Conduit Technical Standard

Procedure Number EN 4.04 P04

1. Scope

To state the technical standards for power and streetlight cable conduits.

2. Purpose

These standards apply for the installation of power and streetlighting conduits by developers and ActewAGL personnel.

3. Procedure

3.1. Conduit Location

In major private developments and new suburb developments ActewAGL will provide a drawing or will approve a developer’s drawing detailing the numbers, size, location and types of all conduits required together with cable jointing pits if necessary.

3.2. Conduit Location

Conduits shall comply with:

- AS2053 Conduits and fittings for Electrical Installations
- AS3000 SAA wiring rules
- AS1477 Unplasticized PVC (UPVC) Pipes and fittings for pressure applications
- AS1074 Steel Tubes and Tubulars.

All insulating conduits shall be coloured light orange.

All metal conduits shall be galvanized to comply with AS1650.

3.3. Conduit Location

The following are standard sizes and strengths used by ActewAGL.

- 32mm medium or heavy duty insulating conduit to AS2053.2
- 25mm medium duty galvanized steel tube (water pipe) to AS1074
- 50mm medium or heavy duty insulating conduit to AS2053.2
- 40mm medium duty galvanized steel tube (water pipe) to AS1074
- 100mm medium or heavy duty insulating conduit to AS2053.2
- 100mm class 9 or class 12 pressure pipe to AS1477
- 100mm medium duty galvanized steel tube (water pipe) to AS1074
- 125mm medium or heavy duty insulating conduit to AS2053.2
- 125mm class 9 or class 12 pressure pipe to AS1477
- 125mm medium duty galvanized steel tube (water pipe) to AS1074
- 150mm medium or heavy duty insulating conduit to AS2053.2
- 150mm class 9 or class 12 pressure pipe to AS1477
- 150mm medium duty galvanized steel tube (water pipe) to AS1074

- AS2053.2 refers to Rigid plain conduits of insulating material
- Insulating materials include Unplasticized PVC (UPVC)
- Conduits to AS2053.6 – Profile wall, smooth bore conduits are not acceptable
3.4. **Conduit Location**

A marker tape shall be installed above the following conduits:

- Heavy duty conduits to AS2053.2
- Class 12 pressure pipes to AS1477; and
- Medium duty galvanized steel tubes (water pipe) to AS1074

The marker tape shall be placed a minimum of 200mm above the conduit and shall conform to AS2648.1, be of minimum width 150mm and coloured light orange with black lettering stating “DANGER ELECTRIC CABLES”.

3.5. **Conduit Location**

Additional mechanical protection shall be installed with the following conduits:

- Medium duty conduits to AS2053.2; and
- Class 9 pressure pipes to AS1477

The additional mechanical protection shall be:

- Precast concrete slabs or electric bricks with the word “ELECTRIC” indented in letters 25 mm high and complying with the requirements of AS3000; or
- 75 mm of poured 15MPa concrete; or
- Polymeric cable cover strip of a material equivalent to conduit to AS2053.2 and having a thickness not less than 3 mm, and installed in accordance with AS3000.

The mechanical protection shall be placed not more than 75 mm above the conduit, shall be not less than 150 mm wide and shall overlap the conduit or conduits by at least 40 mm.

Where polymeric cable cover strips are used, marker tape as discussed in Section 3.4 Marker Tape is not required.

3.6. **Conduit Location**

Conduits installed by boring do not require a marker tape or additional mechanical protection. However, the depth to the top of the conduit must be a minimum of 750mm where high voltage cables are proposed to be installed and 600mm for low voltage and service cables.

Any bore pipes are to have an internal diameter equivalent to the internal diameter of conduit specified. All relevant conduit to bore pipe connections are to be made in a trade-like manner using commercially available connectors that ensure a water tight seal is made.

3.7. **Conduit Location**

The following drawings are relevant to these standards:

- Drg 8912-02 Underground Service Conduit Requirements.
- Drg 390-002 Conduit Installation Roadways and Driveways.

These drawings are included in this procedure.

3.8. **Minimum Invert Levels**

50/40mm Service conduits within the lease boundaries shall have an minimum invert level of 600mm below the finished surface level and at the front boundary the minimum invert level shall be 850mm below finished surface level.

