

Roads

Master Specification

RD-EL-C3 Supply and Installation of Conduits and Pits

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RD-EL-C3 Supply and Installation of Conduits and Pits

1 General

- 1.1 This Part specifies the requirements for the supply and installation of conduits and pits for electrical and telecommunications purposes.
- 1.2 Where relevant to the Contractor's work, the Contractor shall comply with:
- a) AS/NZS 2053 Conduits and Fittings for Electrical Installations.
 - b) AS/NZS 2648.1 Underground marking tape - Non-detectable tape.
 - c) AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules).
 - d) AS/CA S008 Requirements for customer cabling products.
 - e) AS/CA S009 Installation requirements for customer cabling (Wiring Rules).
- 1.3 The following Departmental Drawings referenced in this Part are listed in Table RD-EL-C3 1-1, includes all current published amendments:

Table RD-EL-C3 1-1 DIT Standard Drawings

Drawing No	Sheet No.	Title
S-4055	34	Plastic Electrical Pit No. 7 with Concrete Covers
	35	Plastic Electrical Pit No. 8 with Concrete Covers
	36	Plastic Electrical Pit Nos. 6 & 8 (2 Lids / Pit)
	56	Road Lighting - Submersible Switchboard / Isolation Pit - Single Phase for P2 and P3 Pit Applications
	66	Plastic Pits - Non Secured Concrete Lids & Surrounds
	67	Plastic Pits & Secure Steel Lids - Class A & Surrounds
	68	Plastic Pits & Secure Steel Lids - Class A & B Surrounds
	69	Plastic Pits & Lockable Steel Lids Class A & B Surrounds
	70	Secure & Lockable Steel Lid Components
	73	Signal Controller - UPS Distribution General Layout & Interconnection Single Line Diagram

- 1.4 The Department's Technical Standards and Guidelines including above drawings are available from the following web site: <https://www.dpti.sa.gov.au/standards>.
- 1.5 Where this Part specifies a higher standard than that required by the above Australian Standards, the requirements of this Part will take precedence.

2 Compliance with Legislation

- 2.1 The Contractor shall comply with:
- a) Plumbers, Gas Fitters and Electricians Act 1995 (SA); and
 - b) Electricity Act 1996 (SA).
- 2.2 The Contractor's attention is drawn to Section 12 "Licensed contractor's work to be carried out by registered worker" and Section 13 "Obligation of workers to be registered" of the Plumbers, Gas Fitters and Electricians Act.
- 2.3 Pursuant to Section 61 "Electrical Installation Work" of the Electricity Act, the Contractor shall provide an electrical certificate of compliance, signed by a registered worker authorised to carry out such work, that the installation of the conduit and pits comply with the Electricity Act 1996.
- 2.4 Provision of the certificate of compliance shall constitute a **Hold Point**.
- 2.5 Works incorporating conduits for communications cabling shall comply with the applicable Australian Communications and Media Authority (ACMA) standards.

3 Materials

Pits

- 3.1 Pits shall be made of materials that are capable of being buried in soil without adverse effects. Pits made from plastic or polycarbonate materials are acceptable. Plastic materials shall be UV stabilised. Pits and covers shall provide sufficient strength to support a wheel loading of at least one tonne without any visible damage, including to the underside of the lid.
- 3.2 Pits shall be made to the approximate dimensions shown on Drawing No. S-4055 Sheet 66-69.

Pit Covers

- 3.3 Pit covers shall:
 - a) be made of reinforced concrete, keyed steel or other suitable materials with appropriately positioned lifting holes;
 - b) be tapered to facilitate easy removal (with tools) and replacement of covers;
 - c) where specified, be of secure construction such that it is not possible to remove covers without the use purpose designed tools. Secure lids shall be fabricated as detailed on Drawing S-4055 Sheet 67 and 68;
 - d) incorporate a permanent non-slip pattern on the top, created by means of casting, engraving or moulding;
 - e) be designed such that ground water can escape without removing the cover and prevent the entry of soil or any other objects; and
 - f) fit flush with the pit and the pit surround when a gasket is installed.
- 3.4 All covers shall be marked with the State logo and the following:
 - a) "ELECTRICAL" or similar where the pits houses electrical power and / or control cabling; or
 - b) "COMMUNICATIONS" or similar where the pits houses communications cabling.
- 3.5 The markings shall be marked permanently on the top of the cover by means of casting, engraving, etching moulding or similar means in a clearly legible size and font. The method of marking shall be selected so as to remain legible, and to resist damage from abrasion and UV.

