
Introduction:
This Update is to inform the target audience of new standard constructions which have been introduced to the Underground Construction Manual. The construction standard is for Ergon Energy assets within community title schemes. The construction drawings are attached to this Operational Update.

Easement Requirements:
As community title developments are all on private land and there are no road reserves, easements will be required for the Ergon Energy assets. The following easements are required:

- Padmounted Substations, site size shall be as per drawings 5000 and 5114. The easement will be exclusive to Ergon Energy, i.e. no other services can cross the easement
- Cable trenches, easement width shall be equal to the required trench size. The easement for cable trenches will not restrict other services from crossing the easement provided the minimum separations are maintained
- Pillars will not require an easement

In all cases Ergon Energy assets are to be located on common land within the community title and not within individual lots.

Easements for padmounted substations and cable trenches are to be granted at no cost to Ergon Energy and are required to be registered prior to energisation of the connection assets.

Other Requirements:
Where the Ergon Energy assets will be inside community title schemes which are gated, the offer process should include requirements for 24 hour access to our assets.

The construction drawings for Community Title developments will be included in the next release of the Underground Construction Manual.

For more information contact:
Adam Bletchly, Underground and Public Lighting Standards Engineer on (07) 4931 2783

*All current Operational Updates should be posted to noticeboards*
TABLE 1

<table>
<thead>
<tr>
<th></th>
<th>Gas</th>
<th>Water</th>
<th>Comms</th>
<th>Comm Lighting</th>
<th>TV</th>
<th>Sanitary Drainage</th>
<th>Storm Water</th>
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<tbody>
<tr>
<td>HV</td>
<td>300</td>
<td>500*</td>
<td>300</td>
<td>300</td>
<td>500*</td>
<td>500</td>
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* This separation only applies to services with an internal diameter less than or equal to 200mm.

TABLE 2

<table>
<thead>
<tr>
<th></th>
<th>Gas</th>
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<th>Comms</th>
<th>Comm Lighting</th>
<th>TV</th>
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<td>100</td>
<td>100</td>
<td>300</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

NOTES:

1. Ergon Energy cables and conduit shall not be closer than 500mm to the building line (face of facia) or the real property boundary.
2. For minimum separation between Ergon Energy cables and other services running parallel refer Table 1. Services crossing Ergon Energy cables shall:
   - Cross at an angle of not less than 45°
   - Have a minimum vertical separation as per Table 2.
   All separation distances are measured from the exterior surface of conduit cables not centrelines or inner wall surfaces.
3. Preference is for Water & Gas services to enter at the alternate property boundary to electricity. Where this is not possible these services may enter the property at the same boundary as the electricity. The following shall apply where all services enter at the one boundary:
   - Ergon Energy pillar shall be installed as per sheets 5 & 7.
   - Minimum separation as per Table 1 & 2 shall be maintained.
4. Gas main, telecommunications conduit and water main to be laid on road side of trench to controlling authority / owner and Australian standard requirements.
5. Community power cables and conduits in group title developments shall be a minimum:
   - 300mm from Ergon Energy High Voltage conduit.
   - 100mm from Ergon Energy Low Voltage conduit.
   and constructed in accordance with AS/NZS 3000.
UNDERGROUND DISTRIBUTION
TRENCHING - COMMUNITY TITLE
TRENCH SECTION

Bedding sand as specified.

HV Conduit as required (2 x 150 max.)

LV Conduit as required (4 x 100 max.)

Gas warning tape

Gas trace wire

Gas main

Communication warning tape as required

Communication as required

Cable protection cover 100 ± 50 above conduit

Building line or property boundary

1050 Roadway

750 max. Ergon trench width

Limit of Ergon trench

Additional trench width as required by other services

Back of kerb or edge of road pavement

Road Pavement

300 m in.

Ergon trench width

500 ± 50 Roadway

350 ± 50 Footpath

900 Footpath

900 Footpath

End of Roadway

Footpath

Footpath

Footpath
NOTE:

1. The alignment and depth of services shall be as per sheet 1 & 2 or controlling authority requirements. Alignments are not to be inferred from this plan.

2. Low Voltage conduit only is shown. Refer Sheet 8 for High Voltage conduit.

3. Provide polymeric cable protection to all conduit inside the community title area. Where conduit is installed in road reserve and in the electricity footpath allocation polymeric cable protection is not required. Refer drawing 5124 Sh1 for specific requirements.
NOTE:
Tie caution tape orange to end of service conduits and extend to above ground for future conduit location.

Cross Road conduit

Service conduit

Community Lighting Service Conduit
Exit Direction As Required

Pillar base

Polymeric Cable Protection Cover

R.P. Street Alignment

Finished Surface Line
NOTE: 25 x 25 Timber stake suggested to locate bends until backfilled.

- 100 dia. 1830 Rad. 45° bend
- Mains Cables as required

- 80 dia. 450 Rad. 90° bend
- Cross Road cable

- Community lighting service conduit exit direction as required

- Polymeric cable protection cover not shown.
NOTE:
Tie caution tape orange to end of service conduits and extend to above ground for future conduit location.
R.P. Street Alignment

Service conduits

Real Property Boundary

Survey peg

NOTE:
25 x 25 Timber stake suggested to locate bends until backfilled

45°

75

75

45°

Timber stake
Refer Note

Outline of pillar base (over)

C Pillar
Datum

50

120

400

NOTE:
to locate bends until backfilled

25 x 25 Timber stake suggested

100 dia. 1830 Rad. 45° bend
Mains Cables as required

100 dia. 1830 Rad. 45° bend
Cross Road cable

Polymeric Cable
Protection Cover
Not Shown.