Street lighting conduits, as specified by ActewAGL Design Officer, when laid in separate trench shall have an invert level of 600mm below the finished surface level.

All other conduits shall have a minimum invert level of 950mm below the finished surface level, including the level of roads. At all times the electrical conduits shall pass under gas lines and there shall be a minimum separation clearance of 150mm between the electrical conduits and the gas line.

Conduits shall not be installed to a depth greater than 1.5 metres without prior approval from ActewAGL’s Design Officer. In no circumstances shall the ends of the conduits be at a depth such that an excavation greater than 1.5 metres is required to install cables into the conduits. This requirement is to avoid shoring
of trenches.

For conduits installed by boring refer to Section 3.6 *Conduits Installed by Boring*.

### 3.9. Conduits Under Roadways

Conduits under roadways shall Design at least 1000mm beyond kerb, roadway edge, property line and/or obstructions. Obstructions include all gas lines, Telstra plant, water mains, storm water mains, pram crossings and footpaths.

50/40mm conduits under roads shall be laid from the ActewAGL electrical trench alignment, on one side of the carriageway, to the property boundary on the other side of the road. The invert of the conduit and the separation clearance between the conduit and any gas line shall be in accordance with Section 3.8 Minimum Invert Levels.

### 3.10. Town House Developments

At minipillar locations within Town House style developments there shall be a minimum clearance around the minipillar location of 1200mm for all other services such as all gas lines, Telstra or other communications plant and hydraulic services.

Where the conduits are to be laid in a common trench arrangement with other hydraulic service pipes, the conduits shall be laid such that there is no other service above the electrical conduit/s and a minimum separation of 300mm between the electrical conduit/s and the closest hydraulic service pipe.

### 3.11. Draw Wire

All 50/40mm conduits shall be provided with a continuous galvanised steel draw wire of 1.5mm minimum diameter.

Each conduit run of 30m or longer of 100mm diameter or larger shall be provided with a galvanised steel draw wire of 2.5 Minimum diameter (equivalent to 12 SWG).

### 3.12. Conduit Installation General

Metal conduits and fittings shall have no internal burrs or other Designions.

Conduit ends shall be plugged or capped with a non-perishable cover to prevent the entry of foreign material. The plugs or caps are to be fitted such that dislodgment prior to cable installation is prevented.

All conduit runs between cable jointing pits shall be straight as far as possible. Where conduits are to be installed on curves, these shall be assembled in several lengths before attempting to form large radius bends. (See Section 3.14 Bends and Bending Radii).

Maximum conduit run length between the cable jointing pits shall not exceed 200m.

Vehicular access is required to cable jointing pits.

### 3.13. Recommended maximum number of cables in conduits

Refer to Appendix A for two matrices detailing the maximum number of cables of varying sizes recommended to be put inside the conduits specified.

### 3.14. Drainage of Conduits

Where the ground level at the street end of a conduit is above the floor level of the building in which the conduit terminates, a drain shall be provided from the conduit to ensure the conduit is drained and water does not enter the switchboard. One of the following methods shall apply:

- Where the conduit rises on the outside of the building the drain shall be in the form of a 10mm diameter hole in the conduit, arranged to point towards the wall approximately 300mm above ground level so that the entry of water and debris is minimised.

- Where the conduit is not on the outside of the building, a 15mm PVC pipe shall be solvent-welded into the conduit without protruding into the bore. It shall be arranged to discharge to the
exterior of the building, approximately 300mm above ground level.

- A special drainage pit may be required in some cases such as an indoor substation etc. ActewAGL’s Design Officer is to be contacted in the first instance for details.

**3.15 Bends and Bending Radii**

Unless otherwise specified, the sum of conduit bend angles shall not exceed 90 degrees in a single run. A common exception is where each end of the conduit is turned up into street lighting columns.

Bending radii shall not be less than:
- Nominal 32/25 conduit - 250mm.
- Nominal 50/40 conduit - 450mm.
- Nominal 100, 125 and 150mm conduit - 1200mm.

**3.16 Conduit Marking**

Where Conduits are laid under existing kerbed roads, their location shall be marked by means of a Ramset nail driven into the kerb face directly above the centre of the conduit(s) with a disc or plate with “ActewAGL Electrical” stamped on it.

