LUMINAIRES**

### **9.1 GENERAL**

The lighting systems to be installed in the new and exiting Aged Care facility include:

- Luminaires and lamp types as shown on the drawings and as scheduled in Appendix E1;
- Lighting systems suitable for residence bedrooms and ensuites;
- Building internal artificial lighting comprising of various luminaires and lamp types selected to suit the various tasks performed;
- Lighting systems suitable for office and administration areas;
- Basement carpark lighting systems;
- 24 hours internal building security lighting;
- External building lighting including security lighting;
- Landscape and courtyard lighting systems;
- Monitored emergency evacuation and exit lighting.

The Contractor shall supply all luminaires, lamps, tubes, diffusers etc., as scheduled complete with all necessary mounting brackets and accessories.

The Contractor shall include for the packing, cartage, freight, duty, insurance, GST, delivery and storage on site of all luminaires and accessories.

The Contractor shall ensure that recessed luminaires are compatible with the ceiling systems prior to ordering and shall arrange for any necessary supports for the luminaires in the ceiling by the Builder.

The Contractor shall be responsible for the care of all luminaires and accessories prior to the handing over of the building and shall replace or make good any damaged luminaires to the satisfaction of the Superintendent and the Principal.

Luminaires shall have the cable entries and other openings sealed with "Silastic" or approved equivalent after installation of the wiring to prevent the ingress of moisture and insects.

All lamps shall be supplied and installed in accordance with manufacturers requirements. Non compatible lamps and control gear shall not be used in conjunction with each other.

Lamps shall be commissioned in accordance with lamp manufacturers requirements to ensure that warranty commitments on behalf of the lamp supplier are honoured.

Erect all luminaires, fittings and lighting controls in a workmanlike manner, square with other details, maintaining straight and true lines and vertical drops.

Suspended luminaires shall be wire suspended in accordance with the lighting supplier's recommendations. Each end of the luminaire shall be suspended using two wires.

All luminaires shall be securely fixed in position as shown on the drawings and mounted to facilitate easy lamp replacement.

Luminaires shall be complete in all respects and comply fully with AS/NZS 3137.

The final location and mounting height of all luminaires as scheduled shall be confirmed and co-ordinated with the Architect prior to installation.

Discharge lighting shall be provided with power factor correction to correct to a minimum power factor of 0.9 lagging. Capacitors used shall comply with AS/NZS 2644.

Unless specified otherwise on the drawings, all fluorescent luminaires shall be provided with Tri phosphor T5, 4000 deg K lamps

Unless specified otherwise, all luminaires shall be provided with electronic control gear.

The trim colour of all luminaires shall be confirmed with the Architect prior to placing orders.

All luminaires, diffusers etc., shall be clean at the time of handing over of the buildings.

#### **9.1.1 CROSS REFERENCES**

##### **General**

Comply with the 'General Requirements' and the 'General Electrical Services Requirements' sections.

##### **Related sections**

Refer to the following sections:

- Emergency Evacuation Lighting, for emergency luminaires and exit signs.

#### **9.1.2 STANDARDS**

##### **Standards**

Luminaires: To AS 3137.

Road lighting luminaires: To AS 3771.

Radio interference limits: To AS/NZS 4051.

#### **9.1.3 INTERPRETATIONS**

##### **Definitions**

Proprietary luminaires: Luminaires available as a catalogue item.

Custom-built luminaires: Luminaires manufactured to order.

#### **9.1.4 DESIGN**

##### **Performance of custom-built luminaires**

Select, design and use reflectors, accessories and control equipment to the lamp manufacturer's recommendations and which allow the lamps to achieve the performance given in the lamp manufacturer's published data sheets.

Luminaires shall comply with:

- Photometric performance as specified.
- Thermal performance.
- Acoustic performance.
- Air handling requirement.
- Comply with Cat. 'A' luminaires unless otherwise specified.
- Shielded against the ingress of insects for external luminaires.

#### **9.2 LUMINAIRES**

##### **General**

Luminaires shall generally be designed and constructed to include:

- easy lamp replacement;
- removal of components where the luminaire is mounted in its normal operating position.

#### **9.2.1 COMPLETE**

##### **Lamps**

Provide luminaires complete with lamps and accessories.

#### **9.2.2 PROPRIETARY LUMINAIRES**

##### **Modifications**

Carry out to the original manufacturer's standards, unless otherwise notated below.

### **9.2.3 FLUORESCENT**

#### **Recessed**

Reflectors: Parabolic (or otherwise scheduled).

Diffusers: K19 Prismatic (or otherwise scheduled).

#### **Surface mounted**

Diffusers: K19 prismatic wrap-around (or otherwise scheduled).

### **9.2.4 INCANDESCENT**

- Provide luminaires with ES bases (commercial) Bayonet Cap (domestic);
- Internal cabling to be 1.0mm<sup>2</sup> fibreglass insulated;
- Fix directly to slab ceiling via 2 off fixing points;
- Ceiling mount via 2 adjustable spring clips;
- Conceal all visible fixing screws;
- Provide adequate cooling to ensure no deterioration of lamp performance.

### **9.2.5 EXTRA LOW VOLTAGE DICHROIC LUMINAIRES**

- Luminaires to be designed to withstand heat concentrations;
- Provide 50mm clear space around all luminaires for in-ceiling mounting;
- Provide open and clean ventilation chambers in luminaire recesses
- Luminaires to be aligned vertically unless otherwise noted;
- Where ELV transformers supply lighting tracks, install a circuit breaker for each circuit protection;
- Provide low voltage transformers with fuse protection, unless otherwise noted;
- Provide Regulative labelling at switchboard for ELV lighting (refer AS 3000);
- Install transformers for ELV lights and maximum light fitting wattage.

### **9.2.6 HIGH INTENSITY DISCHARGE LUMINAIRES**

- Install a thermal overload device to all ballasts to avoid the ballast overloading if the lamp fails to start;
- Adhere to the component manufacturer's recommendation on internal component spacing;
- Confirm with the lamp manufacturer the compatibility between control gear/lamp with respect to the performance of lamp efficiency, colour rendition, lamp flicker and life;
- Provide shielded cover to lamps where there is a risk of the lamp imploding or exploding.

### **9.2.7 CONSTRUCTION**

- No light leaks within luminaires and junction of ceiling to lamps;
- All luminaire components and trims to be securely fixed to avoid dislodgment or displacement;
- Luminaires to be capable of being securely fixed to all mounting points;
- Luminaire dimensions to be uniform and square in appearances;
- No components to deform whilst in usage;
- Enable lamp replacement to occur without total dismantling of the fitting;
- All luminaires to be fixed by multiple (min. 2) fixing points;
- All recessed luminaires to be supplied with 2000 mm of 1 x 3-core 1.0 mm<sup>2</sup> + 2 (32/0.2mm) flexible cable and 3-pin plug top.
- Provide a valid certificate of approval for all luminaires.

### **9.2.8 METAL WORK**

Construct carcasses with 0.8 mm (min.) thick zincanneal sheet steel. Carcass shall be a 'light box' in design and be sealed (except for air slots).

Ensure carcass is rigid and totally self-supporting. Torsional twisting is unacceptable.

Light fittings shall be suitable for end-to-end mounting.

Ground smooth all welds, fill all visible spot welds for high quality finish.

Exposed trim shall be continuous at joints and smooth finish.

All components to be corrosion resistant, viz.:

- Zincanneal steel;
- Cadmium plate bolts/nuts;
- Aluminium/stainless steel/brass/bronze for external use.

Ensure no light leaks occur above the ceiling zone from the metal work carcass (downlights exempted).  
Tape over future punchouts.

For return air slots, provide painted black metal baffles to avoid line of sight viewing into the ceiling space.

All metal work components to be painted.

Where metal wire acts as a reflecting surface, reflectance to be greater than 85.

### **9.3 ACCESSORIES AND CONTROL EQUIPMENT**

Provide thermal test results as appropriate.

#### **9.3.1 BALLASTS**

##### **Electronic fluorescent lamp ballasts**

Standards: To AS 3963 and AS 3134.

Power factor: > 0.9.

Current total harmonic distortion: < 15%.

Maximum number of 2 lamps/ballast.

##### **Reactive fluorescent lamp ballasts**

Standard: To AS 2643.

Connections: Provide quick-connect terminals or wiring, suitable for the operating temperature close to the ballast.

Number of ballasts: Provide separate ballasts for each lamp.

##### **Maximum ballast losses at operating temperature table**

<b>Lamp Size (W)</b>	<b>Ballast grade — switch start type</b>
	<b>Low loss (W)</b>
18	5
36	5.5
58	7.5

##### **Discharge lamp ballasts**

High pressure mercury vapour and low pressure sodium vapour metal halide types: To AS/NZS 60922 and AS/NZS 60923.

High pressure sodium vapour type: To IEC 662.

Metal halide type:

- ≤ 150 W: Reactors or electronic controlgear;
- > 150 W indoor: To the lamp manufacturer's recommendation;
- > 150 W outdoor: To the lamp manufacturer's recommendation.

Ignitors: Provide ignitors which cut out when lamp ignites.

### 9.3.2 TRANSFORMERS

Standards: To AS 3108 and AS 2125.

#### **Electronic**

- Power factor > 0.9;
- Total harmonic distortion < 15%;
- Maximum numbers of 2 lamps/ballast;
- Losses < 6%;
- Cable length from transformer to lamp(s) shall be to the manufacturer recommendations to comply with AS/NZS 4051.

#### **Iron Core**

- Integrated thermal overload cut-out switch;
- Individual transformers for 50W/75W ELV lamps (unless otherwise noted);
- Short circuit protected transformer;
- 5% voltage regulation across range.

### 9.3.3 CAPACITORS AND FILTERS

#### **Power factor correction**

General: Correct each luminaire to a minimum power factor of 0.9 lagging.

Capacitors: To AS 2644.

#### **Type**

Self-heating, hermetically sealed, provided with a built-in protection device.

Tolerance maximum 10%.

For dimmed luminaires, provide central power factor correction facilities on the dimmer line side.

### 9.3.4 FUSES

Type: 25 mm long, 6 mm diameter cartridge.

#### **Fuses table**

Lamp	Fuse
Fluorescent, 1 or 2 lamps	2A
Discharge, 50–250W	5A
Discharge, 400–1000W	10A

#### **Integral fuses**

Provide integral fuses for high intensity discharge (HID) lamp ballasts.

### 9.3.5 FLUORESCENT LAMP STARTERS

#### **Standard**

To AS 4111.

#### **Starter switches**

Provide starter switches which are compatible with the lamp and controlgear.

#### **Electronic starters**

Provide electronic starter switches which are compatible with the lamp/controlgear.

#### **Location**

Mount starters in readily accessible location within the luminaires, minimum 75mm from lamp base or end caps.

### **9.3.6 LAMP HOLDERS**

#### **Fluorescent**

Tombstone holder to provide 1mm air gap for lamp and be screw fixed within luminaire. Holder to be flexible to suit lamp length and contain swivel action for fitment of lamp.

#### **ELV Tungsten**

Low voltage tungsten lamp holders to contain high temperature contacts (GE type or approved equal).

## **9.4 LAMPS**

### **9.4.1 GENERAL**

#### **Standards**

Fluorescent: To AS 1201.

Incandescent: To AS 2325.

High pressure mercury vapour: To IEC 188.

Low pressure sodium vapour: To IEC 192.

High pressure sodium vapour: To IEC 662.

Tungsten halogen: To IEC 357.

### **9.4.2 FLUORESCENT**

Cathodes: Low resistance.

Bi-pin caps: Standard.

Lamps: 26 mm diameter, correlated colour temperature (CCT) 4100 °K or as scheduled, colour rendering > 60 or as scheduled.

### **9.4.3 COMPACT FLUORESCENT**

Cathodes: Low resistance.

Non-dimmed lamps: Two pin

Dimmed lamps: Four pin

Lamp correlated colour temperature: 4000 °K or as scheduled.

Colour rendering: > 80 or as scheduled.

### **9.4.4 INCANDESCENT**

#### **Type**

Tungsten filament for general lighting service, rated  $\leq 250$  V.

Long life lamp rated at 2000 hrs (av)

#### **Bulb finish**

Internally frosted, unless otherwise necessary for correct operation of the lamp.

#### **Lamp cap type table**

<b>Lamp rating</b>	<b>Cap type</b>
$\leq 100$ W	Bayonet (B22), medium Edison screw (E27), small Edison screw (E14), or small bayonet
$> 100, \leq 200$ W	Medium Edison screw (E27) or bayonet (B22)
$> 200$ W	GOLIATH EDISON SCREW (E40/45)

### **9.4.5 TUNGSTEN HALOGEN**

#### **Low voltage dichroic**

Filament rated at 12 Volts

Lamp life 4,000 hours.

Sealed beam container.

#### **Low voltage bi pin**

Filament rated at 12 Volts.

Lamp life 2,000 hours.



**Main voltage**

Filament rated at 240 Volts.  
Lamp life 2,000 hours.

**9.5 METAL HALIDE**

Provide lamps of the ceramic (option) type.

**9.6 INSTALLATION**

**9.6.1 GENERAL**

**General**

Mount luminaires on proprietary supports using battens, trims, noggings, roses and packing material, as necessary.

**Levelling**

Adjust the length of suspension rods or chains so that the lighting system is level and even.  
Tolerance:  $\pm 3$  mm.

**Suspension**

Rods: Steel pipe suspension rods fitted with gimbal joints.  
Chains: Electroplated welded link chain.  
Wire: Stranded stainless steel.

**Surface mounted luminaires**

General: Fit packing pieces to level luminaires and prevent distortion of luminaire bodies. Use packing strips to align end to end luminaires.

Fixing: Use 2 fixings at each end of fluorescent luminaires. A single fixing at each end in conjunction with 1.6 mm backing plates may be used for narrow luminaires.

**Recessed luminaires**

Connect recessed troffer fluorescent luminaires to a plug socket outlet.

**Lighting tracks**

Locate associated low voltage transformers within 600 mm of the track.

**9.7 MAINTENANCE**

The following maintenance works shall be undertaken.

**Practical completion**

Inspect and clean luminaires, particularly high quality specular diffusers.

**3-monthly**

Inspect and clean luminaires and replace as required all lamps including incandescent and dichroic lamps.

12 monthly or at the end of the Defects Liability period.

Inspect, clean as required and report on the adequacy of all lighting systems as installed.

## **9.8 LIGHTING CONTROLS**

### **9.8.1 GENERAL**

Light switches shall be rated 15 Amps and suitable for switching inductive loads. Unless specified otherwise, mount light switches 1050 mm above the finished floor level

The final location of the light switches and detectors shall suit the operational requirements of the Principal and shall be confirmed with the Architect.

The proposed lighting control methods shall be confirmed with the Client prior to proceeding with the installation and wiring. Allow for any variations in requirements.

Detectors shall be provided to automatically switch off the lighting in the room or particular area after a preset time when no movement is detected. They shall be programmed to enable luminaires to be switched on via a low voltage tactile switch.

Co-ordinate with Conson Australia Pty Ltd, the supplier of the lighting control system, for the final location, testing, adjusting programming and commissioning of the detectors including control system components and allow for all associated costs in the Tender.

All luminaires ballasts supplied shall be compatible with the proposed Conson lighting control system.

Allow for final adjustments, base commissioning and programming to be carried out by Conson

Provide all other necessary electrical accessories to complete the lighting controls installation.

### **9.8.2 LIGHTING MANAGEMENT SYSTEMS**

The main facilities and features for the control of the lighting are shown on the drawings and lighting control schematic.

Supply, install and connect a Conson Lighting Management System supplied by Conson Australia as follows:

The system shall include all light switching and dimming, via low volt tactile mechanisms to control modules located at the distribution boards as shown drawings.

The 230 volt side of the electrical installation shall be conventionally wired from control modules to light fittings.

The drawings show initial switching patterns, selected dimmed circuits and grouping of light fittings.

Preset and macro functions shall be programmed to the Consultants and Clients requirements by Conson Australia.

All tactile mechanisms and associated switches shall match face plates as specified by the Architect.

The system shall include the following minimum characteristics:

- All modules shall be din rail mounted in standard electrical enclosures installed adjacent to the distribution boards.
- Configured in such a manner that in the event of a bus failure the base functions of the system are still operable.
- Cabling not to be limited to category 5 or figure 8 cable to allow for future expansion.
- Contains open architecture to enable non-system proprietary devices such as sensors, lift interfacing, door switches etc to activate the system directly via voltage free contacts.
- Be capable of up to 32 channels of InfraRed (IR) and Ultra High Frequency (RF) control.

- IR codes to be learnable and transferable to provide integrated audio/visual, lighting and curtain control via a single IR hand unit.
- Contains inherent mutually blocked relays to allow control of motorised curtains and blinds via direct switching, IR and RF.
- No programming required for base testing and commissioning.
- Programming to be via an infrared programming tool.

#### **9.8.3 SCOPE OF WORKS**

**Conson provides:**

- All conson proprietary modules, detectors, dimmers, relays, power supplies etc.
- assistance with base commissioning
- Programming

**Contractor to provide:**

- All cabling, installation and termination of cabling between light switch points and other system input devices (typically a Cat 5, 4 pair cable) and conson modules (dimmers, relays etc) located in an enclosure installed adjacent to the distribution boards.
- All 230 volt feeds and terminations to luminaires and other equipment as shown on the drawings.
- All light switches, GPO's, and associated bakelite.
- Base commissioning

**Notes:**

Lighting manufacturers to supply fluorescent fittings complete with digital dimmable ballasts as scheduled.

**Equipment supplier:**

Conson Australia Pty Ltd.  
Contact Neil Brown.  
Ph. 61-3-9754-2999  
Fax. 61-3-9754-2072  
Email [tecs@ozemail.com.au](mailto:tecs@ozemail.com.au)

## **9.9 EMERGENCY EVACUATION LIGHTING**

### **9.10 GENERAL**

Design, supply, install, connect, test and commission a Famco Masterminder (MLC) monitored emergency evacuation lighting and exit signs system complying with BCA, AS/NZS 2293 and Fire Brigades requirements comprising:

- Disconnection and removal of all redundant emergency luminaires and exit signs including associated controls and wiring.
- Monitored, self contained, non-maintained LED recessed emergency luminaires.
- Monitored, self contained, maintained/sustained, surface mounted fluorescent emergency luminaires.
- Monitored, self contained, maintained LED recessed blade type exit signs with running man legend.
- Monitored, self contained, maintained LED surface mounted exit signs with running man legend.
- Masterminder transponder unit ITU-1 installed adjacent to each distribution board that supplies emergency lighting sub-circuits.
- Control unit with modem SCU5 installed adjacent to the PC in the main communications room
- Wiring and connections
- Testing, programming and commissioning.

The emergency lighting luminaires and exit signs shall be as shown on the drawings and as scheduled in Appendix E1.

All fittings shall be type tested in accordance with AS/NZS 2293.

Exit signs shall comply with the latest version of AS2293 and incorporate the "Running Man" legends.

Emergency lighting luminaires and exit signs shall be monitored, self-contained type complete with sealed Ni-Cad battery and test switch. Duration of operation shall not be less than two (2) hours.

The Contractor shall submit the proposed emergency lighting luminaries and exit signs for approval. Emergency lighting luminaires and exit signs supplied with lead acid batteries will not be accepted.

All emergency lighting and exit signs lighting circuits shall originate from the bus section of the distribution board and be connected to circuit breakers labelled:

"WARNING:  
INTERRUPTING SUPPLY WILL DISCHARGE THE  
EMERGENCY LIGHTING BATTERIES"

All emergency lighting luminaries and exit signs shall be identified by visible numbers on traffolyte labels with 5.0 mm black lettering on white background.

Clearly label the fittings in a position that can be readily seen without the removal of the fitting or any covers and diffusers, etc.

The Contractor is advised that Standards Australia published a revised edition of AS2293.1 in May 2005 titled "Emergency Escape Lighting and Exit Signs for Buildings, Part 1: System Design, Installation and Operation".

