

Underground Distribution Construction Policy Manual

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1 Scope

The purpose of this document is to define the policies governing the design and construction of underground electrical reticulation up to 11 kV within the ENERGEX distribution area. All work relating to the design, construction and auditing of these underground systems, which become part of the ENERGEX underground network, shall be performed in accordance with these policies.

This document makes reference to other publications, which form part of the detailed requirements to be met. It is the responsibility of the reader to verify that policies in this document are current. The most current version of this document is available on ENERGEX's Intranet site.

The ENERGEX Distribution Planning Officer or Subdivision Technical Officer must approve any deviations from policies in this document and related referenced material for application to a specific project.

2 Referenced Documents

The following reference documents form part of the requirements of underground design and construction and are referred to by this policy manual.

Reference Document	
WCS 2	Construction of the Underground Electricity Distribution System
WCS 61.1	Trenchless Technology Installation of Underground Infrastructure
WCS 31	Commissioning and Operation of the Distribution Network
WCS 34	Inspection, Testing, Installation and Maintenance of Network Earthing Systems
WCS 47.1	The Design of Estates
WCS 47.2	Consultancy Services for the Project Management of Estate Construction and Public Street Lighting Construction
WCS 47.3	Design of Rate 2 Public Lighting Installation
WCS 47.4	Planning and Design of the ENERGEX Electrical Distribution and Sub-transmission Networks
WCS 47.6	The Design of Large Customer Connections
WCS 61	Underground Infrastructure Civil Works
WCS 61.2	Construction of Concrete Pits for Underground Infrastructure
894	Design the Distribution Network
305	Underground Distribution Construction Manual
5318-A4	Underground Design Manual
796	Public Lighting Construction Manual
576	Public Lighting – Standard Condition for Public Lighting Services
767	Queensland Public Lighting Design Manual
796	Queensland Public Lightning Construction Manual
982	Subdivision Standards – Developer Design and Construct Estates
337	ENERGEX Safety Management System
1029	Working on Roadways
310	ENERGEX Environmental Management System: Environmental Standard
Form 01049	Subdivisions Electricity Supply Agreement
338	ENERGEX Safety Manual
297	Network Labelling & Signage Manual
295	Supply & Planning Manual
694	Standard Network Building Blocks - Feeders
693	Standard Network Building Blocks - Substations
758	Distribution Earthing Manual
AS 1345	Identification of the contents of pipes, conduits, and ducts
AS 1657	Fixed platforms, walkways, stairways and ladders – Design, construction and installation

3 Subdivision Supply Process

The control conditions, which apply to the design and construction of electrical reticulation for underground subdivisions, are described in RED 982 "Subdivision Standards – Developer Design and Construct Estates".

This document defines the sequence, processes, and guarantees given by ENERGEX to an applicant for relevant information to permit the design and construction of underground electrical reticulation.

Upon completion of construction, the following documents shall be forwarded to ENERGEX for auditing to proceed and acceptance of the underground electrical reticulation:

- Certificate of Completion
- "As Constructed" drawings
- Test Certificates

ENERGEX Process Diagram in RED 894 "Design the Distribution Network" describes the control conditions, which allow for 11 kV and LV capital extensions to the network.

4 Design & Installation

4.1 General

The design of underground residential electrical reticulation, which shall form part of the ENERGEX network, shall be in accordance with this policy manual, the *Underground Design Manual*, the *Standard Network Building Blocks – Feeders* (RED 694), *Standard Network Building Blocks - Substations* (RED 693 Section 3), RED 982 "Subdivision Standards – Developer Design and Construct Estates", and the *Supply & Planning Manual*.

Where a developer is constructing the work, the Designer should seek conceptual approval from ENERGEX. With respect to adequacy of design proposals and their subsequent approval, the acceptance and decision of the ENERGEX Subdivision Technical Officer shall be final and binding.

All cables in URD estates shall be installed in conduits and shall be detailed on the works plan.

Only approved products and services shall be used in the design and construction of underground reticulation systems, which are intended for connection to the ENERGEX network.

For consumers' mains to be installed in publicly controlled land, the Designer must have consulted ENERGEX and with all entities who may have an interest in the proposed location of the electric cable (relevant service authorities, local government etc) and **obtain that approval in writing**.

All new distribution network padmount transformers, ground mounted transformers and ring main units are to be installed above 1:100 year Flood Level or the prescribed Defined Flood Level (DFL), whichever is the highest.

4.2 System Configuration

ENERGEX's primary distribution system in urban and rural areas consists of 11 kV radial feeders supplying 11 kV/415 V distribution substations.

Suitably located 11 kV sectionalisers are installed which permit supply to be switched from an alternative source when required. The location of 11 kV underground sectionalisers shall be approved by ENERGEX.

The low voltage underground network consists of a three-phase network, which is divided into sections. Each section is supplied from a separate distribution substation. Individual residential supply is taken from above ground service pillars, which are located at lot boundaries.

In a direct buried system, a temporary energised stop end low voltage joint is constructed at each temporary end of a low voltage distributor circuit, to facilitate future extension of the low voltage distributor at a latter stage of the reticulation.

A two-way above ground link pillar is used to create "*normally open*" points between sections of the low voltage network supplied from neighbouring padmount substation.

A three-way above ground pillar is used to provide points of isolation within low voltage distributor circuit, which incorporate long branch circuits.