Conduits under kerbed roads in new development areas shall have their location marked by means of a 100mm high “E” stamped into the kerb face directly above the centre of the conduit(s).

In Town House style developments, following conduit inspection and subsequent backfilling of conduits terminating at property line or open spaces, a marker peg shall be provided to indicate the end of the conduit. This peg shall be labelled clearly with the letter “E”. Prior to the installation of underground cables, the developer shall expose the conduit ends.

**3.17 Conduit Inspection**

**3.17.1 General**

All conduit installations are subject to inspection by ActewAGL Design Officers. A minimum of 24 hours notice must be provided to ActewAGL’s Design Officer to arrange the conduit inspection.

ActewAGL will not undertake the installation of underground permanent cables on site until the conduit installation has met with its approval and an “As-Executed” plan or sketch has been provided by the builder/developer detailing the location of the conduit(s). A copy of the plan shall also be located within each main switchboard or meter box for each unit.

**3.17.2 Private Developments**

ActewAGL’s Design Officer will provide the builder/developer with the original copy of the “Conduits/Substations Inspection Report” (Form EW886) that will indicate whether the conduit installation is in accordance with the Conduit Requirements drawing and these standards or not. This report will also indicate the extent of defects etc.

Subsequent inspection will be necessary until the conduit installation meets ActewAGL’s approval.

**3.17.3 Suburb Developments**

Upon completion of the conduit installation written advice of this is to be forwarded to ActewAGL so that conduit marks may be inspected and recorded.

Where conduit marks have been omitted the contractor shall prove that the relevant conduits exist and shall provide the marks as required.

The developer shall expose the ends of any conduits if so required by ActewAGL.

Where excavation fails to prove the existence of conduits the developer shall be responsible for the installation of the missing conduit(s) and all reinstatement of the excavated area/s.

If bitumen or concrete surfaces are to be excavated, by ActewAGL, for conduit repairs or to install missing conduits, within the normal 12 month liability period, the developer is responsible for the reinstatement of
the excavated surface. The developer is also responsible for all relevant permit approvals.

3.18. **Communications**

Conduits required for communications purposes shall be of nominal size 100mm (bore) and conform to one of the following:

- UPVC self supporting pipe 4.5metre length, medium duty, minimum ID 100mm, minimum wall thickness: 4mm, colour: white.
- Rigid, UPVC, profile wall, smooth bore, "Corflo Telstra or other communications Ducting" conduit, mean OD 114mm, colour: white.

1. **Definitions and abbreviations**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>UPVC</td>
<td>Unplasticised Polyvinyl chloride</td>
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2. **Responsibilities**

<table>
<thead>
<tr>
<th>Position</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Standards Manager</td>
<td>Approves changes and specification of procedure</td>
</tr>
<tr>
<td>Design officers</td>
<td>Implementation of procedure</td>
</tr>
<tr>
<td>Developers</td>
<td>Adherence of procedure</td>
</tr>
</tbody>
</table>

3. **Legislation and compliance**

- AS2053 Conduits and fittings for Electrical Installations
- AS3000 SAA wiring rules
- AS1477 Unplasticized PVC (UPVC) Pipes and fittings for pressure applications
- AS1074 Steel Tubes and Tubulars.

Compliance Guides

HSE-CG-030 HSE Aspects of Design and Development

ISO 9001 Section 7.3  
ISO 14001 Section 4.3.1  
AS/NZS 4801 / OHSAS 18001 4.4.6

4. **Related documents**

- Form EW866 Conduits/Substations Inspection Report

*Form EW 866 is a printed Form and is available from Oracle iProcurement*

5. **Document control**

<table>
<thead>
<tr>
<th>Version</th>
<th>Author/Editor</th>
<th>Description of changes</th>
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<td>2</td>
<td>R Goggin</td>
<td>Updated into new format</td>
<td>Branch Manager Technical Regulation and Standards 31 January 2013</td>
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NOTES

1. All points of entry & conduits routes shall be determined by the service marker or as shown on the approved building plan or approved conduit request drawing.