The Contractor is advised that this standard will be mandatory during this contract.

Attention is drawn of the need to provide pictorial elements, i.e. "Running Man" on the exit signs in lieu of the wording "EXIT".

Co-ordinate with Famco for the final location of fittings, testing, adjusting programming and commissioning the system and allow for all associated charges in the Tender. Famco contact details are Gary Barr, M: 0434 510 924, Email: [garyb@famco.com.au](mailto:garyb@famco.com.au).

Allow for Famco to monitor the Masterminder system, including 6 months and 12 months tests during the 12 months maintenance period.

#### **9.10.1 CROSS REFERENCES**

##### **General**

Comply with the 'General Requirements' and the 'General Electrical Services Requirements' sections.

##### **Related sections**

Refer to the following sections:

- Wiring and accessories, for cabling requirements;
- Luminaires, for general information.

#### **9.10.2 STANDARDS**

##### **General**

Design and installation: AS 2293.1.

Inspection, tests and maintenance: AS 2293.2.

#### **9.11 QUALITY**

##### **9.11.1 CONTRACTOR'S SUBMISSIONS**

###### **Product data**

Submit manufacturer's data for each type of luminaire and exit sign including tables indicating the maximum luminaire spacing for a given mounting height.

###### **Type test data**

Submit the following:

- Photometric data and temperature test reports for each type of luminaire and exit sign;

###### **Shop drawings**

Submit the following:

- Construction details, overall dimensions and wiring arrangement for each type of luminaire and exit sign;

#### **9.12 COMPONENTS**

##### **9.12.1 SINGLE-POINT SYSTEM LUMINAIRES**

###### **General**

Visual indicator lights: Provide a red indicator, readily visible when the luminaire is in its operating location, which indicates that the battery is being charged.

Inverter system: Provide protection of the inverter system against damage in the event of failure, removal or replacement of the lamp, while in normal operation.

Local test switches: Provide a momentary action test switch, accessible from below the ceiling, on each luminaire to temporarily disconnect the mains supply and connect the battery to the lamp.

Common test switches: Where required, provide a common test switch on the local distribution board which disconnects main supply to the emergency luminaires without disruption to the normal lighting.

The switch should be a momentary type connected to a 90 minute timer with auto reset at the end of the test period.

### **Monitored system**

System Type: Famco Masterminder mains injected system.

Monitored schedule to allow for easy replacement/addition of further luminaires.

Processor: Provide all data gathering and reporting system hardware and software to provide full centralised monitoring of the complete system.

### **Batteries**

General: Use nickel-cadmium batteries capable of operating each lamp at its rated output continuously at least 2 hours during acceptance tests and 1.5 hours during subsequent tests.

Battery life: At least 3 years when operating under normal conditions at an ambient temperature of 25°C and subject to charging and discharging at 6-monthly intervals.

Marking: Indelibly mark each battery with its date of manufacture.

## **9.13 INSTALLATION**

### **9.13.1 GENERAL**

#### **Power supply to single-point systems**

Provide a 240 V unswitched active supply to each luminaire and exit sign, connected from the nearest local lighting final sub-circuit.

#### **Data monitoring for single-point systems**

Provide internal monitoring via a data cable connection from the Masterminder transponder unit installed at the distribution boards to a central monitoring PC installed in the main communications room.

## **9.14 COMPLETION**

### **9.14.1 COMMISSIONING**

#### **Mains supply**

Before commissioning, ensure mains supply has been continuously connected for at least 24 hours.

#### **Single-point systems**

Disconnect the mains supply to each general lighting final sub-circuit and verify the correct operation of luminaires and exit signs for a continuous period of 2 hours. Then restore normal supply and verify the operation of the indicator lights on each luminaire.

### **9.14.2 COMPLETION TESTS**

#### **Single-point systems**

Carry out the 6-monthly procedures before Practical Completion and again before the end of the maintenance period.

### **9.14.3 CERTIFICATION & MAINTENANCE**

#### **General**

Carry out the 6-monthly procedures and log book on site to BCA requirements.

The contractor shall provide a completed Fire Safety Certificate to comply with the current regulations for practical completion.

All equipment, parts and materials supplied and fitted during the twelve (12) months maintenance period shall be provided at no cost to the Principal.

#### **9.14.4 EMERGENCY LIGHTING LOG BOOK**

In addition to the Operation and Maintenance Manuals, the Contractor shall supply a vinyl covered hardback commercial quality log book to house all testing logs of the emergency evacuation and exit lighting system.

The log book shall be of a type acceptable to the Superintendent and the local Authorities having jurisdiction and shall contain the initial testing data for the installation.

## **10. TELECOMMUNICATIONS CABLING**

### **10.1 GENERAL**

Become fully informed of the contract work by inspection of the site and by other means considered necessary for the supply, installation, testing, commissioning and certification of a Cat 6 voice/data structured cabling and communications system for the new and existing aged care facility. Unforeseen difficulties due to neglect of this precaution shall not relieve any responsibility for the full and proper execution of the works.

Provide full details of the proposed installation to the system supplier to achieve the certification warranty to Cat 6 standard

The system shall be equal to ModTap, Lucent Technologies, Nordex, AMPS or approved system with certification from the system manufacturer.

The supply, installation, testing, commissioning and certification of the communications systems and cabling shall be carried out by a licensed, authorized Installer approved by the Principal with the ultimate responsibility for the completed systems and cabling borne by the Contractor.

The preferred installer for the communications and cabling systems shall be confirmed with the Principal.

Tenderer's shall propose and submit a comprehensive structured cabling solution to define the telecommunications infrastructure (racks, patch panels, frames, patch cords, cables, faceplates and outlets) necessary to build a uniform premises distribution system, which will function for a multi-media communications solution to support up to 1000Mbps (1GBE) and to provide a 20 year warranted system.

A structured cabling solution that uses Cat 6 components and optical fibre backbone cabling shall be capable of providing up to 1 Gigabit Ethernet operation using full duplex transmission.

The solution shall define the method(s) of flexible patching for the telecommunications services to enable simple moves, additions and changes without frequent rewiring of locations.

Size of the communications equipment racks (CER's) and mounting arrangements shall be confirmed with the Principal prior to ordering. The CER's shall be installed in the main communications room and communications cupboards as shown on the drawings. Final positions shall be confirmed with the Principal.

Allow 25% spare patch panels and cable managers in the CER's for the termination of an additional 25% future outlets which is in addition to the number of outlets shown on the drawings.

A manufacturer's 20 year warranty shall be provided for the permanent links.

Install all proprietary cabling and accessories as per the manufacturer's installation, testing and commissioning criteria, so that the cabling system is covered for the full term of the manufacturer's warranty period.

#### **10.1.1 SCOPE**

The works covered by this section of the specification comprises the items listed below together with all minor and incidental works not specifically mentioned but required for the satisfactory operation of the complete system.

The main facilities are shown on the drawings and schematic.



Briefly, this work includes but is not limited to the following:

- Disconnection and removal of redundant communications services and infrastructure at the appropriate stage of the works as detailed;
- Provision of temporary installations to maintain voice and data services to bedrooms and other rooms and areas of the existing facility during the various stages of construction;
- Provision of the Telecommunications Utility/Company underground conduits including civil works;
- Coordination with the Telecommunications Utility/Company for installation and termination of the incoming lead-in cables;
- Provision of a new "Krone" main distribution frame MDF in the MDF room;
- Spare MDF capacity for future provisions as specified on the schematic.
- Provision of a new "Krone" test point frame TPF in the main communications room (CR);
- Telephone block cabling between the MDF and TPF;
- Tie cabling between the TPF and PABX including terminations. PABX to be supplied by the Principal;
- Tie cabling between the new MDF and existing MDF to maintain the existing telephone services in the Convent and Nurses Home operational;
- Termination of all punch down modules;
- Communications equipment racks (CER's) complete with fibre termination trays, patch panels, cable managers, power rails and UPS;
- Server equipment rack CR2 in CR. Fit out of rack CR2 by the Principal including the tie cabling to rack CR1.
- Ancillary equipment rack CR3 in CR including the provision of tie cabling;
- 3KVA, single phase UPS rack mounted in rack CR3 to provide minimum 1 hour backup.
- Multi pair telephone backbone cabling between MDF, TPF and CER's. Allow for terminating one cable pair per port in the CER's;
- Optical fibre cabling system between CR and CERs including terminations;
- UTP horizontal data/voice cabling system (Cat 6) and terminations;
- Provision of cable trays for the support of cabling;
- Provision of durable (Traffolyte) identification labels on outlets and patch frames;
- Supply and installation of suitable power outlets for CER's, PABX, etc., including outlets in CR;
- Provide all conduits with draw wires;
- Protective earthing of the cable trays, conduits, ducts, racks and exposed metal in the distribution system;
- Provide all communication earthing to ACMA Standard;
- Supply and installation of RJ45 outlets for voice, data and wireless access points;
- Supply patch leads as detailed on the schematic;
- Provide Technical Reference Conductor and connections;
- Supply of all plant, labour, materials and testing equipment necessary for the complete and proper installation of the systems;
- Inspections, testing and commissioning. Tests shall include the full set of tests required to confirm performance to AS/NZS IEC 61935.1 and AS/NZS 3080 permanent link specification;
- Work/installation shall conform to AS 3080;
- Guarantees, warranties and spare parts;
- As installed documentation and manuals including termination records, cable route plans, commissioning test results and maintenance log books;
- All cabling is to be certified and test sheets provided.

#### **10.1.2 LOCATION OF EQUIPMENT**

The positions of all outlets for data shown on the drawings are approximate only.

The final location of all outlets and equipment shall be determined in co-operation with other services and architectural drawings that will be made available on site during the course of the contract period, to be verified as acceptable by the Superintendent.

No cost variation will be allowed for outlets finally located within 3,000mm of the position indicated on the tender drawings.

### 10.1.3 COMPLIANCE WITH AUTHORITIES AND STANDARDS

Carry out all work strictly in accordance with the correct regulations and requirements of the Australian Communications Authority (ACMA).

Work not covered by the requirements of Statutory Authorities shall comply with the latest edition of the appropriate publication from the Standards Association of Australia.

Provide certification that the works meet the detailed standards.

#### STANDARDS AUSTRALIA

Compliance is required as stipulated in the Communications Cabling Manual which consists of the following parts and standards.

Part 1	Introduction.
Part 2	Regulatory information.
Part 3	Customer equipment.
Part 4	Installation practises – Domestic and small business premises.
Part 5	Installation practises – Large buildings and campuses.
Part 6	Separations.
Part 7	Telecommunications earthing.
Part 9	Standards index/extracts.
SAA/SNZ HB27	Handbook for field testing balanced cable installation.
ACMA TS 008	Requirements for Authorised Cabling Products.
TS 009	Installation Requirements for Customer Cabling (wiring rules).
AS/NZS 3080	Integrated telecommunications cabling systems for commercial premises.

#### IEEE STANDARDS

- 10 Base T;
- 100 Base T.

### 10.1.4 CROSS REFERENCES

#### General

Comply with the 'General Requirements' and the 'General Electrical Services Requirements' sections.

#### Related sections

Refer to the Wiring and accessories section, for electrical cabling requirements.

### 10.1.5 STANDARDS

#### General

All work shall be carried out in accordance with the relevant Australian Standards, the Wiring Rules and the requirements of the Australian Communications Authority (ACMA).

Compliance is required for the following standards in particular:

TS001	Safety requirements for customer's equipment
TS008	Requirements for authorised cabling products
TS009	Installation requirements for customer cabling.
TS010	General premises and domestic premises cable's licence and inspection requirements.
AS3000	SAA Wiring Rules.
AS3080	Commercial Building Telecommunication wiring.
AS3084	Cable Accommodation and Pathways.
AS3548	Electromagnetic Interference - limits and methods of measurement of information technology equipment.
AS3815	A guide to Coaxial cabling in single and multiple premises.
AS/NZS 3085.1	Administration of communications cabling systems.

AS/NZS 3086	Integrated telecommunications cabling systems for small office/home office premises.
EIA/TIA TSB-36	Additional Cable Specifications for UTP Cable
EIA/TIA TSB-40A	Additional Transmission Specifications for UTP Connecting Hardware
EIA/TIA 568A	Commercial Building Telecommunications Wiring Standard
EIA/TIA 569	Commercial Building Standard for Telecommunications Pathways and Spaces
ISO 11801	Communications Cabling Systems for Commercial Premises
IEEE 802.3	
SP2840	Commercial Building Telecommunications Cabling Standard.

#### **10.1.6 AUTHORITIES APPROVALS**

Pay any fee lawfully imposed by ACMA for inspection.

#### **10.2 QUALITY**

The work shall be performed by the holder of an appropriate ACMA licence, and by personnel certified by the respective system supplier to install the cabling system.

##### **10.2.1 CONTRACTOR'S SUBMISSIONS**

###### **Product data**

Submit product data for components.

Submit proposed method of cable and terminal outlet labelling.

Provide certificate of compliance from an ACMA approved test house, for all cables and terminations used.

##### **10.2.2 ACMA APPROVED ITEMS**

Document all items such as cabling, outlets, frames and equipment required to be ACMA approved, with the approval number. Submit the documented list for inspection to the Superintendent.

Inspect all equipment required to have an ACMA approval label, to ensure that the labels exist. If labels have not been installed by the manufacturer then obtain the approval number from the manufacturer and install labels on the equipment.

##### **10.2.3 GENERAL REQUIREMENTS**

Obtain acceptance from the Superintendent for the following:

- As-installed drawings and cabling records;
- Details of the type and method proposed for fixing of equipment;
- Samples of all accessories, apparatus and fittings proposed to be used in the works.

Submit proposed cabling diagrams to the Superintendent for acceptance prior to commencing the installation.

Provide detailed riser diagrams, complete record cards for all cross connect frames and certification by the ACMA licensed contractor of the installation's compliance with the Communications Cabling Manual, to the Superintendent for acceptance on completion.

##### **10.2.4 SAMPLES AND DETAILS**

Ensure that samples of all accessories, fittings, apparatus and details of workings submitted for inspection and acceptance are accompanied by a detailed schedule, in duplicate, listing the items submitted, together with make and catalogue references where appropriate.

One copy will be returned to the Electrical Sub-Contractor installed by the Superintendent and noting those items which have been accepted and the date of such acceptance.

All samples submitted shall be suitably labelled and when accepted, be retained by the Superintendent on site and used as a reference for materials and workmanship which shall be employed on the works.

#### **10.2.5 STANDARDS OF WORKMANSHIP**

All cabling work shall be carried out by an ACMA licensed contractor and certified installer for the cabling system being installed.

Certification of the system is to be provided by the Contractor.

#### **10.2.6 CABLING RECORDS**

Complete all records required by ACMA and provide complete record book at each distribution frame.

Provide a wall mounted (in the CR) laminated architectural drawing of the floor detailing the outlet numbers and floor outlet locations.

The Certificate of Practical Completion for the works will not be issued until such time as the inspected and accepted as-installed drawings and cabling records have been issued.

#### **10.2.7 TESTING AND COMMISSIONING**

Testing and commissioning of the complete communications installation includes a working demonstration of satisfactory performance for the Proprietor.

Carry out continuity tests on all cables for termination and pair integrity.

Keep a record of all tests carried out and submit all test results, suitably tabulated, to the Superintendent for inspection and acceptance.

All items found to be defective and any fuses blown during testing and commissioning shall be replaced by the Sub-contractor at his own expense.

#### **10.2.8 CERTIFICATE OF PRACTICAL COMPLETION**

A Certificate of Practical Completion will be issued by the Superintendent when:

- The installation has been satisfactorily completed;
- As-installed drawings and cabling records have been submitted to an acceptable standard;
- Certification of network cabling performance is provided.

### **10.3 CABLES**

#### **10.3.1 GENERAL**

Ensure that the whole installation is fixed to create a completely flush, fixed and finished installation.

The work shall include the installation and termination of both ends of all cable.

**Note that in particular, long runs of integrated telephone and data cables parallel with power cables must be avoided. AS 3080 stipulates minimum separation. Where telephone and data cables run parallel to power cables the separation shall be as detailed in AS 3080.**

Cabling shall not rest on or be supported by the ceiling, ceiling grid or ceiling support system.

### **10.3.2 CABLING LABELLING**

Label the data backbone cables clearly at each end. Label also the data block cabling in each riser they pass through. Use alpha numerical characters to provide a self-explanatory label. Labelling on block cabling shall indicate the source and destination of the cable.

Labelling shall be Grafoplast or a similar system manufactured from durable materials and securely attached to the cables. The lettering on the labels shall be permanent, i.e. resistant to fade and mechanical damage.

Label the horizontal UTP distribution cabling with a number at both ends. The use of a marker pen on the sheath is acceptable providing the ink is not easily rubbed off. The numbering system shall be in a logged order with each cable in the installation having a different number, e.g. cables on each level numbered in a clockwise direction.

Details of the proposed labelling scheme shall be provided to the Superintendent for acceptance.

### **10.3.3 HORIZONTAL UNSHIELDED TWISTED PAIR (UTP) CABLING**

The horizontal UTP cable shall be 4-pair unshielded twisted pair 6 (enhanced) cable.

Horizontal cabling shall consist of PVC sheathed and insulated 4-pair 24-AWG twisted pair cable. The UTP cable shall meet UTP 6 enhanced specification. The UTP cable must be certified by the manufacturer suitable for 6 enhanced.

The four pair UTP cable shall be terminated with care taken to ensure the twist is maintained to the point of termination. The length of sheath removed for termination is to be minimised.

### **10.3.4 FIBRE CABLES (VERTICAL CABLING)**

The fibre optic vertical riser cable shall be purpose designed for riser use. The fibre cable shall have each fibre jacketed enabling fibres to be broken out and directly terminated with an Ic bayonet connector.

Vertical fibre cables shall have a minimum number of cores as stipulated on the drawings, 62.5 micron core, 125 micron clad multi-mode graded index fibre per cable.

Each fibre shall have the following specifications:

- Maximum attenuation of 4 dB/km for a 0.85 micrometre wave length and 1dB/km for a 1.3 micrometre wave length;
- Minimum transmission bandwidth of 100 MHz/km for a 0.85 micrometre wave length and 400 mHz/km for a 1.3 micrometre wave length.

### **10.3.5 TELEPHONE CABLING (VERTICAL CABLING)**

Provide multi-pair Cat 3 UTP telephone cables with the number of pairs as indicated on the schematic.

### **10.3.6 CARRIER LEAD-IN CABLE**

By the Carrier.

## **10.4 SUPPORTS**

### **10.4.1 CABLE MANAGEMENT SYSTEM**

Lace the 4-pair UTP horizontal cabling to a suitable cable management system so as to provide a neat appearance and strain relief. The cable management must include horizontal and vertical cable runs and allow easy installation of additional UTP horizontal cabling.

### **10.4.2 CABLE SUPPORTS**

Support the data cables by a cable tray system and catenary wires, saddles or hangers in the false ceiling where required.

Fix the cables to the support system by ties, straps or saddles, at 1,000 mm centres for vertical runs and 2,000 mm centres for horizontal runs on cable trays and 300 mm centres for catenary wires, hangers etc.

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.

Ensure that bends in cables have a minimum inside radius of not less than that specified by the manufacturer. If bending radius is not specified by the manufacturer, a minimum inner bending radius shall be twelve times the outside diameter of the cable.

### **10.4.3 DATA CABINET LEAD MANAGEMENT**

Provide the lead management in the data cabinets to eliminate the "spaghetti" look of the data communications rack. The lead management shall consist of horizontal rings and vertical rings.

## **10.5 ACCESSORIES**

### **10.5.1 DATA/TELEPHONE SOCKET INSTALLATION**

Supply, install and connect all data/telephone cable sockets and their mountings.

Where outlets are integrated with furniture and flooring, liaise with other trades to establish detailed mounting provisions and all requirements to install the telephone and data sockets. Data outlets shall be 8-way modular sockets type RJ45.

