

# B8 Street Lighting Construction



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## B8 STREET LIGHTING CONSTRUCTION

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## 8.1 SCOPE

This Technical Specification sets out the requirements for the provision of the City's street lighting, conduits for RMS traffic control and telecommunications cables.

The City provides street lighting within many city streets over and above those provided by the electricity authority Ausgrid. This Technical Specification only relates to those street lights that are under the direct control of the City.

## 8.2 STANDARDS AND GUIDELINES

Unless stated otherwise in the Technical Specification, the approved drawings or elsewhere in the construction documents, all work shall comply with the current and relevant Australian Standards and/or RMS Standards.

Any variations or ambiguity between the Technical Specification, other construction documents and Australian Standards shall be referred to the City's Representative for direction before proceeding with the work.

The following list indicates the Australian Standards and/or RMS Standards applicable to this section. This list is not exhaustive and may not include all standards that may apply to the work to be undertaken. It is the responsibility of the Service Provider to ensure that all relevant standards are met.

- AS1158 Lighting for roads and public spaces, Parts 1 to 6
- Sydney Light Design Code City of Sydney Public Domain Design Codes
- RMS QA Specification R151 Street Lighting
- AS 1049 Telecommunications cables – Insulation and sheath – Polyethylene
- AS 1052 Electromagnetic interference measuring equipment. Part 2 – Equipment for the frequency range of .015 MHz to 1000 MHz
- AS 1822 Earth and bonding clamps
- AS 3000 SAA wiring rules
- AS 3080 Integrated communications cabling systems for commercial premises
- AS 3108 Approval and test specification – Isolating transformers and safety isolating transformers
- AS 3439 Low-voltage switchgear and controller assemblies
- AS 3702 Diagrams, charts and tables for electro-technology
- AS/NZS 3000 SAA Wiring Rules
- AS 6059 Degrees of protection provided by enclosures for electrical equipment
- The service and installation rules Electricity Association of NSW
- Ausgrid local service and installation rules
- RMS Standard Installation Details.
- Ausgrid Network Standards:
  - NS 156 Working near or around underground cables
  - NS 130 Specification for laying of underground Cables up to 22Kv
  - NS 172 Design Requirements for cable jointing pits and vaults
- IEEE C62.41.2 Recommended Practise on Characterisation of Surges in Low Voltage AC Power Circuits
- IES LM-79 Electrical and Photometric Measurements of Solid State Lighting Products
- IES LM-80 Measuring Lumen Maintenance of LED Light Sources
- IEC 62612 Self-Ballasted LED Lamps for general Lighting services Performance Requirements.

## 8.3 MATERIAL

### 8.3.1 LIGHTS, POLES AND MASTS

The procurement of poles and luminaries shall be by the following arrangements:

Item	Procured By
Smartpole	May be procured by the City or Service Provider on a site-by-site basis.
Smartpole furniture	May be procured by the City or Service Provider on a site-by-site basis.
Other street lights	May be procured by the City or Service Provider on a site-by-site basis.
Pedestrian light poles	May be procured by the City or Service Provider on a site-by-site basis.
Floodlights	May be procured by the City or Service Provider on a site-by-site basis.

All redundant light poles shall be removed by the Service Provider and deposited to Ausgrid's or the City's storage as required in a manner that is ethical, efficient, and where practicable maximises a value outcome for the City.

The Service Provider is to prioritise re-use and recycling ahead of disposal to landfill, which is considered an undesirable outcome. The Service Provider must remove all City of Sydney visual identifiers such as logos and labels from any unwanted items before disposing of items.

### 8.3.2 DUCTS

Ducts and bends shall be coloured, heavy-duty rigid uPVC pipes in accordance with the requirements of *AS3000 Wiring Rules* and as shown in the street lighting details drawings.

Conduits and conduit fittings for all cabling must be category A orange heavy duty rigid uPVC manufactured in accordance with *AS/NZS 2053 Conduits and fittings for electrical installations* and with solvent welded joints. All the conduits must be of the sizes shown on the drawings.

Conduits shall:

- Be installed using the loop in and loop out system
- Be free from conduit fittings other than junction boxes, wall boxes, bends or couplings.

Be of a minimum diameter as noted on the drawings; oval conduits are unacceptable.

- Be provided with a 3mm diameter minimum nylon cord where specified for future wiring or wiring for other trades
- Comply with relevant sections of *AS/NZS 2053 Conduits and fittings for electrical installations*.

Flexible conduits shall:

- Be heavy duty uPVC (note: approved alternative materials are encouraged with lower energy impact, greater recycled content and easier recycling at end of life)
- Be provided between fixed conduit and equipment which is likely to be moved or subject to vibration
- Be fitted with brass or nylon terminators
- Be connected to a concealed fixed conduit via a flush mounted junction box with a terminator secured by locknuts to the cover plate
- Not be used in concrete walls or slabs unless otherwise approved by the City's Representative.

Conduit for underground wiring shall:

- Comprise heavy duty rigid uPVC conduit
- Be fitted with corrosion resistant fittings
- Be installed over approved routes.

### 8.3.3 PITS

In-fill lids are to be used for pits in granite footways.

Cable pits must be Australian Power Products or approved equivalent injection moulded plastic with reinforced concrete lids. The pit lids are to be labelled using stainless steel disc – 75mm “COS-Electrical” engraved – epoxied onto brick or paver or pit lid wherever applicable.

Pits installed on the pathways shall be of Class C infill PIT Lid and on the roads shall be of Class D Infill PIT lid.

### 8.3.4 ELECTRICAL CABLING

Light poles shall be connected to City of Sydney circuits originating from the main switchboard.

Main cables shall be a minimum of 16 sq.mm 4C+E XLPE. Refer to the street lighting single line diagram drawing for required cable sizes. The cable manufacturer shall be Olex or the equivalent.

All the cables from the base of the pole to the light fixtures shall be 2C+E 2.5 sq.mm PVC/PVC.

Separate electrical circuits shall be provided for power outlets in Smartpoles. All the cables for power outlets shall be minimum of 16 sq.mm 2C+E XLPE cable.

All cables shall:

- Be installed over routes which have been fully coordinated with other services
- Follow the basic routes as indicated on the street lighting plan drawings or as described herein
- Be identified at each end by approved labels, fixed to cable sheaths or conduit, and identifying the cable size, type and purpose.

### 8.3.5 MAIN SWITCHBOARDS (MSB)

MSB assemblies shall be:

- From an approved manufacturer as detailed further in this Technical Specification; City of Sydney Standard MSB (single phase/three phase) drawings shall be refereed for overall dimensions and details
- Designed to facilitate easy access to and removal of component parts and to facilitate the undertaking of a thermograph survey of all joints and terminations without the need to isolate any parts or circuits
- Constructed and with containing equipment to the approval of the local Electricity Distributor and Electricity Retailer
- Made to incorporate main protective devices with fusing or tripping characteristics which are coordinated with other protection devices of the Electricity Distributor and other protective devices on the line and load sides of the device.
- All assemblies shall comply with the requirements of *AS 3439.1 Low-voltage Switchgear and Controller Assemblies*, and the additional requirements of this Technical Specification.
- Certified type-tested components shall be used in the construction of all switchboards.

The installed position of assemblies shall allow adequate access for operation and maintenance when doors are open or equipment is in the ‘operate’ or ‘test’ position.

#### 8.3.5.1 DIVERSITY FACTORS

Each individual circuit and busbar system shall be capable of carrying its full rated current as nominated.

Where busbar ratings are not nominated, the rated diversity factor of each assembly shall be in accordance with Table 1 in Clause 4.7 of *AS 3439.1 Low-voltage Switchgear and Controller Assemblies* with all spaces filled by circuits rated at 90 per cent of the aggregate of the maximum space ratings.

Assumed currents as noted on the drawings shall be used for temperature rise tests without further diversity factors.

### 8.3.5.2 FORMS OF SEGREGATION

The form of segregation for each assembly shall be as noted on the drawings.

### 8.3.5.3 PROSPECTIVE SHORT CIRCUIT CURRENT

The short circuit protection and short circuit strength of each assembly shall be suitable to withstand the thermal and dynamic stresses of the short circuit capacity specified herein.

Unless stated otherwise, a minimum 25 kA shall be adopted.

The main switchboard shall be designed to withstand a prospective fault level not less than the level at the point of supply or a higher level as specified herein. The assembly shall be detailed to withstand this short circuit strength for the period indicated without damage and shall do so without the inclusion of current protection devices.

### 8.3.5.4 DEGREE OF PROTECTION

A degree of protection shall be provided in accordance with *AS 1939 Degrees of protection provided by enclosures for electrical equipment* for switchboard assemblies and externally located assemblies at IP66.

Cable entries into switchboards shall not void the specified degree of protection.

### 8.3.5.5 TESTS

Routine tests of all assemblies shall be provided as required by *AS 3439.1 - Low-voltage Switchgear and Controller Assemblies*, and certified test results issued to the City's Representative prior to delivery.

Where assemblies incorporate components that are not type tested or partially type tested as defined in *AS 3439.1 Low-voltage Switchgear and Controller Assemblies*; the method of construction shall be type tested in accordance with the requirements of *AS 3439.1 Low-voltage Switchgear and Controller Assemblies*. Components used for type testing shall not be used in the construction of the assembly.

Partially type-tested arrangements may be derived by calculation as permitted by *AS 3439.1 Low-voltage Switchgear and Controller Assemblies*.

All assemblies shall be fully in accordance with Type Test Certificate, recognised by the relevant testing authority for temperature rise and short circuit withstand, to Australian Standard certifying compliance of construction and all equipment (including circuit breakers and busbars).

Type Test Certification for verification of short circuit requires withstand strength for all sections of busbars to be unconditional. No advantage shall be taken of short circuit protective devices in the assembly.

Temperature rise testing shall be carried out by an approved independently registered testing facility prior to delivery. Where mobile independently registered test facilities are available, testing may be carried out at the manufacturer's factory.

