



**Ergon Energy Corporation Limited**

# **Specification for UDC ELECTRICAL WORKS**

## **RSC08**

Abstract: Installation of cables, pillars, cabinets, public lighting, padmounted substations and high voltage switchgear for Underground Distribution Construction (UDC)

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## 1. Purpose and Scope

This specification details Ergon Energy's requirements for installation of cables, padmounted substations, free-standing switchgear, pillars, Public Lighting and associated equipment in underground distribution construction (UDC).

All work shall be to Ergon Energy's required Construction Standard and in accordance with the Construction Issue Plan and drawings provided, this specification including the attachments forming part of the specification, and referenced documents.

The Contractor shall provide all tools and equipment required to correctly carry out work to Ergon Energy's Construction Standard. This includes cable rollers, pulling socks, compression equipment including dies, etc.

## 2. References

### 2.1 Ergon Energy controlled documents

This specification shall be read in conjunction with the Ergon Energy documents listed below and if conflict is found to exist between various parts of this specification & the listed documents, priority shall be given in the following order:

- RSC06, UDC Main Specification,
- Construction Issue Plan and drawings provided
- This specification
- Underground Construction Manual
- Overhead Construction Manual
- Lighting Construction Manual

Any specification and construction manual referenced in this specification may be accessed through the Ergon Energy website. [www.ergon.com.au](http://www.ergon.com.au)

## 3. Definitions, Acronyms, and Abbreviations

### 3.1 Definitions

**3.1.1 As Constructed Plan:** The Construction Issue Plan to which approved variations and other required information during the course of construction has been added.

**3.1.2 Audits:** Checking for compliance with the applicable Ergon Energy specifications and drawings, *Electrical Safety Act 2002* (Qld) and *Electrical Safety Regulation 2002* (Qld).

**3.1.3 Certificate of Acceptance - Electrical Works:** (Required for Developer Design and Construct only) A certificate issued by Ergon Energy to the Project Manager advising that the work as detailed on the Certificate of Completion has been inspected and accepted by Ergon Energy.

**3.1.4 Certificate of Completion - Electrical Works:** A certificate from the Project Manager advising all works undertaken by the Contractor have been completed in accordance with the design and Ergon Energy's requirements.

**3.1.5 Construction Issue Plan:** A Construction Plan or plans that has been assessed as compliant by Ergon Energy and certified by the RPEQ, or nominated representative, for use in construction of the Project.

**3.1.6 Construction Standard:** The standard of construction required by Ergon Energy. This is the standard of construction that ensures a quality of supply acceptable to Ergon Energy's customers, continuity of supply and the least long-term cost to Ergon Energy. Construction shall be in accordance with Ergon Energy specification and drawings as applicable to the satisfaction of the Liaison Person. Construction carried out by the Developer's Contractors shall meet this standard.

**3.1.7 Contractor:** A company or person (including a subcontractor engaged by the Contractor) approved by Ergon Energy and selected by the Developer to undertake electrical works associated with the Project.

Where necessary in this specification, reference may be made to the Civil Contractor (undertaking the associated civil works) and the Electrical Contractor (undertaking works to this specification) for the purpose of coordination during construction as necessary.

**3.1.8 Customer Connection Officer (CCO):** The Ergon Energy officer who is responsible for facilitating connection of the Development to the Ergon Energy electrical network.

**3.1.9 Designer:** A company or person approved by Ergon Energy and selected by the Developer to design and oversee material procurement associated with the Project. The Designer is required to resolve issues that may be encountered during construction and considered to impact on their design.

**3.1.10 Developer:** Any person or company which enters into an agreement with Ergon Energy for the electrical reticulation works.

**3.1.11 Development:** Works within an area which the Developer has entered into an agreement with Ergon Energy for the electrical reticulation works.

**3.1.12 Electricity Footpath Allocation:** The corridor in the footpath allocated by the local authority for the installation of electric cables and plant. All trench alignments and maximum widths detailed on regional "Trench Detail" drawings are contained within the applicable Electricity Footpath Allocation.

**3.1.13 Laws:** includes legally binding law, legislation, statute, acts, ordinances, regulations, by-laws, orders, awards and proclamations that are enacted, issued or promulgated by the State of Queensland or any relevant local authority.

**3.1.14 Liaison Person:** The Ergon Energy officer who may carry out from time to time audits of materials procured for and/or the construction of the electrical works undertaken for the Developer for compliance to Ergon Energy's materials and construction specifications.

**3.1.15 Project:** All electrical works to be undertaken for installation of electrical reticulation infrastructure and includes a Development.

**3.1.16 Project Manager:** A company or person approved by Ergon Energy, selected by the Developer and nominated in the Network Extension Agreement to facilitate, manage and coordinate electrical works for the Project.

**3.1.17 Public Lighting:** Road lighting installed as part of the Project, in accordance with the "QTSC Group, Standard Conditions for the Provision of Public Lighting Services" document.

**3.1.18 Site Manager:** The Contractor's site representative with authority to deal directly with the Project Manager as required for completion of the Project. The Site Manager is also required to have authority to submit and sign the Certificate of Completion – Electrical Works and accompanying certificates.

## 3.2 Acronyms and Abbreviations

- **CMEN:** Common Multiple Earthed Neutral
- **HV:** High Voltage
- **LV:** Low Voltage
- **RMU** Ring Main Unit
- **RPEQ:** Registered Professional Engineer Queensland
- **UDC:** Underground Distribution Construction.

## 4. Security

The Developer has responsibility for all issues of site security within the Development.

## 5. Safety, Environmental and Ergonomic Considerations

Refer clause 6.

## 6. Acts, Regulations and Requirements

### 6.1 Laws and Authorisations

The Developer/Contractor must comply with all Laws and relevant statutory requirements.

