



Underground LV Connections up to 100A

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Document no: ENG-030	Document Rev: 1	Issue Status: Approved	Issue Date: 30/12/11	Page 1 of 11
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<h2>Contents</h2>

1. PURPOSE.....	3
2. POLICY.....	3
3. SCOPE.....	3
4. REFERENCES.....	3
5. GENERAL.....	5
6. PILLAR AND PIT INSTALLATION	7
7. SERVICE CONNECTIONS	10

1. Purpose

To establish guidelines for underground LV connections rated up to 100A on Wellington Electricity's LV distribution network.

2. Policy

All new underground connections to Wellington Electricity's network (rated up to 100 A) shall be made via a service pillar or underground pit, with some exceptions as detailed in section 6.5 and 6.6 below.

Pillars and pits shall be installed, tested and connected in accordance with this document.

3. Scope

This document covers the physical installation requirements for a service pillar or pit, the work processes to be followed by the installer of the service pillar or pit and the connection of a customer mains cable, as well as the recording of data associated with the work carried out.

4. References

All designs and construction activities shall generally comply, where applicable, with the Electricity Act 1992 and Amendments, the Electricity (Safety) Regulations 2010, Electrical codes of practice (in particular NZECP 34 and NZECP 35), AS/NZS 3000, the Safety Manual – Electricity Industry, and equipment manufacturers' maintenance manuals.

Reference Standards	Title	Page
AS/NZS 3000:2007	Electrical installations (known as the Australian/New Zealand Wiring Rules)	5
AS/NZS 4026:2001	Electric cables – For underground residential distribution systems	7
Wellington Electricity		
ENS-150	Cable and Duct Installation	6, 10
ENS-309	Underground Subdivision Design	6
ENG-030	LV Connections up to 100A	10
ENS-064	Loop impedance tests on the LV distribution network	7
ESG-003	Safe Work Practices Manual	6
Other		
EEA publications	Safety Manual – Electricity Industry (SM-EI)	5
NZECP 34:2001	Electrical safe distances	5
NZECP 35:1993	Power systems earthing	5
NZ legislation	Electricity Act 1992 and Amendments	5
	Electricity (Safety) Regulations 2010	5, 10
End Of References		

The following controlled document drawings are referenced in this document, or to be referred to in conjunction with this document.

Drawings	Title	Page
END-1102	Service pit arrangement – Details of typical connections to overhead line	
END-2121	Double-sided underground reticulation	
END-2122	Service pit arrangement – Typical cross-section and installation details	8
END-2123	Service pit arrangement – Up to three single phase customer connections plus earth	
END-2124	Service pit arrangement – Three phase customer connection plus earth	
END-2125	Service pit arrangement – Details of earth conductor	
END-2126	Service pit arrangement – Details of neutral screen cable breakout	7,11
END-2127	Service pit arrangement – Three phase plus single phase customer connections plus earth	
END-2128	Underground service cable – Jointing of tails to unscreened cable for connection to overhead line	
END-2129	Service pit arrangement – Four to six single phase customer connections	
END-2150	Service Pillar, Tuds & Commercial pillar identification chart	
END-2151	Network Pillars – Service, link and distribution	
END-2152	Service Pillar Connections	
END-2153	Network Pillar (Bolted LV Break Point)	
END-2154	Service Pillar Sitting	8
End Of Drawings		

5. General

All works shall be designed, constructed and maintained to minimise as far as reasonably practicable the risk of injury to persons or damage to property due to failure of the works, having regard to recognised natural occurrences in the areas in which the works are situated.

This guideline is to be read in conjunction with Wellington Electricity Network Standard *ENS-309 Underground Subdivision Design* which outlines the principles and technical requirements for underground subdivision design.

5.1 Health and safety

All work associated with the physical installation of LV service pillars and pits and the connection of customer services shall be carried out in accordance with Wellington Electricity's Health and safety management plan, the safety rules for the New Zealand electricity generation, transmission and distribution industry as described in the Safety Manual (Electricity Industry) and in Wellington Electricity's Safe work practices manual.