Conduit

- 3.6 Unless otherwise specified, electrical conduits shall be heavy duty rigid PVC conduit to AS 2053, colour orange for underground cable and UV stabilised for above ground. Communications conduits shall conform to ACMA and / or other relevant standards. Communications conduits shall be white and compliant with AS/CA S008. Flexible conduits shall not be used without the prior approval of the Principal. Minimum depths of cover within rail boundaries shall comply with the Table RD-EL-C3 8-1
- 3.7 Separation and size of Conduits shall comply with RD-EL-D3 "Conduit Design for Road Lighting, Traffic Signals and ITS".

Marking Tape

- 3.8 Marking tape shall comply with the requirements of AS 2648.1.
- 3.9 Marking tape shall be installed in accordance with AS3000 (electrical) and / or AS/CA S009 (communications), as appropriate.

Concrete conduit protection

- 3.10 Concrete shall be minimum grade N20.

4 Design of Conduits and Pits

- 4.1 If any details relating to the location and size of conduits and pits have not been provided by the Principal, the Contractor shall prepare a conduit system design in accordance with RD-EL-D3 "Conduit Design for Road Lighting, Traffic Signals and ITS".
- 4.2 At least 10 working days prior to the commencement of supply and / or installation of conduits and pits, the Contractor shall provide the Conduit System Design, including complete details of the location and size of conduits and pits.
- 4.3 Provision of this documentation shall constitute a **Hold Point**.

5 Trenching, Boring and Backfill

- 5.1 Excavation and backfill of trenches shall comply with RD-EW-C2 "Trench Excavation and Backfill".
- 5.2 Under-road boring shall comply with RD-EW-C3 "Boring".
- 5.3 Reinstatement of any existing pavements to be retained shall comply with RD-PV-C6 "Reinstatement of Existing Pavements".
- 5.4 All work associated with the installation and / or removal of conduits and pits shall be completed prior to the construction of any new road pavement.

6 Installation of Electrical Conduit

General

- 6.1 Conduits shall be laid out in straight lines avoiding unnecessary bends and generally parallel or normal to the carriageway.
- 6.2 Variations in levels or changes in direction of underground ducts shall be achieved by using the natural flexibility of the conduits. Where this is not possible, the use of 45° sweep bends is permitted with radius of 580 mm for 80 mm diameter conduits and 320 mm radius for 50 mm diameter conduits.
- 6.3 "Large sweep" bends shall be used to provide entry into junction pits and light pole footings. No more than 180° total change of direction is permitted in any run of conduit between pits.
- 6.4 Conduit joints shall be thoroughly cleaned of dirt and grease and burrs removed where any conduit is cut to length, before being cemented together using a solvent cement approved by the conduit manufacturer.
- 6.5 Draw cords shall be installed in all electrical conduits and be continuous and without joints for the full length of the conduit. A 1 m length "tail" shall be provided at each end of the draw cord. Tails shall be coiled, secured and neatly laid in the relevant area. Draw cords shall be 4 mm diameter polyethylene mono rope with a breaking load of 5 kN. A draw chord shall remain in a conduit following installation of cables.

Cover

- 6.6 Notwithstanding AS 3000, the cover for conduits without additional protection shall be a minimum of 500 mm and a maximum of 800 mm below finished level. Conduits shall be installed at a uniform depth. Where the existence of public utility services, other underground obstructions or ground conditions restrict the laying of conduits to less than 500 mm cover, the conduits shall be encased in concrete in accordance with AS 3000 or as approved by the Technical Regulator.
- 6.7 Prior to pouring concrete, a **Hold Point** shall apply.