The proof of performance and verification that the assemblies comply with the Type Test requirements specified shall include, as minimum requirements:

- Verification by relevant NATA Type Test Certification to *AS 3439.1 Low-voltage Switchgear and Controller Assemblies* for short circuit withstand and temperature rise
- The provision of acceptable Type Test Certification and all the completed associated test data, which shall be NATA-endorsed for Type Tests to *AS 3439.1 Low-voltage Switchgear and Controller Assemblies* and which indicate that all parts of the assemblies do not exceed the limits of the values, as specified herein.

Type Test Certificate documentary evidence from a recognised NATA testing authority shall be submitted certifying that previous successful type in accordance with *AS 3439.1 Low-voltage Switchgear and Controller Assemblies*, and as specified have been carried out on switchgear and busbars of applicable assemblies for short circuit withstand and temperature rise and have successfully withstood the fault currents specified herein for the time specified.



All tests, as specified herein, shall have been carried out by a Testing Authority which holds a NATA accreditation certificate to carry out the testing, including a current accreditation certificate for quality assurance.

The type test characteristic values shall be the values specified for assemblies. The type test characteristic values specified are the minimum requirements that shall have been obtained for previous testing.

However, values that exceed the minimum requirements may be offered, but these higher values shall be subject to approval by the City's Representative.

#### 8.3.5.6 DISCRIMINATION OF SWITCHGEAR

All switchgear shall be selected to provide discrimination between upstream and downstream devices (devices include circuit breakers and fuses). In general, discrimination shall be arranged so that in the event of a fault, only that switchgear immediately upstream of the fault shall operate to clear the fault. Switchgear manufacturers' proprietary interlock tripping systems shall be used to achieve discrimination where required.

All details of protection settings shall be submitted with shop drawings demonstrating the discrimination of selected devices, commencing from Ausgrid protective devices and/or alternate supply (generator) paths and finishing at final sub-circuit protection devices.

Final settings of all adjustable protective devices, and plotted curves demonstrating discrimination of devices, shall be provided within the operation and maintenance manual.

#### 8.3.5.7 SERVICE CONDITIONS

The service conditions for all switchboards shall be as noted in *AS 3439.1 Low-voltage Switchgear and Controller Assemblies*.

A pollution degree of three (3) shall apply.

#### 8.3.5.8 SWITCHBOARD DRAWINGS

Shop drawings of switchboard/assemblies shall be submitted that incorporate metered/unmetered conductors and/or Ausgrid equipment for their acceptance prior to approval submission.

Shop drawings and as-built drawings shall be in the approved pdf and/or Autocad format and show the following information:

- Manufacturer's name and type of any standard equipment
- The general arrangement of equipment
- Full details of cabinet construction and dimensions
- The method of supporting busbars and equipment
- A description of all materials to be used
- Clearances between live parts, and live parts and earth
- Busbar dimensions and ratings
- Internal wiring sizes and ratings
- The size and wording of labels
- Wiring diagrams and schematics of instrument protection and control circuits
- Front elevation
- Vertical section through each compartment
- Sheet metal details
- Finishing process details
- Weights of assemblies heavier than 500 kilograms
- Calculations where PTTA assemblies are being adopted
- Calculations verifying the maximum internal temperature ratings will not be exceeded

- Details of:
  - Compliance with AS 3439.1 *Low-voltage Switchgear and Controller Assemblies*
  - Maximum fault withstand ability
  - IP rating to AS 1939 *Degrees of protection provided by enclosures for electrical equipment*

#### 8.3.5.9 MANUFACTURE

Assemblies shall be manufactured by an approved firm. The following manufacturers are currently approved by the City:

- KE Brown
- Relec
- Fuji SMBE Harwal Pty. Ltd.

#### 8.3.5.10 CABINET CONSTRUCTION

This section shall only apply to the switchboard. Refer to Section 8.3.5.12 Switchboard Enclosures for overall enclosure details.

Cabinets shall have:

- 2mm sheet steel construction fitted with doors attached with lift-off pintle hinges. Where approved, small enclosures with all dimensions less than 450mm may be fabricated from 1.6mm thick sheet steel
- Edges concealed by folding
- Fully welded ground external joints
- Suitable means of securing the complete assembly to the building structure
- A separate compartment for Electricity Distributor equipment, where required, incorporating a means of fitting the Electricity Retailer's seals
- Flush fronted type with only toggles, handles, indicators, dials and like equipment for operational use protruding through the front panel
- Single core cables arranged such that they do not pass through individual holes in ferrous metal enabling eddy currents to be established
- Sets of cabling for incoming or outgoing circuits grouped together to minimise the magnetic field strength generated
- Outgoing cables arranged so they do not pass through busbar chambers
- A maximum height of 1800mm
- Adequate space for outgoing wiring, with consideration for the types of cables entering and leaving the assembly
- Cable entries and/or gland plates, sized to suit the cables and installation requirements
- Gland plates of insulating material unless required to be brass for mineral insulated metal sheathing (MIMS) cabling
- Sealed cut outs for busbar and cabling installation where cabinets are extendable
- Natural ventilation by means of louvered vents in the upper and lower sections, backed with fine bronze wire mesh for switchboards larger than 0.3 m<sup>3</sup> in volume. All vent locations shall encourage natural ventilation to limit temperature rise within the ambient conditions.

Assemblies exposed to weather or where situated in adverse environments shall contain:

- Thermostatically controlled anti-condensation heaters of fixed resistor type
- A ventilated cavity space at the top of assemblies to prevent condensation accumulating on the inside
- Note: approved alternative solutions such as improved ventilation are encouraged to lower energy impact.

Freestanding cubicle type assemblies shall have:

- Adjacent cubicles bolted together to provide a rigid structure

- A supporting base frame formed from 75mm galvanised channel sections
- Removable lifting eyebolts or equivalent facilities
- Rear access to each section by means of lift-off panels
- Sheet metal segregation barriers enabling arc fault containment between adjacent compartments or cubicles where required to suit the form of construction
- Sufficient cabling space at the rear for cables entering from above or below with vertical cable fixing inserts for cable anchorage
- Explosion vents at the top of each segregated compartment.

Floor-mounted assemblies shall have:

- An open base and a wiring compartment with a cover panel for access to cables and/or conduits that pass through the base of wall/floor mounted assemblies
- A full complement of conduit knockouts in a removable cover plate at the top and bottom of the enclosure
- Front access only with cable fixing inserts for cable anchorage for cables rated over 100A.

Doors shall:

- Be fabricated from 2mm minimum folded sheet steel
- Have a heavy duty tumbler type lock complete with two keys per cabinet which are common to all switchboard locks installed. A standard lock coding shall be adopted
- Be secured in the closed position by means of a minimum of two (2) large diameter, captive, knurled, cylindrical head screws for doors providing access to busbar and wiring components only
- Have folded metal stiffeners and bracing to achieve rigidity and prevent warping or sagging
- Have flush mounted escutcheons for recessed switchboard enclosures
- Have chromium-plated lift-off pintle type hinges
- Have latching bars on doors larger than one (1) metre high
- Have suitable lifting handles on doors larger than one (1) metre high
- Have compressible neoprene gaskets contained within a metal channel
- Be sized so that the weight of any door does not exceed 20 kilograms
- Be fitted with circuit schedules on the inside of the door for fuse and circuit breaker distribution switchboards which shall be typewritten and placed in transparent non-flammable pockets. Refer also to Section 8.3.5.18 Labelling of this Technical Specification.
- Be fitted with braided earthing straps in instances where equipment is fitted to doors.

Removable panels, escutcheons and cover plates shall:

- Be fabricated from a minimum 2mm folded sheet steel
- Be no larger than one (1) metre in height or width, and in no case exceed 0.6m<sup>2</sup> in area
- Be provided with two polycarbonate lifting handles
- Be secured with large head chromium-plated screws with larger diameter nylon washers for panels sized 0.2 m<sup>2</sup> and smaller
- Incorporate cut outs which:
  - Expose only toggles, handles, indicators, dials and similar items
  - Are adequately stiffened where long cut outs are provided for equipment groups.
- Allow multipole circuit breakers to be replaced with three (3) single pole breakers without requiring extra fill in sections containing proprietary plastic inserts or painted metal covers over unused openings
- Be provided with locating pins or hangers on the switchboard able to retain the panel in place when all fixings are released.

### 8.3.5.11 FINISHES

Ferrous metal shall:

- Be cleaned free from rust, corrosion, grease and scale
- Have rough surfaces filled and rubbed smooth
- Be finished with an electrostatically applied polyester thermoset powder coat oven-baked finish to give a minimum thickness of 0.07mm. As an alternative and where approved be painted using at least one (1) coat of rust-inhibiting self-etching primer, an undercoat of zinc-enriched paint and two (2) coats of gloss enamel.

The enclosure shall have:

- Surfaces finished in a colour selected by the City's Representative
- The interior finished in gloss white colour
- Internal mounting and gear trays finished in gloss white colour.

The Service Provider shall retouch minor chips or blemishes on site to the satisfaction of the City's Representative.

Ripple paint finishes will not be accepted.

The Service Provider shall submit a painted colour sample, approximately 300mm x 300mm for approval prior to painting.

Non-ferrous parts shall be passivated zinc-plated or tinned.

External handles, bolt heads, catches, locks, nuts and screws shall be stainless steel or chromium plated.

### 8.3.5.12 SWITCHBOARD ENCLOSURES

The complete switchboard shall be capable of being exposed to the weather with a minimum IP rating as previously noted.

For switchboard ventilation, approved alternative solutions are encouraged to lower energy impact.

#### Main switchboard

The main switchboard enclosure shall be a powder-coated colour: Storm Front Pearl by Dulux (subject to confirmation – Service Provider shall request from the City's Representative the colour four (4) weeks prior to the actual colour being required).

Refer to Council Main Switchboard General Arrangement: Elevation in Street Lighting Details drawing for the size of the main switchboard enclosure.

