
POWERCO ELECTRICITY NETWORK CONNECTION STANDARD - AEN

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1 GENERAL

1.1 Scope

Powerco is committed to providing Consumers with a safe, reliable and efficient Network having regard to good industry practice. In order to achieve this goal Powerco needs to apply its approved design, construction and operating standards throughout the network, including the area of connecting new load to the Network.

Prior to energising or upgrading a network connection, there are Retailer requirements and Distributor requirements that need to be fulfilled. This standard sets out Powerco's requirements as a Distributor.

This document covers all Points of Connection to Powerco's Electricity Networks and specifically covers the following:

- (a) Technical criteria to be met by the Consumer's Installation;
- (b) Network Access Controls through which Powerco carries out its 'Duties of Principals' under the *Health and Safety in Employment Act* to ensure personal safety; and
- (c) The requirement for the supply of Connection information, including as-built information relating to the Connected Consumer's Installation, for Powerco's records.

This standard excludes Distributed Generation, which is subject to the *Electricity Industry Participation Code 2010, Part 6 Connection of Distributed Generation* and Powerco's *173S003 Distributed (DG) Generation Policy*.

1.2 Application

This standard applies to new Points of Connection or the upgrade of existing Points of Connection on Powerco's Electricity Networks. This standard applies to Powerco assets, Powerco employees, Contractors, Retailers and End-Consumers.

1.3 Referenced Documents

1.3.1 Legislation

- Electricity Act
- Electricity Industry Participation Code 2010 (supersedes Electricity Governance Rules 2003) and pursuant Codes of Practice
- Electricity (Safety) Regulations and pursuant Codes of Practice (NZECP)
- Electricity (Hazards from Trees) Regulations
- Health and Safety in Employment (HSE) Act
- Unit Titles Act
- NZECP 35:1993 - Power Systems Earthing
- NZECP 36:1993 - Harmonic Levels
- AS/NZS 3000 *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

1.3.2 Industry Standards

Electricity Commission Guidelines for Metering, Reconciliation and Registry Arrangements for Embedded Networks

The National Code of Practice for Utilities' Access to the Transport Corridors

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SM-EI	Safety Manual - Electricity Industry (SM-EI) – Parts 1 – 3 inclusive
IEC 354	Loading Guide for Oil-Immersed Power Transformers
BS CP1010	Loading Guide for Oil-Immersed Transformers
AS/NZS TR IEC 61000.3.6:2012	Electromagnetic Compatibility (EMC) - Limits - Assessment of emission limits for distorting loads in MV, HV and EHV power systems
AS / NZS 3000:2007	Electrical Installations (known as the Australian / New Zealand Wiring Rules)
AS/NZ 4360:2004	Risk Management
NZS 6108:1984	Accommodation for Electrical Supply Substations in Customers Buildings
EEA Publication.	Guide for Livening of Service Connections to Premises.
EEA Publication	Guide for the Connection of High Voltage Electrical Installations.
EEA Publication	Power Quality (PQ) Guidelines.

1.3.3 Powerco Documents

100R001	Risk Management Charter
150S016	Selection Use and Maintenance of Electrical Safety Equipment
170S001	Permanent Disconnections - Electricity Network
173S003	Distributed Generation (DG) Policy
210S002	Electricity Employee Competency Certification
220S002	Powerco Common Definitions Standard
220S007A	Network Equipment Commissioning Standard - Process - Part A
220S007B	Network Equipment Commissioning Standard – Part B - Technical Policies And Minimum Testing Practices
310S011	Powerco Electricity Lines Ownership Policy
310S035	Powerco Environmental Management System
310S067	Streetlight Supply, Control and Ownership Policy
310S103	Guide to Customer Initiated Work Process - Electricity Networks
370S006	Powerco Predecessors - Electricity and Gas Networks
392S002	Health And Safety Requirements For Network Contractors
392S011	Powerco's Network Easements Policy
393S004	Electrical Equipment Numbering and Labelling Requirements
393S008	Overhead Line Design Standard
393S009	Underground Distribution Network Design Standard
393S010	Overhead Line Construction Standard
393S011	Underground Distribution Network Construction Standard
393S012	Distributed Generation Over 10kW Connection Standard
393S017	Permanent Earthing Standard
393S024	Network Fuse Protection Standard
393S040	High Voltage Metering Units Specification Guidelines
393S089	Distributed Generation Up To 10kW Connection Standard

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393S107A	Part A - Low-Voltage Service and Link Boxes and Cabinets Specification
393S107B	Part B - Low-Voltage Service and Link Boxes and Cabinets List of Approved Boxes and Cabinets

1.4 Definitions

Unless stated otherwise, all words and phrases used in this document shall have the meaning defined in: -

- *Electricity Act 1992*
- *Electricity (Safety) Regulations 2010*
- *AS/NZS 3000:2007 - Electrical Installations (known as the Australian / New Zealand Wiring Rules)*
- *Powerco's 220S002 Common Definitions Standard*
- Common English language definitions

Advanced Metering	Means an electronic meter that measures electricity, records consumption, and meter event information, have two way communications, can be remotely read, and may have additional functionality such as remote disconnection/reconnection, tamper detection, outage detection etc.
Berm	The strip of land between the property boundary and the edge of the Carriageway, whether that is defined by the edge of the seal or dish channel.
Builders Temporary Supply	Means a connection serving the same function as defined for Temporary Supplies.
Carriageway	The portion of the Road or Motorway primarily for the use of travelling vehicles, including the sealed Shoulders.
Certificate Of Compliance (Electrical)	Means a certificate issued in respect of an installation on which prescribed electrical work has been done (refer Electricity (Safety) Regulations 2010, Regulation 67 <i>Certificate of Compliance</i>).
Certificate of Compliance (definition as from 1/7/2013)	Means a certificate, issued under regulation 65, regarding the lawfulness and safety of prescribed electrical work done on an installation or part installation. (E(S)R 2010 definition)
Certified Design (definition as from 1/7/2013)	Means a design for an installation that has been certified in accordance with regulation 58. (E(S)R definition)
Consumer / Customer	This term has the same definition and meaning as defined in the Electricity Act 1992, namely "...any person who is supplied, or who applies to be supplied, with electricity."
Consumer's Installation	For the purposes of this standard Consumer's Installation means any items which are used or designed or intended for use in, or in connection with the conversion, transformation, transportation or use of electricity and which are owned by a Consumer and that form part of a system for transporting electricity between the Distributors Network and the ICP, and excludes the Distributor's equipment.
Consumer's	For the purposes of this standard Consumer's Premises means the land and

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Premises	buildings owned or occupied by a Consumer, and any land over which the Consumer has an easement or right to pass electricity, including: - <ul style="list-style-type: none">(a) The land within the boundary where the electricity is consumed;(b) The whole of the property, if the property is occupied wholly or partially by tenants or licensees of the owner or occupier; and(c) The whole of the property that has been subdivided under the <i>Unit Titles Act 2010</i>.
Contractor	A person engaged by Powerco (otherwise than as an employee) to do any work for gain or reward, including a sub-contractor or any employee of a sub-contractor, in a place of employment.
Data Logger (Data recorder)	Means an electronic device that records data over time or in relation to location either with a built in instrument or sensor or via external instruments and sensors. The information stored within the loggers memory can be downloaded either locally or remotely.
De-energise	As defined in SM-EI and means the process of disconnecting the Consumer's Installation or equipment from The Network by removing a fuse or link or the opening of a switch in order to prevent further transportation of electricity to or from an ICP.
Distribution Network	Means the distribution system controlled by Powerco and includes the 22kV, 11kV, 6.6kV and LV portions of this system.
Electricity Distributor	As defined in the Electricity Act and means "...a person who supplies line function services to any other person or persons."
Electrical Installation (Installation)	<p>(a) Means –</p> <ul style="list-style-type: none">(i) In relation to a property with a point of supply, all fittings beyond the point of supply that form part of a system that is used to convey electricity to a point of consumption, or used to generate or store electricity; and(ii) In relation to a property without a point of supply, all fittings that form part of a system that is used to convey electricity to a point of consumption, or used to generate or store electricity; but <p>(b) Does not include any of the following:</p> <ul style="list-style-type: none">(i) An electrical appliance;(ii) any fittings that are owned or operated by an electricity generator and that are used, designed, or intended for use in or in association with the generation of electricity, or used to convey electricity from a source of generation to distribution or transmission lines;(iii) any fittings that are used, designed, or intended for use in or in association with the conversion, transformation, or conveyance of electricity by distribution or transmission lines <p>(Electricity Act 1992 and E(S)R 2010 definition)</p>
Electric Line (known in earlier versions of this document)	Means all conductors (including fittings supporting, or connected to, those conductors), whether above or below ground, that are used or intended to be used in, or in connection with, the supply of electricity from the outgoing terminals of a generating station, a building, enclosure, or other structure to: <ul style="list-style-type: none">(a) the incoming terminals of another building, enclosure, or other

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as 'Service Main').	structure; or (b) an appliance, in any case where the appliance is supplied with electricity other than from a terminal in a building, enclosure, or other structure. (E(S)R 2010 definition)
Electrical safety Certificate (definition as from 1/7/2013)	Means a certificate, issued under regulation 74A, regarding the electrical safety of an installation or part installation that is connected to a power supply. (E(S)R 2010 definition)
Electrically Safe	Means, in relation to works, installations, fittings, appliances, and associated equipment, that there is no significant risk that a person or property will be injured or damaged by dangers arising, directly or indirectly, from the use of, or passage of electricity through, the works, installations, fittings, appliances, or associated equipment (E(S)R 2010 definition)
Electrically Unsafe	Means, in relation to works, installations, fittings, appliances, and associated equipment, that there is a significant risk that a person may suffer serious harm, or that property may suffer significant damage, as a result of dangers arising, directly or indirectly, from the use of, or passage of electricity through, the works, installations, fittings, appliances, or associated equipment (E(S)R 2010 definition).
Embedded Network	An Embedded Network is an electricity distribution network that is owned by someone other than the local network owner, where Consumers have ICP's allocated and managed by the Embedded Network owner (or another distributor appointed for that purpose), and the electricity traded is reconciled at the point of connection between the Embedded Network and the local network. <u>Network Extensions</u> can exist within an Embedded Network. In these situations an electricity distribution network that is owned by someone other than the local network owner, where Consumers have ICP's allocated and managed by the local network owner, the electricity traded is reconciled at the Point of Supply for the local network at the grid exit point (GXP). Consumers connected to them are switchable and therefore have a choice of retailer. <u>Consumer Networks</u> are an electricity distribution network that is owned by someone other than the local network owner. Consumers connected to these networks are not switchable and therefore have no choice of retailer.
Energising	As per the meaning defined in the SM-EI and includes the process of electrically livening, and/or energising an Installation to The Network.
Exclusive Fittings	Means fittings used or intended to be used for the purpose of supplying electricity exclusively to that property (Electricity Act 1992 definition).
Fittings	Means everything used, or designed or intended for use, in or in connection with the generation, conversion, transformation, conveyance, or use of electricity (Electricity Act 1992 definition).
Feeder	Means a high voltage circuit served by automatic switchgear at 3.3kV and above.
Generator	Means any person that has assets that have the capability to generate electricity.
GXP	Means Grid Exit Point. Point of connection on the National electricity grid where electricity may flow out of the grid.

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HV (High Voltage)	As defined in SM-EI and means any voltage exceeding 1000 Volts a.c. or 1500 Volts d.c.
Installation Control Point (ICP)	Means an installation control point being 1 of the following: a) a point of connection at which a customer installation is connected to a network other than the grid: b) a point of connection between a network and an embedded network: c) a point of connection between a network and shared unmetered load. (Electricity Industry Participation Code 2010 definition)
Line Owner	Means a person that owns works that are used or intended to be used for the conveyance of electricity.
Lines	Means works that are used or intended to be used for the conveyance of electricity (Electricity Act definition).
Load	“Load” means an Installation: - <ul style="list-style-type: none"> ▪ An electrical impedance connected to the network. ▪ The total electrical demand for electrical energy on Powerco’s network.
Load Control Equipment	As defined by the Electricity Commission - <i>Model Use of System Agreement – Interposed (December 2005)</i> means the equipment (which may include, but is not limited to Ripple Receivers and Relays) which is from time to time installed in, over, or upon a Consumer’s Premises for the purposes of receiving Load Management Service signals.
Load Management Service	As defined by the Electricity Commission - <i>Model Use of System Agreement – Interposed (December 2005)</i> a “Load Management Service” means providing a signal for the purpose of reducing or interrupting delivery to all or part of a Consumer’s Premises, including as an example, but without limitation, delivery to a water heater, on a basis agreed between the Distributor and the Retailer. In this document this means a Powerco approved “Suitable Interruptible Load”.
Load Control Ripple Receiver or Relay	Means a device used to decode a signal injected onto The Network by the Load Control System. The purpose of this equipment is to activate, or deactivate an appropriate Ripple Receiver or Relay in order to perform specific functions.
LV (Low Voltage)	As defined in SM-EI and means any voltage exceeding 50 Volts a.c. or 12 Volts ripple free d.c. but not exceeding 1000 Volts a.c. or 1500 Volts d.c.
Mains	Means those fittings forming part of an installation that are used for the supply of electricity to the MEN switchboard of the installation that is closest to the point of supply (E(S)R 2010 definition).
Metering Equipment	Means any apparatus for the purpose of measuring the quantity of electricity transported through an ICP along with associated communications facilities to enable the transfer of metering information.
Multiple Tenancy Installation	One building that has a single point of connection to the Powerco Network, with multiple tenancies that are individually metered. Each tenancy will be separately isolatable and have its own ICP
Network (The)	Means a collective term commonly used as an abbreviation to mean the whole of the electricity distribution system - i.e., high voltage or low voltage delivery systems. In this document, The Network is taken to mean Powerco’s network (or Powerco’s Works as defined in the Electricity Act 1992)

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Network User	Means an electricity Generator or Retailer who has a valid Use Of System Agreement with the Distributor; or a Consumer who has a valid Network Connection Agreement with Powerco.
Paralleling	For the purpose of this document, parallel means the connection of two or more circuits that are supplied from separate sources of electrical energy that are of the same output voltages and phasing.
PCC	Means Point Of Common Coupling of the Consumer. Refer to AS/NZS 61000.3.6 for guidance on determining this point.
Pillar Box	Contain links and fuses and provide multiple alternative feeds. Predominantly located in Central Business District (CBD) areas. Generally larger than Service Boxes or Link Boxes.
Point of Connection	Means a point at which electricity may flow into or out of a network and, for the purposes of the Technical Code A of Schedule 8.3, means a grid injection point or a grid exit point (Electricity Industry Participation Code 2010 definition).
Point of Isolation	In this document the Point of Isolation refers to the physical location of a device (For example: switch, fuse or link) which enables de-energisation of the connection from the Network.
Point of Supply	Point of Supply in relation to a property means the point(s) on the boundary of the property at which exclusive fittings enter that property except that: <ul style="list-style-type: none"> a) If there are both High Voltage lines and a Transformer owned by the electricity distributor on the property, the Point of Supply is the point at which electricity from the Transformer enters exclusive fittings; or b) If there are non-exclusive fittings on the property, the Point of Supply is the point at which those fittings become exclusive fittings; or c) If the exclusive fittings on the property are owned by a Consumer that is a tenant or licensee of the owner or occupier of the property, the Point of Supply is the point at which those exclusive fittings enter the area leased or licensed by the owner; or d) If there is a specific agreement that any other point on the property is the Point of Supply, the Point of Supply is the agreed point. (Electricity Act 1992 definition).
Power Supply	Means a supply of electricity (Electricity Act 1992 definition).
Premises	For the purposes of this document means an installation.
Price Category/Tariff Option	Means the charges levied by the Distributor on the Retailer for Distribution Services provided by the Distributor.
Principal	Means a person who or that engages any person (otherwise than as an employee) to do any work for gain or reward.
Residential	Means areas that are zoned residential in the Local Authority District Plan.
Retailer (of Electricity)	Means a person who supplies electricity to another person or persons for any purpose other than for resupply by the other person or persons; and “electricity retailing” has a corresponding meaning.
Rights of Access	Means safe and unobstructed access to and within a Consumer’s premise; <u>and</u> Reasonable use of facilities and amenities available to the network User or