Community lighting
service conduit
exit direction as required

Cross Road cable

100 dia. 1830 Rad. 45° bend

UNDERGROUND DISTRIBUTION
TRENCHING - COMMUNITY TITLE
CONDUIT BEND DETAILS AT PILLAR
240mm² 4 CORE CROSS ROAD CABLE

DATE: 22/07/15
PASSED: A. Bletchly
DRAWN: L. Burton

Ergon Energy Corporation Ltd
ABN 50 087 646 062

FILE: 5 5453307

Dwg 5330 Sh 7
NOTE:
Provide 'E' Marker at all kerb crossings

Electricity Footpath Allocation for community title is 500mm min. from property boundary or building line to 1250mm. All other services to be on roadside of electricity allocation.
1. Locate pillar base with the long side parallel to property boundary or building line.
2. Dimension to top of pillar base shall be above the finished surface level (i.e., the ground surface after turf is laid).
3. Install pillar base horizontally.
4. No excavated soil shall be used as foundation material under pillar base.

**NOTES:**

- ORANGE CAUTION TAPE
- AND POLYMERIC CABLE
- PROTECTION COVER
- NOT SHOWN.

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**UNDERGROUND DISTRIBUTION**

**TRENCHING - COMMUNITY TITLE**

**PILLAR BASE INSTALLATION**

**ERGON ENERGY**

**DATE** 22/07/15

**PASSED** A. Bletchly

**DRAWN** L. Burton

**FILE:** 5 545162 8

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**ERGON ENERGY CORPORATION LTD**

ABN 60 087 646 062
# Padmounted Substation Installation

## Site

### General

The padmount substation site shall be to the satisfaction of Ergon Energy and fulfil the requirements of the subsequent clauses including:

- Be sensitive to the local environment
- Be secure from third party and environmental damage
- Be relatively flat and structurally sound
- Not be subject to tidal inundation, storm tide or flooding (1:100 year risk)
- Provide secure access for operational purposes
- Not be an obstruction or public nuisance

Along coastal areas the site must be located as far as possible from the shoreline and sheltered from salt spray.

A site should not be located where impact by traffic is likely and, if at a truncated section of the street alignment or other non-regular shaped site the following shall apply:

- The front edge of the substation plinth shall be 200mm from and as near to parallel as possible to the R.P. Street Alignment.
- The specified rectangular size of the site shall not be reduced.

### Site Size

The minimum area required to accommodate a front entry padmounted substation shall be:

<table>
<thead>
<tr>
<th>Site Size</th>
<th>Padmounted Substation Earthing Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000 x 2800</td>
<td>Common earth locations for flat site</td>
</tr>
<tr>
<td>4800 x 5000</td>
<td>Common earth locations community title for flat &amp; sloping sites with retaining walls</td>
</tr>
<tr>
<td>3400 x 3000</td>
<td>Common earth locations sloping sites other than community title</td>
</tr>
<tr>
<td>3000 x 5200</td>
<td>Common earth locations raised padmounted substations</td>
</tr>
<tr>
<td>12000 x 7200</td>
<td>Separate earth other than raised padmounted substations for flat &amp; sloping sites with retaining wall</td>
</tr>
<tr>
<td>12000 x 9600</td>
<td>Separate earth raised padmounted substations</td>
</tr>
</tbody>
</table>

Note: Site size requirements are being reviewed with a view to rationalize the number of options.

### Substation Orientation

Front entry padmounted substations shall be oriented such that the LV and HV panels are easily accessible from the dedicated footpath.

### Fire Risk Zone

Protection shall be provided against fire initiated or propagated by any part or element of the padmount substation. The site selection shall provide for the protection of:

- Each building adjacent to or near a padmount substation from the fire hazard originating at the padmount substation.
- Padmount substations from the fire hazards originating in the building adjacent or near the installation.

The below provides the minimum distances required for the separation of padmount substations and buildings:

- Residential buildings (BCA class 1 or 10) - 3.0m
- All other buildings - 6.0m

Drawing 5335 sh 1 & sh 2 show the fire risk zone around a padmount substation.

The separations given are the minimum and any additional separation required by the building owner or local authority shall apply.

Where the separation distance cannot be met between padmount substations and buildings, a barrier with FRL 120/120/120 shall be provided. Where a building or building surface within the fire risk zone has a minimum FRL 120/120/120 no additional barrier is required. The minimum dimensions for fire barrier is shown on drawing 5335 sh 3.

The separation required between the padmount substation and a barrier of fire rated building is 1.0m.
1 SITE (CONT'D)

1.5 EMF
The table below lists the separation distance between padmounted substations and buildings for which human occupation can be expected for significant periods of time.

<table>
<thead>
<tr>
<th>SUBSTATION SIZE</th>
<th>RESIDENTIAL</th>
<th>COMMERCIAL / INDUSTRIAL</th>
<th>SCHOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>315 kVA</td>
<td>3m</td>
<td>4m</td>
<td>4.5m</td>
</tr>
<tr>
<td>500 kVA</td>
<td>4.5m</td>
<td>5m</td>
<td>5.5m</td>
</tr>
<tr>
<td>750 kVA</td>
<td>-</td>
<td>6m</td>
<td>7m</td>
</tr>
<tr>
<td>1000 kVA</td>
<td>-</td>
<td>7m</td>
<td>8m</td>
</tr>
</tbody>
</table>

1.6 URD
The developer shall provide a padmounted substation site(s) as required by Ergon Energy at no cost to Ergon Energy. The site shall be included in the road reserve, or located on freehold property. No padmounted substations are to be located in Trustee Reserves.

Where the developer required the padmount to be included:

a) In the Road Reserve:-
The Developer shall obtain all necessary approvals from the Department of Transport or the Local Authority.

b) On Freehold property (including residential or parkland):- The Developer shall provide Ergon Energy with a registered easement at no cost to Ergon Energy.