2. The conduit shall terminate at the property line.

3. A marker peg shall be provided to indicate the end of the conduit.

4. Conduit ends shall be plugged or capped to prevent the entry of foreign material.

5. The conduit shall enter the meter box as indicated on this drawing.

6. A continuous galvanised steel drain wire of 2.5mm minimum dia shall be provided in each conduit.

7. The minimum conduit bending radii shall be 650mm elbows must not be used.

8. The sum of conduit bend angles shall not exceed 50° in a single run.

9. The meter box shall have sufficient space for three services fuses.

10. The pipe and meter box shall be insulated from the timber frame with damp-proof material as required by the relevant authority.

11. The conduit shall be 50mm dia and shall be category "A" heavy duty rigid orange conduit to AS2825.

12. See drawing 8912-03 for drainage details where required.

13. Conduit to connect to existing ActewAGL conduit, otherwise 950mm Min - 1000mm Max cover.

CADD

STANDARD DRAWING

UNDERGROUND SERVICE
CONDUIT REQUIREMENTS

A4  8912-02
NOTES:
1. A ROAD OPENING PERMIT MUST BE OBTAINED PRIOR TO EXCAVATION.
2. CONCRETE TO BE INSTALLED IN ACCORDANCE WITH ACY CONSTRUCTION DESIGN SPECIFICATIONS.
3. BACKFILL TO BE CRUSHED ROADBASE OR EQUIVALENT AND COMPACTED IN ACCORDANCE WITH ACT PUBLIC WORKS BASIC SPECIFICATION.
4. CONCRETE DRIVEWAYS TO BE REPAIRED AS SOON AS POSSIBLE AFTER TRENCH BACKFILL IS COMPLETE. EXPANSION JOINT STRIPS TO BE PLACED ON EACH SIDE OF TRENCH CUT.
5. BLOCK PAVED SURFACES ARE TO BE REINSTATED BY AN ACT GOVERNMENT ACCREDITED CONTRACTOR. THIS IS TO BE ORGANISED AS SOON AS POSSIBLE AFTER TRENCH BACKFILL IS COMPLETE.
6. COLD MIX BITUMEN IS A TEMPORARY REINSTATEMENT. THE PERMANENT SEALED SURFACE WILL BE REINSTATED BY AN ACT GOVERNMENT ACCREDITED CONTRACTOR.
7. MARKER TAPE TO BE INSTALLED A MINIMUM OF 200mm ABOVE THE CONDUIT. POLYETHYLENE PROTECTION STRIP IS REQUIRED WHERE CONDUITS ARE NOT HEAVY DUTY AS SET OUT IN AS4059 OR CLASS 12 (REFER CONDUIT TECHNICAL STANDARDS). POLYETHYLENE PROTECTION STRIP SHOULD OVERLAP CONDUITS AT LEAST 40mm AND SHOULD BE PLACED NO MORE THAN 15mm ABOVE THE CONDUIT. MARKER TAPE NOT REQUIRED IF PROTECTION STRIP INSTALLED.
8. NUMBER & SIZE OF CONDUITS TO BE DETERMINED BY ACTEWAGL PROJECT OFFICER.
## Appendix A - Maximum number of cables in conduits

### GUIDE TO THE MAXIMUM NUMBER OF HV CABLES INSTALLED IN CONDUIT

<table>
<thead>
<tr>
<th>Type &amp; number of Cores</th>
<th>Conductor cross sectional area</th>
<th>Cable Diameter (mm)</th>
<th>Minimum Bending Radius (mm)</th>
<th>Conduit size (internal diameter)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50mm</td>
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<tr>
<td>HV One Core</td>
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<td></td>
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<td></td>
<td>35 mm²</td>
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<td>0</td>
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<td>240 mm²</td>
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<td>300 mm²</td>
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### GUIDE TO THE MAXIMUM NUMBER OF LV CABLES INSTALLED IN CONDUIT

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<th>Type &amp; number of Cores</th>
<th>Conductor cross sectional area</th>
<th>Cable Diameter (mm)</th>
<th>Minimum Bending Radius (mm)</th>
<th>Conduit size (internal diameter)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50mm</td>
</tr>
<tr>
<td>LV One Core</td>
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</tr>
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<td></td>
<td>70 mm²</td>
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<td>150 mm²</td>
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<td>300 mm²</td>
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<td>360</td>
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<td>16 mm²</td>
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<td>330</td>
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<tr>
<td>LV Four Core</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>16 mm²</td>
<td>22</td>
<td>400</td>
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<td>120 mm²</td>
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<td></td>
<td>240 mm²</td>
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