Several important work principles must be adhered to when accessing a service pit and pillar for any reason:

- The service pit or pillar area must be made safe to the public by erecting barriers and/or cones
- Insulated rubber gloves must be worn
- Connectors and cables within the service pit must be lifted out of the pit prior to disconnection or connection
- Customer mains cables must not be connected unless a white plastic tag bearing the words "Tested and approved for livening" is attached to the service branch cable neutral connector in the service pit or pillar by the pit or pillar installer/tester
- Neutral conductors must be connected first and disconnected last
- Live connections shall be made with only one phase conductor exposed at any time
- All customer mains cable connections must be labelled to show customer identification details
- Only products approved by Wellington Electricity shall be used in a service pit or pillar system
- Pit connectors shall be installed in accordance with the installation instructions provided by the product manufacturer
- When leaving the service pit, all fuse carriers must be closed and the pit lid must **always** be replaced and locked

5.2 Qualification and training

Only authorised persons may install, test and liven service pillar and pit systems or enter a pillar or pit to make customer connections (disconnections) to (from) Wellington Electricity's LV distribution network.

An authorised person will be a suitably qualified and experienced individual, who has undergone specific product training and demonstrated an acceptable level of competence in the use of the products.

Upon satisfactorily completing the product training, a certificate will be issued to the individual by the trainer, and shall be presented to Wellington Electricity upon request.

5.3 Wellington Electricity cable types

Neutral-screened cables are acceptable and generally preferred, but require a transition joint to suit the service pit system. Refer to Wellington Electricity Network Standard Drawing *END-2126 Service pit arrangement – Details of neutral screen cable breakout* (this drawing is also to be used for three core neutral screen). The transition joint shall be inside the pit for ease of future access.

Double-insulated non-screened cable manufactured in accordance with *AS/NZS 4026*, has been approved by Wellington Electricity for use in service pit systems.

For customer mains cables refer to section 7.2 below.

5.4 Load balancing

All service branch cable connections shall be made phase continuous, i.e. service branch cable phase A to distribution network cable phase A, etc. All service branch connections shall be three-phase tee-joints (i.e. all pillars and pits shall have three phases available internally).

In a new subdivision, fuse pillar and pit connectors shall be placed only on the phases of the service branch cable that are specified in the design for customer mains cable connections. Spare cores shall be capped. The design of the reticulation system shall allow for the loads to be balanced across all phases, which shall be achieved by placement of the fuse pillar and pit connectors.

5.5 Installation of connection components

- The connection components shall be fitted in complete compliance with the manufacturer's installation instructions
- Components shall be used only for the purpose for which they are intended
- Components must not be modified in any way

5.6 Electrical tests

Electrical tests shall be performed on each service branch cable, builder's temporary supply cable, and customer mains cable as an integral part of the electrical livening and safety certification procedure.

The electrical tests shall be carried out by a suitably qualified and experienced person in accordance with the *Electricity (Safety) Regulations 2010*.

Category 3 type (minimum) test instruments shall be used, with fused leads.

After running the service branch cable to the service pit or pillar and fitting connectors, but prior to fitting the customer's mains cable, the following electrical tests shall be carried out:

- **Polarity** – to verify the correct voltages at and between each phase conductor, and the neutral conductor
- **Loop impedance** – to measure the loop impedance between the service branch neutral conductor and the phase conductor at the pit (refer to Wellington Electricity standard *ENS-064 Loop Impedance Testing on the LV Distribution Network*)

Polarity and loop impedance tests shall also be completed prior to livening each customer mains cable.

6. Pillar and pit installation

6.1 Wellington Electricity standard drawings

These requirements shall be read in conjunction with the following Wellington Electricity standard drawings for service pit and pillar installation.

Drawing no.	Title
END-1102	Service pit arrangement – Details of typical connections to overhead line
END-2121	Double-sided underground reticulation
END-2122	Service pit arrangement – Typical cross-section and installation details
END-2123	Service pit arrangement – Up to three single phase customer connections plus earth
END-2124	Service pit arrangement – Three phase customer connection plus earth
END-2125	Service pit arrangement – Details of earth conductor
END-2126	Service pit arrangement – Details of neutral screen cable breakout
END-2127	Service pit arrangement – Three phase plus single phase customer connections plus earth
END-2128	Underground service cable – Jointing of tails to unscreened cable for connection to overhead line
END-2129	Service pit arrangement – Four to six single phase customer connections
END-2150	Service Pillar, Tuds and Commercial pillar identification chart
END-2151	Network Pillars – Service link and distribution
END-2152	Service Pillar Connections
END-2153	Network Pillar (Bolted LV Break Point)
END-2154	Service Pillar Sitting

6.2 Service pillar and pit location

Service pillars and pits will generally be located at every second section side boundary, no more than 100 mm from the road reserve boundary. The general principles to be followed when locating service pillars and pits are outlined in Wellington Electricity Network Standard Drawing *END-2154 Service Pillar Sitting*.