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	the Consumer and ordinarily used in association with the Distributor's Equipment at the Consumer's premise.
Ripple Receiver	See definition above for Load Control Ripple Receiver or Relay.
Road	For the purposes of this document 'road' has the meaning applicable to the specific type including: 'road', 'local road', 'main road' and 'motorway', as defined by the <i>National Code of Practice for Utility Operators' Access to Transport Corridors</i> .
Road Corridor	Includes Roads as defined above and includes all land from boundary to boundary (including the Berm and Carriageway). (<i>National Code of Practice for Utility Operators' Access to Transport Corridors definition</i>).
Rural	Means Areas zoned rural in the Local Authority District Plan.
Service Box	A facility that is designed to allow access to the underground LV network for the connection of service-cables. Note: Service boxes are also known as service pillars, pillar boxes and pods. (as defined in Part A - Low-Voltage Service and Link Boxes and Cabinets Specification). Service boxes are generally used to supply domestic / small installations; these boxes are smaller than Link Boxes or CCBD type Pillar Boxes and are typically fitted with fuses rated up to 60 Amps.
Service Main	Refer to definition of 'Electric Line'.
Service Pillar	A service pillar is a point of supply, usually fused, to a customer's service main.
System Operator	Means the System Operator appointed pursuant to the Electricity Industry Participation Code 2010 including any Codes of Practice issued pursuant to the Electricity Industry Participation Code.
Temporary Supplies	Means a temporary connection given to builders and other tradespeople for the purposes of providing electricity supply at a worksite where there are no existing electricity network supplies available.
TOU	Means an abbreviation of the words Time of Use.
U/G	Means an abbreviation for the word Underground.
Urban	Means areas that are not zoned rural in the Local Authority District Plan.
Use of System Agreement	Means a written agreement that exists between Powerco Limited and each individual Energy Retailer
Work	For the purposes of this document, work is deemed to encompass prescribed electrical work, applying effort, labour; to handle, execute and operate on or around network assets.
Works.	(a) Means any fittings that are used, or designed or intended for use, in or in conjunction with generation, conversion, transformation, or conveyance of electricity; but (b) Does not include any part of an installation (Electricity Act 1992 definition).

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1.5 Health and Safety Hazard Identification and Management

Contractors and Service Providers to Powerco shall obey the requirements of Powerco standard *Health And Safety Requirements For Contractors – 392S002*.

A systematic method of identifying all hazards shall be applied to all projects and worksites, generally as required by *Safety Manual – Electricity Industry (SM-EI) Parts 1, 2 & 3*. Appropriate hazard mitigation methods shall then be implemented before work commences.

This process is particularly important when selecting materials and equipment for use on Powerco electricity network.

Particular attention shall be given to the ability to apply effective worksite earthing equipment and any equipotential bonding requirements, to comply with all SM-EI earthing requirements.

Personnel shall use personal protective equipment (PPE) as per the requirements of: -

- Powerco standard *Selection Use and Maintenance of Safety Equipment 150S016*. This standard outlines where and when staff, contractors and Service Providers alike should be wearing personal protective equipment (PPE).
- *Safety Manual – Electricity Industry (SM-EI) – Parts 1 – 3 inclusive*.

When working with materials such as insulating oils, gases and other hazardous substances the requirements of Section 7 of the SM-EI shall be adhered to.

1.6 Environmental Considerations

Environmental considerations shall be in accordance with the requirements of Powerco's *310S035 Environmental Management System*.

1.7 Risk Identification and Management

A systematic method of identifying all risks shall be applied to all design, construction and maintenance projects undertaken on the Powerco network, generally as required by *Powerco's 100R001 Risk Management Charter*. Appropriate risk mitigation or reduction methods shall then be implemented before work commences on any network asset.

1.8 Copyright

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1.9 Document Owner

Contact Person: Technical Services Manager

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2 CONTRACTOR RESPONSIBILITIES**2.1 Working On The Network**

All parties working on Powerco's network shall:-

- Be responsible for ensuring that all Installations that they connect to the Network comply with the requirements of this standard.
- Not connect; any new Installation that does not comply with the requirements of this standard, or where the connection has not been approved for connection by Powerco according to the requirements of Powerco's *310S103 Guide to Customer Initiated Work Process - Electricity Networks*.
- Ensure that the requirements of the *Electricity (Safety) Regulations* are complied with, including and not necessarily limited to:
 - Assessing that the works and installation are electrically safe. For example: ensuring completed Certificates of Compliance and other certification have been issued and associated design information and test results are attached.
 - Regulation 38 *Testing works before connecting to supply*.
- Comply with the requirements of Powerco standards:
 - *220S007A Network Equipment Commissioning Standard – Process - Part A*.
 - *220S007B Network Equipment Commissioning Standard – Part B – Technical Policies And Minimum Testing Practices*.
- Ensure that permanent disconnections of Installations comply with the requirements of Powerco standard *170S001 Permanent Disconnections – Electricity Network*.

2.2 Connection Prerequisites

Prior to the energising of an Installation supplied from the Network, the party connecting (or reconnecting) the Installation shall ensure that the following requirements have been fulfilled:

- (a) Compliance with the *Electricity (Safety) Regulations*, including but not limited to:-
- The Regulations contained in *Part 5 Safety of Installations*, evidenced by the issue of required certification (Certificate of Compliance and, after 1 July 2013, and Electrical Safety Certificate), required inspection, design information, manufacturer's instructions (after 1 July 2013) and test results.
 - Regulation 38 *Testing works before connecting to supply*.
 - Regulation 17 *Maintaining Safe Distances*.
- (b) Metering has been installed, inspected and approved by the meter owner and complies with:
- The requirements of the *Electricity (Safety) Regulations*.
 - *Electricity Industry Participation Code 2010*, including but not limited to, *Part 10 Metering Arrangements*.
 - Relevant standards determined by accepted industry good practice.
 - Section 6 *Technical Criteria – Retail Equipment* of this standard.

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- (c) Sufficient space is allowed for the installation of Powerco's Load Control Equipment on the Installations main switchboard.
- (d) A Main Earthing System exists for the Installation that complies with the requirements of the *Electricity (Safety) Regulations* and AS/NZS 3000 *Electrical installations (known as the Australian/New Zealand Wiring Rules)*.
- (e) The Electric Line and Installation meets the following requirements:
 - Complies with the *Electricity (Safety) Regulations*, including but not limited to:
 - The Regulations contained in *Part 5 Safety of Installations*.
 - Regulation 38 *Testing works before connecting to supply*.
 - Electrically safe.
 - Correct polarity and phase rotation.
 - Regulatory requirements of Testing and Certification are fulfilled.
 - Service fuse(s) are correctly rated with respect to the electric Line size, fault level, and connection capacity of the Installation in accordance with Regulations and Powerco's *393S024 Network Fuse Protection Standard*.
 - The installation, Works and Fittings are compatible with the supply system.
- (f) The contractor must have approval from the Consumer's Energy Retailer to energise the Installation in accordance with the *Use of System Agreement* which is in effect between Powerco and the Retailer.
- (g) The Retailer must have approval from Powerco prior to energising the ICP.
- (h) *Builders Temporary Supplies* shall comply with all of the requirements of clause 3.4.6 *Temporary Supplies* of this standard prior to their being energised.
- (i) Any specific terms and conditions as required by Powerco and accepted by the Consumer shall be met prior to livening.

For HV installations the requirements of clause 3.8 *HV Connections* for pre-connection verification, including compliance with *Regulation 73(4) Verifying Safety Before Connection Installations up to 30 June 2013* and then *Regulation 64 Exemption For Domestic Electrical Wiring Work of the Electricity (Safety) Regulations*.

3 GENERAL TECHNICAL REQUIREMENTS

3.1 General

While the standard supply to most new Consumers will be a single phase, 230-volt, 60-amp supply, larger or other special supply requirements can be arranged (for example: three phase 400/230 volt).

The type of network connection provided for a Consumer will be dependent upon the network connection capacity required, the position of the Consumer's main switchboard and the location and nature of the Consumer's Installation.

Before being connected to Powerco's network all Consumer Installations and appliances shall have been designed, constructed, configured, and installed to comply with the requirements of this standard and the following:-

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- All applicable electricity Acts and Regulations
- AS / NZS 3000:2007
- *393S008 Overhead Line Design Standard*
- *393S010 Overhead Lines Construction*
- *393S009 Underground Network Design Standard*
- *393S011 Underground Distribution Network Construction Standard*

3.2 Network Point of Isolation

The Network Point of Isolation is the point at which electricity may flow between the Network and the Consumer's Installation.

A unique Installation Control Point (ICP) means the point at which the retailer is deemed to supply electricity to the Consumer.

The Network Point of Isolation is determined by the Distributor so as to ensure Isolation (de-energisation) without affecting the integrity of the Network or the conveyance of electricity to any other ICP. It is at the Point of Isolation that a connection is energised or de-energised (isolated from the Network).

The examples in *Appendices A to L* detail the Point of Isolation and Point of Supply in various connection scenarios. In circumstances not covered by examples, the Distributor shall determine the Point of Isolation and where applicable, its Metering requirements.

Existing connections may be treated on a case by case basis, due to the cost implications for existing Consumers, in order to comply with the Distributor's isolation requirements.

For any Consumer Supply where, as of **1 September 2008**, there is no singular Point of Isolation, the Distributor will agree to an alternative measure for an agreed period of time. Existing connections may be treated on a case by case basis, due to the cost implications for existing Consumers, in complying with the isolation requirements.

Each new ICP created after **7 October 2002** must be able to be de-energised without de-energisation of any other ICP, as determined by the Distributor so as to ensure that the Consumer Supply can be De-energised or Disconnected without affecting the integrity of the Network, or the conveyance of Electricity to any other ICP.

3.3 Consumer's Point of Supply

The Consumer's Point of Supply is the location in the electrical circuit where ownership of the equipment relating to the supply of Electricity changes between the Distributor and the Consumer. Refer to section *1.4 – Definitions*.

In some instances the Distributor will own Fittings on the Consumer's premise that is on the Consumer side of the Point of Isolation. This may include, but is not limited to equipment such as switches, transformers, Metering Equipment, and Load Control Equipment.

Examples of Point of Supply demarcation are detailed in the examples in *Appendices A to L*.

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3.4 Requirements for Connection of Installations to the Network

New Electric Line and Installations must meet the requirements of this standard and the associated Technical Standards referred to in this standard.

If existing connections don't meet the requirements, then:-

- Either Powerco will be responsible for grandfathering them into compliance.
- Or the Consumer is responsible.

Rights of access must be allowed to the Distributor's Equipment on the Consumer's Premises.

Metering Data for each ICP will be provided by means of a single meter register or data logger channel for each variable Price Category or Tariff Option.

3.4.1 Low Capacity Permanent Connections

To be supplied by a suitably rated fuse (maximum of 60-amps per phase). Typically these type of connections are supplies to Council owned power supply outlets that the likes of Council lease site public power supplies, Telco cabinets and Council flow meter sites can connect to. Each supply must comply with the requirements of clause 2.2 *Connection Requirements* (for example: metered and allocated an ICP).

3.4.2 Streetlight and Under-Veranda Lighting Connections

Shall be supplied by a suitably rated fuse (maximum of 40-amps per phase) that is capable of supplying a highly inductive/capacitive load. Each supply must comply with the requirements of clause 2.2 *Connection Requirements*. Refer to Powerco's 310S067 *Streetlight Supply, Control and Ownership Policy* for guidance on ownership details.

3.4.3 Unmetered Connections

To qualify for an unmetered supply the load shall be less than 1kVA and use less than 3,000kWh per annum and consist of fixed wired equipment.

Note: All street lighting and under veranda lighting loads shall comply with the requirements of clause 3.4.2 above (including Under Veranda lighting).

Powerco reserves the right to require the installation of a sealable load limiting circuit breaker at the Consumer's expense. Powerco must approve all unmetered loads and allocate an ICP where applicable to ensure suitable traceability of the connection and ensure adherence to the *Electricity Industry Participation Code*.

In all cases, the Consumer's Energy Retailer must also approve the adoption of the proposed unmetered connection prior to its connection to the network.

Note: Temporary Supplies shall not be connected as Unmetered Connections – refer to clause 3.4.6 below.

3.4.4 Urban Areas

Connection capacities up to 3 phase 60 amps are usually available from the LV distribution system. At a few locations connections up to 400 amps can be made direct onto this system. Connection capacities between 100 and 400 amps may require the installation of a shared or dedicated transformer on the Consumer's property. A capital contribution may be required from a Consumer requesting a change in capacity.

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3.4.5 Rural Areas

In some rural areas the network distribution system consists of two (2) wire HV. In those instances only single-phase 230-Volt or split phase 240/480-Volt supplies are available.

In these areas the largest capacity connection available without upgrading the HV distribution to a three (3) wire network is 50-kVA single phase. A capital contribution may be required by a Consumer requiring an upgrade to three phase supply.

In rural areas the large distances between Consumers often requires Consumers to be supplied via a shared or dedicated transformer installed specifically for the Consumer.

A prospective Consumer requiring a 60 amp supply and further than 150 metres from an existing transformer, a new closer transformer may be required. This transformer can be located on a pole in the road reserve with the Consumer taking supply via LV Electric Line. In situations where the Consumer's main switchboard is further than 150 metres from an HV line in the road reserve the most economic solution is usually the installation of an HV line across the Consumer's property to a transformer close to the main switchboard. Powerco may require a capital contribution from the Consumer.

3.4.6 Temporary Supplies

Temporary Supplies (commonly called Builders Temporary Supplies) shall be treated as being a Consumers Installation so they must be located on property owned by the Consumer.

They shall be allocated an ICP and metered in accordance with the requirements of Section 2.2 *Connection Prerequisites* and Section 6 *Criteria For Metering Equipment*.

The connection between a Temporary Supply outlet and Powerco's Distribution Pillar or pole shall be by means of an Electric Line (that meets the requirements of this standard) in order to provide a clear demarcation between Powerco's networks and the Consumers Installation.

Temporary Supply power outlets shall not be fixed to Powerco's assets. This includes (but not necessarily limited to) distribution Service Boxes, Pillar Boxes, Link Boxes and overhead HV and LV Distribution poles.