The colour of outlet where mounted on workstation and wall mounted, is to be approved by the Superintendent.

The connectors shall be non-shuttered outlets non-keyed RJ45 outlets and shall be flush mounted horizontally aligned and integrated into the work station furniture and/or power poles.

The RJ45 modular connectors must meet the Mechanical and Electrical characteristics detailed in AS 3080 Table 23 and 24.

### **10.5.2 LABELLING OF DATA/TELEPHONE OUTLETS**

Provide all outlets with a permanent label containing a unique outlet number. The label must be machine printed or engraved; hand printed labels are not acceptable. The labelling system shall be supplied by the outlet manufacture if suitable. If the manufacturer cannot provide a labelling system or the manufacturer's labelling system is unsuitable then an alternative labelling system such as a Trifoliate, or equivalent is acceptable.

The alphanumeric coding on the labels shall be self explanatory indicating the location of the outlet and the patch frame on which it is terminated, e.g. N/3-15 would indicate that the outlet is the 15<sup>th</sup> outlet on the third floor.

Locate the labelling above the coloured surround of the outlets.

#### **10.5.3 UTP CROSS-CONNECTING FRAMES (CCF)**

The cross connecting frames shall be RJ-45. All horizontal and vertical cabling shall be terminated on RJ-45 patch panels allowing cross connect using RJ-45 patch leads. The RJ-45 patch panels to be mounted in 19" racks.

#### **10.5.4 FIBRE PATCH PANELS**

Fibre patch panels shall provide fibre termination and patching and fibre management.

Fibre patch panels and the fibre management system shall be a rack mountable system. The fibre patch panel shall provide termination onto lc style connectors. The fibre management system shall provide suitable attachment of the fibre riser cable and accommodate the surplus fibre patch lead length.

#### **10.5.5 CABINETS FOR RACK MOUNT EQUIPMENT**

Provide the communications room with 19" cabinets for equipment. Each cabinet shall have capacity of 45RU (rack units).

Supply each rack with a vertical power distribution module.

#### **10.5.6 EQUIPMENT SHELVES**

Provide equipment shelves for non rack mountable equipment. Racks are to be provided with vertical and horizontal cable tidy units.

#### **10.5.7 PATCHLEADS**

Provide appropriate patch leads for all services. The quantity of patch leads is detailed in the Appendix.

The patch cables shall be provided using multi pair cable with modular plugs factory crimped at both ends. The lead assemblies shall be suitable for Cat. 6 use. Patch leads shall be of such length to allow connection of equipment to nominated outlets.

It should be noted that UTP patch leads providing connection must not exceed 5 metres in length. The quantity of each length of patch lead is detailed in the appendix.

Optional coloured patch leads are to be priced, the colours available are to be provided for client selection.

Fly leads to be supplied by others.

#### **10.5.8 LC FIBRE CONNECTORS**

The lc compatible fibre connector shall be a low loss crimp connector with a ceramic ferrule and plastic strain relief boot. The lc connector must be able to provide a reliable termination with low insertion loss.

The connectors must meet the Optical and Mechanical characteristics detailed in AS 3080 Table 27.

Note: Connectors must be protected by dust covers to protect the optic element.

#### **10.5.9 LC TO LC CONNECTOR FIBRE PATCH LEADS**

The lc to lc connector fibre patch leads shall be manufactured by a specialist manufacturer, i.e. not manufactured on site. The manufacturer shall provide each fibre patch lead with certification. Fibre patch

leads shall be supplied with protective dust covers which must be left on until they are installed on patch panels. Quantity of fibre patch leads to be supplied is tabulated in the Appendix.

## **10.6 EARTHING**

### **10.6.1 TELECOMMUNICATIONS TECHNICAL REFERENCE CONDUCTOR (TRC)**

Provide a Technical Reference Conductor to the Computer and Floor Communications Racks and CCFs frames as specified by ACMA Technical Specification TS 009.

Earthing to the metallic enclosures (racks) shall be provided from the electrical earth.

## **10.7 INSTALLATION**

Support cables on cable trays, catenary wires and from the building structure at 200 mm centres horizontally and 500 mm centres vertically.

Note that telephone and data cables parallel with power cables must be separated by minimum distances or appropriately shielded.

Where the minimum separation can not be met the telephone and data cables shall be installed in steel enclosure appropriately earthed in accordance with ACMA Standards and AS 3080.

Where data and power cable cross the cross over shall be made at right angles and appropriate barrier provided.

Cabling shall not rest on or be supported by the ceiling or ceiling grid.

## **10.8 COMPLETION**

### **10.8.1 COMPLETION TESTS**

#### **General**

To AS 3080 clauses 8.4, 8.5 and 8.6.

Test each pair in every cable for:

- Continuity;
- Correct sequence;
- Reversed pairs;
- Transpositions and split pairs.

Test the insulation resistance of each pair in the outer layer of every cable, and of one pair to earth.

Test the copper cable installation for:

- The location of any reflection due to impedance changes and faulty terminations using a time domain reflectometer; and
- Near-end crosstalk (NEXT) and signal attenuation using a suitable measuring device.

Sample testing may be carried out (and result documented) in accordance with A 1199.

Provide copies of the test results to the Superintendent.

### **10.8.2 MAINTENANCE**

#### **Records**

General: Submit log books for each distribution frame with details of cable terminations and provisions for recording cable, line and jumper information.



Location: Secure log books in each distribution frame records holder.

## **11. MASTER ANTENNA TELEVISION**

### **11.1 GENERAL**

Provide a Master Antennae Television System MATV to serve the new and existing Aged Care facility.

The main facilities for the MATV system are shown on the drawings and schematic

The MATV system shall receive and distribute free-to-air VHF and UHF TV, Foxtel Satellite Pay TV and the RAI Italian International channel to all bedrooms and outlets shown on the drawings via a centrally located MATV antennae System.

In addition, the system shall provide two additional in house TV channels for VCR/DVD

The system shall be suitable for receiving and distributing monochrome and colour, analogue and digital signal transmissions for all local television including AM and FM radio stations in accordance with AS 1367.

This includes the provision of antennae's, amplifiers, couplers and co-axial cables, including the backbone cabling to splitter units, multi switches and tap off units installed in the comms cupboards.

The Contractor shall undertake a detailed design of the system and shall guarantee a clear picture and sound reception on all channels at all points of the system in compliance with this specification.

Carry out signal strength tests to obtain a strong enough signal for satisfactory distribution within the buildings.

Design the MATV system to allow for the connection of the number of outlets located as shown on the drawings.

Engage a specialist MATV Sub-Contractor having qualifications and experience with MATV systems of a similar size and complexity as required for this project.

Become familiar with the site, assess by inspection the scope and requirements for the provision of a MATV system as specified below, and allow for all of the scope and requirements to be included in the tender.

The location of the antennae's on the roof including supporting methods shall be confirmed with the Architect and Principal prior to installation of the antennae's

The MATV system shall be designed and installed based on each residence arranging their own Foxtel Pay TV subscription.

#### **11.1.1 CROSS REFERENCES**

##### **General**

Comply with the 'General Requirements' and the 'General Electrical Services Requirements' sections.

##### **Related sections**

Refer to the Wiring and accessories section, for cabling requirements.

#### **11.1.2 STANDARD**

##### **General**

To AS 1367.

### **11.2 SCOPE**

The scope for the provision of the MATV system shall include but is not be limited to the detailed design, supply, delivery, installation, testing, commissioning including defects maintenance of a complete MATV system. The scope includes:

- Disconnection and removal of redundant free-to-air antenna and supports, co-axial cabling, MATV components and outlets at the appropriate stage of the works as detailed
- VHF and UHF roof mounted antennae's suitable for analogue and digital TV reception.
- Roof mounted Foxtel satellite dish.
- Relocation and re-connection of the RAI Italian International satellite dish at the appropriate time during stage 1 or early part of Stage 2.
- All necessary roof mounted supports for the antennae's.
- Head end equipment wall mounted in the main comms room during stage 1 incorporating the amplification and filtration equipment. The head end shall be expandable to encompass the installation of additional MATV outlets in the existing Convent and Nurses Home to be refurbished in the future including the future development of 72 apartments and 11 villa units.
- Connection of the new free-to-air antennae and relocated RAI satellite dish to the existing head end to maintain the operation of the existing MATV system in the Covent and Nurses Home.
- Various types of splitters, drop taps, multi switches installed in the comms cupboards. Ensure suitable access is provided to these devices.
- Amplification equipment installed in the comms cupboards necessary to maintain signal strength and quality.
- Provision of F type outlets located as shown on the drawings.
- Provision of co-axial cables. Backbone cables shall be RG11 shielded quad and drop cables RG6 shielded quad.
- Rack mounted head end ancillary equipment including radio tuners, VCR, DVD, decoders and monitors in the ancillary communications rack CR3 located in the main Communications room.
- Complete all wiring and connections.
- Undertake all testing, commissioning and certification in accordance with the Principal's requirements.

### **11.3 QUALITY**

#### **11.3.1 SAMPLES**

##### **General**

Submit samples of outlets.

#### **11.3.2 CONTRACTOR'S SUBMISSIONS**

##### **Product data**

Submit product data for components, including antenna specification sheets.

##### **Shop drawings**

Submit shop drawings showing the system block diagram, and expected signal levels at branches and outlets. Indicate proposed antennae locations.

### **11.4 MASTER ANTENNA TELEVISION SYSTEM**

#### **11.4.1 GENERAL**

##### **Frequency response**

VHF and UHF broadcast reception: 50 MHz to 1 GHz.

Broadband and satellite reception: 50 MHz to 2.125 GHz.

Digital: Australian COFDM digital terrestrial TV system.

#### **11.4.2 ANTENNAE**

##### **Standards**

To AS 1417.1 and AS 1417.2.

##### **Location**

Provide and adjust the antenna and obtain the maximum signal level and minimise ghosting.

#### **11.4.3 DISTRIBUTION AMPLIFIERS**

##### **Gain**

Sufficient to provide the signal levels while maintaining at least 6 dB reserve gain.

##### **Signal levels**

Maximum 120 dBuV.

Minimum on trunk cables 75 dBuV.

#### **11.4.4 OUTLETS**

##### **Type**

Coaxial cable sockets flush-mounted on high-impact resistant plastic plate. Provide components fixed on a printed board assembly, fitted with "F" type connectors or clamp and screw connectors for the coaxial cable termination.

Analogue signal strength at each outlet shall be 68dBuV  $\pm$ 3dB.

Digital signal strength at each outlet shall be 57dBuV  $\pm$ 3dB.

##### **Blocking capacitors**

100 pF, 2.2 kV a.c.

##### **Fly leads**

For each outlet, provide a 2 m long coaxial cable fly lead fitted with a suitable plugs.

#### **11.4.5 CABLES**

##### **General**

Lengths  $\geq$  4 m or distribution cabling: RG 6 or R 1103.

Backbone cable for broadband and satellite reception: RG 11 or R 1140.

Sheath: Black PVC V75.

##### **Connectors**

Crimp type 'F' connectors.

#### **11.5 COMPLETION**

##### **11.5.1 COMPLETION TESTS**

###### **Tests**

Outlets: At each designated outlet, measure and record

- The signal strength and the carrier-to-noise ratio of each nominated service;
- The inter-modulation between services; and
- Isolation between outlets.

Amplifiers: Measure and record carrier-to-noise ratio at head amplifier and distribution amplifiers.

#### **11.6 MAINTENANCE**

Re-measure the signal strengths at the end of the 12 month maintenance or Defects Liability period. Compare results with original test recorded data.

## **12. ELECTRONIC SECURITY**

### **12.1.1 GENERAL**

Provide and connect a integrated PC based electronic security control system comprising of access controls, intruder detection, security control panels, CCTV surveillance, intercom, wiring and connections.

The main facilities for the systems are shown on the drawings and schematic

The security access control system shall be a GE Challenger system or approved equivalent.

The location of the access controlled doors, security control panels, door monitors, CCTV cameras and intercom stations are shown on the drawings. Final locations shall be confirmed with the Principal prior to commencing the installation.

The systems shall be expandable to encompass the future expansion into the existing Convent and Nurses Home. Allow for 50% minimum expansion for future provisions.

Engage a specialist Security Sub-Contractor having qualifications and experience with security systems of a similar size and complexity as required for this project.

The Contractor shall co-ordinate with the specialist Sub-Contractor for the provision of the systems and shall allow for all associated costs in the Tender.

### **12.1.2 CROSS REFERENCES**

#### **General**

Comply with the 'General Requirements' and the 'General Electrical Services Requirements' sections.

#### **Related sections**

Refer to the following sections:

- Uninterruptible power supply, for power supply and backup.
- Wiring and accessories, for cabling requirements.

### **12.1.3 STANDARDS**

#### **General**

Intruder alarm systems: To AS 2201 Parts 1, 2, 3, 4 and 5, as appropriate.

### **12.1.4 LICENCE**

#### **General**

The electronic security system provider must be a licensed security organisation.

## **12.2 SCOPE**

The scope shall include the design, supply, installation, connection, commissioning and testing of an integrated electronic security control system including but not limited to the following:

- Disconnection and removal of all redundant access door controls, key pads, power supplies and cabling at the appropriate stage of the works as detailed.
- Door access controls comprising of types shown on the drawings. Final locations of the access controlled doors shall be confirmed with the Principal prior to commencing the installation.
- Door entry and exit key pads.
- Manual break glass door release buttons.
- Connections for auto sliding doors connected to the access control system
- Monitoring of external doors including doors from stairs.
- Duress alarm buttons located at reception with silent alarm to administration office. A display at the administration shall identify the location and time that each alarm was initiated.
- Door monitors interfaced with the nurse call system wanderer's alert receivers.
- Master security control panel MSCP wall mounted in the main communications room.

- Door controllers and data gathering panels installed in the communications cupboards.
- High level interface with the fire indicator panel FIP to release all access controlled doors in the event of a fire alarm. System to be automatically reset when the fire alarm signal is removed.
- Low level interface with the nurse call system.
- High level interface with the CCTV surveillance system.
- Interface with the MDF for remote alarm monitoring. Allow also the provision of local audible alarms.
- Alarm management via a PC, colour monitor, printer and back up recorder located in the main communications room.
- Provision of all necessary software and programming.
- CCTV surveillance system comprising of digital colour cameras, DVR's and power supply rack mounted in the ancillary communications equipment rack CR3
- Patch panel(s) and network switches in comms rack CR3 including data outlets and Cat 6 cabling for LAN connectivity.
- Power supplies with battery back up for the master security control panel, door controllers and data gather panels with back up time as specified below.
- Intercom system and cabling comprising of a master intercom station installed in the reception area and intercom stations located at entry doors located as shown on the drawings
- All access control doors are to be made "fail safe" in the event of a power supply failure.
- Provision of all associated power supplies, wiring and final connections.
- Testing and commissioning in accordance with the Principal's requirements.

## **12.3 QUALITY**

### **12.3.1 SAMPLES**

#### **General**

Submit samples of the following:

- Door contacts and reed switches;
- Key or card readers;
- Electric door strikes and door release devices;
- Duress alarm switches.

### **12.3.2 CONTRACTOR'S SUBMISSIONS**

#### **Product data**

Submit data showing dimensions and space requirements for the following:

- Door contacts and reed switches;
- Detection devices;
- Key or card readers;
- Electric door strikes and door release devices;
- Television monitors, cameras and associated equipment;
- Intercom stations;
- Vehicle control systems;
- Duress alarm switches.

#### **Shop drawings**

Submit shop drawings showing the following:

- Block diagram of all systems;
- Panel layouts and dimensions;
- Power supply requirements;
- Wiring access necessary for door frames;
- Cut out dimensions;
- Fixing provisions for cameras and monitors.

## **12.4 POWER SUPPLY**

### **12.4.1 MAINS SUPPLIES**

#### **General**

Provide permanent extra low voltage or 240 V mains supply to the following:

- Intruder alarm panels and access control panels including sub panels;
- Electric door strike local panels or control equipment;
- CCTV monitors and cameras;
- Intercom stations.

#### **Marking**

Label the switchboard circuit breaker from which power for the security systems is obtained "SECURITY SYSTEM - Do not switch off".

### **12.4.2 BATTERIES AND CHARGERS**

#### **General**

Provide a sealed battery and charger system contained within a separate compartment within the panels.

#### **Capacity**

At least 4 hours for the complete system in normal stand-by mode ie., under no load, and at least 1 hour for normal access control of entry/exit doors ie., under load.

## **12.5 INTRUDER ALARM SYSTEMS**

### **12.5.1 PANELS OR PROCESSORS**

#### **Capacity**

General: Provide separate sectors for each nominated internal detection zone, and for normally-closed and normally-open perimeter detection zones.

Tamper alarms: Provide separate tamper alarm sectors and, if applicable, alarm circuit supervision.

#### **Delayed sectors**

Provide one adjustable time delay entry/exit sector, with adjustment range 0 - 30 s and tamper protection.

#### **Spare capacity**

Provide sufficient plug-in module and power supply capacity for the addition of 25% spare zones.

### **12.5.2 MOVEMENT DETECTION DEVICES**

#### **General**

General: Provide movement detectors which cover designated areas.

Installation: To AS 2201.1.

### **12.5.3 DOOR CONTACTS**

#### **Magnetic reed switches**

Provide magnetic reed switches which operate when

- A personnel door is opened > 20 mm at the lock/latch edge;
- The fixed leaf of a double door is opened > 20 mm at the lock/latch edge; or
- A vehicular door is opened > 100 mm.

#### **Door lock sensors**

General: Provide micro switches or magnetic contacts in lock keepers or door locks which incorporate a bolt movement sensing device.

Function: To detect bolt movements > 10 mm.

#### **12.5.4 DURESS ALARM SWITCHES**

##### **Desk or furniture mounting**

Provide plug socket connections for duress alarm switches fixed to items of furniture. Conceal wiring and secure to avoid accidental disconnection.

##### **Wall mounting**

Recessed at 900 mm above finished floor level.

##### **Disconnection alarm**

Connect so that removal of plugs from sockets will automatically register as a duress alarm.

#### **12.5.5 EXTERNAL AUDIBLE AND VISUAL ALARMS**

##### **General**

Provide a corrosion-resistant weatherproof metal enclosure containing a siren and blue strobe light. Fix directly under eaves or in locations not readily accessible without a ladder.

#### **12.5.6 ANTI-TAMPER DEVICES**

##### **General**

General: Provide anti-tamper devices to alarm panels, detectors and external equipment, control and activating devices, and access control devices.

Function: To register an instantaneous alarm if covers are removed or vital wiring is disconnected.

#### **12.5.7 ALARM CIRCUIT SUPERVISION**

##### **General**

General: At each detection device, provide alarm circuit supervision using an "end-of-line" device connected via a separate circuit within the cable.

Function: To register an instantaneous alarm if cable characteristics change, such as when cut or short circuited.

#### **12.5.8 EVENT LOGGING PRINTER**

##### **General**

General: Provide an event logging printer connected to the alarm and access control panels.

Function: To generate a printed report showing the date, time and category of alarm initiations and access control entries.

#### **12.5.9 MONITORING**

##### **General**

Provide a monitoring system in the alarm panel or processor for transmission of alarms and monitoring of the system by a security monitoring base station, or by other parties responsible for attending to alarms. Select from the following:

- Telephone dialler;
- Direct lease line via telecommunications carrier lines;
- Connection to local building security monitoring station;
- Mobile telephone link.

#### **12.6 ELECTRONIC ACCESS CONTROL**

##### **12.6.1 ACCESS CONTROL PROCESSORS OR PANELS**

###### **Capacity**

Provide separate entry/exit control modules for each designated door.

###### **Users**

Program the system to match the number of authorised users with unique access codes.



**Time zones**

At least 4 per day, with provision for weekends and public holidays.

**12.6.2 DOOR CONTROL DEVICES**

**General**

General: Provide electric strikes, electric locks, drop bolts, or similar devices to suit door construction and hardware.

