

ELECTRICAL SERVICES SPECIFICATION

FOR

**LINUWEL STEINER SCHOOL
NEW SCIENCE BUILDING**



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1: GENERAL ELECTRICAL SPECIFICATION

1.01 SCOPE OF WORK

This electrical contract consists of, but is not necessarily limited to the supply, installation and commissioning of the following:-

1. SWITCHBOARDS & DISTRIBUTION BOARDS - The design and supply of the switchboards and distribution boards, installation and commissioning.
2. LIGHTING - The supply of Luminaires, installation and commissioning of the lighting system.
3. POWER - The supply of GPO's, etc., installation and commissioning of the above items.
4. CABLING - Supply of cables, conduits, pits, installation and commissioning.
5. TELEPHONE/DATA – Design, supply installation and commissioning of the extensions to the existing telephone/data and systems as shown on the contract drawings and detailed herein.

1.02 GENERAL

Scope of work

This contract is for the supply, installation and commissioning of the complete Electrical Services, including lighting and power, cabling and accessories. Works to be performed are shown on the contract drawings or noted within this specification.

Note: The school is still in operation so existing electrical and communications supplies to existing occupied areas are to be maintained. All interruptions to services are to be outside of school hours.

Operating environment

Provide an electrical system and elements which are suitable for the ambient service conditions and operating environment with components and equipment suitable for the system application.

Service conditions: Refer to the general service conditions for the contract.

Standards: Building Code of Australia

Natspec Services Section 800, 815, 825 and 828

AS3000

Supply Authority Service Rules

All other relevant Australian Standards including those nominated within the body of this document.

1.03 INSPECTION

Notice

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

- Concealed cabling prior to covering.
- Switchboard terminations, prior to installing escutcheon plates.

- Required tests.

1.04 TESTS

Test certificates

Provide copies of test certificates for all tests.

Number of copies of test

certificates: 3 Copies

Tests schedule Confirmation of Circuits
Megger tests
Load Balance Data

1.05 CONTRACTOR'S SUBMISSIONS

Product data

Submit manufacturer's published product data, including

- technical specifications;
- recommendations for installation; and
- type test or factory test data.

Shop drawings

Submit shop drawings showing dimensions of equipment, location, circuit identification and labelling details.

Work-as-executed drawings

Prior to practical completion submit work-as-executed drawings showing the "as installed" location of electrical cables, services and equipment including the depth of underground cables, in relation to permanent site features and other underground services.

Operating and maintenance manuals 3 Copies of Manual showing:

Details of all equipment supplied, including part numbers, brochures, drawings, supplier details and recommended spares.

Instructions on safe operation and maintenance

Complete set of test reports and drawings.

Samples

Submit samples of the following: All luminaires other than types specified.

1.06 CONSTRUCTION GENERALLY

System integration

Interconnect the elements so that the system performs its required functions.

Wiring

Conceal wiring runs, except within EDB cupboards.

Concealed wiring: Easily rewirable, without damage to finishes or materials.

Exposed wiring permitted: Within EDB cupboards.

Building Penetrations

Limitations: Unless prior approval has been given do not penetrate

- existing structural members including external walls, fire walls, floor slabs and beams; or
- membrane elements including damp-proof courses, waterproofing membranes and roof coverings.

Reticulation to Outlets

Conceal all wiring and conduits wherever possible. The choice of wiring system will be influenced by the construction and finish of each wall, floor, ceiling, etc. and any potential hazard, eg. exposure to weather, mechanical damage.

Acceptable wiring methods are:-

- TPI cables in LD-UPVC conduit for power sub-circuit wiring.
- TPI cables in LD-UPVC conduit in slabs or TPS cables within ceiling spaces for sub circuit wiring to lighting and ceiling fan circuits.
- TPI cables or TPS cables enclosed in LD-UPVC conduit at switch drops.
- TPS wiring for lighting and power circuits in timber or steel stud partitions.

Where concealment is impractical, enclose wiring in conduit or duct. Use steel conduit where mechanical damage is possible.