The main switchboard shall have two (2) compartments, one on top of the other. One compartment shall be assigned for meters and all Ausgrid-required equipment, and the second compartment shall contain all switch and control equipment for the City of Sydney.

The doors shall be fully lockable to prevent access by unauthorised people. The meter compartment shall be locked with a key to suit Ausgrid requirements. The City of Sydney compartment shall be locked with a key to suit City of Sydney asset requirements. The Service Provider shall request the type of key arrangement required from the City's Representative two (2) weeks prior to requiring such information.

The main switchboard shall be mounted on a concrete plinth. Refer to Council Main Switchboard General Arrangement: Elevation in Street Lighting Details drawing.

The panels will have logo plates (250mm x 150mm) with the necessary details to be confirmed with the City's Representative.

### 8.3.5.13 BUSBARS

Internal busbars shall:

- Comply with *AS/NZS 3439.2 Low-voltage Switchgear and Controller Assemblies*
- Be derated for the density of the conductor and for the temperature within the enclosure
- Be manufactured from high conductivity hard-drawn copper bar with radius edges
- The current rating of main busbars shall not be less than the current rating in the Single Line Diagram drawings. The main busbars shall have a diversity rating of one (1) for the current rating.
- Be of minimum size 25mm x 4mm except for tee offs to miniature circuit breakers
- Be arranged for miniature circuit breakers so that a multipole circuit breaker can be replaced with single pole breakers without disturbing the three-phase busbar assembly
- Have neutral busbars of the same current rating and size as the phase busbars
- Have neutral busbars installed with the phase busbars to reduce eddy current heating of adjacent ferrous materials
- Be provided for all connections carrying 100A or above
- Be arranged so that all joints, terminations and fixings are fully accessible
- Be disposed and supported so that under short-circuit conditions no busbar material is stressed to more than 25 per cent of its breaking load or 33 per cent of its elastic limit, whichever is the lesser, for a one-second fault current
- Have fully lapped joints finished, coated with acid-free petroleum jelly and bolted together with passivated zinc-plated steel bolts, washers, nuts and locknuts
- Be arranged for future extensions to adjacent assemblies where required
- Have a removable section where mounting current transformers so that transformers may be removed or replaced without disturbing the remainder of the assembly
- Be supported on synthetic resin-moulded type insulators, panels and cleats. Bobbin insulators secured through the busbar are not acceptable
- Have insulation with shrink on PVC phase identification on busbar sections rated over 200 amps. Should PVC sleeving be adopted for insulation purposes, a minimum of two (2) layers shall be used meeting a 1mm overall wall thickness
- Have busbar joints insulated with removable insulation fixed with ties of synthetic material suitable for 120°C applications and arranged so that the insulation is in permanent contact with the busbars and bolts
- Be identified as follows:
  - A phase – Red
  - B phase – White
  - C phase – Blue
  - Neutral – Black.
- Have PVC-dipped insulation, two coats, for three-phase busbar assemblies rated up to 250 amps for connection to miniature circuit breakers.

### 8.3.5.14 INTERNAL WIRING

All instrument, indicator and control wiring shall:

- Be of stranded copper conductors, minimum size 1.0mm<sup>2</sup> V75 grade 0.6/1 kV PVC insulated
- Be supported on the square grid form using approved ducting and channels for groups of cables and approved plastic clips for single circuits. Adhesive type cable clips shall not be used.
- Be identified using an engraved or moulded thimble suitably and securely fixed to the wire adjacent each terminal connection of the wire
- Be connected to a minimum approved 30A rating terminal blocks of moulded insulating material which are labelled and numbered for the termination of all external wiring and to be terminated using approved crimping lugs
- Comprise flexible conductors where connected to equipment mounted on doors or in positions subject to movement.

All other interconnection wiring not of copper bar shall:

- Be made with copper conductors sized for 120 per cent of the calculated demand
- Be installed having consideration to short-circuit capacity
- Employ full-section neutral conductors.

All wiring terminal blocks shall be screw type. Insulation displacement terminals are not acceptable.

#### 8.3.5.15 CABLE TERMINATIONS

All terminals shall be of adequate size to accommodate the cable sizes specified irrespective of the rating of the switchgear.

Busbar stub connections shall be provided on terminals for cables rated at 100A and above suitable for the connection of bolted cable lugs.

- All termination connections shall be fully accessible for inspection and servicing, and identified as nominated within *AS 3439.1 Low-voltage Switchgear and Controller Assemblies*.

#### 8.3.5.16 LINKS

Links for terminating neutral and earthing connections shall be:

- brass or copper and square or rectangular
- Provided with the same number of terminals as there are active poles and numbered to correspond
- Be fitted with tunnel type terminals for cables up to 6mm<sup>2</sup> and stud type terminals to accept cable lugs for other cables
- Installed over the full length of multi-compartment switchboards and be fully accessible.

#### 8.3.5.17 HARDWARE

All bolts, screws and nuts shall:

- Have metric threads conforming to *AS 1275 Metric Screw Threads for Fasteners*
- Have hexagonal-shaped heads
- Be non-ferrous metal, or alternatively passivated zinc-plated
- Be fitted with flat and spring washers
- Be chromium-plated where exposed to view.

Self-tapping screws and pop rivets will not be accepted.

Non-metallic bolts and screws may only be used to secure internal non-metallic segregation barriers.

#### 8.3.5.18 LABELLING

Shop drawings of the labels shall be provided, approved and agreed by all prior to installation.

Shop drawing labels shall:

- Be adjacent every item on the front of the assembly
- Indicate the position of equipment which is concealed from view behind panels and doors
- Indicate the function of main controls, submain controls, relays, fault current limiters, links, contactors, relays, starters and switches
- Indicate the current rating of fuses for fault current limiters and the equipment protected by the fault current limiter
- Indicate the settings of adjustable tripping characteristics of circuit breakers

- Be positioned on the rear of main controls and submain controls of back connected assemblies so that the control can be identified from the rear
- Identify in the form of a numeral for each single pole of sub-circuit controls, including each pole of multi-pole controls
- Be located on each assembly and indicate:
  - The assembly reference number as directed
  - Supply mains, number, size and type
  - The origin of supply mains
  - The designed prospective fault level applicable
- Other requirements as indicated in AS 3439.1 *Low-voltage Switchgear and Controlgear Assemblies*.
- Be fixed onto the cover plate in front of fault current limiters which are mounted behind the cover plate and displaying the wording 'Fault Current Limiters Behind Panel'
- Indicate 'on/off' and other positions of all controls, switches, isolators and circuit breakers unless clearly indicated on the equipment
- Be fixed in position and indicate the circuit number and maximum rating where provision is made for the mounting of future equipment
- Indicate the purpose of the circuit breaker for sub-circuit circuit breakers to which frequent access is required for switching and testing purposes, e.g. light circuits, security lights and emergency lights.

Labels shall be arranged so that they can be readily replaced by fixing with a minimum of two (2) chromium-plated or stainless-steel screws, secured by spring washers or nuts or by drilling and tapping sheet metal. Self-tapping screws are not acceptable. Lettering shall be a minimum of 8mm high.

A line diagram of all connections and controls shall be mounted in a clear acrylic windowed frame located adjacent or on the rear of distribution switchboard doors.

Provide a label fixed to the front of the main switchboard indicating:

- The switchboard manufacturer
- Designed service conditions
- Weight
- Safety instructions, where applicable
- All information required by AS 3439 *Low-voltage Switchgear and Controlgear Assemblies*.
- Shop drawings of enclosure door labels shall be provided, approved and agreed by all parties prior to installation. The enclosure doors shall have white Traffolyte labels with black uppercase 10mm high lettering as per the following:

Enclosure	Text
Main Switchboard (Meter Compartment)	ENERGY AUTHORITY METER ENCLOSURE
Main Switchboard (City of Sydney Compartment)	CITY OF SYDNEY (INSERT SITE-SPECIFIC LOCATION)
Main Switchboard (Meter Compartment)	ENERGY AUTHORITY METER ENCLOSURE
Main Switchboard (City of Sydney Compartment)	CITY OF SYDNEY (INSERT SITE-SPECIFIC LOCATION)

### 8.3.5.19 EQUIPMENT

The requirements of these sub-sections, where appropriate, shall also apply to switchgear and control components mounted remote from an assembly.

### 8.3.5.20 CIRCUIT BREAKERS

Miniature circuit breakers shall incorporate the following features:

- Arc interrupting device
- Inverse time current characteristic
- Trip to operate when breaker is locked on
- Thermal and magnetic tripping mechanism
- Non-welding contacts
- Compliance with *AS 3111 Approval and Test Specification*
- Be interchangeable for single and multi-pole units used on final sub-circuits
- Have an interrupting capacity adequate for the maximum prospective fault current to which they may be subjected, and not less than 10 kA
- Incorporate similar features and uniformity of style regardless of frame size and rating.

Moulded case circuit breakers shall:

- Incorporate similar features as listed for miniature circuit breakers and be of the same manufacturer
- Be fitted with operating toggle extensions to limit the force required to operate
- Be labelled to indicate the trip unit model and settings where the trip unit is not clearly visible
- Comply with *AS 2184 Low Voltage Switch Gear*.

### 8.3.5.21 HRC FUSES

HRC fuse carriers and bases shall:

- Comply with *AS/NZS 60269 Low-voltage fuses general requirements*
- Have a moulded plastic insulated fuse carrier of sufficient depth to prevent inadvertent contact with live parts
- Have a fuse indicator which is visible without the need to remove the fuse
- Have fully shrouded base contacts
- Be of BS88 style equal to GEC Redspot manufacture unless otherwise approved.

### 8.3.5.22 HRC FUSE CARTRIDGES

HRC fuse cartridges shall:

- Be class G for general purpose in accordance with *AS/NZS 60269 Low-voltage fuses general requirements*
- Be GEC Type T.