Termination of Conduits in Pits or at Stobie Poles

- 6.8 The hole for the entry of the conduit shall be neatly drilled to a maximum of 10 mm larger than the outside diameter of the conduit and shall be effectively sealed with a flexible sealant (Selleys All Purpose Sealant or similar). Where possible, bell mouths shall be fitted to the entry and exit of every

- conduit, including intermediate points, prior to the commencement of cable installation and shall remain in place after installation.
- 6.9 For intermediate pits (i.e. pits which will have cable running through them but that cable will not exit the conduit system), the entry and exit conduits shall align as much as possible.
 - 6.10 For terminating pits (i.e. pits where the cable exits the conduit system and terminates inside above ground equipment), the ends of conduits shall enter at 45° and protrude into the pit for a minimum of 25 mm and a maximum of 50 mm to facilitate drawing-in of cables.
 - 6.11 The ends of conduits at post footings shall terminate 25 mm inside the recess in the concrete footing.
 - 6.12 Where the conduits are to be connected into an SAPN underground service pit, the hole for the entry of the conduit shall be neatly drilled to a maximum of 10 mm larger than the outside diameter of the conduit or as specified by SAPN.
 - 6.13 Where conduits are attached to stobie poles, the installation of 50 mm diameter conduit in the stobie pole channel or the face of the stobie pole shall be mechanically protected with galvanized pipe as shown on Drawing No. 4516, sheet 1. Bending of the galvanized pipe shall not be permitted after the 50 mm PVC conduit has been inserted.

Additional Requirements for Consumer Connections

- 6.14 Conduits shall be the diameter shown on the SAPN Drawing and laid in accordance with the Drawings.
- 6.15 Low voltage conduits shall be terminated in low voltage service pillars as shown on the Drawings and the following SAPN Drawings:
 - a) E1921 - UD LV Service or Junction Pit, Looped, Footpath Use.
 - b) E1922 - UD Low Voltage - Service Pillar – Looped.
- 6.16 The Contractor shall contact SAPN Utilities to obtain copies of these drawings.

7 Installation of Electrical Pits

General

- 7.1 The Contractor shall install all cable draw-in pits, intermediate and junction pits as necessary for the work.
- 7.2 Notwithstanding any drawing showing a formed pit, pits shall comply with Clause 3 "Materials". All pits shall be minimum size P2, unless shown otherwise on the drawings or otherwise approved by the Principal.
- 7.3 Pits shall be installed with the long dimension oriented in the direction of the main conduit run.
- 7.4 Prior to backfilling, covers shall be fitted and visually checked to ensure that the pit is parallel to the edge of the footpath, kerb or property boundary, and is flush with the surface of the surrounding footpath, or is built-up at a maximum grade of 1:14, to conform to the fall of the footpath.
- 7.5 Pits shall be bedded in Sa-C Type C sand. Sand shall be compacted following the pit manufacturer's recommended procedures and practices. Pit sides shall be checked before and after compaction. No inward bowing of pit sides is acceptable. Temporary bracing shall be used in pits as required to prevent bowing of sides during compaction.
- 7.6 Pits shall be surrounded with a reinforced concrete apron of minimum 100 mm thickness and width (measured from each pit side). The edges of the apron shall be finished with an edging tool. Where multiple pits are installed together (e.g. Comms and Electrical), a shared apron may be used. At least 100 mm spacing shall be provided between pits to allow the installation of the shared concrete apron between pits.
- 7.7 A template constructed of timber (or other suitable material) slightly larger in size than the pit lid shall be installed in the top of the pits (in place of the lid) prior to pouring the concrete apron, to prevent the pit edges bowing in during pouring / curing of the concrete apron.

- 7.8 Pit lids shall be checked for proper fit before and after pouring the concrete apron. Pits where lids do not fit correctly shall be rectified prior to inspection / handover.
- 7.9 Pits shall be set flush with the finished level of the surrounding area, which shall be shaped so that water does not pond within 1 m of the pit.
- 7.10 All debris inside the pit shall be cleaned up and cleared at completion of the pit and conduit installation, replacement or upgrade.

