Cabling of premises for telecommunications

Lead-in cabling and building entry facilities for homes

IT'S HOW WE CONNECT

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Summary

This document provides summary guidance to developers, builders, electricians, telecommunications cabling providers and consumers about the installation of telecommunications lead-in cabling including the cable entry arrangements at the building. For detailed information, refer to Telstra Document No. 017153a00, *Cabling of premises for telecommunications — A complete guide to home cabling*.

This document is optimised for reading on a tablet or portable computer to take advantage of hyperlinks, document search functions and on-screen magnification of photographs and drawings.

CONTENTS

1 PURPOSE

The purpose of this document is to provide essential guidance for the installation of telecommunications lead-in cabling and cable entry arrangements at the building ("building entry facilities") for the connection of broadband and telephone services that may be supplied by any of the following technologies:

- copper twisted pair cable — for telephone and ADSL (Asymmetric Digital Subscriber Line) services
- HFC (Hybrid Fibre-Coax) — otherwise known as "Cable" (for Cable internet and Cable pay TV)
- FTTP (Fibre To The Premises) — for telephone, broadband and, in some cases, TV services.

The guidance provided by this document is intended to ensure that the cabling is compatible with the **National Broadband Network (NBN)** to which all homes are expected to be connected eventually.

For essential guidance on internal cabling for the home, refer to Document No. 017153a01, *Cabling of premises for telecommunications — Essential information for home cabling*.

The Telstra documents may be downloaded from the "Builders" menu of the Telstra Smart Community® website (http://www.telstra.com.au/smart-community/builders/).

2 SCOPE

This document applies to any building constructed for use as a home. It applies to detached buildings (single dwellings) as well as semi-detached buildings (town houses, villas, etc.). While the document generally describes cabling for new buildings, it may also be applied to building renovations where the lead-in cabling is to be upgraded or replaced.

3 INTRODUCTION

3.1 Broadband services and the National Broadband Network

"Broadband" is the general term used to describe services that operate at higher frequencies or digital bit rates than are necessary to transmit the human voice (e.g. for high-speed access to the internet).

The National Broadband Network (NBN) is a telecommunications network that is being constructed by NBN Co Limited, a company established by the Commonwealth Government to provide access to high-speed broadband services by all Australian residents by the year 2021. In densely populated ("urban") areas, services will mainly be supplied using Fibre-To-The-Premises (FTTP) technology, whereas in sparsely populated ("rural") areas, services will be supplied using fixed wireless or satellite technology.

For more information, refer to Document No. 017153a00, *Cabling of premises for telecommunications — A complete guide to home cabling*.

3.2 What is lead-in cabling?

Lead-in cabling is the cabling from the last distribution point in a carrier's telecommunications network to the "network boundary", e.g. a Network Termination Device (NTD) in a customer's premises.

Lead-in cabling will normally be installed underground unless aerial cabling distribution is already being used in the street and/or the ground conditions or circumstances preclude underground installation. Telecommunications carriers decide whether to install their lead-in cabling underground or aerial based on technical, safety, economic and any applicable environmental or regulatory factors.

Underground cabling is used in virtually all new property developments.

3.3 Home cabling elements

A pictorial summary of the elements that make up a typical, modern home cabling installation is provided in Figure 1. The part of the installation covered by this document (017153a02) is circled.

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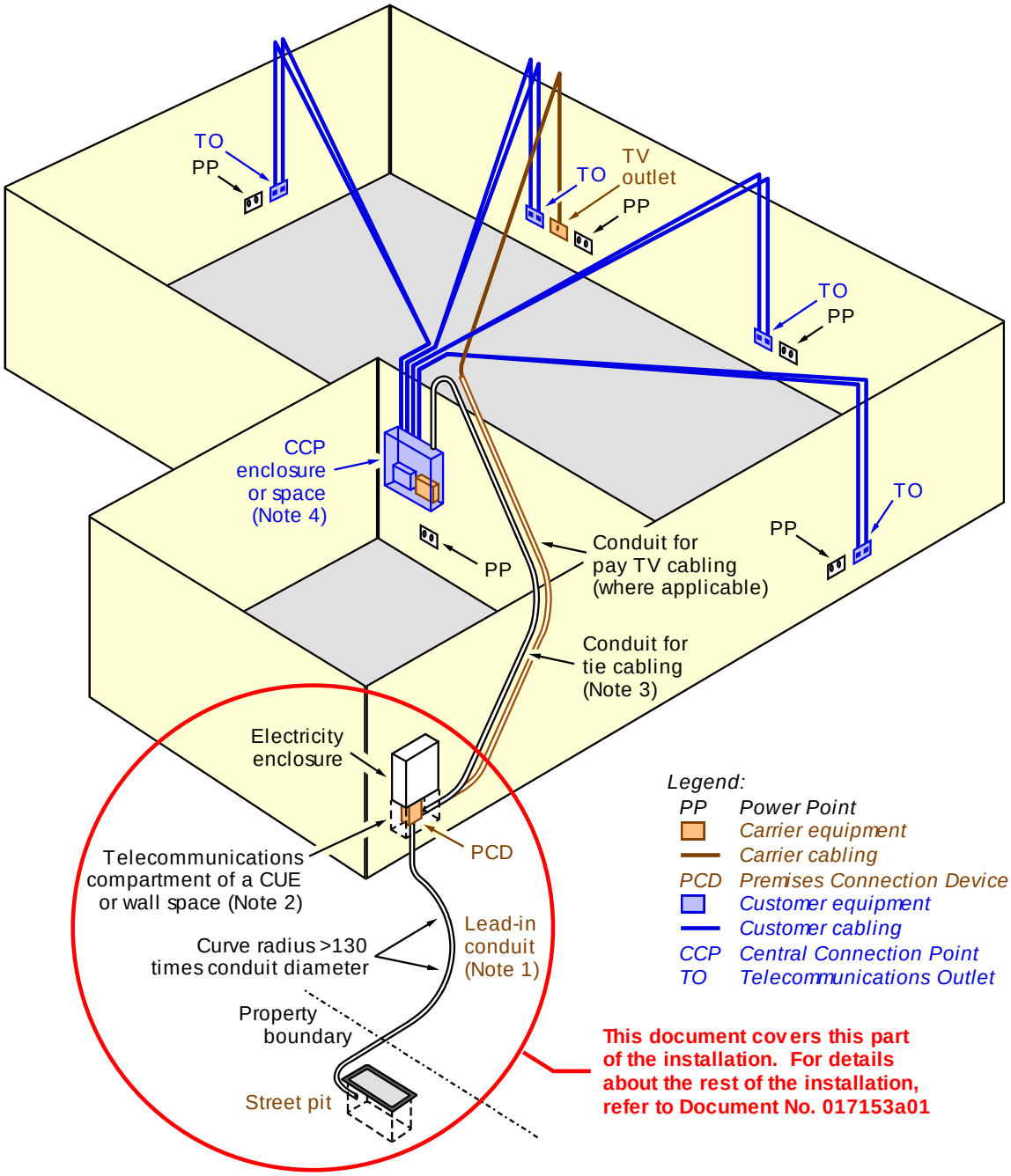
Figure 1 Home cabling elements



Notes:

1. The lead-in conduit is used for pulling in twisted pair, coaxial, or optical fibre lead-in cabling, as applicable.
2. The use of a Combined Utilities Enclosure (CUE) is recommended. A CUE will house any style of PCD and avoids the need to work out conduit positioning for the PCD. Refer to 6.2 for details.
3. A cabling pathway (conduit) is required between the PCD and the CCP for installation of "tie cabling" between the PCD and the CCP **after** building completion. The conduit is used for pulling in twisted pair, coaxial, power supply or optical fibre cabling, as applicable. A second conduit may be required for coaxial cabling for cable TV (where available). The length of tie cabling between the PCD and the CCP should not exceed **25 m** unless it is certain that an **indoor** FTTP NTD will be installed, in which case the length should not exceed **40 m**.
4. The CCP enclosure may be sized to house some or all of the powered electronic devices required to operate some services (e.g. NTD, modem or gateway). Alternatively, the devices may be located outside the CCP enclosure or in a separate enclosure.

4 UNDERGROUND LEAD-IN CABLING

If it is known that **aerial** lead-in cabling will be used, skip to section 5 on page 30.

4.1 General

Where underground lead-in cabling is to be installed, the builder, home owner or customer is required to arrange and pay for suitable trenching for the lead-in cabling between the carrier's cabling entry point at the boundary of the premises ("property entry point") and the cabling entry point at the building ("building entry point"). "Trenching" means clearing of land along the cabling route, digging of the trench and reinstating the land after the cabling is installed. Refer to 4.4.5 on page 18 for details.

The builder, owner or customer may also be required to supply and install the lead-in conduit (see 4.2.5).

In **urban areas**, lead-in cabling is installed in conduit irrespective of the distance between the property boundary and the building. Where the total length of the conduit **will exceed 50 m**, **intermediate pits** are required at no more than **50 m intervals** to provide access points for pulling cables (see Figure 4).

In **rural areas**, Telstra installs its lead-in cable directly in the ground without conduit except for about the last 3 m to the building where conduit is used for additional cable protection.

Note: It is unlikely that FTTP will be installed in rural areas in the foreseeable future. In rural areas, NBN services are likely to be supplied by fixed wireless or satellite. Nevertheless, copper lead-in cabling may be required for the supply of a telephone service and, if available, an ADSL service may also be supplied via this cable.

4.2 Conduit requirements

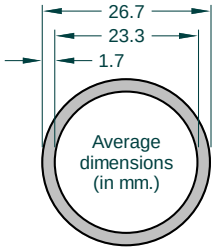
4.2.1 Conduit material and size

For an individual home, the lead-in conduit must be **rigid UPVC** with an **inside diameter** (**ID**) of **23 mm**. Flexible or corrugated conduit must **not** be used for underground lead-in cabling. The cross-sectional dimensions of the conduit are illustrated in Figure 2.

Notes:

1. This conduit size is referred to by Telstra as "20 mm" conduit (its nominal inside diameter) or "P20" ("Plastic 20 mm").
2. Any conduit manufactured to Australian Standard AS/NZS 2053 (e.g. marked as "20 mm", "25 mm" or "32 mm" and including "2053" in the markings) is physically incompatible with Telstra and NBN Co networks and is **not** suitable for lead-in cabling. Polyethylene conduit or pipe is also **not** suitable for lead-in cabling.

Figure 2
Conduit dimensions



4.2.2 Conduit colour and markings

Lead-in conduit and bends must be coloured **white**. Conduit of any other colour is **not** acceptable. For **Telstra** lead-in cabling, the conduit and bends may be marked "Telstra", "NBN" or "Communications". Any of these markings are acceptable to Telstra as long as the conduit ID is 23 mm.

Note: Alternative conduit markings may not be acceptable to NBN Co for NBN lead-in cabling.

4.2.3 Bends and curves

No more than **two underground 90° bends** with a minimum inner bend radius of **300 mm** are permitted between access points. Composite bends may be used at the building footings as shown in Figure 37 on page 43. A **third 90° bend** with a minimum inner bend radius of **100 mm** is permitted **above ground** at the cable access point **at the building** (e.g. in the wall cavity). Only **prefabricated bends** may be used. Conduits must **not** be bent on site (e.g. by application of heat).

Curvature of glued lengths of conduit **is allowable** without affecting the number of bends that may be used as long as the **curvature radius** is no less than **130 times the nominal inside diameter of the conduit** (in practical terms, this means curving the conduit without distorting the cross-sectional roundness of the conduit). Refer to Figure 4.

Where it would be necessary to use more than two underground 90° bends (e.g. to effect a sharp change of direction in the middle of the conduit run), an intermediate access pit must be used as a cable pulling point. Refer to Figure 5.

4.2.4 Conduit installation

Conduit and bend joints must be glued with solvent cement.

The conduit markings should face upwards when the conduit is laid in the trench so as to be visible if the conduit is exposed by digging after its initial installation.

A pull-cord or cable must be threaded through the lengths of conduit during assembly for later installation of the lead-in cable by the carrier. Each end of the conduit must be plugged to prevent the ingress of silt or debris into the conduit.

4.2.5 Who provides the conduit?

In new developments that are in NBN Co's "long-term fibre footprint", the lead-in conduit and any necessary pits are to be supplied and installed by the builder, owner or customer to NBN Co's specifications. In the absence of any NBN Co specifications for lead-in conduit, the lead-in conduit requirements described in this document may be used as a guide.

Where the lead-in cabling is to be connected to the Telstra network to supply a Telstra service, the supply and installation the lead-in conduit and any necessary pits in a customer-supplied trench are included in the Telstra connection charge for the service. However, the builder or owner may opt to supply and install the lead-in conduit for expediency, in which case it must be installed in accordance with Telstra's requirements as described in this document.

4.2.6 Conduit integrity

To be "FTTP ready", the lead-in conduit and bends must be capable of passing an optical fibre cable that has a pre-terminated connector protected by stiff plastic tubing and covered by a polypropylene hauling sock. This assembly has a total diameter of up to 18 mm for a length of about 800 mm and is semi-rigid. The protective tubing and hauling sock protect the optical fibre and optical connector while the cable is being pulled through the lead-in conduit and ensure that no pulling force is exerted on the connector. The sock will not pull through small-radius conduit bends due to its large diameter and relative stiffness.

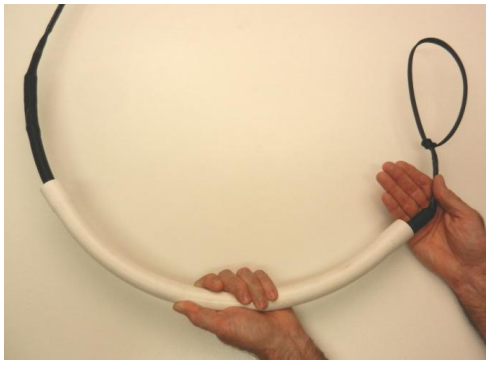
Figure 3 shows an optical fibre cable assembly threaded through 300 mm and 100 mm radius bends.

Note: Optical fibre cables with factory-fitted connectors may be preferred by some carriers to simplify installation and reduce installation costs by avoiding the need for expensive field splicing equipment and skilled operators. The main disadvantages of using cable with factory-fitted connectors are:

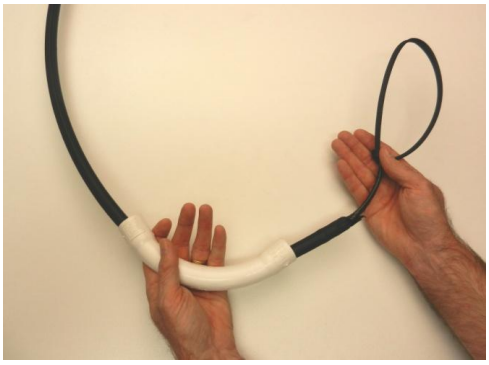
- The integrity of the conduit used to pull in the cable is very important.
- The cables are supplied in predetermined lengths, so slack cable needs to be stored somewhere (e.g. in the pit, PCD or a building cavity).

Figure 3 Pre-terminated optical fibre lead-in cable threaded through 23 mm ID conduit bends

(a) 300 mm radius bend (for use underground)



(b) 100 mm radius bend (for use in the wall cavity)

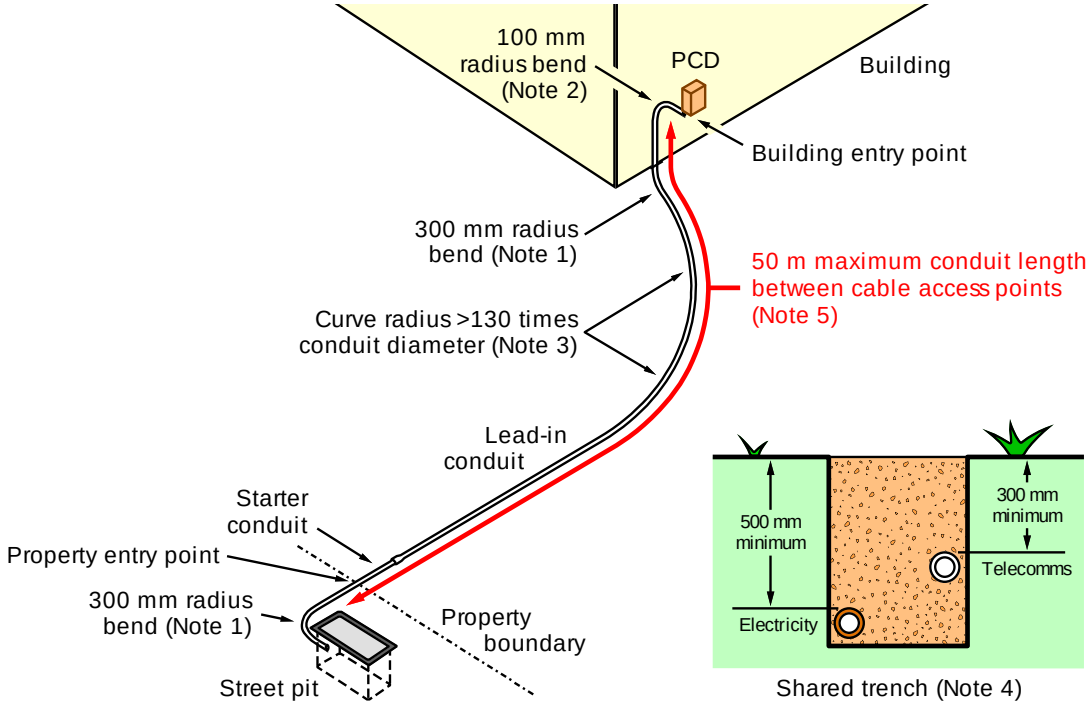


Notes:

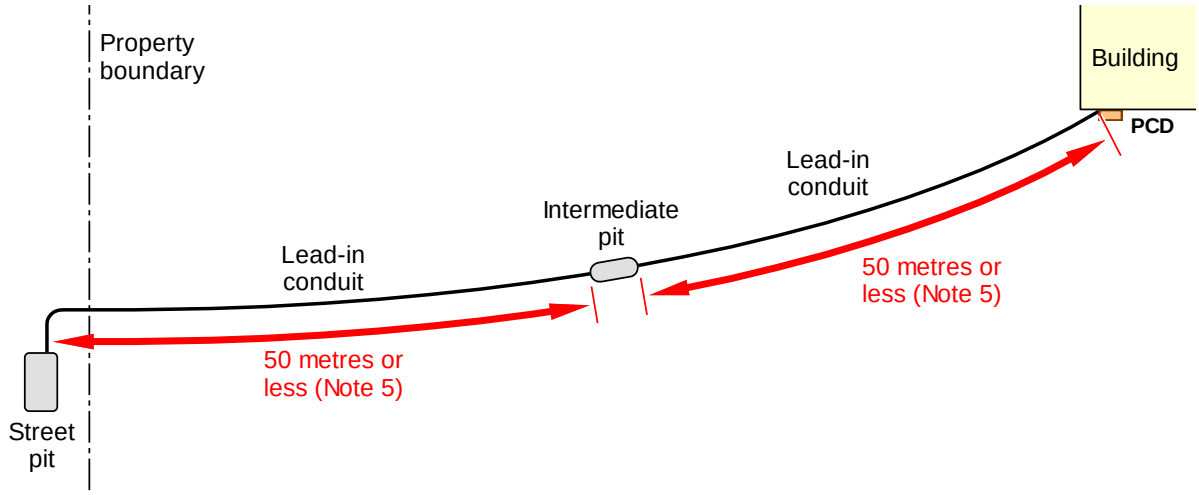
1. 300 mm radius bends are used at pits and vertically at the building footings.
2. A 100 mm radius bend is only permissible in the wall cavity of the building.
3. It can be seen from the above pictures that the cable hauling sock is a tight fit in the conduit, so clear, undamaged conduit and large radius bends are essential.

Figure 4 Lead-in conduit length, curvature and bend limitations

(a) Standard urban lot



(b) Large urban lot (or street pit distant from the premises)



Notes:

1. Underground bends must have a minimum inner bend radius of 300 mm. Composite bends may be used at the building footings as shown in Figure 37 on page 43.
2. A prefabricated bend with a minimum inner bend radius of 100 mm is allowable in the wall cavity of the building.
3. The conduit may be curved to a minimum radius of 130 times the nominal inside diameter of the conduit (i.e. 2600 mm in the case of 23 mm ID conduit which has a nominal inside diameter of 20 mm). In practical terms, this means curving the conduit without distorting the cross-sectional roundness of the conduit.
4. A shared trench with the electricity mains is recommended. No separation is required between the orange electricity conduit and the white telecommunications conduit but the white conduit should be laid above (on top of) the orange conduit where possible. Refer to 4.5.8 on page 23 for details.
5. If the total length of conduit between access points will exceed 50 m, one or more intermediate pits must be installed at intervals not exceeding 50 m.

Figure 5 Right and wrong use of intermediate pits

(a) Intermediate pit for pulling cables

(b) Intermediate pit for change of conduit direction

Notes:

1. A size 2 ("P2") pit may be used as an intermediate pit for lead-in conduit to a single dwelling. The minimum internal dimensions (in mm) of a size 2 pit are 490 L x 125 W x 500 D. These pits are usually round-ended as shown above.
2. The conduit should be glued to a bush that is installed flush with the inside wall of the pit except in highly reactive soils where the conduit may be extended no more than 50 mm inside the pit. The bush or conduit must be a tight fit through the pit wall to minimise the entry of silt into the pit.
3. The bottom edge of the conduit must enter the pit no less than 50 mm above the inside surface of the bottom of the pit (this is to reduce the risk of silt or debris entering and clogging the conduit over time).
4. Where more than one conduit enters the same end of the pit (e.g. for branching of conduits as shown in Figure 12 on page 16), the conduits must be separated at the pit by at least 25 mm.

4.2.7 Use of lead-in conduits/pits/cables

Lead-in **conduit** must **not** be used for customer cabling (e.g. for private cabling to another building in the premises). Customer cabling must be installed in separate conduit but may share the lead-in trench. Separate conduit must be provided for the installation of customer cabling between buildings.

Lead-in **pits** should not be used for customer cabling unless this is unavoidable (e.g. due to limited space for locating pits), in which case only lead-in pits supplied and installed by the builder, owner or customer may be shared with customer cabling. In such cases, the customer cabling must be clearly labelled in the pit. Lead-in pits installed by the carrier (i.e. with the carrier's markings) must **not** be used for customer cabling.

4.3 Property entry point

4.3.1 Description

The property entry point is the point where the carrier's lead-in cabling will enter the private land in which the building is located, including

- any land occupied in common with, or shared with, multiple occupants (e.g. land controlled by a body corporate); and
- any private easement or right of way (e.g. a driveway).

The carrier determines the location of the property entry point based on the location of the nearest suitable lead-in cable connection point. Where radio technology is used to supply a service to the premises, the property entry point is the base of the radio shelter or antenna structure from which the cabling runs to the building.

4.3.2 Urban residential areas

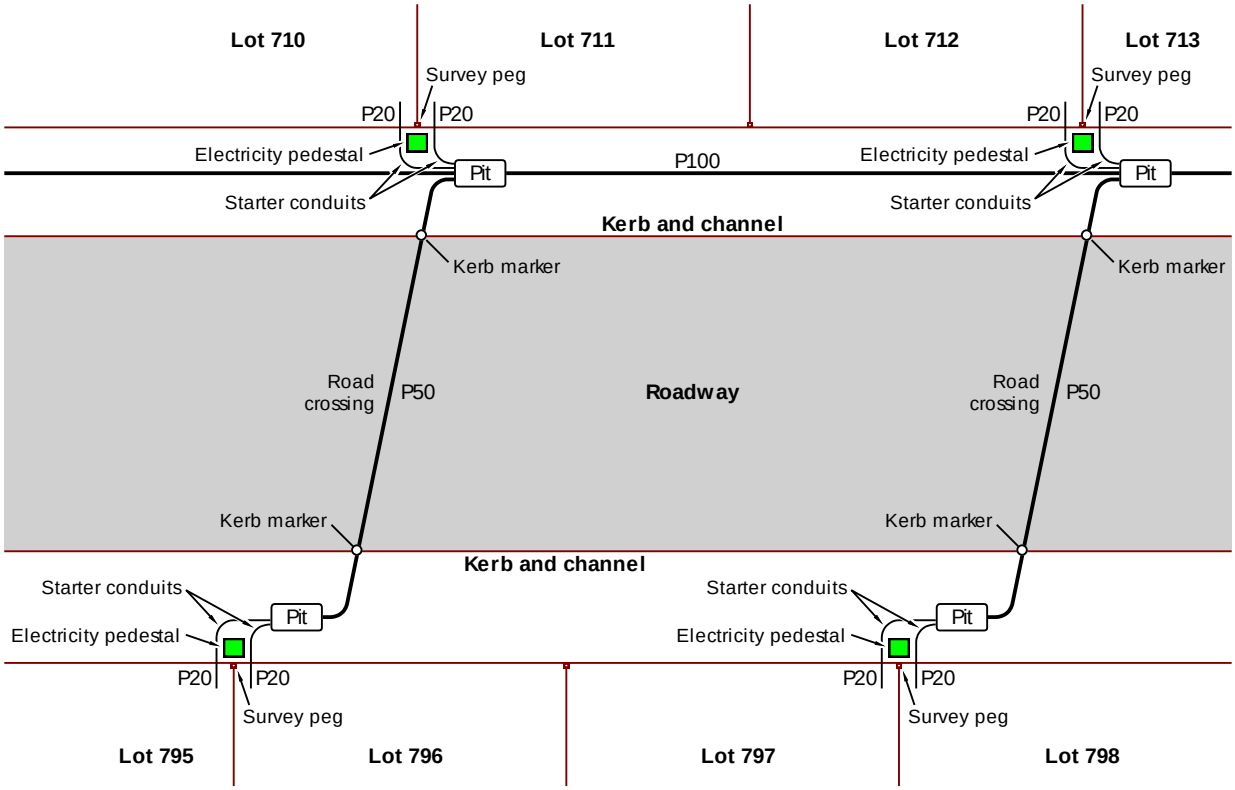
In urban residential areas, underground lead-in cabling is typically fed from a pit or pole in the street or a public easement adjacent to (usually at the rear of) the property. In some cases, the property entry point location will be evident from the location of the telecommunications pits and may be confirmed by digging at the property boundary to locate the "starter conduit". In other cases, the location of the property entry point may not be obvious and the relevant carrier may need to be consulted.

Typical street cable distribution arrangements for new urban residential estates are illustrated in Figure 6 and Figure 7. Figure 8 shows typical "starter conduit" locations.

4.3.3 Commercial/Industrial and rural areas

The cable distribution arrangements for homes located in commercial/industrial areas and rural communities may differ from the arrangements shown in Figure 6 and Figure 7, and are not specifically covered by this document. You should seek advice from the relevant carrier as to the location of the property entry point in such cases. For Telstra contact details, see 4.4.6.

Figure 6 Typical telecommunications street distribution cabling for new urban residential estates using single-sided distribution with pits on both sides of the street



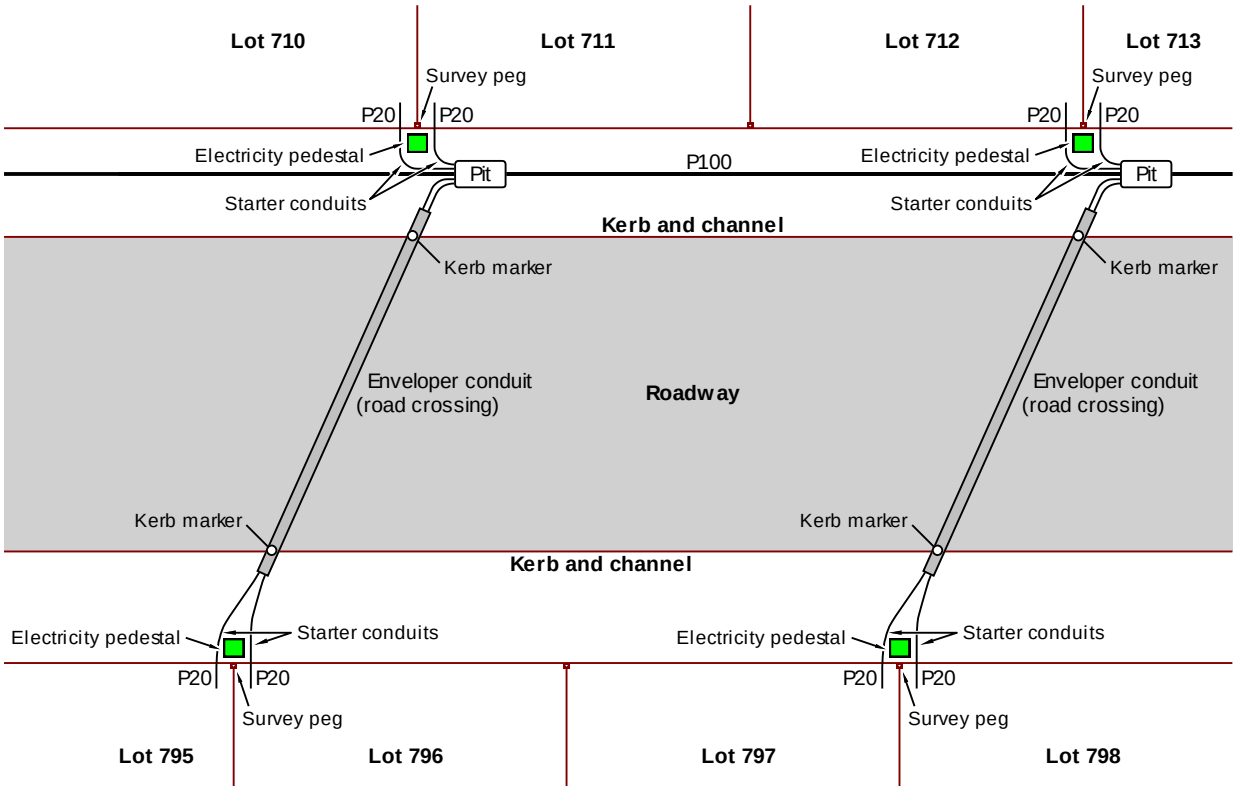
LEGEND:

P20	Plastic 20 mm (nominal inside diameter) conduit
P50	Plastic 50 mm (nominal inside diameter) conduit
P100	Plastic 100 mm (nominal inside diameter) conduit

Notes:

1. The lead-in cable may be coiled up in the nearest pit ready to pull through the lead-in conduit to the building. The cable is only to be pulled in by the carrier's installer. Other persons are **not** authorised to open the pit or to pull in the lead-in cable.
2. The starter conduits should extend at least to the property boundary and may extend one to two metres into the property (see Figure 8).