1.7 Commercial and Industrial or Landscaped Areas
Whether the padmounted substation is for the sole use of that complex, or is required as part of the distribution network, the owner is required to grant Ergon Energy an easement for the padmounted site, access and cabling.

1.8 Parklands - for other than URD
Obtain the necessary approval for an easement to accommodate the padmounted substation, cabling and access to site.

1.9 Cabling and Access Requirement

Cabling and Access
A 3.0m wide easement, or road reserve, from the front of the site is required for cabling and access.

Cabling Only
Should the cabling route not be available in conjunction with access, a 1.0m wide cable easement is required to the front of the padmount. Additionally 2.0m x 3.0m (padmount site width) is required immediately in front to allow spreading of cables for entry to the padmount and also include the buried earth cable.

2 SITE PREPARATION
Sites shall be prepared in accordance with the included construction drawings.

3 CONSTRUCTION OF RETAINING WALLS
Retaining walls shall be constructed around the perimeter of a padmounted substation site where:

- A change in ground level of 300mm or more occurs within 2.0m of the boundary of the padmounted substation site.
4 PADMOUNTED SUBSTATION FOUNDATION

4.1 Uniculvert
Uniculvert foundations shall not be constructed where site and ground conditions do not provide an even or equal bearing capacity for the padmounted substation, or where no HV switchgear is fitted and the cable is connected directly to the transformer HV terminals.

Uniculvert foundations for both stable and unstable soil conditions shall be constructed in accordance with Drawing No. 5005.

4.2 Concrete Piers
Concrete piers shall be installed where the site ground conditions do not provide an even or equal bearing capacity for the padmounted substation foundation, or where no HV switchgear is fitted and the cable is connected directly to the transformer HV terminals.

At sites where shallow rock is encountered use the uniculvert foundation type if applicable.
Concrete piers shall be constructed in accordance with Drawing No. 5009.

4.3 Raised Blockwork
Raised blockwork foundations shall not be constructed where site and ground conditions have either of the following conditions:
- Soil bearing pressure <100kPa.
- Water table within 500mm of the base of the foundation.

4.4 Unstable Sites
Where sites are very unstable, and conventional foundation construction techniques as described in this document cannot be applied, a special design shall be required.

In such circumstances, the developer shall obtain a certified design from a Civil Engineer (RPEQ) for Ergon Energy's consideration. No special designs for padmounted substation foundation construction shall be used without the approval of Ergon Energy.

5 BACKFILLING AND FINAL SITE FINISH

All backfill of the site must be compacted before final site finish in accordance with the applicable drawing.

5.1 Common Earthing Sites
Sealing of the cable apertures in the precast concrete plinth and construction of the concrete surround slab over the ground surface shall be in accordance with drawing No. 5004.

5.2 Separate Earthing Sites
In addition to the requirements of Clause 5.1 the remaining ground surface between the concrete surround slab and site extremities shall be finished in accordance with drawing No. 5175.

5.3 Raised Blockwork Foundation - Common Earthing Sites
The substation 3.0m x 5.2m site surface is to be finished with interlocking masonary paving (besser "interlock" or equivalent approved by Ergon Energy) installed in accordance with the manufacturer's installation specifications. A concrete slab shall not be provided.

5.4 Raised Blockwork Foundation - Separate Earthing Sites
In addition to the requirements of clause 5.3 the remaining ground surface between the barrier kerb (around the paving) and site extremities shall be finished in accordance with Dwg no. 5300 Sh 3.
6 ADDITIONAL REQUIREMENTS

6.1 Commercial and Industrial Installation
The preferred location of padmounted substation sites at commercial and industrial developments is at the real property street alignment. Switchgear cabinet doors shall face the adjoining footpath.

Should the site be located in restricted areas such as carparks and between buildings, an additional minimum 2.0m of clear access shall be provided in front of, and for the full width of the site (ie 4.8m depth). This will provide a safe working platform and access around latched open doors for emergency operations.

Padmounted substations shall be located on the development in areas where clear, all weather access is provided for personnel and heavy equipment at all times.

Easy access for a mobile crane must be available for the purpose of installation or replacement.

Ergon Energy cable conduits for the development may be placed in the substation site and shall pass down the sides of the uniculvert foundation. No conduits shall pass through or under the uniculvert foundation. Conduits shall be 750mm minimum depth below the finished surface level. The substation site surface is to be finished with a concrete slab (refer to drawing No. 5004). The 2.0m apron in front of the substation cabinet shall be finished with a concrete slab sectioned with construction joints for ease of future removal.

6.2 Padmounted Substations in Landscaped Areas
Where the padmounted substation is located in a landscaped area (gardens) the following shall apply:

- An additional 2.0m apron shall be provided in front of, and for the full width of the site (ie 4.8m depth). This will provide a safe working platform and access around latched open doors for emergency operations.

- The substation site surface is to be finished with a concrete slab (refer to drawing No. 5004).

- The 2.0m apron in front of the substation site shall be finished with a concrete slab sectioned with construction joints for ease of future removal.

6.2 Padmounted Substations in Landscaped Areas (CONT'D)
When planting vegetation in landscaped areas and gardens, ensure vegetation does not encroach on the padmounted substation site. Take into consideration the fully matured size of vegetation to allow continuing access to the site.

Ergon Energy cable conduits for the development may be placed in the substation site and shall pass down the sides of the uniculvert foundation. No conduits shall pass through or under the uniculvert foundation. Conduits shall be 750mm minimum depth below the finished surface level.

6.3 Padmounted Substations Installation in Parklands
Where the padmounted substation is located in Council Parklands, the installation shall be in accordance with the requirements of drawing No. 5010 Sheets 1 or 2. A 2.0m apron as specified in Clause 6.2 shall be provided.