Locations for Electrical Pits

- 7.11 In addition to the locations specified on the drawings, pits shall be installed as per RD-EL-D3 "Conduit Design for Road Lighting, Traffic Signals and ITS".

Drain Outlet

- 7.12 When a suitable drainage point is located near a pit, the Contractor shall drill a central drain outlet in the base of the pit and install a 50 mm PVC "stormwater" class drainpipe so that any water flows into the drainage point.

Underground Service Pit for Signal Controllers

- 7.13 Where practicable, the underground service pit shall be installed at a minimum distance of 5 m from the signal controller base in footpaths, islands or medians as located during layout of footings and pits and installed as per Drawing No. S-4055, sheet 73. Underground service pits shall not be located in painted islands / medians.

8 Installation of Telecommunications Conduit

- 8.1 Telecommunications conduit shall comply with the requirements specified in AS/CA:S008 and shall be installed in accordance with the requirements of AS/NZS:S009 Section 18 Underground Cabling.
- 8.2 Telecommunication conduit shall be located at least 450 mm below the natural ground where located in the road reserve and shall be laid out in straight lines avoiding unnecessary bends and generally parallel or normal to the carriageway. The conduit shall be able to be identified in the field as the property of the Department.
- 8.3 If the minimum cover cannot be provided (e.g. due to ground conditions), the conduit shall be installed in accordance with AS/CA S009 Para 18.6.2. Where this is required, the Contractor shall obtain the approval of the Principal's authorised representative for the proposed installation method PRIOR to installing the conduit. Provision of the Principal's approval shall constitute a **Hold Point**.
- 8.4 Minimum depths of cover within rail boundaries shall comply with the Table RD-EL-C3 8-1.

Table RD-EL-C3 8-1 Minimum Cover below Rail Level

Line Category	Cover below rail level (metres)
Main Lines	1.2
Secondary Lines	1.0
Elsewhere	0.6

- 8.5 In all cases, minimum cover depths shall be maintained to a minimum distance of 3 m measured perpendicular to the outer rail.
- 8.6 Notwithstanding the maximum number of bends specified in AS/CA S008, the Department requires that no more than 90 degrees total bends (cumulative in all directions) shall occur between pits. If direction changes totalling more than 90 degrees are required, additional pits shall be installed to facilitate the direction changes.
- 8.7 ONLY if it is not possible nor practical for any reason to comply with para 8.6, up to a maximum of 3 90 degree bends may be used. In this case, all bends shall be encased in concrete to prevent hauling ropes / draw cords / cables from "burning" through the conduit and becoming trapped. Prior approval from the Principal for a departure from para 8.6 shall be obtained through the design review process. Such departures shall be recorded on the project's Non-Conformance Register.

- 8.8 Bends shall be accomplished using pre-manufactured “sweeper” (large-radius) bends matching the conduit size and type. Flexible conduit shall not be used for underground conduit connections.
- 8.9 Where practical, direction changes may be accomplished by curving the conduit in the ground to a curvature radius of no less than 130 times the conduit diameter. This shall not constitute a bend for the purposes of clause 8.8 above.
- 8.10 “Bell” ends shall be fitted to all conduit terminations within pits, and shall remain installed after cables are hauled. Bell ends shall be glued to the conduit using an appropriate conduit adhesive.
- 8.11 Draw cords shall be installed in all communication conduits and be continuous and without joins for the full length of the conduit. A 1 m length “tail” shall be provided at each end of the draw cord. Tails shall be secured in the pit at each end of the run, to avoid being inadvertently pulled back into the conduit from the other end. Draw cords shall be 4 mm diameter polyethylene mono rope with a breaking load of 5 kN. A draw cord shall remain in a conduit following installation of cables. As per RD-ITS-C3 “Telecommunications Cabling”, draw cords shall not be used to haul cables – they shall rather be used to haul through a purpose-designed braided hauling cable.
- 8.12 White marking tape compliant with AS/NZS 2648.1 shall be installed along all communications conduit installations at a minimum of 100 mm above the conduit, or in accordance with section 10 below in the case of a shared services trench.