Figure 7 Typical telecommunications street distribution cabling for new urban residential estates using single-sided distribution with pits on one side of the street only

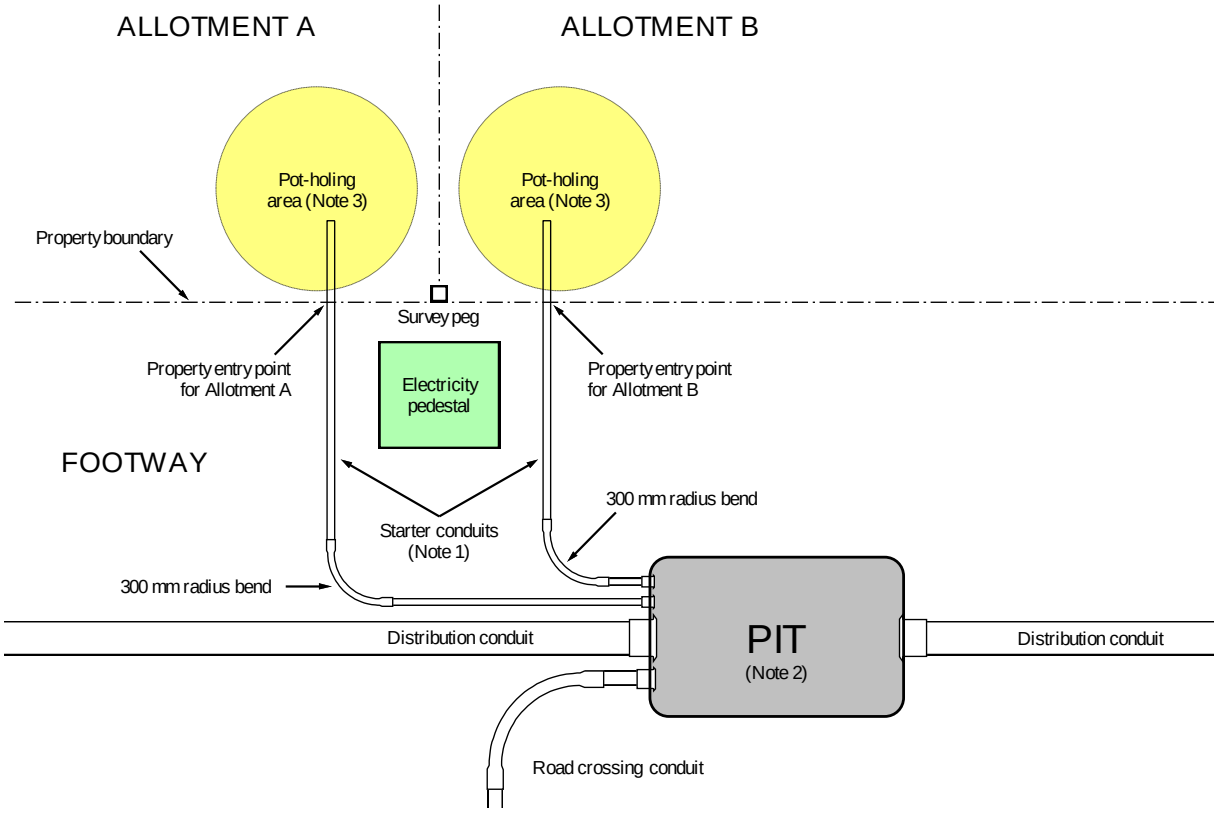


LEGEND: P20 Plastic 20 mm (nominal inside diameter) conduit
P100 Plastic 100 mm (nominal inside diameter) conduit

Notes:

1. The lead-in cable may be coiled up in the nearest pit ready to pull through the lead-in conduit to the building. The cable is only to be pulled in by the carrier's installer. Other persons are **not** authorised to open the pit or to pull in the lead-in cable.
2. The starter conduits should extend at least to the property boundary and may extend one to two metres into the property (see Figure 8).

Figure 8 Typical starter conduit arrangements (urban residential)



Notes:

1. In new urban residential estates, starter conduits will usually be provided as shown and be installed at least to the property boundary but they may extend one to two metres into the property. The minimum depth of cover for these conduits is normally 300 mm — or 450 mm if the conduit runs parallel with the property boundary for some distance before it enters the property.
2. Where pits are only installed on one side of the street (see Figure 7), the starter conduits on the non-pit side of the street should straddle the electricity pedestal as indicated in Figure 7.
3. "Pot-holing" (e.g. careful hand digging with a wooden-handle shovel) may be necessary to confirm the location of the starter conduit. With new building construction, the starter conduit may be exposed when the trench is being dug for the electricity mains.

4.4 Lead-in cabling route

4.4.1 Copper lead-in cabling

By default, any lead-in cabling that is not being provided in a designated FTTP estate is deemed to be copper cabling. With copper lead-in cabling, separation from electrical power hazards and the ability to provide effective lightning surge suppression are primary considerations in determining the lead-in cabling route. For a typical urban home, the lead-in cabling should take the shortest practicable path between the starter conduit and the **side of the building where the electricity enclosure is located**.

Complications may arise where:

- there is more than one building in the premises;
- the electricity enclosure is located at a detached building or structure; or
- power is fed to the premises from a nearby HV transformer (rural premises).

The flow chart in Figure 14 may be used to determine the appropriate lead-in cabling route for copper lead-in cabling.

4.4.2 Optical fibre lead-in cabling (FTTP)

Any lead-in to be provided in a designated FTTP estate is deemed to be an optical fibre lead-in. If there is any doubt, the lead-in must be treated as a copper lead-in.

With optical fibre lead-in cabling, there is less concern about electrical power hazards and there is no need to consider lightning surge suppression requirements. Nevertheless, an external FTTP NTD requires connection to the building electrical earthing system (although the length of the earthing conductor is not important, as is the case with lightning surge suppression). For a typical urban home, the lead-in cabling may take the shortest practicable path between the starter conduit and the building entry point which should preferably be near the electricity enclosure for the reasons given in 4.4.3.

Conduit integrity is very important with optical fibre lead-in cabling.

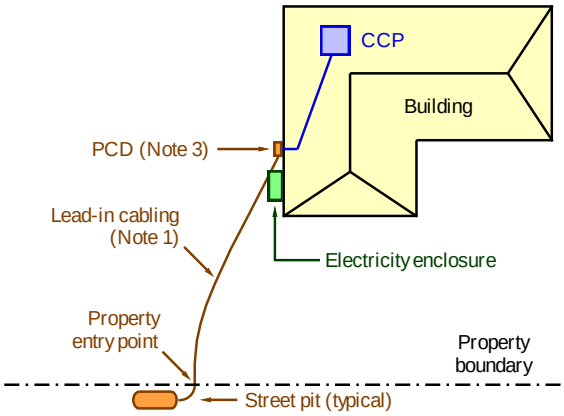
4.4.3 Single dwelling

For a single residential dwelling, the building entry point should be located near the electricity enclosure (meter panel or switchboard) to ensure that the carrier has future ready access to the PCD, to facilitate earthing of the PCD to the building electrical earthing system where necessary and to keep away from any gas cylinders that may be installed at the building. Accordingly, the lead-in cabling should run from the starter conduit at the property entry point to the electricity enclosure location — even if this means trenching across the front of the building. Refer to Figure 9.

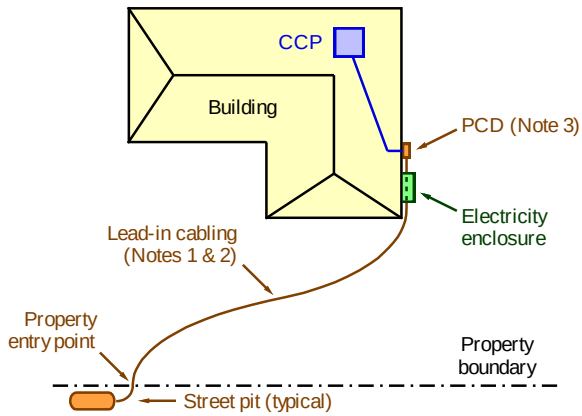
Where trenching across the front of the building is not possible (e.g. due to difficult terrain, extensive landscaping, retaining wall, paved driveway, swimming pool, etc.), the lead-in cabling may take the most direct path to the building. In such cases, care must be taken to avoid gas cylinders (see 6.3.3.1) which are normally located away from the electricity enclosure. Also, if the premises is in a defined lightning risk situation and is connected to a copper network, there may be a need to install "lead-in extension" cabling for the purpose of providing effective lightning surge suppression (see Figure 10).

Figure 9 Typical path of the lead-in cabling to a single dwelling

(a) Electricity enclosure on the same side of the building as the property entry point



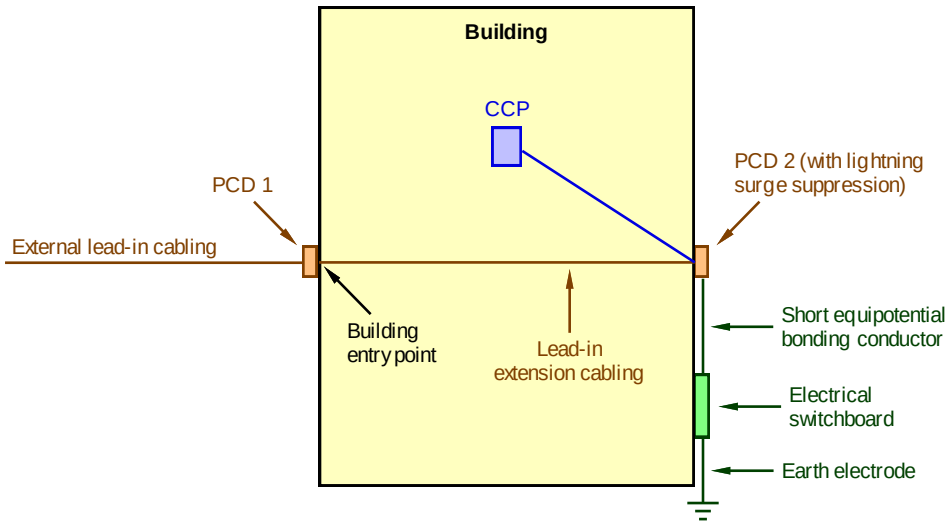
(b) Electricity enclosure on the opposite side of the building to the property entry point



Notes:

1. The cabling path must be such that there are no bends in the conduit between the starter conduit and the building footings unless these are made via an intermediate pit (see 4.2.3). Sweeping curves that will allow the glued lengths of conduit to be laid in the trench without significant stress are permitted, as indicated in example (b) above.
2. Where trenching across the front of the building is not possible (e.g. due to difficult terrain, extensive landscaping, etc.), the lead-in cabling may take the most direct path to the building. In such cases, care must be taken to avoid gas cylinders (see 6.3.3.1 on page 40) which are normally located away from the electricity enclosure. Also, if the premises is in a defined lightning risk situation and is connected to a copper network, there may be a need to install "lead-in extension" cabling for the purpose of providing effective lightning surge suppression (see Figure 10).
3. The carrier's PCD will be mounted on the wall below or beside the electricity enclosure where practicable.

Figure 10 Lead-in extension cabling for lightning surge suppression (copper lead-ins)



Notes:

1. Where copper lead-in cabling runs to the opposite side of the building to the electrical switchboard and lightning surge suppression is required, the installation of "lead-in extension cabling" will be necessary to achieve a short equipotential bonding conductor between the electrical earthing system and the lightning surge suppressors. The total length of the bonding/earthing conductor between the earthing bar in the electrical switchboard and the lightning protector should preferably be less than 1.5 m but in any case must not exceed 10 m.
2. Where lead-in extension cabling is required, such cabling must either be installed on the external perimeter of the building or the conductors of the cable used must be at least double the cross-sectional area of the external lead-in cabling conductors to minimise the risk of fire under surge conditions. Lead-in extension cabling is installed by the carrier.
3. More information about lead-in extension cabling is provided in Telstra Specification 012882, *Alteration of Telstra Facilities in Homes and Small Businesses — Information for Cabling Providers*.

4.4.4 Multiple buildings

If there is only one building in the premises and the property is a typical urban lot, skip to 4.4.5 (page 18).

4.4.4.1 General

Where the premises will contain two or more buildings (e.g. the main building and an "outbuilding") and the buildings will require separate telecommunications services, separate lead-in cabling and/or separate PCDs may be required for each building. Whether or not separate lead-in cables will be required may depend on the lead-in cabling technology used, i.e. whether the cable is copper or optical fibre. Refer to 4.4.4.2 and 4.4.4.3.

4.4.4.2 Copper twisted pair lead-in cabling

With copper lead-in cabling, it is essential that the lead-in cabling runs to the building or structure where the electrical switchboard is located to ensure that effective lightning surge suppression can be provided if required.

Where the electricity enclosure is installed at a separate detached building or structure (e.g. a fence, pole or garage), the lead-in cabling may need to be run via the building or structure at which the electricity enclosure is located, as shown in Figure 11 and Figure 13 (a). However, care must be taken to avoid any pole carrying a power transformer as shown in Figure 13 (b). In some cases, it may be possible or desirable to run separate lead-in cabling directly to an outbuilding, as shown in Figure 12.

The appropriate lead-in cabling method may be determined using the flow chart in Figure 14 — but the relevant carrier should be contacted for advice in such cases prior to digging the trench for the cabling.

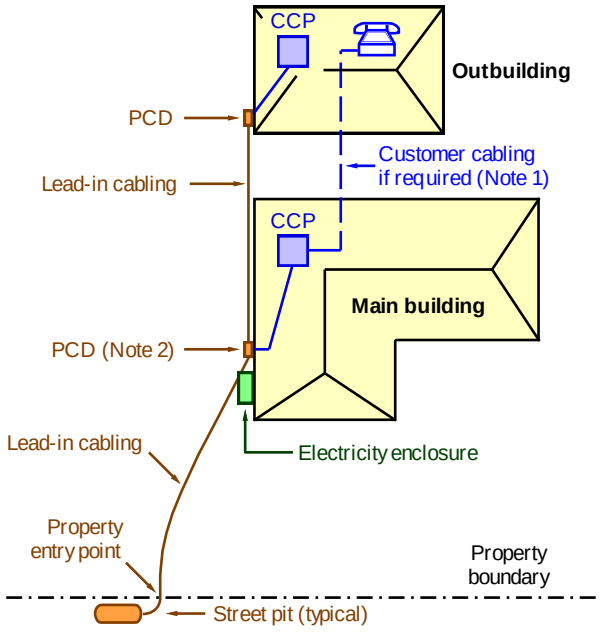
4.4.4.3 Optical fibre lead-in cabling (FTTP)

With optical (FTTP) networks, the lead-in cabling may run directly to the building no matter where the electrical switchboard is located but, for technical and safety reasons, the FTTP NTD must be installed at the same building where the telecommunications service is to be used by the occupant. However, while the FTTP NTD cannot be located at a detached building or structure such as a separate garage or a fence, a separate PCD (i.e. a splice box) may be located at a detached building to provide an intermediate connection point, e.g. for branching of a separate optical fibre cable running to a separate building. Refer to Figure 11 for examples.

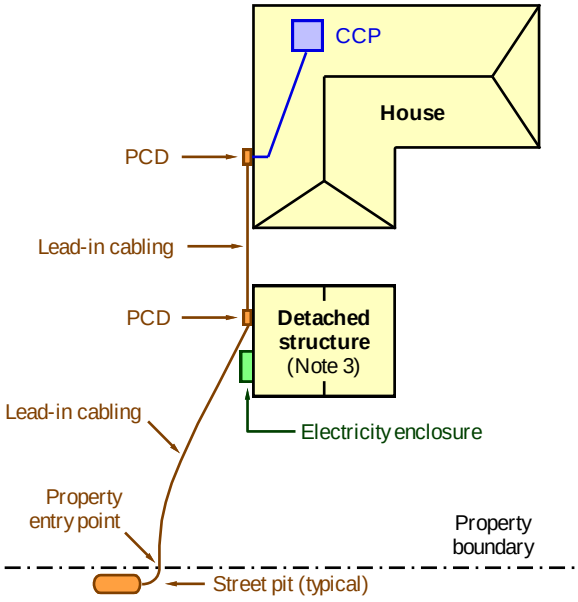
In some cases, it will be more expedient to run separate lead-in cabling to the separate buildings in accordance with Figure 12.

Figure 11 Typical path of the lead-in cabling to an outbuilding or to the main building where the electricity enclosure is located at a detached building or structure

(a) Lead-in cabling path for the supply of a separate telecommunications service to the outbuilding



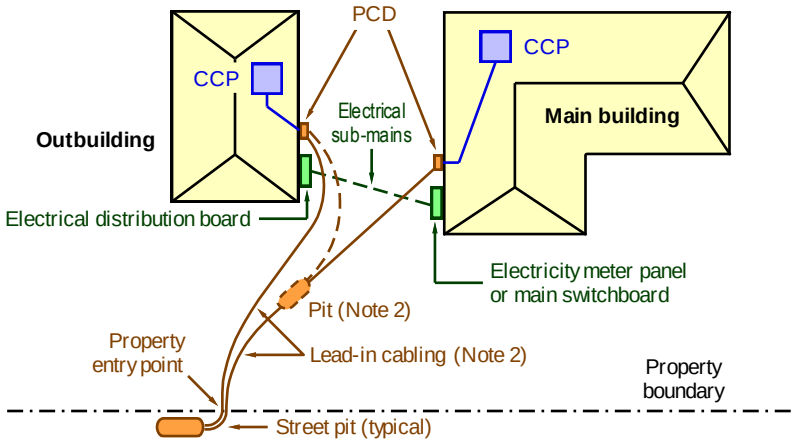
(b) Lead-in cabling path where the electricity enclosure is located at a detached building or structure



Notes:

1. Any customer cabling required between the main building and the outbuilding, e.g. for additional access points (telecommunications outlets) as shown in arrangement (a), must be separate and distinct from the lead-in cabling, i.e. it must use separate cable and conduit to the lead-in cable and conduit.
2. The PCD at the main building may be used as a branching point for the lead-in cabling to the outbuilding. Unrestricted access to this PCD must be guaranteed; otherwise the arrangement shown in Figure 12 must be used.
3. The detached structure at which the electricity enclosure is located may be a garage, shed, pole or fence. Arrangement (b) may apply for copper lead-in cabling where this is required in accordance with the flow chart in Figure 14. For optical fibre lead-in cabling, arrangement (b) would normally only apply where the lead-in cabling needs to be installed in two sections due to site conditions (e.g. retaining walls) or because a separate telecommunications service is required in each building.
4. The lead-in cabling must **not** be run near any pole that carries a SWER (Single Wire Earth Return) transformer, e.g. rural properties. Refer to Figure 13 (b).

Figure 12 Lead-in cabling directly to an outbuilding

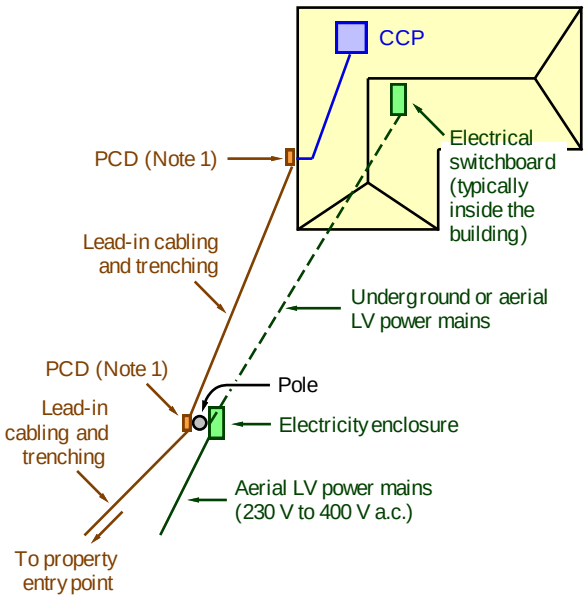


Notes:

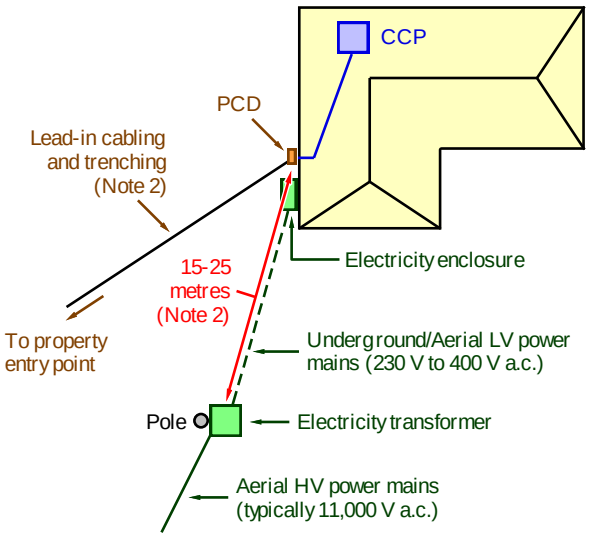
1. In some cases, the lead-in cabling may need to be provided via the main building for technical reasons. Refer to Figure 11 and, for copper lead-in cabling, the flow chart in Figure 14 to determine whether it may be appropriate to provide lead-in cabling via the main building rather than directly to the outbuilding.
2. Some lead-in trenching and conduit may be common, using a pit where the lead-in cables branch off.
3. Any customer cabling required between the buildings, e.g. for intercommunication between the buildings, must be separate to the lead-in cabling, i.e. using separate cable and conduit to the lead-in cable and conduit.

Figure 13 Typical path of the lead-in cabling where the power mains are fed from an electricity enclosure or a transformer located on a pole (acreage or rural properties)

(a) Low voltage (230 V to 400 V a.c.) power mains connected via an electricity enclosure on a pole



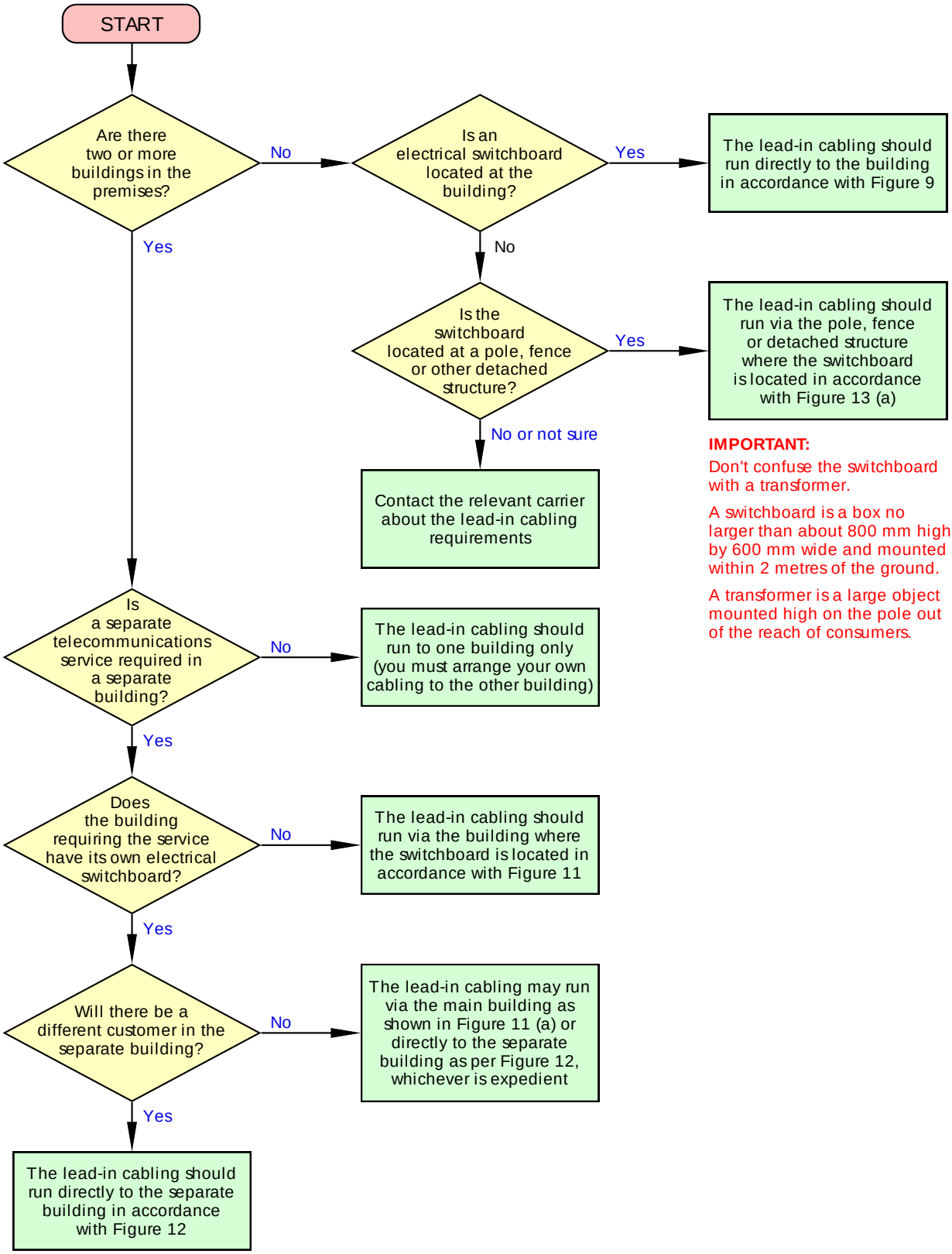
(b) High voltage (e.g. 11,000 V a.c.) power mains connected to a transformer on a pole



Notes:

1. In case (a), if copper lead-in cabling is to be installed, the carrier may need to install PCDs at both the pole and the building for lightning surge suppression purposes. In such cases, the PCD at the building should also be located on the external wall as close as possible to the electrical switchboard for effective earthing of lightning protectors.
2. In case (b), the carrier's PCD should be kept at least 25 m away from any pole carrying a SWER (Single Wire Earth Return) transformer or at least 15 m away from any other electricity transformer.

Figure 14 Determining the appropriate lead-in cabling route to a particular building (copper lead-in cabling)



Note: For optical fibre lead-in cables (e.g. Telstra or NBN Co FTTP estates), there is no need to use this flow chart. The lead-in cabling may run directly to the building where the service is required per Figure 9 or Figure 12.

4.4.5 Rural areas

In rural areas, NBN services are likely to be supplied using satellite or fixed wireless technologies. Where Telstra installs copper cabling to supply a standard telephone service, ADSL may be available.

In rural areas, Telstra normally buries the lead-in cable directly in the ground without conduit and marks the route at regular intervals with signs and marker posts. With directly buried cable there is no limitation on the number of bends in the cabling. However, the cable route should be as direct as possible between cable route markers to enable subsequent location of the cable for repairs and to reduce the risk of accidental damage to the cable during any digging or cultivation activities.

Where practicable the path of the lead-in cabling should follow established geographical features such as private roadways, tracks, right-of-ways, fence boundaries, etc. to minimise the risk of disturbance. Traversing of cultivated land or grazing paddocks should be avoided if possible. Where the cable runs beside a fence or property boundary, it must be spaced at least 1 m from the fence line (see also 4.5.6 regarding proximity to power poles).

For long cable runs in rural areas, Telstra may opt to plough its lead-in cable directly into the ground instead of requiring the provision of an open trench. Nevertheless, even if the lead-in cable is to be ploughed in, the last section of lead-in cable to the building should be installed in conduit, so an open trench will be required for at least the last 3 m of lead-in cabling to the building. Advice should be sought from Telstra as to lead-in trenching and conduit requirements in rural areas.

4.4.6 Contacting Telstra about Telstra lead-in cabling

4.4.6.1 New lead-in cabling

Where it is necessary to contact Telstra for trenching advice for the installation of **new** lead-in cabling, please call the appropriate number listed below and follow the procedure listed.

Home 13 2200

Business 13 2000

- To the automated voice greeting, respond "**connections**", then "**fixed line phone**", and then your **telephone number** or "**I don't have one**", as applicable.
- Inform the Telstra consultant that you are calling about pre-provisioning of your premises.
- State the address to which the enquiry is related and, if requested, your name and contact number.
- Discuss your requirements with the Telstra consultant who will tell you the name and contact number of the Telstra contractor for your area.
- Call the Telstra contractor who will assist you with your enquiry.
- The Telstra consultant or the Telstra contractor may provide you with a reference number for any follow-up enquiries.

4.4.6.2 Existing lead-in cabling

If the lead-in trenching is for relocation of **existing** lead-in cabling (e.g. due to building renovations or land redevelopment), please call the following number:

Home or Business 1800 810 443

You will receive a brief automated voice greeting and then you will be switched through to the Telstra Network Integrity Team with which you may discuss your requirements.

You may be given a reference number for any follow-up enquiries.

4.5 Lead-in trench

4.5.1 Safety

4.5.1.1 General

For new buildings, all service cables, conduits and pipes are usually exposed at the time of installation of the lead-in cabling, minimising the hazards for the installer and the risk of damage to other services. Ideally, the lead-in cabling should be installed in the trench being dug for the electricity mains (see 4.5.8).

For established premises, the location of other underground services may be unknown. Accordingly, the trench should be dug by an experienced person who is familiar with underground service arrangements and who is suitably accredited or licensed where required by the relevant authority. Careless excavation work may result in personal injury (e.g. through contact with live underground power cables) or costly damage to underground conduits, pipes and cables. Service providers (including Telstra) may seek to recover their entire repair and associated costs in the event that any damage is caused to their assets.

4.5.1.2 Locating existing underground services

In order to avoid personal injury or damage to property, existing underground services should be located and identified by an experienced, suitably accredited or licensed person.

Methods for locating underground services include:

- Before any earth breaking activity is contemplated, contact the Dial Before You Dig (DBYD) "free call service", by telephoning 1100 or by visiting the DBYD website at http://www.1100.com.au for information about any underground services that may be in the vicinity (note that while plans supplied by DBYD may contain information about underground services on public or adjoining land, you are not required to dig the trench outside the boundary of your premises, e.g. in public footways, roadways or in neighbouring premises).
- Review any property documentation (e.g. building plans, electrical specifications, plumbing plan).
- Visually inspect the site noting the location of conduits, pipes or cables emerging from the ground at buildings, sheds, swimming pools, fountains, electric barbecues, garden lights, external power outlets, etc.
- Visually inspect the footway and verge for the location of any power, water, gas, sanitation, stormwater, drainage or telecommunications facilities (e.g. pedestals, pits, poles, meters, kerb markers, drains, conduits/pipes, cables).
- Ascertain the likely path of underground services using the above indicators.
- Verify the location of services using a cable locator or similar equipment, if available (note that existing services may not have been installed in a straight line).
- Verify the presence or absence of underground services at appropriate points along the chosen trenching route by careful hand digging (see below).

Where there is evidence of underground services along the chosen trench route but their position cannot be verified with reasonable accuracy, look for a more suitable route or excavate by careful hand digging where uncertainty exists.

Apply the following precautions when digging the trench:

- Allow for at least 1 m separation from any suspected underground service.
- Except where otherwise required by this document, e.g. if a PCD is to be installed on a pole as shown in Figure 13 (a), keep at least one 1 m away from any pole (to avoid disturbance of the pole footings and to allow for future replacement of the pole without disturbing the lead-in cabling that will be installed in the trench).
- When hand digging, use non-conductive tools (e.g. with wooden handles) and wear insulating (rubber) boots.
- Do not dig the trench any deeper than the recommended depth (see Table 1).

4.5.1.3 Service identification

As a guide only, the types of underground services that may be encountered on private property, and their typical characteristics, are as follows:

- Electrical power — power cables may be installed in orange conduit or covered by orange marker tape or cover strip. However, they may be incorrectly installed in galvanised iron pipe or grey conduit marked "ELECTRICAL" without an orange covering, so take care if you come across any such pipes or conduits.
- Garden lighting — cables for garden lighting operating directly from mains power (230 V a.c.) may be installed in the same way as electrical power cables described above. Cables for garden lighting that operate from a transformer (e.g. 12 V a.c.) are deemed to be non-hazardous and may be buried directly in the ground.
- Piped fuel gas — modern gas lines usually consist of yellow or yellow-ochre pipe (or a black pipe with a yellow stripe) or are covered by a yellowish marker tape, but earlier installations may have used copper or steel pipe.
- Water — potable water is usually supplied in copper, galvanised iron, black polyethylene or white plastic pipe.
- Grey water (recycled water) — pipes used for recycled water are likely to be black polyethylene (preferably with a violet stripe), white plastic or violet plastic pipe.
- Sanitation (sewerage/waste water) — modern sanitation pipes are generally white or light grey plastic, but earlier installations may have used earthenware (e.g. fired clay), concrete or asbestos cement pipes.
- Stormwater — modern stormwater pipes are generally light coloured plastic (e.g. white, grey, pink, blue) but earlier installations may have used earthenware (e.g. fired clay), concrete or asbestos cement pipes.
- Drainage (surface water or seepage drain) — pipes used for drainage of surface or seepage water are usually white plastic or black polyethylene with slots or holes cut in them, but earlier installations may have used earthenware or concrete pipes without seals, rubble (gravel) pits covered with sheeting and soil or a combination of these.

If you damage any underground service, do not attempt to fix it yourself. Get an expert to repair it.

4.5.2 Trench depth

The trench depth requirements are different for urban and rural areas. You may need to contact the relevant carrier for advice as to whether the carrier deems the area to be urban or rural.

To the extent that the terrain will reasonably allow, the conduit (or cable in rural areas where the cable is directly buried) must be installed in a uniform trench of the depth specified in Table 1 for the applicable conditions. The depth specified in Table 1 includes allowance for the depth of the conduit or cable itself.

In urban areas, if the length of the lead-in conduit will exceed 50 m, pits must be installed at intervals of no more than 50 m.