Requests for temporary HV Supplies shall be treated on an individual case-by-case basis. All enquiries should be directed to a Powerco Approved Contractor.

The sketches in *Appendices A, B, C, and D* give connection examples for LV supplies.

Sites where multiple temporary LV Supplies are needed require separate ICP's to be established. The sketches in *Appendices E and L* give connection examples for these types of connections.

Temporary Supply power outlets shall not be energised if they fail to meet the requirements of Section 2 *Contractor Responsibilities*.

3.4.7 Periodic Inspection of HV Installations.

Regulation 62 *High Voltage Installations* of the *Electricity (Safety) Regulations* requires that HV installations are to be subject to a safety checking system as detailed in Regulation 40. The maximum interval between checks is five (5) years. The EEA publication *Guide for the Connection of High Voltage Electrical Installations* provides advice and guidance on the requirements. The Consumer is to immediately advise Powerco in any circumstance where the installation is deemed electrically unsafe, and

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shall provide evidence at Powerco's request that the safety checking has been completed.

If the Consumer does not comply with Regulation 62 *High Voltage Installations* of the *Electricity (Safety) Regulations* and able to provide suitable documentation to Powerco on request then the Consumers installation shall be deemed to be 'Electrically Unsafe'.

3.4.8 Electrically Unsafe Installations

Regulation 15(1) *Using Works, Installations, Fittings, Appliances, and Associated Equipment* of the *Electricity (Safety) Regulations 2010* states that "A person who owns or operates works, installations, fittings, or appliances must not use, and must not allow any other person to use, the works, installations, fittings, or appliances if the works, installations, fittings, or appliances are electrically unsafe. Powerco's Chief Engineer shall authorise the disconnection of an electrically unsafe Installation from the Network if the owner fails to do so.

3.5 Overloads and Protection Requirements

3.5.1 General Overloads and Protection Requirements

For Consumers supplied via a LV fuse, the connection capacity is generally determined by the protection rating of the service fuse. If the Consumer's load exceeds the protection rating, protection operation can result.

For Consumers supplied at LV via direct connection to the LV terminals of a transformer, the nominal capacity of the connection is the transformer rating or the protection rating on the Consumers' main switchboard. Transformers have some overload capacity and Consumers are permitted to utilise this subject to the following conditions:

- The Consumer's installation shall have suitable protection devices capable of isolating the Installation from the network.
- Where the incoming circuit breaker is owned by the Consumer and it is used as to limit over-currents, then the circuit breaker's protection relay/relays shall be limited to the maximum line current allowed by the Consumers Price Category or Tariff Option. The current adjusting mechanisms of aforementioned relays shall be sealed to prevent any adjustment of these settings unless the prior approval of Powerco has been obtained.
- The Consumer's Electric Line and main switch must be rated to carry the overload.
- The loading on the transformer shall not exceed the appropriate values for normal cyclic duty.

3.5.2 Regulations Compliance

Any installation connected to Powerco's electricity network shall be protected against short circuits or earth faults as per *Electricity (Safety) Regulations* and *AS / NZS 3000*.

3.5.3 High Voltage Network Protection

For Consumers supplied via HV fuses the connection capacity shall comply with the requirements of Powerco's *393S024 Network Fuse Protection Standard*.

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3.5.4 Protection Discrimination

In order to ensure satisfactory operation of Powerco's and the Consumer's protection systems, operating times, discrimination, and sensitivity at the point of supply shall be agreed between Powerco and the Consumer. These settings may be reviewed by Powerco from time to time.

3.6 Multiple Connections and Isolation**3.6.1 General Requirements for Multiple Connections**

If there is more than one Installation Control Point (ICP) at or upon any Consumer's premises, no interconnection shall be made between those Connections at any time without the written consent of Powerco's Chief Engineer.

In all cases, each ICP must be able to be separately de-energised from the Network without affecting the electricity supply to any other ICP's present upon the same property.

If the Consumer has more than one Point of Supply to the Network when there are multiple ICP's present at the same premises, the Consumer shall not parallel or tie the Installations or install any facilities that allows those ICP's supplies to be paralleled. This is to avoid the possibility of back feeds creating potentially hazardous situations on the Powerco Network.

Building Fire Regulations should also be considered when planning multiple connections to Consumer premises.

Where a Consumer's premise has made more than one Point of Supply to the Network (more than one ICP) then each connection point must have a separate isolation point so that each Installation can be de-energised.

Where a Developer is creating multiple connections on a common property, the following conditions shall apply:-

- Between two (2) and five (5) connections on a common property are to be individually fused at the Powerco Network connection point, with separate service mains, as per *8.5 Appendix E- 230/400Volt Multiple Connections From The Network To Multiple Installations All Located On Common Property*. Any variation to this policy will be considered on a case by case basis, as outlined under section *3.6.2 Multiple Tenancy Installations*.
- Greater than five (5) tenancy connections per lot, building or apartment, shall have a fused boundary pillar (or transformer LV fuse) with a single three phase fuse disconnect unit, with internal reticulation and fusing.

3.6.2 Multiple Tenancy Installations

Multiple Tenancy Installations – One building that has a single point of connection to the Powerco Network, with multiple tenancies that are individually metered. Each tenancy will be separately isolatable and have its own ICP.

All applications for Multiple Tenancy Installations must be submitted in writing to Powerco Customer Works, with the following information:

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- The capacity of each tenancy (No. of phases and amps) and the nature of the proposed connection (residential, retail shop, food outlet, commercial, storage unit).
- A single line diagram showing the proposed fusing and electrical layout at the tenancy isolation point, verifying that each connection can be separately isolated.
- A site / building layout plan, with clarification on how the individual isolation points will be accessible to Powerco.
- Information on which Powerco Approved Contractor will be verifying the internal fusing capacity and isolation points arrangement prior to livening.
- For Commercial / Industrial sites, the capacity at the Powerco Network Connection point shall not be greater than the sum of the individual tenancies. This applies to sites connected to the LV Network and those connected to a transformer that is dedicated to the site.

3.7 Generation Connections

All Generators connected to Powerco's Network, or to an Installation connected to Powerco's Network, shall comply with the following requirements: -

- *173S003 Distributed Generation (DG) Policy Standard*, which is available on request or download from Powerco's website.
- *393S089 Distributed Generation Up To 10kW Connection Standard*.
- *393S012 Distributed Generation Over 10kW Connection Standard*.

Where a Consumer has generating equipment installed for emergency power supply purposes, suitable interlocks shall be provided that prevent the generator being connected to the network and exporting energy.

Enquiries regarding Distributed Generations should be directed to distributedgeneration@powerco.co.nz

3.8 HV Connections

Connection of any HV installation to Powerco's Electricity Networks shall comply with the requirements of the Electricity (Safety) Regulations 2010 which are described in the *EEA Guide for the Connection of High Voltage Electrical Installations*, shall be verified in accordance with the Guide, and a verification Statement provided by the Consumer that the installation is electrically safe and complies with the Regulations.

Any Consumer can take supply at 11kV but it is generally only economic for capacities in excess of 1MVA or when the Consumer has a special need for an HV supply.

Typical configurations for HV network connections will be via an incoming isolation device such as dropout fuses, circuit breaker, isolator, or fuse switch. The incoming isolation device will be supplied and maintained by Powerco but the Consumer shall provide suitable accommodation for this equipment.

When supply is required from paralleled HV feeders to meet loading or security requirements, special protection facilities will be required – refer to section 3.6 *Multiple Connections And Isolation* for details.

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3.9 Earthing

The Installation's earthing system shall be designed to comply with the relevant regulations of the Electricity (Safety) Regulations 2010 and associated Electrical Codes of Practice - in particular *NZIECP 35 Power Systems Earthing*. Reference shall also be made to Powerco's *393S017 Permanent Earthing Standard*.

Deviations from these requirements require prior written approval from Powerco's Chief Engineer.

3.10 Fault Level Considerations

3.10.1 Short Circuit Rating

The short circuit rating of Consumers' equipment at the Point of Connection should be not less than maximum prospective fault level of the Distribution Network to which it is connected.

The choice of equipment for connection at low voltage may take into account reduction in the fault level caused by the Electric Line.

Consumers can obtain the maximum prospective short circuit current at their point of Connection on request to Powerco.

3.10.2 Consumer Contribution to Fault Levels

The design of the Network may need to take into account the contribution to fault level by the Consumer's apparatus such as large motor loads.

In order to permit these assessments to be carried out, information should be exchanged on prospective fault-power in-feed at the connection point.

3.11 Trees Near Lines

For safety reasons, Consumers must ensure that the trees and shrubs on their property are kept well clear of all overhead power lines. Where trees or shrubs may cause safety concerns, Powerco may temporarily disconnect power to the Consumer. This will be arranged through the Consumer's Electricity Retailer.

Powerco's website (http://www.powerco.co.nz/G_P_V/Policies/trees_a.htm) provides guidance on how to avoid Power Outages through the management of trees near power lines. The site also provides a list of Powerco's Approved Tree Contractors.

4 TECHNICAL REQUIREMENTS FOR CONSUMER INSTALLATIONS AND APPLIANCES

4.1 Load Power Factor

The power factor of a Consumer's load measured at the metering point shall not be less than 0.95 (lead or lag). The following table gives guidance for typical electric motors as to the

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required capacitance required to meet 0.95. Non typical motors and those with capacities of greater than 10kW require individual engineering analysis to determine their load power factor.

Capacity of Motors		Sync Speed 3,000rpm	Sync Speed 1,500rpm	Sync Speed 1,000rpm
kW	hp	(kVAr)	(kVAr)	(kVAr)
0.75	1	0.5	0.75	1.0
1.5	2	0.5	1.25	1.75
2.2	3	0.75	1.5	1.75
3.0	N/A	0.75	2.0	2.0
N/A	5	1.0	2.25	2.5
4.0	5.5	1.25	2.5	2.75
N/A	6	1.25	2.5	3.0
5.0	N/A	1.5	2.5	3.0
5.5	7.5	1.75	2.5	3.25
7.5	10	2.0	3.0	3.5
N/A	12.5	2.75	3.25	4.0
10	N/A	3.0	3.5	4.5
N/A	15	3.5	3.75	5.0

4.2 Voltage Fluctuations

Some electric appliances such as motors with fluctuating loads and welders can cause voltage fluctuations in the distribution network resulting in annoyance to other Consumers. The Consumer's Installation or electrical appliances shall not cause voltage fluctuations at the point of supply in excess of the threshold of irritability in the *Electricity Regulations* and its associated *Electrical Codes of Practice* referred to in *Schedule 2*.

4.3 Motor Starting

The starting of electric motors can cause severe voltage dips on the network resulting in irritation to other Consumers.

The motor starting limitations of this standard are those recommended in the *NZ Electrical Supply Authority Engineers Institute Committee* report on Motor Starting Currents for a.c. motors. Motor starting limitations are summarised in the following paragraphs.

4.3.1 Exempt Motor Sizes

AC motors up to and including the ratings listed in the following table are not subject to starting current limits and may be started direct on line without specific permission to connect.

Table 1 - Schedule of Exempt Motor Sizes

Location and Rating	Rural	Urban Residential	Urban Non-Residential

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Single Phase (not exceeding)	0.75kW	1.5kW	2.2kW
Three Phase (not exceeding)	2.5kW	4.0kW	7.5kW

4.3.2 Non Exempt Motors

All a.c. motors above the ratings specified in Table 1 shall be approved by Powerco Asset Management Group prior to connection. The criteria used for approval is that the relative voltage changes on motor start-up shall not exceed the values in Table 2.

Table 2 - Schedule of Allowable Relative Voltage Change

Frequency of Starting	At PCC	At Zone Substation 11kV Bus
In excess of 10 starts per hour	1%	0.5%
In excess of 3 starts per day but not more than 10 starts per hour	3%	1.0%
Not more than 3 starts per day including not more than 1 start between the hours of 5pm and 11pm on any day	6%	1.5%
Emergency equipment started infrequency (e.g. fire pumps)	12%	2%

NB: PCC = Point Of Common Coupling - refer to section 1.4 – *Definitions*

4.3.3 Multiple Motor Installations

In installations where several large motors start automatically, the effect of these motors starting simultaneously when supply is restored after a power interruption needs to be considered.

Should several motors on a Consumer’s installation start automatically when supply is restored after an interruption, then unless delayed starting is installed to the satisfaction of Powerco, the relative voltage change will be assessed on the basis of all motors on automatic control starting simultaneously.

4.4 Harmonic Disturbances

Harmonics shall be managed in accordance with the EEA *Power Quality (PQ) Guidelines*.

Harmonic voltages and currents introduced into the network by a Consumer’s installation or appliances shall not exceed the levels specified in the following documents:

- NZECP 36 *Harmonic Levels*
- AS/NZS TR IEC 61000.3.6:2012 *Electromagnetic Compatibility (EMC) - Limits - Assessment of emission limits for distorting loads in MV, HV and EHV power systems*

Note: *Electricity (Safety) Regulations, Regulation 31 Requirements related to quality of supply.*

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4.5 Capacitors

Capacitors are generally installed in a Consumer's installation or appliances to provide power factor correction. They can be part of a power factor correction unit or associated with individual appliances such as motors or fluorescent light fittings.

The excessive absorption of ripple control signals by capacitors shall be prevented by the installation of suitably rated blocking chokes on the network side of individual capacitors or groups of appliances containing capacitors.

Consumers are permitted to install unblocked capacitor kVAR capacity up to 2% of connection kVA capacity.

Note:

For 3 phase connections the maximum kVAR per phase is 1/3 the total kVAR allowed. For capacitor loads exceeding the limit above, specific permission to connect shall be obtained from Powerco. The Consumer shall be responsible for the provision and correct operation of the blocking chokes.

Consumers installing fluorescent lighting loads are advised to use fittings with lead-lag ballasts which will provide power factor correction without the risk of ripple signal absorption. Electronic fluorescent lighting ballasts do not require capacitors for power factor correction; hence they also will not absorb ripple control signals.

4.6 Load Control Policies

As from **1 September 2008** the following interruptible load (load control) policies shall apply.-

The purpose of these policies is to minimise constraints on Powerco's distribution system and the electricity transmission system. They will also allow Powerco to respond to system emergencies that can occur on Powerco's distribution network or on Transpower's grid as and when they arise by controlling that load.

4.6.1 New Connections To Powerco's Network.

All new installations comprising suitable interruptible loads (per clause *4.6.3 Suitable Interruptible Loads*) shall be capable of being controlled by Powerco's Load Control System by means of an approved Ripple Receiver or Relay (refer clause *4.6.4* below).

The purpose of this equipment is to allow Powerco to interrupt both commercial and residential connections.

4.6.2 Existing Connections To Powerco's Network.

All existing installations comprising Suitable Interruptible Loads (per clause *4.6.3 Suitable Interruptible Loads*) shall continue to be capable of being controlled by Powerco's Load Control System by means of an approved Ripple Receiver or Relay (refer clause *4.6.4 Approved Powerco Ripple Receiver or Relays*). In this regard "controlled" means switched On or Off. The purpose of this equipment is to allow Powerco to interrupt that load. This policy applies to both commercial and residential installations.

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4.6.3 Suitable Interruptible Loads.