Three (3) spare HRC fuse cartridges of each rating and type used, including fault current limiting fuses, regardless of whether they are incorporated within a circuit breaker or not, shall be provided on a labelled panel adjacent to each switchboard or within a spares compartment of the switchboard.

### 8.3.5.23 SWITCHES AND ISOLATORS

All switches and isolators shall:

- Comply with *AS/NZS 3947.3 Low-voltage switchgear and controlgear switches and AS 3133 Approval and test specification – Air-break switches*
- Be rated for AC-23 utilisation category
- Be fault make and load break rated
- Be spring-assisted manual closing
- Be suitable for the prospective fault current specified in this Technical Specification
- Have double make and break contacts
- Include a mechanical on and off visual indicator linked directly to the main contact movement.



#### 8.3.5.24 AUXILIARY AND CONTROL SWITCHES

Auxiliary and control switches less than 100A rating shall:

- Comply with *AS 3133 Approval and test specification – Air-break switches*
- Have contacts of minimum 10A continuous rating
- Be rotary snap action type
- Be of Kraus & Naimer manufacture, or an approved equivalent.

#### 8.3.5.25 CONTACTORS

Contactors shall:

- Comply with *AS/NZS 3947.1 and 4 Low-voltage switchgear and controlgear switches* as appropriate
- Be suitable for AC3 utilisation category with Type 2 coordination duty
- Have IP20 protection to *AS 1939 Degrees of protection provided by enclosures for electrical equipment*
- Be rated for operation at 60°C
- Have a minimum current rating of that specified for the protective device immediately preceding where no rating is specified
- Be suitable for uninterrupted duty
- Be capable of withstanding the let through current of the protection device preceding it to ensure Type 2 protection
- Be of the block type
- Be of Sprecher + Schuh manufacture or approved equivalent, consistent and tested with circuit breakers
- Have renewable type main contacts, auxiliary contacts and operating coils
- Contain at least one spare set of normally open and closed contacts.

#### 8.3.5.26 SURGE DIVERTERS

Suitable surge diverters shall be provided on each phase of the main switchboard incorporating the following features:

- Capable of withstanding surges to *ANSI C62.41, IEEE Recommended Practice on Surge Voltages in Low-Voltage Categories A, B and C*
- Rated to 70kA
- Transverse and common mode protection
- Fitted with local indication visible on the front of the switchboard
- Fitted with voltage-free contacts for transmission of remote alarm
- Independent certification of performance.

A transient voltage surge suppression system shall be provided in accordance with Standards UL 1449 and UL 1283 on the inputs of consumers' mains to the main switchboard.

The system operating conditions shall be 400 VAC, 50 Hz, three-phase, neutral and earth.

Each system shall incorporate 70 kA transient voltage surge suppressors between each phase and earth, each phase and neutral, and neutral and earth.

The whole system shall be duty lifecycle tested to survive 10,000 surges at 20 kV, 10 kA, IEEE C62.41 Category C3 surge current with less than 5% degradation of clamping voltage.

All surge suppressors to provide external system monitoring for faults via voltage-free contacts.

### 8.3.5.27 MOUNTING OF EQUIPMENT

All equipment shall be mounted:

- Within the assembly cabinet with only toggles, indicators, handles and dials protruding
- On fixing rails or insulating panels
- To not rely on busbars for support
- To enable easy access for adjustment, replacement or maintenance
- So that arc discharges during faults are not directed towards live metal or insulating medium.

Equipment that is intended for future installation shall have mountings, studs, busbar connections and escutcheon openings provided with painted blanking covers.

Equipment shall be installed so that a unit can be simply replaced without disturbing adjacent units.

Circuit breakers rated above 100A shall:

- Be arranged for back connection where installed within free-standing cubicle type switchboards
- Be arranged for front connection where installed within wall-mounted switchboards
- Be installed with the supply connected to the top terminals where mounted vertically
- Be arranged so that the toggles operate in a vertical direction with all on and off positions in the same direction unless otherwise approved
- Be mounted so that the operating toggles of adjacent circuit breakers are in straight alignment
- Be provided with a 75mm air gap between circuit breakers rated up to 200 amps or a 100mm air gap for circuit breakers rated above 200 amps where more than two (2) circuit breakers are mounted adjacent each other
- Not be horizontally mounted in vertical stacks in common compartments where moulded case circuit breakers are used.

Miniature circuit breakers shall be:

- Secured by separate clip in type fixings as provided by the circuit breaker manufacturer
- Mounted on a lift-out chassis assembly
- Mounted so that the toggle operation to the on position is upwards for all vertically mounted breakers
- Separately mounted at the top of the switchboard where used as a main switch/isolator.

HRC fuses for fault current limiters shall not project through the cover plates.

Time switches shall be mounted so that they are accessible for adjustment without the need to remove switchboard covers.

Equipment which has a liquid crystal display (LCD) shall be mounted at a suitable height to enable clear reading of the instrument display and within 700mm to 1600mm above floor level.

All isolating switches and circuit breakers shall be mounted so that any interlock preventing the opening of the door when the equipment is on is defeatable for maintenance access (thermo-scanning or similar).

### 8.3.5.28 INSTALLATION OF SWITCHBOARDS

All switchboards shall be secured in position with masonry anchors and screws or bolts.

Cubicle-type switchboards shall be levelled with approved packing.

Entry holes into switchboard enclosures shall be cut only by means of hole saw or machine punching. Flame equipment for making entry holes is not acceptable.

The Service Provider shall provide a location plan of the main switchboard comprising a floor plan diagram on a photo-sensitive anodised aluminium sheet 0.8mm thick with black lining on a matte silver background and mounted at the fire indicator panel or other location as directed.

### 8.3.5.29 TESTING AND COMMISSIONING

#### 8.3.5.29.1 FACTORY TESTING

The main switchboard shall be tested in accordance with the applicable parts of *AS 3439 Low-voltage Switchgear and Controlgear Assemblies*. All instrumentation and control functions shall be tested to prove their correct operation. The set points for adjustable devices, such as sensing relays, shall be recorded on test results and additionally marked within the switchboard, with adjustment points sealed to prevent movement and unauthorised tampering. Calibrated instruments shall be used for all tests.

Results of all tests including dielectric strength, and the instruments used to conduct tests, shall be recorded and a copy provided within the operation and maintenance manual. Where initial tests are unsuccessful, the results of these tests together with the corrective measures taken shall also be provided. All test results shall be signed and dated.

Upon completion of factory fabrication of the main switchboard and inspections by Authorities, where required, and prior to the switchboard being shipped to the site, pre-delivery inspections of the switchboard at the factory shall be arranged.

Proposed commissioning test schedules and protocols shall be submitted for approval by the City's Representative in conjunction with shop drawings. Protocols shall be fully detailed and include, but not be limited to, schedules in tabulated format covering:

- Proposed calibrated and where permissible non-calibrated instruments to be used and the tests for which each shall be used
- Functioning of all switch gear to confirm correct and uninhibited operations over all phases
- Injection tests for all meters with 0%, 50% and 100% of full-scale readings
- Set points for all adjustable devices such as sensing relays, timers and the like
- Space on each page for signature and date of witness tests.

Factory testing of controls shall be accomplished using a purpose-made and labelled test panel with all required inputs simulated by the operation of switches, and all required outputs indicated by lamps, or an equal arrangement as approved.

Factory testing shall include the demonstration of monitoring systems specified as part of this contract, in conjunction with metering, controls and function-testing detailed above.

Once testing has been completed, factory test results shall be verified and submitted for approval. Following that approval, a witness test shall be arranged with the City's Representative with one (1) week's notice allowed for the arrangement of witness testing.

#### 8.3.5.29.2 ON SITE TESTING

Upon completion of the installation, complete testing of all switchboard controls with all internal and external interfaces and controls connected and operational shall confirm their functionality. Any functions requiring rewiring adjustment or modification shall be retested.

To verify the operations of all external controls and monitoring, it shall be coordinated and arranged for all trades to be present.

Signed test results shall be submitted in an approved format confirming the completion of the tests, prior to arranging witness testing by the City's Representative.

### 8.3.5.30 MAIN SWITCHBOARD MAINTENANCE

The following tasks shall be performed and written confirmation provided within one (1) month prior to the completion of the defects liability period:

- Tighten all busbar joints, cable terminations and connections during out-of-hours periods at a time as agreed
- Remove by vacuum cleaning all dust and debris from within the switchboard enclosure
- Wipe down and polish the exterior surfaces of the switchboard
- Replace nursery hardware items and ineffective dust seals.

### 8.3.6 CABLES

Unless otherwise detailed for a particular requirement, all cables shall:

- Have copper conductors
- Have stranded conductors
- Be of a minimum size of 2.5mm<sup>2</sup>
- Be insulation-coloured as follows:
  - Actives of single phase: Red.
  - Actives of multi-phase:
 

A phase	Red
B phase	White
C phase	Blue
Neutral	Black.
  - Switchwires: As required, but same colour for similar functions.
  - Earthwires: Green/yellow.

#### 8.3.6.1 THERMO PLASTIC INSULATED CABLES

Thermo Plastic Insulated (TPI) cables shall:

- Be insulated with 0.6/1 kV grade PVC compound type V75 or higher for cables larger than 25mm<sup>2</sup>
- Be insulated with 450/750 V grade PVC compound type V90 or higher for cables equal to or less than 25mm<sup>2</sup>
- Comply with *AS/NZS 5000 Electric cables - Polymeric insulated.*

### 8.3.7 LUMINAIRES

The Service Provider shall provide LED luminaires where specified and/or indicated on the drawings in compliance with approved solutions to minimise energy impact.

Service Providers must also provide details of the componentry and performance of the luminaires. This will include but not be limited to:

- LED chip manufacturer
- LED lamp functional life at 30% lumen depreciation
- LED lamp rated lumen output
- LED lamp binning
- Optical variation during life
- LED driver voltage range
- Luminaire illuminance at ground level (in lux)
- Luminaire operating temperatures
- Correlated Colour temperature

- Colour Rendering Index
- Photometric Data in IESNA & CIE format
- Aesthetics and appearance of the luminaires, including showing how the luminaires will appear mounted on lighting columns, brackets, walls and ceiling mountings by providing photographs or diagrams
- LM-79 and LM-80 compliance
- Component materials including housing.