Fail-safe: Connect door control devices in a fail-safe mode to permit egress in the event of power failure.

**Authorised products**

Electromagnetic locks: Use equipment listed in the SSL Register of Accredited Products - Fire Protection Equipment.

**Glass doors**

Provide tumbler, drop bolts or magnetic holders.

**Double leaf doors (solid frame)**

Provide an electric strike or lock on the fixed leaf, connected to the door frame using concealed flexible wiring.

**12.6.3 ACTIVATION**

**General**

General: Provide keypads, card readers or other activation devices, and locate next to entry points.

External: Provide weatherproof hoods or housings for external units.

Mounting height: 1.2 m.

**12.6.4 INTERCOM**

**Base station**

General: Provide an intercom master station located in the main Reception area interconnected with individual intercom stations installed at the entry doors located as shown on the drawings. Include speakers and microphones.

Type: Surface mounted, removable handset type

Operation: Provide an audible tone device to indicate that the individual intercom station is being called, and a press-to-talk switch so that the master station can communicate with the intercom station only when the switch is held down.

Schedule: Provide a schedule holder and card identifying individual intercom stations. Locate next to the intercom master station.

Door control: Provide integral momentary action door release switches to operate the door release or opening mechanisms at the entry doors.

**Intercom stations**

General: Provide wall mounted intercom stations installed at the entry doors and interconnected with the master intercom station.

Type: Wall mounted flush stainless steel panel.

Dial: Digital push-button type.

Weatherproofing: If exposed to the elements, provide a hood above the panel

#### **12.6.5 CONNECTION TO OTHER SERVICES**

##### **General**

General: Provide or supply, as appropriate, key pads or other devices to match access control system devices. Provide and connect wiring to the designated services.

#### **12.7 CLOSED CIRCUIT TELEVISION**

##### **12.7.1 GENERAL**

Design, supply, install, connect, test and commission an IP addressable CCTV surveillance system as specified below and as shown on the drawings.

The CCTV surveillance system shall provide coverage of the rooms and areas as shown on the drawings.

Final location of the CCTV equipment and cameras, including the aiming of cameras shall be confirmed with the Principal prior to installation.

##### **12.7.2 SCOPE**

The scope of the CCTV surveillance system installation shall include but is not limited to the following:

- Provision of fixed dome type digital colour cameras installed in the locations as shown on the drawings
- Provision of fixed digital colour cameras enclosed in vandal resistant and weatherproof housing installed in the entry to the basement carpark and in the locations as shown on the drawings
- Provision of a 19" colour monitor located in the main communications room.
- Multi channel multiplexer, digital video recorders DVR's and power supply rack mounted in the ancillary equipment rack CR3 located in the main communications room.
- High level interface with the master security control panel
- Wiring and connections
- Testing and commissioning

The CCTV surveillance system shall be complete with a multi channel multiplexer suitable to interface with new colour cameras and colour surveillance monitor.

Digital video recorders, DVR's shall be installed and connected to the multiplexer, programmed and tuned to enable correct operation with the cameras.

CCTV cameras shall be compatible with the multiplexer and DVR's.

##### **12.7.3 CAMERAS**

##### **General**

Provide high resolution, fixed digital colour CCD cameras to meet the following criteria:

- Cameras trained on doorways shall provide pictures suitable for identifying facial features and main items of upper and lower body clothing. Faces shall occupy no less than 20% of the picture height.
- Cameras used for general surveillance shall provide pictures suitable for identifying main items of upper and lower body clothing. A 1.6m tall person should occupy no less than 25% of the picture height
- Cameras providing general surveillance of external assets shall provide pictures suitable for confirming interference by a person(s).

Determine camera height on site so as to obtain a good view under light fittings, signs and other objects

**Positioning and adjustment**

Position and aim cameras to provide optimum coverage and to minimise the effect of shadows or direct light sources.

**Lenses**

Provide lenses with apertures and focal lengths selected to provide coverage of designated areas and to enable persons within the field of view to be readily distinguishable on monitors.

**Motorised cameras**

Where specified, provide camera drives which provide remote control of camera rotation and tilt, and of lens focal length.

**Internal cameras**

Provide dome camera housings for each indoor camera.

**External cameras**

Provide corrosion-resistant weatherproof housings for cameras located externally, which allow cameras to perform to manufacturer's specification.

**Fixing**

Provide mounting brackets and hardware which rigidly fix cameras, monitors and accessories to buildings or structures.

**12.7.4 MONITORS**

**General**

CCTV surveillance colour 19 inch LCD monitor shall be supplied and installed in the main communications room to monitor the CCTV surveillance system. The monitor shall be compatible with the rest of the security system.

Final location of the monitor and other CCTV equipment within the main communications room shall be confirmed with the Principal prior to installation

**12.7.5 VIDEO CASSETTE RECORDERS DVR'S**

**General**

Provide heavy duty DVR's supplied and connected to the multiplexer, programmed and tuned to enable the correct operation with the CCTV cameras.

The DVR's shall be time lapse type with adequate channels to suit the number of cameras installed and to record events for up to 120 hours that can be viewed at a later date.

DVR's and multiplexer shall be rack mounted in the communications equipment rack CR3 located in the main communications room and interfaced with the security system so that they are activated when an alarm signal is received from designated security zones.

**12.7.6 VIDEO SWITCHING SYSTEM**

**General**

Provide a switching system which enables each camera to be scanned sequentially at predetermined intervals and which, on receipt of an alarm signal, interrupts the scanning sequence and switches to the relevant security zones.

**12.7.7 CABLING**

Use coaxial cable from each camera to the DVR's and /or multiplexers without joins or breaks

All cabling from the cameras to the DVR's shall meet the following requirements:

- Video – RG6
- Power – Fig 8 24/020.

## **12.8 COMPLETION**

### **12.8.1 MANUALS**

#### **General**

Submit records to AS 2201.1.

### **12.8.2 COMPLETION TESTS**

#### **General**

Carry out tests, including out-of-hours tests, to demonstrate the security system's performance. Include the following:

- Test components for correct function and operation;
- Demonstrate that devices perform on site, to at least the level stated in the manufacturer's performance specification for that device;
- Test the operation of alarm sectors and panel functions, including open and short circuit tests;
- Demonstrate that the system functions under mains fail condition;
- Demonstrate operation of the battery and charger including a full discharge/recharge over the designated time.

### **12.8.3 MAINTENANCE**

#### **General**

Standard: To AS 2201.1.

Frequency of routine visits: 3 monthly.

Monitoring: During the maintenance period:

- Monitor the security system; and
- Determine the causes of alarms.

#### **False alarms**

Notification of false alarms: On the first working day after a false alarm, submit notification of the circumstances surrounding the false alarm and action necessary to prevent similar occurrences.

Alterations due to false alarms: Carry out alterations necessary to eliminate false alarms due to:

- Technical faults, selection, siting or aiming of devices; or
- Environmental conditions evident at the time of installation.

#### **Call out**

Respond to call outs for breakdowns or other faults requiring corrective maintenance. Attend on site within 24 hours of notification. Rectify faults, and replace faulty materials and equipment.

## **13. PUBLIC ADDRESS SYSTEM**

### **13.1 GENERAL**

Provide a public address PA system including zone controls, amplifiers, microphones, zone mixer, on/off volume control, channel selector, rack mounted audio equipment and speakers. The PA system shall be linked to the Police radio and PABX systems.

The main facilities for the PA system are shown on the drawings and schematic.

The public address system shall be Australian Monitor manufacture, or equal approved.

#### **13.1.1 SCOPE**

The work covered by this section comprises the following items together with all minor and ancillary works, not specifically mentioned, but required for the satisfactory operation of the complete public address system:

- Disconnection and removal of all redundant PA speakers, head end equipment, power supplies and wiring at the appropriate stage of the works.
- General multi-channel Public Address (PA) and radio monitoring system.
- Power supply and associated ELV cabling.
- Interface to other systems.
- Microphones located as shown on the drawings.
- Amplifiers sized to suit the number of speakers and zones plus spare capacity and inputs for future expansion into the existing Convent and Nurses Home as shown on the drawings and schematic.
- Background music source(s) including CD/DVD player, cassette deck, iPOD and AM/FM radio tuner.
- Zone selection control switch panel, including master switch.
- Local volume control where necessary
- Interface with the fire indicator panel
- Hearing loops as required.
- Training.
- As-built drawings and operating manuals.
- Testing and commissioning.
- Warranty and 12 months defects liability period.
- Maintenance during the defects liability period.

#### **13.1.2 CROSS REFERENCES**

##### **General**

Comply with the 'General Requirements' and the 'General Electrical Services Requirements' sections.

##### **Related sections**

Refer to the Wiring and accessories section, for cabling requirements.

#### **13.1.3 STANDARD**

##### **General**

To AS 1127.2, AS1127.3, AS 1127.4, AS 1127.5, AS 1127.6, AS 3250, AS 3548, AS 4251.1 and AS 4252.1.

### **13.2 QUALITY**

#### **13.2.1 SAMPLES**

##### **General**

Submit samples of:

- speakers;
- on/off volume control.

### **13.2.2 CONTRACTOR'S SUBMISSIONS**

#### **Product data**

Submit product data for components, including amplifier specification sheets.

#### **Shop drawings**

Submit shop drawings showing the system block diagram.

### **13.3 EQUIPMENT**

#### **Amplifiers**

Provide amplifiers to suit five (5) Police radio channels and public address from either the watch house microphone or PABX. Amplifiers shall be suitable for speech reinforcement sized to suit the connected load plus 20%.

The amplifiers shall incorporate the following:

- Volume control.
- Power/on/off indication.
- Bass and treble control.
- Surge protection.

#### **Zone Selection Panel**

The speaker zone switch panel shall incorporate the following:

- Master switch with lock on facility.
- Interference (crackle) free momentary action switches for each zone.

#### **Microphone**

Provide microphone and desk stand to suit the watch house console. The microphone shall be Electro voice CP212, or equal approved.

PA function shall override radio monitoring functions.

#### **On/off Volume Control and Channel Selector**

Within each room provide a PA control panel comprising on/off control, channel select (1–5) and room volume control.

Channels shall be:

- Position 1     PA only
- Position 2     District channel P2
- Position 3     UHF from Melbourne
- Position 4     AM Broadcast Radio Station
- Position 5     FM Broadcast Radio Station

#### **Speakers**

Speakers shall be ceiling flush mounted type suitable for voice reproduction and the PA system amplifiers, nominally 100mm diameter.

## **14. NURSE CALL SYSTEMS**

### **14.1 GENERAL**

Supply, install, test and commission a "CarePlus" (or approved equivalent) IP based Nurse Call system throughout the new and existing Aged Care facility.

The main facilities for the nurse call system are shown on the drawings and schematic.

The nurse call head end system shall have sufficient spare capacity and provisions for the future expansion into the existing Covent and Nurse Home with an allowance for a minimum of 35 bedrooms.

The scope shall include the staged disconnection and removal of all redundant nurse call system components, power supplies and wiring at the appropriate stage of the works.

### **14.2 STANDARDS**

Nurse Call Systems: to AS 3811

### **14.3 CROSS REFERENCES**

General: Comply with the General Requirements Section

Related Sections: Refer to Electrical (Communications Cabling) Specification, to Electrical (Fire Detection) Specification, and to MATV section of Electrical specification.

### **14.4 SCOPE**

The scope for the provision of the nurse call system shall include but is not be limited to the design, supply, delivery, installation, testing, commissioning including defects maintenance of a complete nurse call system. The scope includes:

Supply and install throughout the new and existing Aged Care facility nurses call and emergency call systems comprising:

- Nurse call and Emergency buttons with cancel.
- Nurse call buttons in wet areas shall be IP66 rating
- Pendant handset nurse call with 3 metre cord
- Over door lights for nurse call and emergency call indication.
- Provision of 5 LCD annunciator screens installed in the staff stations
- Provision of 10 floor mats and 10 bed mat out of bed sensors including interfaces.
- Wanderer's alert interfaced.
- 19" nurse call racks fitted out with nurse call interface modules
- Nurse call head end, rack mounted in the ancillary rack CR3 located in the main Communications room.
- Power supplies with battery backup.
- Provision of a new DECT telephone system messaging interface.
- Tones and chimes sounding differently for each of the call types.
- Backbone cabling to be of Cat 5 minimum wired from the rack mounted nurse call interface modules to the nurse call devices to facilitate a universal cabling strategy.
- Interfaces between the nurse call system head end and the FIP, access controls, pager transmitter and DECT phone system.
- Interface the new nurse call system with the existing system during change over of the systems allowing for continuity of the existing system as required by the Client
- Software and programming
- Testing and commissioning

Distinctly different coding shall be used for nurse call, transmission to pagers, so that each area will receive local, discrete signals for the wards served by the staff member carrying that pager.

Each indicator light above each door shall be fitted with colour coding for nurse call, emergency call with colours meeting Australian Standards.

## **14.5 SYSTEM COMPONENTS**

The system components and requirements shall comprise of the following:

### **Room Call Stations**

- Call stations are to be backlit
- Call/Cancel buttons are to be Silicon type
- Reassurance light on call point
- Colour coded and labelled according to priority
- Can be installed vertically or horizontally
- Call station to have built in audible reassurance
- Ability to interface bed light switching
- Nurse Call and Emergency priority to be on one plate.

### **Wet Area Call Stations**

- Termination must use 3M Scotchlocks
- Meet IP66 rating
- No exposed electronics
- Reassurance light on call station
- Call/Cancel buttons are to be Lexan based

### **Pendant Handset**

- Pendant is to be Silicon type
- Meet IP68 rating
- Minimum 3 meter cord

### **Ward/Overdoor light**

- Require minimum of 3 colour zones
- LED based indicators
- Observable from side on

### **Annunciator / Display / Whiteboard**

- LCD monitor type display (17")
- Display all calls in order of priority
- Priority to be colour coded
- Time and date displayed
- Duration of call to be displayed on screen

### **Chime/Sounder**

- Different tones for each priority
- Recorded voice alarm
- Customisable tones in MP3 format
- Volume control

### **Nurse Call Head-End**

- 19" rack mountable
- IP based system
- RJ45 sockets for input and output
- Embedded platform (No PC required)

### **Software**

- Web based staff allocation
- Ability to program scheduled reminder messages
- Call escalation capability



- LAN interface
- Web base reporting on local LAN network to include
  - Calls per room
  - Average calls per room
  - Call respond time per room
  - Search on room, date and response times.

#### **Interfaces**

- DECT interface for messaging with optional alarm button integration
- High level fire interface
- Paging interface
- Access control interface
- Wanderer Alert Interface
- Out of bed sensors
- Nurse call pendant interface with the light switch for the over bed light
- Interface the new nurse call system with the existing system during change over of the systems

### **14.6 MANUFACTURE**

The system shall be of reputable manufacture, have parts readily replaceable and engraved to site direction to clearly indicate function.

### **14.7 POWER SUPPLY**

A.C. power shall be derived from the local, essential power, extra low voltage transformer supplies located in the electrical services cupboards. Communications equipment shall be located in the communications services cupboards.

Provide 2 hour battery backup to the system, based upon normal power consumption for the number of points connected to the system. Locate battery backup within the communications cupboards adjacent to the nurse call racks and at the head end

### **14.8 SYSTEM WIRING**

Backbone cabling shall be installed using Cat 5 cabling as part of the universal cabling system specified in the Communications Cabling Section. Allow to liaise with the Communications Cabling contractor to ensure that the end-to-end Mod Tap certification is not compromised where the Nurse Call systems interfaces occur.

Submit details of the schematic wiring proposed for the system prior to works commencement for approval by the Engineer. Show the interface between the universal Cat 5 cabling and any system specific cabling required.

### **14.9 OPERATION**

- System operation will be in response to pressing an emergency or nurse call push button located as shown on the drawings or via the pendant handset.
- Call will show as the relevant colour on overdoor light, register at all nurse base annunciator panels in the area, and will register as a page on the allocated nurse's pager and DECT phone. Tones to sound.
- Pressing an emergency call button will illuminate the respective room indicator and send the alarm to all pagers and DECT phones. A distinct emergency call tone shall sound until the call is cancelled. Cancellation of emergency call shall be at the call point itself.

Wet area calls shall be of a higher priority than normal calls. Hierarchy shall be as follows:

- Fire
- Emergency Call
- Assistance Call

- Wet area call
- Ward or lounge nurse call.

#### **14.10 DECT PHONE SYSTEM**

Supply, install, test and commission a "KIRK 800" (or approved equivalent) DECT phone system in the new and existing Aged Care facility to provide the coverage as shown on the drawings.

The main facilities for the DECT phone system are shown on the drawings and schematic.

The DECT phone system shall have sufficient spare capacity and provisions for the future expansion into the existing Covent and Nurses Home.

The scope shall include the staged disconnection and removal of the redundant DECT phone system components, power supplies and wiring at the appropriate stage of the works allowing for continuity of the existing system as required by the Client

Allow for the following:

- DECT phone system head end
- Up to 32 line extensions from the PABX
- Base stations as shown on the drawings
- Repeaters as required
- Kirk 4040 handsets. Allow for a minimum of 25 handsets
- Interface and provision of messaging from the nurse call system
- Base station outlets and wiring.
- Inbuilt duress system on handsets interfaced with the nurse call system
- DECT phone system interface with the intercom stations installed at front entry doors
- Software and programming
- Testing and commissioning

#### **14.11 SAMPLES**

Provide samples of all lamps, call points, handsets, buzzers, etc, for the Superintendent's Approval.