All Interruptible Loads should be able to deliver satisfactory service when being controlled under Powerco’s normal load control strategies.

Interruptible Loads that commonly fit these criteria include: -

- Electric water-heater of between 100 to 500 litres storage capacity and fitted with a heating element of 1.2kW or more.
- Electric storage heaters (non water) fitted with a heating element of 3kW or more.
- ICP’s with a total irrigation load capacity above 50kW.
- Cool Store refrigeration load.

Should a Consumer choose not to have any of the above appliances controllable, the Consumer shall pay the appropriate Price Category or Tariff Option (i.e., the Consumer shall be ineligible for a Controlled Price Category or Tariff Option).

Powerco may switch other loads than those listed above for the purpose of minimising Network constraints in accordance with specific contracts with the Consumers Retailer.

Powerco may also control load at its discretion for purposes other than minimising Network constraints in accordance with specific contracts with Individual Consumers.

Where Advanced Metering is installed, the unit must either have, or be installed, in conjunction with a Ripple Receiver or other receiving device, capable of receiving a Ripple Control Signal from the Distributor.

A Residential Consumer will be allocated to the relevant, or Consumer elected Controllable Tariff as appropriate by their electricity Retailer. Where a Consumer elects an Uncontrolled tariff, the ‘Controllable’ load will be Controlled in emergency situations only, being under System Operator instruction.

4.6.4 Approved Powerco Ripple Receiver or Relays.

The following load control Ripple Receiver or Relay are approved for use in their designated network regions (Note: Network Region descriptions are based networks owned by Powerco predecessor organisations. Powerco’s *Powerco Predecessors - Electricity and Gas Networks 370S006* contains ownership details of these network):

Network Region	Frequency	Code
Thames Valley	217 Hz	Semagyr 50a
Coromandel	217 Hz	Semagyr 50a
Tauranga	283 Hz	Semagyr 52
Hawera GXP’s	615 Hz	DECABIT
Opunake GXP’s	283 Hz	DECABIT
Taranaki (with the exception of Hawera and Opunake GXP’s)	317 Hz	DECABIT
Wanganui	383 Hz	DECABIT
Manawatu	317 Hz	DECABIT
Wairarapa	283 Hz	DECABIT

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4.7 Signalling

The Network may not be used for the purpose of conveying signals unless express and prior written approval is given by Powerco's Chief Engineer.

Should the Consumers use their own electrical installation to convey signals, Powerco will not provide any warranty as to the electrical characteristics or signalling properties of the Network, or the Network's capability or suitability in that regard. The signals shall not cause any interference or damage to the Network or to other Consumers connected to the Network, and the Consumers shall be responsible for installing suitable blocking filters to ensure any signals do not interfere with the Network or other Consumers installations.

4.8 Radio and Television Interference

Consumers' installations and appliances shall not impose interference on the network that affects the operation of radios or television or other communication systems.

4.9 Consumer Disturbances

Consumer initiated disturbances shall be managed in accordance with AS/NZS 61000.3.6:2012 *Electromagnetic Compatibility (EMC) - Limits - Assessment of emission limits for distorting loads in MV, HV and EHV power systems*.

4.10 Unbalanced Loads

All polyphase loads connected to the network shall be evenly balanced across all phases of the distribution network as can be practically achieved.

5 TECHNICAL CRITERIA – ELECTRIC LINE**5.1 Low Voltage Connections**

Connection of service lines to premises/installations, both in the case of new work and in the case of disconnection/reconnection for any purpose, shall comply with:

- Electricity (Safety) Regulations 2010, including but not limited to Regulations contained in Part 5 *Safety of Installations*.
- Electricity (Safety) Regulations 2010, Regulation 38 *Testing works before connecting to supply*.
- The EEA *Guide for Livening of Service Connections to Premises*.

Low voltage connections can be made by connection of an LV Electric Line onto the network LV distribution system or by connection to the LV side of a transformer located on the Consumer's premises. The requirement for a transformer is dependent upon; the connection capacity required, the capacity and present loading on any existing LV distribution in the vicinity and the distance from the Consumer's property boundary to the Consumer's main switchboard.

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Each connection application will be considered individually and the most appropriate connection method determined by Powerco.

5.1.1 Electric Line Neutral Size

All Electric Line neutral conductors should be the same size as the phase conductors. This will reduce the chance of neutral conductor overloads due to unbalanced loads and harmonics.

5.1.2 Pilot Wires

In areas where Ripple Control Signals are unavailable a pilot wire for water heating/space heating/night supply control will be required to be included in the service/distribution main if the area concerned has a pilot control system or is likely to be fitted with one. Contact Powerco's Electricity Planning Manager to assist in determining the best connection methodology.

Where the pilot wire is one of the cores of a composite cable, the minimum cross sectional area is 2.5mm² (copper).

The minimum cross-sectional area shall be 4mm² (copper) if the pilot is a separate conductor and when underground, it must have additional protection against mechanical damage and the outer covering be suitable for direct burial.

New or replacement of existing Networks pilot wire shall use core insulation coloured to industry standard colours (typically red) to identify as a phase conductor.

5.1.3 Isolation Points

Isolation of each individual Electric Line must be possible, and will generally be carried out using the LV fuses. Contractors must ensure that removing LV Electric Line fuses to disconnect one Consumer will not also isolate another Consumer.

5.1.4 Structural Requirements

An Electric Line should not add a physical force or bending moment to the Network beyond what the design allowance built into the network equipment can safely withstand – refer Powerco's *393S008 Overhead Line Design Standard* as the means of compliance with this requirement.

5.2 Aerial LV Electric Line

Aerial Electric Line shall maintain the safe distances as required by the *Electricity (Safety) Regulations, Regulation 17 Maintaining safe distances*.

Where open pair Electric Line are permissible the phase conductors shall be covered with black PVC and the neutral conductor shall be bare. The Consumer is responsible for providing solid supports for conductor insulators and terminations for their Installation.

It is recommended where possible, neutral screened cable is used for aerial Electric Line due to the enhanced safety this provides, for all parties.

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5.3 LV Underground Electric Line**5.3.1 General**

Underground service/distribution main cables may share the same trench as other services. It is recommended for good working practice that the following clearances are observed, although this should be confirmed with the owners of the other services.

- (a) 150mm from neutral screened cables to Telecom and Fibre Optic cables.
- (b) 450mm from cables other than neutral screened cables to Telecom and Fibre Optic cables.
- (c) 300mm from sewers and water pipes.

Cables laid in road reserves are required to be plotted to sufficient accuracy for future location in accordance with the requirements of *The National Code of Practice for Utilities' Access to the Transport Corridors* and those details shall be provided to Powerco in accordance with the time limits imposed by the code.

No Powerco records are kept of service/distribution main cable routes on private property. It is recommended that Contractors either provide details to the Consumer or advise the Consumer to make their own records. Both Powerco and Telecom operate cable locating services for a nominal charge.

Powerco's own practice and recommendation is that all service/distribution Electric Line shall be buried at a depth not less than 600mm.

Both ends of each phase conductor of an underground service/ distribution main must be colour coded in accordance to the colour/s stated on the wiring application.

5.3.2 LV Underground Electric Line in LV Underground Areas

LV Electric Line in areas with underground LV distribution will be connected to the distribution network via an LV service box of appropriate size located on the property boundary.

5.3.3 Service Boxes

Service boxes are special purpose junction boxes that accommodate LV service fuses and provide facilities for connection to the LV underground distribution cables.

Service boxes are normally located on the street side of the Consumer's property boundary. Powerco will, after consulting with the Consumer or developer, determine the position of the service box. In residential areas, service boxes are generally placed on the street frontage at the junction of two property boundaries allowing the box to serve two Consumers.

Where a subdivided lot is more than ten (10) metres from an existing service box, a new service box will need to be established at the property boundary.

NOTE: Service boxes must be of a type approved in Powerco's *393S107B Part B - Low-Voltage Service and Link Boxes and Cabinets – List Of Approved Boxes and Cabinets*.

5.3.4 Connection of Electric Line into Service Boxes

The connection of LV Electric Line into service boxes will be physically undertaken either by Powerco or by a Powerco approved contractor.

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The Consumer is responsible for the fitting of any Electric Line tails and for the provision of suitable cable lugs.

5.4 LV Underground Electric Line in an Overhead Area

5.4.1 Pole Top Supply

In areas where the existing LV distribution network is overhead, Consumers can be connected via an underground Electric Line running direct from a pole top to meter box or main switchboard by having the Electric Line buried to the base of a nearby pole, attached to the pole and terminated onto a pole top fuse subject to the following conditions:

1. A suitable pole must be available on the same side of the street as the Consumer and within 2 metres of the Consumer's boundary.
2. The physical circumstances such as ground levels and footpath conditions are suitable for the installation of an underground cable.
3. All Electric Line cables shall be copper neutral screened. If the phase conductors are aluminium then appropriate bi-metallic stalk lugs shall be supplied by the Consumer.
4. The cable in the road reserve will be laid parallel to or at right angles to the street. The cable shall be installed in accordance with the requirements of *AS / NZS 3000*.
5. The cable shall cross the Consumer's property boundary at a location determined by Powerco that results in minimum trenching in the road reserve. All trenching and reinstatement shall be in accordance with the requirements of the local roading authority.
6. The cable shall be appropriately mechanically protected above the ground level in accordance with the requirements of Powerco's 393S011 Underground Distribution Network Construction Standard.
7. The cable length shall allow for 9 metres of cable up the pole.
8. Where connection to a pole mounted fuse is to be made, the connection shall utilise a Neutral Screen Assembly and a Block Sleeve on each phase to prevent water ingress under the phase insulation. The cores of the cable shall be clearly marked at both ends to avoid any confusion. Labelling shall comply with Powerco's 393S004 *Labelling and Safety Signage Requirements*.

5.4.2 Service Box Supply

In circumstances where an underground connection is required and the conditions for a pole top supply cannot be met, an underground supply can be provided in an overhead area via a boundary service box in the road reserve.

5.5 HV Electric Line and Substations

When it is necessary to install a substation on a Consumer's premises, the Consumer shall make available on the Consumer's premises suitable space to accommodate the transformer, HV cable or lines, associated switchgear and metering equipment. The Consumer shall grant

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an easement in Powerco's favour for access to the transformer and all fittings that are associated with the conveyance of electricity to both the Consumer and other Consumers.

Substations shall generally comply with *NZS 6108 Accommodation for Electrical Supply Substations in Customers Buildings*.

All substations and HV circuits on the Consumer's property shall be designed and constructed in accordance with the requirements of the following Powerco documents: -

- *393S009 Underground Distribution Network Design Standard*
- *393S011 Underground Distribution Network Construction Standard*
- *393S008 Overhead Line Design Standard*
- *393S010 Overhead Line Construction Standard.*
- *393S040 High Voltage Metering Units – Purchasing Guidelines Specification.*

Connection of any HV installation to Powerco's Electricity Networks shall comply with the *EEA Guide for the Connection of High Voltage Electrical Installations*.

6 CRITERIA FOR METERING EQUIPMENT

6.1 Metering Requirements

Metering Equipment is to be provided in accordance with requirements of Powerco and the Consumers Electricity Retailer, and:

- Shall not rely on summated meter readings from multiple meters on the Consumer's premises.
- Must comply with the Protection and Isolation requirements of this standard.
- Where associated with an Embedded Network, comply with the Electricity Commissions "*Guidelines for Metering, Reconciliation and Registry Arrangements for Embedded Networks*".
- In accordance with the drawings contained within the Appendices of this document as they relate to Connection and Metering.
- From **1st March 2009**, all upgrades of existing Points of Connection require a separate Metering point to be installed for each Point of Supply for each Consumer.
- All connections over 3000 kWh shall be metered.

Note: Multiple use of an installation is the responsibility of the installation owner.

6.2 Metering Required By Powerco

Powerco may install an additional set of metering equipment at or after, any Consumer's Point of Supply for checking and Distribution Network management purposes.

Consumers should provide appropriate space within their premises to accommodate the metering equipment.

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6.3 Privately Owned Street Lighting (Including Under Veranda)

This clause was removed in version 7 of this document. (refer clause 3.4.2 *Streetlight and Under-Veranda Lighting Connections*).

6.4 Metering Of Powerco Assets

Electricity consumed by Powerco owned building's (For example: Zone Substation control buildings, Offices, Depots and Radio Huts) shall be treated as if they are a Consumer's Installation, therefore an ICP must exist and the energy consumed accounted for by Powerco's designated Retailer.

Note: Electricity consumed by Powerco equipment for the purposes of distributing and operating Powerco's electricity network's – that is Works - shall be exempted from this requirement.

7 STREETLIGHTING

Each streetlight site / position is regarded by Powerco an installation as defined in AS/NZS 3000 *Wiring Rules*.

All work and connection of any streetlight to Powerco's Electricity Networks shall be in accordance with the following:

- Electricity Act
- Electricity (Safety) Regulations
- AS/NZS 3000 Wiring Rules
- Applicable Electrical Codes of Practice (ECP's)

7.1 Network Connection

Connection of streetlights to Powerco's Electricity Networks shall be undertaken by Powerco Approved Contractors only.

Each streetlight pole / column shall have a switchboard. The connection point shall be the supply side fuse terminal at the switchboard.

Streetlights shall be directly connected to Powerco's electricity networks by a single core cable of 10mm² Neutral Screen (minimum CSA).

Where more than one streetlight is supplied from an LV network connection, the number of streetlights supplied shall be limited to the load capacity of the cabling. The supply cable shall be looped in and out of each streetlight pole / column respectively.

Streetlight loading shall be distributed evenly between all three phases with consideration to load balancing of Powerco's LV Distribution Network.

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7.2 Streetlight Wiring and Earthing

A switchboard shall be installed inside the streetlight pole at a height not lower than 300mm above finished ground level. The switchboard shall meet the requirements of AS/NZS 3000 *Wiring Rules* and be equipped with a neutral bar, earth bar, and HRC fuse or Miniature Circuit Breaker (MCB). The neutral and earth bar shall be linked with a removable link. Cable sizes and connections shall be as shown in Section 7.2.3 *Diagram – Streetlight Earthing*.

7.2.1 Earthing

Each streetlight pole / column shall be earthed by means of a 10mm² copper insulated earthing conductor connected to an earth electrode. The earth electrode shall be 16mm diameter (minimum).

The earthing conductor shall be connected to the earth electrode in accordance with 393S017 *Permanent Earthing Standard* (connection type). Fusion (e.g. exothermic welding) type connections shall not be used, instead use shear bolt type connections.

7.2.2 Luminaires mounted on Powerco Poles

Where luminaries are installed on Powerco poles, each luminaire shall be directly connected to Powerco's LV Network supply by means of an HRC fuse, connected to the phase conductor.

Fuse protection shall be in accordance with Powerco's 393S024 *Network Fuse Protection Standard*.