### 6.2 Safety Management System

The Developer/Contractor shall have documented and implemented a safety management system that complies with all current statutory requirements.

### 6.3 Other authorities

The Developer/Contractor must comply with specific requirements of other authorities and utilities.

## 7. Extent of Work

### 7.1 General

Unless advised otherwise in writing, details of the location and extent of work for the Project shall be included in the Construction Issue Plan and drawings provided.

All work shall be in accordance with the Construction Issue Plan and drawings provided, this specification, the Underground Construction Manual, Overhead Construction Manual & Lighting Construction Manual.

### 7.2 Access to the Ergon Energy Distribution System

The Contractor shall not have access to the Ergon Energy distribution system unless specifically authorised in writing by Ergon Energy. The following tables define responsibility for supply and

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installation of materials for connection to the Ergon Energy distribution system associated with the Project.

Note however Ergon Energy shall notify in writing, on a case-by-case basis, where supply of material and installation as detailed in the following tables does not apply.

<b>ERGON ENERGY LV COMMISSIONING</b>		
<b>Description</b>	<b>Material Supply</b>	<b>Construction</b>
New Pillar to existing pillar	Developer supply LV cable between pillars & terminations for New pillar  Ergon supplies termination for existing pillar  (Developer pays)	Developer installs LV cables in both pillars & terminates in New Pillar  Ergon terminates in existing Pillar  (Developer pays)
New Pillar to existing Padmount	Developer supply LV cable between Pillar and Padmount, also termination for Pillar  Ergon supply termination for Padmount  (Developer pays)	Developer installs LV cable & terminate in Pillar.  Ergon installs cable and terminates at Padmount.  (Developer pays)
New Pillar to pole	Developer supply LV cable between Pillar and pole, also terminations for Pillar  Ergon supply pole termination, cable guard, earthing etc for pole. (Developer pays)	Developer install LV cable & terminate in Pillar.  Ergon fit to pole, install earthing, pole termination etc (Developer pays)  Note: Developer shall not have access to or work on pole.
New Padmount to pole	Developer supply LV cable between Padmount and pole, also terminations for Padmount  Ergon supply pole termination, cable guard, earthing etc for pole. (Developer pays)	Developer install LV cable & terminate in Padmount.  Ergon fit to pole, install earthing, pole termination etc (Developer pays)  Note: Developer shall not have access to or work on pole.



ERGON ENERGY HV COMMISSIONING		
Description	Material Supply	Construction
New Padmount to existing Padmount	Developer supply HV cable & termination for new Padmount	Developer install HV cable & terminate in new Padmount
	Ergon supply termination for existing Padmount (Developer pays)	Ergon inserts and terminates HV cable in existing Padmount (Developer pays)
New Padmount to Pole	Developer supply HV cable & termination for new Padmount	Developer install HV cable & terminate in new Padmount
	Ergon supply Pole termination, cable guard, earthing etc for pole. (Developer pays)	Ergon fit to pole, install earthing, pole termination etc (Developer pays)  Note: Developer shall not have access to or work on pole.
New Padmount to existing RMU	Developer supply HV cable & termination for new Padmount	Developer install HV cable & terminate in new Padmount
	Ergon supply termination for existing RMU (Developer pays)	Ergon inserts and terminates HV cable in existing RMU (Developer pays)
New RMU to existing Padmount	Developer supply HV cable & termination for new RMU	Developer install HV cable & terminate in RMU
	Ergon supply termination for existing Padmount (Developer pays)	Ergon inserts and terminates HV cable in existing Padmount (Developer pays)
New RMU to existing RMU	Developer supply HV cable & termination for new RMU	Developer install HV cable & terminate in new RMU
	Ergon supply termination for existing RMU (Developer pays)	Ergon inserts and terminates HV cable in existing RMU (Developer pays)
New RMU to Pole	Developer supply HV cable & termination for new RMU	Developer install HV cable & terminate in new RMU
	Ergon supply Pole termination, cable guard, earthing etc for pole. (Developer pays)	Ergon fit to pole, install earthing, pole termination etc (Developer pays)  Note: Developer shall not have access to or work on pole.

## 7.3 HV and LV Terminations

Where coordination of the installation of underground cable and terminations is not possible, the Contractor shall ensure cable is left in a safe and secure manner with the radius of any bend greater than the minimum specified in the Underground Construction Manual. Cables are to be protected from damage when exposed to the elements. Unless advised otherwise by the Liaison Person the closest point of the cable shall be not less than:

- 1.5m from a pole, or pegged position of a future pole

- 1.5m from the plinth or foundation of a padmounted substation or RMU.

## 8. Construction Manual Drawings

This document makes reference to specific drawings contained within the Ergon Energy Underground Construction Manual, Overhead Construction Manual, and Lighting Construction Manual.

Where Underground Construction Manual drawings are referenced the manual name is not stated, however, the folder name is nominated in upper case letters followed by the drawing number. eg “LV CONSTRUCTION drawing No 5025” refers to drawing No 5025 which resides within the LV CONSTRUCTION folder of the Underground Construction Manual.

Where Overhead Construction Manual drawings, or Queensland Public Lighting Construction Manual drawings, are referenced the manual name is stated, followed by the folder name in upper case letters and then by the drawing number. eg “Queensland Public Lighting Construction Manual, COLUMNS MINOR ROAD drawing No 1-6-4-1” refers to drawing No 1-6-4-1 which resides within the COLUMNS MINOR ROAD folder of the Lighting Construction Manual.

Should a Developer / Contractor not have a current version of UDC construction specifications or the Underground Construction Manual, Overhead Construction Manual and Lighting Construction Manual, as applicable, these documents may be sourced via the Ergon Energy website or by contacting Ergon Energy (ph 13 10 46).