7 SPACING BETWEEN PADMOUNTED SUBSTATION AND OTHER METAL OBJECTS - SEPARATE EARTHING SITES
No buildings/residences, fences, including their foundations, LV switchboard earths, or metallic objects are permitted within the clearance zone around the padmount.

Clearance to Telstra assets shall be as noted on EARTHING drawing No. 5014 Sheet 1.
NOTES:

1. The fire risk zone shown applies to the following padmount substation constructions:
   - 315 kVA
   - 500 kVA
   - 750 kVA
   - 1000 kVA

2. The fire risk zone shown applies to Building Code of Australia (BCA) class 1 & 10 buildings.

3. This drawing is indicative only. The fire risk zone extends 3.0m from the outer point of the padmount substation.

4. Easement details shown on this drawing are indicative only, actual easement size will depend on earthing arrangement and padmount substation location.

Legend:

- Fire zone

F.G.L

No other structures in this zone (unless fire protected)

Residential Boundary ✗ Substation Boundary ✗ R.P. street alignment ✗
NOTES:
1. The fire risk zone shown applies to the following padmount substation constructions:
   - 315 kVA
   - 500 kVA
   - 750 kVA
   - 1000 kVA
2. This drawing is indicative only. The fire risk zone extends 6.0m from the outer point of the padmount substation.
3. No buildings shall be in the fire risk zone unless they meet the requirements of a fire resistance surface. Refer sheet 3 for details.
4. Easement details shown on this drawing are indicative only, actual easement size will depend on earthing arrangement and padmount substation location.

No other structures in this zone unless protected
NOTES:

1. The fire risk zone shown and barrier requirements apply to the following padmount substation constructions:
   - 315 kVA
   - 500 kVA
   - 750 kVA
   - 1000 kVA

2. Fire resistance surface is a barrier or building surface having a minimum FRL 120/120/120.

3. This drawing is indicative only. The minimum size required for the fire resistant surface shall extend 6.0m from the outer point of the padmount.

4. Easement details shown on this drawing are indicative only, actual easement size will depend on earthing arrangement and padmount substation location.
NOTES:

1. Clearance radius is taken from the LV enclosure. Refer table in clause 1.5 of drawing 5000 sh 2 for required distance.
NOTES:

1. Refer drawing 5000 for installation requirements.

2. Ergon Energy's Padmount Substation site shall be levelled and surrounding area graded to ensure NO PONDING of water occurs.

3. No services other than the Ergon Energy's electric cables shall pass through this padmounted substation site.

4. Clear access to the padmounted substation shall be maintained for Ergon Energy's personnel & heavy equipment.

5. After installation is complete the site surface is to be finished with a concrete slab. (Refer drawing 5338).

6. Mature landscaping (including trees, sprinklers etc) shall not encroach onto the padmounted substation site.

7. The finished surface of the adjacent footpath, in front of the padmount cabinet, shall be level to ensure that the cabinet doors will swing into the fully open position.
NOTES:

1. Backfill Cable Pit with bedding sand and compact in place. Refer TRENCHING Drawing No. 5115.

2. Reinforced concrete surround slab:
   a) 100/125mm thick slab:
   b) 11 TM trench mesh reinforcement in centre of slab:
   c) 25 MPa grade concrete:
   d) Finish by wood float or by nylon broom.

3. The top face of the concrete surround slab shall be 100mm Min. above the final surface level (when turf is laid).

4. The concrete slab is to slope away from plinth falling at a slope of 1 in 25.

5. Cable apertures through the precast concrete plinth shall be backfilled to 50mm from the top of plinth. A 30mm deep layer of 1:16 ratio weak mix concrete shall be placed to seal aperture.

6. The surface of the surround slab may be finished with a stencil pattern surface to match the surrounding pavements of the development. (Use Textcrete or equivalent product. Construct to supplier's specifications).

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**Concrete edge beam to perimeter 150 wide x 150 deep below finished surface level.**

**Earth grid under concrete edge beam**

**Uniculvert or Pier**

**Foundation**

**Finished Ground Line**

**Cable Pit**

**Polyethylene barriers to front of apertures**

**Abelflex sealant joint between plinth and concrete slab**

**Finished Ground Line**

**Un-reinforced 100 / 125mm thick concrete slab**

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**SECTION A**

**SECTION B**

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**R.P. Street Alignment**

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**5000**

**Concrete Edge Beam**

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**Fall**

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**Fall**

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**Fall**

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**Footpath**

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**LV**

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**PADMOUNTED SUBSTATION**

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**HV**

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**Site Boundary (Level Site)**

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**Section A**

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**Finished Ground Line**

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**Backfill Cable Pit**

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**Refer note 1.**
NOTES:

1. Foundation design details are as follows:
   · Unstable soils are soft clay to sandy gravel with a soil strength of 50-150 kPa. These soil types REQUIRE a base slab as shown.
   · Stable soils are very stiff clay to shale/rock with soil strength of 150kPa or higher. These soil types DO NOT REQUIRE a base slab.
2. Lift the uniculvert and Base Slab separately with 4 x 1.3 tonnes Reid Swiftlift lifting eyes. Refer to ASSEMBLIES Page 509.
3. Position the top face of the Uniculvert at the finished ground level of the site, as detailed on the Project's Civil Construction drawings.
4. Do NOT remove the uniculvert end wall knockouts.
5. The uniculvert shall be constructed level. Under no circumstances shall it be allowed to tilt forward towards the footpath.
6. If a deep excavation is constructed under the padmounted substation cabinet and in front of the foundation then the front edge of the plinth shall be propped for the period the excavation remains open.
7. Refer drawing No. 5338 for site finish concrete surround.