In rural areas where the cable is normally buried directly in the ground without conduit, pits will usually only be necessary for long cable runs to joint cables (in some areas, aboveground jointing posts may be used for this purpose instead of pits). The carrier (usually Telstra) will install any necessary cable jointing pits or posts as required.

Table 1 Trench depth required (Note 1)

		Urban area	Rural area (cable directly buried without conduit)	
		For 23 mm ID conduit	Soil & non-continuous rock (Note 2)	Continuous rock (Note 3)
Non-trafficable area, driveway or private footway (Note 4)	Minimum	350 mm	500 mm (where deep cultivation ploughing is not likely)	250 mm
	Maximum	550 mm	650 mm	650 mm
	Recommended (Note 5)	400 mm	550 mm	300 mm
Private roadway (Note 4)	Minimum	500 mm under the lowest point	500 mm under the lowest point (usually the gutter or kerb)	

Notes:

1. If it is not possible to provide the required depth due to ground conditions, seek advice from the carrier.
2. "Soil" means sand, gravel, clay, loam or silt. "Non-continuous rock" means stones and boulders ("floaters") set in soil.
3. "Continuous rock" means rock in continuous strata or prevailing on a massive scale. It can only be removed by blasting and ripping or by using a rock breaker or a rock saw.
4. Private footways and roadways are typically found in town-house/villa complexes, retirement villages, caravan parks, etc. Such complexes do not generally have clearly defined footways.
5. The recommended depth allows for fluctuations in ground conditions and for the use of bedding material, if required, to ensure that the minimum depth of cover above the conduit or cable is achieved.

4.5.3 Trench width

For 23 mm ID conduit or directly buried rural cables, the width of the trench should be no less than 100 mm and should follow the contour of the conduit/cable path as closely as possible (see 4.2.3 on page 6).

4.5.4 Bedding and backfill material

The installed conduit must be supported firmly and evenly on all sides using bedding sand or the excavated material as long as the material does not contain any metal, concrete, rocks or similarly hard material exceeding 50 mm in cross-section. The bedding and backfill material must be free of any timber or other fibrous material that may decompose or attract termites.

4.5.5 Retaining walls and embankments

Where there is, or will be, a retaining wall or embankment in the path of the lead-in cabling:

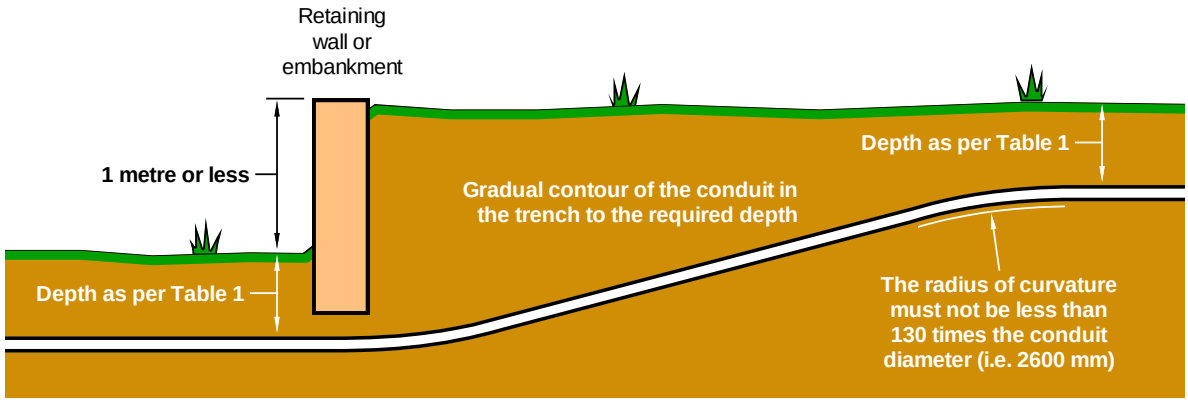
(a) If the vertical height of the retaining wall or embankment does not exceed 1 m, the trenching/ conduit may continue under the wall or embankment at a gradual incline to resume the appropriate depth set out in Table 1 on the high side of the wall/embankment (see Figure 15). Alternatively, the technique described in (b) may be applied.

(b) If the vertical height of the retaining wall or embankment exceeds 1 m, the trenching/conduit must end at the foot of the retaining wall or embankment and recommence at the high side of the wall/embankment at the depth set out in Table 1 (see Figure 16).

(c) If the wall or embankment is at a gradual incline to the horizontal, the trenching/conduit should follow the incline as close as practicable to the appropriate depth set out in Table 1 (see Figure 17).

Note: If one side of the wall or embankment is on public property (such as a footway) or a neighbouring property, the trenching/conduit on that side of the wall/embankment is the carrier's responsibility.

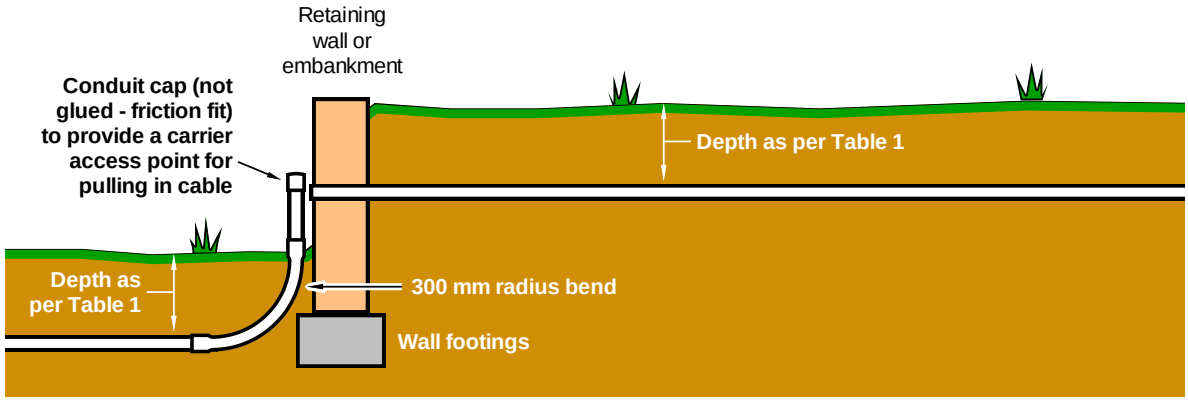
Figure 15 Lead-in conduit arrangement where a retaining wall or embankment does not exceed a vertical height of 1 m



Notes:

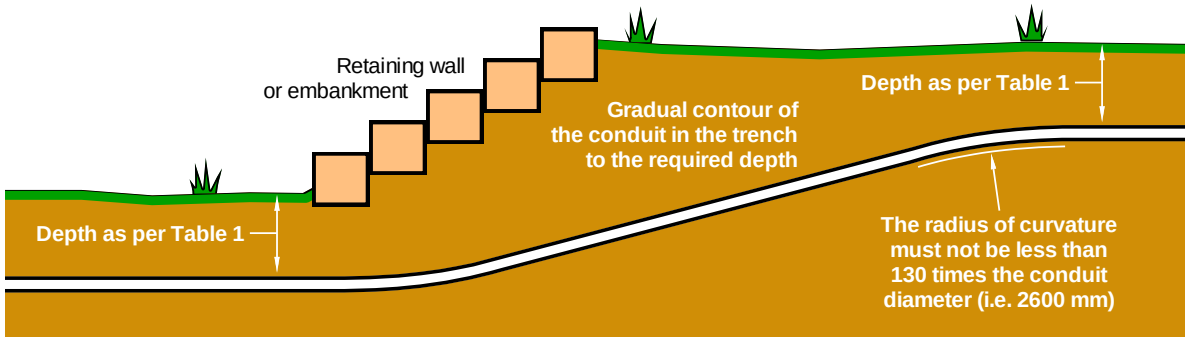
1. The technique may be applied either before or after the retaining wall is installed or an embankment is created.
2. For an existing retaining wall or embankment, the technique shown in Figure 16 may be applied.

Figure 16 Lead-in conduit arrangement where a retaining wall or embankment exceeds a vertical height of 1 m



Note: The carrier may install a metal cover strip over the conduit on the surface of the retaining wall as a mower guard.

Figure 17 Lead-in conduit arrangement for a gradually sloping retaining wall or embankment



Note: The trenching should follow the contour of the finished ground level within the curvature (flexing) constraints of the conduit.

4.5.6 Proximity to power poles

Lead-in trenching should be kept at least 1 m away from any power poles (including poles used for lighting) to allow for future replacement of the pole without disturbing the lead-in cabling — except in cases where the electricity enclosure is installed on the pole and it is necessary to run the lead-in cabling via a PCD on the pole supporting the electricity enclosure. Refer to Figure 13 (a) and Figure 14.

4.5.7 Trenching outside the premises

Your premises includes common property (e.g. controlled by a body corporate) or a private easement or right of way (e.g. for a driveway). You must obtain permission from the body corporate or owner of the easement or right of way before trenching through it.

Do not dig the trench outside the boundary of your premises, e.g. in a public footway, roadway or in neighbouring premises. Trenching outside your premises is subject to land access code requirements and is the carrier's responsibility.

4.5.8 Shared trench arrangements

For new building construction, lead-in cabling may be installed in a shared trench with another service (preferably the electricity mains) to reduce costs and minimise the width of the service corridor through the property. Trench sharing arrangements are illustrated in Figure 18 to Figure 20. Where the trench is shared with more than one other service, their respective separations must be maintained. Local authority requirements, or the requirements of the other utility, may preclude a shared trench with some services.

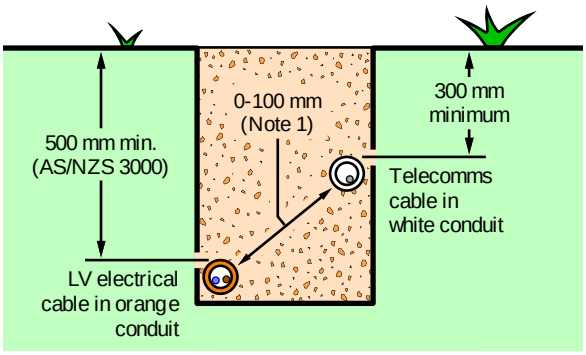
For **Telstra** lead-in cabling, no separation is required from the conduits or cables of another **telecommunications** service unless:

- separation is required by the owner of the other telecommunications service; or
- the other telecommunications service is a conduit or cable of **another carrier**, in which case a minimum radial clearance of **100 mm** is required in accordance with ACIF Industry Code C524, *External Telecommunication Cable Networks*.

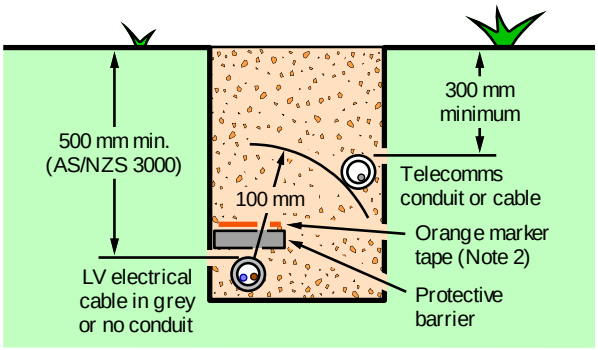
Note: NBN Co may require other telecommunications conduits to be separated from their lead-in conduits.

Figure 18 Shared trench with LV (low voltage) electricity (e.g. normal domestic single-phase or three-phase power mains)

(a) Electrical cable in orange conduit



(b) Electrical cable physically protected by means other than orange conduit

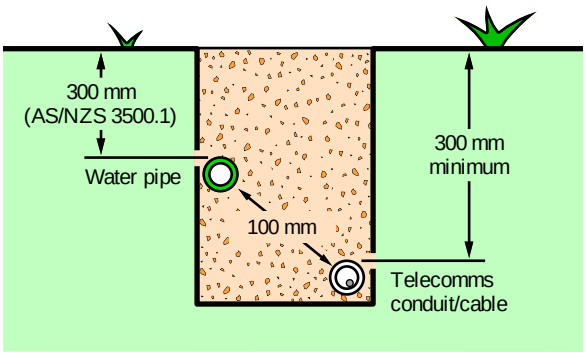


Notes:

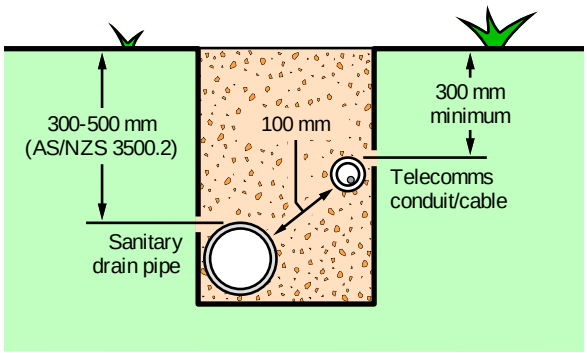
1. No separation is required if the lead-in cable is installed in white conduit and the electrical cable is installed in orange conduit. At least 100 mm separation is required if the electrical cable is installed in orange conduit and the lead-in cable is directly buried without conduit (e.g. rural areas). The telecommunications conduit or cable should be installed above the electrical conduit.
2. Orange marker tape is required where the protective barrier is not orange in colour. The lead-in conduit must be installed above the electrical cable/conduit and separated from it by a minimum distance of 100 mm whether or not the lead-in cable is buried in conduit.
3. Lead-in cabling must **not** share a trench with unprotected electrical cable (e.g. not in orange conduit or not covered by concrete, approved bricks etc.) or electrical cable that is not identified by orange conduit, orange cover strip or orange marker tape. In such cases the lead-in cable must be installed in a separate trench.
4. In some rural areas, Telstra installs a guard wire above the cable to provide additional protection against lightning ground strikes. However, this does not affect the trench depth requirements or the separation distances required from other services.
5. Lead-in cabling must **not** be installed in a shared trench with HV (high voltage) electricity cabling (i.e. cable carrying a voltage exceeding 1000 V a.c.).

Figure 19 Shared trench with water and sanitary pipes

(a) Water service pipe



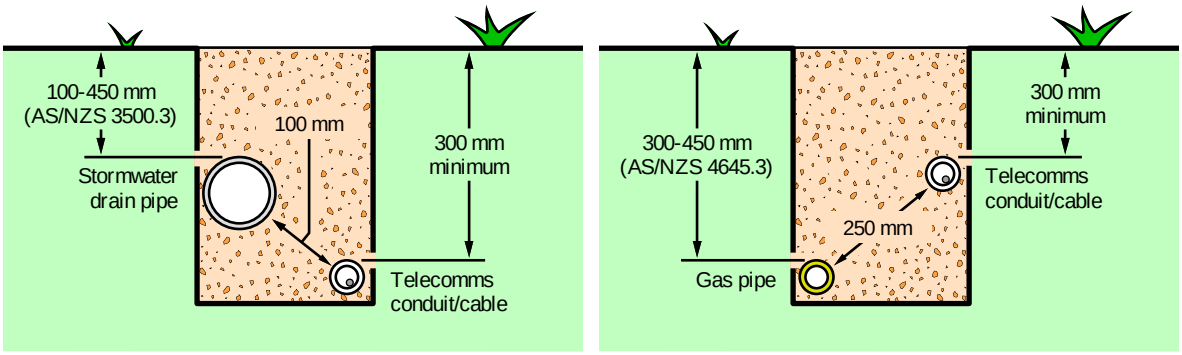
(b) Sanitary plumbing/drainage pipe



Note: The depths shown for water pipe and sanitary plumbing/drainage pipe are provided for guidance. The depths stated are the minimum specified in the relevant standards for burial of the pipe on private property. The required minimum depth may vary according to exposure of the location to vehicular traffic or the type of pipe used.

Figure 20 Shared trench with stormwater and gas pipes

(a) Stormwater drainage pipe **(b) Gas service pipe**



Notes:

1. The lead-in conduit/cable must **not** be installed above the stormwater drainage pipe (this is a requirement of AS/NZS 3500.3).
2. The depths shown for stormwater pipe and gas pipe are provided for guidance. The depths stated are the minimum specified in the relevant standards for burial of the pipe on private property. The required minimum depth may vary according to exposure of the location to vehicular traffic, the type of pipe used or, in the case of gas pipe, the service pressure.

4.5.9 Exclusive (separate) trench

Where it is not possible to use a shared trench with another service, the lead-in cabling must be installed in an exclusive (separate) trench.

For parallel runs with services other than electrical cables, the minimum separation from these services must be in accordance with 4.5.8. For parallel runs with electrical cables, the minimum separation between the lead-in cable or conduit and the electrical cable/conduit must be in accordance with Table 2 and Figure 21.

Where the Telstra conduit crosses the path of another service, the crossover must comply with 4.5.10.

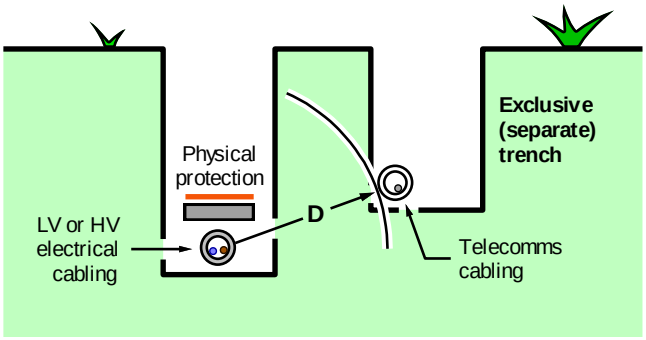
Table 2 Separation from electricity — exclusive trench

	LV (Note 1)		**HV** (Note 2)	
	With protective covering (Note 3)	**Without protective covering** (Note 4)	**With protective covering** (Note 3)	**Without protective covering** (Note 4)
Minimum separation distance "D" (see Figure 21)	100 mm	300 mm	300 mm	450 mm

Notes:

1. LV (Low Voltage) is typically used for electricity mains supply to single dwellings (i.e. 230 V a.c. single-phase power or 400 V a.c. three-phase power).
2. HV (High Voltage) is typically used for electricity mains supply to large multi-residential or large commercial premises (e.g. 11,000 V a.c. power to an HV transformer).
3. For an exclusive trench, try to keep at least 300 mm away from LV and 450 mm from HV whether or not the electricity has a protective covering. Where there is any doubt as to whether the electricity is, or will be, physically protected in accordance with AS/NZS 3000, a minimum separation distance of 300 mm from LV or 450 mm from HV must be maintained.
4. Installation of underground electrical cable in customer premises without a protective covering is not allowable under the electrical wiring rules (AS/NZS 3000). However, there may be cases where AS/NZS 3000 doesn't apply or unprotected cable is incorrectly installed.

Figure 21 Separation from electrical conduit or cable — exclusive trench



Note: The trench must be located such that distance "D" (refer to Table 2) is maintained between the electrical conduit or cable and the lead-in conduit/cable. This distance may be measured radially in any direction from the electrical conduit/cable.

4.5.10 Crossovers with other services

Where the lead-in cabling crosses another service, separation from the other service at the crossover must be in accordance with Table 3.

Table 3 Separation at crossovers with other services within customer premises

Other service	Lead-in separation requirements
LV electrical cable with a protective covering	The lead-in cabling must be separated from the electrical cable by at least 100 mm at the crossover, and should cross **above** the electrical cable (see Figure 22). The lead-in cabling may only cross under the electrical cable if a concrete protective covering is installed above the electrical cable at the crossover in accordance with Figure 25.
LV electrical cable **without** a protective covering (Note 1)	The lead-in cabling must cross at least 300 mm **above** the electrical cable (see Figure 23) unless a protective covering of concrete is provided over the electrical cable 600 mm each side of the crossing as shown in Figure 24, in which case a 100 mm separation is allowable. If it is necessary for the lead-in cabling to cross under the electrical cable: • it should only be installed by boring; • a concrete protective covering must be installed above the electrical cable at the crossover in accordance with Figure 25; and • a minimum separation distance of 300 mm must be maintained from the electrical cable at the crossover.
HV electrical cable with a protective covering	The lead-in cabling must be separated from the electrical cable by at least 300 mm at the crossover, and should cross **above** the electrical cable (see Figure 22). The lead-in cabling may only cross under the electrical cable if a concrete protective covering is installed above the electrical cable at the crossover in accordance with Figure 25.
HV electrical cable **without** a protective covering (Note 1)	The lead-in cabling must cross at least 450 mm **above** the electrical cable (see Figure 23) unless a protective covering of concrete is provided over the electrical cable 600 mm each side of the crossing as shown in Figure 24, in which case a 300 mm separation is allowable. If it is necessary for the lead-in cabling to cross under the electrical cable: • it should only be installed by boring; • a concrete protective covering must be installed above the electrical cable at the crossover in accordance with Figure 25; and • a minimum separation distance of 300 mm must be maintained from the electrical cable at the crossover.
Water service pipe	The lead-in cabling must cross at least 100 mm **below** the water pipe at an angle not less than 45° and should be covered by white marker tape complying with AS/NZS 2648.1 laid 150 mm above the lead-in cabling for at least 1 m either side of the crossing (Note 2).
Sanitary plumbing/ drainage pipe	The lead-in cabling must cross at least 100 mm **above** the pipe at an angle not less than 45° and should be covered by white marker tape complying with AS/NZS 2648.1 laid 150 mm above the lead-in cabling for at least 1 m either side of the crossing (Note 2).
Stormwater drainage pipe	The lead-in cabling must cross at least 100 mm **below** the pipe at an angle not less than 45° and should be covered by white marker tape complying with AS/NZS 2648.1 laid 150 mm above the lead-in cabling for at least 1 m either side of the crossing (Note 2).
Gas service pipe	The lead-in cabling must cross at least 100 mm **above** the pipe at an angle not less than 45° and should be covered by white marker tape complying with AS/NZS 2648.1 laid 150 mm above the lead-in cabling for at least 1 m either side of the crossing (Note 2).
Telecommunications	The lead-in cabling must cross at least 100 mm **above or below** (whichever is expedient) the other telecommunications conduit or cable and should be covered by white marker tape complying with AS/NZS 2648.1 laid 150 mm above the lead-in cabling for at least 1 m either side of the crossing (Note 2).

Notes:

1. Installation of underground electrical cable in customer premises without a protective covering is not allowable under the electrical wiring rules (AS/NZS 3000). However, there may be cases where AS/NZS 3000 doesn't apply or unprotected cable is incorrectly installed.
2. Marker tape that complies with Australian Standard AS/NZS 2648.1, *Underground marking tape Part 1: Non-detectable tape*, is required to be at least 75 mm wide (preferably 100 mm or 150 mm wide) with black block lettering at least 25 mm high. The text should contain "COMMUNICATION" or "TELECOMMUNICATION" to identify the service. The text must be repeated at intervals of 1 m or less.

Figure 22 Crossing *above* electrical cable with a protective covering that complies with AS/NZS 3000 requirements

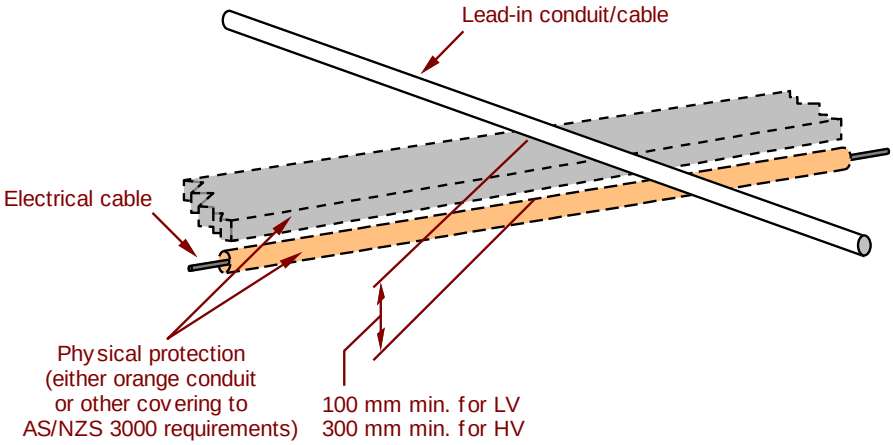
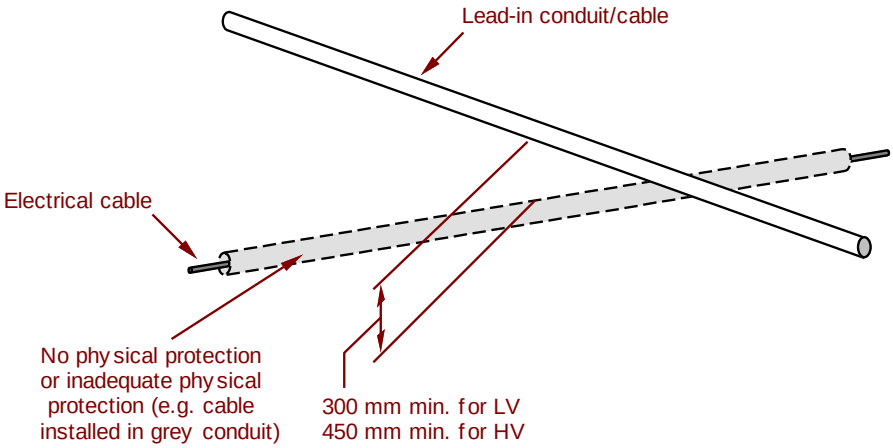
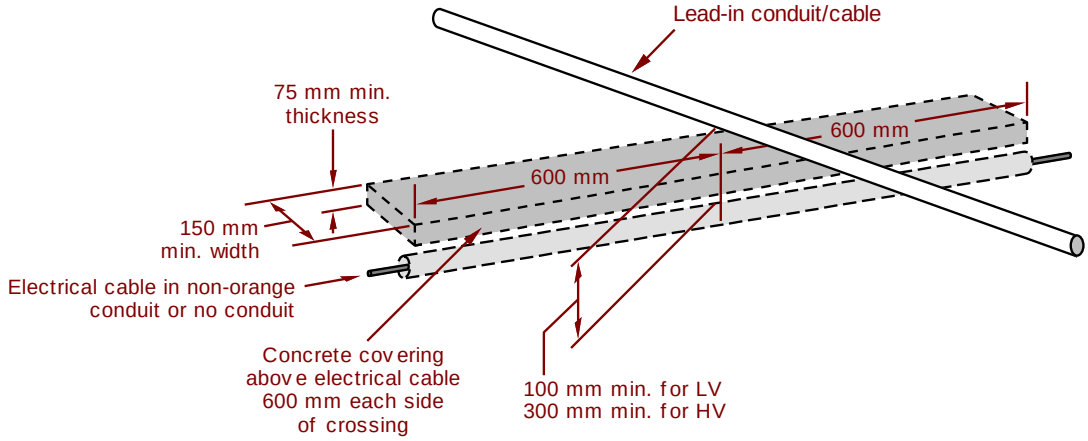


Figure 23 Crossing *above* electrical cable with NO protective covering



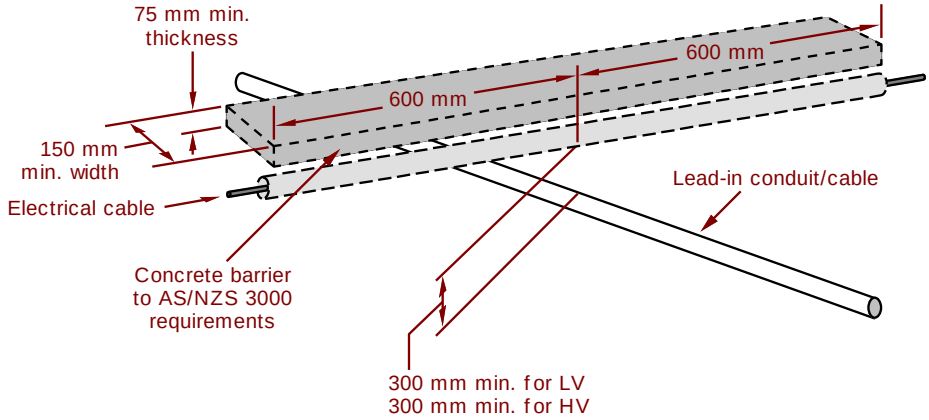
Note: Installation of underground electrical cable in customer premises without a protective covering is not allowable under the electrical wiring rules (AS/NZS 3000). However, there may be cases where AS/NZS 3000 doesn't apply or unprotected cable is incorrectly installed.

Figure 24 Crossing *above* electrical cable with a concrete protective covering that complies with AS/NZS 3000 requirements installed at the crossing



Note: The concrete covering is to protect against accidental contact with the electrical cable if excavating along the path of the lead-in cabling subsequent to its initial installation.

Figure 25 Crossing *under* electrical cable



Notes:

1. Lead-in cabling should only be installed under electrical cable during boring. If a concrete protective covering to AS/NZS 3000 requirements has not been provided above the electrical cable, a concrete strip at least 150 mm wide and 75 mm thick must be provided 600 mm each side of the crossing.
2. The concrete covering is to protect against accidental contact with the electrical cable if excavating along the path of the lead-in cabling subsequent to its initial installation.

4.6 Lead-in cable

The carrier will supply, install and connect the lead-in cable. The customer's cabler must **not** pull the lead-in cable through the conduit or connect it to the PCD.

Note: Lead-in cabling must **not** be used for customer cabling purposes. Customer cabling must be separate and distinct from lead-in cabling.

5 AERIAL LEAD-IN CABLING

To skip the aerial lead-in cabling information, go to section 6 (premises connection devices) on page 35.

5.1 General

Where aerial lead-in cabling is to be installed for connection to the Telstra network to supply a Telstra service, the customer is required to pay the cost of erection, by Telstra, of any Telstra poles that are required within the confines of the customer's premises, including clearing of land along the cabling route, digging of the pole holes and reinstatement of the land after the poles are installed (such poles are normally only required with acreage or rural properties). The supply of the poles and the cable, and the installation of the cable on the poles, is included in the basic telephone new service connection charge.

Telstra will not permit the customer or a third party (e.g. a contractor of the customer's choosing) to install the Telstra poles but the customer may reduce Telstra's pole installation charges by arranging clearing of the land, digging the holes and backfilling them under Telstra direction and supervision.

5.2 Lead-in cabling route

The route of the lead-in cabling will be determined by Telstra in accordance with the principles set out in 4.4.1 to 4.4.4 (pages 12 to 16). This information may be used to determine the likely PCD location.

5.3 Private poles and trees

For safety reasons, Telstra will not use trees or customer-owned poles to support new aerial Telstra lead-in cabling. This includes any poles installed by the customer to support the power mains.

5.4 Power utility poles

Telstra may agree to use poles owned by a power utility (subject to the agreement of the power utility) because they are regularly inspected and properly maintained by the power utility. However, the use of such poles is at Telstra's discretion.

5.5 Inspection and maintenance of poles

Telstra regularly inspects Telstra-owned poles and replaces any defective poles at Telstra's cost.

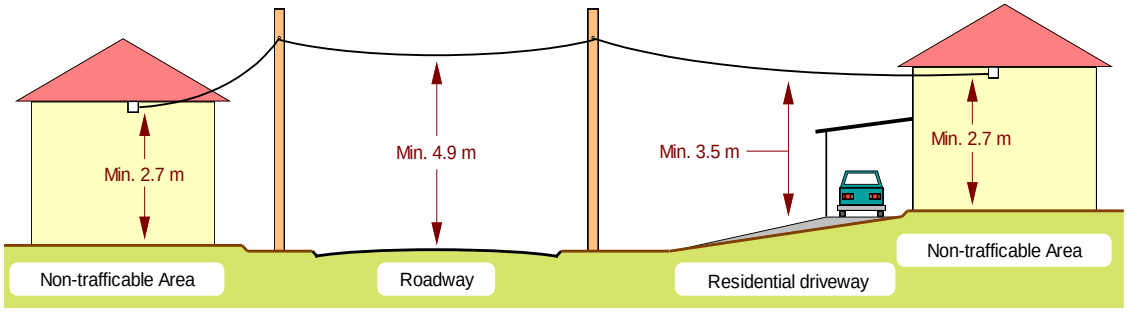
5.6 Clearance of aerial lines from the ground

The minimum ground clearances required for aerial lead-in cabling in residential areas are as follows (see Figure 26):

- over any private land not traversable by road vehicles 2.7 m
- over any residential driveway 3.5 m
- over any commercial/industrial driveway or private roadway 4.9 m.