## 9. Variation from Construction Issue Plan

### 9.1 General

All variations proposed during the course of the work shall be communicated to the Designer for approval in accordance with Clauses 9.2 and 9.2.1 or 9.2.2 as applicable and, where variations are allowed, the detail shall be included in the As Constructed Plan.

### 9.2 Submission for Variations

Variations to Construction Issue Plan shall be submitted to the Designer, in accordance with the following clauses, allowing sufficient time for assessment/approval and re-issue prior to construction.

#### 9.2.1 Design by Developer

Where electrical design has been undertaken by the Developer the proposed variation shall be submitted in writing to the Designer and a copy of correspondence provided to the Customer Connection Officer.

#### 9.2.2 Design by Ergon Energy

Where electrical design has been undertaken by Ergon Energy the proposed variation shall be submitted in writing to the Liaison Person.

## 10. Pre-Start Meeting

Prior to the commencement of site work a meeting may be required, at Ergon Energy’s discretion. The meeting shall be arranged and facilitated by the Developer or nominated representative and involve, as a minimum, the Project Manager, Contractor, Liaison Person and representatives of any other authorities involved in the Project. Note the meeting shall be scheduled to allow

sufficient time for all issues that may be raised to be resolved prior to the commencement of site work. Unless advised otherwise by the Developer the meeting shall be held in conjunction with the pre-start meeting for civil works.

## 11. Audits

### 11.1 During Construction

The Contractor is responsible for supervision of construction and, together with the Project Manager, compliance with the specification and Construction Issue Plan. However, Ergon Energy may also undertake site Audits at various stages of construction.

The Project Manager shall notify the Liaison Person to arrange site Audits that shall normally be arranged within two (2) working days of the request being received. Where significant travel is required from the relevant Ergon Energy Depot additional notice is required as agreed with the Liaison Person.

Notification shall be given for Audits at the following stages:

- **Cable Installation** - when all cable hauling equipment is on site and prior to initial cable installation.
- **HV Cable Terminations / Joints** - at initial cable termination / joint.
- **Padmounted Substation and HV Switchgear Sites** - after the installation of earthing and prior to backfilling, also after installation and connection of cables and prior to backfilling.
- **Pillar Installation** - at initial pillar base installation, crimping of lugs and fuse panel fitting.
- **Earthing Installation Testing** - at commencement of installation and testing and as subsequently directed by the Liaison Person.

Should the Project Manager fail to provide notice for site audits as defined above, the Project Manager shall be responsible for exposing conduits and cables or undertaking such other work as is deemed necessary by the Liaison Person to make a satisfactory Audit.

Random Audits may be undertaken throughout the course of construction at the discretion of the Liaison Person.

Note that Ergon Energy shall not be liable for rectification works or replacement of materials due to erosion or subsidence, or damage from any other cause, to excavations and/or materials that may result from excavations being left open pending Audit by the Liaison Person.

The Project Manager shall notify the CCO of electrical work completion dates, (12) weeks in advance and the date is firmed up (6) weeks out from completion. This will allow Ergon Energy to programme the work to have supply available to continue the continuity of work from receipt of the Certificate of Completion – Electrical Works to commissioning and issuing the Certificate of Acceptance – Electrical Works.

### 11.2 Faults Found During Audits

Faults found shall be rectified by the Contractor as soon as possible, at a time, and in a manner acceptable to the Liaison Person.

### 11.3 Final Audit - General

On receipt of the Certificate of Completion – Electrical Works, Ergon Energy shall carry out a detailed audit to ensure compliance with the *Electricity Act 1994* (Qld) and *Electricity Regulation 2006* (Qld) and with Ergon Energy's specification, Construction Issue Plan and drawings provided. This Audit does not excuse the Developer from faults found at a later time.

Required information shall be added to the Construction Issue Plan in a neat and legible manner to enable the information to be easily understood. Changes shall be marked-up in red and be to scale and dimensioned; 'freehand' sketches are unacceptable.

The As Constructed Plan shall be returned to the Liaison Person prior to the final audit.

## 11.3.1 Design by Developer

Should faults be found during the final Audit the Certificate of Completion – Electrical Works, including accompanying required documentation, shall be returned to the Developer to enable access for rectification purposes. Following rectification of faults by the Developer the Developer shall submit a new Certificate of Completion – Electrical Works, together with accompanying required documentation, and a re-Audit shall be conducted.

## 11.3.2 Design by Ergon Energy

Faults shall be rectified in accordance to the applicable Ergon Energy process.

### A.2.1 Re-Audits

Re-Audits shall be carried out to ensure that faults, if any, have been rectified. Ergon Energy shall apply a charge for each re-Audit.

## 12. Electricity Footpath Allocation and Alignments

Real property pegging must be completed and allotment numbers and final footpath levels established prior to pillars, Public Lighting, padmounted substations and pits being installed. Equipment incorrectly located relative to the final boundary locations shall be rejected.

All conduits and cables shall be installed where specified within the Electricity Footpath Allocation and in accordance with the *Electricity Act 1994* (Qld) and *Electricity Regulation 2006* (Qld). Ensure the specified clearances to other services shown on the drawings are maintained. Refer to the applicable TRENCHING drawing for the Ergon Energy Region (& locality if specified).

## 13. Cable Protection Requirements

### 13.1 Cable Depths

The top of the conduits or cables below finished ground shall not be less than the minimum dimension shown on the applicable TRENCHING drawing & the maximum depth shall be not more than 300mm deeper than shown.

**Note:** Where physical obstructions such as other services prevent achievement of the above minimum depth requirements, additional protection shall be provided in accordance with TRENCHING drawing 5016 for footpaths and 5017 for roadways. Note that the polymeric cable protection cover must be marked with the words "ELECTRIC CABLE" or similar along its length.

Written approval shall be obtained from the Liaison Person for any proposed variation in depth or alignment and such information recorded on the As Constructed Plan.