9 Installation of Telecommunication Pits

General

- 9.1 Telecommunications pits shall be installed in accordance with (as a minimum) the requirements of AS/CA S009 Section 18 “Underground Cabling”.
- 9.2 Pits shall be bedded in Sa-C Type C sand. If electricity cables pass underneath the communications pit, a protective concrete slab shall be provided underneath the pit before placing the bedding sand. Alternatively a self-compacting material, such as stabilised sand, can be used to backfill.
- 9.3 Prior to backfilling, covers shall be fitted and visually checked to ensure that the pit is parallel to the edge of the footpath, kerb or property boundary and is flush with the surface of the surrounding footpath, or is built-up at a maximum grade of 1:14, to conform to the fall of the footpath.
- 9.4 Sand shall be compacted following the pit manufacturer’s recommended procedures and practices. Pit sides shall be checked before and after compaction. No inward bowing of pit sides is acceptable. Temporary bracing shall be used in pits as required to prevent bowing of sides during compaction.
- 9.5 Pits shall be surrounded with a reinforced concrete apron of minimum 100 mm thickness and width (measured from each pit side). The edges of the apron shall be finished with an edging tool. Where multiple pits are installed together (e.g. Comms and Electrical), a shared apron may be used. At least 100 mm spacing shall be provided between pits to allow the installation of the shared concrete apron between pits.
- 9.6 A template constructed of timber (or other suitable material) slightly larger in size than the pit lid shall be installed in the top of the pits (in place of the lid) prior to pouring the concrete apron, to prevent the pit edges bowing in during pouring / curing of the concrete apron.
- 9.7 Pit lids shall be checked for proper fit before and after pouring the concrete apron. Pits where lids do not fit correctly shall be rectified prior to inspection / handover.

Location of Pits

- 9.8 At a minimum, pits shall be located mid-block (between major intersections), at transverse connections, and at all major intersections / junctions. Pits shall be installed at the splice point between transverse and longitudinal connections of conduit.
- 9.9 Unless shown otherwise on the drawings, the pit location shall be designed in accordance with RD-EL-D3 “Conduit Design for Road Lighting, Traffic Signals and ITS”.

- 9.10 Wherever there is a possibility that water could drain into pits, water shall be drained to low points en route and conduit plugs shall be used to seal vacant conduits.

10 Electrical Trench Caution Tape and Cable Position Marker Posts

- 10.1 Plastic tape marked "Electrical Cable" or "Telecommunications Cable" shall be laid along the full length of all conduit trenches, 300 mm above the conduit, unless otherwise specified. More than one tape shall be laid in trenches wider than 500 mm. Orange cable slabs may be used as an alternative to the tape.
- 10.2 Electrical cable position marker posts, with identification plate indicating alignment direction, shall be installed at changes of direction and not more than 200 m apart and in accordance with Attachment A: "Buried Cable Warning Sign Post Details and Installation" and Attachment B: "Buried Power Cable Warning Sign".
- 10.3 Intermediate cable position marker shall be installed for fibre optic cable conduits.

11 Verification of Conduit Condition

- 11.1 Unless specified otherwise, the Contractor shall undertake an internal inspection of all conduit (including conduit designed to incorporate additional cable(s) at a later stage). The inspection shall use video camera, borescope or similar equipment. It shall be undertaken after the completion of all construction work directly above the conduit and provide documentary evidence that the conduit and cables have not been damaged during installation or by subsequent construction work.

12 "As-Constructed" Drawings

- 12.1 Upon completion of the work, the Contractor shall provide to the Principal "As-Constructed" drawings showing in detail the actual location and depth of conduits and pits, size of cabling, and any other relevant data on the base construction drawings.