The electrical design of residential underground estates must integrate with the existing network and future development of adjacent areas.

4.3 Easements

Where necessary, the Developer shall grant to ENERGEX any easement for electricity purposes. The agreement shall define the terms and conditions specified by ENERGEX.

All costs incurred in effecting the registration of easement/s (including survey, engrossment, perusal by or on behalf of ENERGEX, stamp duty, lodgement fees etc) shall be the responsibility of the Developer. Please refer to RED 982 "*Subdivision Standards – Developer Design & Construct Estates*" for more details.

The minimum width of an easement for the installation of underground electrical cables and associated plant shall be 2.0 metres.

Note: The minimum width of an easement for the installation of overhead powerlines shall be determined by ENERGEX.

An easement for vehicle access shall be negotiated based on the type of plant required to gain access.

Underground cable installations shall not be constructed through private lots using easements to provide access between streets or stages of a development. Developers shall create a laneway (road reserve) between property allotments to provide a suitable access for underground cable installation and maintenance.

4.4 Road Reserves for Front Entry Padmount Transformers

The standard road reserve for the front-entry type padmount substation is 4.8m wide and 5.0m deep in common earthed areas; and 12.6m wide and 8.9m deep in separately earth areas. The front edge of the reserve shall be along the road reserve boundary.

The adoption of a substation road reserve site shall be in accordance with those options available in the *Underground Distribution Construction Manual*.

4.5 Underground Cables

Only electrical cables as scheduled in the *Underground Distribution Construction (UDC) Manual* shall be used to construct underground electrical reticulation intended for connection to the ENERGEX electrical distribution network.

4.6 Cable Joints

Cable joints shall be located and constructed in accordance with the *Underground Distribution Construction Manual*. Only ENERGEX approved jointing systems may be constructed.

4.7 Conduits

4.7.1 For future use

The ENERGEX Distribution Planning Officer or Subdivision Technical Officer shall advise where conduits for future use shall be installed.

Conduits shall be installed and sealed in accordance with the *Underground Distribution Construction Manual*.

4.7.2 For footway streetlighting cables

Street lighting cable shall be installed in PVC conduits in accordance with the *Underground Distribution Construction Manual*.

4.7.3 For road crossings

Road crossing conduits shall be installed in accordance with the *Underground Distribution Construction Manual*.

4.8 Substation/Transformer ratings

Front entry padmount transformers shall be positioned such that they are located near the geometric centre of the low voltage load.

Transformers and high voltage switchgear and other ancillary substation equipment shall be selected from the schedule in the *Underground Distribution Construction Manual*.

4.9 Service Pits

(Trial Areas Only – located at Inala, North Lakes and Runaway Bay)

Service pits shall be positioned and installed in accordance with the *Underground Distribution Construction Manual*. Service pits shall provide a maximum connection of two 3 phase residential supplies.

4.10 Insulation Piercing Connectors

(Trial Areas Only – located at Inala, North Lakes and Runaway Bay)

ENERGEX approved insulation piercing connectors shall be used to effect the connection between service mains at consumers' mains and other services at pits and pillars.

Customer cables shall be restricted to single cored double insulated cables up to 16 mm² copper conductors.

A MEN cable and street lighting cable cannot be taken out of the same service pit or pillar.

Insulation piercing connectors shall be installed on nominated phases at each service pit and pillar in accordance with the detailed instructions contained within the *Underground Distribution Construction Manual*.

Cables shall be installed into insulation piercing connectors in accordance with the *Underground Distribution Construction Manual*.

4.11 Service Tee Joints

(Trial Areas Only – located at Inala, North Lakes and Runaway Bay)

Service tee joints shall be located and constructed in accordance with the *Underground Distribution Construction Manual*.

A maximum of two 16 mm² service cables may be contained within one service tee joint.

As required, a live stop end may be incorporate into a service tee joint in accordance with the *Underground Distribution Construction Manual*.

4.12 Service Tee Joint Exclusion Zone

(Trial Areas Only – located at Inala, North Lakes and Runaway Bay)

A Service Tee Joint Exclusion Zone is created in accordance with the *Underground Distribution Construction Manual*. No other utility or service belonging to another organisation shall pass through this zone

4.13 Above Ground Loop Pillars

Designs of underground residential electrical reticulation shall make use of the following types of above ground pillars:

- **One and two-way distribution pillars** - to distribute electricity to lots.
- **Two way link pillars** - to create LV distribution mains normally open interconnect between adjacent padmount transformers.
- **Three way pillars** - to create a LV distribution mains sectionalising point. Three way pillars shall only be installed where a low voltage distributor spur supplies at least fifteen residential dwellings.

Above ground pillars shall be installed and constructed in accordance with the *Underground Distribution Construction Manual*.

Where the stage of the electrical reticulation results in a low voltage distributor ending at a normally open point or three way intersection, the above ground pillar shall be installed in its final position. To facilitate the future installation of the next distributor cable, a conduit starter may be installed in accordance with the *Underground Distribution Construction Manual*.

Above ground pillars may be used to provide electricity to other equipment with the approval of ENERGEX.

All electrical terminations shall be constructed in accordance with the *Underground Distribution Construction Manual*.

4.14 Pillar Exclusion Zone

A pillar exclusion zone is created in accordance with the *Underground Distribution Construction Manual*.

No other service shall pass through or be located within the ENERGEX pillar exclusion zone.