### 13.2 Identification of Underground Cables

The presence of buried underground electric cables must be identified. Methods of identification shall include:

- laying a strip of Orange Caution Tape at the depth shown on the drawings; and

- placement of inground cable warning plaques or above ground warning markers directly above the cable or conduit. If required, the locations shall be detailed on the Construction Issue Plan or advised by the Liaison Person.

### 13.3 Protection – Mechanical

The minimum requirement for mechanical protection of underground electric cables is to be provided in accordance with CONSTRUCTION PRACTICES drawing No 5124.

### 13.4 Electronic Cable Markers – Conduit ends

The location of each buried conduit end, or change in direction, may be required to be identified by the installation of an electronic cable marker placed approximately 150mm above the line of conduit or cable. Electronic cable marker locations shall be detailed on the Construction Issue Plan or advised by the Liaison Person.

### 13.5 Electronic Cable Markers – Cable joint

The location of each cable joint is required to be identified by the installation of an electronic cable marker placed approximately 150mm above the joint.

## 14. Installation Coordination

### 14.1 Supply of Earth Cable for Civil Works

In areas of poor earthing the addition of an earth cable in trenches may be required and, if required, the Construction Issue Plan shall show the location and extent. Supply and delivery to site of the cable is the responsibility of the Electrical Contractor, and the Electrical Contractor shall liaise with the Civil Contractor and Liaison Person to ensure cable is made available prior to trench excavation and conduit installation.

**Note:** It shall be the responsibility of the Electrical Contractor to complete any joints in the cable where required the appropriate crimp link shall be used.

### 14.2 Padmounted Substation and HV Switchgear Earthing and Site Finish

The Electrical Contractor shall install the necessary earthing at padmounted substation and HV switchgear sites during civil works. The timing of earthing installation shall be coordinated between the Contractors to suit the foundation installation works.

**Note:** The Electrical Contractor shall notify the Civil Contractor when all cables are installed and backfilling of cable pits is complete so the Civil Contractor may return to complete site finish.

### 14.3 Cables

#### 14.3.1 Design by Ergon Energy

Where Ergon Energy has responsibility for cable installation, it is the responsibility of the Developer to locate, excavate, and expose conduit ends for pulling in cables at padmounted substations, termination poles, each pillar location and all other locations such as cable joints shown on the Construction Issue Plan. The timing of this shall be coordinated by the Developer to suit the installation of cables, pillars etc.

#### 14.3.2 Design by Developer

Where Ergon Energy has responsibility for completing works in accordance with clause 7.2, Ergon Energy will locate, excavate, and expose cable/conduit to undertake necessary works.

## 15. Cable Installation

### 15.1 Coordination

The Electrical Contractor shall liaise with the Developer and Civil Contractor to coordinate installation of cables as specified in clause 14.

### 15.2 General

Prior to the installation of the cable the Contractor shall ensure the conduit is clean and clear of any foreign matter.

The Contractor shall be responsible for carrying out a visual inspection for cable damage on receipt of cable prior to installation. Should damage be detected the cable shall not be installed and the Liaison Person shall be immediately notified.

HV cables shall be inspected by the Contractor for signs of moisture or water contamination prior to installation. Remove end caps from the initial length of cable to be run from the drum and inspect prior to cable installation. At subsequent cable cuts also inspect the cable. Should moisture or water be identified in the cable notify the Liaison Person immediately for direction. Recap cut cable ends promptly.

The approved methods for resealing cut cables are as follows:

- 11kV and 22kV cable for installation shall be fitted with only heatshrink end caps.
- 11kV and 22kV cable on drums and at termination positions shall be sealed by either heatshrink or coldshrink cap(s) applied over cleaned cable sheath. A single cap shall be applied to 3 core and 1 core cables, Triplex cables shall have a cap applied to each core.
- LV cable left on the drum shall be sealed by application of either a heatshrink or coldshrink cap over the cleaned cable sheath.
- LV cable cut at loop positions shall be protected from condensation or water entry by sealing the end with clear plastic and PVC tape or equivalent.

Where cable sheath or end seal damage has occurred following receipt of cable, eg during installation, the Liaison Person shall be immediately notified. Repair shall be undertaken as directed by the Liaison Person, or the cable replaced if so directed. All costs associated with repair or replacement shall be borne by the Contractor.

Striking on cables after installation shall be avoided. Care must also be taken to avoid damage to cables by sharp tools or falling objects.

### 15.3 Joints

Joints are generally not allowed in low voltage cables unless detailed on the Construction Issue Plan.

Unless required joint positions are detailed on the Construction Issue Plan, high voltage cable shall be installed in as long a length as possible to reduce the necessity for joints. All intended joint positions require prior approval by the Liaison Person and a cable overlap of 1 metre shall be allowed at each joint position.

## 15.4 Installation

Cable shall be installed entirely in accordance with the Electricity Supply Association of Australia "Guide to the Installation of Cables Underground" C (b) 2 - 1989, this specification and safe working practices.

Cable may be pulled via either a flexible wire cable stocking or, alternatively, some other means approved by the Liaison Person. The Contractor shall ensure water does not enter the cable during installation.

Cable shall be visually checked for any signs of damage as it leaves the drum. Ensure stones, rubble, or other injurious particles are not drawn into conduit by either adherence to the cable or by motion of the cable over loose rubble adjacent the conduit entry.

All conduit cable entry and exit points require suitable rollers and support to prevent damage to cables and conduits

Cable lubricant shall be used to reduce friction between cable and conduit.

Where cable is to pass around a corner and a pit is required, special corner rollers and/or skid plates shall be used. Take care to ensure the cable does not approach or leave rollers at an excessive angle.

Where cable may be installed from either end of a route, reduction of the necessary cable pulling tension is possible by taking into account the location of bends and the net difference in elevation between ends of the route.