## **APPENDIX E1**

### **SCHEDULE OF LUMINAIRES**



## LUMINAIRE DATA SHEET

PRODUCT NAME: **Nova**

TYPE NUMBER: **A1**

DESCRIPTION: Recessed High Performance Louvre Fluorescent

DIMENSIONS: **1200x300x50mm**

FINISH: **White**

LAMP:  **1x28W T5**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Recessed Plaster

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Orien**

TYPE NUMBER: **A2**

DESCRIPTION: Recessed High Performance Lens Fluorescent

DIMENSIONS: **1200x300x50mm**

FINISH: **White**

LAMP:  **2x28W T5**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Recessed Plaster

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Specus**

TYPE NUMBER: **A3**

DESCRIPTION: Surface Opal Lens Fluorescent

DIMENSIONS: **1245x180x70mm**

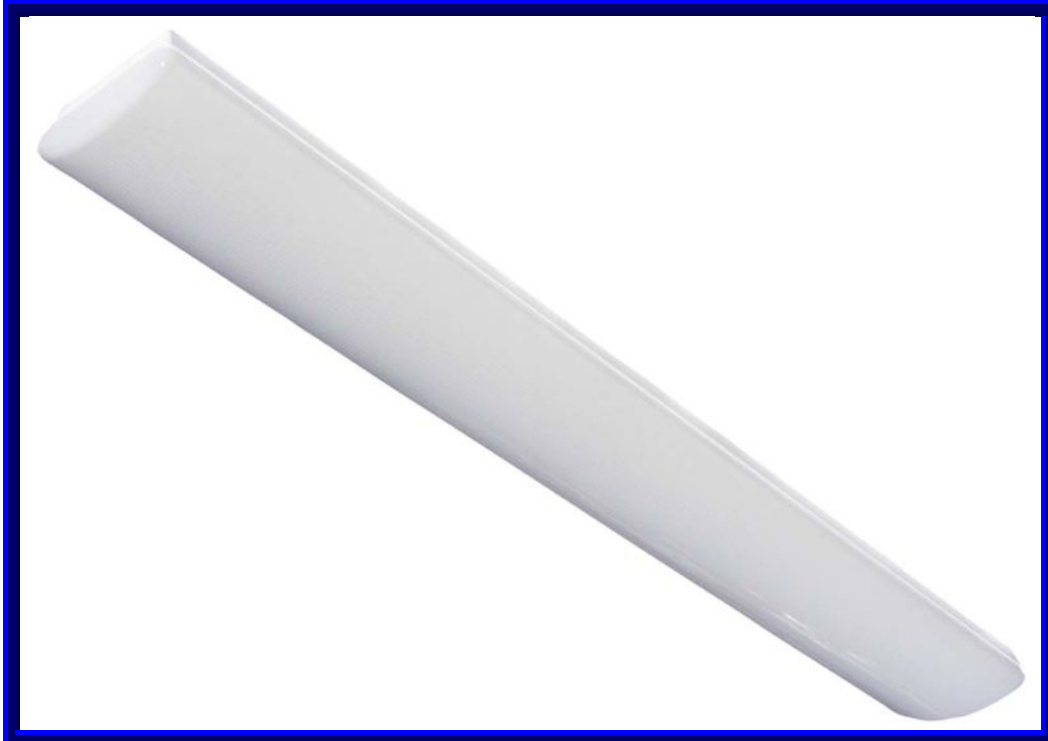
FINISH: **White**

LAMP:  **2x28W T5**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Specus**

TYPE NUMBER: **A4**

DESCRIPTION: Surface Opal Lens Fluorescent

DIMENSIONS: **1245x112x80mm**

FINISH: **White**

LAMP:  **1x28W T5**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Specus**

TYPE NUMBER: **A6**

DESCRIPTION: Surface Opal Lens Fluorescent

DIMENSIONS: **645x112x80mm**

FINISH: **White**

LAMP:  **1x14W T5**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux







## LUMINAIRE DATA SHEET


PRODUCT NAME: **Europa**

TYPE NUMBER: **B1**

DESCRIPTION: Weatherproof Fluorescent IP66

DIMENSIONS: **1280x136x90mm**

FINISH: **Grey**

LAMP:  **2x28W T5**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET


PRODUCT NAME: **Europa**

TYPE NUMBER: **B2**

DESCRIPTION: Weatherproof Fluorescent IP66

DIMENSIONS: **1280x86x90mm**

FINISH: **Grey**

LAMP:  **1x28W T5**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME:	<b>Uniform</b>
TYPE NUMBER:	<b>B3</b>
DESCRIPTION:	Low Profile Metal Halide Carpark Luminaire
DIMENSIONS:	<b>708x259x137mm</b>
FINISH:	<b>Grey</b>
LAMP:	<b>250w Chromafit Lamp</b>
CONTROL GEAR:	<b>Ironcore</b>
MOUNTING DETAILS:	Surface Mount
MANUFACTUER:	Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Slimlamp**

TYPE NUMBER: **B4**

DESCRIPTION: Low Profile Diffused Fluorescent

DIMENSIONS: **595x25x35mm**

FINISH: **White**

LAMP:  **1x14w T5**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Silvia Mini**

TYPE NUMBER: **BL**

DESCRIPTION: Metal Halide Bollard

DIMENSIONS: **130diax550mm**

FINISH: **Black**

LAMP: **35wMH Ceramic Arc 3000K Warm**

CONTROL GEAR: **Ironcore**

MOUNTING DETAILS: Surface Mount via buried Rag Bolt assembly provided

MANUFACTURER: Versalux





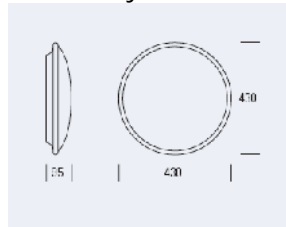
## LUMINAIRE DATA SHEET

PRODUCT NAME: SL430/55T5E/O/W

TYPE NUMBER: **C1**

DESCRIPTION: Surface Oyster

DIMENSIONS:



FINISH: **White with Opal Lens**

LAMP: **55w T5 Circular 3000K Warm**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: LED





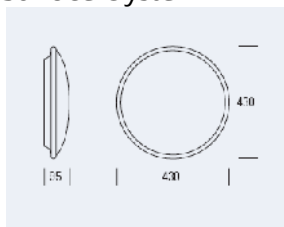
## LUMINAIRE DATA SHEET

PRODUCT NAME: SL430/55T5EDD/O/W

TYPE NUMBER: **C2**

DESCRIPTION: Surface Oyster

DIMENSIONS:



FINISH: **White with Opal Lens**

LAMP: **55w T5 Circular**

CONTROL GEAR: **Electronic DSI Dim**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: LED





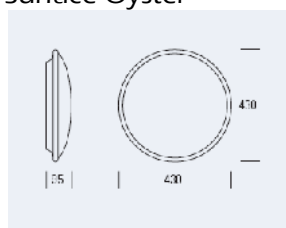
## LUMINAIRE DATA SHEET

PRODUCT NAME: SL430/40T5E/O/W

TYPE NUMBER: **C3**

DESCRIPTION: Surface Oyster

DIMENSIONS:



FINISH: **White with Opal Lens**

LAMP: **40w T5 Circular**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: LED







## LUMINAIRE DATA SHEET

PRODUCT NAME: **6601A**

TYPE NUMBER: **C4**

DESCRIPTION: Heat Lamps & Light no Fan

DIMENSIONS: **425x264mm**

FINISH: **White**

LAMP: **2x275w Heat Lamps, 1x1 1w CFL**

CONTROL GEAR: **Ironcore**

MOUNTING DETAILS: Semi-Recessed to manufacturer's instructions

MANUFACTURER: Clipsal





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Aztec Facetted**

TYPE NUMBER: **D1**

DESCRIPTION: Recessed Fluorescent Downlight

DIMENSIONS: **198dia x136 mm**

FINISH: **White**

LAMP:  **1x18w**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Recessed

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Aztec Facetted**

TYPE NUMBER: **D2**

DESCRIPTION: Recessed Fluorescent Downlight

DIMENSIONS: **198dia x136 mm**

FINISH: **White**

LAMP:  **2x18w**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Recessed

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **331-Snoot**

TYPE NUMBER: **D3**

DESCRIPTION: Recessed Fluorescent Downlight

DIMENSIONS: **120dia x185 mm**

FINISH: **White**

LAMP:  **1x18w 3000K Warm**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Recessed

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME:	<b>Zero</b>
TYPE NUMBER:	<b>D4</b>
DESCRIPTION:	Recessed Metal Halide Downlight
DIMENSIONS:	<b>118dia x87 mm</b>
FINISH:	<b>White</b>
LAMP:	<b>20wMH MR16 Ceramic Arc 3000K Warm</b>
CONTROL GEAR:	<b>Electronic</b>
MOUNTING DETAILS:	Recessed
MANUFACTURER:	Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Aztec Facetted**

TYPE NUMBER: **D5**

DESCRIPTION: Recessed Fluorescent Downlight

DIMENSIONS: **198dia x136 mm**

FINISH: **White**

LAMP:  **2x18w**

CONTROL GEAR: **Electronic DSI Dim**

MOUNTING DETAILS: Recessed

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Aztec Facetted**

TYPE NUMBER: **D6**

DESCRIPTION: Recessed Fluorescent Downlight

DIMENSIONS: **198dia x136 mm**

FINISH: **White**

LAMP:  **2x26w**

CONTROL GEAR: **Electronic DSI Dim**

MOUNTING DETAILS: Recessed





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Elena**

TYPE NUMBER: **D7**

DESCRIPTION: Recessed Fluorescent Downlight IP67 Bug-proof

DIMENSIONS: **180dia x235mm**

FINISH: **White**

LAMP:  **1x18w**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Recessed

MANUFACTURER: Versalux







## LUMINAIRE DATA SHEET

PRODUCT NAME: **Paola**

TYPE NUMBER: **D8**

DESCRIPTION: Surface Fluorescent low Profile Downlight IP65 Bug-proof

DIMENSIONS: **250x250x90mm**

FINISH: **Aluminium Grey**

LAMP:  **2x26w**

CONTROL GEAR: **Ironcore**

MOUNTING DETAILS: Surface

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Paolina**

TYPE NUMBER: **D9**

DESCRIPTION: Surface Fluorescent low Profile Downlight IP65 Bugproof

DIMENSIONS: **150x150x100mm**

FINISH: **Aluminium Grey**

LAMP:  **1x18w**

CONTROL GEAR: **Ironcore**

MOUNTING DETAILS: Surface

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Paola**

TYPE NUMBER: **D10**

DESCRIPTION: Surface Fluorescent low Profile Downlight

DIMENSIONS: **250x250x90mm**

FINISH: **White**

LAMP:  **2x26w**

CONTROL GEAR: **Ironcore**

MOUNTING DETAILS: Surface

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Goldstar FMX9992/FP**  
 TYPE NUMBER: **EM1**  
 DESCRIPTION: LED Non Maintained Emergency  
 DIMENSIONS: **80mmdia**  
 FINISH: **White**  
 LAMP: **LED**  
 CONTROL GEAR: **Electronic Famco Masterminder Monitored**  
 MOUNTING DETAILS: **Recessed**  
 MANUFACTURER: **Famco**



### MAXIMUM PERMISSIBLE SPACING FOR EMERGENCY LUMINAIRES

PHOTOMETRIC CLASSIFICATION			MOUNTING HEIGHT - M															
			2.1	2.4	2.7	3.0	3.3	3.6	4.0	4.5	5	6	7	8	9	10	15	20
F9992/F9993	C0	D40	16.7	17.4	18.0	18.6	19.1	19.6	20.1	20.8	21.3	22.1	22.7	23.0	23.1	23.1	19.4	



## LUMINAIRE DATA SHEET


PRODUCT NAME: **Europa**

TYPE NUMBER: **EM2**

DESCRIPTION: Weatherproof Maintained Emergency Fluorescent IP66

DIMENSIONS: **660x136x90mm**

FINISH: **Grey**

LAMP:  **2x14W T5**

CONTROL GEAR: **Electronic Famco Masterminder Monitored**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux



## LUMINAIRE DATA SHEET


PRODUCT NAME: **Europa C0-D50 C90-C80**

TYPE NUMBER: **EM3**

DESCRIPTION: Weatherproof Maintained Emergency Fluorescent IP66

DIMENSIONS: **1280x136x90mm**

FINISH: **Grey**

LAMP:  **1x28W T5**

CONTROL GEAR: **Electronic Famco Masterminder Monitored**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET


PRODUCT NAME: **Europa C0-D50 C90-C80 C180-D80**

TYPE NUMBER: **EM4**

DESCRIPTION: Weatherproof Maintained Emergency Fluorescent IP66

DIMENSIONS: **1280x136x90mm**

FINISH: **Grey**

LAMP:  **2x28W T5**

CONTROL GEAR: **Electronic Famco Masterminder Monitored**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux







## LUMINAIRE DATA SHEET

PRODUCT NAME: **FMX99747**

TYPE NUMBER: **EM5**

DESCRIPTION: Exterior Emergency Maintained Bulkhead IP65

DIMENSIONS: **265dia 105mm**

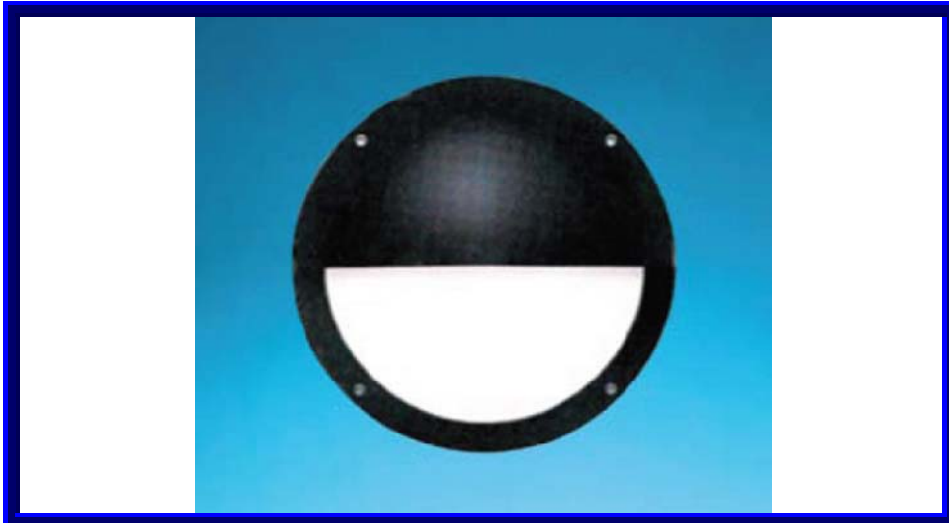
FINISH: **Black**

LAMP:  **1x26w PLC**

CONTROL GEAR: **Electronic Famco Masterminder Monitored**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Famco



### MAXIMUM PERMISSIBLE SPACING FOR EMERGENCY LUMINAIRES

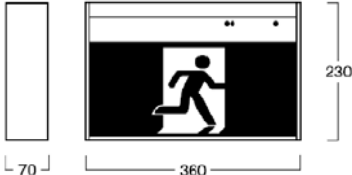
PHOTOMETRIC CLASSIFICATION			MOUNTING HEIGHT - M															
			2.1	2.4	2.7	3.0	3.3	3.6	4.0	4.5	5	6	7	8	9	10	15	20
<b>F99747</b>	<b>C0</b>	<b>D4</b>	7.2	7.3	7.3	7.3	7.3	7.2	6.9	6.5	5.8	3.1						
	<b>C90</b>	<b>D4</b>	7.2	7.3	7.3	7.3	7.3	7.2	6.9	6.5	5.8	3.1						





## LUMINAIRE DATA SHEET

PRODUCT NAME: **FMX9920L/SS/RMS**  
 TYPE NUMBER: **EX1**  
 DESCRIPTION: LED Maintained Single Sided EXIT Running Man Straight  
 DIMENSIONS:



FINISH: **White**  
 LAMP: **LED**  
 CONTROL GEAR: **Electronic Famco Masterminder Monitored**  
 MOUNTING DETAILS: **Surface Mount**  
 MANUFACTURER: **Famco**



### MAXIMUM PERMISSIBLE SPACING FOR EMERGENCY LUMINAIRES

PHOTOMETRIC CLASSIFICATION			MOUNTING HEIGHT - M															
			2.1	2.4	2.7	3.0	3.3	3.6	4.0	4.5	5	6	7	8	9	10	15	20
F9920L/SS	C0	D3.2	6.5	6.6	6.6	3.5	6.4	6.2	5.8	5.1	4.1							
	C90	E2	5.2	5.2	5.4	5.2	5.0	4.6	4.8	4.0								

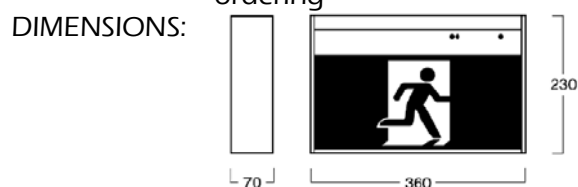


## LUMINAIRE DATA SHEET

PRODUCT NAME: **FMX9920L/SS**

TYPE NUMBER: **EX2**

DESCRIPTION: LED Maintained Single Sided EXIT Specify Direction when ordering



FINISH: **White**

LAMP: **LED**

CONTROL GEAR: **Electronic Famco Masterminder Monitored**

MOUNTING DETAILS: **Surface Mount**

MANUFACTURER: **Famco**



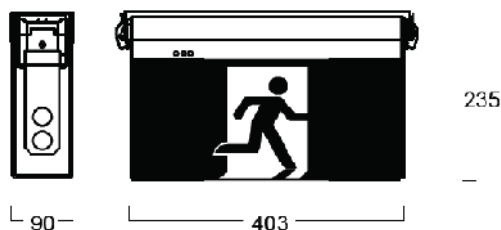
### MAXIMUM PERMISSIBLE SPACING FOR EMERGENCY LUMINAIRES

PHOTOMETRIC CLASSIFICATION			MOUNTING HEIGHT - M													
			2.1	2.4	2.7	3.0	3.3	3.6	4.0	4.5	5	6	7	8	9	10
<b>F9920L/SS</b>	<b>C0</b>	<b>D3.2</b>	6.5	6.6	6.6	3.5	6.4	6.2	5.8	5.1	4.1					
	<b>C90</b>	<b>E2</b>	5.2	5.2	5.4	5.2	5.0	4.6	4.8	4.0						



## LUMINAIRE DATA SHEET

PRODUCT NAME: **FMX9920L/WP/SS/RMS**  
 TYPE NUMBER: **EX3**  
 DESCRIPTION: LED Maintained Single Sided EXIT Weatherproof Running Man Straight  
 DIMENSIONS:



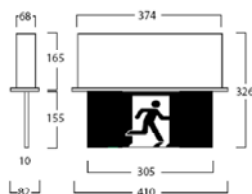
FINISH: **White**  
 LAMP: **LED**  
 CONTROL GEAR: **Electronic Famco Masterminder Monitored**  
 MOUNTING DETAILS: **Surface Mount**  
 MANUFACTURER: **Famco**



### MAXIMUM PERMISSIBLE SPACING FOR EMERGENCY LUMINAIRES

PHOTOMETRIC CLASSIFICATION			MOUNTING HEIGHT - M													
			2.1	2.4	2.7	3.0	3.3	3.6	4.0	4.5	5	6	7	8	9	10
<b>F9920L/SS</b>	<b>C0</b>	<b>D3.2</b>	6.5	6.6	6.6	6.5	6.4	6.2	5.8	5.1	4.1					
	<b>C90</b>	<b>E2</b>	5.2	5.2	5.4	5.2	5.0	4.6	4.8	4.0						

PRODUCT NAME: **FMX9917/L/DS/RMR-RML**  
 TYPE NUMBER: **EX4**  
 DESCRIPTION: LED Maintained Double Sided EXIT  
 DIMENSIONS:



MANUFACTURER: Famco



PHOTOMETRIC CLASSIFICATION			MOUNTING HEIGHT - M															
			2.1	2.4	2.7	3.0	3.3	3.6	4.0	4.5	5	6	7	8	9	10	15	20
F9917L/SS	C0	E1.25	4.2	4.2	4.0	3.6	4.0	3.0										
	C90	C1.25	3.2	3.1	2.8	2.4	1.7											
F9917L/DS	C0	E1.6	4.8	4.8	4.8	4.4	4.0	4.2	3.8									
	C90	E1.25	4.2	4.2	4.0	3.6	4.0	3.0										



# LUMINAIRE DATA SHEET



## LUMINAIRE DATA SHEET

PRODUCT NAME: **Axium Glass**

TYPE NUMBER: **F1**

DESCRIPTION: **Suspended Architectural Fluorescent**

DIMENSIONS: **1190x132x84mm**

FINISH: **Anodised**

LAMP:  **1x28W T5**

CONTROL GEAR: **Electronic DSI Dim**

MOUNTING DETAILS: **Continuous Wire Suspension, Suspensions Height AFL TBC with Architect**

MANUFACTURER: **Versalux**



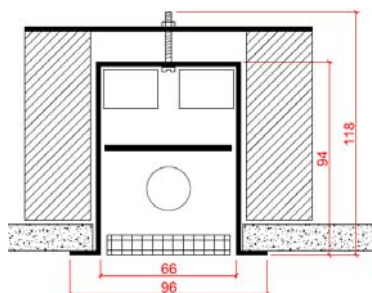
## LUMINAIRE DATA SHEET

PRODUCT NAME: **ICON**

TYPE NUMBER: **F2**

DESCRIPTION: Wall wash Fluorescent

DIMENSIONS:



1195mm long

FINISH: **Anodised Silver Asymmetric Louvre**

LAMP:



**1x28W T5**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: **Recessed**

MANUFACTURER: **Versalux**







## LUMINAIRE DATA SHEET

PRODUCT NAME: **Slick**

TYPE NUMBER: **F3**

DESCRIPTION: Low Profile Fluorescent

DIMENSIONS: **1195x58x25mm**

FINISH: **White**

LAMP:  **1x28w T5 3000K Warm White**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount Under Staff Station Benches Lamp facing away from viewer