4.15 Electrical Analysis

Designers preparing designs for low voltage underground reticulation shall give consideration to system capacity and voltage drop. In determining likely energy growth and voltage drop, designers must take into consideration anticipated customer loads.

Where the development of the estate includes proposed commercial centres and schools for example, consideration of the future additional energy loads shall be made and incorporated into the proposed design and works plan.

For long runs or underground street light circuits fault loop impedance calculations shall be made in accordance with the *Public Light Policy and Design Manual*.

4.16 Voltage Drop

LV electrical reticulation designs shall be such to ensure that the supply at the customer's terminals remain within $\pm 6\%$ of the standard voltage of 240 volts.

The maximum design voltage range at distribution transformer terminals is 242 to 248 volts.

A maximum service voltage drop of 4 volts must be taken into account. A further allowance must also be made for phase imbalance.

The maximum allowable voltage drop at the last service pit (or pillar) on a LV distributor cable shall be 11 volts.

Voltage drop analysis is to be completed as per the *Supply & Planning Manual*.

4.17 After Diversity Maximum Demand

The After Diversity Maximum Demand (ADMD) refers to the maximum demand per customer for a given number of customers.

For all new underground residential estates within the ENERGEX area, a nominal ADMD factor as per the Supply & Planning Manual shall be applied.

Requests to vary the ADMD for particular developments shall be directed to the ENERGEX Distribution Planning Officer or Subdivision Technical Officer.

4.18 Service Phasing

The following principles shall be adopted when determining service phasing:

- the total number of services on each phase shall as far as possible be equal
- the sum of the moments of each phase shall as far as possible be equal
- designs shall as far as possible, eliminate possible future out-of-balances

4.19 Distribution Earthing Philosophy and Practice

Refer to the *Distribution Earthing Manual*.

4.20 Protection

Protection requirements for high and low voltage cables and substation equipment shall be in accordance with the ENERGEX *Standard Network Building Blocks – Feeders, Standard Network Building Blocks - Substations* and the *Underground Distribution Construction Manual*.

4.21 Street lighting

Public street lighting in ENERGEX distribution networks shall be installed in accordance with the *Queensland Public Lighting Construction Manuals*.

The designer shall refer to the *ENERGEX Public Lighting Manual – Standard Condition for Public Lighting Services* and consult directly with the local council in order to determine the required conditions of street lighting scheme for each road and open space of the development, and design in accordance to the *Queensland Public Lighting Design Manual*.

5 Construction Management

5.1 Allocation of ENERGEX plant

In public footways, the area from the real property boundary to a point 900 mm towards the carriageway is *reserved* for electricity distribution purposes. Pillars, service pits and conduits shall be installed in this allocation in accordance with the *Underground Distribution Construction Manual*.

Within rural underground estates, ENERGEX plant shall generally be installed within the standard electricity supply corridor. Other alignments shall be considered by ENERGEX where the following can be provided:

- Written agreement from the local Authority for the proposed alignment of footway cables.
- Agreement from the local Authority to bear the full costs of relocation of ENERGEX plant if the local authority installs future stormwater infrastructure within the proposed cable alignment.
- Proposed finished footpath levels and grades do not preclude the entry of plant and machinery required to maintain installed ENERGEX plant.
- Mechanical protection is provided over the cable in the non-standard alignment.

Any cables designed outside the nominated electricity alignment as shown in the *Underground Distribution Construction (UDC) Manual* must be approved by the ENERGEX Distribution Planning Officer or Subdivision Technical Officer.

In Community Title Developments, ENERGEX electricity supply cables and plant must be installed on common ground. A minimum width of one metre of common ground is to be allocated at the side of a roadway, offset from the back edge of kerb away from the roadway and free of obstructions, for this purpose.

The allocated corridor shall be an area that is turfed with cross overs for driveways and parking bays only. The allocated corridor shall be free of all landscaping (such as gardens including mulched beds, shrubs and trees) and permanent structures (such as rubbish bin enclosures, carports, townhouses and retaining walls).

ENERGEX electricity supply cables and plant, shall not be installed in designated areas with limited access, such as swimming pool enclosures, under gazebos, tennis court enclosures etc.

5.2 Trenching

Prior to trenching, the Operator shall ensure that existing plant owned by ENERGEX and other utilities are located.

5.3 Temporary Marking of Existing Underground Services

Temporary marking of the location of underground services situated in road reserves shall be in accordance with the requirements of AS 1345 and the *Underground Distribution Construction Manual*.

Orange paint in accordance with AS 1345 shall be used for the temporary marking of the position of ENERGEX underground services and pegs used to locate ENERGEX poles, stays and structures prior to installation.

5.4 Survey Marks

All bench marks, pegs and surface markers shall be preserved and maintained in their true positions. Any permanent survey marks within the construction zone must be identified on works plans. Where the works are likely to disturb permanent survey marks, the consultant must advise the authority controlling permanent survey marks, and follow their requirements at the developer's cost.

5.5 Breaking of Sealed Surfaces

The Operator shall employ techniques to break and remove sealed surfaces such that adjacent surfaces are not damaged.

Edges of trenches shall be cut through the full thickness of the sealed surface unless directed otherwise by the owner of the sealed surface.

Repairs to damaged sealed surfaces, shall be carried out by the Operator to the satisfaction of the local council.