Housing materials should be primarily constructed of metal. Finish should be powder-coated and rust-resistant. Drivers must be mounted internally, be replaceable and accessible without tools. All screws shall be stainless steel. Captive screws are needed on any components that require maintenance after installation. No parts should be constructed of polycarbonate unless it is UV stabilized (lens discoloration will be considered a failure under warranty). Ingress Protection shall be rated a minimum of IP65.

Prior to commencing installation, the Service Providers shall confirm that all luminaires proposed have been submitted to and approved by the Australian Energy Market Operator (AEMO), the body responsible for unmetered load table listings in Australia.

Lighting shall be controlled and switched as detailed on the lighting control schematic in the street lighting details drawing.

#### 8.3.7.1 LUMINAIRE TYPE

All luminaires are to comply with the current City of Sydney LED supply contract.

#### 8.3.7.2 LUMINAIRE LABELS

Labels shall:

- Be provided on all luminaires
- Comply with AS 3137- Approval and test specification-Portable lamp standards and brackets
- Indicate the manufacturer's name and lamp size. The type and colour are specified here.
- Be concealed from normal view where practicable, for example, behind the diffuser.

#### 8.3.8 MCB + RCD AT BASE OF THE POLE

Electrical contractors shall supply and install a minimum of 10A MCB type C + 30mA RCD at the base of each pole.

## 8.4 INSTALLATION

The Service Provider must provide and carry out the following activities required for the work specified in this Technical Specification:

- Supply and install the City's freestanding main switchboard as indicated on the street lighting plan drawings including the detailed design of the board and the sizing of all sub-circuits from the board
- Install electrical connections from the main switchboard to the pits nominated by Ausgrid
- Supply all necessary materials and installation of ductlines in connection with electrical supplies to light poles
- Liaise and arrange with Ausgrid and the City's Representative regarding the removal of existing light poles, delivery of new poles and installation of new poles prior to initiating the removal of all Ausgrid redundant equipment
- Liaise and work in association or in conjunction with Ausgrid for the installation of underground ducts and pits

- Arrange attendance of Ausgrid inspectors for installation, inspection and acceptance of the work
- Supply all necessary materials and installation of new pits complete with conduits and pit lids. Install pit requirements to the relevant authority's installation requirements and those detailed in the stone paving section
- Supply all necessary materials and installation of concrete foundations for street lighting poles
- Complete foundations with conduits, reinforcing and galvanised steel rag bolt assembly to AS 1798 *Lighting poles and bracket arms*
- Provide new street lighting and LV power cabling from the City's main switchboards to all new street lighting and to high-level GPO outlet supply in Smartpoles
- Provide weatherproof outlets on the poles at high level for a future connection supplied from the phase circuit which is not controlled by PE cell
- Carry out tests on the completed ductline as described in this Technical Specification to demonstrate the acceptability of the ductline
- Arrange attendance of Ausgrid for installation of ducts and services into Ausgrid pits
- Pay for application and costs of establishing Ausgrid electrical supplies to the main switch boards
- Maintain temporary lighting and electrical supplies for the duration of the project
- Liaise and arrange with Telstra and other telecommunication providers regarding the route of conduits for telecommunications cabling
- Implement any other modification required to meet standards and to obtain the City's Representative approval
- Ensure that waste packaging materials for which a commercial recycling option is available are recycled as opposed of being disposed of as general waste to landfill. At a minimum, this includes cardboard/paper, metals and soft plastic wrapping.
- Comply with the following:
  - The current statutory requirements in place
  - RMS and Ausgrid design standards for electrical design for traffic signals installations.
- No separate cabling dedicated for the supply of low-level GPOs is required to be installed in the reticulation conduits. GPOs are to be supplied specifically from the phase circuit, not controlled by the PE Cell at the Main Switchboard.

The notice specified in B1: Preliminaries and General Construction shall be provided so that inspection may be made of the following:

### Hold Points

- Marked ductline route and the location of each pit and street light
- MSB delivered
- MSB fitted to plinth
- Lighting operational prior to decommissioning of Ausgrid lighting.

### Witness Points

- Excavation with conduit and pits in place prior to backfill
- Poles prior to mounting on footing
- Survey check of pole position
- Draw wires and cables pulled in
- Electrical inspection and test.

### 8.4.1 STATUTORY AUTHORITIES – AUSGRID

The Service Provider shall make application and pay all costs for the procurement of the following electrical services:

- Main switchboards
- Special small services connections
- Temporary power connections.

The ductline route shall be coordinated with Ausgrid and conduits, cable and modify pits installed as required.

Plans and specifications for street light ductlines works shall be prepared to meet the standards and requirements of Ausgrid and be approved by Ausgrid prior to commencement of work.

The Service Provider shall ensure all Works comply with Ausgrid requirements (sub-section 8.4.1.1).

#### 8.4.1.1 AUSGRID REQUIREMENTS

The Service Provider shall abide by Ausgrid Admittance to Premises Regulation, Electrical Safety Rules and Regulations for Working on the Sub-Transmission and Distribution Systems, where work is to be carried out near Ausgrid equipment or conductors which are in service.

The Service Provider shall ensure that the Works proceed with care in order to avoid damage to any existing service.

The City requires all lighting circuitry to be loop-in, loop-out (all phases for Smartpoles) to each light position.

The Service Provider shall be responsible for any damage caused to existing services, including pipes, cables or other works in or under the site.

Should any damage be caused to existing Statutory Authority services, repairs will be carried out by that Statutory Authority and the costs involved shall be charged to the Service Provider.

Where required, the Service Provider shall use an approved and accredited/authorised Service Provider to carry out works normally performed by the electricity distributor. Refer to the NSW Service and Installation Rules.

#### 8.4.1.2 CONTINUITY OF SUPPLY AND SHUTDOWNS

The electrical supply shall not be shut down without the consent of the City's Representative. The Service Provider shall supply all temporary power for all power and lighting loads required to maintain statutory services, i.e. street and traffic lighting shall be maintained to statutory requirements and power to private properties (during the changeover to undergrounding works), throughout the contract.

### 8.4.2 TEMPORARY WORKS

#### 8.4.2.1 TEMPORARY WORKS IN CONNECTION WITH STREET LIGHTING

The Service Provider shall maintain street lighting and pedestrian lighting as required by *AS 1158 Lighting for roads and public spaces* throughout the Works until such time as the new systems have reached Practical Completion. Note that Ausgrid existing lighting and power shall only be removed once the new City Of Sydney lighting network is operating and power to other services is commissioned through the new undergrounding network to be provided as part of this contract.

#### 8.4.2.2 TEMPORARY ELECTRICITY SUPPLY

The Service Provider shall arrange with the Supply Authority to provide a temporary electricity supply (builders supply) as required during the construction stage of the Works. The temporary electricity supply and all associated equipment and wiring shall be removed on completion of the Works.

All necessary metering, equipment, wiring, connections, and the like shall be provided and installed as required.

The temporary electricity supply, equipment, wiring and the like shall comply with the requirements of the Supply Authority, WorkCover Australia and all other relevant Code and Authority requirements.

The Service Provider shall liaise with Ausgrid to ensure that there will be no disruption to tenants' electricity supply for the duration of the Contract.

The Service Provider shall pay all costs involved.

#### 8.4.3 LIGHTS POLES AND MASTS

Smartpoles with cladding and without cladding are totally different types of poles and cladding cannot be retrofitted on the poles without cladding. The Service Provider is to ensure that the correct type of pole is installed.

All internal cabling and connections within the light pole shall be provided to the requirements of *AS/NZS3000*.

The Service Provider shall provide all below-ground works, erection of the light pole, street lighting electrical connection, small power services electrical connection, equipotential bonding and RMS signalling and electrical connection.

The Service Provider shall coordinate with the pole manufacturer to verify all power and signalling provisions, connections and testing at the time of installation.

The Service Provider shall provide all internal cabling and connections, earthing cabling and connections, RMS cabling and connections within the new light poles.

#### 8.4.4 DUCTLINE TRENCH WIDTH AND DEPTH

Excavations shall be in accordance with B2: Earthworks.

The width and depth of the street lighting ductline shall comply with the minimum dimensions as Ausgrid details. It should be noted that at the termination of ductlines under road gutters, the minimum cover over the ductline is to be 750mm.

Trenches are to be excavated so that the ductlines can be laid with 300mm clearance all round from other obstructions, unless otherwise approved by the City's Representative and the relevant Utility Authority.

Twenty metres (20m) of fully excavated trench shall be maintained ahead of all incomplete ductlines to allow for deviation if required. The Service Provider shall allow for any costs incurred by having to carry out portions of the work at times outside normal hours or to avoid inconvenience to the public or occupiers of premises near the ductline route. The Service Provider shall liaise with the City's Representative prior to proceeding.

All other ductlines should be installed at a depth indicated by *AS 3000 Wiring Rules* Table 3.7 or by Ausgrid's local service and installation rules, whichever is the greater depth.

#### 8.4.5 DUCTLINES

UPVC new ducts are to be installed as shown indicatively on the City-approved street lighting plan drawings. The Works shall include the supply of all necessary materials, labour and plant. Generally, the ducts shall be laid along the route in the positions and at the depths indicated by Sub-section 8.4.4 of this Technical Specification and the drawings. The final position and depth of the ducts may be changed on site with the approval of the City's Representative to avoid obstructions. The Service Provider shall lay the ducts at such



varied positions or depths and shall make no charge for such variation. The duct ends shall be smooth and cleanly cut with sharp edges removed. A socket shall be formed at one end of each pipe and bend. Additional pits shall be provided where necessary.