Location of Wall Boxes

Consistent with design requirements and wherever possible minimise costs arising from cutting and chasing masonry by locating wall mounted outlets on accessible walls (eg. cavity walls).

Single brick walls, face both sides, are a common construction in schools, and require "biscuiting" of bricks or other cutting to allow conduit access. Rendered brick walls or other masonry construction require chasing.

Inform the Project Architects as early as possible of any need to cut bricks, chase etc.

Caution with Conduits in Concrete

Embedded Conduits displace their own volume in concrete and, depending on their location, number and spacing, could affect the structural performance of a slab or column.

A high concentration of conduits occurs at switchroom and switchboard cupboards.

Exercise caution with embedded conduits in area where slab penetrations will occur.

Membranes: Where approval is given to penetrate membranes, provide a waterproof seal between the element and the penetrating pipe, conduit or cable.

Fire rated elements: Seal the penetration using a system conforming to AS 4072.1.

Non fire rated elements: Seal penetrations around conduits and sleeves with a weak sand:cement mix or other approved material. Seal the space between cables within sleeves with a pliable waterproof compound. If the building element is acoustic rated, maintain the rating by packing the penetration with a suitable insulation.

Concrete building elements: Obtain approval for the location of sleeves or core holes.

Labelling

General: Provide labels to operable control devices and indicators showing circuit origin.

Wiring: Identify the origin of wiring by means of legible indelible marking using a machine type marking system.

Single line diagram: Provide a single line diagram of the electrical installation performed under this contract, in a glazed frame adjacent to the main switchboard.

- Format: Non-fading print, size not smaller than A3.

1.07 COMMISSIONING**Circuit Demonstration**

Demonstrate correct operation of all power and lighting circuits.

Demonstrate the correct operation of power circuits and security and external lighting control

Balance the load on all distribution boards

Operating and maintenance instructions

Prior to handing over, instruct the principal's staff in the recommended methods for operating and maintaining the system.

1.08 QUALITY ASSURANCE AND OCCUPATIONAL HEALTH & SAFETY

The Electrical Contractor is to comply with Head Contractors requirements.

2: WIRING

2.01 GENERAL

Cross references

Refer to the following sections:

- GENERAL ELECTRICAL REQUIREMENTS.
- GROUNDWORKS, for trenching for underground wiring.

Scope of Work

This section of the specification is for the design, supply, installation, documentation, testing and commissioning of the wiring for the installation.

2.02 CONTRACTOR'S SUBMISSIONS

Power cable ratings

Submit calculations of current ratings and voltage drop, to AS 3008.1 if the Contractor wishes to use power cables other than those specified.

2.03 MAINS AND SUBMAINS

Mains Supply and install new submains as shown on the single line diagram.

Sub Mains: Supply and install new submains as shown on the single line diagram.

All submains to be run as follows:

- Underground. In HDUPVC Conduits, via cable pulling pits.
- Within or under Building. On hot dipped galvanised perforated tray.

2.04 WIRING SYSTEM INSTALLATION

Installation methods

Rendered brick partition: Use flush wall boxes and chase conduits into wall.

Face brick partition. Use flush wall boxes and conceal conduits in brickwork. Do not chase any face bricks.

Face brick external cavity wall: Use flush wall boxes and run conduits in internal leaf of wall. No cables are to be run in cavities.

Stud partition: Use flush wall boxes and run conduits in cavity. Secure GPO's, that are mounted on inboard material, from behind.

Segregation: Provide segregation between power and other wiring as required by specified Standards.

Underground: In HDUPVC conduit, via cable pulling pits. Electrical Contractor to submit details of pit location prior to installation.

Telephone Wiring:

- PABX wiring to be concealed.
- Buried cables to meet AUSTEL requirements.

Straight-through joints

Do not use without permission of Superintendent.

Cable joints

Locate joints in accessible locations and install junction box. Mains and submains cables may not be joined.

Cable Location Identification

Prior to any trenching taking place the Electrical Contractor is to survey the route and identify any possible crossing of existing service routes.

Where service routes are to be crossed the location is to be confirmed using approved locating equipment. Once the service is located all digging in the vicinity is to be by hand.