5.6 Removal, Care and Reinstatement of Grassed Areas

Where the trench alignment is within established grassed areas, the Operator shall be responsible for the removal, care, and reinstatement of removed sections from the trench alignment. The Operator shall employ techniques, which prevent damage to adjacent grassed areas not forming part of the trench alignment.

On the completion of backfilling, all grassed areas disturbed by trenching and the work methods employed, shall be reinstated to a condition similar to those found prior to trench excavation.

5.7 Maintenance of barricades and trenches

Operators shall comply with the requirements of Section 31 of the Workplace, Health and Safety Act, to ensure that all employers and their workers on the work site discharge their Workplace, Health and Safety obligations.

Signs, barricades, lights and trench covers required for vehicular and pedestrian management, shall remain in place and be regularly inspected and maintained until such time as the safety hazard no longer exists.

The condition of barricades used around trenches and jointing holes shall be regularly monitored. The Operator shall immediately rectify any situation, which presents a potential hazard.

5.8 Minimum and Maximum Cover Over ENERGEX Plant

The following minimum and maximum cover shall be maintained over ENERGEX plant. Where these cannot be achieved, the consultant will determine if the provisions in *Underground Distribution Construction Manual* Section C2 Sheet 3.2 for reduced cover with additional mechanical protection, or increased depth to go under the obstruction is appropriate. Evidence (i.e. photo or plans showing levels of the conduits and obstructing pipes) of a conflict must be provided.

It is the responsibility of the consultant to ensure that the infrastructure design and coordination of other service works do not result in reduced cover over ENERGEX plant.

5.8.1 Footways

The minimum acceptable cover over all ENERGEX plant for electrical distribution and control systems installed below the finished ground level approved by the local authority in footways shall be 600 mm. Maximum trench depth shall be in accordance with *Underground Distribution Construction Manual* Section C2 Sheet 2.1.

5.8.2 Local Roadways

The minimum acceptable cover over ENERGEX plant for electrical distribution and control systems installed within local roadways shall be 750 mm. Maximum trench depth shall be in accordance with *Underground Distribution Construction Manual* Section C2 Sheet 2.1.

5.8.3 Department of Main Roads

The minimum acceptable cover over ENERGEX plant for electrical distribution and control systems installed in roadways controlled by the Department of Main Roads (DMR) shall be 1200 mm. Maximum trench depth shall be in accordance with *Underground Distribution Construction Manual* Section C2 Sheet 2.1.

5.9 Bedding material

Only bedding material meeting the technical requirements as specified in the *Underground Distribution Construction Manual* shall be used.

Bedding material shall be installed and compacted in layers as specified in the *Underground Distribution Construction Manual*.

Bedding material shall be installed such that the required separations as defined in this document and the *Underground Distribution Construction Manual* are achieved.

5.10 Minimum Separation from Other Plant

Except in situations where otherwise stated in the *Underground Distribution Construction Manual* regarding gas pipes and public lighting circuits, ENERGEX plant, which is to be connected to the ENERGEX underground network, shall not be installed:

- Within 300 mm of another authority's plant where the installed plant will form part of the ENERGEX high voltage and low voltage network.
- Within 100 mm of communications conduits and low voltage network on joint use trenching

Where ENERGEX cables and conduits cross another underground service, ENERGEX's plant shall pass under the service maintaining a minimum separation of 300 mm (this may be reduced to 100mm for storm water crossings only).

Increased depth of up to 2.5m below surface is acceptable for short lengths (up to 5m) to go below obstructions. Reduced cover in accordance with *Underground Distribution Construction Manual* Section C2 Sub-Section 3.2 is acceptable when passing over the top of obstructions (minimum 300mm cover). Where it is not practical to install ENERGEX plant under or over other underground services in accordance with above, the consultant must seek approval from the ENERGEX Distribution Planning Officer or Subdivisions Technical Officer for an alternative arrangement that will not have a negative impact on cable ratings.

5.11 Cable Installation

5.11.1 Direct Laid Cables

Cables laid direct shall be installed in accordance with *Underground Distribution Construction Manual*.

5.11.2 Cables Installed in Conduit Systems

Conduit through which cable is to be pulled shall be tested in accordance with the *Underground Distribution Construction Manual*.

Cables shall be installed into conduits in accordance with the *Underground Distribution Construction Manual*.

Low voltage cable shall not be installed in electrical conduits having an internal diameter of less than 80 mm and an internal free space factor of less than 50%.

High voltage cable shall not be installed in electrical conduits having an internal diameter of less than 125 mm and an internal free space factor of less than 50%.

5.11.3 Control of Pulling Tension

The maximum pulling tension specified by the manufacturer of the cable being pulled shall not be exceeded. The *Underground Distribution Construction Manual* provides a guide to safe pulling methods and typical maximum pulling tensions for generic cables used on the ENERGEX underground network. It is the responsibility of the Operator to check maximum pulling tensions permissible prior to cable installation.

Methods shall be employed whilst pulling all high voltage cables which allow the applied pulling tension to be verified during installation. The *Underground Distribution Construction Manual* provides guidelines for methods that are acceptable.

The Operator shall be free to employ other monitoring techniques, however the ENERGEX auditor/assessor must approve these.

5.11.4 Cable Pulling Eyes and Anchored Eye Bolts

These shall be installed in accordance with the *Underground Distribution Construction Manual*, and utilised as shown in ESAA C (b) 2. Anchored eye bolts shall be assessed for safe working loads in accordance with methods covered in ESITrain Course, "Power Winching - Lesson 2".