#### 8.4.5.1 CONDUITS ENTERING SMART POLES

Refer to the street lighting details drawing and manufacturer's pole drawings for Smartpole conduit requirements. The Service Provider is to provide custom-made reducers to suit, and is to allow adequate lead time for their procurement. The class of conduit shall be in accordance with the method of installation as required by *AS 3000 Wiring Rules*. The conduits shall be run in a straight line from pit to pole with one 90-degree bend at the pole to accommodate the rag bolt assembly. Where this installation is not possible, the Service Provider shall obtain acceptance from the City's Representative prior to backfilling.

Electrical conduits shall be laid at a depth of 600mm in footways with the communications conduits at a depth of 250mm and laid directly above. Electrical conduits under the road shall be laid to a minimum depth of 750mm with the communication conduits at a depth of 300mm and laid directly above.

As-built details (drawings) shall be provided and submitted to the City's Representative showing the precise location and depth of burial of all conduits installed.

#### 8.4.5.2 INSPECTION OF DUCTS PRIOR TO LAYING

The City's Representative shall be given notice to inspect all ducts before installation. The Service Provider shall ensure that all ducts are free from defects and foreign material, which could damage the cable and otherwise render the duct unsuitable for use, and notify the City's Representative the ducts are ready for their inspection.

The Service Provider shall obtain the City's Representative's approval if repairs to unsuitable ducts are to be attempted. Ducts which cannot be repaired to the satisfaction of the City's Representative shall be removed from the work site and replaced at no cost to the City.

#### 8.4.5.3 JOINING OF DUCTS

All ducts shall be forced well into the socket and solvent welded. The joints shall be watertight and installed in accordance with the manufacturer's instructions.

#### 8.4.5.4 TEMPORARY PLUGGING OF DUCTS

Where the laying of ducts is temporarily discontinued and at the end of street blocks (under road gutters) and Limits of Contract, the exposed ends of the ducts shall be plugged with approved duct plugs. The plugs shall remain in position until the work is resumed. A drawing of the duct plugs to be used is to be provided by the Service Provider for approval by the City's Representative and Ausgrid.

#### 8.4.5.5 BEDDING OF DUCTS

The ductline shall be bedded with material complying with Bedding and Pipe Support Material of B10: Stormwater Drainage Construction.

Sand shall be placed around the ducts to the thickness shown on the Ausgrid standard trench detail. PVC pipeline and conduits shall not be covered until the pipe temperature has stabilised to no more than 1°C above that of the ground temperature.

#### 8.4.5.6 INSTALLATION OF DUCTS INTO PITS

Installation of ducts into existing Ausgrid pits shall be carried out by Ausgrid at the Service Provider's cost.

Installation of ducts into all other pits shall be carried out by the Service Provider.

Where new conduits enter pits, the ends are to be cut off flush with the inside wall, slightly bell mouthed, and the entry finished off to the satisfaction of the City's Representative.

#### 8.4.5.7 CUT LENGTHS OF DUCT

The duct installation will, wherever possible, comprise full lengths of duct as manufactured. Where it is necessary to cut lengths of duct at a particular location, the ends will be trimmed square, the edges deburred and the internal surfaces chamfered.

The length of ductline may be constructed from both ends towards the middle. In this case, a length of duct may be cut and inserted into the line to connect together the two ends approaching from opposite directions.

It will be necessary to use slip couplings supplied by the manufacturer for this purpose. The length of pipe to be installed will be measured and cut to length no less than 10mm shorter than the gap to be filled, and the joints made using the slip couplings in accordance with the manufacturer's instructions.

#### 8.4.5.8 DUCT PLUGGING

After the ducts between adjacent existing vaults and at limits of each street block and Limits of Contract have been cleaned and tested to the satisfaction of the City's Representative, the Service Provider shall plug each duct with an approved duct plug. The Service Provider shall supply a drawing of the duct plugs intended to be used.

#### 8.4.5.9 INSTALLATION OF WARNING STRIP

Polythene film warning strips to indicate the presence of the ductlines shall be laid in the trench at a depth shown on Ausgrid standard details and *AS 3000 Wiring Rules*

### 8.4.6 UNDERGROUND CABLE ROUTES

#### 8.4.6.1 SURVEY

The Service Provider shall accurately record the routes of underground cables before backfilling and supply the drawing to the City's Representative.

#### 8.4.6.2 PITS

- Construction of any utility pits shall be carried out to the specific requirements of that utility authority
- Soil shall be compacted to prevent settlement of the pits and associated cables
- The Service Provider shall take full responsibility for unrecorded obstructions in excavation sites. While the City's Representative has provided records of known obstructions, the accuracy of the information provided is limited and the City's Representative will not take responsibility for inaccurate records
- Any additional excavation required for the construction of a pit due to the presence of an obstruction shall be included in the contract work. This shall also include surface breaking, planking, backfilling and any associated temporary reinstatement.
- No payment shall be made for inconvenience or additional expense incurred by the Service Provider during the construction of a pit due to the presence of any obstructions
- Drainage shall be provided from the bottom of cable pits, either to absorption trenches filled with rubble or to the stormwater drainage system

- Pits shall be supplied and installed where indicated, or required for ease of cable installation. All pits shall be installed with the top of the cover flush with the finished ground level.
- All pits shall be installed as one unit in the same form that they are received from the manufacturer, i.e. pits are not to be disassembled for installation
- Plastic pits, where permitted for use, are outlined on the street lighting plan details drawing and shall be installed in accordance with the manufacturer's guidelines.

The Service Provider shall fix a 150mm x 150mm x 1.6mm brass plate for paver infill pit covers. The plate shall be suitably engraved according to the service cables within the pit, e.g. power, security lighting, telephone, public address, computer, miscellaneous services and the like. The engraving shall be legible and durable.

#### 8.4.6.3 SMARTPOLE CABLING

Refer to the manufacturer's manual.

### 8.4.7 SWITCHBOARDS

#### 8.4.7.1 SWITCHBOARD INSTALLATION WORKS

The Service Provider shall construct a concrete footing to support the cabinet as shown in the Council Main Switchboard General Arrangement: Elevation in the Street Lighting Details drawing.

Switchboards shall be located as indicated on street lighting plan drawings. The Service Provider shall submit details of the final intended location to the City's Representative for approval prior to the Works proceeding.

The Service Provider shall liaise with Ausgrid to include the connections from the substation to the main switchboard.

Conduits and cables are to be provided between the main switchboard and the existing Ausgrid pit as indicated in street lighting plan drawings.

#### 8.4.7.2 POWER FOR TESTING

The Service Provider shall make all necessary arrangements and applications for full permanent power to be connected before the date of practical completion. The time of connection shall be arranged to suit the building program. The Service Provider shall ensure submains, controls and associated items for equipment and systems installed by others are connected prior to testing. Lighting shall not be connected to the supply for general usage before practical completion without prior approval.

The Service Provider shall arrange for the City's Representative to make all necessary applications to the Electricity Retailer for supply agreements which will be transferred to the City's name from the date of practical completion. Connection of a permanent supply prior to practical completion may be made in the name of others subject to approval.

#### 8.4.7.3 EARTHING

The Service Provider shall provide an earth connection to all outlets regardless of whether it is required by the regulations or not. The main earth conductor shall be run to and connected to a bolted, labelled connection on the earth electrodes, and be PVC covered. Details shall be provided of the earthing installation at the main switchboard position.

### 8.4.8 CABLES

#### 8.4.8.1 ELECTRICAL CONNECTION

The Service Provider shall comply with the Working Drawing section of this Technical Specification and liaise with Ausgrid and Telstra regarding their circuitry requirements where required.

#### 8.4.8.2 SPECIAL SMALL SERVICES CONNECTION

Special small services connection requirements are detailed within the New South Wales service and installation rules.

All works to Ausgrid service pits shall be carried out under the supervision of Ausgrid field services personnel.

#### 8.4.9 WEATHERPROOF SOCKET OUTLETS

Weatherproof outlets shall be supplied on the poles as per the Schedule of Smartpoles. All pole furniture and sockets are supplied by the City's Representative.

High-level GPOs shall be a weatherproof outlet mounted on the outside of the pole immediately below the outreach arm. The outlets shall be connected to a separately controlled City of Sydney supply. Power supply of these outlets shall be on, and not controlled by photoelectric cell. A circuit provided solely for this purpose shall be indicated in the street lighting single line diagram drawing.

#### 8.4.10 STREET LIGHTING CONNECTION

Street lighting connection requirements are detailed within the New South Wales services and installation rules.

The Service Provider shall provide details of all busbars, fixings, studs and clearances required to be incorporated within equipment for the satisfactory connection of cables where equipment and/or switchboards are provided by others.

Written details shall be submitted of verified loadings and calculated maximum demand, fault level and voltage drop for the proposed route length and wiring method of respective sub-main cables.

No variation will be allowed for replacement of cables due to failure in verifying the proposed loads.

The core cable between light standards shall be looped via the City of Sydney pits and ductwork system.

The Smartpole lighting circuit shall be on a three-phase cable and utilize the alternative phase as cabling work is completed on the poles along the cable route as indicated in the street lighting details drawing.

The four core and earth cables shall be terminated at the respective City of Sydney Switchboard.

All redundant cable shall be removed by the Service Provider.

#### 8.4.10.1 EARTHING

The Service Provider shall supply and install the earthing system for the installation including all cabling, clamps, test links and all associated accessories and equipment in accordance with *AS 3000 Wiring Rules*. All communications and technical system earths shall be adequately separated from power system cables.

##### 8.4.10.1.1 CABLING ACCESSORIES AND APPLIANCES

Lighting fittings and socket outlets shall be earthed by means of the earth conductor, which forms part of the respective circuit cabling. A separate earthing conductor shall be used for each circuit. Earthing conductors shall be run back to the earth bar with the switchboard from where the supply originated. All exposed metal fittings, such as cable trays and ducts, associated with the Electrical Services shall be earthed.