Note: This information is provided for guidance only in determining whether a raiser pole may be required at the building (see Figure 29 and Figure 30). The lead-in cable will be installed by the relevant carrier.

Figure 26 Minimum ground clearances for residential aerial lead-in cabling



Note: At least 5.5 m clearance (or as specified by the relevant transport authority) is normally required above any part of a freeway, primary arterial or collector road or highway.

5.7 Clearance from other services

5.7.1 At poles and in-span

The minimum separation distances required from low voltage (230 V AC single-phase or 400 V AC three-phase) power mains, associated fittings and terminations on poles or in-span are set out in 5.8 (h).

5.7.2 At the building

Sufficient separation must be provided at the building between the lead-in cable attachment point and any insulated low voltage power service lead such that **600 mm** can be maintained between the power cables and fittings and the **body of a person working on the lead-in cabling**. This means that if the telecommunications worker cannot safely access the lead-in cable or attachment on the side of the cable or attachment furthest from the power cables and fittings, a separation of at least 1200 mm will be required between the power cables and fittings and the lead-in cables and fittings at the building.

5.8 Use of Telstra poles for power mains

While Telstra will not use any poles installed by the customer to support the LV power mains, Telstra will allow Telstra-owned lead-in poles to be used to support the customer's low voltage (LV) power mains (i.e. 230 V AC single-phase or 400 V AC three-phase) under the following conditions:

(a) Only poles erected at the customer's cost (as described in 5.1) may be used, i.e. poles installed in accordance with the standard terms and conditions for the supply of a Telstra telephone service as set out in Telstra's "Our Customer Terms" available online at www.telstra.com.au/customer-terms/ (the poles are supplied at Telstra's cost but are erected at the customer's cost).

(b) Telstra must be notified of this requirement **prior** to the commencement of pole installation.

(c) The customer must pay any additional cost incurred to meet this requirement (e.g. any extra pole height required to accommodate the power mains).

(d) The customer must arrange and pay for the installation and maintenance of the power mains on the Telstra poles, including transfer of the power mains to any poles subsequently replaced by Telstra.

(e) Only Telstra poles located within the boundaries of the customer's premises may be used. Telstra poles located outside the customer's real property boundary must **not** be used to support the customer's power mains.

(f) High voltage power lines (exceeding 1000 V AC) must **not** be installed on the Telstra poles.

(g) The power mains must be installed **above** the aerial Telstra cable at a height that, taking into account the required separation distances described in (h), would enable the following minimum ground clearances to be maintained for the Telstra aerial cabling (see 5.6):

(i)	Over any private land not traversable by road vehicles	2.7 m
(ii)	Over any residential driveway	3.5 m
(iii)	Over any commercial/industrial driveway or private roadway	4.9 m

(h) The power mains, associated fittings and terminations must be separated from the aerial Telstra cabling, associated fittings and terminations by the following minimum distances:

(i)	Insulated power mains	At the pole	600 mm
		In span	600 mm
(ii)	Uninsulated power mains	At the pole	1200 mm
		In span	600 mm
(iii)	Light fitting, stay fitting or power conduit	At the pole	50 mm

5.9 Use of Telstra poles for customer cabling

Telstra will allow Telstra-owned lead-in poles to be used to support customer cabling under the following conditions:

(a) Only poles erected at the customer's cost (as described in 5.1) may be used, i.e. poles installed in accordance with the standard terms and conditions for the supply of a Telstra telephone service as set out in Telstra's "Our Customer Terms" available online at www.telstra.com.au/customer-terms/ (the poles are supplied at Telstra's cost but are erected at the customer's cost).

(b) Only Telstra poles located within the boundaries of the customer's premises may be used. Telstra poles located outside the customer's property boundary must **not** be used for customer cabling.

(c) The poles must be of sufficient height and the Telstra lead-in cable must be installed on the poles at sufficient height to allow installation of the customer cabling in accordance with (d), (e), (f) and (g).

(d) The customer cabling must be installed below the aerial Telstra cabling.

(e) The customer cable and associated pole fittings must be separated from the Telstra cable and associated pole fittings by at least 300 mm at the pole.

(f) The customer cable must be separated in-span from the Telstra cable by at least 300 mm.

(g) The customer cabling must be installed in accordance with the relevant requirements of the ACMA wiring rules including minimum ground clearances (currently the same as described in 5.6).

(h) The customer cable must not be installed within any Telstra underground conduit or pit or within any Telstra conduit installed on the pole.

5.10 Aerial cable attachment at the building

The cable attachment point should be as close as possible to the building electricity enclosure to facilitate location of the PCD in accordance with section 6. The location and height of the point of attachment to the building or other structure must allow a route from the pole to the building that:

- does not cross any adjacent property;
- is unobstructed by existing trees or foliage; and
- is capable of maintaining the specified ground clearances and separation from power cables described in 5.6 and 5.7.

Note: The location of the cable attachment point must also take into account any planned structural additions to the premises, future tree growth or prospective planting of any trees along the proposed cable path.

The cable attachment point at the building must be within reach of a standard one-person extension ladder that is able to be safely erected and secured at the site. The attachment must be made at the perimeter of the building (e.g. fascia, bargeboard or external wall) and not at any point on the roof.

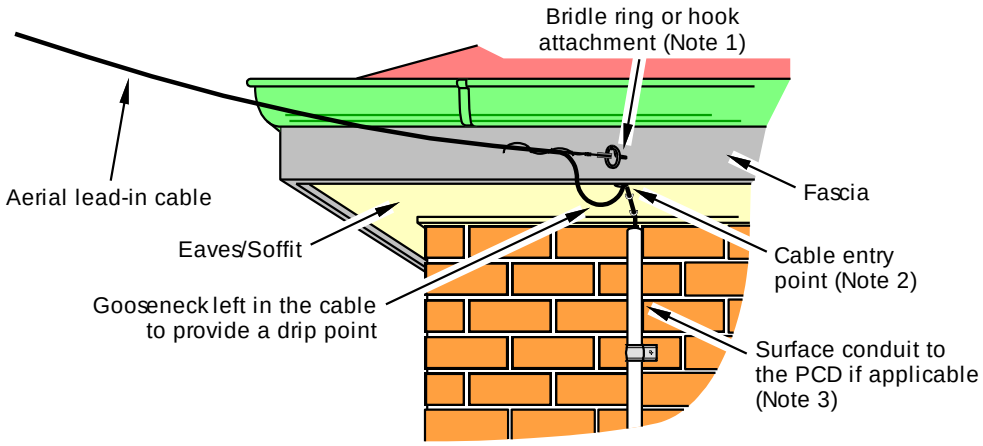
The preferred means of attachment of aerial lead-in cable to the building is to a solid timber fascia or bargeboard or a metal fascia/bargeboard backed by structural timber. The structural member into which the attachment is made must be of sufficient strength to withstand a tension of 2000 Newtons (approximately 200 kgf).

The proposed point of cable attachment with the required structural integrity should be marked on the building plan or the building itself by the builder. Up to three cables of the following description (in any combination) may be attached to the same attachment point:

- 2-pair lead-in cable with integral bearer (ALIC — Aerial Lead-In Cable)
- RG6 or RG11 coaxial "messenger" cable (i.e. with integral bearer)
- single-core optical fibre cable with integral strengthener(s).

The various means of attaching aerial telecommunications cables to buildings are illustrated in Figure 27 to Figure 30.

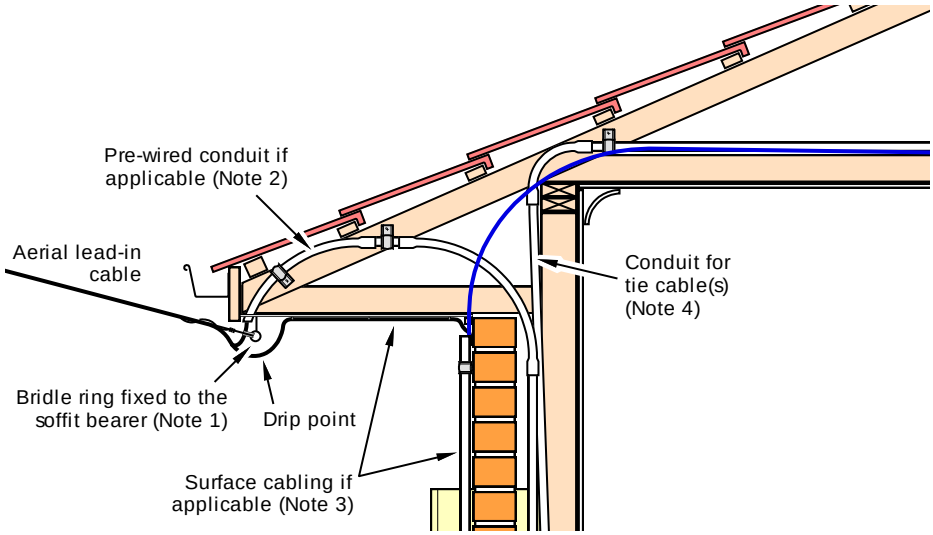
Figure 27 Attachment of aerial cable to the fascia



Notes:

1. This is the preferred means of attachment to the building if the fascia has sufficient structural integrity and the aerial cable will have sufficient ground clearance.
2. If the building has been prepared in accordance with 7.4.4 (page 52) or 7.5.4 (page 58), the lead-in cable may be pulled through the concealed conduit to the CUE or PCD.
3. For an established building, the lead-in cable will usually be extended to the PCD via conduit fixed to the external surface of the building.

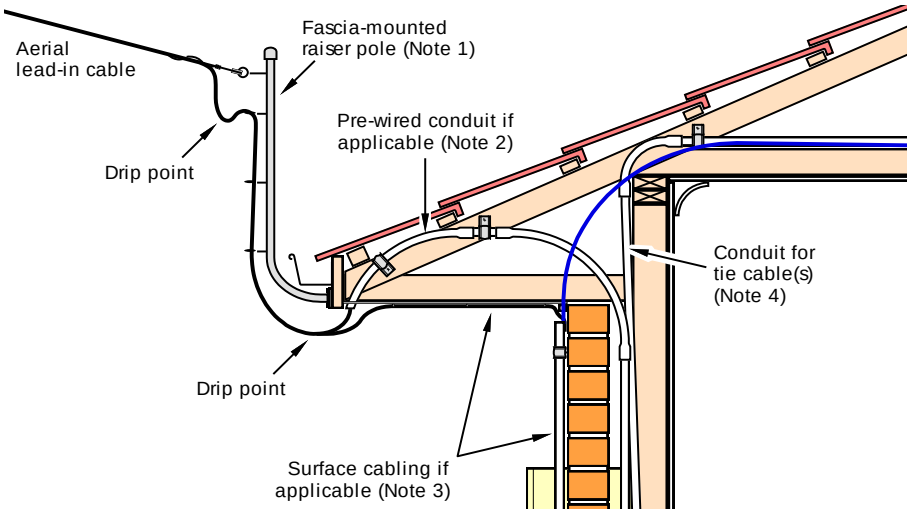
Figure 28 Attachment of aerial cable to the soffit bearer



Notes:

1. This method of attachment may be used if the fascia has insufficient strength to support the aerial cable attachment — as long as the cable will not rub against the fascia or gutter and there will be sufficient ground clearance if this method is used.
2. If the building has been prepared in accordance with 7.4.4 (page 52) or 7.5.4 (page 58), the lead-in cable may be pulled through the concealed conduit to the CUE or PCD.
3. For an established building, the lead-in cable will usually be extended to the PCD via conduit fixed to the external surface of the building.
4. If the building has been prepared in accordance with 7.4.4 or 7.5.4, the tie cable(s) may be pulled through the concealed conduit to the CCP. Otherwise, the tie cable(s) may need to be run via surface-run conduit.

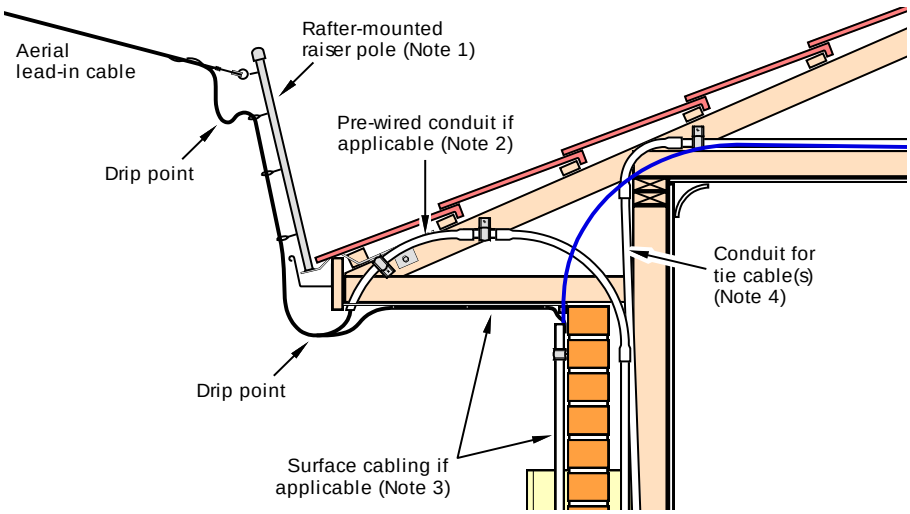
Figure 29 Attachment of aerial cable to a raiser pole attached to the fascia



Notes:

1. A raiser pole must be used where insufficient ground clearance can be obtained by attaching the aerial cable directly to the fascia. The raiser pole may be attached to the fascia as shown above if it has sufficient structural integrity to support the pole. The length of the raiser pole will not exceed 1200 mm and is installed by the carrier.
2. If the building has been prepared in accordance with 7.4.4 (page 52) or 7.5.4 (page 58), the lead-in cable may be pulled through the concealed conduit to the CUE or PCD.
3. For an established building, the lead-in cable will usually be extended to the PCD via conduit fixed to the external surface of the building.
4. If the building has been prepared in accordance with 7.4.4 or 7.5.4, the tie cable(s) may be pulled through the concealed conduit to the CCP. Otherwise, the tie cable(s) may need to be run via surface-run conduit.

Figure 30 Attachment of aerial cable to a raiser pole attached to the rafter/truss



Notes:

1. A raiser pole must be used where insufficient ground clearance can be obtained by attaching the aerial cable directly to the fascia. Where the fascia does not have sufficient structural integrity to support the pole, the pole must be attached to the roof rafter or truss as shown above. The length of the raiser pole will not exceed 1200 mm and is installed by the carrier.
2. If the building has been prepared in accordance with 7.4.4 (page 52) or 7.5.4 (page 58), the lead-in cable may be pulled through the concealed conduit to the CUE or PCD.
3. For an established building, the lead-in cable will usually be extended to the PCD via conduit fixed to the external surface of the building.
4. If the building has been prepared in accordance with 7.4.4 or 7.5.4, the tie cable(s) may be pulled through the concealed conduit to the CCP. Otherwise, the tie cable(s) may need to be run via surface-run conduit.

6 PREMISES CONNECTION DEVICE (PCD)

6.1 Description

The premises connection device (PCD) facilitates the transition from outdoor (underground or aerial) cabling to indoor cabling. No matter what wireline telecommunications network technology is used to supply the telecommunications services, the lead-in cabling will be connected to a PCD at the external wall of the building and will be interconnected to the indoor termination equipment via one or more indoor "tie" cable(s). The PCD may or may not be the network boundary and may vary in form and function depending on the telecommunications network technology used.

Typical PCDs are shown in Figure 31 and Figure 32.

Figure 31 Typical PCDs that are not the network boundary

Telstra FTTP (optical fibre) splice box

This box is 260 H x 250 W x 72 D

NBN Co FTTP (optical fibre) splice box

This box is 210 H x 175 W x 75 D

Standard Telstra HFC (coaxial) isolation box

This box is 215 H x 136 W x 63 D

Larger Telstra HFC (coaxial) isolation box

This box is 250 H x 270 W x 85 D

Notes:

1. The above devices are shown in relative size. These devices are not NTDs and do not require an earth. They are installed by the carrier.
2. The larger Telstra isolation box may be used for housing an RF amplifier (e.g. for more than 3 coaxial outlets).
3. At least 150 mm of clear space is generally required on all sides of all PCDs for cabling and access purposes. This clearance distance may be reduced for a PCD housed in a combined utilities enclosure (see 6.2) or between two PCDs located on the same wall (refer to 7.5.6.3 on page 64 for an example).

Figure 32 Typical network boundary PCDs (NTDs)

Telstra ADSL NTD for twisted pair lead-in cable

This NTD is 260 H x 250 W x 72 D

Telstra FTTP NTD for optical fibre lead-in cable

This NTD is 345 H x 305 W x 110 D

Notes:

1. The above NTDs are shown in relative size. They require a hard-wired communications earth (see section 9).
2. The NTD on the left may be installed by the builder's or customer's registered cabler. Refer to Telstra Document No. 012688, *Telstra Network Termination Device — Information for Cabling Providers*.
3. The NTD on the right is installed by Telstra. Telstra will cease using these NTDs for new installations in late 2013 and will use indoor NTDs instead. Refer to Document No. 017153a00 for more information.
4. At least 150 mm of clear space is generally required on all sides of the NTD for cabling and access purposes. This clearance distance may be reduced for an NTD housed in a combined utilities enclosure (see 6.2) or between the NTD and another PCD located on the same wall (refer to 7.5.6.3 on page 64 for an example).

6.2 External combined utilities enclosure (CUE)

6.2.1 Description

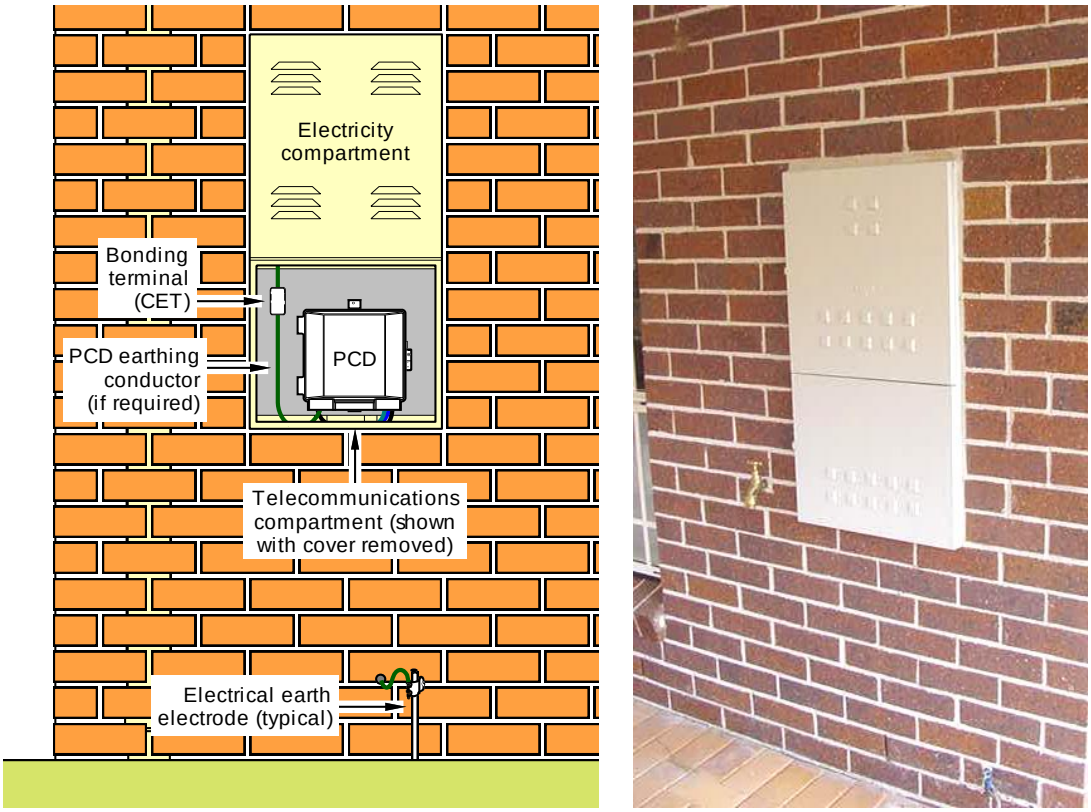
With new homes, it is preferable for the builder or electrician to provide a Combined Utilities Enclosure (CUE) for termination of the building entry conduit and housing of the PCD. Refer to Figure 33.

The CUE allows the cabling and equipment for various utilities such as electricity, telecommunications and, optionally, gas or water, to be housed in a single, compartmentalised enclosure. A CUE:

- improves the overall appearance of the building;
- simplifies the conduit and cabling arrangements, especially where the telecommunications network technology is unknown or is likely to change;
- provides convenient storage space for slack telecommunications cables (i.e. within the CUE);
- avoids problems with mounting PCDs on low-density cladding materials such as polystyrene;
- provides additional protection for the PCD and associated cables from the weather, hosing or impact from garden tools, balls, toys, etc.;
- facilitates effective earthing of the PCD, where required;
- improves accessibility by service personnel; and
- assists in implementing standardised installation practices.

The CUE must be installed by the electrician as part of the electrical installation.

Figure 33 Combined electricity and telecommunications enclosure (installed by the electrician)



Note: The equipotential bonding conductor for the CET (Communications Earth Terminal) must be installed by the electrician. The CET may be installed by either the electrician or the telecommunications installer. See section 9 for details.

6.2.2 CUE requirements

Telstra's requirements for CUEs are set out in Telstra Specification 010062, *Combined Utilities Enclosures* (Issue 4). The essential Telstra requirements for CUEs are as follows:

(a) The minimum internal dimensions of the space in which the PCD is to be housed must be 480W x 415H x 140D (in mm). The depth ("D") is measured between the face of the backboard described in (c) and the inside surface of the door.

(b) The telecommunications compartment door aperture must be at least 375W x 375H (in mm).

(c) A backboard of insulating material (e.g. timber) that is at least 400 mm wide and 18 mm thick must be provided for mounting of the PCD and must extend at least 350 mm below the horizontal plane of the top edge of the door aperture.

(d) A sturdy metal plate must be provided over any electrical conduits or cables that run behind the telecommunications backboard described in (c). A minimum clearance of 20 mm must be provided between the metal plate and the rear of the backboard for the passage of cables.

(e) Suitable cable entry facilities or knock-outs must be provided and must be accessible within the telecommunications compartment.

B&R Enclosures (http://www.brenclosures.com.au/nbn-enclosure.htm) manufactures a range of CUEs complying with Telstra Specification 010062, and these are available through electrical suppliers. Suitable enclosures are as follows:

State	Model No.	Description	Height (mm)	Width (mm)	Depth (mm)
NSW	CSN0401	Houses electrical meters & comms	934	482	255
	CSN042201	Houses electrical meters, switchboard & comms	1105	482	255
NT	CSQ0401	Houses electrical meters & comms	934	482	255
	CSQ042201	Houses electrical meters, switchboard & comms	1106	482	255
QLD	CSQ0401	Houses electrical meters & comms	934	482	255
	CSQ042201	Houses electrical meters, switchboard & comms	1106	482	255
TAS	CST022102	Houses electrical meters, switchboard & comms	1105	482	255
VIC	CSV022102	Houses electrical meters, switchboard & comms	1105	482	255

Where a CUE has been provided and meets the carrier's requirements, the PCD will be mounted inside the CUE as illustrated in Figure 33.

6.3 Where an external combined utilities enclosure (CUE) is not provided

6.3.1 General

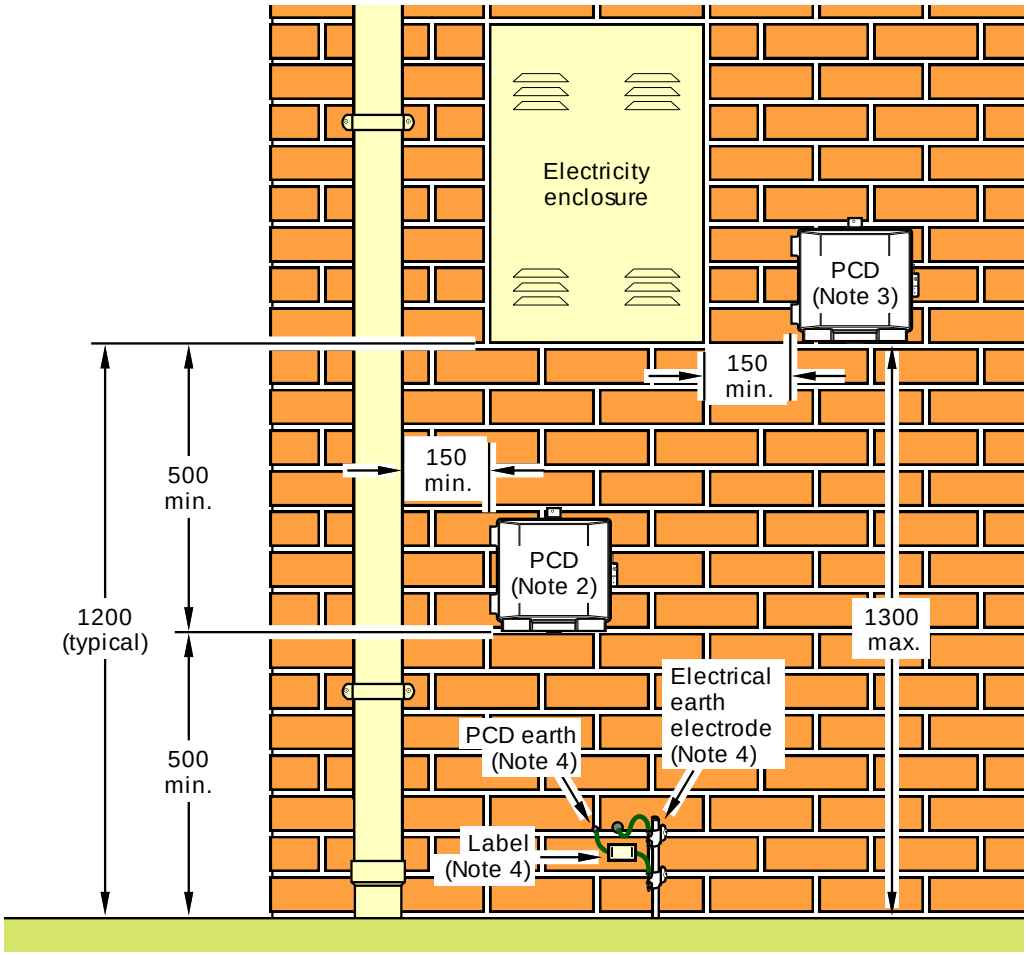
Where a CUE has not been provided, the PCD must be installed independently on the external wall.

The PCD must be installed:

- at a minimum height of 500 mm and a maximum height of 1300 mm from finished ground level, measured to the bottom of the lowest part of the PCD;
- at a minimum distance of 150 mm from the electricity enclosure or any other building fixture, measured to any part of the PCD with the cover closed; and
- outside any gas exclusion zone described in 6.3.3.1 (page 40).

These requirements are summarised in Figure 34.

Figure 34 PCD installation for new buildings where a CUE is not provided



Notes:

1. All measurements are in mm.
2. In areas that do not have a reticulated gas service (including homes where cylinder gas will be used), the preferred location for the PCD for new buildings under construction is below the electricity enclosure at a height of 500 mm to 600 mm above finished ground level. Locating the PCD below the electricity enclosure minimises the risk of obstruction by such things as downpipes, windows, doors, adjoining fences/gates and gas cylinders.
3. In areas that have a reticulated gas service, the gas meter is usually installed in the space below the electricity enclosure, in which case the preferred location for the PCD is at least 150 mm to the left or right of the electricity enclosure and at the same height as the electricity enclosure (usually about 1200 mm from finished ground level). In pre-wiring situations, if the PCD is to be located beside the electricity enclosure it will be necessary to ascertain the location of downpipes, doors, windows, adjoining fences, etc. from the building plan to determine which side of the electricity enclosure to install the PCD and the building entry conduits.
4. If the PCD requires an earth connection (refer to Figure 32), this should be made directly to the electrical earth electrode if it is accessible; otherwise, a suitable bonding conductor must be provided by the electrician from the main earthing bar of the electrical switchboard in accordance with section 9.
5. Where more than one PCD is installed (e.g. one for twisted pair lead-in cable and one for coaxial lead-in cable), they should be positioned at least 50 mm apart (measured between the nearest part of each PCD with the cover closed) even if the same lead-in conduit will be used to pull in the separate lead-in cables (see Figure 53 on page 65 for an example).

6.3.2 Low-density wall cladding (e.g. polystyrene)

If low-density cladding such as polystyrene is to be used, suitable backing board must be provided by the builder behind the cladding at the PCD location to support the PCD. In such cases, the intended position for the PCD should be marked on the building plan or the actual building by the builder.

6.3.3 PCD positioning

6.3.3.1 Separation from gas facilities

The PCD must be positioned:

- at least 500 mm above or 1000 mm to the side of any gas meter or associated fitting in accordance with Figure 35
- outside the conical exclusion zone around any gas cylinder as shown in Figure 36.

Lead-in conduit/cabling and tie conduit/cabling running to/from the PCD must be separated from any gas pipe, meter, cylinder or associated fitting by a minimum distance of 150 mm (see 8.2.2.2 on page 70).

Figure 35 Exclusion zone for gas meters

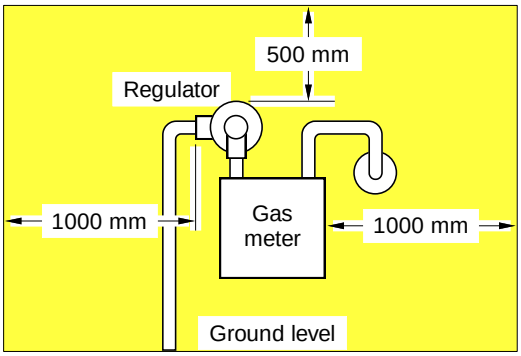
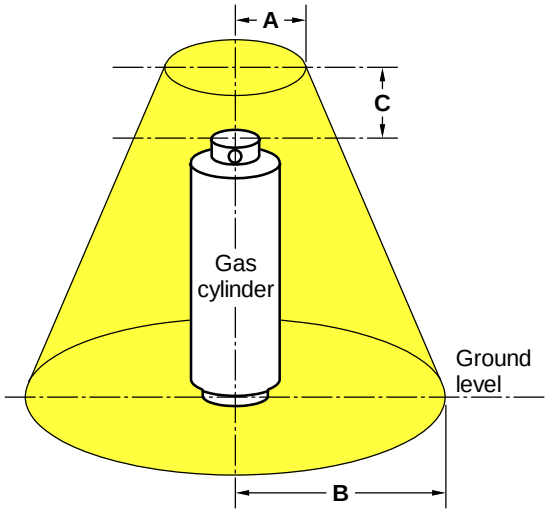


Figure 36 Exclusion zone for gas cylinders



	Exchange cylinder	In-situ fill cylinder
A	500 mm	1500 mm
B	1500 mm	3500 mm
C	500 mm	500 mm

6.3.3.2 Separation from water services

The PCD must be positioned at least **300 mm** in any direction from a **water meter** or **water tap**.

Lead-in conduit/cabling and tie conduit/cabling running to/from the PCD should be separated from any water pipe, water meter or associated fitting by a minimum distance of 50 mm (see 8.2.2.2 on page 70).

6.3.3.3 New buildings

6.3.3.3.1 Areas with reticulated gas

In areas that have a reticulated gas service, the gas meter is usually installed in the space below the electricity enclosure (meter panel or switchboard). In such areas, the preferred location for the PCD is at least 150 mm to the **left or right of the electricity enclosure** and at the **same height as the electricity enclosure** (usually about 1200 mm from finished ground level). In pre-wiring situations, if the PCD is to be located beside the electricity enclosure it will be necessary to ascertain the location of downpipes, doors, windows, adjoining fences, etc. from the building plan to determine which side of the electricity enclosure to install the PCD and the building entry conduits.