5.11.5 Minimum Bending Radius

The manufacturer's minimum cable bending radii shall not be exceeded during cable installation. A guide to the minimum bending radii for generic cables used on the ENERGEX underground network is provided in the *Underground Distribution Construction Manual*. It is the responsibility of the Operator to check and verify the manufacturer's minimum cable bending radii prior to cable installation.

5.11.6 Sealing Cable Ends

Cable ends shall be sealed whilst being pulled into an open trench and into conduits. Cable ends shall be sealed to prevent the ingress of moisture and other foreign matter into the cable using ENERGEX approved products and methods, which encapsulates the end(s) of cable.

After cutting cables on site, if not immediately being jointed or terminated, all cable ends shall be sealed using ENERGEX approved methods.

Where cable damage or the entry of foreign matter is evident, the Operator shall immediately notify the ENERGEX Supervising Officer.

The Operator shall be responsible for the integrity of sealed ends on cables whilst cables are under his/her control and once installed in their final position until such time as the cable end has been terminated or jointed.

5.12 Conduit Installation

Conduits shall be selected in accordance with the *Underground Distribution Construction Manual*.

Conduits, conduit couplings and fittings shall be installed in accordance with the *Underground Distribution Construction Manual*.

5.12.1 Footpath Conduits

Footpath conduits for future use shall be installed such that the required minimum cover and separation are attained. Where cables are not immediately installed into newly installed conduit, the ends of conduits shall be sealed using ENERGEX approved methods to prevent the entry of foreign material.

5.12.2 Footpath Street Lighting Conduits

Street lighting cables within the footpath shall be installed in 40 mm HD PVC conduit from the service pit (or above ground pillar) into the base of the street lighting column. Street lighting conduits shall be installed in accordance with the *Underground Distribution Construction Manual*.

5.12.3 Road Crossing Conduits

Road crossing conduits shall be installed at locations as indicated on the works plans and in accordance with the *Underground Distribution Construction Manual*.

Conduit ends shall be sealed using ENERGEX approved methods to prevent the entry of foreign material.

At initial installation of road crossing conduits prior to the construction of the road pavement, ENERGEX, Telstra, Optus and other communication carrier conduits shall terminate 900 mm from the real property survey peg. Where the conduit bank changes level the gradient shall have a minimum radius of 1 830 mm.

5.12.4 Draw Ropes for Future Use Conduits

A draw rope having a minimum breaking strength of 1.0 kN shall be installed in all future use conduits.

5.12.5 ENERGEX Broadband Communications Cable Conduit

ENERGEX Broadband Communications Cable 100 mm white MD UPVC conduit shall be installed in accordance with the *Underground Distribution Construction Manual*.

Installed conduits shall be fitted with a continuous metallic tracer/draw wire suitable for passing an electric current to accurately identify the conduit.

5.12.6 Configuration of Conduits

Configuration of conduit banks shall be in accordance with the *Underground Distribution Construction Manual*. Configuration of conduits in banks shall take into consideration the overall excavation required for the installation and the ease with which access to conduits can be facilitated in the future.

5.12.7 Minimum radius of conduit bends

The minimum radius of conduit bends shall be in accordance with the *Underground Distribution Construction Manual*.

5.12.8 Kerb Markers for Conduits

All electricity conduit road crossing locations shall be clearly marked with 'E' markers. These shall be installed in accordance with the *Underground Distribution Construction Manual*.

5.13 Cable Identification Markers

Where cables and other ENERGEX Plant are installed outside the normal electricity supply corridor such as parks, easements, and car parks, kerb markers or surface markers shall be installed in accordance with the *Underground Distribution Construction Manual*.

5.14 Conduit Installation Using Directional Boring

Conduits installed by directional boring techniques shall be in accordance with WCS 23, *"Installation of Conduits using Underground Directional Boring"*.

Conduits used in directional boring for the purpose of electric cable installation shall comply with the requirements specified in the *Underground Distribution Construction Manual*.

5.15 Mechanical Protection for ENERGEX Plant

Polymeric protective cover strip shall be installed in accordance with the *Underground Distribution Construction Manual*.

5.16 Backfilling and Reinstatement of Excavations

Backfill material shall be selected and installed in accordance with the *Underground Distribution Construction Manual*.

Excavated material may be used for bedding and/or backfill material with the approval of the ENERGEX auditor/ assessor.

5.17 Warning Tape

Marked plastic warning tape shall be installed in accordance with the *Underground Distribution Construction Manual*.

5.18 Cable Joint Markers

Cable joint markers shall be installed by ENERGEX in accordance with the *Underground Distribution Construction Manual*. Cable joint markers shall be installed by ENERGEX with a high voltage cable sealing end.

5.19 Electricity Service Pits

ENERGEX approved service pits shall be installed in accordance with the *Underground Distribution Construction Manual*.

5.20 Communication Pits

Communication pits shall be located in accordance with the *Underground Distribution Construction Manual*.

5.21 Above Ground Loop Pillars

Above ground loop pillars shall be installed in accordance with the works plans and the *Underground Distribution Construction Manual*.

5.22 Distribution Padmount Substations

5.22.1 Selection of Site and Approval

Padmount sites shall be selected in accordance with the criteria specified in the *Underground Distribution Construction Manual*.

5.22.2 Site Preparation

Preparation of a padmount substation site shall be in accordance with the *Underground Distribution Construction Manual*.