Conduit ends shall be sealed around cable immediately upon completion of cable pulling, with expanding polyurethane foam ('Fomofill' or equivalent), to prevent entry of dirt or other foreign matter.

## 15.5 Minimum Cable Bending Radius

Conduit ducting runs are provided with bends as specified in Underground Construction Manual CONSTRUCTION PRACTICES folder. Locations where specified bends are not practical, and at locations where cable is direct buried eg bends at padmounted substations and pole terminations, the minimum bending radius for individual cables shall be in accordance with Underground Construction Manual MATERIAL DATA folder.

## 15.6 Maximum Cable Pulling Tension

The maximum pulling tension when installing cable by mechanical equipment, by means of a cable stocking grip on the sheath(s) or pulling directly on the conductor(s), shall not be exceeded. Except where a lower pulling tension is nominated for a particular cable pull on the Construction Issue Plan, the maximum pulling tension for each cable is provided in the Underground Construction Manual MATERIAL DATA folder.

The means employed to ensure the allowable cable pulling tension is not exceeded shall be to the satisfaction of the Liaison Person.

## 15.7 Cable Location Log

A cable log certificate shall accompany the As Constructed Plan to confirm depth and alignment of cables installed in conduits. The certificate shall confirm all cables have been installed to correct alignment and depth. The actual log if requested shall be neat and legible, presented in tabular form. Information provided on the log shall include all installed cables and as a minimum:

- Project name and location
- Construction Issue Plan No
- Contractor details
- date
- street name
- size and No of conduits installed
- depth below finished surface level to the top of the cables at appropriate spacings
- alignment from property boundary
- other information considered necessary by either the Contractor or Liaison Person

**Note:** If the cable location log identifies any cables that are not installed to the appropriate specification they shall be rectified prior to issuing the Certificate of Completion – Electrical Works.

## 16. Backfill and Reinstatement of Excavation

### 16.1 General

Cable pits at padmounted substations, termination poles, cable joints and any other locations shown on the Construction Issue Plan shall be backfilled and reinstated.

Cable identification and protection shall be in accordance with clause 13.

### 16.2 Bedding Material and Backfill in Defined Locations

In certain locations, such as where a major feeder cable occurs in a Project, a specific cable installation design is required and non-standard trench, conduit positions, bedding material and backfill is necessary. Construction information shall be provided on the Construction Issue Plan and by the Customer Connection Officer or Liaison Person.

**Note:** The specific requirements shown on the Construction Issue Plan and other information provided by Ergon Energy override the “Bedding” specified in clause 16.3.

### 16.3 Bedding Material

“Bedding” as specified in CONSTRUCTION PRACTICES drawing No 5080 shall be used as bedding material around cable and conduit.

Place bedding material around cable, conduit, joints etc and ensure the minimum separation detailed on the applicable trenching drawing is maintained. Ensure no voids are formed and bedding material completely surrounds cable, conduit etc. Lightly compact the bedding material prior to backfilling the remainder of the trench.

### 16.4 Backfilling

Backfilling is to be completed as soon as practicable after the installation of cables.

Footpath trenches shall be backfilled to meet local authority requirements. Rock, sharp objects or any other material that could damage conduit is not permitted in backfill within 200mm of the conduit.



## 17. LV Pillar and Distribution Cabinet Installation

### 17.1 Pillar Bases

Pillars shall be positioned in accordance with the applicable drawing in the TRENCHING folder and the Construction Issue Plan.

The base shall be installed on sufficient compacted bedding material so that the top is within 10mm of horizontal (with the aid of a spirit level) and 75mm to 100mm above the finished footpath level (after allowing for turfing or grassing). Install with the longer side of the base parallel to the R.P. Street Alignment.

A 200mm wide heavy duty polymeric cable cover may be installed on top of all 1200 radius conduit bends at the pillar as part of the civil works; refer the applicable drawings in the TRENCHING folder. If cable cover prohibits the pillar base from being installed in the correct location, trim cable cover as required.

**Note:** The cable cover provides mechanical protection so must extend to under the outside edge of pillar base.

Extend the 40 dia service conduits as detailed on the applicable TRENCHING drawing and extend the Public Lighting Conduit to a minimum of 25mm above ground. A flexible conduit may be used for this purpose.

### 17.2 Pillar Fuse Panels

Fuse panels, where utilised, shall be so positioned that the panel fits into the tapered slots in the base and is tightened by tapping the panel top with a rubber hammer or wooden mallet. Care shall be exercised to not damage panels or bases.

### 17.3 Pillar Covers

Covers shall be positioned on the bases and firmly secured by tightening the 'D' head fixing screws into the bases with a maximum torque of approximately 15Nm.

### 17.4 Distribution Cabinets

Installation shall be in accordance with the Construction Issue Plan and Underground Construction Manual drawings.

## 18. Cable Terminating and Jointing

### 18.1 General

Cable terminations and joints shall be undertaken by a cable jointer (paper-lead & polymeric), Restricted Cable Jointer (polymeric only), or Electrical Fitter and Mechanic, acceptable to Ergon Energy and holding the appropriate license issued by the Electrical Licensing Board Queensland. Additionally, cable jointers shall be trained in application of the brand and type of kit being installed and provide evidence to confirm such.

LV terminations, HV terminations and joints, shall be performed in accordance with the drawings, manufacturer's details and good industry practice.

The Contractor shall take all precautions necessary to ensure cables, terminations and joints are not contaminated by moisture or other matter.

The jointer shall be equipped with all trade tools, including special tools and crimping devices, necessary to perform work to the Construction Standard.

The Liaison Person may inspect crimping devices, dies, etc. and periodically witness jointing.