2.05 CABLE SELECTION**Cable**

Use multi-stranded copper cable.

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

PVC insulated cables: Use V75 minimum insulation.

For mains and sub-main cable sizes, refer to the single line drawing.

Note: Voltage drop in final sub-circuits is to be limited to 1.25%. Check with the Supply Authority for rulings on methods of determining maximum demand on final sub-circuits.

2.06 CONDUITS**Installation**

Install conduits in parallel runs with right angle changes of direction.

Inspection fittings

Use accessible type.

Draw cords

Provide draw cords in conduits not in use. Leave 1 m of cord coiled at each end of the run. Tag draw cords to identify destinations.

Material: Polypropylene cord, or insulated stranded earth wire, 2.5 mm² minimum size.

Non-metallic conduits and fittings

To AS 2053.

2.07 WALL/SKIRTING DUCTS

Type

Provide either surface or recessed proprietary type of extruded aluminium construction with powder coat or colourbond finish. Provide proprietary drop in screw fixed cover to match duct body. Covers fixed with self tapping screws will not be accepted.

Minimum Size

150mm high x 35 mm deep 2 channel.

Finish

Powder Coat, colour bond or PVC laminate finishes are acceptable. Submit the manufacturers range of standard colour finishes for Principal's selection.

Installation of Outlets

Fit outlets to duct, both socket and telecommunications outlets, in accordance with manufacturers recommended method of installation.

2.08 UNDERGROUND CABLING**Trenches**

Backfilling: Place backfill in layers not exceeding 200 mm loose thickness and compact to the required density.

Backfill soil thermal resistivity: Where the thermal resistivity of the excavated soil exceeds 1.2 K.m/W backfill trench with either cement-bound sand or gravel in accordance with AS 3008.1.

Under Floor Slabs

All trenching to be backfilled and compacted to the original ground compaction. (See Note 1)

Note 1: If this compaction cannot be achieved do not trench under slabs. Discuss alternate cabling route with Building Superintendent.

Note 2: All trenching under floor slabs is to take place prior to formwork being installed.

Minimum depth: 500mm

Under roadways

Under roadways and areas subject to traffic movement, install cables in a duct or conduit extending to not less than 1 m on either side of the sealed surface or trafficable area.

Minimum depth: 500mm

Sealing ducts, pipes and conduits

Seal the buried entries to ducts, pipes and conduits with a pliable non-setting waterproof compound. Seal spare ducts, pipes or conduits immediately after installation, and seal the others after the cable installation.

Survey

Prior to backfilling accurately record the routes of underground cables.

Location marking

Accurately mark the location of underground cables by route markers consisting of a marker plate set flush in a concrete base not less than 200 mm diameter x 200 mm deep, placed 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.

2.09 CABLE PITS

Proprietary cable pits

Use proprietary moulded pits up to and including 1200 x 1200 mm.

Proprietary item: Polycrete or equivalent

Thickness: 10 mm minimum or to suit the expected loading.

Material: Reinforced concrete, fibre cement, glass reinforced concrete, or polymer concrete.

Pit cover

Provide a pit cover which will withstand the expected loads and fit flush with the top of the pit.

Material: Concrete, cast iron, galvanised steel or other material suitable for the application, environment and loading.

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

Lifting handles: Supply lifting handles for each size of pit cover.

Drainage

Provide drainage from the bottom of the cable pit to an absorption trench filled with rubble or to the stormwater drainage system.

Absorption trench: Minimum size 300 x 300 x 2000 mm long.

2.10 ACCESSORIES

Flush mounting

Provide accessories of the flush mounted type. All accessories in these areas are to be similar to existing.

Restricted location

Do not install wall boxes across the junction of wall finishes.

General purpose outlets

Mount the outlet with the earth pin at the 6 o'clock position.

Proprietary item: Clipsal or HPM Standard Pattern or equivalent.

Pin arrangement: Standard

3 phase switches

Proprietary item: Wilco/Clipsal 56 series or equivalent

Minimum rating: 20 A, 500 V A.C.