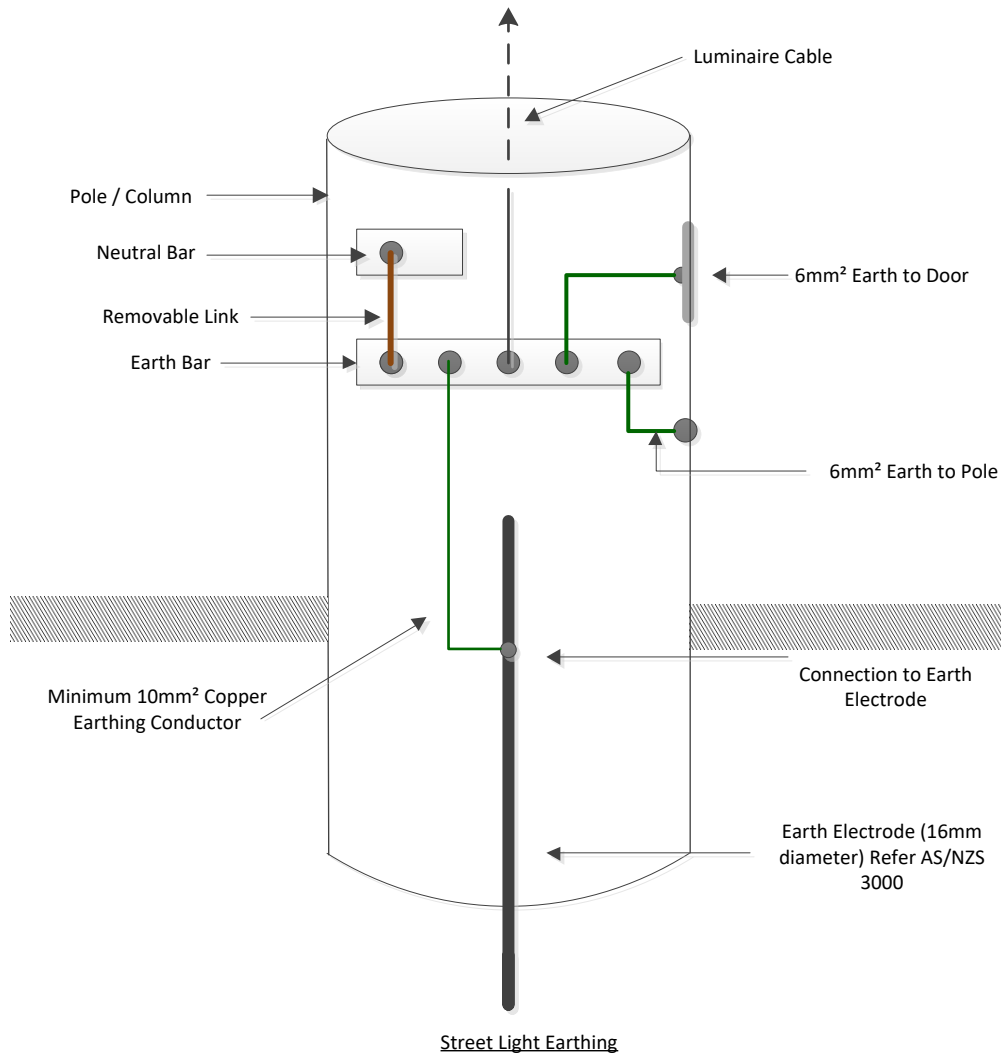
The HRC fuse link shall be 6 amps with utilization category gG with rupturing capacity 120KA.

The fuse carrier shall be 30 amp rated and mounted on the cross arm.

Each alternate luminaire shall be connected to an alternate phase for load balancing purposes.

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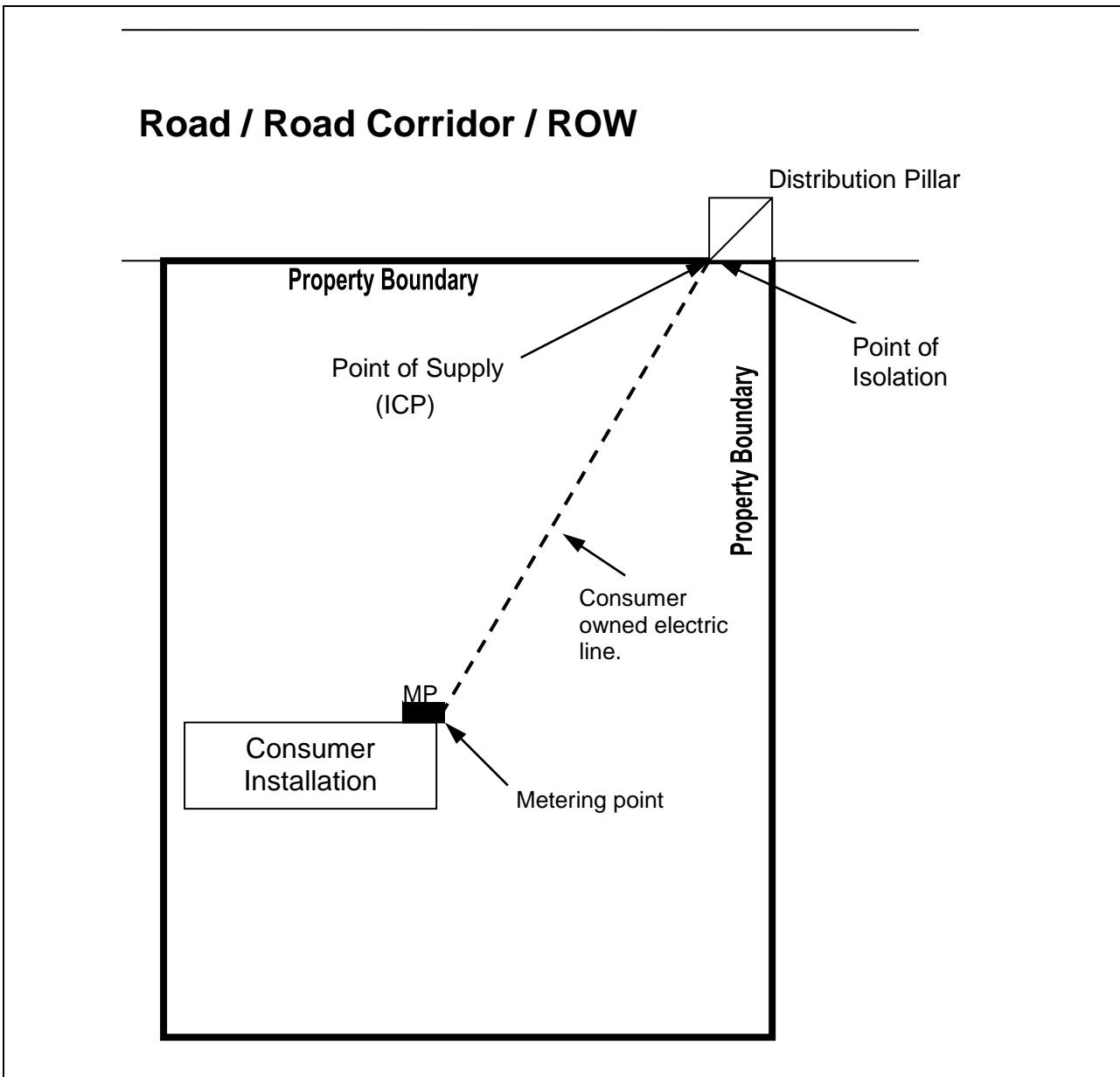
7.2.3 Diagram – Streetlight Earthing