6.3.3.3.2 Areas without reticulated gas

In areas that do not have a reticulated gas service (including a home where cylinder gas will be used), the preferred PCD location for new buildings under construction is **below the electricity enclosure** at a height of 500 mm to 600 mm above finished ground level. Locating the PCD below the electricity enclosure reduces the risk of obstruction by downpipes, windows, doors, adjoining fences/gates, gas cylinders, etc.

6.3.3.3.3 PCD location away from the electricity enclosure

Where the electricity enclosure is on the opposite side of the building to the side where the property entry point is located and the underground or aerial lead-in cable cannot be run across to this side of the building (e.g. due to difficult terrain, extensive landscaping, retaining wall, paved driveway, swimming pool, trees, etc.), the PCD may be located at the side of the building nearest to the property entry point as long as the builder, electrician or customer provides a suitable earthing conductor at the PCD location if an earth is required (see Figure 32 and section 9). In such cases, care must be taken to avoid gas cylinders (see 6.3.3.1) which are normally located away from the electricity enclosure. Also, if the premises is in a defined lightning risk situation and will be connected to a copper network, there may be a need to install a PCD on each side of the building joined by "lead-in extension" cabling (see Figure 10).

For optical (FTTP) networks, the PCD may be located on the opposite side of the building to the electricity enclosure if this is expedient — as long as the builder, electrician or customer provides a suitable earthing conductor at the PCD location if an earth is required and care is taken to avoid gas cylinders. Refer to Figure 32 and section 9 for details.

Note: Even though optical fibre is not electrically conductive, optical PCDs must be separated from gas facilities in accordance with 6.3.3.1 in case fusion splicing of fibres needs to be carried out at the PCD.

6.3.3.4 Established buildings

For established buildings (e.g. building reconstruction or renovation), it will normally be necessary for the PCD to be located beside (not below) the electricity enclosure or, in some cases, near the existing building entry point which may not be near the electricity enclosure. In all cases, the PCD must be installed within the height limitations shown in Figure 34 and must be separated from gas and water services in accordance with 6.3.3.1 and 6.3.3.2.

A suitable earthing/bonding conductor must be provided for connection to the PCD, if required (refer to Figure 32 and section 9).

7 BUILDING ENTRY CONDUITS

7.1 Description

Building entry conduits are the conduits that provide for the penetration of the telecommunications cables into the building. The conduits must allow cables to be pulled through them while preventing the entry of water or vapour into the building or the covert entry of termites.

For some types of building construction (e.g. brick veneer), conduits may be partially concealed inside the wall cavity; otherwise they may be fastened to the surface of the external wall. Each method has its advantages and disadvantages. Concealed conduits produce a neater result — as long as the conduits are positioned correctly.

The integrity of the building entry conduits is very important to ensure that cables can be pulled through them without stress or damage.

In particular, the conduits and bends must be capable of allowing an optical fibre cable with a factory-fitted connector within a protective boot or hauling sock to pass through them (see 4.2.6 on page 7). Pre-formed bends **must** be used — conduit must **not** be bent on site whether or not this is done by the application of heat or using a bending tool.

The use of some form of Premises Connection Device (PCD) on the external wall of the home is an essential part of the building entry facilities.

The PCD:

- provides a transition from outdoor type cable to indoor type cable;
- supports mitigation against the entry of water and termites to the building via the lead-in conduit;
- facilitates future repair or replacement of the telecommunications lead-in cabling or tie cabling; and
- provides an external access point for testing of cables or services at the building.

If it is not possible to use an external PCD for some reason, the relevant carrier must be consulted.

Under no circumstances should underground lead-in conduit terminate inside the building unless a "drainage pit" is used at the external wall of the building to reduce the risk of entry of water and termites to the building via the conduit. Refer to 7.6 (page 68).

7.2 Lead-in entry conduit

7.2.1 Conduit type

For homes, **white**, **rigid** (UPVC) plastic conduit and fittings with an **inside diameter (ID) of 23 mm** that complies with 4.2.1 and 4.2.2 is used for installation of the lead-in cable(s) between the property entry point and the PCD. No more than the equivalent of **two 90° bends** is permissible **at the building**, comprising:

- one **300 mm radius** bend (or equivalent where composite bends are used over the footings) in the **underground** portion; and
- one **100 mm radius** bend in the **aboveground** portion (e.g. within the wall cavity).

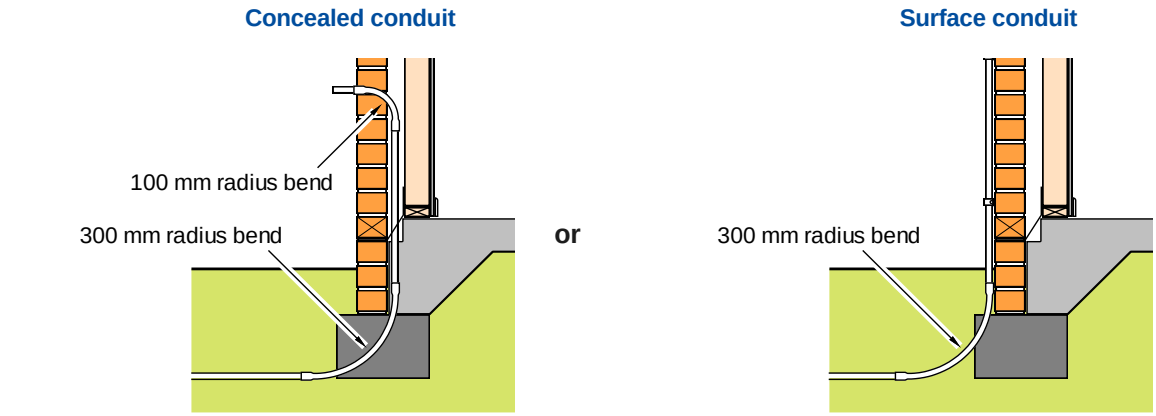
Refer to Figure 37.

Note: Another 300 mm radius bend may be used at the street pit, making a total of three bends (the maximum permissible) between cable access points (see Figure 4).

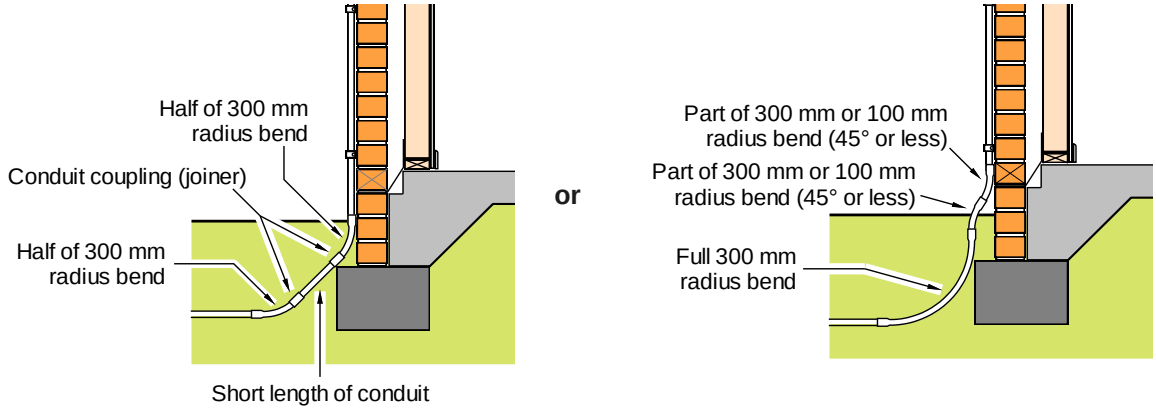
Flexible conduit with a minimum outside diameter (OD) of 25 mm may be used on the **external wall** to protect the cable between the point where the rigid conduit terminates on the external wall and the PCD, as long as the flexible conduit can be separated from the rigid conduit for future access. **This is for information only** — the **carrier** will install any flexible lead-in conduit that is required on the external wall.

Figure 37 Lead-in conduit and bends at the building

(a) Conduit installed in the building footings



(b) Conduit installed over the building footings



Notes:

1. No more than the equivalent of two 90° bends, comprising one **300 mm radius** bend **underground** and one **100 mm radius** bend **aboveground**, are permissible at the building. Another 300 mm radius bend may be used at the street pit, making a total of three bends (the maximum permissible) between cable access points (see Figure 4).
2. Only **pre-formed bends** may be used. Conduit must **not** be bent on site (e.g. by application of heat or using a bending tool). Flexible/corrugated conduit must not be used for this purpose.

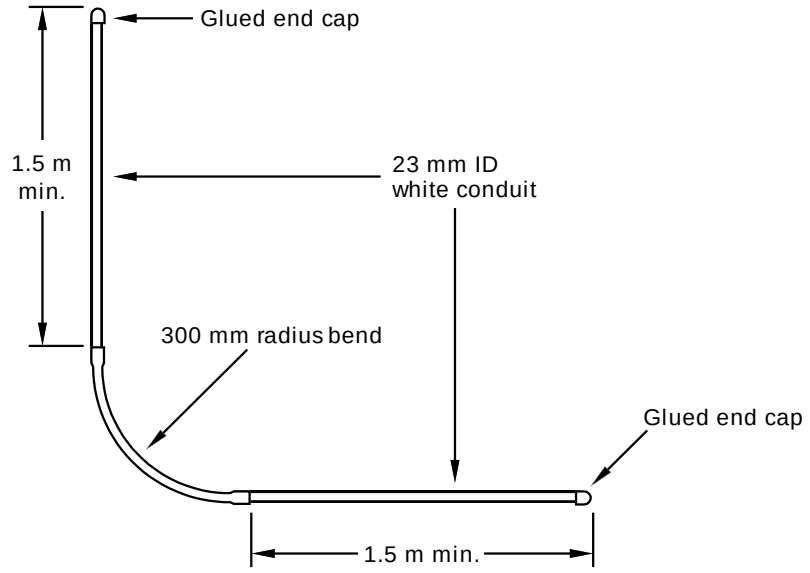
7.2.2 Lead-in conduit positioning in the building foundations

Conduit for underground lead-in cabling should be installed in the building footings before the concrete is poured. A conduit/bend assembly should be located in the building footings in accordance with Figure 38. Otherwise, the conduit will need to be installed over the footings later, but it may protrude from the wall as shown in Figure 37 (b).

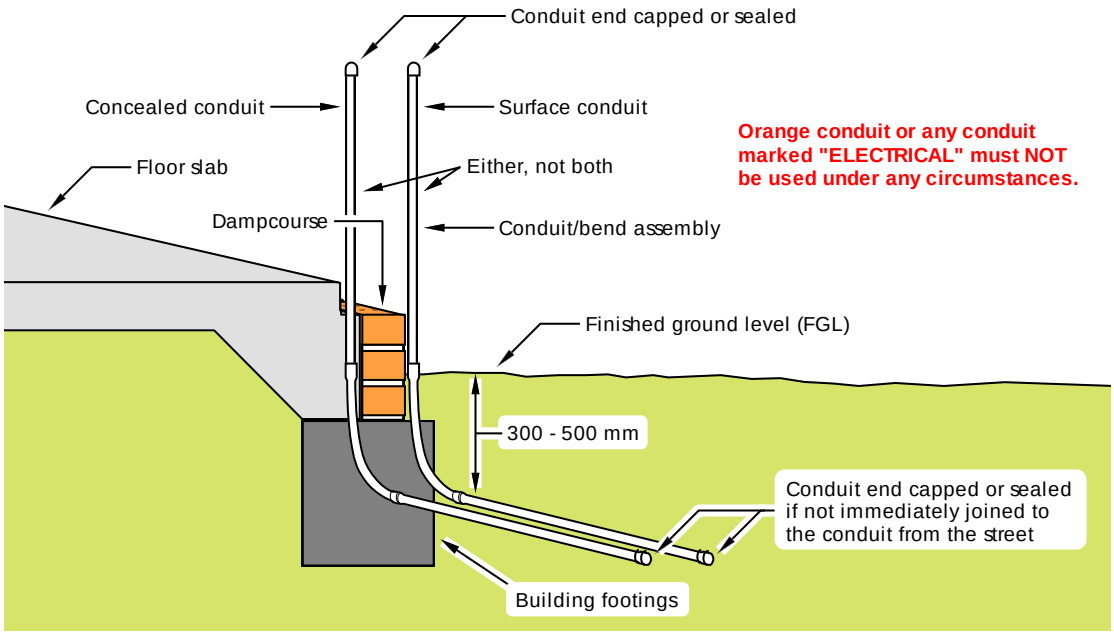
Any conduit installed in the building footings must comply with 7.2.1. Suitable lengths of conduit must be glued to the bend using solvent conduit cement. Conduit of any other size (whether it has a larger or smaller diameter) will not be useable by the carrier.

Figure 38 Lead-in building entry conduit installation

(a) Conduit and bend assembly (Note 1)



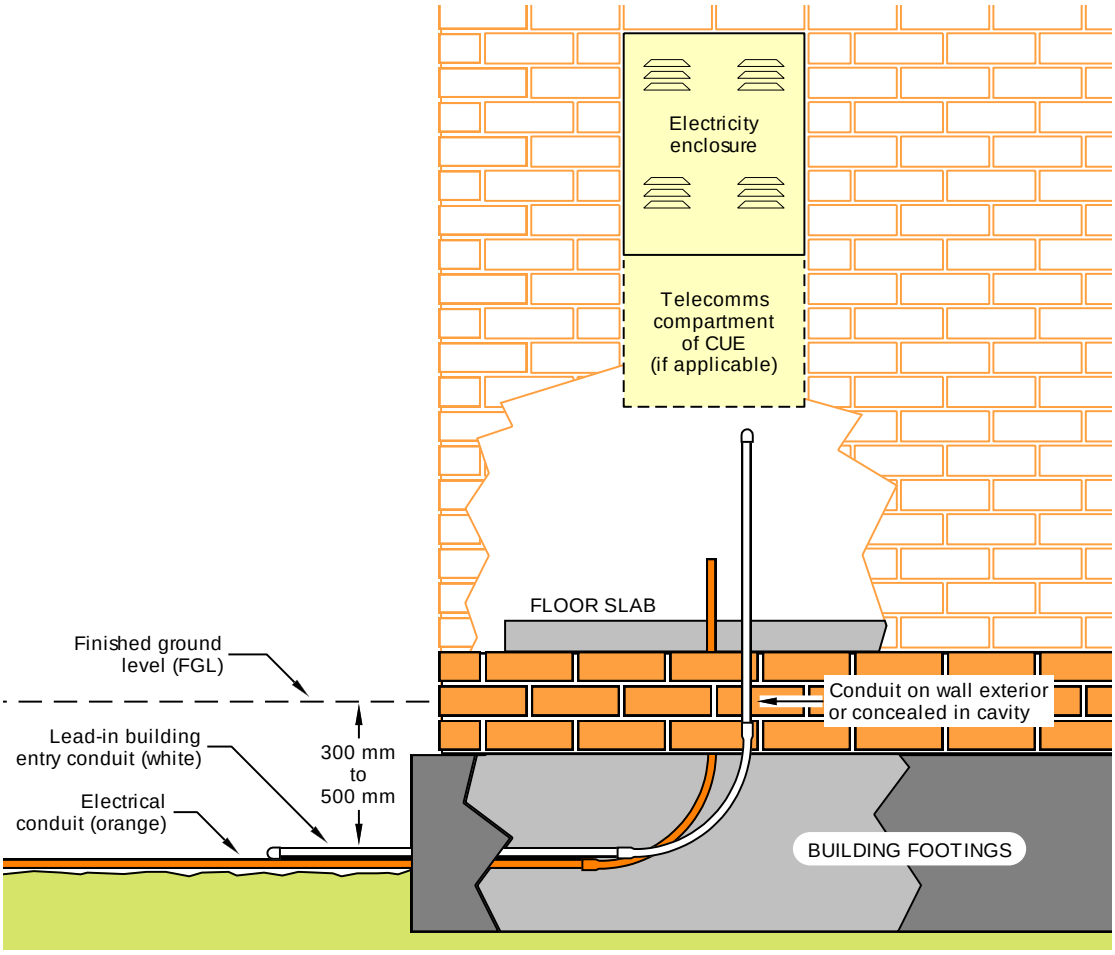
(b) Positioning of the lead-in conduit/bend assembly in the building footings



Notes:

1. The conduit/bend assembly must be made from suitable lengths of **white, 23 mm ID, UPVC conduit** complying with 7.2.1 glued to a **300 mm radius** bend using solvent conduit cement. For Telstra lead-in cabling, the conduits and bends may be marked “Telstra” or “NBN”. Conduits or bends of the same inside diameter but marked “Communications” may also be used — however, any conduit or bend marked as “20 mm” or “25 mm” and including “2053” in the markings (i.e. manufactured to Australian Standard AS/NZS 2053) is physically incompatible with Telstra and NBN Co networks and is **not suitable** for lead-in building entry conduit.
2. The end of the conduit/bend assembly should be capped to:
   - prevent the entry of debris or silt into the conduit during building construction; and
   - as a safeguard in case it is never used to ensure that it does not provide a corridor for the entry of water or termites into the wall cavity (the cap should be glued to any conduit laid in a trench or positioned in the wall cavity — to be cut away later when jointing the lead-in conduit or the bend in the wall cavity).

Figure 39 Building entry conduit positioning relative to the electricity enclosure



Notes:

1. The conduit may enter the building footings from any direction as long as it is pointed in the general direction of the carrier's property entry point (if it is not already joined to the lead-in conduit from the property entry point).
2. Where a CUE is not, or will not be, provided, the vertical section of the lead-in conduit must be correctly positioned in relation to the intended PCD location, as the use of flexible conduit or more than one bend within the wall cavity is not permitted for the lead-in cabling.

7.2.3 Termite barriers

Virtually all buildings in mainland Australia require a termite barrier to be installed around the perimeter of the building or on isolated piers, posts or stumps used to support the building or such things as verandas and staircases. The purpose of the barrier is to impede termite entry to the building and to ensure that any shelter tubes constructed by termites over the barrier are visible.

Common termite barriers consist of exposed slab edge, stainless steel mesh, metal capping, graded stone or chemically treated soil. Whatever method is used, the lead-in conduit will bridge or breach the termite barrier where the conduit enters the building. Termites can build a shelter tube around some barriers but they are then in the open where they can be detected more readily during regular inspections by a competent person. Bridging or breaching of these termite barriers by such things as conduits and cables may defeat the protection measures taken.

For new building construction, it is important that any underground lead-in conduit be installed at the building footings before the termite barrier is installed so that the conduit is treated appropriately by the termite barrier installer.

For established buildings, any new underground lead-in conduit installed will either bridge or breach the existing termite barrier. Where the conduit penetrates the termite barrier (e.g. graded stone, chemically treated soil), the barrier must be reinstated at the penetration point by a qualified termite barrier installer. Where the conduit bridges the termite barrier (e.g. exposed slab edge, stainless steel mesh or metal capping), the conduit must be installed in a way that does not impede clear visual inspection of the termite barrier where it is bridged (e.g. it must not be fixed into a corner against two adjoining walls or against another conduit or pipe). Additionally, the conduit must not cover any weepholes.

7.3 Conduit for tie cabling

7.3.1 Description

Tie cabling is the cabling between the PCD and the CCP. It may consist of customer cabling, multi-core DC power cabling, extension of the carrier's lead-in cabling, or a combination of these. For details, refer to Document No. 017153a01, *Cabling of premises for telecommunications — Essential information for home cabling*.

At least one **white**, **rigid** (UPVC) plastic conduit with a minimum **inside diameter (ID)** of **23 mm** should be provided between the PCD and the CCP or, if this is not possible, between the PCD and a suitable access point for pulling in the tie cable(s), as shown in Figure 40 and Figure 41. The requirements for the tie cabling conduits are set out in 7.3.2.

Note: Where the PCD is likely to be an outdoor FTTP NTD or if two PCDs will be installed, the provision of a **second conduit** may be required **for coaxial cabling** (see Figure 1).

The conduit for the tie cabling will:

- provide a pathway between the PCD and the CCP for the installation of the tie cabling either before or after building completion and for replacement of the cabling at some future time to accommodate any change in telecommunications network technology;
- protect the cabling from damage during construction activities;
- help to ensure that the cabling is not dislocated or entombed in the wall cavity during construction;
- ensure that any required cable separation requirements of the telecommunications and electrical wiring rules are met;
- where a CUE is not used, correctly position the cabling at the PCD location; and
- protect the cabling from possible rodent damage after construction (optical fibre cables in particular may be susceptible to damage by rodents due to the absence of an electric field around the cable).

7.3.2 Conduit requirements

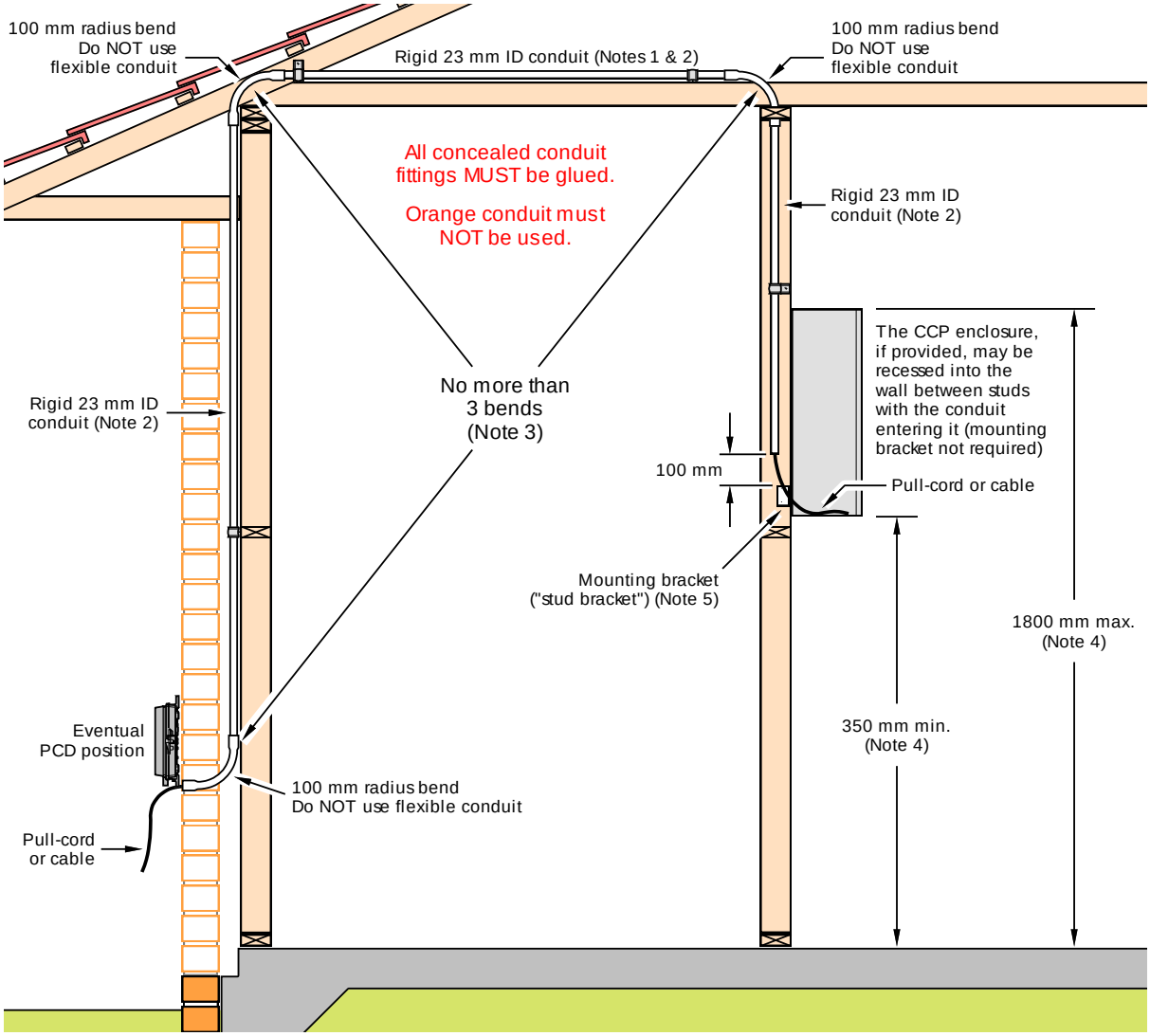
The conduit for the tie cabling is to comply with the following:

- **White, rigid (UPVC) plastic conduit** with a minimum **inside diameter (ID)** of **23 mm** must be used (e.g. Telstra or NBN "20 mm" conduit or 32 mm UPVC "Communications" conduit to AS/NZS 2053).
  Note: 32 mm (outside diameter) conduit won't fit in some external wall cavities (e.g. within double-brick walls or between bracing ply and brick veneer). Check with the builder or bricklayer before using 32 mm conduit.
- There must be **no more than 3 x 90° bends** between cable pulling points.
- Each bend must have an **inner bend radius of 100 mm or greater**.
- A 3 mm polypropylene, braided cord (or equivalent) must be threaded through the conduit and bends to be used as a **pull-cord** for the tie cable(s).
- All conduit and fittings **must be glued** to prevent them coming apart.
- The conduit must be **restrained along its length** to prevent movement while pulling cable in.
- Orange conduit, flexible conduit or any conduit marked "ELECTRICAL" **must not be used**.

7.3.3 Conduit installation

The conduit should be installed through the roof space (or through the floor space of the upper floor of a two-storey home). Arrange the conduit markings to be visible to any person working in the roof space after building completion. The conduit may be installed in the concrete slab but this carries a high risk of error in positioning the conduit at the internal wall (i.e. at the CCP) and the conduit being waterlogged due to rain during construction which may lead to premature failure of the internal tie cable(s).

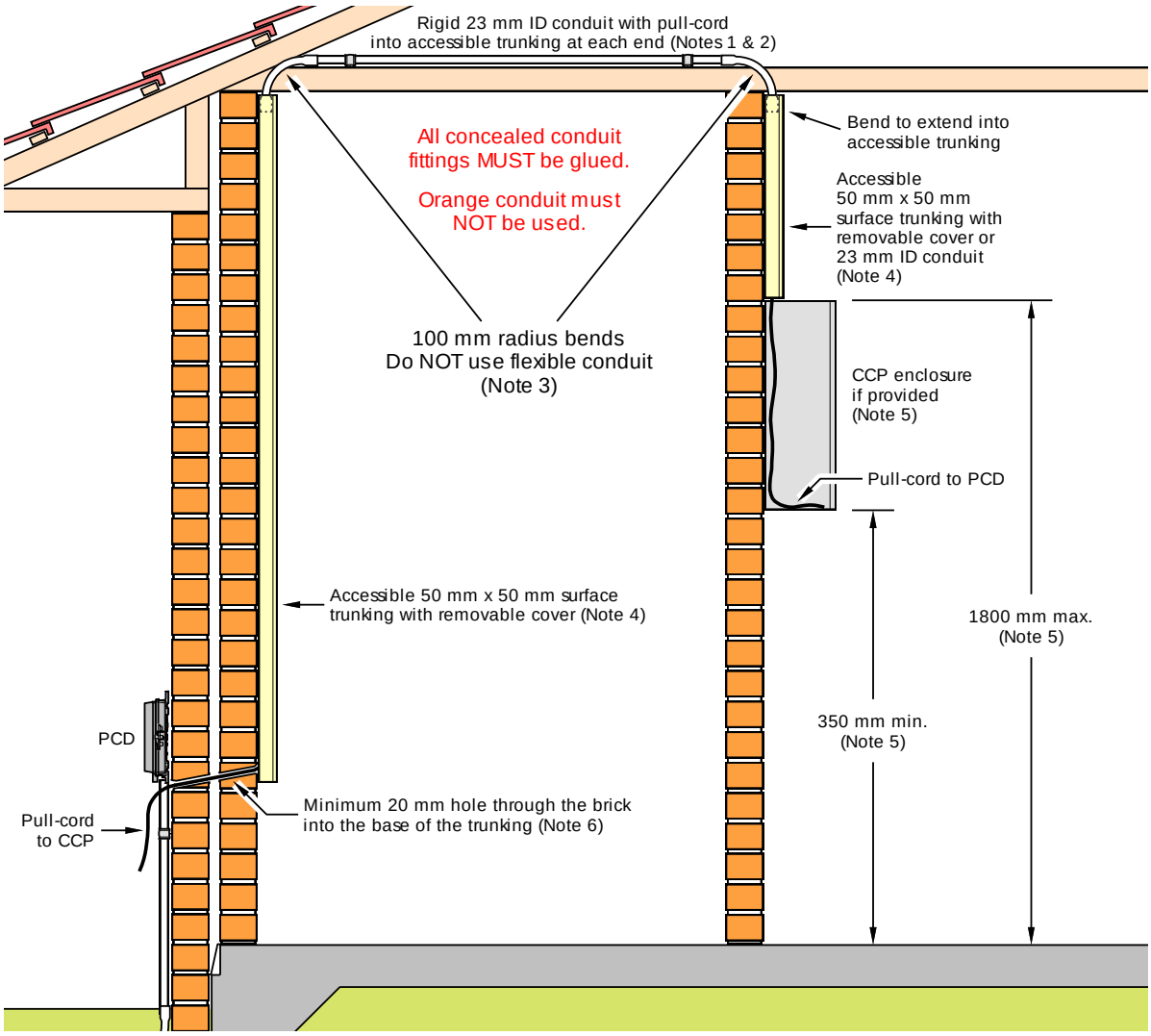
Figure 40 Typical conduit installation for tie cabling in cavity walls



Notes:

1. For a two-storey home, the conduit may pass between or through the bearers of the upper floor (subject to compliance with building codes) or through the roof space of the upper storey as long as the total length of cabling between the PCD and the CCP will not exceed **25 m** unless it is certain that an **indoor** FTTP NTD will be installed, in which case the length should not exceed **40 m**. The CCP may be located in the lower or upper floor, whichever is convenient. Where solid masonry or double-brick building construction is used, it may be necessary to chase the conduit into the walls unless surface-mounted conduit or trunking is acceptable to the customer (see Figure 41).
2. Use rigid conduit with a minimum inside diameter (ID) of 23 mm (e.g. Telstra or NBN “20 mm” UPVC conduit). Do **not** use orange conduit, flexible conduit or any conduit marked “ELECTRICAL”. Extra conduit(s) may be required for any coaxial cables (see Figure 1).
3. Use no more than 3 x 90° bends between cable pulling points. The inner bend radius of each bend must be 100 mm or greater. The conduit must be restrained along its length to prevent movement while pulling cable in.
4. Normally the CCP enclosure would be installed between wall studs above the nogging (about 1200 mm above the floor). If the CCP enclosure will be lower or higher, the bottom of the enclosure should be no less than 350 mm from the floor and the top of the enclosure should be no more than 1800 mm above the floor. Whether the powered electronic devices are to be located inside or outside the enclosure, they should be installed within the range of 350 mm to 1800 mm from the floor (i.e. no part of any device should be outside that range).
5. Where a CCP enclosure is not installed between the wall studs, install a mounting bracket 100 mm below the end of the conduit as a place marker for the tie cable.

Figure 41 Typical conduit/trunking installation for tie cabling on solid masonry or double-brick walls



Notes:

1. For a two-storey home, the conduit may pass between or through the bearers of the upper floor (subject to compliance with building codes) or through the roof space of the upper storey as long as the total length of cabling between the PCD and the CCP will not exceed **25 m** unless it is certain that an **indoor** FTTP NTD will be installed, in which case the length should not exceed **40 m**. The CCP may be located in the lower or upper floor, whichever is convenient.
2. Use rigid conduit with a minimum inside diameter (ID) of 23 mm (e.g. Telstra or NBN "20 mm" UPVC conduit). Do **not** use orange conduit, flexible conduit or any conduit marked "ELECTRICAL". Extra conduit(s) may be required for any coaxial cables (see Figure 1).
3. Use no more than 3 x 90° bends between cable pulling points. The inner bend radius of each bend must be 100 mm or greater. The conduit must be restrained along its length to prevent movement while pulling cable in.
4. The trunking must be accessible for removal of the cover and insertion of the cable(s). The conduit and pull-cord must extend into an accessible part of the trunking. Conduit may be chased into the wall or run on the surface of the wall in preference to using surface-mounted trunking, as long as the conduit complies with 7.3.2.
5. The bottom of the CCP enclosure should be no less than 350 mm from the floor and the top of the CCP enclosure should be no more than 1800 mm above the floor. Whether the powered electronic devices are to be located inside or outside the enclosure, they should be installed within the range of 350 mm to 1800 mm from the floor (i.e. no part of any device should be outside that range).
6. A hole must be drilled through the external wall from the bottom of the PCD into the trunking at a slight upward angle. The hole must be at least 20 mm diameter to pass an optical fibre cable fitted with a connector. Extra hole(s) may be required for any coaxial cable(s) (see Figure 1).