Special Purpose Outlets

Clock Outlets: 4 round pin outlet.

Provide a matching plug for each outlet.

Socket Outlets

Socket Outlets fitted with removable face plates must be of a type that requires the use of a tool to remove such face plates.

2.11 APPLIANCES**Support**

Where ceiling mounted appliances are heavy, or vibrate, and the ceiling structure is inadequate for support, support them from the building structure.

2.12 EARTHING

Provide a complete earthing system for the installation, in accordance with AS3000, AUSTEL Customer Premises Cabling Manual and the local Supply Authority's requirements. provide one main earthing point at the Main Switchboard and run a separate earthing conductor with each sub-main and telephone Main Distribution Frame.

2.13 EARTHING OF STEEL FRAMED PARTITIONS

Connect all sections of steel framed partitions to earth bar in local distribution board associated with each area. Use separate minimum 2.5mm² stranded copper insulated earth cable system to make connections. Do not use general subcircuit light and power earthing systems.

3: LIGHTING

3.01 GENERAL

Standards

To AS 3137.

Emergency evacuation lighting: To AS 2293.1 and AS 2293.2.

Scope of Work

This section covers the supply and installation and commissioning of the lighting system.

3.02 LUMINAIRES

BALLAST

Unless otherwise specified, all luminaires shall be fitted with approved electronic ballasts.

Ballasts shall be 100% environmentally stress screened, and be designed and manufactured to ISO9001, in addition to conforming to the following standards:

EMC Emitted RFI	EN55015
Immunity	EN61547
Supply Harmonics	EN61000 3.2
Safety	EN60928 (C)
Performance	EN60929

Lamps

Generally lamps are to have a correlated colour temperature of 3000°K and a minimum colour rendering index of 84 Ra.

Generally linear fluorescent lamps are to be 26mm diameter triphosphor lamps with minimum output at 100 hours of 89 lumen/watt and less than 10% depreciation in output after 12,000 hours of operation.

Packaging

Pack luminaires and components in robust, sealed packages.

3.03 INSTALLATION

General

Mount luminaires on proprietary supports, brackets and hangers.

Submit proposed mounting arrangements for approval. Provide screws, trims, noggins, roses and packing material, as required. All installation methods to be submitted and approved by the Builder's representative.

Noggins: Minimum size 75 x 50 mm.

Location

Position luminaires to provide an even level of illumination throughout the room, and as follows:

Where one luminaire is required position it centrally within the room.

- Position rows of luminaires so that the distance from the wall is half the distance between rows.

Surface mounted luminaires

Fit packing pieces to level luminaires and prevent distortion of luminaire bodies. Use packing strips to align end to end luminaires.

Fixing: Use two 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. Securely fix luminaires to structural members of ceilings or walls as follows:

Fixing to timber: Steel woodscrews No. 10 x 25 zinc-plated round head.

Fixing to metal: Steel screws No. 10 x 25 zinc-plated round head. Rustproof the screw/metal contact points.

Fixing to concrete: Expanding bolts M5 x 40.

- Fixing to hollow blocks: M5 galvanised round head screws with spring loaded butterfly toggles.

Washers: Use zinc-plated washers 3 x screw diameter under all screw heads.

Recessed fittings to be supplied with lead and plug. Cabling to be fitted with plug base.

3.04 LIGHT FITTINGS

All luminaires shall be as shown on the contract drawings unless otherwise approved by the Superintendent. If alternatives are offered, the contractor must supply a sample and complete technical data on all proposed fittings.

3.05 ACCESSORIES**Switches**

Switches should generally be mounted inside spaces near their main entry and at about 1.2m above floor level. Switches to match brands and types of GPO's.

3.06 PHOTO ELECTRIC SWITCH

Provide Photo Electric switches to control external lighting with the following features:

- Light sensitive controller (P.E. Cell) to turn switch on and off at dusk and daybreak respectively and incorporating a time delay circuit, so that it is not affected by sudden or brief change in light level caused by intermittent cloud cover, reflections, vehicular lights or artificial lighting.