##### 8.4.10.1.2 EQUIPOTENTIAL BONDING

All street lighting poles shall be equipotentially bonded in accordance with *AS 1768 Lightning protection*. All equipotential bonding shall be connected to the earth bar within each street lighting pole. From this earth bar, reinforcement bars shall be connected within the footing to give a combined maximum of 10 ohms or less.

#### 8.4.10.1.3 BALANCE OF LOAD

Unless otherwise indicated, the electrical installation shall be balanced as closely as possible between the individual phases of the supply cable.

### 8.4.11 WIRING METHODS

The Service Provider shall install all wiring so that it can be readily renewed, repaired or relocated without affecting finishes and construction.

#### 8.4.11.1 INSTALLATION OF WIRING

All cables shall:

- Be installed between equipment without any joints
- Be installed on the loop in, loop out principle without the use of connectors for sub-circuit wiring
- Be installed so that they can readily be withdrawn for the purposes of relocation and/or rewiring
- Be installed such that they are not bent through a radius less than the minimum bending radius recommended by the manufacturer
- Be installed free of joints.

#### 8.4.11.2 THERMO PLASTIC INSULATED CABLES

Thermo Plastic Insulated (TPI) cables shall:

- Be enclosed within conduits or cable troughing
- Not be drawn into conduit systems until the conduit run is complete and swabbed out
- Be jointed only at outlet or switch positions.

##### 8.4.11.2.1 DERATING

The sizes of conductors as specified are the minimum size which shall be provided.

The size, grouping, spacing, enclosure and location of cables shall be installed so that the current rating of the conductors as permitted by *AS 3008 Electrical installations – Selection of cables* with the appropriate derating factors applied, is not less than the specified current rating of the circuit breaker or fuse which protects the conductor.

Where conductors are installed, grouped, spaced or enclosed in such a manner that their derated current rating is less than the specified current rating of the protective device, the size of the conductor shall be increased to provide a current rating of the conductor which is not less than the specified current rating of the respective protective circuit breaker or fuse.

### 8.4.12 LIGHTNING PROTECTION SYSTEM

The Service Provider shall provide, test and commission a complete lightning protection system as shown in the drawings and as described here:

The lightning protection system shall comply with the relevant recommendations of *AS/NZS1768 Lightning Protection* and the requirements in this Technical Specification for earthing and shall incorporate the following major components:

- Down Conductor System
- Earth Terminations.

All mounting, bonding and jointing of conductors within the lightning protection system shall be by means of approved purpose-made cleats, clamps, links and the like, equal to Furse or Erico manufacture.

#### 8.4.12.1 DOWN CONDUCTORS

The steel lighting pole shall be used as the down conductor system.

#### 8.4.12.2 EARTH ELECTRODES

The steel reinforcement of the concrete footings of each lighting pole shall be used as the earth electrodes for the system.

#### 8.4.12.3 UNDERGROUND WIRING

All underground wiring is to be in accordance with the approved drawings.

##### 8.4.12.3.1 ANTI-TERMITE TREATMENT

Treat the ground surrounding cables, pipe enclosures and cable pits forming part of the electrical installation, to provide protection against termite attack. Treatment distance shall be a maximum of 300mm from each item and in accordance with *AS 3660 Termite management in and around existing buildings and structures*.

The method of laying and protecting the cables/pipes and the termite deterrent application shall be in accordance with the manufacturer's recommendations.

The anti-termite treatment shall be carried out by a firm specialising in the work. Prior advice shall be given so that the treatment undertaken may be witnessed by the City's Representative.

Alternative systems meeting the above requirements and complying with *AS 3660 Termite management in and around existing buildings and structures* may be submitted for approval by the City's Representative.

#### 8.4.13 DISCONNECT AND REMOVE

All existing street furniture, traffic signals and lighting poles shall be surveyed and detailed in terms of positions, electrical supply requirement, intended usage within this contract (e.g. re-use or return to authority) and ownership.

Where street furniture is connected to the Ausgrid LV network or street lighting network, the following procedures shall be followed:

- The owner shall be contacted and notified in writing of the intent to demolish the service 20 working days prior to the Works commencing
- The Service Provider shall disconnect the electrical supply and make safe in accordance with Ausgrid's requirements
- The Service Provider shall remove and store equipment for four (4) weeks and notify the owner in writing of the intent to dispose of equipment after that period
- Where the LV or street lighting electrical supply is intended to be re-used, the Service Provider shall make the necessary changes to the Works to comply with street lighting or special small services detailed within this Technical Specification.

##### 8.4.13.1 DEMOLITION

Disposal of removed luminaires shall involve component recycling whenever possible.

Unwanted luminaires must be disposed in a manner that is ethical, efficient, and where practical maximises a value outcome for the City.

The Service Provider is to prioritise re-use and materials recycling ahead of disposal to landfill, which is considered an undesirable outcome. The Service Provider must remove all City of Sydney visual identifiers such as logos and labels from any unwanted items before disposing of them.

### 8.4.13.2 METHOD STATEMENT

The Service Provider shall provide a written method statement of the disconnection and making safe of Ausgrid's LV and street lighting networks to any street furniture and lighting poles. This method statement shall be forwarded to Ausgrid and approved prior to any works of this nature commencing.

The method of retaining statutory street and traffic light arrangements during the Contract shall also be submitted. As part of the electrical undergrounding works being undertaken by Ausgrid, Ausgrid-appointed Service Providers will also be installing temporary poles and lighting and this needs to be accounted for within the method statement. The Service Provider shall allow for attendance of Ausgrid-appointed Service Providers for interfacing purposes.

### 8.4.13.3 DISCONNECTION OF STREET LIGHTING POLES

Removal and making safe of existing Ausgrid service to the lighting poles and masts shall be completed as part of undergrounding works under this contract by the Service Provider who shall also liaise with Ausgrid to carry out inspection of works and works to their street lighting/small power service.

### 8.4.14 PEDESTRIAN CROSSING LIGHTING

The provision of pedestrian crossing lighting is only included if it is nominated as a site-specific requirement. Refer to drawings for nominated luminaires.

Pedestrian crossing floodlights are required to provide compliant lighting for all pedestrian crossings and at intersections as indicated in street lighting plan drawings and to comply with the requirements of *AS 1158 Lighting for roads and public spaces* and the RMS guidelines.

The pedestrian crossing floodlight shall be mounted on the outreach of the street lighting pole as indicated on the street lighting details drawing. The mounting height is to be at the same height as the street lighting luminaire. Pedestrian crossing floodlights shall be orientated towards the pedestrian crossing and as indicated in the pedestrian crossing floodlight orientation schedule in the street lighting details drawing.

This new floodlight is required prior to the removal of any existing floodlight mounted on nearby existing Ausgrid poles. The floodlight shall be supplied from the same street lighting circuit as the street light pole which it is attached to. The floodlight shall be controlled by the same PE cell which controls the street lighting circuits and is to be installed by the Service Provider. Refer to the street lighting single line diagram drawing for further clarification.

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## 8.5 INSPECTION, TESTING AND COMMISSIONING

### 8.5.1 WORKING DRAWINGS AND AS-BUILT DRAWINGS

The Service Provider shall provide working drawings as required.

Information required includes but is not limited to:

- Rating of cables
- General arrangement of ductlines and pits both in plan and longitudinal section.
- Cross-sections showing the locations of ducts.
- Plan location of the ductlines accurately specified by offset measurements from building lines to create ductline at 20m intervals, at each end of each duct run and at each change of direction of the ductlines
- Schematic connection details and circuit drawings for all Ausgrid and City supplies
- New lighting pole connection details for RMS, Telstra and Ausgrid incoming conduits and cables
- Switchboard metering and enclosure

- New main switchboard schematic control arrangements and metering arrangements
- Arrangement of keys and locks for required street furniture
- Amended Schedules.

## 8.5.2 TEST AND INSPECTIONS

### 8.5.2.1 TESTING ON-SITE DURING CONSTRUCTION

The Service Provider shall carry out all tests necessary to prove the correctness of the installation as the Works progress.

### 8.5.2.2 SITE TESTING

The Service Provider shall test the installation to the satisfaction of the City's Representative and the Statutory Authorities prior to the acceptance of the installation and the commencement of the defects liability period. The test shall comprise thorough inspection of the entire installation and the operational and performance tests required to confirm compliance with this Technical Specification.

The necessary facilities, labour, apparatus and instruments shall be supplied and properly calibrated for carrying out the tests. The City's Representative shall be given seven (7) working days' notice in writing of the tests.

### 8.5.2.3 TEST CERTIFICATES

Test certificates, dated and signed by a responsible person shall be supplied in duplicate to the City's Representative. All tests and test certificates required and as recommended by the appropriate Australian Standards and the details of new lighting installation inspection, test and completion certificate as listed at the end of this section, shall be undertaken, completed, approved and signed off.

### 8.5.2.4 COMMISSIONING

Witness testing of the entire lighting installation is required to be carried out by the Design Engineer. These tests are to be conducted during the evening.

### 8.5.2.5 ENERGISING

No component of the installation shall be energised until it has been inspected by the City's Representative and Ausgrid where required and a certificate of approval issued.

### 8.5.2.6 TESTING OF COMPLETED DUCTLINE

The Service Provider:

- Shall provide all necessary test equipment and operators to carry out the routine tests, specified below, after completion. Any other tests, which the Service Provider or the City's Representative may wish to have carried out to prove the fitness of the installation, shall also be carried out at this time.
- Will not be allowed any extension of time for the carrying out of these tests.
- Shall be entirely responsible for the proper performance of the equipment and material under test.
- Shall rectify any defect revealed by the tests and, at their own expense, shall repeat such tests as often as may be necessary to obtain the results required.

Ductlines must be clear and suitable for use.



### 8.5.3 TESTING

Where the structure is used as the earthing system, progressive testing of the earth system shall be undertaken to ensure that all components are within specified requirements and to provide notification to the City's Representative of any remedial works required early in the construction phases.