The standard lay position for the distribution network cable is in the road reserve within 800 mm of the boundary. The cable is usually installed with 600 mm cover below ground level, at a distance of 400-600 mm from the boundary.

Where service pits are used, the service pit shall be installed directly above the distribution network cable, as shown on Wellington Electricity Network Standard Drawing *END-2122 Service pit arrangement – Typical cross-section and installation details*. The service branch tee-joint shall be located not less than one metre from the service pillar or pit in order to achieve an adequate bending radius for the service branch cable at the entry hole in the base of the service pillar or pit.

All service pits shall, unless impossible due to circumstances that are accepted in writing by Wellington Electricity, be installed with the lid clip positions perpendicular to the road reserve

boundary. All service pit lids shall be installed with the entry hole for the lid-opening tool in the clip position furthest from the road reserve boundary, as shown in figure 6.1 below.

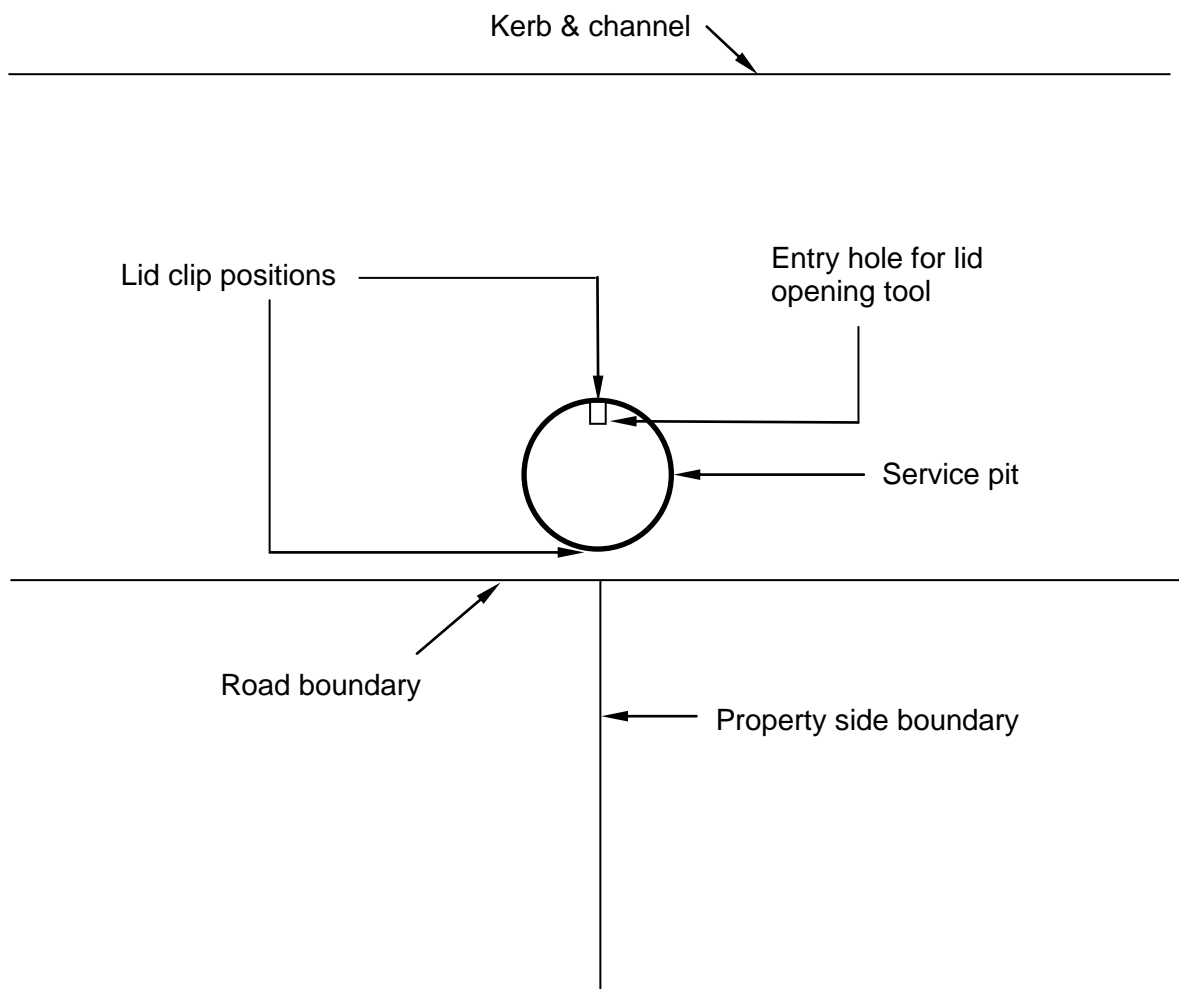


Figure 6.1 – Service pit or pillar location

6.3 Foundations

Service pits and pillars shall be installed within suitable foundation material and if required, soil support enhancement such as concrete or coarse metal shall be used. Backfill around cabling shall not be sharp or present a risk of damage to network or consumer cabling.

6.4 Earthing

For underground distribution systems using pillars, the neutral conductor shall be earthed at intermediate pillars where the cables are bolted, and at end of runs. Neutrals shall be continuous through link pillars.

Where service pits are used, the service branch neutral conductor shall be earthed at every third service pillar or pit, or alternatively at an adjacent service pit that has a spare neutral connector port (where pits are used exclusively).