13 Hold Points

- 13.1 The following is a summary of Hold Points referenced in this Part:

Document Ref.	Hold Point	Response Time
2.4	Certificate of compliance	5 working days
4.3	Provision of conduits and pit sizes and locations	10 working days
6.7	Prior to pouring concrete	1 working days

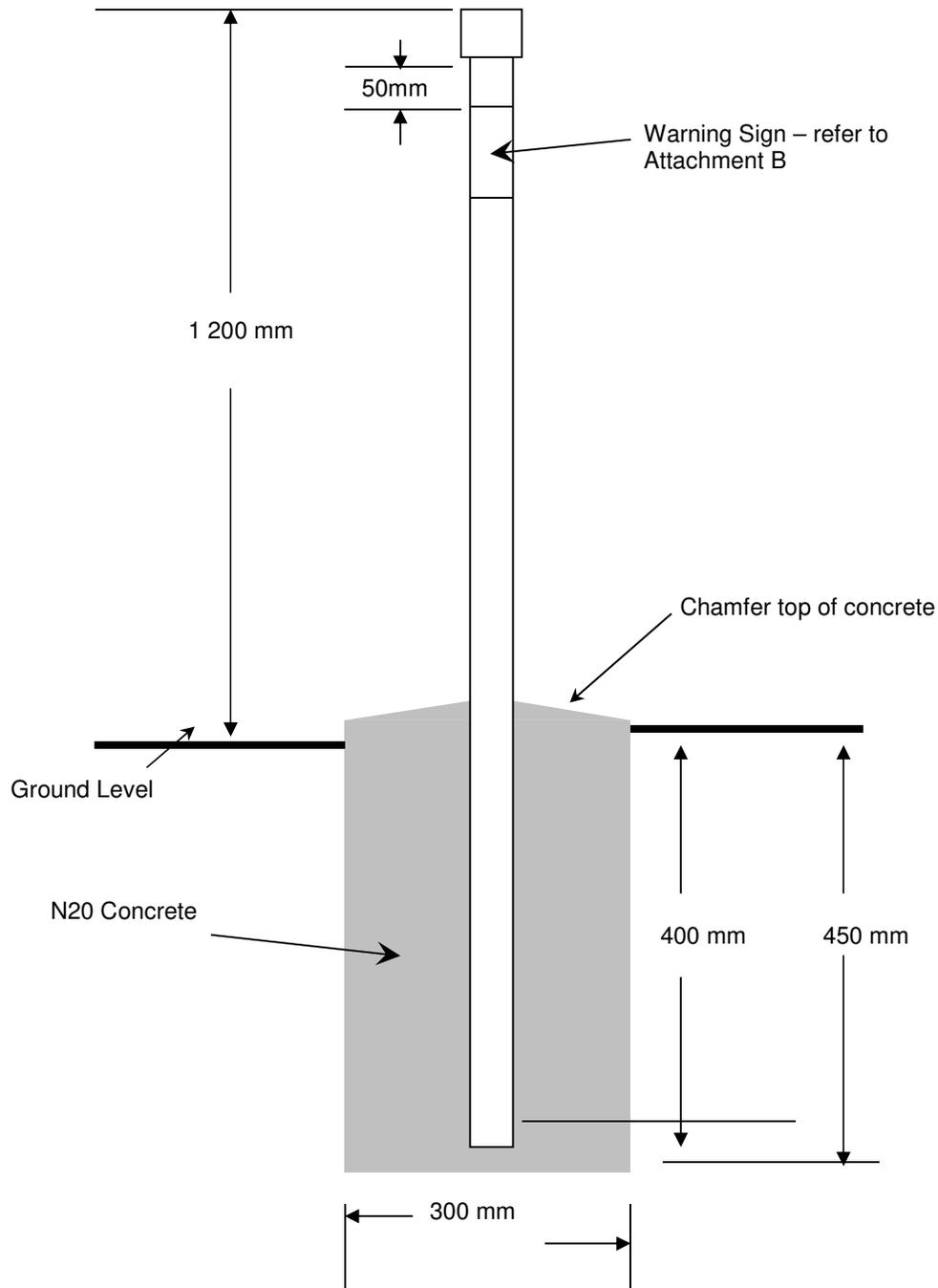
14 Verification Requirements and Records

- 14.1 In addition to any documentation provided at the Hold Points, the Contractor shall supply the following records:

Table RD-EL-C3 14-1 Verification Requirements

Document Ref.	Subject	Record to be Provided
11	Verification of Conduit Condition	Video file showing inside of conduit
12	Conduit and pit location	As-Constructed Drawings

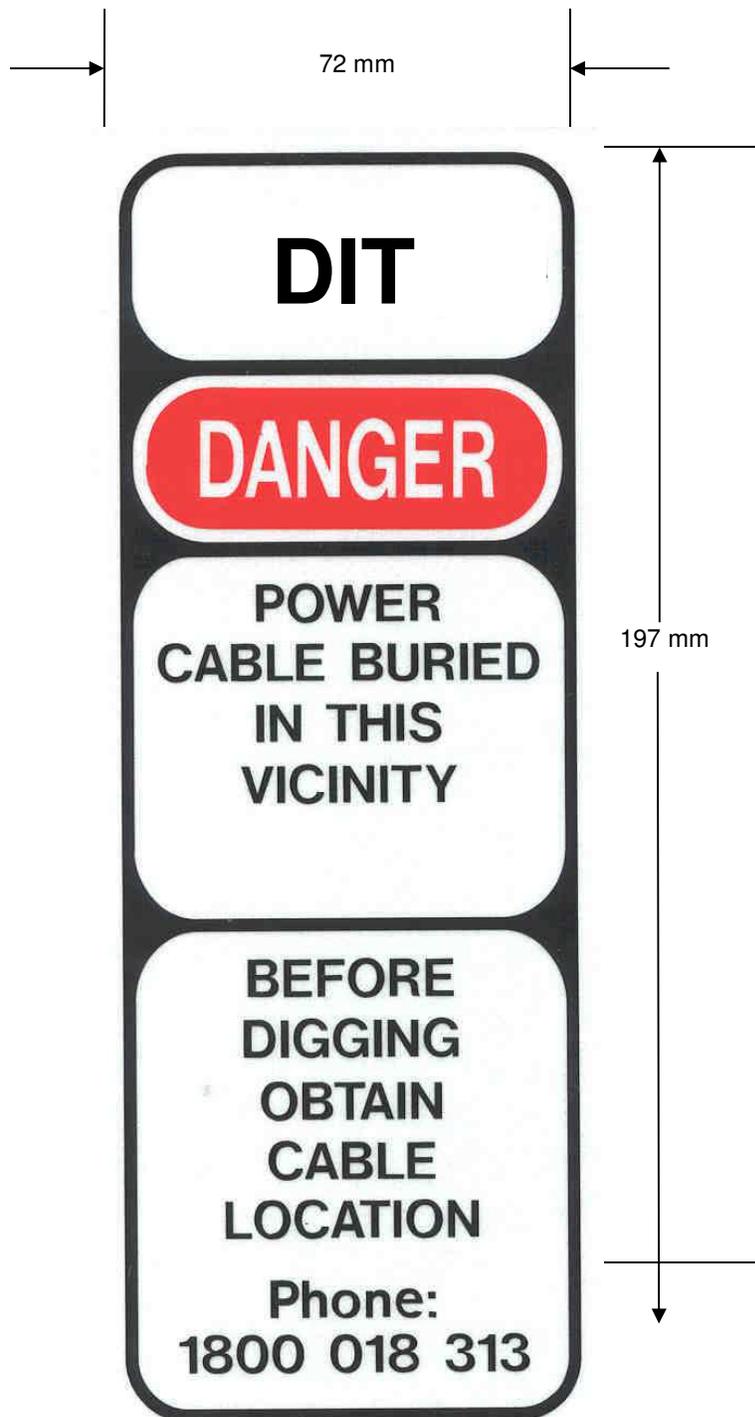
15 Appendix 1: Buried Cable Warning Sign Post Details and Installation



Note:

1. Sketch for illustration only – not to scale.
2. Capped steel post, 60 mm O/D, wall thickness 2 mm.
3. "Signal Red" powder coated finish over full length of post.
4. Posts to be located as shown on drawings.

16 Appendix 2: Buried Power Cable Warning Sign



Note:

1. Background is reflective white.
2. The word DANGER is surrounded by red.
3. All other lettering and borders are in black.