7.4 Building entry conduit arrangements where a CUE is used

If a combined utilities enclosure (CUE) is not being used, skip to 7.5 on page 55.

7.4.1 General

Underground lead-in cabling is used in virtually all new developments. Aerial lead-in cabling may be used in established areas or in new developments where the ground conditions preclude underground cabling construction.

Rigid conduit must be used all the way to the telecommunications compartment of the CUE. **All conduit joints and fittings must be glued.** Flexible conduit should not be used within building cavities due to the difficulty of pulling cables through flexible conduit.

7.4.2 Tie cabling

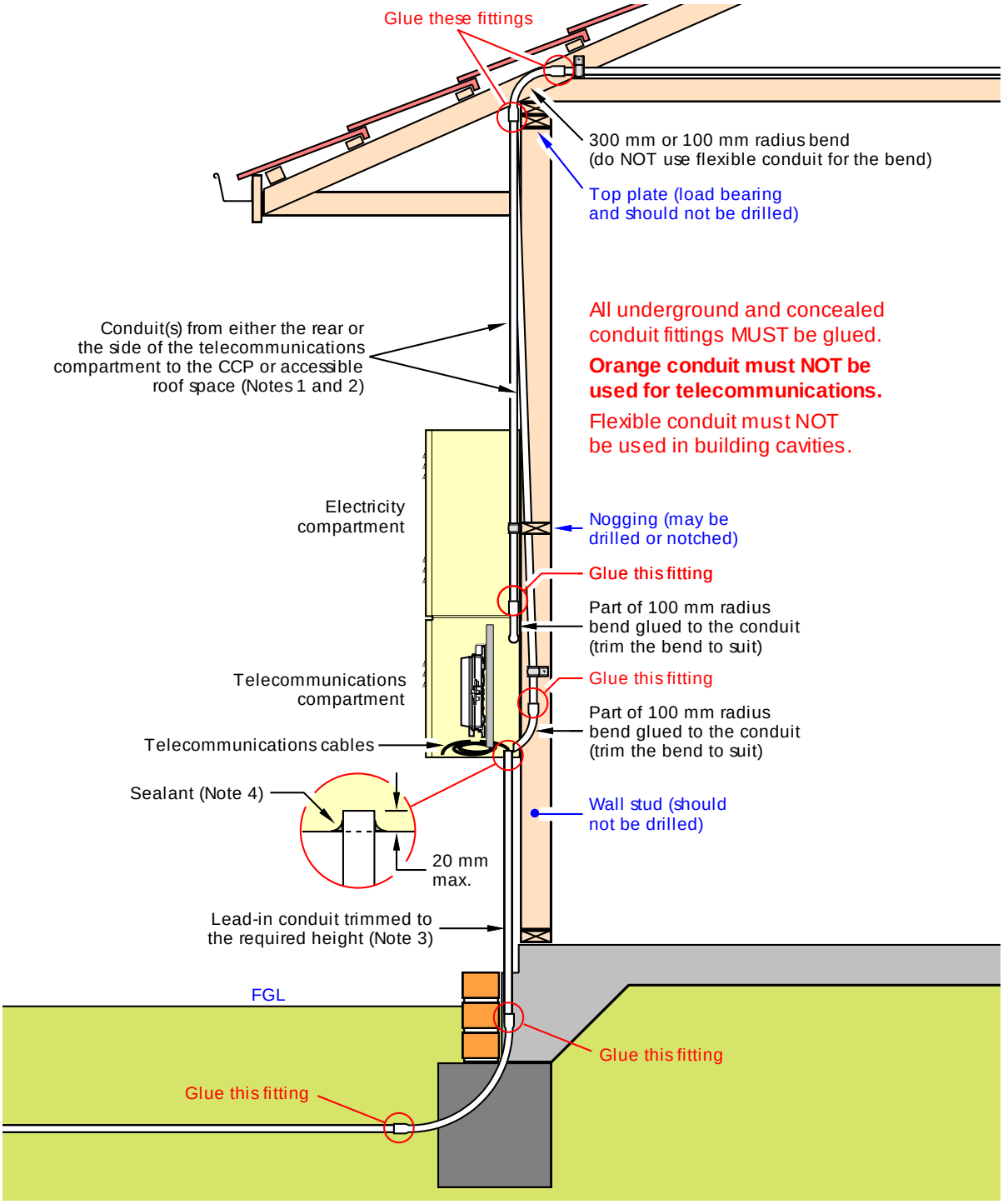
Conduit(s) for the tie cabling will terminate in the CUE as shown in Figure 42 to Figure 45. Refer to 7.3 for more information about conduits for tie cabling.

7.4.3 Underground lead-in cabling

Underground lead-in conduit will terminate within the CUE, which should be designed to allow any water emitting from the end of the conduit to drain to the bottom, front edge of the door opening. To ensure that such water does not drain back into the wall cavity, the outer surface of the conduit should be sealed where it penetrates the CUE (e.g. using an ant-resistant, flexible sealant). The end of the conduit should terminate no more than 20 mm above the penetration to the CUE to ensure that it is visible for inspection under the backboard for termite activity.

Figure 42 and Figure 43 show typical conduit arrangements for cavity wall (e.g. brick veneer and timber or metal framed) buildings. For buildings of solid masonry or double-brick construction, refer to Figure 41 for typical tie cabling conduit arrangements.

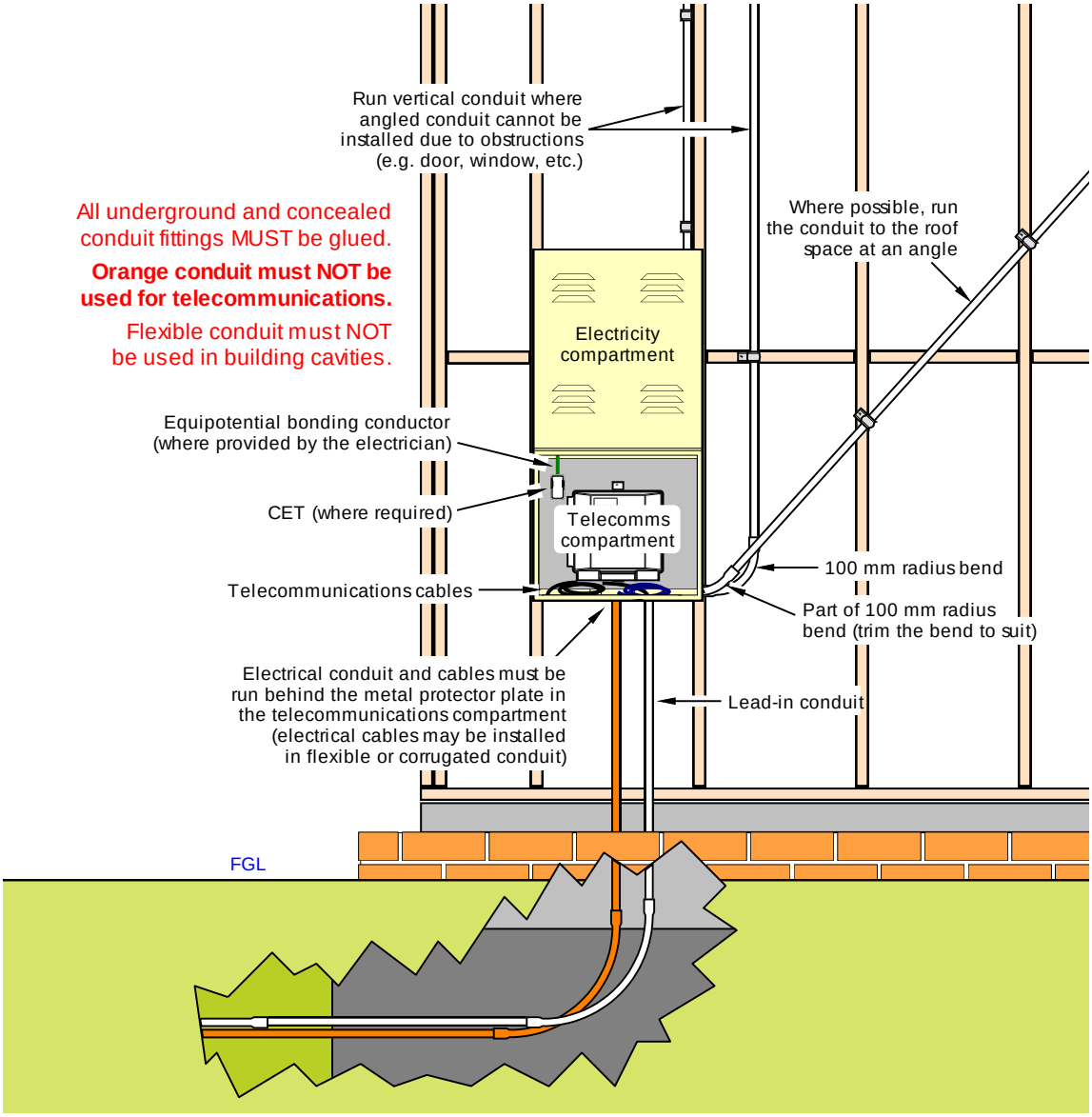
Figure 42 Conduit arrangements for a CUE installation on a cavity wall — side view



Notes:

1. Run the conduit for the tie cabling to either the side or the rear of the telecommunications compartment, as appropriate. Where the conduit runs behind the enclosure, run it between the studs, not on the front of the studs. Ensure that the telecommunications cables are separated from the power cables in accordance with 8.2.2.1.
2. Secure the conduit to the wall studs and/or noggings with conduit saddles or half-saddles. Glue all conduit and bend joints so that the fittings will not come apart when cables are being pulled through them.
3. The lead-in conduit must not be drilled under any circumstances, as this may allow the covert entry of water or termites to the wall cavity via the underground lead-in conduit.
4. The lead-in conduit should be sealed where it enters the CUE to prevent any water emitting from the conduit from draining into the wall cavity.

Figure 43 Conduit arrangements for a CUE installation on a cavity wall — front view



Notes:

1. If possible, run the conduit to the roof space at an angle so that:
   - the conduit bend at the top will fit comfortably between the top plate and the roof battens; and
   - the cabling will be clear of the power cables running from the electricity compartment in the roof space.

   Alternatively, the conduit may run directly to the CCP if it is to be located on the internal side of the same wall on which the CUE is located.
2. Where it is not possible to run the conduit at an angle, run it vertically beside the enclosure or between the wall studs behind it. Ensure that the telecommunications cables are separated from the power cables in accordance with 8.2.2.1.

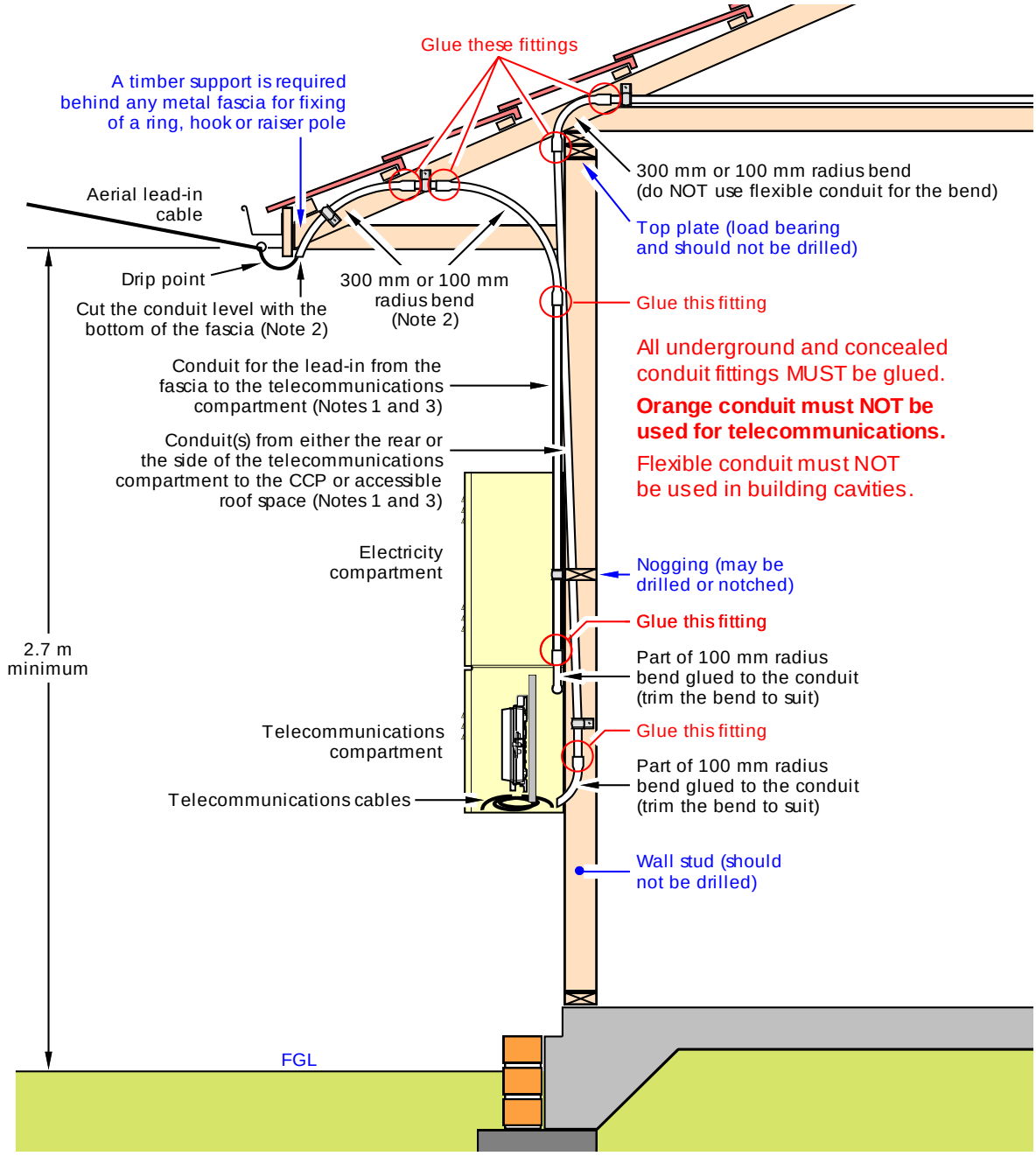
7.4.4 Aerial lead-in cabling

Aerial lead-in cabling is normally only used in established suburbs or in rural areas where the nature of the terrain precludes underground cabling.

Aerial lead-in conduit will terminate within the CUE, which should be designed to allow any rainwater that gets into the conduit at the fascia to drain to the bottom, front edge of the CUE door opening. With aerial lead-in cabling, there is no need to worry about inspection of the end of the conduit for termite activity.

Figure 44 and Figure 45 illustrate typical conduit arrangements for cavity wall (e.g. brick veneer and timber/metal framed) buildings. For buildings of solid masonry or double-brick construction, refer to Figure 41 for typical tie cabling conduit arrangements.

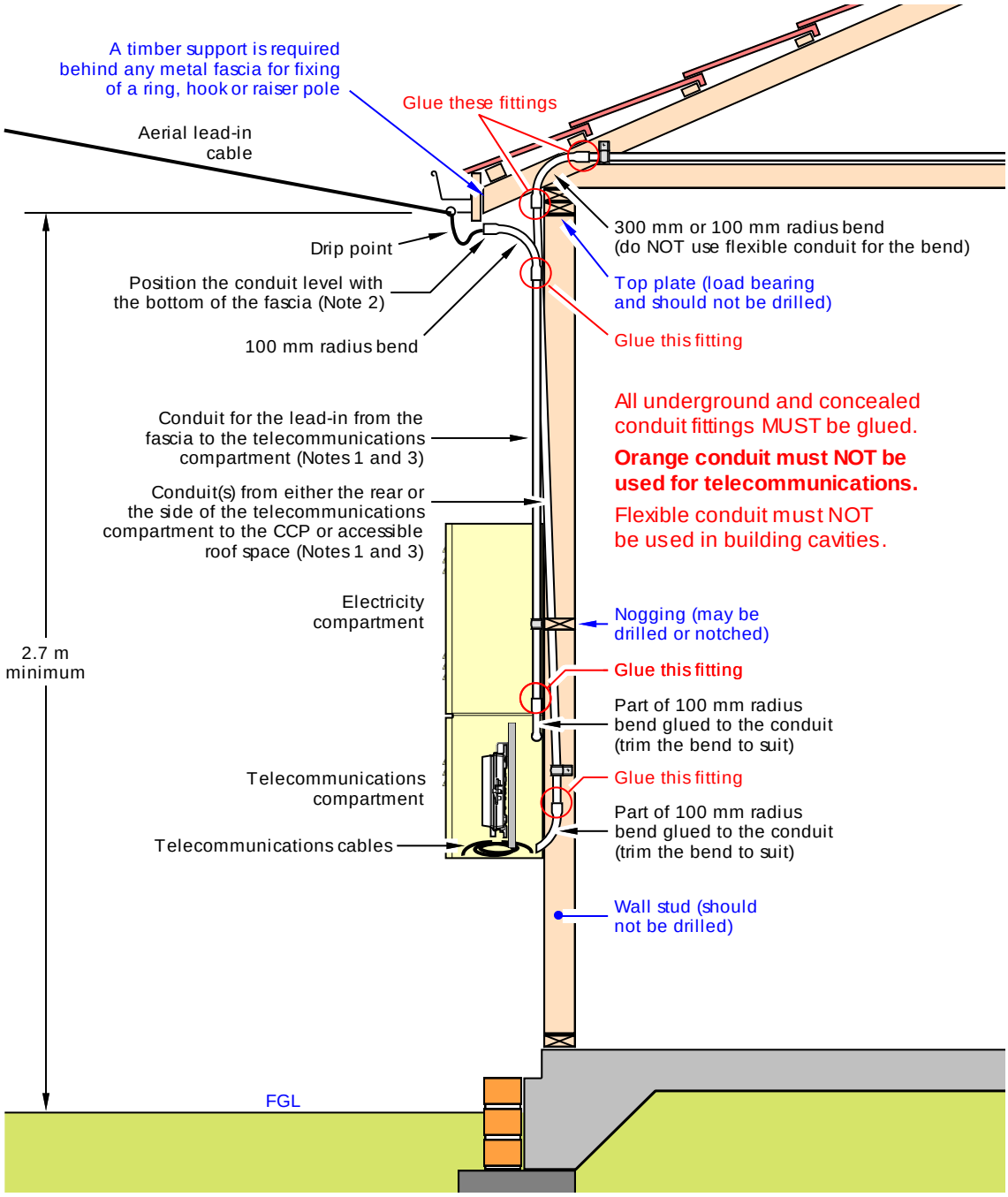
Figure 44 Conduit arrangements for a CUE installation on a cavity wall — building with 450 mm to 600 mm eaves



Notes:

1. Run the conduits for the lead-in cabling and tie cabling to either the side or the rear of the telecommunications compartment, as appropriate. Where the conduits run behind the enclosure, run them between the studs, not on the front of the studs. Ensure that the telecommunications cables are separated from the power cables in accordance with 8.2.2.1.
2. Fix the bends firmly to the eaves truss as shown such that the conduit is hard up against the inside of the fascia. 100 mm radius bends may be used where 300 mm radius bends won't fit. Cut the conduit flush with the bottom of the fascia. All bends must be glued to the conduit.
3. Secure the conduits to the wall studs and/or noggings with conduit saddles or half-saddles. Glue all conduit and bend joints so that the fittings will not come apart when cables are being pulled through them.

Figure 45 Conduit arrangements for a CUE installation on a cavity wall — building with narrow or no eaves



Notes:

1. Run the conduits for the lead-in cabling and tie cabling to either the side or the rear of the telecommunications compartment, as appropriate. Where the conduits run behind the enclosure, run them between the studs, not on the front of the studs. Ensure that the telecommunications cables are separated from the power cables in accordance with 8.2.2.1.
2. Fix the top bend as shown such that the top of the conduit is level with the bottom of the fascia. Cut the conduit flush with the inside face of the fascia. All bends must be glued to the conduit.
3. Secure the conduits to the wall studs and/or noggings with conduit saddles or half-saddles. Glue all conduit and bend joints so that the fittings will not come apart when cables are being pulled through them.

7.5 Building entry conduit arrangements where a CUE is *not* used

If a combined utilities enclosure (CUE) is being used, go back to 7.4 on page 49.

7.5.1 General

Underground lead-in cabling is used in virtually all new developments. Aerial lead-in cabling may be used in established areas or in new developments where the ground conditions preclude underground cabling construction.

Rigid conduit must be used all the way to the external wall of the building. **All rigid conduit joints and fittings must be glued.** Flexible conduit should not be used within building cavities due to the difficulty of pulling cables through flexible conduit. However, if necessary flexible conduit with a minimum outside diameter (OD) of 25 mm may be used on the **external surface** of the building as long as it can be separated from the rigid conduit for future access for pulling in cables (this is for information only — the carrier will install any flexible lead-in conduit that is required on the external wall).

7.5.2 Tie cabling

Conduit(s) for the tie cabling will terminate below the PCD as shown in Figure 46 to Figure 49. See 7.5.5 for details about positioning of the conduits at the PCD location. Refer to 7.3 for more information about conduits for tie cabling.

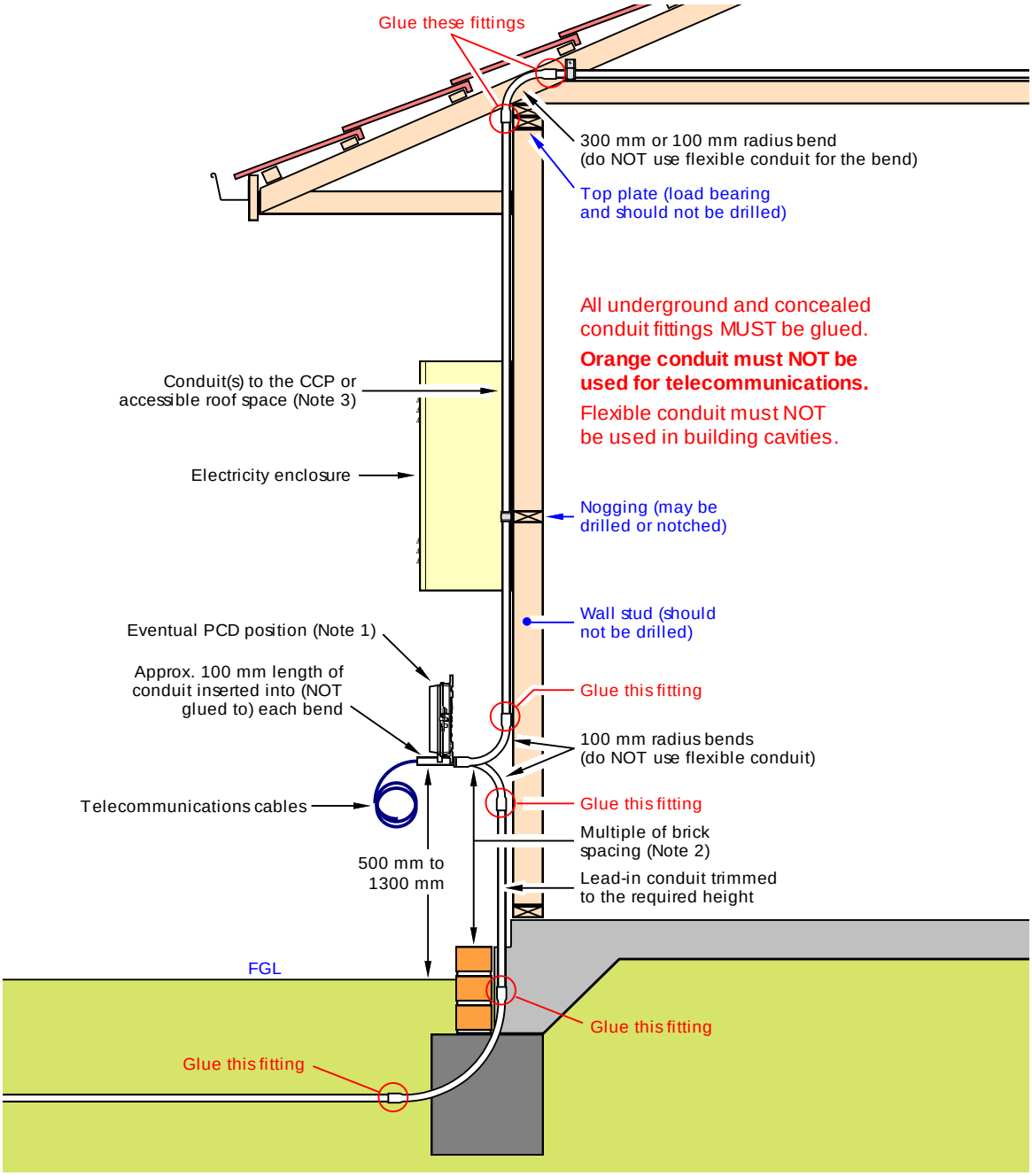
7.5.3 Underground lead-in cabling

Underground lead-in conduit must terminate at the external wall of the building to allow any water or vapour emitting from the end of the conduit to drain harmlessly outside the building and to ensure that the conduit opening is visible to enable inspection for termite activity.

For new buildings under construction, the PCD should be located either under or beside the electricity enclosure in accordance with 6.3.1 (page 38). Where it is not possible to locate the PCD near the electricity enclosure, refer to 6.3.3.3.3 (page 41).

Figure 46 and Figure 47 illustrate typical conduit arrangements for cavity wall (e.g. brick veneer and timber/metal-framed) buildings. For buildings of solid masonry or double-brick construction, refer to Figure 41 (page 48) for typical tie cabling conduit arrangements.

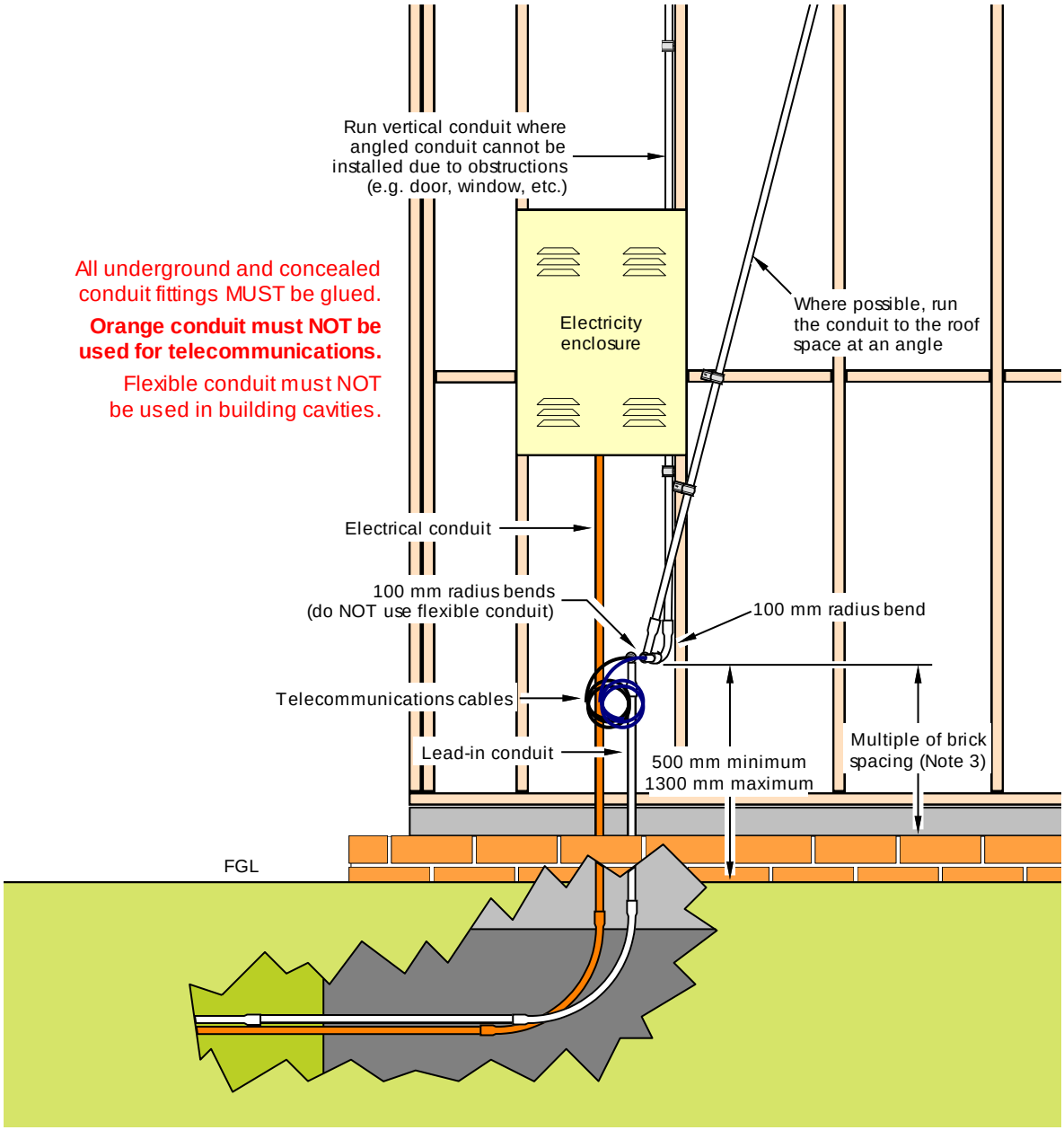
Figure 46 Conduit arrangements for a non-CUE installation on a cavity wall underground lead-in cabling — side view



Notes:

1. For new buildings under construction in an area that does not have a reticulated gas service (including homes where cylinder gas will be used), the PCD should be located below the electricity enclosure, as indicated above, to avoid obstruction by such things as downpipes, windows, doors, adjoining fences/gates and gas cylinders. Otherwise, the PCD should be located beside the electricity enclosure.
2. Fix the horizontal section of each bend a multiple of the brick spacing above the brick base. For standard 230 x 110 x 76 clay bricks, this will be a multiple of 86 mm, e.g. 7 bricks x 86 mm = 602 mm. In areas that have a reticulated gas service, locate the conduits to either side of, and level with the bottom of, the electricity enclosure (see Figure 34 on page 39 and 6.3.3.3.1 on page 40).
3. Where the conduit runs behind the electricity enclosure, run it between the studs, not on the front of the studs. Ensure that the telecommunications cables are separated from the power cables in accordance with 8.2.2.1. Secure the conduit to the wall studs and/or noggings with conduit saddles or half-saddles. Glue all conduit and bend joints so that the fittings will not come apart when cables are being pulled through them.

Figure 47 Conduit arrangements for a non-CUE installation on a cavity wall underground lead-in cabling — front view



Notes:

1. If possible, run the conduit to the roof space at an angle so that:
   - the conduit bend at the top will fit comfortably between the top plate and the roof battens; and
   - the cabling will be clear of the power cables running from the electricity enclosure in the roof space.

   Alternatively, the conduit may run directly to the CCP if it is to be located on the internal side of the same wall on which the PCD is located.
2. Where it is not possible to run the conduit at an angle, run it vertically beside or behind the electricity enclosure. Where the conduit runs behind the enclosure, run it between the studs, not on the front of the studs. Ensure that the telecommunications cables are separated from the power cables in accordance with 8.2.2.1.
3. Fix the horizontal section of each bend a multiple of the brick spacing above the brick base. For standard 230 x 110 x 76 clay bricks, this will be a multiple of 86 mm, e.g. 7 bricks x 86 mm = 602 mm. In areas that have a reticulated gas service, locate the conduits to either side of, and level with the bottom of, the electricity enclosure (see Figure 34 on page 39 and 6.3.3.3.1 on page 40).