The following shall be tested:

- Each individual earth electrode structural footing after construction and before connection to other building elements
- Resistance readings for bonding between down conductor columns during construction prior to concrete pours
- Continuity testing of each light pole down conductor to the ground.

On completion of the system installation, a certificate of compliance shall be provided stating that the system has been satisfactorily installed and commissioned. In a report format, detailed test results of all tests undertaken and the method of testing used shall be provided to the City's Representative.

## 8.6 QUALITY

### 8.6.1 INSPECTIONS

At least two (2) working days' notice shall be given for all inspections.

#### 8.6.1.1 HOLD AND WITNESS POINTS

Preliminaries	
1. Process Held:	Ductline Route and Pit/Streetlight Location
Submission Details:	At least two (2) working days prior to the commencement of excavation.
Release of Hold Point:	The City's Representative will inspect the marked out route and locations, prior to authorising the release of the Hold Point.
2. Process Held:	Main Switchboard
Submission Details:	At least two (2) working days prior to installation of the MSB
Release of Hold Point:	The City's Representative will inspect the MSB, prior to authorising the release of the Hold Point
3. Process Held:	Decommissioning of Lighting
Submission Details:	At least two (2) working days before decommissioning of Ausgrid lighting
Release of Hold Point:	The City's Representative will inspect the operational lighting, prior to authorising the release of the Hold Point
4. Process Held:	Ductline and Pit Placement
Submission Details:	At least two (2) days prior to backfill of the ductlines
Release of Witness Point:	The City's Representative will inspect the installations, prior to authorising the release of the Witness Point unless advised otherwise
5. Process Held:	Poles
Submission Details:	At least two (2) working days before mounting the poles on the constructed footing

Release of Witness Point: The City’s Representative will inspect the poles prior to releasing the Witness Point

6. Process Held: Pole Location

Submission Details: At least two (2) working days before installing the poles

Release of Witness Point: The City’s Representative will review the surveyed location of the pole positions prior to releasing the Witness Point

7. Process Held: Draw Cables

Submission Details: At least two (2) working days before backfill

Release of Witness Point: The City’s Representative shall inspect the draw wires and pulled cables prior to releasing the Witness Point

8. Process Held: Electrical Inspection

Submission Details: At least two (2) working days prior to commissioning of the service

Release of Witness Point: The City’s Representative shall attend the electrical inspection and test prior to releasing the Witness Point

Additional Witness Points are as outlined below in Annexure 1 – Details of New Lighting Installation Inspection, Test and Completion Certificate.

**8.6.2 TOLERANCES**

Item	Activity	Tolerances
1.	Setout	<ul style="list-style-type: none"> <li>All street lights, pits, switchboards and the like shall be installed within 100mm of the location shown on the construction drawings</li> </ul>
2.	Streetlight	<ul style="list-style-type: none"> <li>The offset at the top of the streetlight shall not vary by more than 25mm from the vertical measured on the centreline of the pole</li> </ul>
3.	Pits	<ul style="list-style-type: none"> <li>Finished position of pits to be flush with the adjacent roadway or footway level</li> </ul>

## ANNEXURE 1

### DETAILS OF NEW LIGHTING INSTALLATION INSPECTION, TEST AND COMPLETION CERTIFICATE

All commissioning and pre-handover inspections are to be carried out by the Service Provider and witnessed by an accredited representative from City of Sydney, City Infrastructure. All completed forms are to be submitted to the Manager, City Infrastructure and Traffic Operations, City of Sydney.

#### VISUAL INSPECTION

Location:

Service Provider:

Type of Installation: (e.g. public domain lighting, illuminated sign and the like)

Date of Inspection:

#### STRUCTURAL INSPECTION WITNESS POINTS

Mark  Satisfactory or  Unsatisfactory On Completion:

- 1. Location of Lighting Equipment as per Drawing
- 2. Planting Depth/Footing size of Lighting Equipment as per Specification
- 3. Location of Cable as per Drawing
- 4. Depth of Cable as per Specification
- 5. Location of Road Crossing as per Drawing
- 6. Depth of Road Crossing as per Specification
- 7. Column footing as per Specification
- 8. Verticality Correct
- 9. Optical Orientation Correct

ANNEXURE 1: DETAILS OF NEW LIGHTING INSTALLATION INSPECTION,  
TEST AND COMPLETION CERTIFICATE, CON'TMark  Satisfactory or  Unsatisfactory On Completion:

1.	<input type="checkbox"/>	Correct termination of cables in the column, lantern and control gear
2.	<input type="checkbox"/>	Circuit conductors identified correctly
3.	<input type="checkbox"/>	Conductor size correct for normal operation (or as specified)
4.	<input type="checkbox"/>	Single pole or fuse in the phase conductor only
5.	<input type="checkbox"/>	Outer contact of ES lampholder is connected to the neutral conductor
6.		Method of Protection against Direct Contact
	<input type="checkbox"/>	a) Insulation of live parts
	<input type="checkbox"/>	b) Barrier or enclosure
	<input type="checkbox"/>	c) Out of reach (overhead lines only)
7.		Method of Protection against Indirect Contact
	<input type="checkbox"/>	a) Presence of Protective Conductors
	<input type="checkbox"/>	b) Presence of main equipotential bonding conductor
	<input type="checkbox"/>	c) Presence of supplementary equipotential bonding conductor including doors of steel columns but excluding that of concrete columns
8.	<input type="checkbox"/>	Presence of method of local isolation
9.	<input type="checkbox"/>	Fuse ratings correctly rated for their purpose
10.	<input type="checkbox"/>	Labelling in control pillar/switchboard enclosure of isolators and fuses
11.	<input type="checkbox"/>	Prevention of mutual detrimental influence. Proximity of non-electrical services (fences or safety barriers, etc.)
12.	<input type="checkbox"/>	Selection of equipment and protective measures appropriate to external influences
13.	<input type="checkbox"/>	Adequate access to installed equipment
14.	<input type="checkbox"/>	Presence of danger notices or other warning notices
15.	<input type="checkbox"/>	Presence of circuit diagrams enclosed within control pillars/switchboard enclosure
16.	<input type="checkbox"/>	Installation method of cables
17.	<input type="checkbox"/>	Deviation from the materials listed in the specification
18.	<input type="checkbox"/>	Other

(All entries recorded on this sheet to be determined by measurement. All instruments must bear a current calibration label).

Date of Test: \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

ANNEXURE 1: DETAILS OF NEW LIGHTING INSTALLATION INSPECTION, TEST AND COMPLETION CERTIFICATE, CON'T

Instruments to be Used Date when calibrated

Voltmeter 240/415V

Ammeter 0–50 amp

Megger 500V

Loop Impedance Meter

Prospective Short Circuit Tester

**Control Pillar**

**Installation de-energised** (with all fuser carriers removed)

**Continuity of Protective Conductors**

**Polarity** (Rph + Re):-

Mark  Satisfactory or  Unsatisfactory

Circuit 1	Ω	Circuit 1	<input type="checkbox"/>
Circuit 2	Ω	Circuit 2	<input type="checkbox"/>
Circuit 3	Ω	Circuit 3	<input type="checkbox"/>
Circuit 4	Ω	Circuit 4	<input type="checkbox"/>

**Insulation Resistance**

(Note: Remove neutral conductor from PME system)

**Insulation Resistance** (column wiring)

(All columns)

Circuit 1	P-N	Ω
	P-E	Ω
	N-E	Ω

Circuit	Column No.	
	P-E	MΩ
	N-E	MΩ

Circuit 2	P-N	Ω
	P-E	Ω
	N-E	Ω

Circuit	Column No.	
	P-E	MΩ
	N-E	MΩ

Circuit 3	P-N	Ω
	P-E	Ω
	N-E	Ω

Circuit	Column No.	
	P-E	MΩ
	N-E	MΩ

Circuit 4	P-N	Ω
	P-E	Ω
	N-E	Ω

Circuit	Column No.	
	P-E	MΩ
	N-E	MΩ

METHOD OF EARTHING: TN-C-S

ANNEXURE 1: DETAILS OF NEW LIGHTING INSTALLATION INSPECTION,  
TEST AND COMPLETION CERTIFICATE, CON'T

Installation Energised

(Measurements taken under load at cut-out incoming terminals)

Voltage at Origin \_\_\_\_\_ V

Prospective Short Circuit Current at Origin \_\_\_\_\_ KA

Loop Impedance at Origin \_\_\_\_\_  $\Omega$

No. of Phases \_\_\_\_\_

Load at Origin \_\_\_\_\_ A

Measured Load		Voltage at end of circuit	
Circuit 1	A	Circuit 1	V
Circuit 2	A	Circuit 2	V
Circuit 3	A	Circuit 3	V
Circuit 4	A	Circuit 4	V

Loop Impedance at end of each circuit		Prosp. Short Circuit Current at end of Circuit	
Circuit 1	$\Omega$	Circuit 1	KA
Circuit 2	$\Omega$	Circuit 2	KA
Circuit 3	$\Omega$	Circuit 3	KA
Circuit 4	$\Omega$	Circuit 4	KA

ANNEXURE 1: DETAILS OF NEW LIGHTING INSTALLATION INSPECTION,  
TEST AND COMPLETION CERTIFICATE, CON'T

I/We being the person(s) responsible (as indicated by my/our signature(s) below) for the inspection and test of the street lighting and associated electrical installation particulars of which are described on the attached annexures of this form certify that the said work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with City of Sydney current Specification for the Installation of Public Domain Lighting and the Rules for Electrical Installations (AS3000) except for departure, if any, stated in this certificate.

The extent of liability of the signatory is limited to the work described above as the subject of this certificate.

**For the inspection and test of the installation at:**

Name:  
(BLOCK Letters)

Position:

Licence No.:

Company Name:

Signature:  
(of Designer in BLOCK Letters)

Date:

**For and ON Behalf of:**

Address:

Witnessed by (Name)  
(BLOCK letters)

Position:

Signature: Date:

Comments:

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