<table>
<thead>
<tr>
<th>ASSY</th>
<th>DESCRIPTION</th>
<th>QTY</th>
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</thead>
<tbody>
<tr>
<td>509-1</td>
<td>Uniculvert</td>
<td>1</td>
</tr>
<tr>
<td>509-2</td>
<td>Base Slab</td>
<td>AR</td>
</tr>
</tbody>
</table>
**UNIQUE CULVERT FOUNDATION DETAILS**

Compact pit sand

**PMF11U**

Construction Type

Underground Distribution

11kV Padmounted Substations

Front Entry Type - Community Title

Unique Culvert Foundation Details

Date: 25/08/15

Passed: A. Bletchly

Drawn: T. Borg

File: 5 5553392

Dwg: 5339 Sh 2

Ergon Energy Corporation Ltd

ABN 50 087 646 062
### DEEP DRILL EARTHING:
- 35mm² bare copper cable deep drilled to moisture. (minimum of 20m unless good moisture is reached).
- A drilling rig using 75mm bit is required.
- The holes are to be refilled immediately with dry earth enhancing compound. Do not add water. The separation between earth rods shall be at least twice the depth of the drilled hole, e.g. for 20m hole separation shall be minimum 40m.

### DEEP DRILL EARTH TESTING:
- Specified earth resistance may not be achieved for some days after earthing is installed. Where specified resistance is not achieved prior to completion of work on site the installation shall be tested after 7 days and additional earthing added as necessary.

### MATERIAL - COMMON EARTH

<table>
<thead>
<tr>
<th>ASSY</th>
<th>DESCRIPTION</th>
<th>QTY</th>
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<tbody>
<tr>
<td>525-1</td>
<td>Earth padmounted substation</td>
<td>4</td>
</tr>
<tr>
<td>526-1</td>
<td>Connection grid to earth bar</td>
<td>2</td>
</tr>
</tbody>
</table>

### MATERIAL - ADDITIONAL EARTH

<table>
<thead>
<tr>
<th>ASSY</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>524-1</td>
<td>Earth rod additional</td>
<td></td>
</tr>
<tr>
<td>524-2</td>
<td>Earth rod additional depth</td>
<td></td>
</tr>
<tr>
<td>525-2</td>
<td>Earth connector additional</td>
<td></td>
</tr>
<tr>
<td>526-2</td>
<td>Earth - deep drilled</td>
<td></td>
</tr>
</tbody>
</table>

### NOTES:
1. Site grading ring on footpath shall be laid 500mm below ground. Provide orange caution tape laid 250mm below ground over grading ring.
2. Sites with high fault current may require less than 1.0 ohm connected. Refer design.
3. If the required resistance specified by design cannot be achieved when earth grid is connected to MEN then Separate LV earthing is required. Refer drawing no 5014.
4. Tails for earth mat are to be connected to substation earth bar side-by-side, but not using the same bolt.
5. Additional earth rods should be installed with minimum separation of 2 x earth rods depth from previous rods, e.g. single earth rods shall be spaced minimum 4m.

### ADDITIONAL EARTHING:
If required, locate in the Electricity Footpath Allocation at a minimum of 200mm from the R.P. Street Alignment.
- Bury at 500mm deep and provide orange caution tape laid 250mm below ground.

### SEPARATION FROM COMMUNICATIONS:
- Provide the following minimum separation to communications pillars/ cabinets, cable pits/manholes, payphones or miscellaneous earths:
  - Earth rod = 2.0m
  - Bare earth cable = 2.0m
- Provide the following minimum separation to communications cable (conduit):
  - Earth rod = 0.3m
  - Bare earth cable = 0.3m

For separation from other communications assets refer Standards Section.
1 SITE

1.1 General
The padmount substation site shall be to the satisfaction of Ergon Energy and fulfill the requirements of the subsequent clauses including:

- Be sensitive to the local environment
- Be secure from third party and environmental damage
- Be relatively flat and structurally sound
- Not be subject to tidal inundation, storm tide or flooding (1:100 year risk)
- Provide secure access for operational purposes
- Not be an obstruction or public nuisance

Along coastal areas the site must be located as far as possible from the shoreline and sheltered from salt spray.

A site should not be located where impact by traffic is likely and, if at a truncated section of the street alignment or other non regular shaped site, the specified rectangular size shall not be reduced.

1.2 Site Size
The minimum area required to accommodate a rectangular type padmounted substation shall be:

<table>
<thead>
<tr>
<th>PADMOUNTED SUBSTATION EARTHING ARRANGEMENT</th>
<th>SITE SIZE (Width x Depth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common earth locations other than community title</td>
<td>4000 x 6000 for flat site</td>
</tr>
<tr>
<td>Common earth community title and sloping sites in other locations</td>
<td>4600 x 6700 for flat site &amp; sloping site with retaining wall</td>
</tr>
<tr>
<td>Separate earth</td>
<td>12000 x 10000 for flat site &amp; sloping site with retaining wall</td>
</tr>
</tbody>
</table>

1.3 Substation Orientation
Except where not practicable, padmounted substations shall be oriented such that the LV cabinet end is facing the dedicated footpath.

1.4 Fire Risk Zone
Protection shall be provided against fire initiated or propagated by any part or element of the padmount substation. The site selection shall provide for the protection of -

- Each building adjacent to or near a padmount substation from the fire hazard originating at the padmount substation.
- Padmount substations from the fire hazards originating in the building adjacent or near the installation.

The below provides the minimum distances required for the separation of padmount substations and buildings.

- Residential buildings (BCA class 1 or 10) - 3.0m
- All other buildings - 6.0m

Drawing 5345 sh 1 & sh 2 show the fire risk zone around a padmount substation.

The separations given are the minimum and any additional separation required by the building owner or local authority shall apply.