## 18.2 Crimping Tools and Dies

Compression tool and dies used shall be as recommended by the compression fitting manufacturer and to the satisfaction of the Liaison Person. Dies are to be engraved so that the manufacturer's brand or trademark and the designation or size A/F (across the flats) are both clearly visible on the compressed fitting.

## 18.3 Electrical Connections

'Greasing' of bolted connections is essential to prevent ingress of corrosive elements and oxidisation of conducting surfaces. Refer CONSTRUCTION PRACTICES drawing No 5119 for requirements.

Should a tightening torque not be specified in the following clauses all bolts and screws shall be securely tightened.

## 18.4 Low Voltage Pillars and Distribution Cabinets

Terminations in Pillars and Distribution Cabinets shall be in accordance with the applicable LV CONSTRUCTION drawing. M12 bolts shall be tightened to a torque of 50Nm by use of a tension wrench and conductor fixing screws shall be securely tightened.

Cables in pillars shall be joined colour to colour.

## 18.5 Pole Terminations

Orientation of a cable termination shall be such that the termination is facing away from oncoming traffic and in accordance with drawings. Where both HV and LV terminations are installed on the same pole the Liaison Person shall advise the orientation of terminations if not stated on the Construction Issue Plan.

## 18.6 Padmounted Substations

Terminations at LV and HV switchgear and transformers shall be in accordance with the applicable drawings in LV CONSTRUCTION and HV CONSTRUCTION for the switchgear type and transformer installed.

## 18.7 High Voltage Jointing

Jointing pits shall provide complete access around the joint for the process and, where necessary, implement other measures such as covering the sides and bottom of the joint bay with a tarpaulin to prevent contamination of the joint or cables. Refer clause 16 for backfill and reinstatement of excavation.

## 18.8 Low Voltage Jointing

Jointing pits in accordance with clause 18.7 shall be provided.

**Note:** Low Voltage joints are allowed only where detailed on the Construction Issue Plan.

## 18.9 Cable Pits

Cable pits, backfilled with bedding material, are provided at padmounted substations, the base of cable termination poles (if no conduit bend provided) and other locations nominated on the Construction Issue Plan. Pits are provided for the purpose of cable installation and to ensure the minimum bending radius of cables is not exceeded. Refer MATERIAL DATA drawings No 5108 for LV cables, 5109 for HV cables, 5110 for insect protected LV cables, and 5111 for insect protected HV cables. Refer clause 16 for backfill and reinstatement of excavation.

## 19. Padmounted Substation Installation

### 19.1 Coordination

The Electrical Contractor shall liaise with the Developer and Civil Contractor during foundation construction to ensure all earthing is installed prior to site finish as specified in clause 14.

### 19.2 Installation

The padmount substation, including switchgear, shall be installed on the site in accordance with the Construction Issue Plan and standard drawings.

## 20. Public Lighting

### 20.1 General

Public Lighting columns shall be installed in positions shown on the Construction Issue Plan and in accordance with the applicable drawings in Lighting Construction Manual.

Foundations are installed as part of the civil construction.

### 20.2 Barricades to Foundations

As part of civil construction a barricade comprised of 3 star pickets firmly driven into the ground and wrapped with orange plastic mesh have been provided around each foundation.

At the time of erection of Public Lighting columns star pickets and plastic mesh shall be removed and stored to enable the Civil Contractor to reclaim materials.

### 20.3 Erection of Columns

Columns shall be erected so that the deviation from vertical of the column shall not exceed 50mm. Unless shown otherwise on the Construction Issue Plan or directed by the Liaison Person the following outreach arm / luminaire orientation shall apply:

- At straight sections of road, 90° to the line of the kerb. Tolerance on angle to the kerb shall be  $\pm 2^\circ$ .
- At curves in the road, radiate from, or to (as applicable), the curve centre point.

Ensure connection between the foundation and pole is of low resistance, ie contact area between hold down bolt washers and base plate is not painted and bolts are tight.

### 20.4 Supply

The supply cable to Public Lighting columns shall be terminated in a pillar and connected to the lighting column terminal panel in accordance with Queensland Public Lighting Construction Manual. For Minor Road lighting refer, SERVICES drawing No 1-4-7-1 and COLUMNS MINOR

ROAD drawing No 1-6-3-1 and 1-6-3-2 or 1-6-4-1 and 1-6-4-1 as applicable and for Major Road lighting refer SERVICES drawing No 1-4-7-1 and COLUMNS MAJOR ROAD drawing No 1-5-5-1 and 1-5-5-2 or 1-5-6-1 and 1-5-6-2 as applicable.

## 20.5 Grouting Under Base Plates

This operation shall be carried out after columns are erected, aligned and plumbed, and hold down bolts tightened securely.

The space under base plates is to be thoroughly cleaned and be free of moisture immediately before grouting. Completely fill the space under the base plates by ramming a stiff grout mix consisting of 1 part cement to 3 parts clean sand. Splay grout out at approximately 45° from the bottom edges of the base plate as shown on the drawings.

## 21. Identification of Cables

All cables shall be clearly and permanently labelled to the approval of the Liaison Person. The Contractor shall ensure that cables at link pillars, poles and substations are each clearly labelled to provide the street name and pillar number, or service destination of each cable.

## 22. Numbering of Equipment

Electricity distribution system assets are numbered to permit recording for maintenance and other purposes.

Ergon Energy shall allocate numbers to:

- Padmounted Substations
- Free-standing switchgear
- Cable Joints
- Poles
- Pillars and cabinets
- Public Lighting

The Contractor shall attach to assets the equipment identification labels supplied.

## 23. Electrical Testing

Electrical testing shall be conducted in accordance with specification RSC10 Specification for UDC Electrical Testing.