POWERCO ELECTRICITY NETWORK CONNECTION STANDARD - AEN

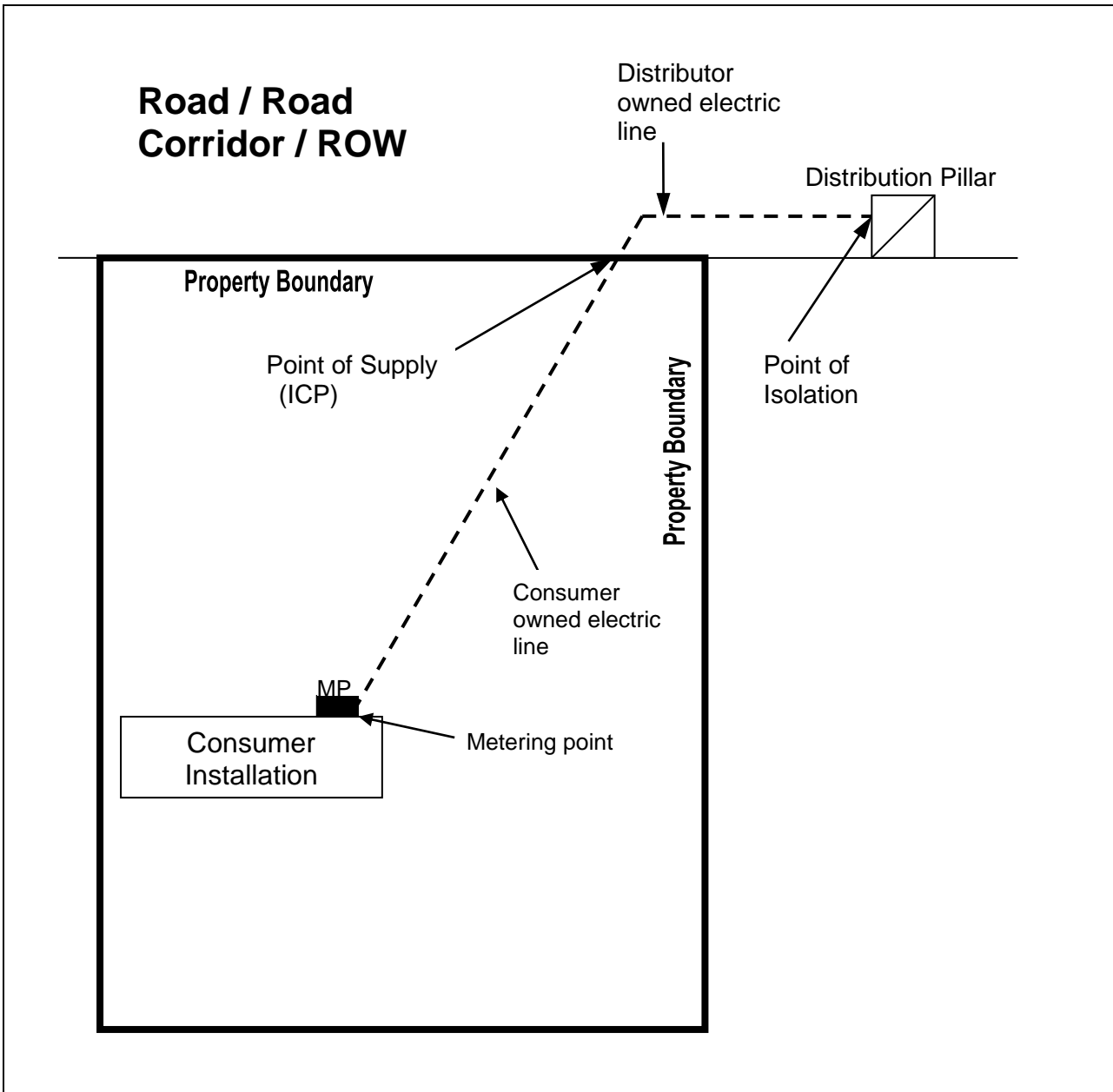
8 APPENDICES – NETWORK CONNECTION EXAMPLES

8.1 Appendix A - 400V / 230V Supply to One Consumer From Distribution Pillar Located On Property Boundary



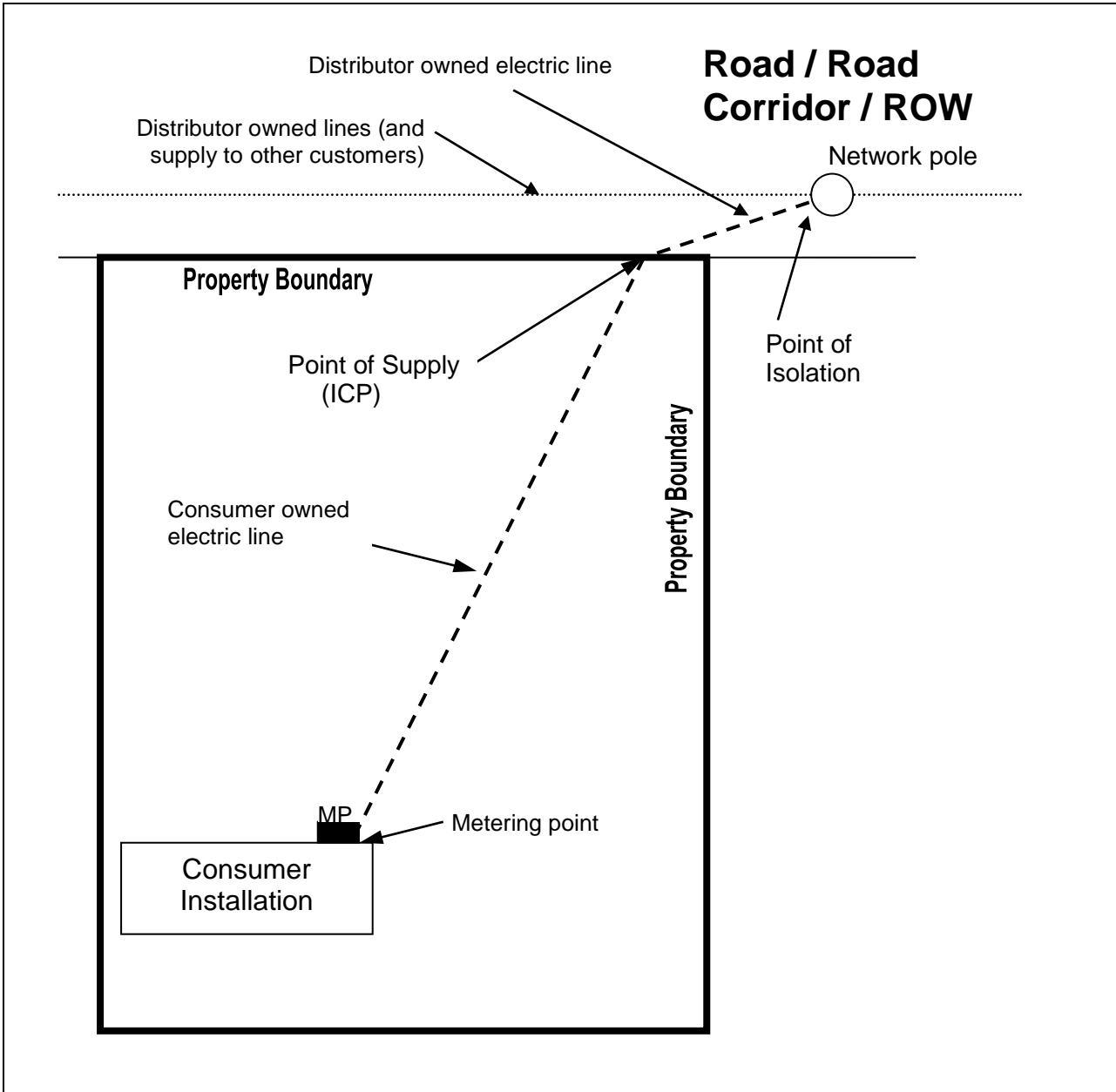
POWERCO ELECTRICITY NETWORK CONNECTION STANDARD - AEN

8.2 Appendix B - 400V / 230V Underground Cable to One Consumer From Distribution Pillar Not Located On Property Boundary



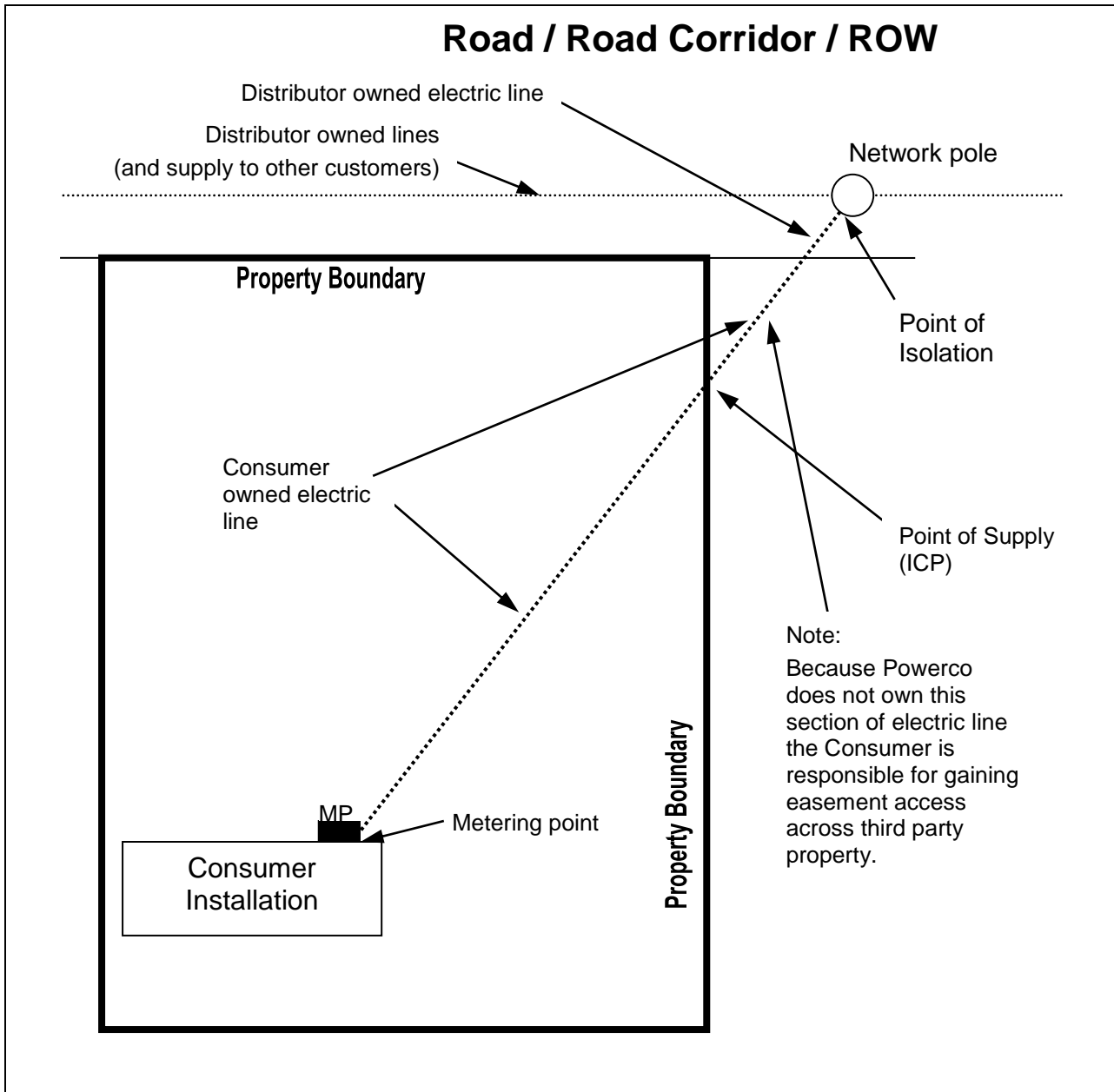
POWERCO ELECTRICITY NETWORK CONNECTION STANDARD - AEN

8.3 Appendix C - 400V / 230V Underground Cable to One Consumer From Overhead Network Pole Not Located On Property Boundary



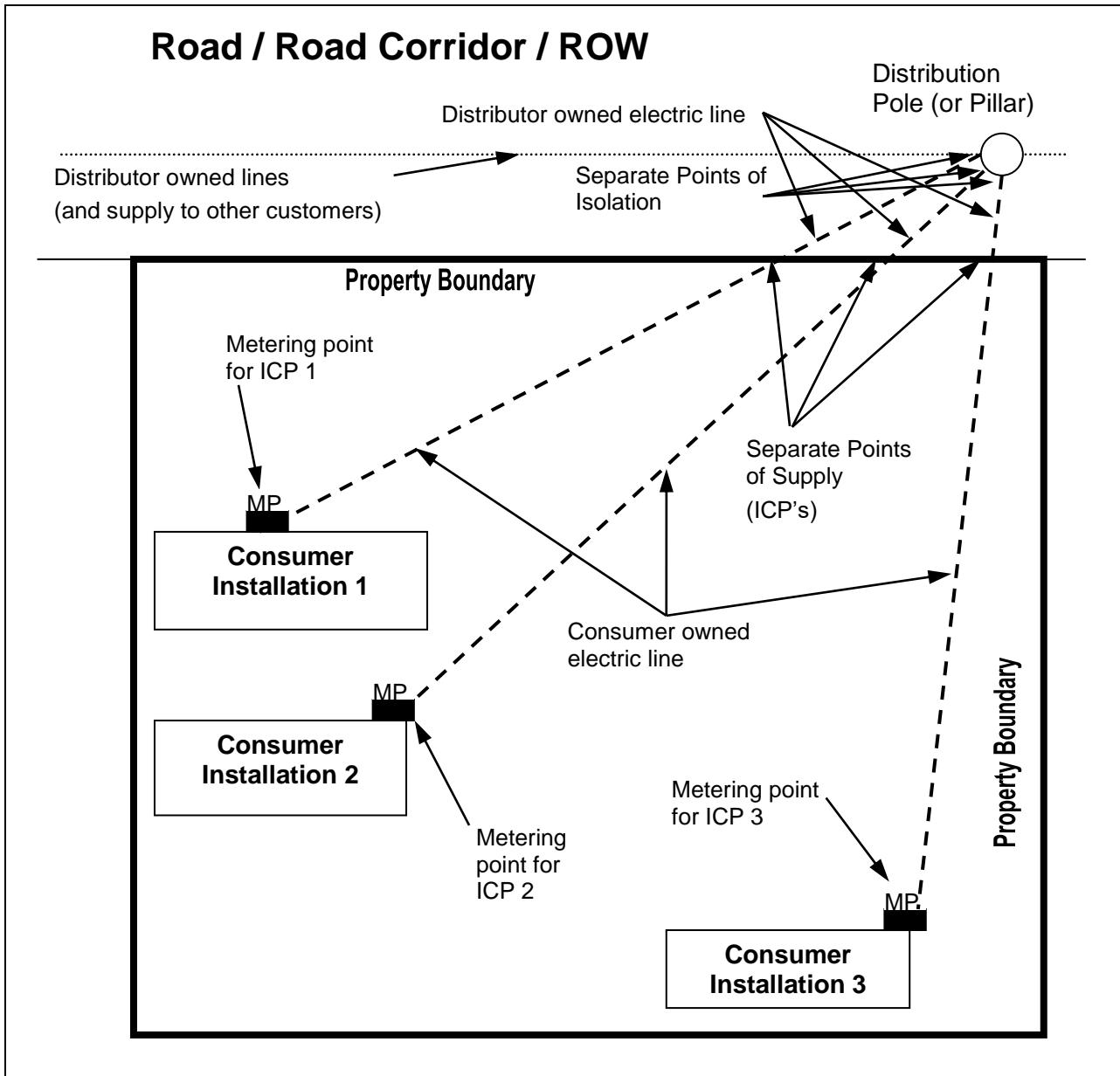
POWERCO ELECTRICITY NETWORK CONNECTION STANDARD - AEN

8.4 Appendix D - 400V / 230V Overhead Connection to Overhead Network Supplied Across Third Party Owned Property



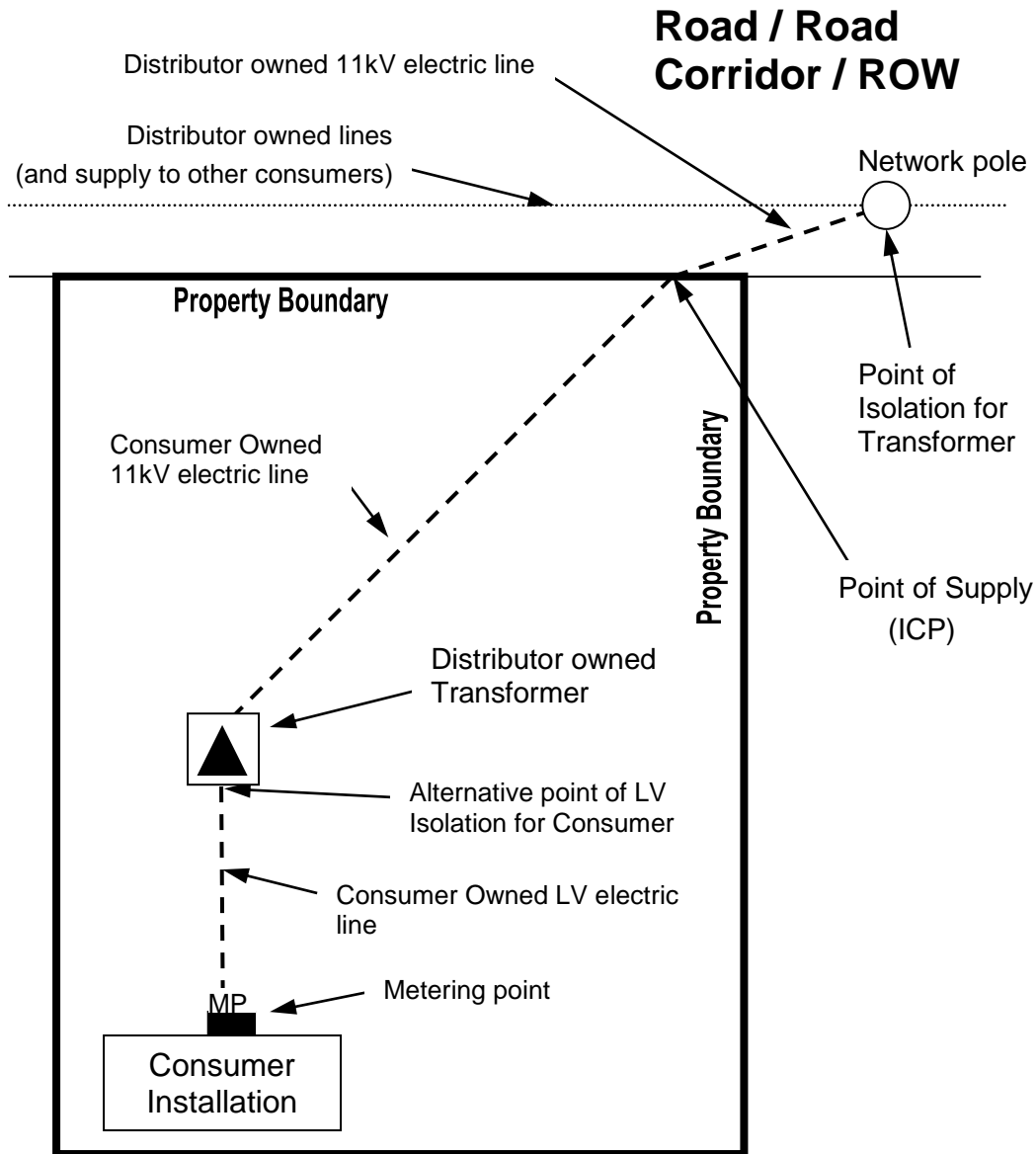
POWERCO ELECTRICITY NETWORK CONNECTION STANDARD - AEN

8.5 Appendix E - 230/400Volt Multiple Connections From The Network To Multiple Installations All Located On Common Property



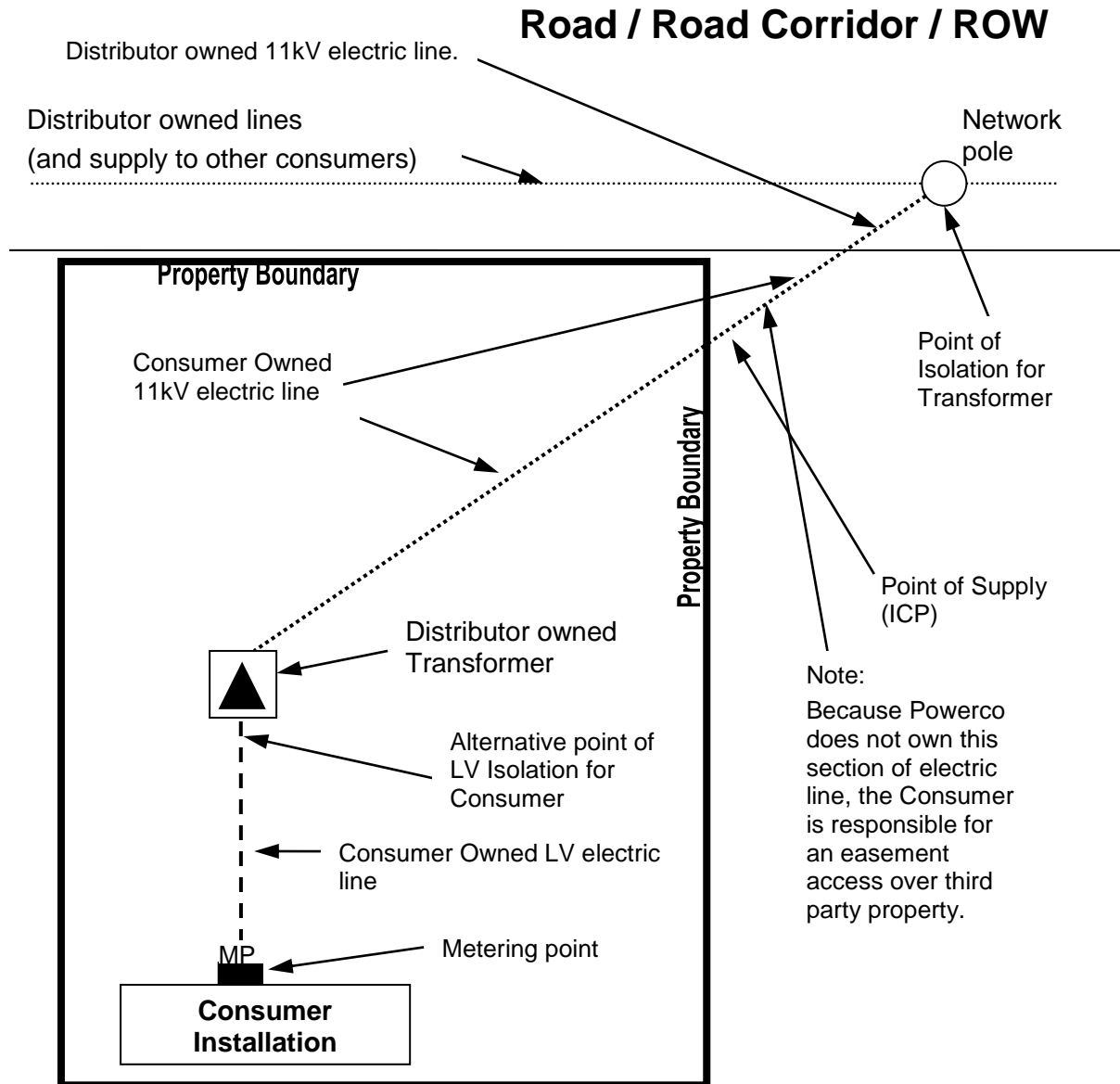
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8.6 Appendix F - 11kV Underground Cable Connected to Overhead Network Supplying One Consumer