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Slimlamp**

TYPE NUMBER: **F4**

DESCRIPTION: Low Profile Continuous Fluorescent

DIMENSIONS: **1195x25x35mm**

FINISH: **White**

LAMP:  **1x28w T5 3000K Warm White**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME:	<b>Trixie</b>
TYPE NUMBER:	<b>NL</b>
DESCRIPTION:	Night Light
DIMENSIONS:	<b>115x80x11mm</b>
FINISH:	<b>White</b>
LAMP:	<b>3.5w LED</b>
CONTROL GEAR:	<b>Electronic</b>
MOUNTING DETAILS:	Surface Mount to GPO Wall Plate, Driver within wall cavity
MANUFACTURER:	Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Tivoli 331-560**

TYPE NUMBER: **P1**

DESCRIPTION: Decorative Metal Halide Pendant

DIMENSIONS: **250dia to 360dia x 560mm**

FINISH: **Glass – White**

LAMP: **35wMH Ceramic Arc 3000K Warm**

CONTROL GEAR: **Ironcore**

MOUNTING DETAILS: Wire Suspended, suspension height TBC with Architect

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Tivoli 331-350**

TYPE NUMBER: **P2**

DESCRIPTION: Decorative Metal Halide Pendant

DIMENSIONS: **250dia to 320dia x 350mm**

FINISH: **Glass – White**

LAMP: **35wMH Ceramic Arc 3000K Warm**

CONTROL GEAR: **Ironcore**

MOUNTING DETAILS: Wire Suspended, suspension height TBC with Architect

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Pro3001**

TYPE NUMBER: **S1**

DESCRIPTION: Metal Halide Spot

DIMENSIONS: **230x 190mm**

FINISH: **White**

LAMP: **20wMH MR16 Ceramic Arc 3000K Warm (option lamp angles)**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount (optional barn doors maybe ordered)

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: **RYS700/24/IP/O**


TYPE NUMBER: **SL**

DESCRIPTION: Surface Wall Luminaire

DIMENSIONS:

660	
	110
110	

FINISH: **White with opal duplex glass and chrom fittings**

LAMP:  **1x24w T5 3000K Warm White**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: LED





## LUMINAIRE DATA SHEET

PRODUCT NAME: **Franco**

TYPE NUMBER: **U1**

DESCRIPTION: Metal Halide uplight

DIMENSIONS: **330x245x128mm**

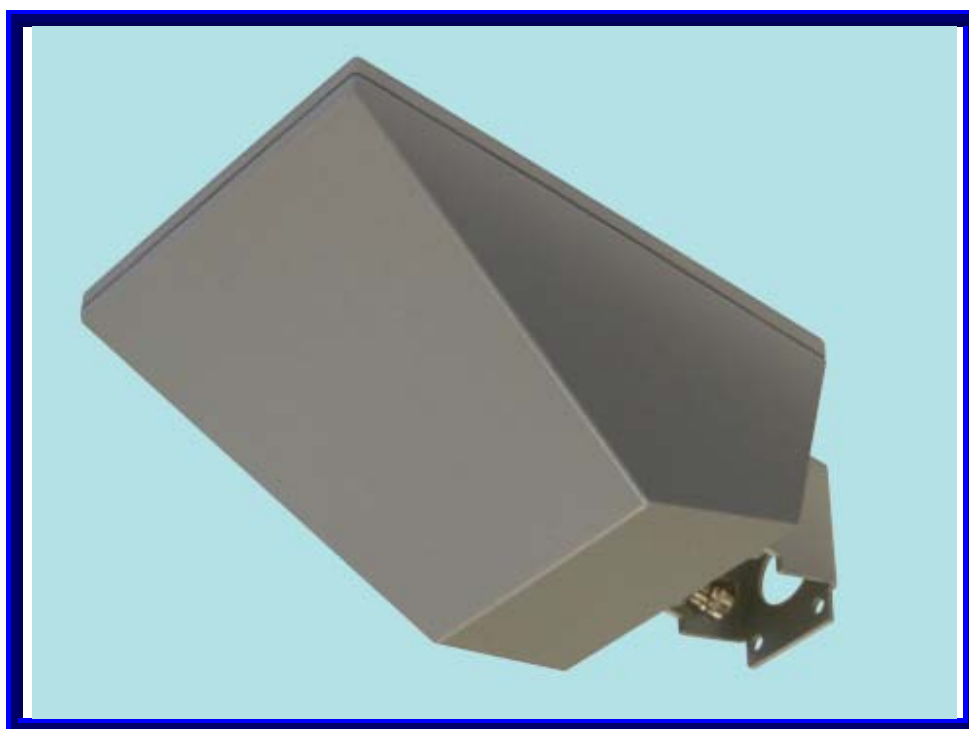
FINISH: **White**

LAMP: **70wMH Ceramic Arc 3000K Warm**

CONTROL GEAR: **Ironcore**

MOUNTING DETAILS: Surface Adjustable Angle Bracket

MANUFACTURER: Versalux

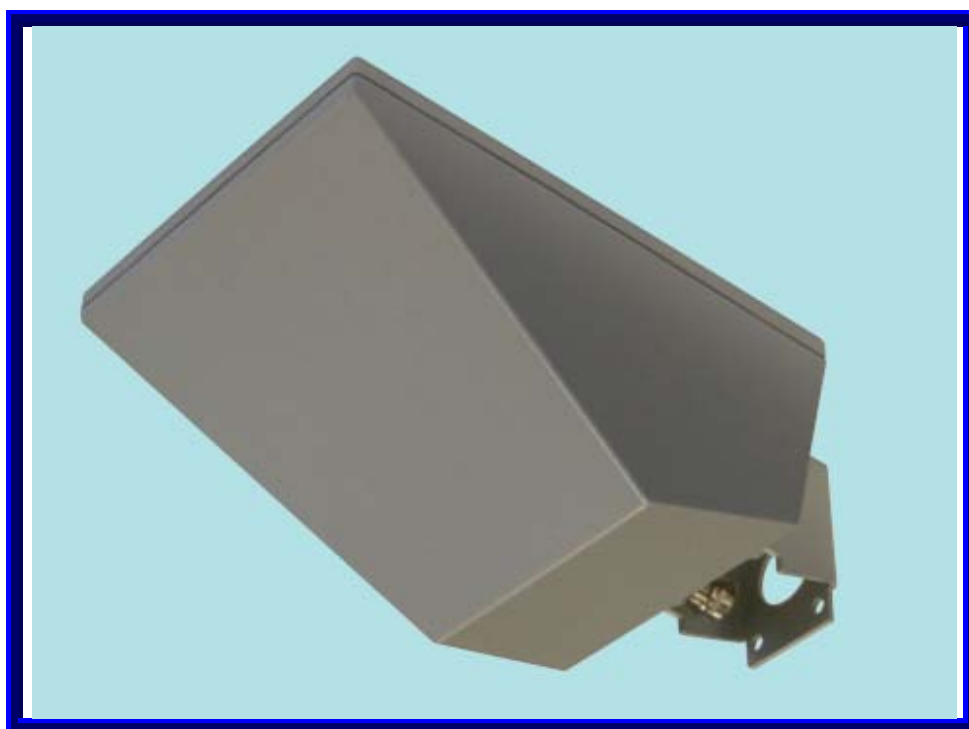






## LUMINAIRE DATA SHEET

PRODUCT NAME:	<b>Mini Franco</b>
TYPE NUMBER:	<b>U2</b>
DESCRIPTION:	Metal Halide uplight
DIMENSIONS:	<b>240x175x107mm</b>
FINISH:	<b>White</b>
LAMP:	<b>20wMH Ceramic Arc 3000K Warm</b>
CONTROL GEAR:	<b>Ironcore</b>
MOUNTING DETAILS:	Surface Adjustable Angle Bracket
MANUFACTURER:	Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME:	<b>Mini Franco</b>
TYPE NUMBER:	<b>U3</b>
DESCRIPTION:	Fluorescent uplight
DIMENSIONS:	<b>240x175x107mm</b>
FINISH:	<b>White</b>
LAMP:	<b>1x26w CFL 3000K Warm</b>
CONTROL GEAR:	<b>Ironcore</b>
MOUNTING DETAILS:	Surface Adjustable Angle Bracket
MANUFACTURER:	Versalux



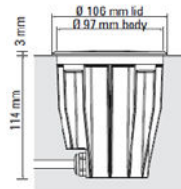
## LUMINAIRE DATA SHEET

PRODUCT NAME: **LS793-LED6W4M27W**

TYPE NUMBER: **U4**

DESCRIPTION: LED Angled Inground

DIMENSIONS:



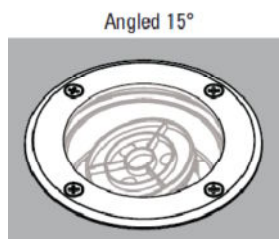
FINISH: **Stainless Steel**

LAMP: **1x6w LED 4300K White**

CONTROL GEAR: **Electronic IP67 -LS100TX**

MOUNTING DETAILS: Recessed flush with mulch 800mm from tree and aimed with 15 degree angle towards tree

MANUFACTURER: Lumascape





## LUMINAIRE DATA SHEET

PRODUCT NAME: RYS700/24/IP/O

TYPE NUMBER: **W1**

DESCRIPTION: Surface Wall Luminaire

DIMENSIONS:



FINISH: **White with opal duplex glass and chrome fittings**

LAMP:



**1x24w T5 3000K Warm White**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: LED





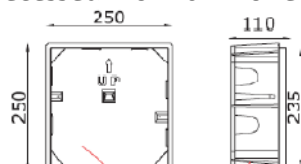
## LUMINAIRE DATA SHEET

PRODUCT NAME: **Alfia**

TYPE NUMBER: **W2**

DESCRIPTION: Recessed Wall Luminaire

DIMENSIONS:



FINISH: **Black**

LAMP: **70wMH Ceramic Arc 3000K Warm**

CONTROL GEAR: **Ironcore**

MOUNTING DETAILS: Recessed using installation

MANUFACTURER: Versalux





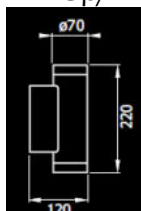
## LUMINAIRE DATA SHEET

PRODUCT NAME: **Emma 70**

TYPE NUMBER: **W3**

DESCRIPTION: LED Up/ Down Column Luminaire

DIMENSIONS:



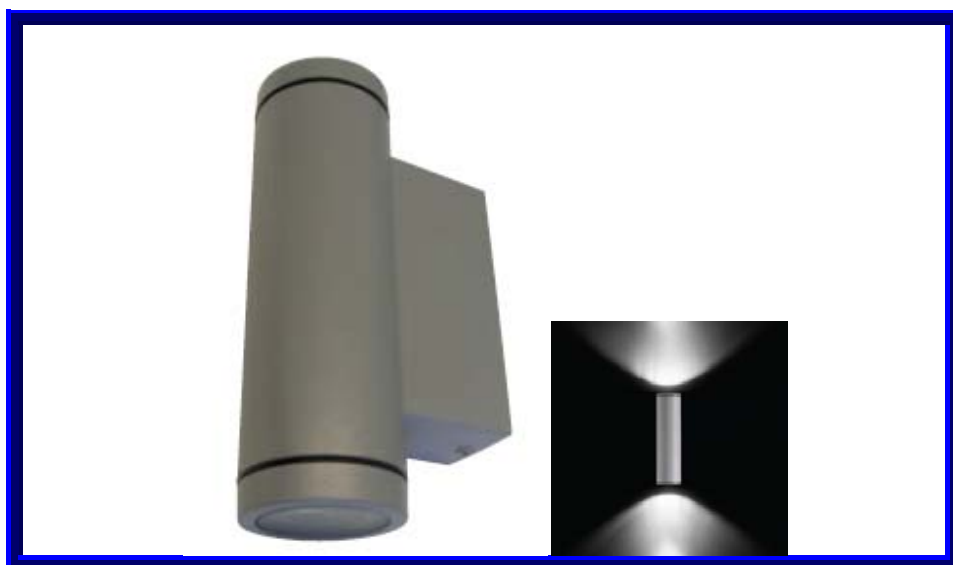
FINISH: **Black**

LAMP: **6x1w LED 3000K Warm**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux





## LUMINAIRE DATA SHEET

PRODUCT NAME: RYS700/24/IP/O

TYPE NUMBER: **W4**

DESCRIPTION: Surface Wall Luminaire

DIMENSIONS:



FINISH: **White with opal duplex glass and chrome fittings**

LAMP:



**1x24w T5 3000K Warm White**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: LED





## LUMINAIRE DATA SHEET

PRODUCT NAME: **F70150**

TYPE NUMBER: **W5**

DESCRIPTION: Exterior IP65 Bulkhead

DIMENSIONS: **265dia 105mm**

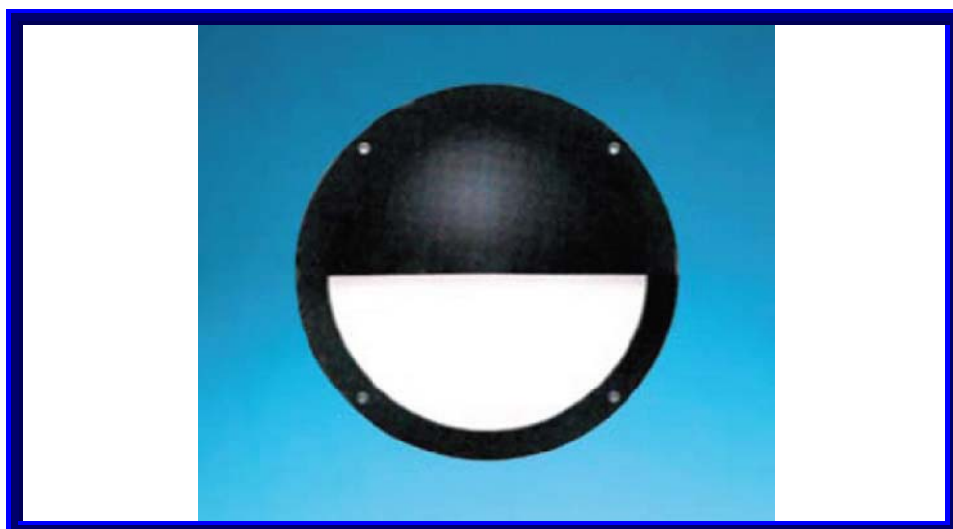
FINISH: **Black**

LAMP:  **1x26w PLC**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Famco







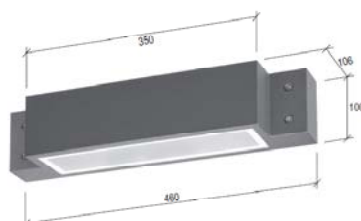
## LUMINAIRE DATA SHEET

PRODUCT NAME: **Clara**

TYPE NUMBER: **W6**

DESCRIPTION: Uni-Directional wall Luminaire IP65

DIMENSIONS:



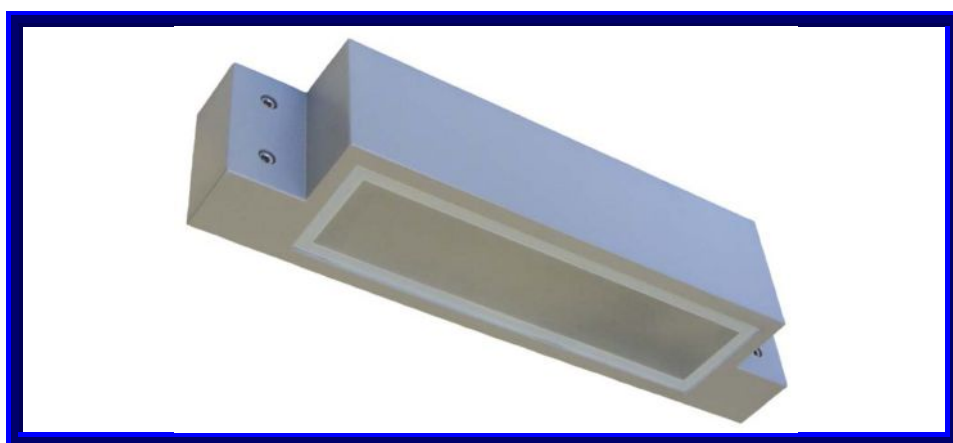
FINISH: **Black**

LAMP: **24w Compact Fluorescent**

CONTROL GEAR: **Electronic**

MOUNTING DETAILS: Surface Mount

MANUFACTURER: Versalux



## **APPENDIX E2**

### **SCHEDULE OF MAINS AND SUBMAINS**



## SCHEDULE OF SUBMAINS

Cable Ref No.	Cable Size and Type	Notes
1	20 x 1C 500mm <sup>2</sup> CU Fire rated cables	Refer reference Note 1 on Drawing E003 for termination of cables in substation. Conduits can be installed touching.
2	8 x 1C+E 300mm <sup>2</sup> CU XLPE/PVC	
3	12 x 1C+E 400mm <sup>2</sup> CU Fire rated cables	Conduits to be spaced 300 mm apart to limit the derating of the cables to 0.88 in accordance with AS/NZS 3008 Table 26(2)
4	8 x 1C+E 150mm <sup>2</sup> CU XLPE/PVC	Conduits to be spaced 300 mm apart to limit the derating of the cables to 0.93 in accordance with AS/NZS 3008 Table 26(2)
5	1 x 4C+E 35mm <sup>2</sup> CU XLPE/PVC	
6	1 x 4C+E 35mm <sup>2</sup> CU Fire rated cables	
7	1 x 2C+E 10mm <sup>2</sup> CU Fire rated cables	
8	1 x 4C+E 35mm <sup>2</sup> CU XLPE/PVC	
9	4 x 1C+E 95mm <sup>2</sup> CU XLPE/PVC	
10	4 x 1C+E 50mm <sup>2</sup> CU XLPE/PVC	
11	4 x 1C+E 50mm <sup>2</sup> CU XLPE/PVC	
12	4 x 1C+E 70mm <sup>2</sup> CU XLPE/PVC	
13	4 x 1C+E 70mm <sup>2</sup> CU XLPE/PVC	
14	4 x 1C+E 95mm <sup>2</sup> CU XLPE/PVC	
15	8 x 1C+E 120mm <sup>2</sup> CU XLPE/PVC	
16	4 x 1C+E 150mm <sup>2</sup> CU XLPE/PVC	
17	4 x 1C+E 95mm <sup>2</sup> CU XLPE/PVC	
18	4 x 1C+E 150mm <sup>2</sup> CU XLPE/PVC	
19	4 x 1C+E 50mm <sup>2</sup> CU XLPE/PVC	
20	8 x 1C+E 120mm <sup>2</sup> CU XLPE/PVC	
21	1 x 4C+E 35mm <sup>2</sup> CU XLPE/PVC	
22	4 x 1C+E 185mm <sup>2</sup> CU XLPE/PVC	
23	4 x 1C+E 70mm <sup>2</sup> CU XLPE/PVC	
24	4 x 1C+E 50mm <sup>2</sup> CU XLPE/PVC	
25	4 x 1C+E 240mm <sup>2</sup> CU XLPE/PVC	
26	8 x 1C+E 150mm <sup>2</sup> CU XLPE/PVC	

## **APPENDIX E3**

### **SCHEDULE OF SWITCHBOARDS**

Switchboard Designation:

DB1

Serves Resident's Bedrooms and  
Common Areas

Type

NHP Terasaki Concept Plus

Segregation:

Form 1

Circuit quantities are indicative only.  
Quantities to be confirmed by  
contractor prior to manufacture

Mounting:

Surface

Complete with door and latch:

Yes - CL001 key

Busbar rating:

250A

Fault rating:

20kA for 0.2 sec with 10kA MCB's &amp; RCBO's

Colour :

Manufacturers standard

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	3P	250A		1	Top centre mounted
Conson Lighting Controls					
Lighting controls	1P	10A	No	1	
Emergency lighting & exit signs	1P	20A	Yes	2	
Bedrooms lighting	1P	20A	Yes	4	
Internal lighting	1P	20A	Yes	26	
External lighting	1P	20A	Yes	5	
Bedrooms power	1P	20A	Yes	8	
Auto sliding doors	1P	20A	Yes	2	
10A GPO'S	1P	20A	Yes	24	
15A GPO's	1P	20A	Yes	3	
Isolators for A/C condensers	1P	25A	No	2	
Wheel chair lift	1P	20A	No	1	
Spares MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				14	
Chassis Size	96P				