Where the separation distance cannot be met between padmount substations and buildings, a barrier with FRL 120/120/120 shall be provided. Where a building or building surface within the fire risk zone has a minimum FRL 120/120/120 no additional barrier is required. The minimum dimensions for fire barrier is shown on drawing 5345 sh 3.

The separation required between the padmount substation and a barrier of fire rated building is 1.0m.
1 SITE (CONT'D)

1.5 EMF
The table below lists the separation distance between padmounted substations and buildings for which human occupation can be expected for significant periods of time.

<table>
<thead>
<tr>
<th>SUBSTATION SIZE</th>
<th>RESIDENTIAL</th>
<th>COMMERCIAL / INDUSTRIAL</th>
<th>SCHOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>315 kVA</td>
<td>3m</td>
<td>4m</td>
<td>4.5m</td>
</tr>
<tr>
<td>500 kVA</td>
<td>4.5m</td>
<td>5m</td>
<td>5.5m</td>
</tr>
<tr>
<td>1000 kVA</td>
<td>-</td>
<td>7m</td>
<td>8m</td>
</tr>
</tbody>
</table>

1.6 URD
The developer shall provide a padmounted substation site(s) as required by Ergon Energy at no cost to Ergon Energy. The site shall be included in the road reserve, or located on freehold property. No padmounted substations are to be located in Trustee Reserves.

a) In the Road Reserve:- The Developer shall obtain all necessary approvals from the Department of Transport or the Local Authority.
b) On Freehold property (including residential or parkland):- The Developer shall provide Ergon Energy with a registered easement at no cost to Ergon Energy.

1.7 Commercial and Industrial or Landscaped Areas
Whether the padmounted substation is for the sole use of that complex, or is required as part of the distribution network, the owner is required to grant Ergon Energy an easement for the padmounted site, access and cabling.

1.8 Parklands - for other than URD
Obtain the necessary approval for an easement to accommodate the padmounted substation, cabling and access to site.

1.9 Cabling and Access Requirement

Cabling Only
Should the cabling route not be available in conjunction with access, a 1.0m wide cable easement is required to the front of the padmount (to align with the front left side where applicable). Additionally 2.0m x 4.0m (padmount site width) is required immediately in front to allow spreading of cables for entry to the padmount and also include the buried earth cable.

Cabling and Access
A 4.0m wide easement, or road reserve, from the front of the site is required for cabling and access.

2 SITE PREPARATION

2.1 Generally
Sites shall be prepared in accordance with the included construction drawings.

2.2 Filled Sites
Sites requiring fill shall be provided with compacted fill in accordance with the following:
- For less than 300mm fill, Rolled or Compacted; or
- For greater than 300mm fill, Controlled.
as defined in AS 2870.
3 SLOPING SITES

3.1 Retaining walls
Retaining walls shall be constructed around the perimeter of the padmounted substation site where the change in round level within the boundary of the site exceeds:

- 200mm in site width
- 400mm in site length or diagonally

Retaining walls shall be:
- Constructed in 200 series concrete masonry block in accordance with AS/NZS 4455
- Outside the 4000mm width x 6000mm depth

The site size shall be increased to include retaining walls, their footings and safety fence.

Note the retaining walls & footings must be located such that the cable routes within the site and in front of the site are not altered or restricted.

Refer applicable TRENCHING folder drawings

A safety fence shall be provided on retaining wall sloping sites where the difference between ground level and the finished surface of the padmount site is 300mm or greater.

Refer drawing No. 5011

The developer shall provide a certified design from a Civil Engineer (RPEQ) for Ergon Energy’s consideration.

No special designs for wall construction shall be used without the approval of Ergon Energy.

3.2 Rural Sites Only

For padmounted substation sites in rural developments or similar where large allotments are provided and a change in ground level of 300mm or more occurs within 2m of the boundary of the site a 1:4 batter slope in lieu of the retaining wall may be allowed at the sole discretion of Ergon Energy.

On cut battered sites a concrete barrier kerb and channel shall be provided outside the 4000mm x 6000mm to ensure this area remains free of water, silt or similar that could require periodic removal or maintenances. The site size shall be extended as necessary to include the kerb and channel.

4 PADMOUNTED SUBSTATION FOUNDATION

4.1 Generally
At stable padmounted substation sites a foundation shall be constructed in accordance with the following:

- 4.1m long substation, base 800mm maximum above ground - refer Drawing No. 5280.
- 4.1m long substation, base 1400mm maximum above ground - refer Drawing No. 5276.

At coastal locations in FN Region, unless agreed otherwise by Ergon Energy, foundations shall be constructed to ensure the base of a padmounted substation is above storm surge level for that location. e.g. In Cairns city, minimum level to the base of a substation shall be AHD 3.6m (R.L. 103.600 Cairns City Council Datum 1976).

LV and/or HV Service Platforms shall be provided where the distance above site surface to top of blockwork at access doors exceeds 400mm.

4.2 Unstable Sites
Where sites are very unstable, and conventional foundation construction techniques as described in this document cannot be applied, a special design shall be required.

In such circumstances, the developer shall obtain a certified design from a Civil Engineer (RPEQ) for Ergon Energy’s consideration. No special designs for padmounted substation foundation construction shall be used without the approval of Ergon Energy.
5 BACKFILLING AND FINAL SITE FINISH

Earth, conduits and cables shall be installed prior to final site finish. All backfill of the site must be compacted before final site finish in accordance with the applicable drawing.

5.1 Common Earthing Sites

The substation 6.0m x 4.0m site surface is to be finished with interlocking masonry paving (Besser "Interlock" or equivalent approved by Ergon Energy) installed in accordance with the manufacturer's installation specification. A concrete slab shall not be provided.