## 24. Earthing

### 24.1 General

Earth resistance measuring equipment, procedure, and form for recording test results are subject to approval by the Liaison Person. Instruments used and method adopted shall produce measurements having an accuracy of  $\pm 2\%$  of actual values in the range of 0.05  $\Omega$  to 100  $\Omega$ . The Contractor shall notify the Liaison Person the dates for earthing installation testing, in accordance with clause 11. The Liaison Person shall advise if tests are to be witnessed.

The Contractor shall be responsible for testing earth installations, recording results of tests on the form included as Appendix C and ensure all resistance values are in accordance with the applicable drawing.

Earthing shall be installed in accordance with the detailed drawings, Construction Issue Plan, and this specification.

Where the standard earthing systems do not achieve the earth resistance values as detailed in the drawings additional earth electrodes shall be installed within the Footpath Electricity Allocation and in accordance with the relevant works drawing and ASSEMBLIES Drawings Page 524-1 and 524-2. Earth resistance tests shall be taken after each additional earth electrode is installed.

Should difficulty be experienced in achieving the required earth resistance values the Contractor shall obtain direction from the Designer. The location of additional earth electrodes installed, or deep drill earthing, shall be recorded by the Contractor on a drawing acceptable to the Liaison Person and provided with the Certificate of Completion.

In locations where particularly poor earthing conditions are encountered and the utilisation of additional earth rods fails to achieve the requirements specified on the drawings, deep drill earthing may be utilised. Refer clauses 24.4 and 24.5 as applicable.

## 24.2 Earth Cable in Trenching

In areas of poor earthing the addition of an earth cable in trenches may be required and, if required, the Construction Issue Plan shall show the location and extent. Cable supply and delivery to site forms part of the electrical work to this specification (refer Clause 14.1 for coordination). Installation in trenches is undertaken as part of the civil works and includes 1.5m of cable coiled at each end of the 'run'. The Contractor shall uncover the cable (if necessary) and make connections or undertake other work as shown in the Construction Issue Plan or as directed by the Designer.

## 24.3 Proximity to Telecommunications

Provide the minimum separation from electrical earths to telecommunications assets as detailed on the applicable EARTHING drawing.

## 24.4 Deep Drill Earthing

In locations where the specified earth resistance is difficult to obtain deep drill earthing shall be installed, in accordance with the applicable drawing, subject to agreement by the Designer.

## 24.5 Deep Drill Earthing – LV Circuits in Common Earth Installations (CMEN)

In locations where particularly poor earthing conditions are encountered and the installation of additional earth rods fails to achieve the requirements specified on the drawings, deep drill earthing may be installed subject to prior agreement. Written agreement from the Designer shall be required.

At each LV circuit, earth rods shall be installed where nominated on the Construction Issue Plan (as required by the Distribution Design Manual) and additionally a deep drill earth installed. The deep drill earth shall be located at the end of the cable run except where more favourable conditions are evident elsewhere on the cable run the earth may be installed in that location. The specified values on EARTHING drawing No 5085 need not be achieved provided the MEN system, when connected, achieves the requirement stipulated on the Construction Issue Plan.

**Note:** This option is allowable on LV circuits only and at padmounted substations the specified requirement on the applicable EARTHING drawing shall be met.

## 24.6 Padmounted Substations

The Electrical Contractor shall liaise with the Developer and Civil Contractor to ensure installation of site earthing during foundation construction as specified in clause 14.

Earthing shall be installed in accordance with the following EARTHING drawings as applicable:

- 11kV - Common Earth Arrangement – No 5013
- 11kV Separate Earth Arrangement – No 5014
- 22kV - Common Earth Arrangement – No 5123
- 22kV Separate Earth Arrangement – No 5125

Except where nominated on the Construction Issue Plan written agreement is required from the Designer prior to installing a Separate Earth Arrangement, and additionally, written agreement from Ergon Energy shall be required. Note that modifications are required to earth connections & LV switchboard etc as detailed on the Separate Earth Arrangement drawings. Common Earth Arrangement requires connection of the following apparatus to the site earthing system:

- transformer tank & any HV surge protection devices;
- LV neutrals & earth leads of LV surge protection devices;
- any metalwork which may reasonably be expected to become energised from the electricity supply system in the event of failure of insulation or contact with a conductor; and
- Screens of HV Underground Cables

Each of the above connections shall be capable of being disconnected without interfering with the others.

## 24.7 Cable Pole Terminations

The local pole earthing system shall be installed as part of the termination installation. Refer clause 7.2.

To ensure correct bonding to earth is achieved for metal cable guards, and other equipment that may be on the same pole, all earthing requirements for cable pole terminations are detailed in Overhead Construction Manual EARTHING.

## 24.8 LV Pillars and Distribution Cabinets

Supply pillars, Linking pillars and Distribution Cabinets shall be earthed where shown on the Construction Issue Plan in accordance with EARTHING drawing No 5085. Cross-Road pillars are not to be earthed (they are earthed through the MEN system).

## 24.9 Public Lighting Light Poles

Columns are “earthed” via the concrete foundation and low voltage MEN neutral connection.

## 25. Certificate of Completion and Certificate of Acceptance

The Certificate of Completion - Electrical Works, Appendix A, shall be provided by the Project Manager stating that all works have been carried out in accordance with this specification and Ergon Energy's requirements. Ergon Energy shall carry out a final audit only after receipt of the certificate and accompanying required documentation.

Ergon Energy shall issue a Certificate of Acceptance - Electrical Works, Appendix B, to confirm acceptance of the work and also commencement of the defects liability period. The Project Manager shall complete the certificate and return a signed copy to the CCO.

**Note:** Any electrical infrastructure found missing or damaged prior to Ergon Energy signing the Certificate of Acceptance shall be repaired at no cost to Ergon Energy.