Specification

- IP25 impact resistant housing, with non-corroding and non-conductive cover, suitable for permanent fixing direct on a wall (not plug-in type).
- Rating 230-250 Volts, 50 Hz, 8 Amps, suitable for AC 3 type load.
- Operating temp range: -10°C to +50°C.

4: SWITCHBOARDS

4.01 GENERAL

Cross reference

Refer to the GENERAL ELECTRICAL REQUIREMENTS section.

Scope of Work

This section covers the design, supply, installation, documentation, testing and commissioning of new switchgear.

Approved manufacturers

Manufacturers to have at least 5 years experience in building the types of switchgear required.

Installation

Fix switchboards into position so that they are level and plumb.

4.02 DESIGN

Standard

To AS 3947 where required.

Circuit protection

Provide circuit protection by means of automatic circuit breakers.

Conductors

Busbars: Provide busbar circuits within the switchboard, extending from the termination of the incoming functional unit to the line side of protective equipment for outgoing functional units.

Cable interconnections: Do not use to link adjacent circuit breakers where proprietary multi pole busbar assemblies are readily available.

Fault levels

The values given are prospective symmetrical r.m.s. values of the short-circuit current at the switchboard input terminals. Provide conductors and equipment suitable for a rated prospective short-circuit withstand current.

Fault current limiting

To comply with Natspec Services.

Degrees of protection

To AS 1939.

Minimum degrees:

- General: IP41 (internal).
- External: IP56

Spare facilities

Provide minimum 25% spare pole capacity or 6 pole spaces whichever is greater.

This applies to both MSB and Distribution Boards.

4.03 PROPRIETARY SWITCHBOARDS

Definition

Switchboards of standard design and manufacture comprising standard components and equipment layout in a single enclosure.

4.04 SWITCHBOARD GENERAL

Definition

Main Switchboard: From which the supply to the whole installation can be controlled.

Distribution Switchboard: From which the supply to part of the installation can be controlled.

Layout

Equipment on doors: Mount control switches, indicating lights and meters on doors set out in a logical manner in functional unit groups. Shield door mounted equipment to prevent inadvertent contact with live terminals or wiring.

Enclosure

Provide a rigid enclosure.

Non-type tested assemblies: Make from sheet metal of rigid folded and welded construction.

Panels

Provide stiffening to panels, to prevent distortion or drumming.

Material:

- General: Minimum 1.6 mm thick zinc-coated sheet steel to AS 1397/Z200.
- Outdoor switchboards: Coating class Z450.

Floor-mounting

Provide mild steel channels, hot-dip galvanised, for mounting the complete switchboard assembly on site.

Wall-mounting

Provide additional internal reinforcing to prevent distortion and through which the fixing bolts pass. For flush or semi-flush switchboards provide an angle trim of the same material and finish as the enclosure.

Escutcheon plates

Provide neat cut-outs for circuit breaker toggles allowing interchangeability of 1, 2 and 3 pole circuit breakers.

Finishes

Apply coatings to all internal and external metal surfaces of the switchboard cubicle, including covers, except for stainless steel, electroplated or anodised surfaces.

Surface preparation of metalwork: Before applying coatings to metalwork, complete welding, cutting, drilling and other fabrication and prepare the surface by a suitable method to AS 1627.

Finish coatings: Apply minimum of two final coats to achieve a completely smooth finish with no noticeable imperfections.

Paint colours: To AS 2700, as follows:

- Exterior of indoor switchboards: Orange X15.
- Interior of switchboards: White.

4.05 CONDUCTORS FOR SWITCHBOARDS – GENERAL

Busbars

Materials: Hard drawn, high conductivity electrolyte tough pitch copper.

Phase sequence: For main busbars and connections to switching devices, red, white and blue from left to right and from top to bottom, when viewed from the front of the switchboard.

Current carrying capacity: Provide busbars of current rating required or, if not stated, based on the frame size of all outgoing functional units and the load diversity factors given in AS 1136.1.

Busbar links: Provide removable links for current transformers.