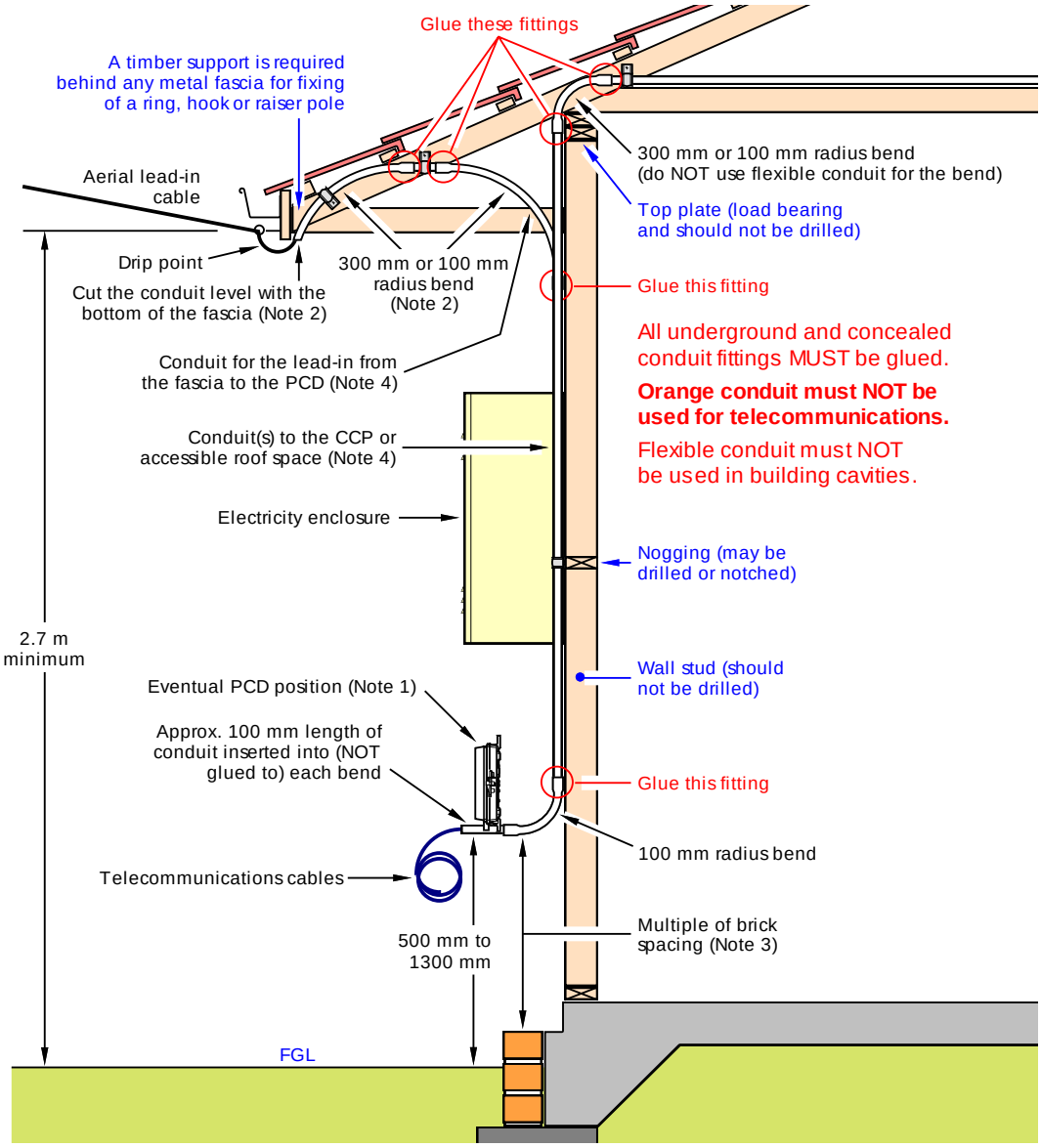
7.5.4 Aerial lead-in cabling

Aerial lead-in cabling is normally only used in established suburbs or in rural areas where the nature of the terrain precludes underground cabling.

For new buildings under construction in an area where aerial lead-in cabling is used, the PCD must be located either under or adjacent to the electricity enclosure so as to provide access to the PCD without the use of a ladder and to support the possible connection of underground lead-in cabling at some future time. Where it is not possible to locate the PCD near the electricity enclosure, it may be located below the point where the aerial cable attaches to the building as long as it is installed within the height limits described in Figure 34. Refer to 6.3.3.3.3 on page 41 for other requirements and precautions.

Figure 48 and Figure 49 illustrate typical conduit arrangements for cavity wall (e.g. brick veneer and timber/metal-framed) buildings. For buildings of solid masonry or double-brick construction, refer to Figure 41 (page 48) for typical tie cabling conduit arrangements.

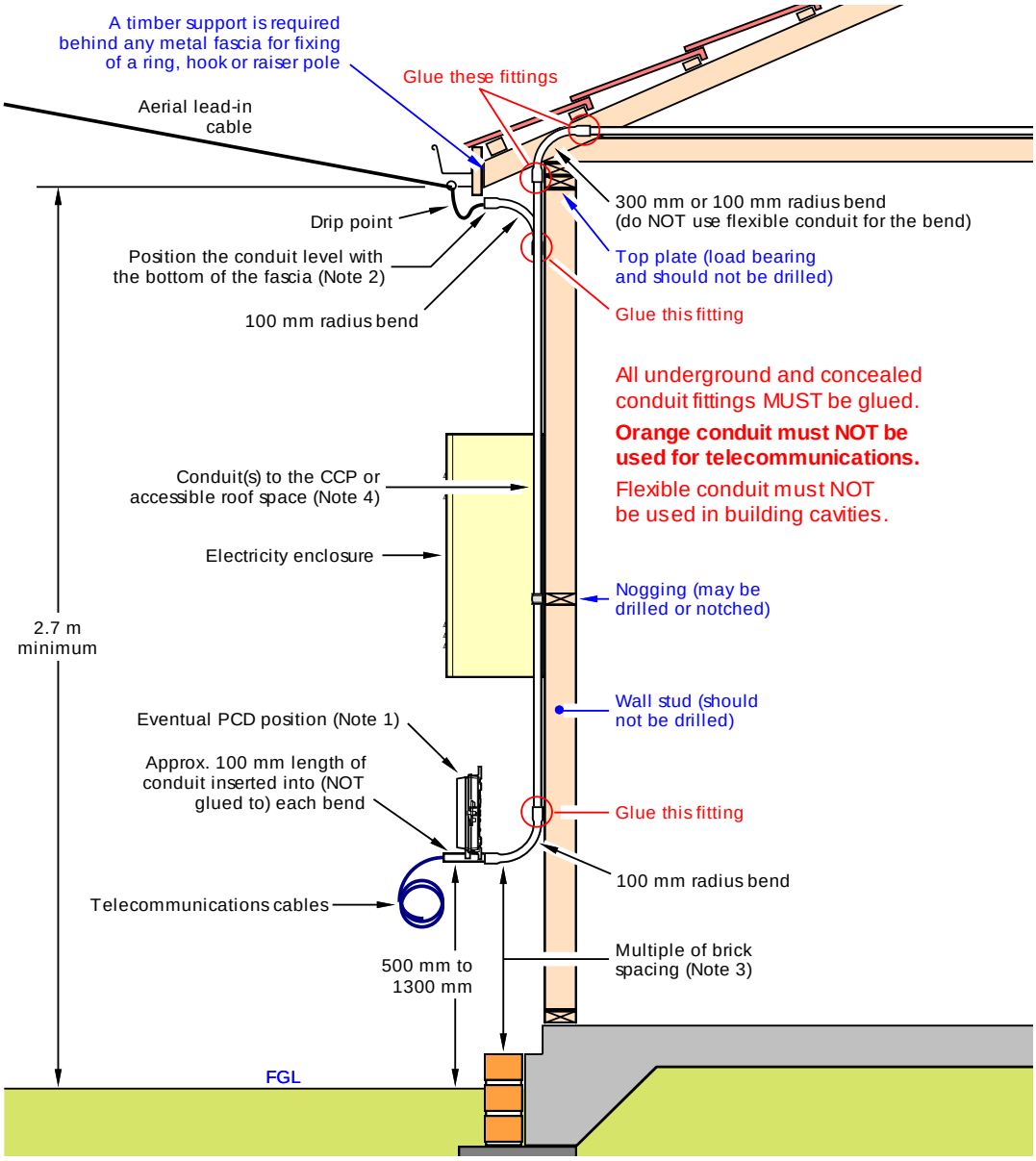
Figure 48 Conduit arrangements for a non-CUE installation on a cavity wall aerial lead-in cabling — building with 450 mm to 600 mm eaves



Notes:

1. For new buildings under construction in an area that does not have a reticulated gas service (including homes where cylinder gas will be used), the PCD should be located below the electricity enclosure, as indicated above, for safe and easy access, to avoid obstruction by such things as downpipes, windows, doors, adjoining fences and gas cylinders, and to facilitate future underground lead-in cabling. Otherwise, the PCD should be located beside the electricity enclosure.
2. Fix the bends firmly to the eaves truss as shown such that the conduit is hard up against the inside of the fascia. 100 mm radius bends may be used where 300 mm radius bends won't fit. Cut the conduit flush with the bottom of the fascia. All bends must be glued to the conduit.
3. Fix the horizontal section of each bend a multiple of the brick spacing above the brick base. For standard 230 x 110 x 76 clay bricks, this will be a multiple of 86 mm, e.g. 7 bricks x 86 mm = 602 mm. In areas that have a reticulated gas service, locate the conduits to either side of, and level with the bottom of, the electricity enclosure (see Figure 34 on page 39 and 6.3.3.3.1 on page 40).
4. Where the conduits run behind the electricity enclosure, run them between the studs, not on the front of the studs. Ensure that the telecommunications cables are separated from the power cables in accordance with 8.2.2.1. Secure the conduits to the wall studs and/or noggings with conduit saddles or half-saddles. Glue all conduit and bend joints so that the fittings will not come apart when cables are being pulled through them.

Figure 49 Conduit arrangements for a non-CUE installation on a cavity wall aerial lead-in cabling — building with narrow or no eaves



Notes:

1. For new buildings under construction in an area that does not have a reticulated gas service (including homes where cylinder gas will be used), the PCD should be located below the electricity enclosure, as indicated above, for safe and easy access, to avoid obstruction by such things as downpipes, windows, doors, adjoining fences and gas cylinders, and to facilitate future underground lead-in cabling. Otherwise, the PCD should be located beside the electricity enclosure.
2. Fix the top bend as shown such that the top of the conduit is level with the bottom of the fascia. Cut the conduit flush with the inside face of the fascia. All bends must be glued to the conduit.
3. Fix the horizontal section of each bend a multiple of the brick spacing above the brick base. For standard 230 x 110 x 76 clay bricks, this will be a multiple of 86 mm, e.g. 7 bricks x 86 mm = 602 mm. In areas that have a reticulated gas service, locate the conduits to either side of, and level with the bottom of, the electricity enclosure (see Figure 34 on page 39 and 6.3.3.3.1 on page 40).
4. Where the conduits run behind the electricity enclosure, run them between the studs, not on the front of the studs. Ensure that the telecommunications cables are separated from the power cables in accordance with 8.2.2.1. Secure the conduits to the wall studs and/or noggings with conduit saddles or half-saddles. Glue all conduit and bend joints so that the fittings will not come apart when cables are being pulled through them.

7.5.5 Conduit positioning at the PCD location

Cables should enter the bottom of the PCD to ensure that water or vapour will not enter the device via the cable entry hole. Therefore, the conduit ends must be positioned at the bottom of the PCD. All Telstra PCDs are designed to allow cables to pass behind them. Any cables coming down the surface of the wall from above the PCD may pass behind a Telstra PCD and then loop up into the cable entry port to form a drip point.

The NBN Co PCD pictured in Figure 31 is not designed to allow cables to pass behind it but it has a cable entry port at the top of the PCD, which may be used by NBN Co installers for cable entry.

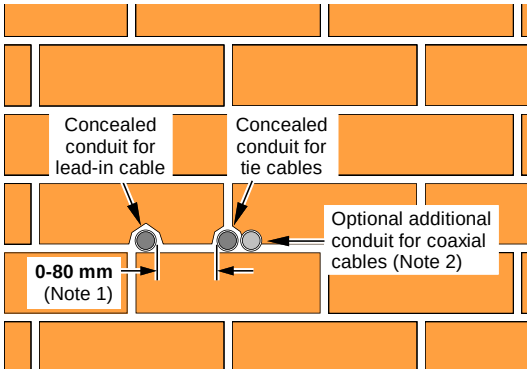
However, cables must **not** enter the top, side or rear of a **Telstra PCD** under any circumstances.

Refer to Figure 50 for correct conduit positioning on a cavity wall for **all** PCD types.

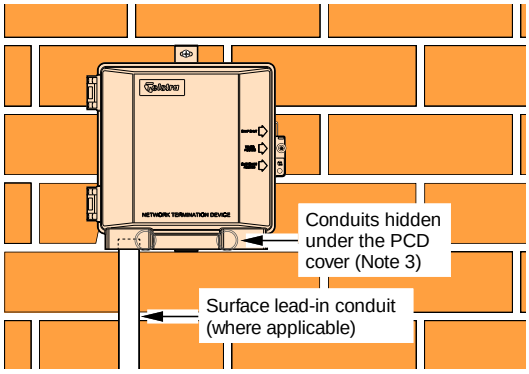
More detailed information is provided in 7.5.6 for various types of **Telstra** PCDs.

Figure 50 Conduit position for all PCDs on cavity walls where a CUE is not used

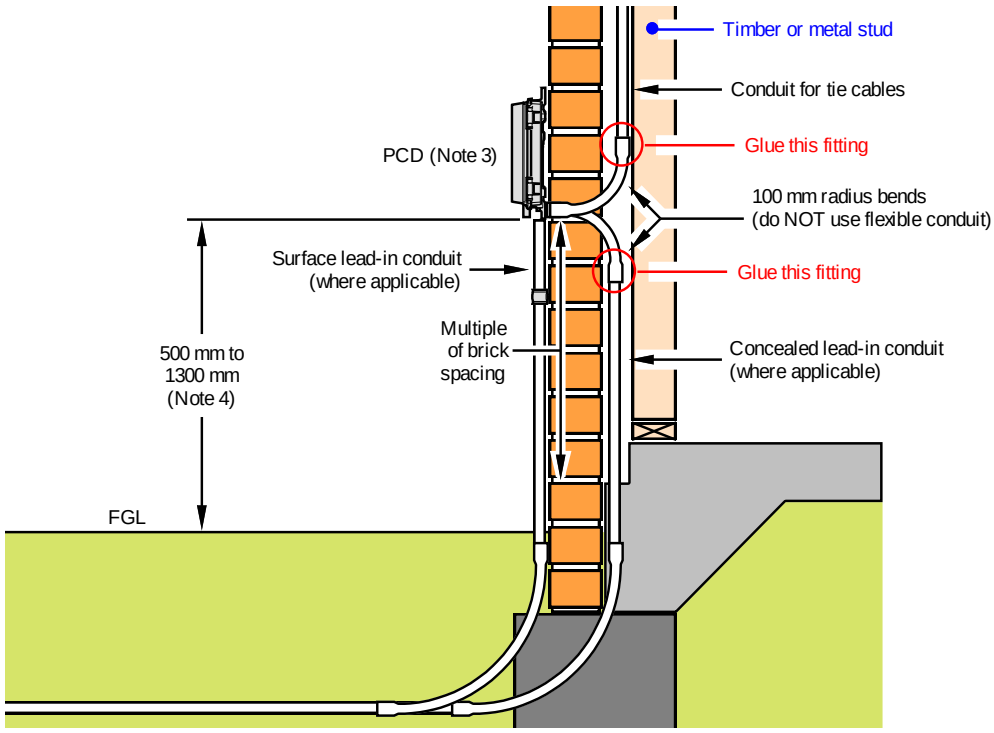
(a) Conduit spacing



(b) Front view of an installed Telstra PCD



(c) Side view of the completed PCD installation



Notes:

1. Optimal conduit positioning varies according to the type of PCD to be installed. Spacing the conduits between 0 mm and 80 mm will ensure compatibility with all PCDs.
2. The provision of a second conduit for the tie cabling is required where:
   - the PCD is likely to be an outdoor FTTP NTD as shown in Figure 32 on page 36 (in which case both conduits should be side by side as depicted in (a) above); or
   - a second PCD is to be installed, e.g. HFC isolation box for Cable internet or pay TV as shown in Figure 31 on page 35 (in which case the conduits should be spaced at least 180 mm apart — see 7.5.6.3 and Figure 53).
3. Telstra PCDs have a skirt on the cover to:
   - protect the cables from direct exposure to sunlight;
   - hide the ends of the conduits from general view while allowing water and vapour to escape from the lead-in conduit outside the PCD; and
   - enable the lead-in conduit opening to be readily inspected for termite activity by a pest inspector.
4. For pre-wiring in areas that do not have reticulated gas (including homes where cylinder gas will be used), locating the PCD below the electricity enclosure will minimise the risk of obstruction by such things as downpipes, fences, gas cylinders, etc. In such cases, positioning the conduits between 500 mm and 600 mm above finished ground level (FGL) will ensure there is sufficient clearance from the electricity enclosure while providing reasonable PCD height for access (see Figure 34 on page 39 and 6.3.3 on page 40).

7.5.6 PCD positioning over the conduits

7.5.6.1 General

Separate PCDs must be provided for twisted pair, coaxial and optical fibre lead-in cables. Where more than one PCD is required (e.g. one for a twisted pair lead-in cable and one for a coaxial lead-in cable), the PCDs should be separated by a minimum distance of 50 mm measured between the closest parts of each PCD with the cover closed. The same lead-in conduit may be used to pull in the separate lead-in cables, so at least one of the lead-in cables will be exposed before it enters the PCD (refer to 7.5.6.3 for an example).

A minimum clearance of 10 mm (20 mm preferred) must be maintained between the end of any underground conduit and the PCD cable entry to ensure that any water or vapour coming out of the conduit can escape externally and to enable any termite activity to be visible to a pest inspector. No minimum clearance is required for the end of any conduit provided for aerial cabling or indoor cabling.

7.5.6.2 ADSL NTD

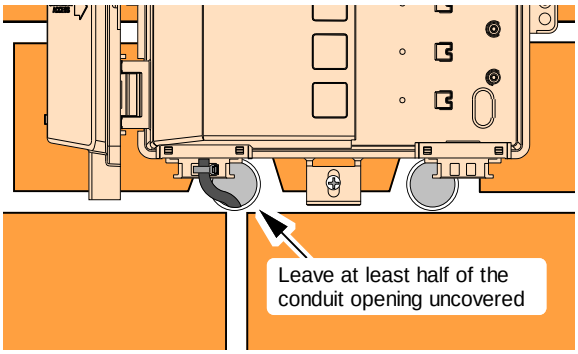
The Telstra NTD used for connection of twisted pair lead-in cables is coloured beige (light brown) and has a "Telco" (Telstra) side and a "customer" (cabler) side. The cable entry ports are spaced at 140 mm centres. Lead-in cable and the earthing conductor must enter the left-hand cable entry port and customer cables must enter the right-hand cable entry port. These cable entry arrangements cannot be reversed. However, flexibility is provided by the ability to pass cables behind and underneath the NTD without being exposed (see Figure 52).

Optimal positioning of the NTD over conduits spaced at 80 mm is shown in Figure 51. Typical positioning of the NTD over conduits located side-by-side is shown in Figure 52.

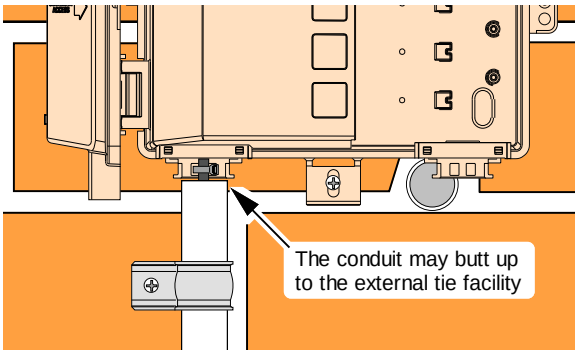
The NTD is normally supplied and installed by Telstra at no charge for the connection of a generic cabling system if the NTD is requested before the time of installation. Alternatively, a registered cabler may supply and install one, if expedient, in accordance with Telstra Specification 012688, *Telstra Network Termination Device — Information for Cabling Providers*.

Figure 51 Optimal Telstra ADSL NTD positioning over conduits spaced at 80 mm

(a) Concealed lead-in conduit (Note 1)



(b) Surface lead-in conduit (Note 2)



Notes:

1. **The end of any concealed lead-in conduit must not be covered by the base of the NTD** to ensure that any water or vapour coming out of the conduit can escape externally and to enable any termite activity to be visible to a pest inspector.
2. **Surface lead-in conduit must terminate 10 mm to 20 mm short of the cable entry hole.** In the case of the ADSL NTD, this will be achieved if the lead-in conduit butts up to the external cable tie facility.

Figure 52 Running cable behind or below the Telstra NTD to the cable entry port (conduits spaced less than 80 mm apart)

Cables running behind the NTD	Cables running below the NTD	Cables hidden by the cover
		

Note: If the lead-in and customer conduits are adjacent to each other, either the lead-in cable or the tie cables may be run behind or below the NTD to the appropriate cable entry port, as in the examples shown above. Either way, the skirt on the NTD cover will hide the cables from general view and protect them from exposure to sunlight. Cables running down the wall to the top of the NTD may run behind the NTD to the bottom of the NTD and then loop up into the cable entry to form a drip point.

7.5.6.3 HFC isolation box

Where HFC is available and is to be installed at the premises, a separate HFC isolation box is required for connection of the coaxial cabling. The standard Telstra isolation box is coloured grey and has three closely spaced cable entry ports, each of which may be used for either the outdoor or indoor coaxial cable entry. An earthing conductor is not required for this box.

A larger isolation box may be used in some circumstances (e.g. to house an RF amplifier), in which case the underground or aerial coaxial lead-in cable normally enters the left-hand cable entry port and each indoor coaxial cable usually enters one of the right-hand cable entry ports.

The isolation box will usually be provided in addition to another PCD, so typical positioning in relation to a separate PCD and the conduits is shown in Figure 53.

The isolation box is supplied and installed by Telstra (for cable internet) or FOXTEL (for pay TV), as applicable, as part of the HFC service. A registered cabler is not authorised to install the isolation box but may install the indoor coaxial cable (tie cable) to Telstra or FOXTEL specifications. Separate conduits are required for the coaxial cables running between the isolation box and the CCP (for cable internet) and between the isolation box and the wall plate at the entertainment point (for FOXTEL).

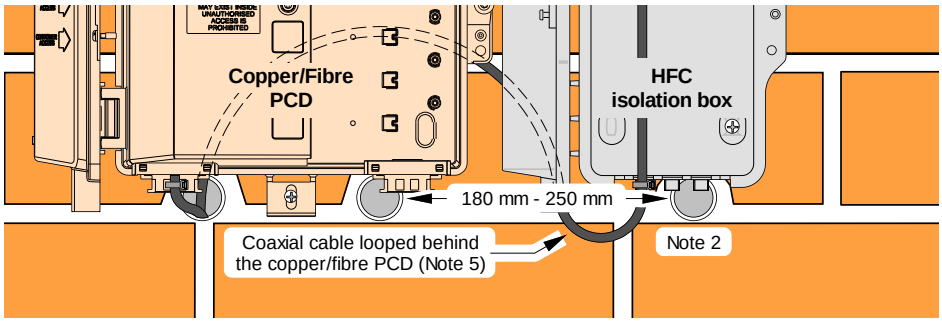
Notes:

1. Telstra coaxial cabling specifications are provided in Document No. 017153a00, *Cabling of premises for telecommunications — A complete guide to home cabling*.
2. It is not necessary to extend the conduit beyond accessible roof space for the FOXTEL cable(s) going to the entertainment point(s) because this would preclude branching of multiple cables to multiple points and, in any case, this cabling should never need upgrading. However, if a cable is damaged during or after building construction, the FOXTEL repairer is not obliged to conceal the replacement cable.

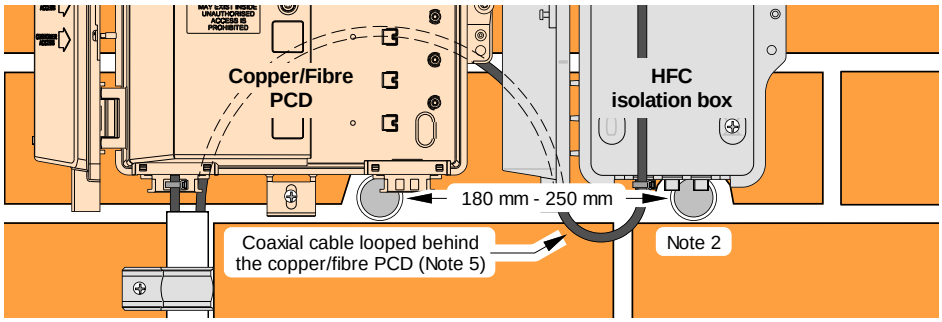
The box should be spaced at least 50 mm away from any other PCD and the conduits spaced 180 mm to 250 mm apart in accordance with Figure 53.

Figure 53 Optimal Telstra HFC isolation box spacing from the building entry conduits

(a) Concealed lead-in conduit



(b) Surface lead-in conduit



Notes:

1. The HFC isolation box should be spaced about 50 mm to the left or right of the other PCD, which means the conduits for the twisted pair and coaxial tie cables should be spaced between 180 mm and 250 mm apart, as shown above.
2. Separate tie cabling conduits will be required for the broadband internet cable and any pay TV (FOXTEL) cable because they will have different destinations (i.e. the internet cable goes to the CCP and the pay TV cable goes directly to the entertainment point).
3. **The end of any concealed lead-in conduit must not be covered by the base of the PCD** to ensure that any water or vapour coming out of the conduit can escape externally and to enable any termite activity to be visible to a pest inspector.
4. **Surface lead-in conduit must terminate 10 mm to 20 mm short of the cable entry hole.**
5. All Telstra PCDs have mounting feet that allow cables to pass behind the PCD.

7.5.6.4 Outdoor FTTP NTD

The outdoor Telstra FTTP NTD is coloured grey and has a "Telco" (Telstra) side and a "customer" (cabler) side. The cable entry ports are spaced at 180 mm centres. The lead-in cable must enter the left-hand cable entry port and customer cables must enter the right-hand cable entry port. These cable entry arrangements cannot be reversed. The earthing conductor should enter the left-hand cable entry port but may enter the right-hand cable entry port if necessary. There is a separate cable entry port for the PSU cable.

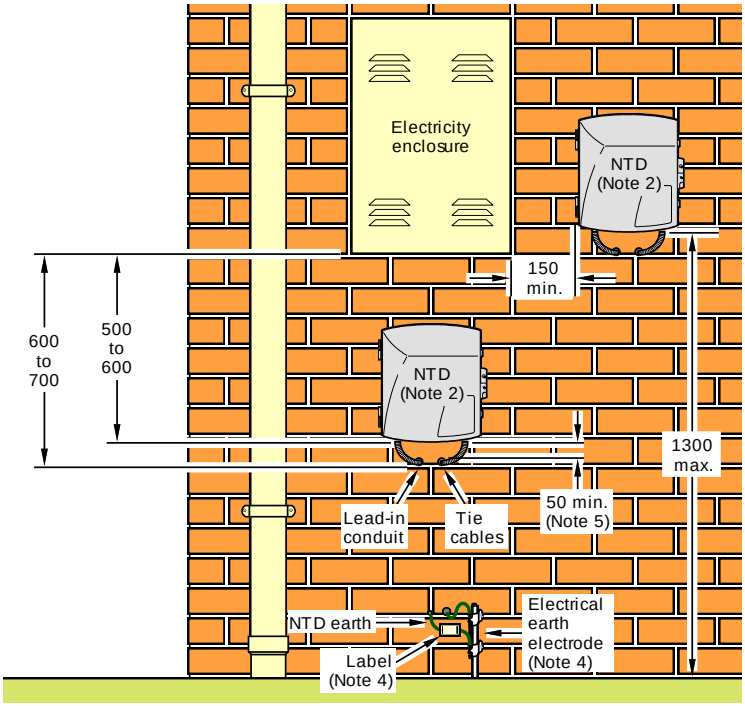
If RF TV (free-to-air TV or pay TV) is to be supplied from the NTD, two 23 mm ID conduits to Telstra or NBN Co. specification will be required between the NTD and the CCP.

The NTD must be positioned 50 mm to 100 mm above the conduits to accommodate the minimum bend radius for the optical fibre lead-in cable, in which case flexible conduit must be used (by the NTD installer) between the rigid conduits and the cable entry ports. The NTD positioning within the height limits described in 6.3.1 (page 38) is shown in Figure 54. Optimal positioning of the NTD over conduits spaced at 80 mm is shown in Figure 55.

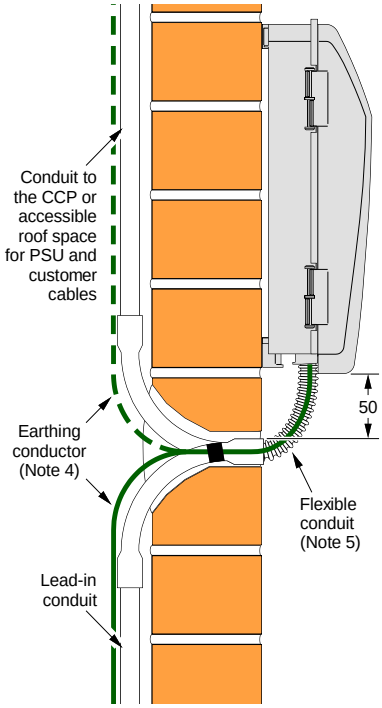
The NTD is supplied and installed by Telstra as part of the FTTP service and is normally installed at the time of service activation.