The earth will comprise of either a driven electrode rod located adjacent to the base of the service pillar or pit in the bottom of the trench, or an exposed length of copper conductor laid in the bottom of the trench, in accordance with the requirements of the *Electricity (Safety) Regulations 2010*.

6.5 New underground service connections

In areas supplied by underground LV circuits, all new connections rated up to 100A shall be via an underground service pillar in preference, although if the location constraints require a pit to be used, this is also acceptable.

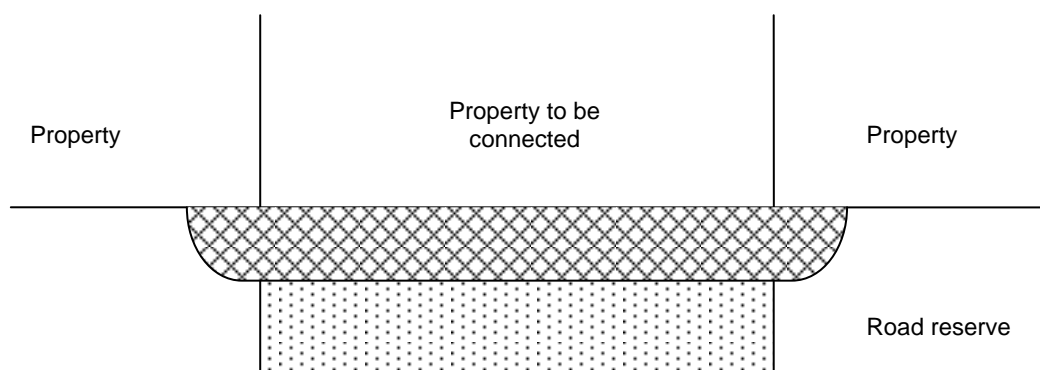
Pillars shall only be installed in new installations where there is suitable protection against damage such as a wall, fence or other structure or is able to be located away from normal vehicle access.

Pits are to be used in narrow, congested or unprotected open spaces, or where the likelihood of vehicle damage is high.

6.6 In areas supplied by overhead LV lines

Where there is a formed kerb and channel, all new connections rated up to 100A shall be via an underground service pillar or pit in accordance with 6.5, unless the connection pole is within 500mm of the property boundary on either side, or is immediately in front of the property road side boundary.

If the connection pole is within 500mm of the property boundary, or is immediately in front of the road side boundary then a direct pole-top termination is permitted without the use of a pit or pillar at the boundary.



Within 500mm of Boundary – Electrician may install cable up pole



Immediately in front of property boundary greater than 500mm may be direct overhead connection up pole, cable installed by WE Contractor

In some circumstances, Wellington Electricity may allow a pole-top termination where the pole is not adjacent to the property boundary. These will be assessed on a case-by-case basis.