5.22.3 Foundation Material and Piers

Foundations and pier installation shall be in accordance with the relevant drawings in the *Underground Distribution Construction Manual*.

5.22.4 Retaining Walls

Retaining walls shall be erected in accordance with the *Underground Distribution Construction Manual*.

5.22.5 Guardrails/Fencing

Guardrails/fencing complying with AS 1657 shall be installed on sloping sites where the difference between ground level and padmount site is 300 mm or greater. Guardrails/fencing shall be installed in accordance with the *Underground Distribution Construction Manual*.

5.22.6 Backfilling

Backfilling and the placement of concrete around the padmount shall be installed in accordance with the *Underground Distribution Construction Manual*.

5.22.7 Padmount Substations and Vegetation

No vegetation shall be permitted within the dedicated padmount substation site. During the padmount site selection process, designers should take into consideration the size and overhand of surrounding mature trees and shrubs.

5.23 Street Lighting Columns

Public lighting columns shall be installed in the positions shown on the works plans and in accordance with the *Underground Distribution Construction Manual*.

5.24 Electrical Jointing & Terminating

Electrical joints and terminations shall be constructed in accordance with the *Underground Distribution Construction Manual* and specific manufacturers' instructions as well as the relevant Standard Work Procedure. Only ENERGEX approved jointing kits and associated materials shall be used to construction joints.

Joints and terminations shall be constructed using new materials only.

Operators Jointers performing jointing and terminating activities must possess the relevant competencies required for the work in accordance with *WCS 2, "Construction of the Underground Electricity Distribution System"*.

Prior to energising low voltage cable, tests in accordance with the *Underground Distribution Construction Manual* shall be performed.

5.25 Identification of Cables

ENERGEX shall be responsible for arranging the identification of existing commissioned high voltage cables to be cut or spiked in accordance with approved ENERGEX procedures and in compliance with HVIA procedures and the *ENERGEX Safety Manual*.

5.26 Installation of Insulation Piercing Connector (IPC)

ENERGEX approved insulation piercing connectors shall be installed onto service cables in accordance with the *Underground Distribution Construction Manual*.

5.27 Preparation of Service Tails in Service Pits

Service cable shall be prepared and installed in service pits in accordance with the *Underground Distribution Construction Manual*.

5.28 LV Mains Cable Terminations In Above Ground Pillar

Distribution mains cables shall be installed prepared and terminated within above ground pillar in accordance with the *Underground Distribution Construction Manual*.

5.29 Preparation of Service Tails in Above Ground Pillars

Service cable shall be prepared and installed in above ground pillars in accordance with the *Underground Distribution Construction Manual*.

5.30 Connecting Street Light Circuits and Non-Residential Services

5.30.1 In Service Pits

Where the works plan indicates that the connection of a street light circuit and/or non-residential services is required at a service pit, each nominated phase(s) and neutral tail of the service cable shall be separately terminated into ENERGEX approved IPCs.

5.30.2 At Above Ground Pillars

Electrical connections of street lighting cables and other non-residential service cables at above ground pillars shall be made in accordance with the instructions contained in the *Underground Distribution Construction Manual*.

5.31 Electrical testing

Completed electrical reticulation shall be tested in accordance with the *Underground Distribution Construction Manual*. Tests shall be performed by qualified staff.

Testing of completed electrical reticulations prior to commissioning shall include:

- Labelling of equipment
- Continuity Tests
- Insulation resistance
- Phasing

All electrical tests shall be performed and recorded in accordance with the *Underground Distribution Construction Manual*.

All test instruments used shall be properly maintained and calibrated every six months by an accredited laboratory. All records of instrument testing and calibration shall be kept for two years. Test Instruments shall bear identification and calibration compliance dates and due dates for re-calibration.

5.32 Earthing

Earthing systems shall be installed and tested in accordance with:

- Standards outlined in the *Distribution Earthing Manual*.
- Procedures outlined in *WCS 34 "Inspection, Testing, Installation and Maintenance of Earthing Systems"*
- The requirements outlined in the *Underground Distribution Construction Manual*.

Earthing installations constructed in addition to that specified on the works plans shall be recorded on the "as constructed" works plan.

5.32.1 Earthing of Padmount Substations

Earthing schemes of Padmount substations shall be constructed in accordance with the *Underground Distribution Construction Manual*.

5.32.2 Earthing of above ground Pillars and Service Pits

Earthing at service pits and above ground loop pillars shall be constructed in accordance with the detailed drawings contained in the *Underground Distribution Construction Manual*.

Earth electrodes and earthing cables shall be installed in accordance with procedures outlined in WCS 34 *"Inspection, Testing, Installation and Maintenance of Earthing Systems"*

5.32.3 Earthing of Public Lighting columns

The earthing of public lighting poles in underground residential estates shall be in accordance with the *Queensland Public Lighting Construction Manual*.

5.33 Numbering and Labelling of Equipment

All labelling of equipment (including cable ends) which shall form part of the ENERGEX network shall be in accordance with the *Network Labelling and Signage Manual*.