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8.7 Appendix G - 11kV Overhead Connection to Overhead Network Supplied Across Third Party Owned Property



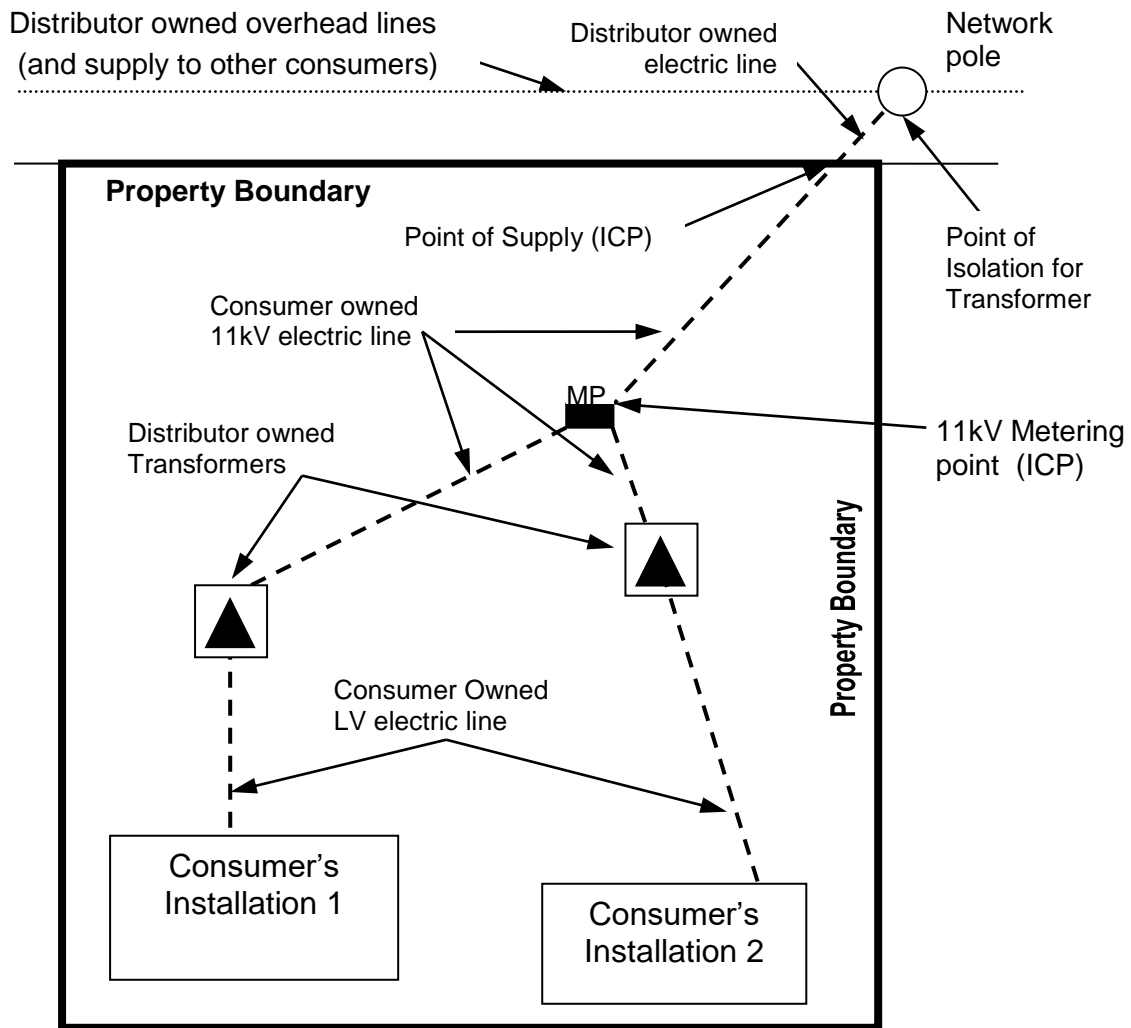
NOTE:

This situation covers a single transformer located on a single property on which single or multiple installations are located, each of which are individually metered. The same situation can be applied to multi-story buildings (e.g. apartments, offices, etc). (Note: If a metered installation has multiple tenants then isolation of these supplies and revenue collection, is the building owners' responsibility).

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8.8 Appendix H – 11kV Consumer Owned Supply With Multiple Transformers Located On Common Property Owned By The Same Consumer

Road / Road Corridor / ROW



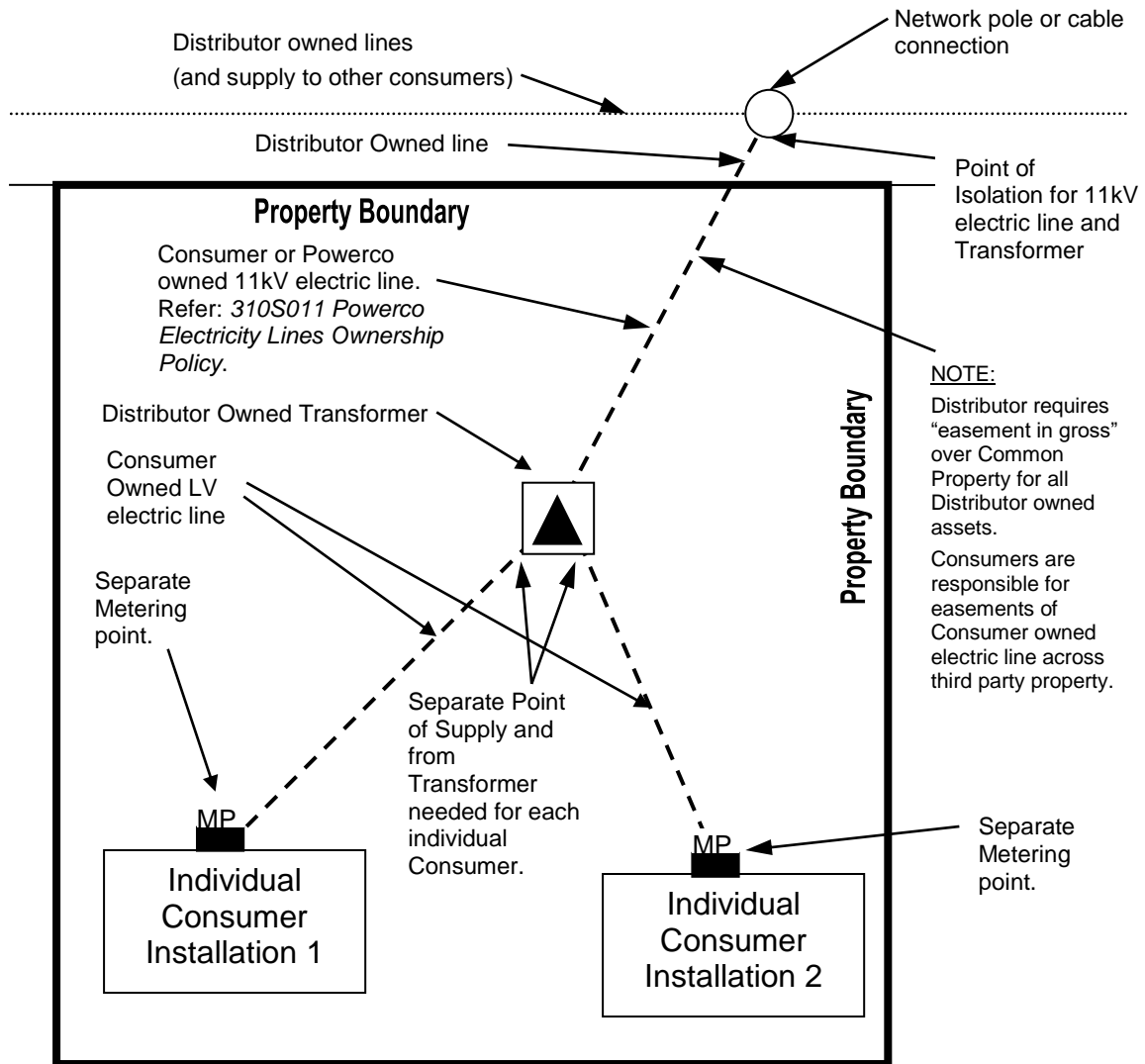
NOTE:

This situation covers a multiple transformers located on a single property on which multiple installations are located but they are collectively metered at a common 11kV meter point. The same situation can be applied to multi-story buildings (e.g. apartments, offices, etc.). (Note: it is the metering point owners responsibility for the paying the metered energy and connection charges for this site). There is no individual Metering Point for each Consumer nor are there any separate Points of Isolation for Consumers occupying this site, to which Powerco has no access rights. Disconnection of the Metering Point from Powerco's network affects the electricity supplies to the entire site.

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8.9 Appendix I – 11kV Supplied Connection To Single Transformer Supplying Multiple Consumers on Same Common Property

Road / Road Corridor / ROW



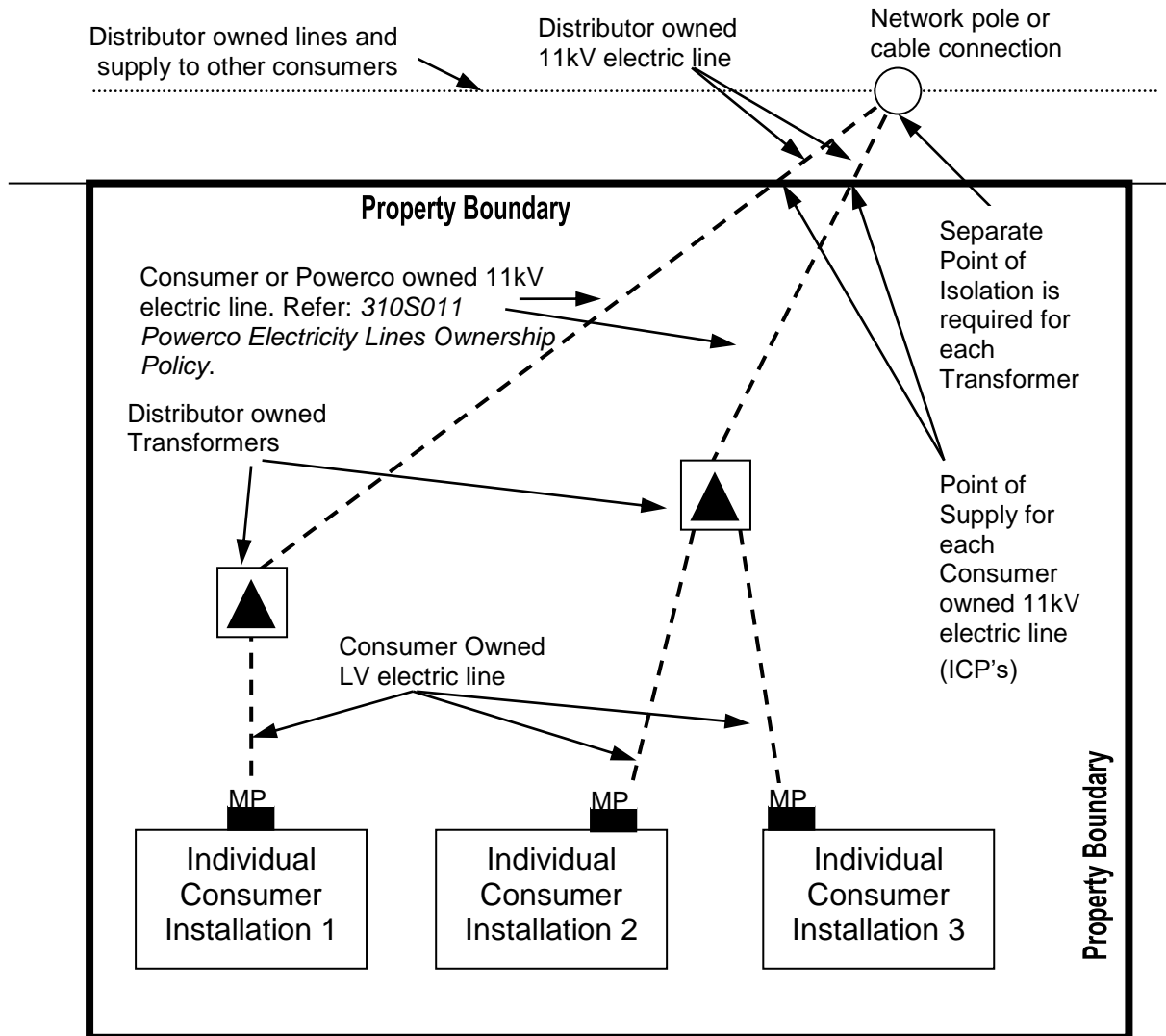
NOTE:

This situation covers a single transformer located on a single property on which multiple installations are located, each of which are individually metered. The same situation can be applied to multi-story buildings (e.g. apartments, offices, etc.). (Note: If a metered installation has multiple tenants then isolation of these supplies, and revenue collection, is the building owners' responsibility). There is an individual Metering Point for each Consumer and a separate Point of Isolation for each Consumer, to which Powerco has access rights and each individual Consumer can be separately isolated from the Network without affecting the supply to any of the other Consumers.