**Switchboard Designation:****DB2****Serves Resident's Bedrooms and  
Common Areas****Type**

NHP Terasaki Concept Plus

**Segregation:**

Form 1

Circuit quantities are indicative only.  
Quantities to be confirmed by  
contractor prior to manufacture**Mounting:**

Surface

**Complete with door and latch:**

Yes - CL001 key

**Busbar rating:**

250A

**Fault rating:**

20kA for 0.2 sec with 10kA MCB's &amp; RCBO's

**Colour :**

Manufacturers standard

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	3P	250A		1	Top centre mounted
Conson Lighting Controls					
Lighting controls	1P	10A	No	1	
Emergency lighting & exit signs	1P	20A	Yes	2	
Bedrooms lighting	1P	20A	Yes	4	
Internal lighting	1P	20A	Yes	22	
External lighting	1P	20A	Yes	5	
Bedrooms power	1P	20A	Yes	8	
10A GPO'S	1P	20A	Yes	16	
15A GPO's	1P	20A	Yes	6	
Hydraulics control panel HCP3	1P	20A	No	1	
Spares MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				15	
Chassis Size	<b>84P</b>				

**Switchboard Designation:****DB4****Serves Resident's Bedrooms and  
Common Areas****Type**

NHP Terasaki Concept Plus

**Segregation:**

Form 1

 Circuit quantities are indicative only.  
 Quantities to be confirmed by  
 contractor prior to manufacture
**Mounting:**

Surface

**Complete with door and latch:**

Yes - CL001 key

**Busbar rating:**

250A

**Fault rating:**

20kA for 0.2 sec with 10kA MCB's &amp; RCBO's

**Colour :**

Manufacturers standard

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	3P	250A		1	Top centre mounted
Conson Lighting Controls					
Lighting controls	1P	10A	No	1	
Emergency lighting & exit signs	1P	20A	Yes	2	
Bedrooms lighting	1P	20A	Yes	10	
Internal lighting	1P	20A	Yes	10	
External lighting	1P	20A	Yes	3	
Bedrooms power	1P	20A	Yes	20	
10A GPO'S	1P	20A	Yes	7	
15A GPO's	1P	20A	Yes	1	
Spares MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				26	
Chassis Size	<b>84P</b>				

**Switchboard Designation:****DB5****Serves Resident's Bedrooms and  
Common Areas****Type**

NHP Terasaki Concept Plus

**Segregation:**

Form 1

Circuit quantities are indicative only.  
Quantities to be confirmed by  
contractor prior to manufacture**Mounting:**

Surface

**Complete with door and latch:**

Yes - CL001 key

**Busbar rating:**

250A

**Fault rating:**

20kA for 0.2 sec with 10kA MCB's &amp; RCBO's

**Colour :**

Manufacturers standard

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	3P	250A		1	Top centre mounted
Conson Lighting Controls					
Lighting controls	1P	10A	No	1	
Emergency lighting & exit signs	1P	20A	Yes	2	
Bedrooms lighting	1P	20A	Yes	11	
Internal lighting	1P	20A	Yes	10	
External lighting	1P	20A	Yes	2	
Bedrooms power	1P	20A	Yes	21	
10A GPO'S	1P	20A	Yes	8	
15A GPO's	1P	20A	Yes	1	
Spares MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				24	
Chassis Size	<b>84P</b>				



**Switchboard Designation:****DB6****Serves Resident's Bedrooms and  
Common Areas****Type**

NHP Terasaki Concept Plus

**Segregation:**

Form 1

Circuit quantities are indicative only.

**Mounting:**

Surface

Quantities to be confirmed by  
contractor prior to manufacture**Complete with door and latch:**

Yes - CL001 key

**Busbar rating:**

250A

**Fault rating:**

20kA for 0.2 sec with 10kA MCB's &amp; RCBO's

**Colour :**

Manufacturers standard

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	3P	250A		1	Top centre mounted
Conson Lighting Controls					
Lighting controls	1P	10A	No	1	
Emergency lighting & exit signs	1P	20A	Yes	2	
Bedrooms lighting	1P	20A	Yes	9	
Internal lighting	1P	20A	Yes	6	
External lighting	1P	20A	Yes	3	
Bedrooms power	1P	20A	Yes	18	
10A GPO'S	1P	20A	Yes	11	
15A GPO's	1P	20A	Yes	1	
3 Phase outlets plant room	3P	20A	No	4	
Spares MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				17	
Chassis Size	<b>84P</b>				

**Switchboard Designation:****DB7****Serves Resident's Bedrooms and  
Common Areas****Type**

NHP Terasaki Concept Plus

Split Chassis

**Segregation:**

Form 1

Circuit quantities are indicative only.  
Quantities to be confirmed by  
contractor prior to manufacture**Mounting:**

Surface

**Complete with door and latch:**

Yes - CL001 key

**Busbar rating:**

250A

250A each chassis

**Fault rating:**

20kA for 0.2 sec with 10kA MCB's &amp; RCBO's

**Colour :**

Manufacturers standard

**Multi Function Meter MFM**

NHP EM4 DIN RS485

MFM to monitor each chassis

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	3P	250A		1	Top centre mounted
Conson Lighting Controls					
Lighting controls	1P	10A	No	1	
Emergency lighting & exit signs	1P	20A	Yes	4	
Carpark lighting	1P	20A	Yes	5	
Bedrooms lighting	1P	20A	Yes	8	
Internal lighting	1P	20A	Yes	11	
External lighting	1P	20A	Yes	5	
Spare MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				10	Chassis Size: 48Pole
Bedrooms power	1P	20A	Yes	15	
Auto sliding doors	1P	20A	Yes	2	
10A GPO'S	1P	20A	Yes	14	
15A GPO's	1P	20A	Yes	6	
Isolator exhaust fan switchroom	1P	20A	No	1	
Hydraulics control panel HCP1	3P	20A	No	1	
Roller Door	3P	20A	No	1	
Spares MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				12	Chassis Size: 60 Pole

**Switchboard Designation:** **DB8** **Serves Resident's Bedrooms and Common Areas**

**Type** NHP Terasaki Concept Plus Split Chassis

**Segregation:** Form 1 Circuit quantities are indicative only.  
Quantities to be confirmed by contractor prior to manufacture

**Mounting:** Surface

**Complete with door and latch:** Yes - CL001 key

**Busbar rating:** 250A 250A each chassis

**Fault rating:** 20kA for 0.2 sec with 10kA MCB's & RCBO's

**Colour :** Manufacturers standard

**Multi Function Meter MFM** NHP EM4 DIN RS485 MFM to monitor each chassis

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	3P	250A		1	Top centre mounted
Conson Lighting Controls					
Lighting controls	1P	10A	No	1	
Emergency lighting & exit signs	1P	20A	Yes	2	
Bedrooms lighting	1P	20A	Yes	7	
Internal lighting	1P	20A	Yes	7	
External lighting	1P	20A	Yes	1	
Spare MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare Poles				14	Chassis Size: 36 Pole
Bedrooms power	1P	20A	Yes	14	
10A GPO'S	1P	20A	Yes	8	
15A GPO's	1P	20A	Yes	1	
Hydraulics control panel HCP2	1P	20A	No	1	
Spares MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				8	Chassis Size: 36 Pole

<b>Switchboard Designation:</b>	<b>DB9</b>	<b>Serves Resident's Bedrooms and Common Areas</b>
<b>Type</b>	NHP Terasaki Concept Plus	Split Chassis
<b>Segregation:</b>	Form 1	Circuit quantities are indicative only.
<b>Mounting:</b>	Surface	Quantities to be confirmed by contractor prior to manufacture
<b>Complete with door and latch:</b>	Yes - CL001 key	
<b>Busbar rating:</b>	250A	250A each chassis
<b>Fault rating:</b>	20kA for 0.2 sec with 10kA MCB's & RCBO's	
<b>Colour :</b>	Manufacturers standard	

**Multi Function Meter MFM**                      NHP EM4 DIN RS485                      MFM to monitor each chassis

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	3P	250A		1	Top centre mounted
Conson Lighting Controls					
Lighting controls	1P	10A	No	1	
Emergency lighting & exit signs	1P	20A	Yes	2	
Bedrooms lighting	1P	20A	Yes	8	
Internal lighting	1P	20A	Yes	11	
External lighting	1P	20A	Yes	1	
Spare MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				9	Chassis Size: 36 Pole
Bedrooms power	1P	20A	Yes	16	
10A GPO'S	1P	20A	Yes	14	
15A GPO's	1P	20A	Yes	5	
Spares MCB's	1P	20A	No	2	
Spare RCBO's	1P	20A	Yes	2	
Spare poles				9	Chassis Size: 48 Pole

**Switchboard Designation:****DB10****Serves Laundry****Type**

NHP Terasaki Concept Plus

**Segregation:**

Form 1

Circuit quantities are indicative only.

**Mounting:**

Surface

Quantities to be confirmed by  
contractor prior to manufacture**Complete with door and latch:**

Yes - CL001 key

**Busbar rating:**

250A

**Fault rating:**

20kA for 0.2 sec with 10kA MCB's &amp; RCBO's

**Colour :**

Manufacturers standard

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	3P	250A		1	Top centre mounted
Conson Lighting Controls					
50A, 400V Washing machines	3P	50A	No	2	
40A, 400V Washing machine	3P	40A	No	1	
15A, 400V Clothes dryer	3P	20A	No	1	
10A, 230V Clothes dryers	1P	20A	No	2	
10A GPO's	1P	20A	Yes	3	
Lighting controls	1P	10A	No	1	
Emergency lighting & exit signs	1P	20A	Yes	1	
Internal lighting	1P	20A	Yes	1	
Spares MCB's	1P	20A	No	1	
Spare RCBO's	1P	20A	Yes	1	
Spare poles				14	
Chassis Size	<b>36P</b>				

**Switchboard Designation:****DBCR****Serves Communications room****Type**

NHP Terasaki NLC metal load centre

**Segregation:**

Form 1

Circuit quantities are indicative only.

**Mounting:**

Surface

Quantities to be confirmed by  
contractor prior to manufacture**Complete with door and latch:**

Yes - CL001 key

**Busbar rating:**

120A

**Fault rating:**

20kA for 0.2 sec with 6kA MCB's &amp; RCBO's

**Colour :**

Manufacturers standard

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	1P	80A		1	
Emergency lighting	1P	16A	Yes	1	
Internal lighting	1P	20A	Yes	1	
10A GPO'S	1P	20A	Yes	1	
15A GPO's	1P	20A	Yes	3	
Isolators A/C condensers	1P	25A	No	2	
10A GPO MATV	1P	20A	No	1	
10A GPO MSCP	1P	20A	No	1	
10A GPO PABX	1P	20A	No	1	
Spares MCB's	1P	20A	No	1	
Spare RCBO's	1P	20A	Yes	1	
Spare poles				8	
Chassis Size	<b>21P</b>				

**Switchboard Designation:** **DBSR** **Serves main site switchroom**  
**Type** NHP Terasaki NLC metal load centre  
**Segregation:** Form 1 Circuit quantities are indicative only.  
**Mounting:** Surface Quantities to be confirmed by contractor prior to manufacture  
**Complete with door and latch:** Yes - CL001 key  
**Busbar rating:** 120A  
**Fault rating:** 20kA for 0.2 sec with 6kA MCB's & RCBO's  
**Colour :** Manufacturers standard

Circuit Designation	Circuit Breaker				Remarks
	Poles	Amps	RCD	Qty	
Main Isolator	1P	80A		1	
Emergency lighting & exit signs	1P	20A	Yes	1	
Internal lighting	1P	20A	Yes	1	
External lighting	1P	20A	Yes	1	
15A GPO's	1P	20A	Yes	1	
Spares MCB's	1P	20A	No	1	
Spare RCBO's	1P	20A	Yes	1	
Spare poles				6	
Chassis Size	<b>12P</b>				

## **APPENDIX E4**

### **WEBFM OPERATIONS AND MAINTENANCE MANUALS**



## MANUALS

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### WEBFM Operations and Maintenance Manuals

The Contractor is to provide completed Operation and Maintenance Manuals to the Principals Authorised Person, the Superintendent, prior to Completion or the date nominated in the approved Commissioning and Handover Plan.

This is a condition precedent to payment for any Completion Amounts due under the Contract.

(a) Use Of WEBFM Proprietary System

The Contractor at its cost is to use the WEBFM OMTrak System for the purpose of producing Electronic O&M Manuals.

WEBFM Pty Ltd  
Ph 02 46 55 50 44  
Fx 02 46 55 50 66  
Email [sales@WEBFM.com.au](mailto:sales@WEBFM.com.au)  
Contact: Nick Suthers Mob: 0430 305 341

The Contractor is to procure the WEBFM O&M system within 30 days of commencement of the Contract or at a time approved by the Principal or Superintendent. The cost of the use of the WEBFM OMTrak system will be to the contractors account for the sum of approximately \$25,000.00 (incl. GST) and included in Provisional Sums of the Contract.

(b) Objectives

The objectives of the Operations and Maintenance Manuals are:

- (i) to be of sufficient detail to enable the Principal to take over any maintenance, operation or use of the works and to do so in a safe, effective and efficient manner
- (ii) to enable progressive and timely development and checking of the Manuals in advance of any completion milestones
- (iii) to be fully completed and finalised prior to the Principals occupation, use or acceptance of the works
- (iv) to be developed in standardised and fully electronic data format suitable for upload to the Principals Asset and Data Management Systems
- (v) to enable complete financial reconciliation of the assets and works showing element and asset costs, life expectancy costs and the like

(c) Capture Of Asset, Maintenance And Operations Data

Contractors must progressively capture and input all relevant data into the WEBFM O&M system in a timely manner during the contract term and prior to any handover of the works. Contractors are required to check and correct the data progressively.

(d) Staged Completions

Where the works are to be completed and handed over to the Principal in stages or separable portions the O&M Manual are to be completed to sufficient detail and content to enable the Principal to assume its responsibilities for the ongoing operation and maintenance of the completed works.

(e) Access By The Principal

The Contractor will make available the O&M Manuals in electronic format via WEBFM internet access for review by the Principal and or the Superintendent at the Contractors cost.

(f) Access By Others

The contractor will provide access to the on-line WEBFM O&M System for other relevant parties including but not limited to:

- (i) Sub-contractors
- (ii) Design Consultants
- (iii) Independent Certifiers
- (iv) Other Parties with responsibilities in regard to development, checking and finalizing O&M Manuals

(g) Quality Assurance Process

The Contractor is to utilize the QA system provided as part of the WEBFM O&M System. All parties with access to the system are to record any errors or omissions and to update the status on any actions taken.

(h) WEBFM Setup

The Contractor is to provide a suitable venue and to co-ordinate attendance of relevant participants to the initial Set-up workshop conducted by WEBFM. The Set-up session is to

- (i) ensure the correct base facility and or asset data is used in the system,
- (ii) to establish the number of manuals and there scope relative to the completed works
- (iii) to agree the respective roles and responsibilities of the parties in development of O&M Manuals
- (iv) to advise the various parties using the system of any special requirements to be addressed in the O&M Manuals
- (v) The Set-Up workshop is to be conducted early in the project term to allow all Parties sufficient time to enable progressive data input prior to completion of any stage or separable portion of the works.

(i) Training

The Contractor is to ensure all relevant staff, consultants and sub-contractors are suitably trained in the proper operation of the WEBFM system.

The Contractor is also to provide at its cost training of nominated Principals representatives, Superintendent or agents in operation of the WEBFM System. The number of trainees nominated will be a reasonable number in consideration of the size and complexity of the works.

(j) Standard O&M Headings

O&M Manuals are to follow the standard headings shown below to ensure consistency for all elements of the works:

- (i) **Introduction & Scope** – overview and description of the systems, the approach taken and other relevant information to ensure the client has an understanding of the equipment and its intended purpose
- (ii) **Assets** - detailed schedule of all financial assets data, maintainable assets data, items and locations all reconciled to the total projects value
- (iii) **Maintenance** - detailed instructions and frequency to ensure proper function of the assets
- (iv) **Operations Data** - detailed instructions for safe and efficient operation of the assets, including general cleaning, proper use and function of the assets/systems and relevant suppliers documentation
- (v) **Spare Parts** - listed items or components required to complete maintenance or operation tasks or for replacements
- (vi) **Warranty and Certificates** - descriptions of all warranties and (both contracted and procured through suppliers) for the assets and descriptions of any certificates issued as part of the works including uploaded copies of all relevant documents
- (vii) **Help and Contact** - Details of any relevant contractors, suppliers and the like who may be used by the owner to support the operation and maintenance of the assets
- (viii) **Drawings and Reference** - lists of all final as built drawings, specifications and other relevant documents forming the final contract scope and other relevant attachments - like product manuals, specifications and the like relevant to the proper operation and maintenance of the works.

Where a particular section is not relevant it may be left blank

(k) Handover Of Asset, Maintenance And Operations Data

The Contractor is to advise the Principal and or the Authorised Person when the Operations and Maintenance data is complete and accurately reflects the works.

The Contractor is to complete the draft O&M Manuals 28 days in advance of Handover of the Works or parts thereof or in accord with the approved Commissioning and Handover Plan whichever is the earlier date.

Should the Principal and or the Authorised Person identify any errors or omissions in the submitted data then within the time period stated in the approved Commissioning and Handover Plan or the issued Defect Notice the Contractor is required to rectify any items and to pay all such costs that may be incurred to update the final data.

(l) Document Completion

The Contractor must integrate the collection of asset data documents, and their subsequent production and submission in accord with the timing set out in the approved Commissioning and Handover Plan (including Inspection and Test Plans and Staged works handover), with progressive development of documents in electronic form.

The number of electronic copies of O&M Manuals shall be as stated in the approved Commissioning and Handover Plan or in the absence of a stated number 1 copy for each defined recipient in the approved Commissioning and Handover Plan. In the absence of any defined recipients a minimum of 6 CD Copies are to be supplied.

Contractors are to advise the Principal or where responsibility for verification of O&M Manuals is vested with the Contractor or another Party when Manuals are at draft stage and ready for review.

Nominated personnel from the Principal, and or Responsible Party in accord with the approved Commissioning and Handover Plan shall access the on-line O&M Manuals and provide comments or directions for any corrections as needed.

The Contractor will update the O&M Manual data in accord with the directions issued and the stated timetable and notify the Principal or Responsible Party of satisfactory completion.

When notified by the Principal or Responsible Party of completion of all O&M Manuals the Contractor is to direct WEBFM to close on-line access (to prevent further alteration to the approved data) and transfer all O&M Data to CD versions for Handover.

(m) Compliance With Laws, Standards And Specifications

The Contractor shall check and verify that all data and attached files and documents that form the completed O&M Manuals comply with the relevant Laws, Standards, Codes and Specifications applicable to the works to enable the proper operation and maintenance by the Principal and or its appointed agents of the completed works.

(n) Work-As-Executed Drawings

The Contractor is to provide to the Principal work-as-executed drawings in electronic formats for Subcontract and Supplier packages showing the completed works as constructed for that stage or portion of the works. Formats are to be PDF and CAD or other format as approved by the Principal.

Ensure the content, accuracy and level of detail of work-as-executed drawings are equivalent to those in the detail design drawings used for construction and are sufficient to describe and to ensure the efficient operation of the assets created under the Contract. Where required to describe the Works, include digital

photographs of specific aspects of the Works in work-as-executed drawings or operations and maintenance manuals.

Include in work-as-executed drawings a survey drawing indicating the position of the Works relative to a primary survey grid. Certify survey drawings using a Registered Surveyor where required by the Principal.

All work as executed and as-built documentation must be in accord with the Specification. Verify each drawing certifying accuracy, completeness, correctness and compliance with CAD conventions.