5.2 Separate Earthing Sites

In addition to the requirements of Clause 5.1 the remaining ground surface between the barrier kerb (around the paving) and site extremities shall be finished in accordance with drawing No. 5177.

6 ADDITIONAL REQUIREMENTS

6.1 Commercial and Industrial Installation

The preferred location of padmounted substation sites at commercial and industrial developments is at the real property street alignment with the LV cabinet end of the padmounted substation facing the adjoining footpath.

Should the padmounted substation site be located elsewhere on the development, clear all weather access to the site shall be provided for personnel and heavy equipment at all times.

Easy access for a mobile crane must be available for the purpose of installation or replacement.

Ergon Energy cable conduits for the development may be placed in the substation site and shall pass down the sides of the foundation. No conduits shall pass through or under the foundation.

Refer Clause 5 for Backfilling and Final Site Finish.

6.2 Padmounted Substations in Landscaped Areas

When planting vegetation in landscaped areas and gardens, ensure vegetation does not encroach on the padmounted substation site. Take into consideration the fully matured size of vegetation to allow continuing access to the site.

Ergon Energy cable conduits for the development may be placed in the substation site and shall pass down the sides of the foundation. No conduits shall pass through or under the foundation.

Refer Clause 5 for Backfilling and Final Site Finish.

6.3 Padmounted Substations Installation in Parklands

Where the padmounted substation is located in Council Parklands, the installation shall be in accordance with the requirements of drawing No. 5116 Sheets 1 or 2.

7 SPACING BETWEEN PADMOUNTED SUBSTATION AND OTHER METAL OBJECTS - SEPARATE EARTHING SITES

No buildings/residences, fences, including their foundations, LV switchboard earths, or metallic objects are permitted within the clearance zone around the padmount.

Clearance to Telstra assets shall be as noted on EARTHING drawing No. 5125 Sheet 1.
NOTES:

1. The fire risk zone shown applies to the following padmount substation constructions:
   - 315 kVA
   - 500 kVA
   - 750 kVA
   - 1000 kVA

2. The fire risk zone shown applies to Building Code of Australia (BCA) class 1 & 10 buildings.

3. This drawing is indicative only. The fire risk zone extends 3.0m from the outer point of the padmount substation.

4. Easement details shown on this drawing are indicative only, actual easement size will depend on earthing arrangement and padmount substation location.

Elevation:
- Residential Boundary
- Substation Boundary

Plan:
- 3.0m
- R.P. Street Alignment
- R.P. street alignment

Legend:
- Fire zone

Alignment:
- R.P. street

No other structures in this zone (unless fire protected)

3.0m

UNDERGROUND DISTRIBUTION
22kV PADMOUNTED SUBSTATIONS
FRONT ENTRY TYPE
FIRE RISK ZONE - RESIDENTIAL
NOTES:
1. The fire risk zone shown applies to the following padmount substation constructions:
   - 315 kVA
   - 500 kVA
   - 750 kVA
   - 1000 kVA

2. This drawing is indicative only. The fire risk zone extends 6.0m from the outer point of the padmount substation.

3. No buildings shall be in the fire risk zone unless they meet the requirements of a fire resistance surface. Refer sheet 3 for details.

4. Easement details shown on this drawing are indicative only, actual easement size will depend on earthing arrangement and padmount substation location.

Legend:
- Fire zone
NOTES:

1. The fire risk zone shown and barrier requirements apply to the following padmount substation constructions:
   - 315 kVA
   - 500 kVA
   - 750 kVA
   - 1000 kVA

2. Fire resistance surface is a barrier or building surface having a minimum FRL 120/120/120.

3. This drawing is indicative only.
   The minimum size required for the fire resistant surface shall extend 6.0m from the outer point of the padmount.

4. Easement details shown on this drawing are indicative only, actual easement size will depend on earthing arrangement and padmount substation location.
NOTES:
1. Clearance radius is taken from the LV enclosure.
   Refer table in clause 1.5 of drawing 5114 sh 2 for required distance.
NOTES:

1. Refer drawing No. 5114 for installation requirements.

2. Ergon Energy's 4600 x 6700 site shall be levelled and surrounding area graded to ensure no ponding of water occurs.

3. No services other than the Ergon Energy’s electric cables shall pass through this padmounted substation site.

4. Clear access to the padmounted substation shall be maintained for Ergon Energy's personnel and heavy equipment.

5. Mature landscaping (including trees, sprinklers etc) shall not encroach onto the padmounted substation site.
NOTES:

1. For foundation, earthing, site finish and cover plate details:
   - 4.1m long substation, base 800mm maximum above ground. Refer drawing No. 5348.

2. At coastal locations in FN region, unless agreed otherwise by Ergon Energy, the base of substation is to be above storm surge level for that location. e.g. in Cairns City ONLY = AHD 3.6m (R.L. 103.600 Cairns City Council Datum 1976)

3. The padmounted substation site shall be paved. Refer drawing No. 5114.

4. Where the distance above paving to the base of substation at HV and/or LV cabinet access doors exceeds 400mm, provide service platform/s and access ladder/s. Refer drawing No. 5280.
### MATERIAL - COMMON EARTH

<table>
<thead>
<tr>
<th>ASSY</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>525-1</td>
<td>Earth padmounted substation</td>
<td>6</td>
</tr>
<tr>
<td>526-1</td>
<td>Connection grid to earth bar</td>
<td>2</td>
</tr>
<tr>
<td>513-1</td>
<td>Connection earth bar to cover plate</td>
<td>2</td>
</tr>
</tbody>
</table>

### MATERIAL - ADDITIONAL EARTH

<table>
<thead>
<tr>
<th>ASSY</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>524-1</td>
<td>Earth rod additional</td>
<td></td>
</tr>
<tr>
<td>524-2</td>
<td>Earth rod additional depth</td>
<td>AR</td>
</tr>
<tr>
<td>525-2</td>
<td>Earth connector additional</td>
<td></td>
</tr>
<tr>
<td>526-2</td>
<td>Earth - deep drilled</td>
<td></td>
</tr>
</tbody>
</table>