## 25.1 Certificate of Completion

The Certificate of Completion – Electrical Works, Appendix A, shall be provided by the Project Manager stating all electrical works have been carried out in accordance with Ergon Energy's requirements. Refer Clause 25.2 or 25.3 as applicable, for Certificate of Acceptance. Ergon Energy shall carry out a final audit only after receipt of the Certificate of Completion, As Constructed Plan and associated documentation. Electricity supply to the Project shall be withheld if all works have not been completed in accordance with the Certificate of Completion.

**Note:** The requirement for a cable location log - refer Clause 15.7

## 25.2 Certificate of Acceptance – Design by Developer

Only one Certificate of Acceptance– Electrical Works, Appendix B, which shall include civil works, (and also initiates the defects liability periods) shall be issued for design by Developer Projects. The certificate shall be issued subsequent to completion of electrical works and electrical testing.

Should faults be found during the final Audit the Certificate of Completion – Electrical Works shall be cancelled and returned to the Developer to enable access for rectification purposes. At the same time the Certificate of Completion – Civil Works shall be returned as part the accompanying required documentation. Should civil works require rectification a new Certificate of Completion – Civil Works shall be submitted.

## 25.3 Certificate of Acceptance - Design by Ergon Energy

Acceptance shall be in accordance to the applicable Ergon Energy process.

## 26. Defects Liability

The defects liability period for electrical works is 24 months from Ergon Energy's issue of the Certificate of Acceptance - Electrical Works.

Subsequent to Ergon Energy accepting the Certificate of Completion - Electrical Works the Developer and Contractor shall consider the installation as live & shall not have access. Faults found during the defects liability period may be rectified by Ergon Energy and all costs shall be recovered from the Developer.



## Appendix ACERTIFICATE OF COMPLETION – ELECTRICAL WORKS

PROJECT NAME: .....

PROJECT No:.....

LOCATION:.....

AS CONSTRUCTED PLAN NO: .....

I/We.....

being the Contractor for the above Project, hereby certify that electricity reticulation detailed on the Construction Issue Plan and associated works schedules have been completed, including the following:

- i. Cables, poles, substations, pillars, distribution cabinets, earthing and other equipment have been installed in accordance with this specification and as shown on the As Constructed Plan attached and signed by the Project Manager.
- ii. Cables, poles, etc have been installed in alignments approved by the appropriate local authority.
- iii. Kerb markers have been installed to mark accurately the location of road crossings conduits and Public Lighting conduits, also warning sign posts/plaques (if required) have been installed.
- iv. Statutory requirements have been complied with in respect to clearances of overhead lines and cover over underground cables.
- v. All High Voltage and Low Voltage cable terminations, connections, and associated earthing have been completed in accordance with this specification and as directed by the Liaison Person.
- vi. Public Lighting has been installed in accordance with requirements of the Construction Issue Plan and applicable authority.
- vii. Earthing resistance tests have been conducted and results are detailed on the attached form “Earthing Resistance Tests” (refer Appendix C).

The works shown on the As Constructed Plan are ready for commissioning.

Note the Project Manager shall sign and date the As Constructed Plan.

Dated this .....day of .....20 .. .

\_\_\_\_\_  
(Print Site Manager Name)

\_\_\_\_\_  
(Site Manager to Sign)

\_\_\_\_\_  
(Company Name)

Attachments: 1 As Constructed Plan  
2 Earthing Resistance Tests  
3 Cable Location Log

CIRCULATION  
- Project File



## Appendix B CERTIFICATE OF ACCEPTANCE – ELECTRICAL WORKS

### DESIGN BY DEVELOPER (DEVELOPER DESIGN AND CONSTRUCT)

<b>PROJECT NAME:</b>	
<b>PROJECT No:</b>	<b>CERTIFICATE DATE</b>
<b>DEVELOPER NAME:</b>	
<p><b>A description of the works covered by this Certificate:</b></p> <p>As Constructed Plan No. _____</p> <p>As per specifications:</p> <p>RSC06, UDC Main Specification</p> <p>RSC07, UDC Civil Works specification</p> <p>RSC08, UDC Electrical Works specification</p> <p>RSC09, Horizontal Directional Drilling specification</p> <p>RSC10, UDC Electrical Testing specification</p> <p>RSC14, UDC Project Management specification</p> <p><b>Exceptions (where required):</b></p>	
<p>The Defects Liability Periods relating to works covered in the above Project commence on the date of this certificate as follows:</p> <ul style="list-style-type: none"> <li>• Civil works – 12 calendar months</li> <li>• Electrical works - 24 calendar months</li> </ul>	
<p>This Certificate is issued on the understanding that the Developer shall:</p> <p>Accept the conditions specified in RSC08 UDC Electrical Works specification, in relation to rectification of the works within the defects liability periods.</p>	
<p>Liaison Person to complete:</p> <p>Name: _____</p> <p>Signature: _____</p> <p>Date: _____</p>	<p>Project Manager to complete:</p> <p>Name: _____</p> <p>Signature: _____</p> <p>Date: _____</p>

# Specification for UDC Electrical Works



## Appendix C EARTHING RESISTANCE TESTS

PROJECT NAME: .....LOCATION: .....

CONSTRUCTION PLAN NO: ..... PROJECT No: .....

SITE DETAILS			DATE OF TEST	RESISTANCE READINGS IN OHMS (AS APPLICABLE)				
IDENTIFIER (ID)	DESCRIPTION	LOCATION		SEPARATE EARTHING		COMMON EARTHING		ISOLATED ELECTRODE
				HV EARTH	LV EARTH	HV/LV EARTH	AREA MEN	

Attach a layout sketch of the substation earth mat and location of additional earthing at substations, pillars, poles and cable guards. Identify deep drill earthing where utilised and record depth.

I certify the accuracy of the above measurements and tests.

Site Manager (Print) \_\_\_\_\_ Site Manager (Sign) \_\_\_\_\_

Contractor Name (Print) \_\_\_\_\_ Date \_\_\_\_\_