Where a pole-top termination is requested, Wellington Electricity will own the cable from the termination to the point where it crosses the property boundary, and therefore will install the section of cable in the road reserve, except where the pole is within 500mm of the boundary. The full length of the cable will be supplied by the customer's electrician, who will trench and install the cable up to the boundary.

Where the length of cable to be installed in the road reserve is 500mm or less, this may be installed by the customer's electrician in accordance with all relevant regulations and Wellington Electricity standards. The cable installation must be witnessed onsite by the Wellington Electricity representative, or nominated Contractor, prior to livening. This cable must be installed on the pole with grey uPVC conduit installed as protection from a minimum of 300mm below ground level, to at least 2400mm above ground level. The conduit must be securely attached to the pole with appropriate saddles or bandit strap. Care must be taken with bandit strap not to damage other service cables on the pole, or position it in such a way that abrasion may occur on other service cables in future.

Where the length of cable to be installed in the road reserve is greater than 500mm then Wellington Electricity's contractor will obtain the road opening notice, trench from the boundary to the pole, install the cable in the berm, make the termination, be responsible for reinstatement in the berm, and complete the as-building of the cable in the berm. The customer will be charged the full cost of this work.

Before livening, the inspector will need to sight CoCs from both the electrician and Wellington Electricity, covering their respective sections of the installed cable. All cable and duct to be owned by Wellington Electricity shall be installed in accordance with Wellington Electricity standard *ENS-150 Cable and Duct Installation*.

6.7 Multiple Connections per Lot

Where there are multiple connections per lot, apartments or back-lots the following criteria shall be followed:

- No more than 2 connections per lot will be installed on a pole
- Between 3 and 5 connections per lot may be supplied via a fused pillar on the boundary
- Greater than 5 connections per lot, or apartments, shall have a fused boundary pillar with a single three phase fuse disconnect unit, with internal reticulation and fusing provided by the customer

6.8 Electrical safety certification

Following the satisfactory completion of the tests specified in section 5.6, the tester shall:

- Fit an approved white plastic tag to the service branch neutral conductor, marked with the words "TESTED AND APPROVED FOR LIVENING"
- Follow the Wellington Electricity process for livening.
- Details of the connection shall be recorded in Wellington Electricity's systems.

7. Service Connections

7.1 Builder's temporary supply

Wellington Electricity will actively encourage electricians to lay the customer mains cable for use as the builder's temporary supply.

Where a builder's temporary supply cable is to be used only for that purpose, it shall be disconnected before the permanent customer mains cable is connected.

The type of cable to be connected to a service pillar or pit for use as a builder's temporary supply shall be double-insulated non-screened or neutral-screened cable, or single core double insulated TPS, $\geq 6\text{mm}^2$. No other cable types will be connected (e.g. multi core TPS cables).

The customer's electrician shall lay the cable to the boundary adjacent to the service pillar or pit and leave a 1400 mm length of cable coiled for connection within the service pillar or pit by others.

Note for Service Pits: If neutral-screened cable is used, a transition joint is required inside the service pit, at the customer's cost, to allow satisfactory termination to the pit connectors.

7.2 Customer mains cable

The type of cable to be connected to a service pillar or pit for use as a customer mains cable shall be double-insulated non-screened or neutral-screened cable, or single core double insulated TPS, $\geq 6\text{mm}^2$. No other cable types will be connected (e.g. multi core TPS cables).

The customer's electrician shall lay the cable to the boundary adjacent to the service pillar or pit and leave a 1400 mm length of cable coiled for connection within the service pillar or pit by others.

Note for Service Pits: If neutral-screened cable is used, a transition joint is required inside the service pit, at the customer's cost, to allow satisfactory termination to the pit connectors and to provide double insulation of the cables used to connect to the pit fuses and connectors. Refer to *END-2126 Service pit arrangement – Details of neutral screen cable breakout*.

7.3 Electrical safety certification

Following satisfactory completion of the electrical tests on the builder's temporary supply or customer mains cable, the tester shall:

- Attach an approved plastic or metal ferrule showing the customer identification details (i.e. the street number of the premises) on the sheath of the customer mains cable within the service pillar or pit
- Follow the Wellington Electricity process for livening.
- Details of the connection shall be recorded in Wellington Electricity's systems.

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