All work as executed and as-built documentation must be uploaded into the WEBFM system. All Attached files to be adequately described in WEBFM Heading and Description boxes per Contract Specification including Drawing title, number, short description of the works, location i.e. Building No etc (similar to drawing register). Where a Zip file is used all contained files and their titles are to be shown in the Description box with sufficient detail to allow easy assessment of each files contents.

(o) Hard Copy Format

The Contractor is to provide Hard Copy versions of O&M Manuals only if specified in the Contract Specification or approved Commissioning and Handover Plan or other contract document.

Where any conflict occurs with any other part of the contract and or specifications in reference to provision of Hard Copy O&M Manuals the Principal in the interests of compliance with Green Building Policy will accept the same number of electronic copies of O&M Manuals in lieu of the number of Hard Copy Manuals nominated.

(p) Electronic Copy Format

The Contractor is to provide to the Principal the specified number of copies of the WEBFM electronic O&M Manuals in CD or DVD disks containing all O&M Manual data, attached files and documents transferred from the on-line web site. Disk Media are to be packaged in a suitably bound Disk Case. Disks and Case are to be fully labelled with the following:

- (i) Project Name (Front Case cover and Spine, All Disk Media);
- (ii) Contractor Name and contact details (logo may be inserted);
- (iii) Compiled date (date when O&M Manuals data transferred to Disk Media);
- (iv) Contents List (include list of all trade manuals in order);
- (v) Installation instructions (inside front Case Cover).

All O&M Manuals are to be supplied in stand alone MS Access database and PDF formats as single electronic systems with suitable hyperlinks to all associated files, photographs and documents for easy retrieval and use by the Principal.

The number of electronic copies of WEBFM O&M Manuals shall be as stated in the approved Commissioning and Handover Plan or in the absence of a stated number 1 copy for each defined recipient in the approved Commissioning and Handover Plan. A minimum of 2 CD Copies are to be supplied.

**TENDER FORM**

for

**ELECTRICAL SERVICES**

at

.....

We, the undersigned, tender to supply, install, commission and undertake a maintenance/ warranty period as detailed in the technical specification, drawings, conditions of contract for the proposed sub-contract as set out hereto.

Addenda received .....

- Fixed Lump Sum Tender	\$ .....
- Provisional Sum	\$ .....
- Contingency Sum	\$ .....
	_____
<b>Sub-Total</b>	<b>\$ .....</b>
<i>GST</i>	<i>\$ .....</i>
	_____
<b>TENDER SUM</b>	<b>\$ .....</b>
	_____

**Tenderer's Name:** .....

**Signature of Tenderer:** .....

**Tenderer's Registration Number:** .....

**Date:** .....

## SCHEDULES

### TENDER PRICE BREAKUP – STAGE 1

This schedule contains a list of all major work items and the tenderer is required to make his own assessment of the work involved from the drawings and specification and enter the total price for each item. All works in the schedule must be priced separately.

1. Supply, earthing and metering	\$
2. Switchboards	
Site main switchboard SMSB	\$
Main distribution switchboard MDB1	\$
Distribution boards	\$
3. Wiring and accessories	
Consumer mains and Submains	\$
Lighting and power sub-circuit wiring	\$
Cable support systems	\$
Underground conduits and trenching	\$
4. Outlets, accessories and appliances fit off	\$
5. Luminaires	
Internal light fittings	\$
External light fittings	\$
Emergency and exit lighting	\$
Lighting controls	\$
6. Nurse call system	\$
7. DECT phone system	\$
8. Wanderer's alert system	
9. Voice/data communications systems and cabling	\$
10. MATV System	\$
11. Public address system	\$
12. Electronic security and CCTV	\$
13. Preparation of "As-Installed" drawings and installation manuals	\$
14. Quality Assurance, Testing and Commissioning	\$
15. Maintenance/Defects Liability Period	\$
16. Demolition and relocation works	\$
<b>LUMP SUM TENDER PRICE</b>	<b>\$</b>
<b>GST</b>	<b>\$</b>
<b>TOTAL TENDER PRICE</b>	<b>\$</b>

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....



## **TENDER PRICE BREAKUP – STAGE 2**

This schedule contains a list of all major work items and the tenderer is required to make his own assessment of the work involved from the drawings and specification and enter the total price for each item. All works in the schedule must be priced separately.

1. Switchboards	
Distribution boards	\$
2. Wiring and accessories	
Lighting and power sub-circuit wiring	\$
Cable support systems	\$
External lighting underground conduits and trenching	\$
3. Outlets, accessories and appliances fit off	\$
4. Luminaires	
Internal light fittings	\$
External light fittings	\$
Emergency and exit lighting	\$
Lighting controls	\$
5. Nurse call system	\$
6. DECT phone system	\$
7. Wanderer's alert system	
8. Voice/data communications systems and cabling	\$
9. MATV System	\$
10. Public address system	\$
11. Electronic security and CCTV	\$
12. Preparation of "As-Installed" drawings and installation manuals	\$
13. Quality Assurance, Testing and Commissioning	\$
14. Maintenance/Defects Liability Period	\$
15. Demolition and relocation works	\$
<b>LUMP SUM TENDER PRICE</b>	<b>\$</b>
<b>GST</b>	<b>\$</b>
<b>TOTAL TENDER PRICE</b>	<b>\$</b>

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....

### TENDER PRICE BREAKUP – STAGE 3

This schedule contains a list of all major work items and the tenderer is required to make his own assessment of the work involved from the drawings and specification and enter the total price for each item. All works in the schedule must be priced separately.

1. Switchboards	
Distribution boards	\$
2. Wiring and accessories	
Lighting and power sub-circuit wiring	\$
Cable support systems	\$
External lighting underground conduits and trenching	\$
3. Outlets, accessories and appliances fit off	\$
4. Luminaires	
Internal light fittings	\$
External light fittings	\$
Emergency and exit lighting	\$
Lighting controls	\$
5. Nurse call system	\$
6. DECT phone system	\$
7. Wanderer's alert system	
8. Voice/data communications systems and cabling	\$
9. MATV System	\$
10. Public address system	\$
11. Electronic security and CCTV	\$
12. Preparation of "As-Installed" drawings and installation manuals	\$
13. Quality Assurance, Testing and Commissioning	\$
14. Maintenance/Defects Liability Period	\$
15. Demolition and relocation works	\$
<b>LUMP SUM TENDER PRICE</b>	<b>\$</b>
<b>GST</b>	<b>\$</b>
<b>TOTAL TENDER PRICE</b>	<b>\$</b>

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....

## **SCHEDULE OF TECHNICAL DATA**

We advise that our Tender includes equipment of manufacturer's listed below. The technical details of the equipment offered shall fully comply with the specification.

### **SWITCHBOARDS**

#### **Site Main Switchboard SMSB**

Manufacturer .....  
Type .....  
Approximate dimensions ..... Lx ..... Hx ..... D ..... kg

#### **Main Distribution Switchboard MDB1**

Manufacturer .....  
Type .....  
Approximate dimensions ..... Lx ..... Hx ..... D ..... kg

#### **Distribution Switchboards**

Manufacturer .....  
Type .....  
Approximate dimensions ..... Lx ..... Hx ..... D ..... kg

#### **Control Power Supplies**

Manufacturer .....  
Type .....  
Overall size and weight ..... Hx ..... Wx ..... D ..... kg

### **CABLING**

<b>Type</b>	<b>Manufacturer</b>
PVC insulated and PVC sheathed	.....
XLPE insulated and PVC sheathed	.....
Fire rated cables	.....

### **CABLE SUPPOTRS**

<b>Type</b>	<b>Manufacturer</b>
Cable tray	.....
Cable ladder	.....
Conduits and fittings	.....

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF TECHNICAL DATA (cont'd)**

**LOW VOLTAGE SWITCHBOARD COMPONENTS**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
Withdrawable air circuit breakers (medium voltage)	.....
Motorised withdrawable air circuit breakers	.....
Surge diverters	.....
ATS	.....
Fuse combination units	.....
Fuses	.....
Control switches	.....
Multi function meters	.....
Current transformers	.....
Miniature over-current circuit breakers	.....
Combination RCD miniature over- current circuit breakers	.....
Moulded case circuit breakers	.....
Load break fault make isolators	.....
Contactors	.....
Phase failure relays	.....
Programmable logic controller	.....

**ACCESSORIES, OUTLETS AND APPLIANCES**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
Accessories and outlets	.....
Other (list)	.....

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF TECHNICAL DATA (cont'd)**

**LUMINAIRES**

<i><b>Component</b></i>	<i><b>Manufacturer</b></i>
A1	
A2	
A3	
A4	
A6	
B1	
B2	
B3	
B4	
BL	
C1	
C2	
C3	
C4	
D1	
D2	
D3	
D4	
D5	
D6	
D7	
D8	
D9	
D10	
EM1	
EM2	

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF TECHNICAL DATA (cont'd)**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
EM3	
EM4	
EM5	
EX1	
EX2	
EX3	
EX4	
EX5	
EX7	
F1	
F2	
F3	
F4	
NL	
P1	
P2	
S1	
SL	
U1	
U2	
U3	
U4	
W1	
W2	
W3	
W4	
W5	
W6	

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF TECHNICAL DATA (cont'd)**

**EMERGENCY LIGHTING MONITORING SYSTEM**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
Manufacturer	.....
Catalogue No.	.....
System type	.....

**LIGHTING CONTROLS SYSTEM**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
Manufacturer	.....
Catalogue No.	.....
System type.	.....

**NURSE CALL SYSTEM**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
System manufacturer	.....
Equipment details	.....

**MATV SYSTEM**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
System manufacturer	.....
Equipment details	.....

**ELECTRONIC SECURITY SYSTEM**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
System manufacturer	.....
CCTV camera type	.....
Key pads	.....
Electric lock types	.....
Electric latch types	.....

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF TECHNICAL DATA (cont'd)**

**PUBLIC ADDRESS SYSTEM**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
System manufacturer	.....
Equipment details	.....

**DECT PHONE SYSTEM**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
System manufacturer	.....
Equipment Details	.....

**WANDERER'S ALERT SYSTEM**

<b><i>Component</i></b>	<b><i>Manufacturer</i></b>
System manufacturer	.....
Equipment Details	.....

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....



## SCHEDULE OF UNIT RATES

The following unit rates are to be used for additions to, or deletions from the specified Contract works (prior to the purchases of affected equipment). **All unit rates given herein shall include all preliminaries and overhead charges and profit.**

For the works associated with Variation to the Contract to which the unit rates given cannot be applied, the variation costs to be submitted for evaluation and approval shall consist of the following sub-divisions.

- a) The supply costs of materials or equipment.
- b) The labour costs involved in the installation of these items of equipment or systems to their approved completion stage.

In determining the value of labour costs, the following charge-out hourly rate shall apply. this unit rate shall be an absolute rate inclusive of any penalty rates and allowances which may form part of the wage award.

## LABOUR RATES

Labour rate applicable for work time on site and in factory and shall include all loadings and allowances apart from overhead and profit covered by item below.

	Normal Time	Rate per Hour Time & Half	Double Time
Supervisor - on site	\$.....	\$.....	\$.....
Qualified Electrical Tradesman	\$.....	\$.....	\$.....
Electrical Apprentice	\$.....	\$.....	\$.....
Drawing Office	\$.....	\$.....	\$.....
Maintenance (call out)	\$.....	\$.....	\$.....

## CABLE SUPPORT SYSTEM

All rates in this section shall include normal allowance for tees, joints, bends, crossovers, set ups, set downs and corners.

Supply and installation of cable ladder per metre in ceiling space including supports and accessories and normal allowance for tees, crossovers set up and set down and bends.

### Supply and installation of cable support system:

	<i>Cable Tray</i>		<i>Cable Ladder</i>	
900mm wide	\$.....	per metre	\$.....	per metre
600mm wide	\$.....	per metre	\$.....	per metre
450mm wide	\$.....	per metre	\$.....	per metre
300mm wide	\$.....	per metre	\$.....	per metre
225mm wide	\$.....	per metre	\$.....	per metre
150mm wide	\$.....	per metre	\$.....	per metre

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF UNIT RATES (cont'd)**

**Supply and installation of conduits with draw wire:**

	<i>Steel</i>		<i>PVC</i>	
32mm cast into concrete	\$ .....	per metre	\$ .....	per metre
20mm cast into concrete	\$ .....	per metre	\$ .....	per metre
32mm cast into brickwork	\$ .....	per metre	\$ .....	per metre
20mm cast into brickwork	\$ .....	per metre	\$ .....	per metre
32mm surface mounted	\$ .....	per metre	\$ .....	per metre
20mm surface mounted	\$ .....	per metre	\$ .....	per metre

**Supply and installation of skirting duct:**

– Straight duct with covers	\$ .....	per metre
– Provision of a mitred corner	\$ .....	per metre

**CABLES**

**Supply and installation of cables (excluding cable tray) per metre of the following copper cables:**

	<i>MIMS</i>		<i>PVC/PVC</i>	
4 x 1 core 240mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
4 x 1 core 150mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
4 x 1 core 120mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
4 x 1 core 95mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
4 x 1 core 35mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
1 x 4 core 25mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
1 x 4 core 16mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre

**Tenderer's Name:** .....

**Signature of Tenderer:** .....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF UNIT RATES (cont'd)**

**Supply and installation of subcircuit cabling fixed to building structure:**

	<i><b>MIMS</b></i>		<i><b>PVC/PVC</b></i>	
3 core 2.5mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
3 core 1.5mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
2 core 6mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
2 core 4mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
2 core 2.5mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
2 core 1.5mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
4 core 2.5mm <sup>2</sup>	\$ .....	per metre	\$ .....	per metre
Nurse call cables			\$ .....	per metre
MATV coaxial cables			\$ .....	per metre
Telecom facilities cabling			\$ .....	per metre

**Supply and installation of cable terminations:**

	<i><b>MIMS</b></i>		<i><b>PVC/PVC</b></i>	
4 x 1 core 240mm <sup>2</sup>	\$ .....	each	\$ .....	each
4 x 1 core 150mm <sup>2</sup>	\$ .....	each	\$ .....	each
4 x 1 core 120mm <sup>2</sup>	\$ .....	each	\$ .....	each
4 x 1 core 95mm <sup>2</sup>	\$ .....	each	\$ .....	each
4 x 1 core 35mm <sup>2</sup>	\$ .....	each	\$ .....	each
1 x 4 core 25mm <sup>2</sup>	\$ .....	each	\$ .....	each
1 x 4 core 16mm <sup>2</sup>	\$ .....	each	\$ .....	each

**Tenderer's Name:** .....

**Signature of Tenderer:** .....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF UNIT RATES (cont'd)**

**LIGHT FITTINGS**

**Supply and installation costs of luminaires, including lamps:**

	<b>Luminaire Supply</b>	<b>Luminaire Installation</b>
A1	\$ .....	\$ .....
A2	\$ .....	\$ .....
A3	\$ .....	\$ .....
A4	\$ .....	\$ .....
A6	\$ .....	\$ .....
B1	\$ .....	\$ .....
B2	\$ .....	\$ .....
B3	\$ .....	\$ .....
B4	\$ .....	\$ .....
BL	\$ .....	\$ .....
C1	\$ .....	\$ .....
C2	\$ .....	\$ .....
C3	\$ .....	\$ .....
C4	\$ .....	\$ .....
D1	\$ .....	\$ .....
D2	\$ .....	\$ .....
D3	\$ .....	\$ .....
D4	\$ .....	\$ .....
D5	\$ .....	\$ .....
D6	\$ .....	\$ .....
D7	\$ .....	\$ .....
D8	\$ .....	\$ .....
D9	\$ .....	\$ .....
D10	\$ .....	\$ .....
EM1	\$ .....	\$ .....
EM2	\$ .....	\$ .....

**Tenderer's Name:** .....

**Signature of Tenderer:** .....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF UNIT RATES (cont'd)**

**LIGHT FITTINGS**

**Supply and installation costs of luminaires, including lamps:**

	<b>Luminaire Supply</b>	<b>Luminaire Installation</b>
EM3	\$ .....	\$ .....
EM4	\$ .....	\$ .....
EM5	\$ .....	\$ .....
EX1	\$ .....	\$ .....
EX2	\$ .....	\$ .....
EX3	\$ .....	\$ .....
EX4	\$ .....	\$ .....
EX5	\$ .....	\$ .....
EX7	\$ .....	\$ .....
F1	\$ .....	\$ .....
F2	\$ .....	\$ .....
F3	\$ .....	\$ .....
F4	\$ .....	\$ .....
NL	\$ .....	\$ .....
P1	\$ .....	\$ .....
P2	\$ .....	\$ .....
S1	\$ .....	\$ .....
SL	\$ .....	\$ .....
U1	\$ .....	\$ .....
U2	\$ .....	\$ .....
U3	\$ .....	\$ .....
U4	\$ .....	\$ .....
W1	\$ .....	\$ .....
W2	\$ .....	\$ .....
W3	\$ .....	\$ .....
W4	\$ .....	\$ .....
W5	\$ .....	\$ .....
W6	\$ .....	\$ .....

**Tenderer's Name:** .....

**Signature of Tenderer:** .....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF UNIT RATES (cont'd)**

**ELECTRICAL ACCESSORIES AND APPLIANCES**

**Supply, install and connection of the following accessories:**

– standard one gang light switch	\$ .....	each
– two gang light switch	\$ .....	each
– 10A GPO (single)	\$ .....	each
– 10A double GPO	\$ .....	each
– 15A GPO	\$ .....	each

**Supply and installation of a connection to an appliance via local isolator:**

– 15 Amp single phase	\$ .....	each
– 15 Amp three phase	\$ .....	each
– 20 Amp single phase	\$ .....	each
– 20 Amp three phase	\$ .....	each
– 50 Amp three phase	\$ .....	each

**EMERGENCY WARNING AND INTERCOMMUNICATION SYSTEM**

**Supply and installation of equipment indicated complete with associated cabling.**

Ceiling mounted public address speaker	\$ .....	each
Horn type public address speaker	\$ .....	each
Warden intercom point	\$ .....	each

**DISTRIBUTION BOARDS**

**Supply and installation of additional miniature circuit breakers to distribution boards as follows:**

	Single Pole	Double Pole	Triple Pole
– 16A MCB	\$ .....	\$ .....	\$ .....
– 80A MCB	\$ .....	\$ .....	\$ .....

**Supply and installation of additional contactors:**

	Mounted in a DB	Mounted in a surface enclosure
– 30A 3P	\$ .....	\$ .....
– 63A 3P	\$ .....	\$ .....
– 100A 3P	\$ .....	\$ .....

**Tenderer's Name:** .....

**Signature of Tenderer:** .....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF DEVIATIONS FROM SPECIFICATION**

Any items of equipment or installation methods of installation sequencing proposed to be supplied or carried out by the tenderer, which deviate in any shape or form from the specified requirements, shall be declared in this Statement of Deviations.

For all items of equipment or installation methods or sequencing not declared in this statement, the specified requirements shall be deemed to be offered by the tenderer, without qualifications, and all associated costs shall be deemed to be included in the tender prices. The list of deviations proposed is as follows:

(If insufficient space for the full list, please attached separate insert to the Schedule.)

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**SCHEDULE OF ALTERNATIVES FROM SPECIFICATION**

All alternatives from this specification and the tender adjustment price shall be listed and detailed below:

**Deviation**

**Cost Adjustment**

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**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....

**SCHEDULE OF PERSONNEL**

**Chief Supervisor**

Name ..... Time With Firm .....  
Experience .....  
.....  
.....

**Foreman — On Site**

Name ..... Time With Firm .....  
Experience .....  
.....  
.....

**Drafting Personnel for the Production of Construction and As-installed Drawings**

Name ..... Time With Firm .....  
Experience .....  
.....  
.....

**EQUIPMENT AND MATERIALS ON COSTS**

Equipment purchase mark up ..... %

**Tenderer's Name:** .....

**Signature of Tenderer:**.....

**Tenderer's Registration Number:** .....

**Date:** .....