5.34 Work Practices

All persons performing work on or near to the ENERGEX network shall comply with the following:

- *ENERGEX's "Safety Manual"*
- *ENERGEX's "Safety Assurance Standard"*
- *ENERGEX's "Safe Working Principles"*
- *Workplace, Health and Safety Act*
- *Workplace, Health and Safety Regulations*
- *Workplace, Health and Safety Advisory Standard for Excavation*
- *ENERGEX's standards as listed in Clause 9 - References found in WCS 2, "Construction of the Underground Electricity Distribution System"*
- Any applicable manufacturer's installation instructions

5.35 Risk Management

Prior to commencing work at any worksite, risk assessments shall be carried out by the Operator in accordance with WCS 2, *"Construction of the Underground Electricity Distribution System"*.

Risk assessments shall continue to be performed by the Operator whilst construction work is in progress.

5.36 Traffic Control

The Operator shall comply with all the requirements for traffic control in accordance with WCS 2, *"Construction of the Underground Electricity Distribution System"*. Service Providers shall comply with the traffic control requirements in *ENERGEX's RED 1029 document "Working on Roadways"* and any relevant Acts and Regulation.

6 Environmental

All work shall be performed in accordance with the requirements of ENERGEX's Environmental Management System: Environmental Standard Manual, Instruction Manual and associated Corporate Environmental Standards.

In conjunction with these instructions, all work shall be performed with regard to the requirements and obligations prescribed by State Legislation and Regulations.

7 Materials

All commercial arrangements for the supply and delivery of materials supplied by ENERGEX shall be in accordance with the *"Subdivision Electricity Supply Agreement", Form 1049*.

The Developer or their representative will provide ENERGEX with a list of materials as required by *RED 982 "Subdivision Standards – Developer Design and Construct Estates"*.

The Developer or their representative shall use their best endeavours and take care to economise the materials supplied by ENERGEX.

8 Management of Construction

The following documents shall be certified by a Registered Professional Engineer (Electrical) in accordance with *WCS 47.1 "The Design of Estates" or WCS 47.3 "Design of Rate 2 Public Lighting Installations"*.

- Works Plans

The following documents shall be certified by a Project Manager in accordance with *WCS 47.2 "Consultancy Services for the Project Management of Estate Construction and Public Lighting Construction"*:

- "As Constructed" drawings
- Certificates of Completion

The commissioning of estates or Public Lighting construction and electricity extensions associated with an estate or Public Lighting construction shall be in accordance with *WCS 31 "Commissioning and Access to the Distribution Network"*.

A Certificate of Completion in accordance with *Standard Work Procedure No 47.2 "Consultancy Services for the Project Management of Estate Construction and Public Lighting Construction"* must be provided by the Project Manager for the construction stating that all works have been carried out in accordance with ENERGEX requirements and comply with the Electrical Safety Act and Regulations, Electricity Act and Regulations and other statutory requirements pertaining to the work. ENERGEX will only carry out an audit after receipt of the Certificate of Completion (copy attached as Appendix 1).

On completion of all works, the following documents shall be prepared and submitted to ENERGEX:

- Certificates of Completion
- "As Constructed" drawings
- Certificate of Test – Part 1
- Certificate of Test – Part 2
- Cable Test report
- Earth Resistance Test Report.

The Project Manager may use the Contractor's own versions of the above mentioned documents provided all information requested is presented in a clear and precise manner and the certification remains unchanged.

Appendix 1

Certificate of Completion

.....
(Estate Name)

.....
Stage No.

.....
(Location)

.....
(ENERGEX Project Number)

I/We being the Developer's Project Manager(s) and having been commissioned to project manage the construction of the electricity reticulation detailed on Works Plan No.....and associated Work Schedules do hereby certify that we have exercised reasonable skill, care and diligence to ascertain that the works have been executed in accordance with:

- (i) The approved Engineering Drawings, Specifications and relevant Australian Standards.
- (ii) Good engineering practices and to a satisfactory standard of workmanship.
- (iii) All ENERGEX requirements.
- (iv) All acts of Parliament, regulations and statutory requirements pertaining to the work have been complied with; including alignments approved by the appropriate local authority for the installation of plant.
- (v) All HV and LV fuses, switches and open points shown on the "As Constructed" works plans are in the "OPEN" position.
- (vi) The polarity and phasing is correct at every service pillar and public lighting service.

I/We further certify that the "As Constructed" information submitted herewith (including information prepared by others) indicates that the completed "As Constructed" works Plan(s) represent a true and accurate record of what have been constructed within the specified tolerances required by ENERGEX.

I/We further certify that all significant variations from the approved Engineering Drawings (outside the specified tolerances) have been resubmitted to the WCS 47.1 or WCS 47.3 Design Consultant for approval and are incorporated in the "As Constructed" information.

I/We further certify that electrical testing has been satisfactorily completed by personnel with current ENERGEX authorisation as detailed on the attached 'Certificate of Tests', Part 1, 2 and 3.

Earth electrodes and substation earth resistances have been measured and are detailed on the attached form 'Earthing Resistance Tests'.

Earthing is as shown on the Construction Advice, which has been authorised by the service provider's authorised recipient.

The works shown on the "AS CONSTRUCTED" Works Plans No..... are ready for commissioning/commissioned.

Date this day of 20.....

Service Provider

.....
Signature

.....
Position

.....
Name of Signature

.....
Company Name and Address

Attachments:

1. Subdivision Plan
2. "AS CONSTRUCTED" Works Plans
3. Certificate of Tests Parts, 1 2 and 3
4. Earthing Resistance Tests
5. Check Sheet (in accordance with WCS 47)

All details included on this document must be typed or printed text (excluding the signature)

Appendix 2

Certificate of Test – Part 1

Insulation Test Report for 4 core LV Cables

ESTATE NAME: _____

ENERGEX PROJECT NUMBER: _____

LOCATION		INSULATION RESISTANCE MΩ	REMARKS
FROM PILLAR/SUB. NO.	TO PILLAR/SUB. NO.		