Jointing: Make busbar joints with high tensile steel bolts, washers and nuts, locked in position with lock nuts or locking tabs. Do not use tapped holes and studs for jointing current carrying sections.

Busbar insulation: Active and neutral busbars: Select from the following:

- Polyethylene: Minimum 0.4 mm thick with dielectric strength in accordance with AS 3000 of 2 kV r.m.s. for 1 minute. Apply by a fluidised bed process in which the material is directly cured onto the bars.
- Fully encapsulated busbars or close fitting busbar insulation mouldings: Not less than 1 mm thick.
- Heat shrink material: Use only on rounded edge busbars.

Wiring

Cable type: Provide PVC insulated copper cables to AS 3147 and rated to AS 3008.1.

Control and indication circuits: Provide conductors of not less than 1.5 mm², with stranding sized to suit the current carrying capacity of the particular circuit.

Terminations

Motor control centres: For connections up to and including 16 mm² provide DIN rail mounted, spring loaded, tunnel type terminal blocks. For connections to circuits above 16 mm² provide stud type terminals not less than 5 mm diameter sized to continuously carry the load. Fit insulated sleeve ferrules to flexible cables terminated in tunnel terminals.

Identification: Identify each cable at both ends with neat ring type ferrules.

4.06 SWITCHGEAR FOR SWITCHBOARDS – GENERAL

Moulded case and miniature circuit breakers

Standards:

- To AS 3858 for fault capacities of 10 kA or more.
- To AS 3111 for miniature overcurrent circuit breakers up to 100 A current rating and less than 10 kA fault capacity.

Type: Automatic trip.

Adjustable current settings: Make provision for sealing of the trip current adjustment control, to prevent tampering, if adjustable with the covers in position. Where the adjustment control is concealed behind the cover or escutcheon, no sealing facility is required. Provide a label mounted on or adjacent to the circuit breaker indicating the rated current and trip current setting.

Trip setting: Set all adjustable short circuit trip settings to the "low" position.

Trip units: Connect circuit breakers with interchangeable trip units so that the trip units are not "live" when the circuit breaker contacts are open.

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

Main Switches

Main Switchboard – Auto Circuit Breaker

Distribution Board – Fault make load break switch

Fuses

Provide fuses which discriminate with other protective equipment.

Let-through energy and peak current cut-off: Suitable for the protected equipment.

Standard: To AS 2005 Parts 10, 20, 21.1, 21.2, and 29.

Type: Use enclosed, high rupturing capacity (HRC) type, except that unenclosed fuses may be used as fault current limiters.

Unenclosed fuses: Provide barriers to prevent inadvertent electrical contact between phases by a foreign metallic straight object, on both sides of each fuse link. Where necessary for safe removal and insertion of the fuse carrier, provide extraction handles.

Earth leakage devices

Standards: To AS 3190 and AS 3111.

Tripping: Maximum tripping time: Type II, to AS 3190 and AS 3000.

4.07 CONTROLGEAR FOR CUSTOM-BUILT SWITCHBOARDS

Control and test switches

Standards: To AS 1431 Parts 1, 2 and 7 and AS 3650.

Push buttons:

- Type: Oil-tight, minimum 22 mm diameter or square. Select push buttons from the same size range for each installation.
- Rated operational current: Not less than 4 A at 240 V a.c.

Rotary switches:

- Set the OFF position at "12 o'clock".
- Rated operational current: Not less than 6 A at 240 V a.c.

Time switches:

- 7 day operation with hour sector changes.
- Operation: Provide day omit and manual override facilities.
- Mains failure operation: Either by 24 hour spring or by a battery with 100 hour operating capacity and a life of 10 years.
- Contact rating: 16 A at 240 V a.c. to utilisation category AC-22.

Control relays

Standards: To AS 2481 and AS 1431.1.

Construction: Latch plug-in types to the receptacle base using a captive clip which may be applied and released by hand.

Minimum contact rating: 5 A at 240 V for a.c. applications to utilisation category AC-22.

Time delay relays: Use time delay relays which are adjustable over the full timing range and have a timing tolerance within 12.5% of the nominal setting.