### MATERIAL - PLATFORM EARTH

<table>
<thead>
<tr>
<th>ASSY</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>513-5</td>
<td>Connection earth bar to service platform</td>
<td>AR</td>
</tr>
</tbody>
</table>

### DEEP DRILL EARTHING:

- 35mm² bare copper cable deep drilled to moisture. (minimum of 20m unless good moisture is reached).
- A drilling rig using 75mm bit is required.
- The holes are to be refilled immediately with dry earth enhancing compound. Do not add water.
- The separation between earth rods shall be at least twice the depth of the drilled hole. E.G. for 20m hole separation shall be minimum 40m

### DEEP DRILL EARTH TESTING:
- Specified earth resistance may not be achieved for some days after earthing is installed. Where specified resistance is not achieved prior to completion of work on site the installation shall be tested after 7 days and additional earthing added as necessary.

### NOTES:

1. Sites with high fault current may require less than 1.0 ohm connected. Refer design.
2. If the required resistance specified by design cannot be achieved when the earth grid is connected to the system MEN then separate LV earthing is required. Refer drawing No. 5125.
3. Additional earth rods should be installed with minimum separation of 2 x earth rods depth from previous rods. E.G. Single earth rods shall be spaced min 4.0m.

### ADDITIONAL EARTHING:

If required, locate in the Electricity Footpath Allocation at a minimum of 300mm from the R.P. Street Alignment.
- Bury at 500mm deep and provide orange caution tape laid 250mm below ground.

### SEPARATION FROM COMMUNICATIONS:

- Provide the following minimum separation to communications pillars/cabinets, cable pits/manholes, payphones or miscellaneous earths:
  - Earth rod = 2.0m
  - Bare earth cable = 2.0m
- Provide the following minimum separation to communications cable (conduit):
  - Earth rod = 0.3m
  - Bare earth cable = 0.3m

For separation from other communications assets refer Standards Section.
Refer sheet 3 for Section A.

Additional earthing as required.
Separation between earth rods shall be as per requirements of note 3.

1 ohm Max.
CONNECTED
(ref. note 2)

10 ohm Max.
DISCONNECTED

Earth Grid
Neutral Bar
L.V. Earth Bar
Substation Earth Bar

Earth Grid
N
MEN.

Assy 525-1
Assy 526-2
Assy selection 524-1 and 2 or 526-2
Assy 525-1 and 525-2

Site Boundary

Assy 526-1
Assy 513-1
Assy 513-5

Station Earth Bar
H.V. Earth Bar
L.V. Earth

Assy 513-5
Assy 526-1

300
300
1100
600

300

2100
400

R.P. Street Alignment

4600 boundary

6700 boundary

4 6 0 0  b o u n d a r y
Refer sheet 2 for plan view
1 CONSTRUCTION CO-ORDINATION

Co-ordination is required during foundation construction and finish of the Padmounted Substation site to ensure installation of conduit, earthing and (where required) service platforms. The Civil Service Provider is responsible for co-ordination of works, notifying Ergon Energy or other Service Provider(s), as required.

2 SERVICE PLATFORMS

Where the distance above paving to the top of blockwork at HV and/or LV cabinet access doors exceeds 400mm, provide service platform(s) and access ladder(s). Refer PADMOUNTED SUBSTATIONS dwg No. 5280 for details.

3 CONCRETE

(a) All concrete work shall be in accordance with AS 3600 & AS 2870.
(b) Concrete for footings and slabs shall be grade N20 to AS 3600.
(c) Minimum cover to reinforcement - 40mm.

4 CABLE CONDUITS


5 EARTHING CABLE PROTECTION CONDUITS

Provide 25 dia UPVC conduit at earth penetrations through 50mm thick unreinforced concrete slab.

6 DRAINAGE SLOTS

Provide approx. 5mm wide slots down to finished ground level to drain sand bedding under paving. Terminate top reinforcement bar each side of slot. On flat sites provide slots at 2m max. spacing on all sides and on sloping sites at 2m max. spacing on 'down hill' sides.

7 MASONRY BLOCKWORK

(a) Concrete blocks shall be grade 15 in accordance with AS2733 and AS3700.
(b) Mortar shall be class M3 in accordance with AS 3700.
(c) Grout shall be 20MPa at 28 days - 10mm maximum aggregate size.
(d) Concrete masonry material and workmanship shall comply with AS 3700.
(e) Masonry blocks shall be 200 series and comply with AS/NZS 4455.
(f) All cores containing reinforcement shall be grout filled. Provide an opening in bottom course to permit clean out of cell space.
(g) Vertical reinforcement to block walls shall be 1/Y12 at corners, beside openings and at 1200mm max. centres.
(h) Reinforce single course bond beam at top of wall with 2/Y12 bars horizontally.

8 ALUMINIUM COVER PLATES & SUPPORT ANGLES

Provide 3mm marine grade Aluminium cover plates fitted to Aluminium support L at (2) openings in blockwork. Obtain final dimensions on site.
22kV PADMOUNTED SUBSTATIONS
RECTANGULAR 4.1m LONG, 800mm MAXIMUM ABOVE
GROUND FOUNDATION, COMMUNITY TITLE

UNDERGROUND DISTRIBUTION

DRAWN: T. Borg
DATE: 22.09.15
APPROVED: C. Noel

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ERGON ENERGY CORPORATION LTD
ABN 50 087 646 062

FILE: 5 55 5348 2
Dwg 5348 Sh 2

NOTE:
1. Refer Note 2
2. Refer Note 6