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8.10 Appendix J - 11kV Supplied Connections With Multiple Transformers On Same Common Property With Multiple Consumers

Road / Road Corridor / ROW



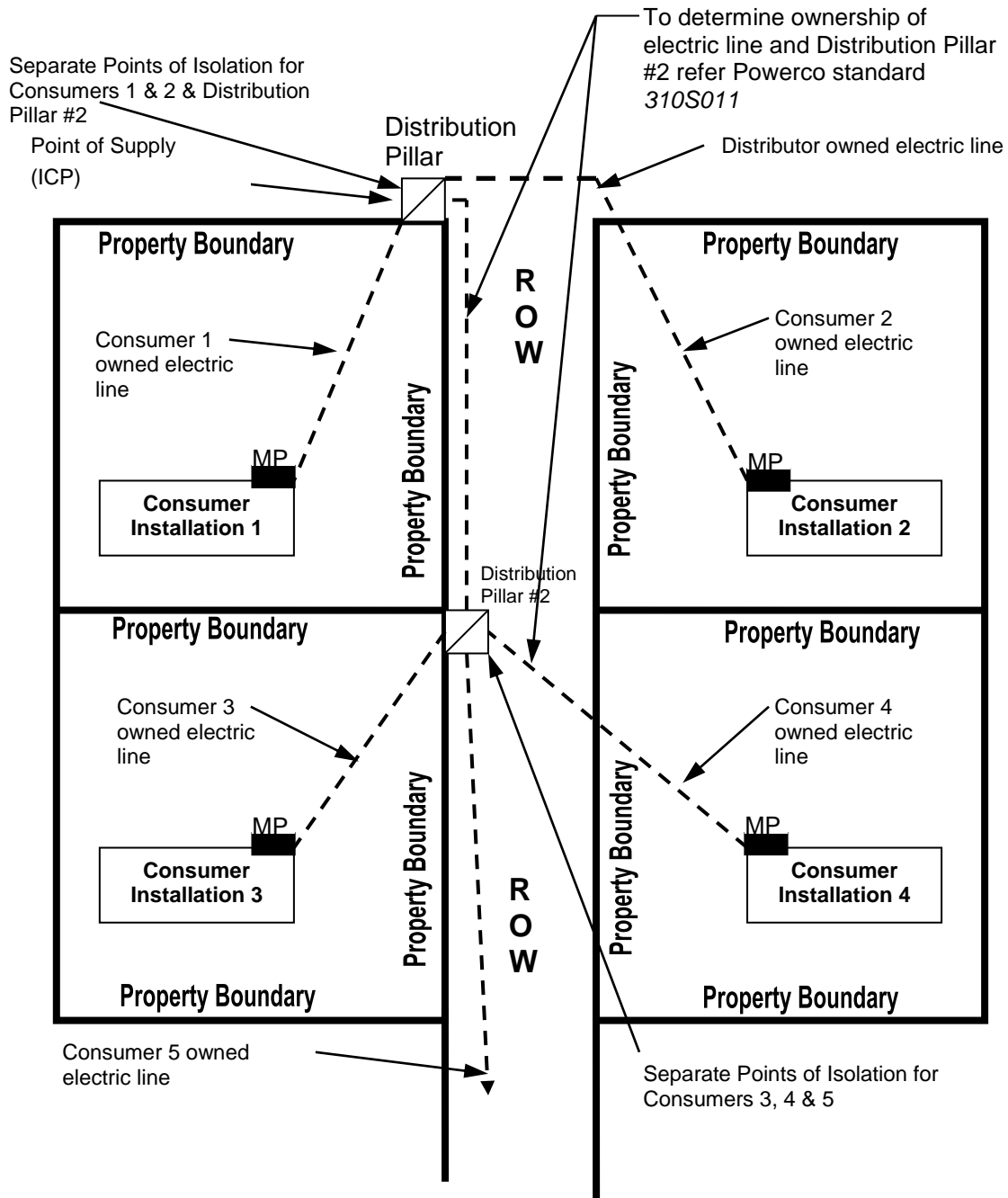
NOTE:

This situation covers multiple transformers located on a single property on which multiple installations are located, each of which are individually metered. The same situation can be applied to multi-story buildings (e.g. apartments, offices, etc.). (Note: If a metered installation has multiple tenants then isolation of these supplies, and revenue collection, is the site owners' responsibility). There is an individual Metering Point for each Consumer and a separate Point of Isolation for each Consumer, to which Powerco has access rights and each individual Consumer can be separately isolated from the Network without affecting the supply to any of the other Consumers.

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8.11 Appendix K - Multiple LV Connections To The Network, Through A Single Point Of Connection (More Than Two Connections, Right Of Way)

Road / Road Corridor / ROW

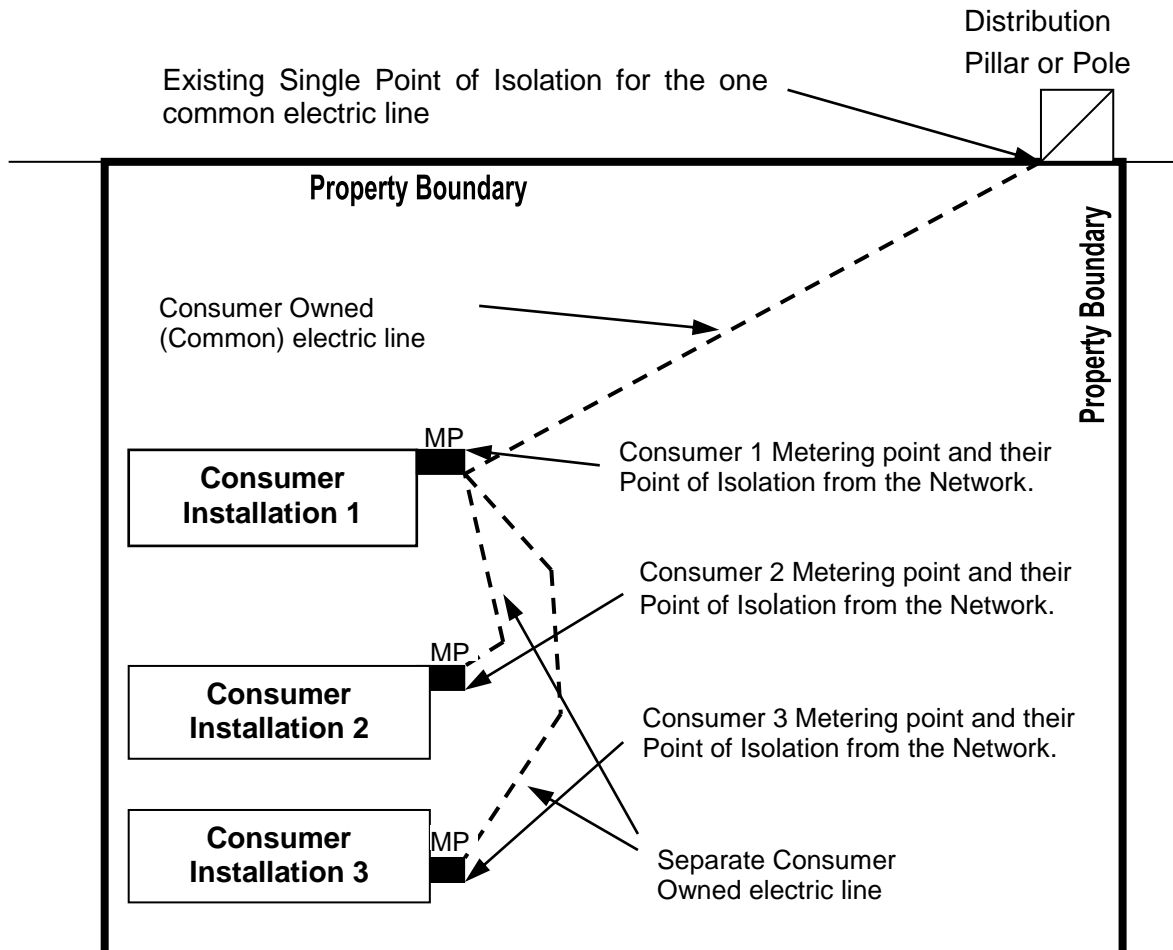


- NOTE:** (a) Distributor requires “easement in gross” over length of its Cable
(b) MP = Metering Point

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8.12 Appendix L - 400V / 230V - Single LV Connection To The Network Supplying Multiple Existing Installations On A Common Property.

Road / Road Corridor / ROW



NOTE:

This situation applies to Installations, including single building multiple tenancy sites. There is an individual Metering Point for each Consumer and a separate Point of Isolation for each Consumer, to which Powerco has access rights and each individual Consumer can be separately isolated from the Network without affecting the supply to any of the other Consumers. (Note: If a metered installation has multiple tenants then isolation of these supplies, and revenue collection, is the building owners' responsibility).

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9 DOCUMENT REVIEW HISTORY:

Version Number	Reviewed By.	Review Date	Reason
1	Electricity Network Planning Manager	Unknown	First Issue of Document Into Powerco's BMS
2	Electricity Network Planning Manager	15/ 4/2002	Unknown
3	P Chappell G Turner R Coleman	23/ 1/2006	Scheduled document review – references updated. Section 5.1.3 added on LV Serviceman Isolation Points. Section 11 (f) also added for Connection Prerequisites. Health and Safety clause 1.5 added. Copyright clause 1.6 added. Extra standards added to clause 1.3
4	K Thomas R Coleman	19/ 8/2008	Major review of previous version of this standard undertaken in order to include new requirements for load control and isolation (developments principally driven by Powerco's Commercial Team). Alignment with amendments of Electricity Act included. Pertinent elements of Powerco's Model Use Of System Agreement included. Numerous changes made throughout document as a result of extensive consultation with Retailers.
5	R Coleman	10/10/2008	Item 6 in Clause 5.5.1 <i>Pole Top Supply</i> altered to refer to <u>Underground</u> Line Construction standard (393S011).
6	R. Coleman D. Devonport G. Turner M. Ireland	5/ 3/2009	Definitions added or amended for Load Management Service and Paralleling. New clause 1.7 Risk Identification and management added. Item 6 in Clause 5.5.1 <i>Pole Top Supply</i> amended to refer to <u>Underground</u> Line Construction standard (393S011). New bullet point added to 6.1 <i>Metering Requirements</i> requiring separate meter point. Appendices sketch's modified to clearly show Powerco's Metering Point requirements for each Consumer plus their Points of Supply and Points of Isolation from the network. References to Advanced metering removed from sketches and accompanying notes. New sketch added to Appendix (7.12) which clarifies Powerco's connecting, isolation and metering requirements for existing multiple installations on a common property.

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7	S. Corbitt R. Coleman M. Whaley	18/ 2/2013	<p>Amended definitions of: Certificate of Compliance, Installation, Installation Control Point, Point of Connection.</p> <p>Included in Section 1.4 definitions of: Certified Design, Line Owner, Lines, Electric Line, Electrical Safety Certificate, Temporary Supplies, Use Of System Agreement, Contractor, Electrical Installation, Electrically Safe, Electrically Unsafe, Fittings, Power Supply, Work, Works.</p> <p>Delete definition of 'Service Mains' (refer 'Electric Line').</p> <p>Reference to 'Pillar Box' amended to 'Service Box' throughout the document.</p> <p>Section 1.1 remove reference to Distributed Generation Regulations and replace with the <i>Electricity Industry Participation Code 2010, Part 6 Connection of Distributed Generation</i>.</p> <p>Updated 1.3.1 <i>Legislation</i> to include <i>CoP for Transportation Corridors, Electricity (Safety) Regulations</i> and <i>EI Participation Code 2010</i>.</p> <p>Updated 1.3.3 <i>Powerco Documents</i> to include title changes to existing standards and include new references to 310S067, 310S103 and 393S107 (also updated throughout standard).</p> <p>In Section 2 updated references to E(S)R 2010 (also changed throughout standard), required space on switch boards for Powerco's Load Control Equipment, included new Temporary Supply clause.</p> <p>Section 2 title changed to 'Contractor Responsibilities'.</p> <p>Sections: 2.1, 2.2, 3.8, 5.2, Reference to Electricity (Safety) Regulations and associated requirements.</p> <p>Reference to Electricity Industry Participation Code 2010 – section 2.2.</p> <p>Section 3.3 title changed to Consumers Point of Connection.</p> <p>Additional section 3.4.8 Periodic Inspection of HV Installations.</p> <p>Additional requirements included in section 3.8</p> <p>Altered <i>Section 3.4 Connection Requirements</i> to redefine Powerco's requirements for Temporary Supplies, and Unsafe Installations.</p> <p><i>3.6 Multiple Connections and Isolation</i> – permission of Chief Engineer now required.</p> <p>3.8 Compliance with Regulations and EEA Guide.</p> <p>4.4 Compliance with Regulations and EEA Guide.</p> <p><i>4.6.4 Ripple Receivers</i> – changed frequency for Hawera to 615Hz (not 283Hz).</p> <p><i>4.7 Signalling</i> – now requires permission of Chief Engineer to change.</p> <p>Remove section 5.1 General.</p> <p>5.2 Compliance with Regulations and EEA Guide.</p> <p>5.2.2 Colour code for pilot conductors.</p> <p><i>5.4.1 General</i> – requires cables to be laid in accordance with <i>CoP for Transportation Corridors</i>.</p> <p><i>5.4.3 Pillar Boxes</i> – must comply with <i>393S107</i>.</p> <p>5.4.4 Reference to LV Network Operating Procedures standard.</p> <p><i>5.5.1(8) Pole Top Supply</i> – labelling must comply with <i>393S004</i>.</p> <p><i>5.6 Compliance with EEA Guide</i>.</p> <p><i>6.1 Metering Requirements</i>- altered to require compliance with requirements of <i>393S007</i>.</p> <p>Deleted clause <i>6.3 Privately Owned Street Lighting</i> – requirements already prescribed in <i>3.4.2 Street Lighting Connections</i>.</p> <p>New clause <i>6.4 Metering Of Powerco Assets</i> added.</p> <p>Points of Supply and Connection changed in <i>Appendix's D and G</i>.</p> <p>Amended diagrams in the Appendices to align with terminology from the Electricity Act, Electricity Regulations and Electricity Industry Participation Code.</p> <p>Various references to 'Point of Connection' changed to 'Point of Supply' or 'Point of Isolation' (Sections: 3.2, 3.3, 3.6).</p>
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POWERCO ELECTRICITY NETWORK CONNECTION STANDARD - AEN

8	S. Corbitt	18/11/2014	<p>Changes requested by CIW to clarify multiple connections on common parcel of land.</p> <p>s1.3.2 added AS/NZS 61000.3.6</p> <p>s1.4 <i>Definitions</i> added Berm, Carriageway, Multiple Tenancy Installation, PCC added 61000.3.6, Road, Road Corridor.</p> <p>s3.6 <i>Multiple Connections and Isolation</i> split into two Subsections:</p> <p>s3.6.1 <i>General Requirements for Multiple Connections</i> (additional information added),</p> <p><i>NEW</i> s3.6.2 <i>Multiple Tenancy Installations</i> added.</p> <p>s4.4 <i>Harmonic Disturbances</i>, additional reference to <i>AS/NZS/STRIEC 61000.3.6:2012 Electromagnetic Compatibility</i>.</p> <p>s4.9 AS/NZS 61000.3.6: <i>referenced</i></p> <p>s6.1 <i>Metering Requirements</i> additional note regarding multiple use of an installation.</p> <p><i>NEW</i> s7 <i>Streetlighting section</i> added.</p> <p>Appendix I and L, additional note regarding multiple installations and tenancy.</p> <p>s8 <i>Appendices</i> - changes made to sketches by altering terminology and adding Notes.</p> <p>s8, Appendix G, H, I, J and L note added regarding multiple installations and tenancy.</p>
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POWERCO ELECTRICITY NETWORK CONNECTION STANDARD - AEN

10 POWERCO STANDARD - DOCUMENT CHANGE REQUEST

Memo To: Technical Services Manager.
Junction Street
New Plymouth.

Change Details:

(Attach separate sheets as necessary).

Paragraphs Affected:

Priority: **Urgent** **Routine** **Low**
(Within 1 week) (Within 12 months) (Next Review)

Submitted By (Print Name)	Date
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Document Change Request - Acknowledgement

Dear

Thank you for your suggestion regarding changes to the above mentioned document.

Your request has been noted and added to our works program. Should we require any additional information regarding your notification then we will be in contact with you.

Thank you for your contribution to improving the quality of Powerco's documentation.

Regards,

.....
Technical Services Manager

.....
Date