Figure 54 Outdoor Telstra FTTP NTD installation where a CUE is not used

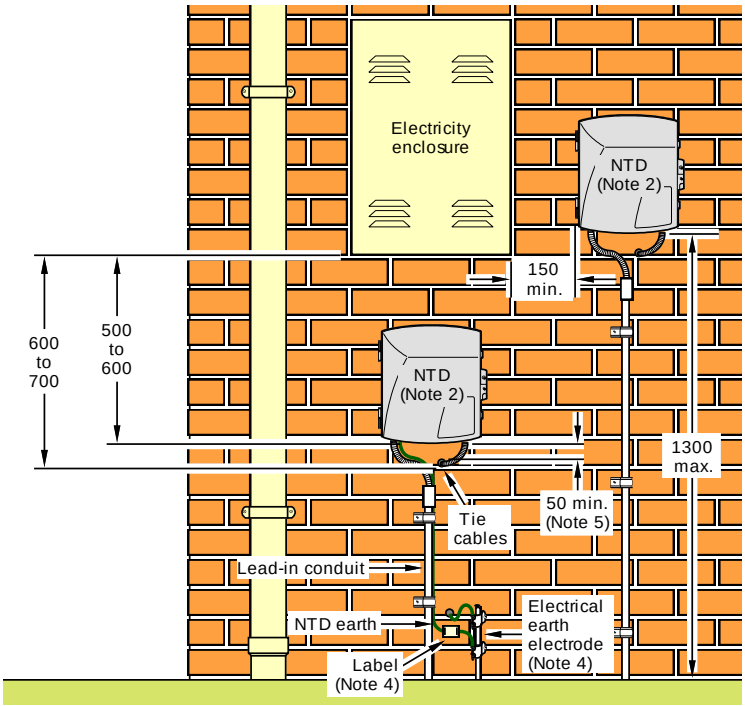
Front view (concealed lead-in conduit)



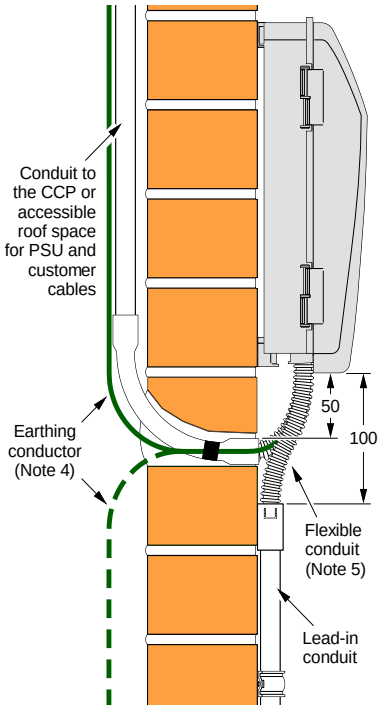
Side view (concealed conduit)



Front view (surface lead-in conduit)



Side view (surface conduit)

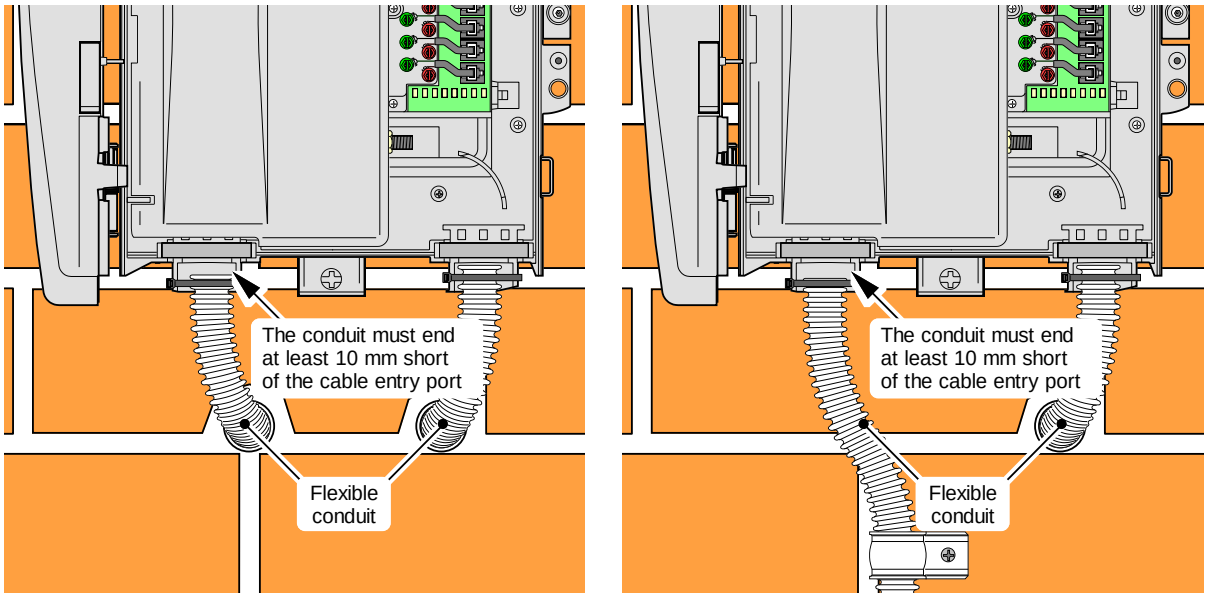


Notes:

1. All measurements are in mm.
2. For general PCD (NTD) location requirements, refer to 6.3.1 on page 38.
3. For conduit positioning in the building footings, refer to 7.2.2 on page 43.
4. For NTD earthing requirements, refer to section 9 (page 72).
5. Spacing of 50 mm to 100 mm is required between the end of the lead-in conduit and the NTD to meet optical fibre lead-in cable bend requirements. Telstra will use flexible conduit to make the final conduit connection to the NTD.

Figure 55 Optimal outdoor Telstra FTTP NTD positioning over conduits spaced at 80 mm

(a) Concealed lead-in conduit **(b) Surface lead-in conduit**



Notes:

1. Flexible conduits are used by the NTD installer to join the rigid conduits to the NTD to protect the cables. The flexible conduit for the underground lead-in cable must terminate at least 10 mm short of the cable entry grommet to ensure that any water or vapour coming out of the conduit can escape externally and to enable any termite activity to be visible to a pest inspector.
2. The flexible conduit for the tie cables may butt up to the cable entry grommet.
3. If the conduits are spaced less than 80 mm apart, the NTD will be positioned over the conduits, by the Telstra installer, so as to ensure that the minimum optical fibre cable bend radius is maintained.

7.5.6.5 FTTP PCD

7.5.6.5.1 General

Where an indoor FTTP NTD is to be provided, an outdoor PCD (optical fibre splice box) will be installed on the external wall to connect the underground or aerial optical fibre lead-in cable to the indoor optical fibre lead-in cable.

7.5.6.5.2 Telstra PCD

The Telstra FTTP PCD (for an indoor NTD) is coloured grey and uses similar casing to the ADSL NTD described in 7.5.6.2 on page 63 but it only has a single access cover. The requirements for positioning the PCD above the conduits are essentially the same as described in 7.5.6.2. However:

- The PCD may need to be positioned 50 mm to 100 mm above the conduits to accommodate the minimum bend radius for the optical fibre cables, in which case flexible conduit must be used (by the PCD installer) between the rigid conduits and the cable entry ports.
- Either cable entry port may be used for either the underground/aerial optical fibre lead-in cable or the indoor optical fibre lead-in cable — or both cables may enter the same (either) cable entry port.

An earthing conductor is not required for this PCD.

The PCD is supplied and installed by Telstra as part of the FTTP service and is normally installed at the time of service activation.

7.5.6.5.3 NBN Co PCD

The NBN Co PCD pictured in Figure 31 on page 35 (for an indoor NTD) is coloured light grey and has a single cover. It does not have a cover skirt to hide the cables entering the bottom of the PCD, so it is assumed that underground lead-in cable entering the PCD will be unprotected to ensure compliance with 7.5.6.1 (page 63). It is also assumed that the tie cable entering the PCD will be unprotected because the PCD has no facility for securing flexible conduit to the PCD (unless it enters the left-hand cable entry port, in which case the underground/aerial lead-in cable must enter one of the other cable entry ports).

Cables cannot pass behind the NBN Co PCD, so cables running down the surface of the wall from above the PCD will either enter the cable entry port at the top of the PCD or run beside the PCD and loop up into a bottom cable entry port.

At the time of writing, NBN Co's practices for installation and connection of the PCD were unclear. The installation of a CUE as described in 6.2 on page 36 would resolve the uncertainty and is recommended for new homes.

7.5.7 PCD fastenings

Impact fasteners should **not** be used to affix the PCD to the wall because these may be too difficult to remove later. The PCD needs to be easily removable to allow future removal and replacement of the PCD for repair or upgrade.

Note: This is for general information only — the Telstra ADSL NTD is the only PCD that may be installed by anyone other than the carrier.

7.6 Drainage pit

7.6.1 Description

A drainage pit is usually only installed in commercial premises or multi-storey apartment buildings where external PCDs are not used. It is mainly used when the lands falls to the building from the property entry point but can also be used to provide a cable/conduit access point immediately before the conduit enters the building. For single dwellings, a drainage pit may be required if the PCD cannot be installed on the external wall and the lead-in conduit cannot terminate at the external wall (e.g. due to extensive glazing). In such cases, the main purpose of the pit is to provide an external access point for sealing the conduit against the entry of water or termites immediately before the conduit enters the building.

Note: While it is possible to seal the conduit at the pit in the street, if the lead-in conduit is damaged in the ground between the pit and the building, there will be a risk of water and termite entry at the point of damage. The risk is minimised if the pit is located adjacent to the building.

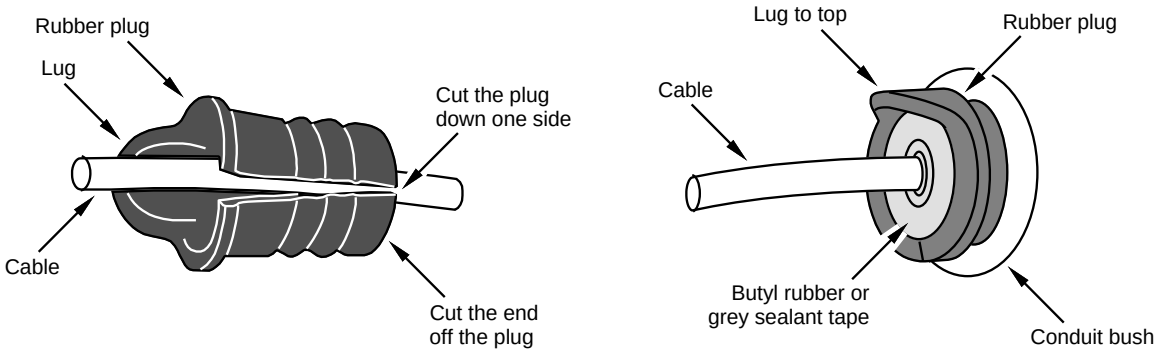
7.6.2 Plugging/Sealing of conduits

For 23 mm ID conduit that runs to a building or that runs downhill into a customer's property, a rubber plug (see Figure 56) is normally used by the carrier to plug the conduit in the pit to minimise water and insect entry to the premises via the conduit.

Figure 56 Typical rubber plug for 23 mm ID conduit

When the lead-in cable is installed in the conduit, the plug must be modified (by the carrier) as shown in Figure 57. If the underground conduit terminates inside a building as shown in Figure 58, the cavity of the plug must be filled with butyl rubber putty or grey sealant tape so as to make the seal watertight and to prevent the entry of insects (especially termites) to the building via the conduit.

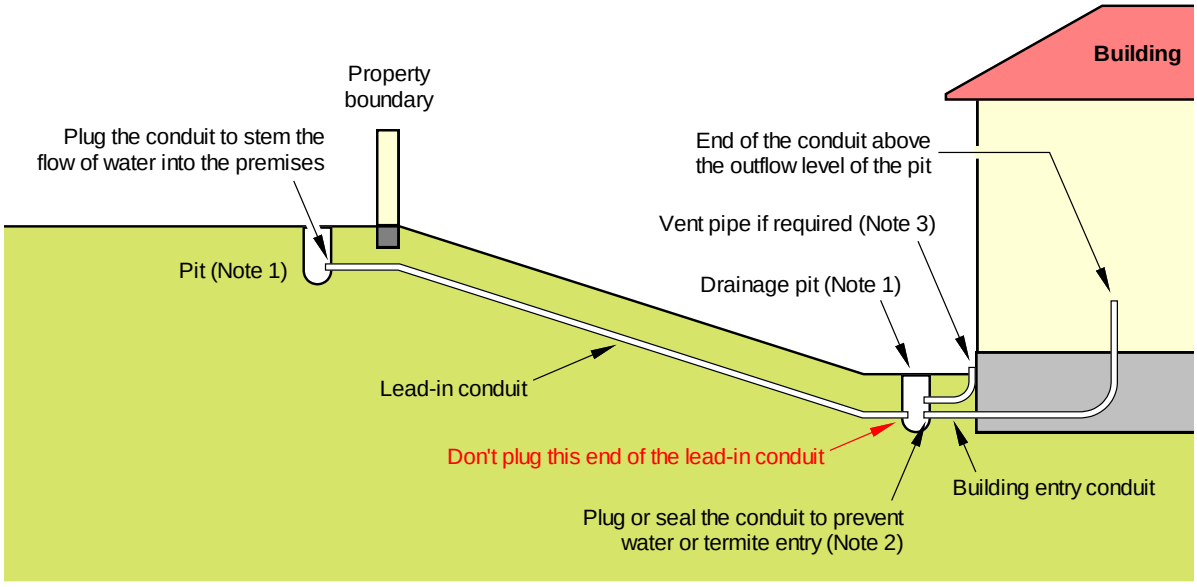
Figure 57 Modification of the rubber plug in the pit for installed cable



Notes:

1. When cable is installed in the conduit, the rubber plug is modified and wrapped around the cable as shown above left and pushed into the end of the conduit as shown above right. If the underground conduit terminates inside a building as shown in Figure 58, the cavity of the plug must be filled with butyl rubber putty or grey sealant tape so as to make the seal watertight and to prevent the entry of insects (especially termites) to the building via the conduit.
2. **This is provided for information only.** Any plugs in the pits must be fitted by the relevant carrier.

Figure 58 Use of a drainage pit



Notes:

1. Conduits must enter the end of the pit (see Figure 5 on page 9).
2. The "network" end of the lead-in and building entry conduits must be plugged or sealed in each pit using a rubber plug (see Figure 56) which must be modified (by the carrier) in accordance with Figure 57 when the lead-in cable is installed.
3. The drainage pit must be drained (or vented using a vent pipe as shown), and would normally sit below the level of the floor of the building. Any drainage or vent pipe must be at least the same size as the lead-in conduit.
4. A drainage pit is not normally required where the lead-in conduit terminates at the external wall of the building (e.g. to connect a PCD). In such cases, any water that trickles down the lead-in conduit should escape harmlessly outside the building and the end of the conduit is also visible for inspection for termite activity.

8 SEPARATION FROM OTHER SERVICES

8.1 General

All cables should be installed thoughtfully and with care to avoid damage during construction of the building and to ensure maximum performance of the completed installation. Compliance with Australian Standard AS/CA S009, *Installation requirements for customer cabling (Wiring rules)*, is the minimum requirement for customer cabling.

8.2 Electricity and gas

8.2.1 Underground conduits/pipes

The telecommunications lead-in cabling must be separated from other underground services in accordance with 4.5.8 to 4.5.10 (pages 23 to 29).

8.2.2 Conduits/Pipes/Cables in/on buildings

8.2.2.1 Separation from Low Voltage (LV) power cables

LV power cables are those cables used to supply 230 V AC single-phase power or 400 V AC three-phase power to appliances and power outlets within a building.

Separation from LV power cables is necessary for safety purposes. The main concern is simultaneous damage to the cable insulation of both wiring systems due to, for example:

- penetration by foreign objects such as nails and screws; or
- crushing or abrasion (e.g. building movement, trampling, impact, pulling one cable over another).

Telecommunications cables on or in the building must be permanently separated from LV power cables for safety purposes by:

- a minimum distance of 50 mm; or
- a barrier of durable insulating material or metal (e.g. enclosure of the cable in conduit); or
- a timber or metal stud, nogging, joist, beam, rafter or roof truss of any thickness.

No spatial separation is required between electrical and telecommunications conduits (for safety purposes) on or within a building.

A telecommunications cable and an LV power cable must not pass through the same bore hole within 50 mm of any securing face of building framework whether or not there is a barrier between the cables. In other cases, telecommunications cable may pass through the same hole (e.g. through wall/ceiling linings or floorboards) as LV power cable if either the telecommunications cable or the LV cable is installed in insulating or metal conduit or suitably designed trunking or ducting that provides a durable barrier between the telecommunications cable and the power cable.

Note: Drills, nails or screws driven into the building framework could penetrate cables passing through bore holes even if the cables are installed in conduit. However, such damage is unlikely for cables passing through wall/ceiling linings (e.g. plasterboard) or floorboards.

A minimum access clearance of 150 mm is required between any telecommunications enclosure (such as a PCD) and any electricity enclosure such as an electricity meter panel or switchboard.

Note: This is an access clearance, not a safety clearance.

8.2.2.2 Separation from services other than power

Telecommunications cables on or in the building must be separated from other non-telecommunications services (such as plumbing) so as not to impede access to, or repair of, the other service. Telecommunications cables must not be fastened to plumbing pipes or the conduits of other services.

Note: A minimum clearance of 50 mm is recommended by Australian Standard AS/CA S009, *Installation requirements for customer cabling (Wiring rules)*, where the telecommunications cabling runs alongside the other service cables, conduits or pipes.

Where the other service is deemed to be hazardous (e.g. a gas pipe or heating oil pipe), the telecommunications cable must be separated from the other service by a minimum distance of 150 mm whether or not the cable is installed in conduit.

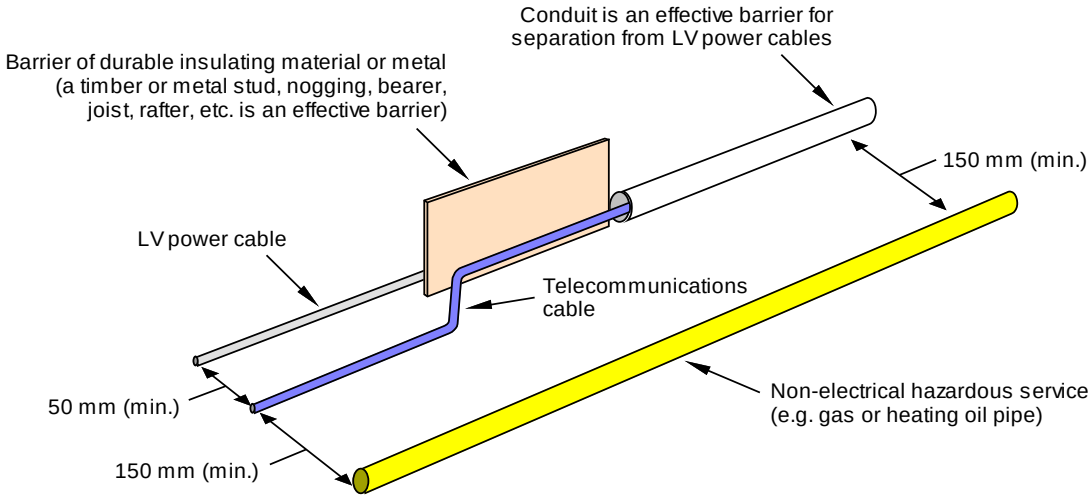
Notes:

1. This separation requirement reduces the risk of damage to the telecommunications cabling or the other service during installation or repair activities, which may cause personal injury or damage to property.
2. See also 6.3.3.1 (page 40) for the requirements for separation of PCDs from gas meters and gas cylinders.

No separation is required between cables of different communications cabling systems, e.g. telephone, data, TV (coaxial), audio (A/V, HDMI or speaker wires).

No separation is required between telecommunications cables and earthing conductors (whether these are associated with telecommunications or electricity) except for lightning down-conductors (see 8.3.2).

Figure 59 Summary of safety separation requirements from LV power cables and non-electrical hazardous services for concealed cabling and outdoor surface cabling



8.3 Other building fixtures

8.3.1 General

Telecommunications conduits emerging from underground should not be installed in a way that may conceal termite activity, e.g. in the corners of external walls or against other conduits or pipes. Refer to 7.2.3 (page 45).

8.3.2 Lightning down-conductors

Lightning down-conductors are earthing conductors installed between a lightning rod or strip located on the roof of the building and an earthing electrode or earthing mat at the base of the building. These are rarely installed on single dwellings but may be installed on multi-storey apartment buildings. Lightning down-conductors are designed to carry thousands of volts and amperes of lightning voltage and current in the event of a lightning strike. It is important to keep metallic cables well away from such conductors to avoid "side-flashing" which may cause fire or injury.

Telecommunications conduits, cables and connection devices must be separated from lightning down-conductors by a minimum distance of **9 m** unless this is impractical, in which case the cabling must be separated from any lightning down-conductor in accordance with the requirements of Australian Standard AS/NZS 1768, *Lightning protection*.

Notes:

1. A separation distance less than 9 m will usually require assessment by a suitably qualified electrical engineer.
2. An earthing conductor for a domestic TV antenna or satellite dish is not a lightning down-conductor.

9 EARTHING

9.1 When is earthing required?

Where the outdoor PCD is an FTTP NTD or an ADSL NTD, an earthing conductor will be required at the PCD location. In the case of an FTTP NTD, the earth is required for electrical safety purposes whereas, for the ADSL NTD, the earth is for lightning surge suppression purposes.

9.2 Equipotential bonding

Where earthing is required, the earth should be derived from the electrical earthing system. This is an important safety requirement to ensure that there is no earth differential at or in the building. Earthing should **not** be achieved by driving a separate earth electrode unless that electrode is also bonded (connected) to the electrical earth electrode.

Telecommunications earthing is obtained from the electrical earthing system by means of "**equipotential bonding**", i.e. by "bonding" (connecting) the two earthing systems together to ensure that they are at "equal potential". The equipotential bonding must be done at the **electrical switchboard** — either inside the switchboard itself by connection to the main earthing bar or main earthing conductor, or outside the switchboard by connection to the main earthing conductor or to the electrical earth electrode. Refer to Figure 4 of Australian Standard AS/CA S009:2013, *Installation requirements for customer cabling (Wiring rules)*. The three allowable methods of equipotential bonding are illustrated in Figure 60.

It is important that there is a **demarcation point** between the electrical earthing system and the telecommunications earthing system so that:

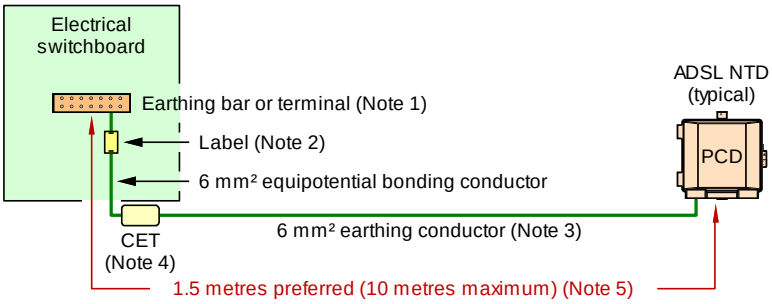
- the telecommunications earth can be isolated from the electrical earth at a single, readily accessible point by either a telecommunications worker or an electrical worker; and
- earthing of telecommunications equipment can be legally performed by a telecommunications worker who is not also a licensed electrical worker.

This demarcation point will be either a **Communications Earth Terminal (CET)** located outside the electrical switchboard or a distinct, removable **connection device on the electrical earth electrode**.

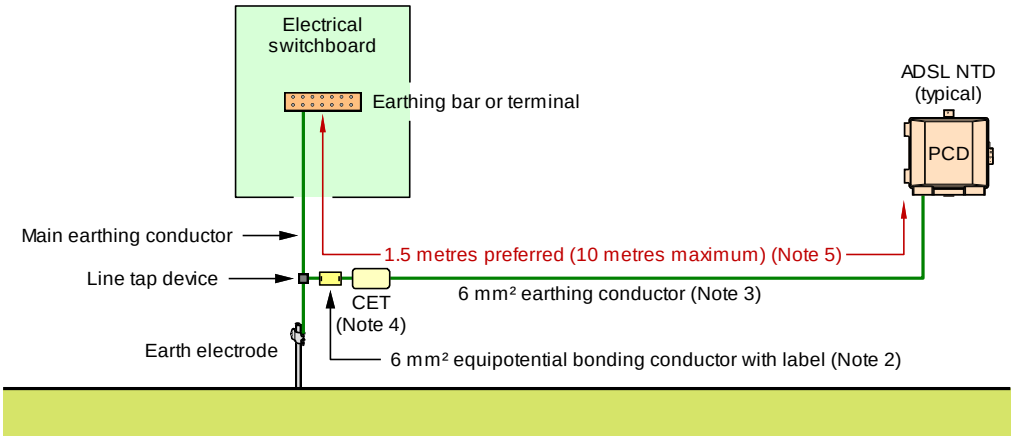
An earthing conductor for telecommunications equipment should not be connected (hard wired) directly to the electrical earthing system even if this is not precluded by the electrical wiring rules (AS/NZS 3000). Furthermore, while telecommunications equipment may use the earth from a power outlet via the power plug and power cord as part of the equipment design, a telecommunications earth should **never** be hard wired from the earthing conductor at the rear of a power outlet.

Figure 60 Equipotential bonding methods

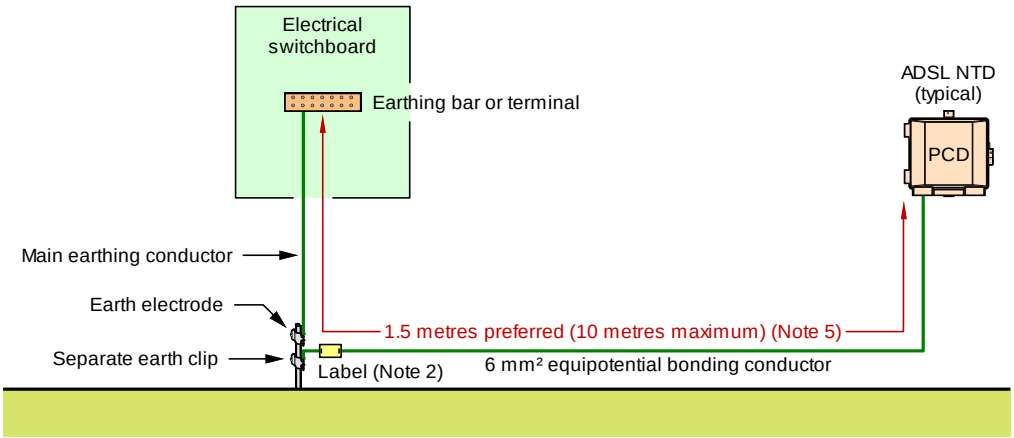
(a) Equipotential bonding to the earthing bar or terminal of the electrical switchboard (Method 1)



(b) Equipotential bonding to the main earthing conductor outside the electrical switchboard (Method 2)



(c) Equipotential bonding to the electrical earth electrode (Method 3)



Notes:

1. Only a licensed electrical worker may access the internals of an electrical switchboard.
2. The equipotential bonding conductor must be labelled “Telecommunications Bonding Conductor” or “Communications Bonding Conductor” at the switchboard end and also at the other end if the other end is not within sight of the switchboard.
3. While a 2.5 mm² earthing conductor is acceptable between the CET and an outdoor FTTP NTD, a 6 mm² conductor is recommended between the CET and the PCD in all cases to ensure compatibility with all PCDs.
4. The CET should be located in the telecommunications compartment of the CUE in accordance with Figure 33 (page 37) or, if a CUE is not provided, the CET may be located in any readily accessible location external to the electrical switchboard — preferably immediately below the switchboard per Figure F3 of AS/NZS 3000:2007.
5. The total length of bonding/earthing conductor between the earthing bar/terminal in the electrical switchboard and the PCD should preferably be less than 1.5 m but, in any case, should not exceed a length of 10 m.

9.3 Installation of earthing conductors

9.3.1 General

A Communications Earth System (CES) conductor may be provided at the CCP for possible earthing of cable screens/shields.

A CET is required if equipotential bonding methods 1 or 2 are used (see Figure 60). The CET should be located within the telecommunications compartment of the CUE (where used) or under the electrical switchboard (see Note 4 to Figure 60). Where bonding method 3 is used, the equipotential bonding conductor may be connected to an earthing terminal located at the CCP. There is no reason why two equipotential bonding conductors cannot be installed for separate purposes, e.g. bonding method 3 for earthing of the outdoor PCD and bonding method 1 or 2 for earthing, via a CET located below the electrical switchboard, to a separate earthing terminal located at the CCP — as long as the indoor earthing terminal and the PCD earth are not interconnected to create an "earth loop" (see the next paragraph). However, it is recommended that a single equipotential bonding connection be made to the electrical earthing system to avoid confusion.

All earthing conductors should be cabled in a "tree" or "star" wiring configuration from the CET or other common earthing point. Care should be taken to avoid intentionally or accidentally earthing the same metallic component at two separate points (such as both ends of a screened cable), which may create "earth loop" currents that could generate noise in the cabling system.

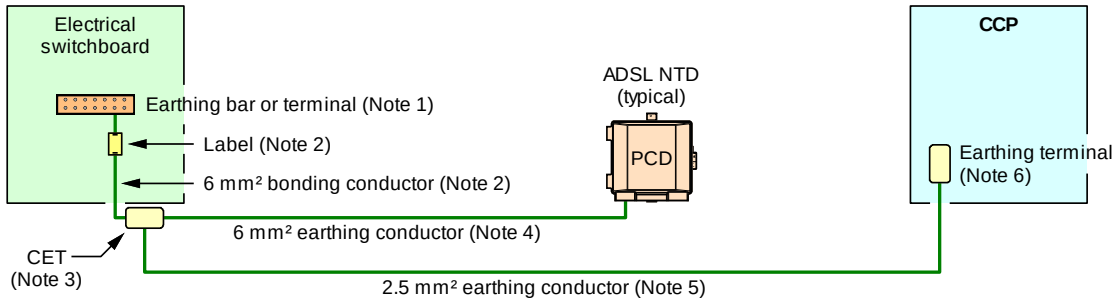
9.3.2 Earthing conductor size and colour

The equipotential bonding conductor must be at least 6 mm² in cross-sectional area (7/1.04 mm) with green/yellow insulation. Any earthing conductor required for end-user lightning surge suppression purposes (such as to an ADSL NTD) must also be 6 mm² with green/yellow insulation. In all other cases, a minimum 2.5 mm² (7/0.67 mm) green/yellow earthing conductor is required, which must be cabled from the CET or other earthing terminal.

Earthing and bonding conductors do not need to be installed in conduit within building cavities.

The recommended earthing conductor arrangement for a generic cabling system is shown in Figure 61.

Figure 61 Recommend earthing conductor cabling for generic home cabling



Notes:

1. Only a licensed electrical worker may access the internals of an electrical switchboard.
2. The equipotential bonding conductor between the earthing bar or terminal of the electrical switchboard and the CET must be at least 6 mm² (7/1.04 mm) copper conductor with green/yellow insulation and labelled "Telecommunications Bonding Conductor" or "Communications Bonding Conductor" in accordance with the requirements of Clause 20.11 of AS/CA S009:2013 and Clause 5.6.2.7 of AS/NZS 3000:2007.
3. The CET should be located in the telecommunications compartment of the CUE in accordance with Figure 33 (page 37) or, if a CUE is not provided, the CET should be located immediately below the electrical switchboard in accordance with Figure F3 of AS/NZS 3000:2007.
4. The earthing conductor between the CET and the PCD should be at least 6 mm² (7/1.04 mm) copper conductor with green/yellow insulation. There is no need to label this conductor. The total length of bonding/earthing conductor between the earthing bar/terminal in the electrical switchboard and the PCD should preferably be less than 1.5 m but, in any case, should not exceed a length of 10 m (see Figure 60).
5. The earthing conductor between the CET and the earthing terminal at the CCP must be at least 2.5 mm² (7/0.67 mm) copper conductor with green/yellow insulation. There is no need to label this conductor. The length of this conductor must not exceed 135 m to ensure that it does not exceed the maximum specified CES resistance of 1 ohm.
6. An earthing terminal may be provided at the CCP for possible earthing of cable screens/shields (refer to 9.3.1). If end-users can access the earthing terminal, it is a requirement of AS/CA S009 for the terminal to have an insulated cover to prevent end-user access to the terminations. All telecommunications earthing connections (e.g. to cable screens/shields) should be made at the CCP.

10 ABBREVIATIONS

For a full list of abbreviations and definitions, refer to Document No. 017153a00.

Acronym	Full expression
AC	Alternating Current
ACIF	Australian Communications Industry Forum (now CA)
ACMA	Australian Communications and Media Authority (formerly AUSTEL and ACA)
ADSL	Asymmetric Digital Subscriber Line
AS/CA	Australian Standard/ Communications Alliance
AS/NZS	Australian Standard/New Zealand Standard
A/V	Audio-Visual
CCP	Central Connection Point (or Cross-Connection Point)
CES	Communications Earth System
CET	Communications Earth Terminal
CUE	Combined Utilities Enclosure
D	Deep
DC	Direct Current
FGL	Finished Ground Level
FTTP	Fibre To The Premises
HDMI	High-Definition Multimedia Interface
HFC	Hybrid Fibre-Coax (“Cable”)
HV	High Voltage
ID	Inside Diameter
kgf	kilogram-force
L	Long
LV	Low Voltage
m	metre(s)
NBN	National Broadband Network

Acronym	Full expression
NTD	Network Termination Device
OD	Outside Diameter
PCD	Premises Connection Device
PP	Power Point
PSU	Power Supply Unit
RF	Radio Frequency
SWER	Single Wire Earth Return
TO	Telecommunications Outlet
TV	Television
UPVC	Unplasticised Polyvinyl Chloride
V	Volt(s)
W	Wide

11 ASSOCIATED DOCUMENTS

Document number	Title
017153a00	Cabling of premises for telecommunications — A complete guide to home cabling
017153a01	Cabling of premises for telecommunications — Essential information for home cabling

12 DOCUMENT CONTROL SHEET

Issue number	Issue date	Details on the change
1	26/08/2013	Approved version for publication