Electronic relays: Incorporate a LED which indicates the energisation state of the relay.

Pneumatic relays: Provide sealed chamber type with internal circulating air with a linear, calibrated time adjustment.

Phase failure relays: Solid-state type phase failure relays which drop out at 85% of the normal voltage or single phase failure, or reverse phase sequence, after an appropriate time delay. Provide a sensing circuit which rejects disturbances having frequencies other than 50 Hz, and induced voltage spikes.

Contactors

Standard: To AS 1029.1 for a.c. contactors.

Type: Block type, air break.

Rated duty: Intermittent class 0.03.

Minimum size: 16 A for 3 phase at 415 V a.c. at utilisation category AC-3. 16 A for single phase at 240 V a.c.

Mechanical endurance: Class 10.

Utilisation category: Not less than AC-3.

Contacts life: 1 million operations at utilisation category AC-3.

Short circuit protection: Type "a".

Auxiliary contacts: Provide auxiliary contacts with minimum one normally open and one normally closed separate contact with rating of 4 A at 240 V a.c.

4.08 ACCESSORIES

Indicator lights

Standard: To AS 1431.2.

Incandescent:

- Type: Oil tight, minimum 22 mm diameter or square.
- Lamps: Changeable from the front of the panel without removing the holder.
- Lamp rating: Minimum 1.2 W and maximum 5 W.

Neon lamps: 240 V, 12 mm diameter with in-built resistor.

LED: 12 or 24 V in chromium plated bezel, nominal 5 mm diameter.

4.09 LABELS**Marking**

For each switchboard, include labels for switchboard designation, functional units, control switches, circuit designations and ratings, incoming cable sizes, fuses, warning notices, switchboard manufacturer's name and source of electrical supply for other than main switchboards. Identify separate sections of enclosures. Use machine engraved laminated plastic or machine engraved metal with filled letters. Unless otherwise specified, danger or warning signs shall be engraved with 10mm white lettering on a red background and information labels shall be engraved with 6mm black lettering on a white background.

Fixing

Screw fix or rivet each label adjacent to the relevant item of equipment.

Material

Two colour laminated plastic, or photo anodised rigid aluminium.

4.10 CIRCUIT SCHEDULE**General**

Provide a schedule holder and typed circuit schedule and install adjacent to the switchboard.

The typed schedule is to show the following information:

- Sub-designation and rating.
- Light and Power circuit number, type and area supplied.
- ELCB and Emergency Lighting operating instructions to be displayed in laminated notice beside each DB

4.11 RESIDUAL CURRENT DEVICE (R.C.D.)

Standard: To AS 3190 and AS 3175

5: TELEPHONE & DATA SYSTEM

5.01 GENERAL

Cross references

Refer to: - GENERAL ELECTRICAL REQUIREMENTS.
- ELECTRICAL WIRING

Standards

To TS008, TS 009 and AS 3080.

Scope of Work

The design, installation and commissioning of the modifications/extensions to the telephone and data block cabling system. Outlets are shown on the contract drawings.

Provide a communication system consisting of the following;

- Cables run concealed through buildings
- Measure route length and ensure that the chosen route to outlets does not exceed 90 metres.
- Supply, install and test all horizontal cables from the existing building distributor in the library to the new data outlets, as shown on the contract drawings.
- Provide distribution point layout plans and cable distribution diagrams, endorsed by cabling system manufacturer/vendor before commencing the installation.
- Extend the existing telephone cabling into the new areas, in the locations as shown on the contract drawings.
- Allow to modify/expand existing system to allow connection of new telephones.

Licence

For cabling work, use personnel holding an AUSTEL cabling licence, or working under the direct supervision of the holder of such a licence.

5.02 CONTRACTOR'S SUBMISSIONS

Records

Submit record books of an approved type with provision for recording cable, line and jumper information, at each distribution frame. Record the details of cable terminations in these books.

5.03 CABLES

General

To TS 008.

Backbone Cables:

Multimode Fibre Optic cable and Multi-pair phone cable between distributors.

Horizontal Cables:

Cat 6a UTP cables to all phone and data outlets.