AUTHORISED TEST PERSON:

NAME: _____

COMPANY: _____

SIGNATURE: _____

DATE: _____

All details included on this document must be typed or printed text

Certificate of Test – Part 2**Low Voltage Continuity, Insulation Resistances and Phasing**

ESTATE NAME: _____

ENERGEX PROJECT NUMBER: _____

1.1 Continuity**DC Resistance Measurement**

SECTION		TEST RESULTS
FROM	TO	

1.2 Insulation Resistances**2500V DC Megger Test**

TESTED BETWEEN		RESISTANCE (MΩ)
A	BCN & E	
B	CN & E	
C	N & E	
N*	E*	

* For CWN (Consac) cable, already performed under sheath test

1.3 PhasingPhase positions and marking checked
to be in accordance with Works Plan

Visual Check _____ Yes/No

AUTHORISED TEST PERSON:

NAME: _____

COMPANY: _____

SIGNATURE: _____

DATE: _____

All details included on this document must be typed or printed text

Appendix 4

Earth Resistance Test Report

NAME OF ESTATE : ENERGEX PROJECT NUMBER:				<u>SOIL CONDITIONS</u> :		WET	DAMP	DRY
SITE DETAILS			DATE OF TESTS	RESISTANCE READINGS IN OHMS				
IDENTIFIER (ID)	DESCRIPTION	LOCATION		SEPARATE EARTHING		COMMON EARTHING		ISOLATED ELECTRODE
				HV EARTH	LV EARTH	HV/LV EARTH	AREA MEN	

Appendix 4 (Cont'd)

Earth Resistance Test Report

Notes

HV Earth	The measurement resistance between the high voltage earthing system and the actual earth For Separate Earthing System.
LV Earth	The measured resistance between the low voltage earthing system and the actual earth (LV earthing system not yet connected to MEN network) For Separate Earthing System.
HV/LV Earth	The measured resistance between a combined earthing system and the actual earth (earthing system not yet connected to MEN network) For Combined Earthing System only.
Local Area MEN	The measured resistance between the actual earth and the MEN network with the HV/LV electrode connected to it.
Isolated Electrode	The measured resistance between a MEN earth electrode and actual earth (electrode not yet connected to the MEN).

Amendment Record

4th August 2014
Version 3

- Section 5.8 modified to clarify requirements for going above/below obstacles. Approval not required with every request but evidence (photos, plans) to be provided with design.
 - 5.10 amended to allow 100mm separation for stormwater. Also maximum depth to pass under obstruction limited to 2.5m without request for approval from Energex.
-

11th January 2014
Version 2

Change to major version number to suit new document management system.
No change to contents.

14th December 2011
Version 1.3

- Subdivision Technical Officer added with the same authority as Distribution Planning Officer but for subdivision / D&C projects.
 - Reference Documents Updated
 - Added BMS 3328 - Subdivision Standards – Developer Design and Construct Estate
 - Removed BMS663 – Subdivision Supply Process.
 - Added WCS 47.6 - The Design of Large Customer Connections.
 - Added WCS 47.4 - Planning and Design of the ENREGEX Electrical Distribution and Sub-transmission Networks.
 - Amended 4.3 – removed paragraph on easement registration and acquisition information (already covered in BMS 3328).
 - Amended 4.17 – ADMD as per Supply & Planning Manual.
 - Amended 5.1 – cables outside nominated alignment must be approved.
 - Amended 5.8 – evidence (e.g. photos) must be provided for any variations.
 - Appendices – added ENREGEX Project Number for all forms.
-

24th November 2011
Version 1.2

The major amendments are:

- Reference Documents Updated:
 - Added BMS 3535 - Distribution Earthing Manual.
 - Added BMS 3929 - Standard Network Building Blocks – Feeders.
 - Added BMS 3930 - Standard Network Building Blocks – Substations.
 - Added BMS 3543 - Queensland Public Lightning Design Manuals.
 - Added BMS 3585 - Queensland Public Lightning Construction Manuals.
 - SWP34.2 (Testing) and SWP34.3 (Inspection & Maintenance of earthing system) consolidated into SWP34.
 - SWP23 UG boring replaced by SWP 61.1.

- SWP 62 replaced by SWP 61.2.
 - Amended 4.1 – new installation requirement for padmount, ground mounted transformers and RMUs to be installed above prescribed or 1:100 year DFL.
-

17 December 2008

Version 1.1

The major amendments are:

- Updating of Reference Documents
 - Updating of Road Reserve requirements to UDC Manual standard
 - IPC Trial areas listed
 - Removal of direct burial of cables as an option in line with the Network Building Blocks
 - Updating of the ADMD in line with the Network Building Blocks/Supply and Planning Manual.
 - Broadband communication conduit to be 100mm white MD UPVC
 - Requirement for streetlight circuits fault loop impedance calculations in accordance with the Public Lighting Policy and Design Manual.
-

1 July 2003

Version 1.0

Initial issue of document in BMS format, previously known as 6510-A4. Incorporates changes to align with revisions to SWP47.