Cable separation

Separate telecommunications cables not enclosed in conduits or ducts from low voltage services by at least 300mm or as indicated in AS3080, APP ZD table ZB1.

5.04 TELECOMMUNICATIONS REFERENCE CONDUCTOR (TRC)**Standard**

To TS 009, TS 008, TS 001

Provision

Provide where the installation includes a main distribution frame.

5.05 OUTLETS**General**

All telephone and data outlets shall be dual RJ45 Cat6a outlets.

5.06 DISTRIBUTION FRAMES**Enclosures**

General: Provide RU style for housing distribution frames.

Shelves: comms rack to be supplied with one fixed and one sliding shelf.

Records

Provide a record holder within each enclosure.

Modular connector patch panels

Terminal strips: Provide terminal strips permanently connected to module sockets using copper track on a printed circuit board. Do not connect terminal strips to sockets using discrete wiring.

Patch frames to be RJ style frames.

Patch cords: To suit patch frame.

Supply sufficient quantity to patch all outlets as shown on the contract drawings.

5.07 HARDWARE

Active and passive hardware is to be supplied by others.

- Provide patch panels and equipment racks suitable for mounting of hardware.
- Hubs (if required)

5.08 COMPLETION TESTS**General**

To AS 3080 Annex A.

Test each pair in each cable for

- continuity;
- correct sequence;
- reversed pairs;
- transpositions;
- split pairs; and
- pin assignments
- Impedance
- Attenuation
- NEXT (near end cross talk)
- Length.

Warranty

The manufacturer's 15-year warranty and contractor must confirm that all technical conditions in this document will be met for the installation of the cabling system.

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 logbooks in each distribution frame records holder.

Identification and labelling, and record documentation: To AS/NZS 3085.1.

5.09 DOCUMENTATION AND LABELING

As part of this installation, documentation shall be made available to the superintendent. This documentation should include a copy of all test results as well as a "Layout plan" showing the location and number of all communications outlets within the building.

All labelling should include the use of a trifoliate, or machine printed adhesive backed label, which should give the location of the distributor, the room and outlet number. All outlet numbers should correspond with the room number, eg. If the room number is 120, then the outlets in that room should be numbered 120-1, 120-2, 120-3 etc. This should be done in a clockwise direction around the room.

6: COMPLETION

6.01 OPERATING & MAINTENANCE MANUALS

Provide operation and maintenance manuals for the complete electrical services including all as installed drawings.

6.02 COMMISSIONING

Requirement

Comply with the following requirements in addition to the requirements for commissioning in the National Building and Services Reference Specification.

Notice

Give 2 working days' notice that commissioning of the electrical services is to commence.

Phase Sequence Check

Confirm that correct electricity supply phase sequence is provided at the main switchboard and all distribution boards and motor control panels.

Circuit Protection

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

Luminaires

Clean the luminaire reflectors, mirrors and diffusers and replace any faulty lamps.

6.03 COMPLETION TESTS

Requirement

Comply with the following requirements in addition to the requirements for testing in the National Building and Services Reference Specification.

Notice

Give 2 working days' notice so that tests may be witnessed by the Superintendents Representative.

Notice of Electrical Work

Provide 1 copy of each Notice of Electrical Work as submitted to the Supply Authority and provide document indicating Supply Authority approval before date of practical approval.

Site Testing

Include the following:

- Insulation resistance measurements on cabling to AS 3000 requirements and cable manufacturer's recommendations.
- Earth resistance measurements to AS 3000.
- Confirmation of effective earthing of the exposed metal of electrical equipment.

- Full functional and operational checks on energised control equipment and circuits, including adjustments for the correct operation of safety devices.
- Checking and where necessary altering connections for the correct motor rotation.

Approval for Energising

Obtain approval before energising newly installed or reconnected wiring or equipment.

Faulty Installation

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

Faulty luminaires

If luminaires develop faults apparently due to design, remove one faulty and one operating luminaire in order to carry out appropriate tests. Submit a written report before rectification work is carried out. Ensure that the remaining luminaires remain in operation while the testing is being carried out.