

Powerco Electricity Network Connection Standard - AEN



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1. General

1.1 Scope

This document (hereinafter referred to as 393S007) prescribes Powerco's requirements for all points of connection to Powerco's electricity networks and specifically (but not necessarily limited to) 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 requirements of the *Health and Safety At Work Act* to ensure personal safety
- c. Prescribing Powerco's requirements for the safe and durable connection of HV and LV overhead and underground networks and equipment onto Powerco's networks that all Powerco employees, external consultants and Powerco service providers (i.e., contractors) shall use
- d. The requirement for the supply of connection information, including as-built information relating to the connected consumer installation for Powerco's records (refer to 393S007 section 3.11 *As-Built Process* for details)

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 process of connecting new load to the network.

Prior to energising or upgrading a network connection, there are Retailer / Trader requirements and distributor requirements that shall be fulfilled. 393S007 sets out Powerco's requirements as a distributor.

This Standard shall be applied in conjunction with Powerco's published Guide to electricity connection charges and Part 6B of the Electricity Industry Participation Code 2010.

All new connections and connection upgrades that are subject to the requirements of Electricity Industry Participation Code Part 6B shall be designed and delivered in accordance with that Part 6B, including application of the Connection enhancement cost allocation requirements (referred to as "minimum scheme" requirements).

Connection solutions shall not include Distributor (Powerco) Enhancement works unless those works are separately identified, justified, and treated in accordance with Powerco's published Guide to electricity connection charges.

Where a customer requests additional capacity, redundancy, or future network capability beyond the minimum scheme requirements, such requests shall be classified as Customer Selected Enhancement/s and shall be separately identified, assessed, and costed in accordance with Powerco's published Guide to electricity connection charges.

Any requirement for a new Pioneer Scheme, or contributions to an existing Pioneer Scheme arising from the proposed works, shall be identified and assessed separately in accordance with Powerco's published Pioneer Scheme Policy.

393S007 does not cover the following:

- ✱ Powerco's distributed generation connection requirements, which are subject to:

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- a. the *Electricity Industry Participation Code 2010, Part 6 Connection of Distributed Generation*.
- b. Powerco's distributed generation connection requirements which are prescribed in the following Powerco standards:
 - 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.

- Connections to Powerco's sub-transmission (i.e., networks operating at 33 kV and above)
- Design works – those requirements are prescribed in Powerco's 393S008 *Overhead Line Design Standard* and 393S009 *Underground Network Design Standard*
- Construction works – those requirements are prescribed in Powerco's 393S010 *Overhead Network Construction Standard* and 393S011 *Underground Network Construction Standard*
- Powerco competencies needed to access and do works on the networks and operate equipment – these requirements are prescribed in Powerco's 210S002 *Electricity Employee Competency Certification*
- The selection of equipment and materials approved for use on Powerco's networks – these are prescribed in Powerco's 393S013B *Network Equipment and Materials - Part B - Classes and Requirements*.

1.2 Application

393S007 applies to new points of connection or the upgrade of existing points of connection on Powerco's electricity networks and applies to Powerco assets, Powerco employees, contractors, Retailer / Trader and end consumers. All connections are enduring from the time they are established.

Note: Powerco's networks are based on networks owned by many predecessor organisations prior to Powerco's existence. Details of those predecessor organisations are provided in 370S006 *Powerco Predecessors - Electricity and Gas Networks*.

1.3 Referenced Documents

1.3.1 Legislation

The requirements of the following New Zealand legislation that have been referenced in 393S007 shall be complied with:

- 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 (i.e., NZECP's)
- Electricity (Hazards from Trees) Regulations

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- Health and Safety At Work Act
- Unit Titles Act
- Fire Safety and Evacuation of Buildings Regulations 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)*

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1.3.2 Industry Standards

The following documents have been referenced in 393S007:

- Electricity Commission - Guidelines for Metering, Reconciliation and Registry Arrangements for Embedded Networks
- The National Code of Practice for Utilities' Access to the Transport Corridors (NCoP)
- SM-EI - Safety Manual - Electricity Industry (SM-EI)
- IEC 354 - Loading Guide for Oil-Immersed Power Transformers
- BS CP1010 - Loading Guide for Oil-Immersed Transformers
- AS/NZS TR IEC 61000.3.6:201 - 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)
- 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.
- Electricity Authority - Memo: Considering Future Generation Requirements in Design of Substation Switchgear and Network Connections (dated 8 January 2021)

1.3.3 Powerco Documents

The following Powerco standards have been referenced in 393S007:

- 100R001 - Risk Management Framework
- 150S016 - Selection Use and Maintenance of Electrical Safety Equipment
- 170S001 - Permanent Disconnections - Electricity Network
- 170S002 - Guide to Permanent Disconnection Process - Electricity
- 173S003 - Powerco Distributed Generation (DG) Policy
- 170S007 - Temporary Isolations and Disconnections of Electricity Installations
- 210S002 - Electricity Employee Competency Certification
- 220S002 - Powerco Common Definitions – Electricity Network
- 220S007A - Network Equipment Commissioning Standard – Part A – Process
- 220S007B - Network Equipment Commissioning Standard – Part B – Testing
- 310S011 - Powerco Electricity Lines Ownership Policy
- 310S035 - Powerco Environmental Management System
- 310S067 - Streetlight Ownership Policy
- 360S014 - As Built Reporting Standard
- 360S016 - Guide to Recording Electricity Assets

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- 370S006 - Powerco Predecessors - Electricity and Gas Networks
- 370S017 - Load Control Channel Standard
- 392S002 - Health and Safety and Environmental Management System Requirements for Powerco Network Contractors
- 392S011 - Powerco's Network Land Access and Easement Policy
- 393S004 - Labelling and Safety Signage Requirements
- 393S008 - Overhead Line Design Standard
- 393S009 - Underground Network Design Standard
- 393S010 - Overhead Network Construction Standard
- 393S011 - Underground Network Construction Standard
- 393S012 - Distributed Generation Over 10 kW Connection Standard
- 393S013B - Network Equipment and Materials - Part B - Classes and Requirements
- 393S017A - Permanent Earthing – Part A - Design Requirements
- 393S017B - Permanent Earthing – Part B - Construction Requirements
- 393S024 - Network Fuse Protection Standard
- 393S040 - High Voltage Metering Units – Purchasing Guidelines Specification
- 393S089 - Distributed Generation Up To 10 kW Connection Standard
- 393S097 - Connection of an Embedded Network to Powerco's Network
- 393S107A - Low-Voltage Service, Link Boxes, Cabinets and Subterranean Vaults – Part A – Specification
- 393S107B - Low-Voltage Service, Link Boxes, Cabinets and Subterranean Vaults - Part B - List of Approved Boxes and Cabinets
- 393S079B - Network Underground Cables – Part B – Approved Cables and Manufacturers List
- 393S133 - Overhead Aerial Conductors Specification – Part A – Specification and Part B - Application Rules

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1.4 Definitions

Unless stated otherwise, all words and phrases used in 393S007 shall have the meaning defined in:

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

Term	Term Meaning
Advanced Metering	is 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	is 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	a connection serving the same function as defined for temporary supplies.
Carriageway, Road / Public Road / Roadway	is the portion of the transportation corridor (i.e., road or motorway) primarily for the use of travelling vehicles, including the sealed shoulders. "Roads" are a public thoroughfare ordinarily used by motor vehicles. It is defined under <i>Part 1</i> section <i>2 Interpretation</i> of the <i>Electricity Act</i> . It does not include a private road, a motorway, any roadway laid out by order of the Maori Land Court or any railway level crossing. Access and the right to carryout works within the transport corridors (e.g., road and rail reserves) is controlled by the <i>National Code of Practice for Utility Operators' Access To Transport Corridors</i> (the <i>NCoP</i>) which is approved by the <i>Minister for Infrastructure</i> under the <i>Utilities Act</i>
Certificate Of Compliance (Electrical)	a certificate issued in respect of an installation on which prescribed electrical work has been done (refer E(S)R regulation 67 <i>Certificate of Compliance</i>).
Certificate of Compliance (definition as from 1 st July 2013)	a certificate, issued under E(S)R regulation 65 <i>Requirement for Certificate of Compliance</i> , regarding the lawfulness and safety of prescribed electrical work done on an installation or part installation (the above is an E(S)R definition)
Certified Design (definition as from 1 st July 2013)	a design for an installation that has been certified in accordance with E(S)R regulation 58 <i>Approval by WorkSafe for Sale of Declared High Risk Articles</i> . (the above is an E(S)R definition)
Consumer / Customer	this term has the same definition and meaning as defined in the <i>Electricity Act</i> , namely "...any person who is supplied, or who applies to be supplied, with electricity." 393S007 uses this term to also include references to customers
Customer Dedicated transformer	is a Powerco description given to a transformer that is only intended to be used exclusively by the consumer to whom it is dedicated and no one else – refer to 393S007 section 0 <i>Customer Dedicated Transformer Connections</i> for more details

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Term	Term Meaning
Consumer's Installation	For the purposes of 393S007 a 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 Premises	For the purposes of 393S007 a consumer's premises means the land and buildings owned or occupied by a consumer, and any land over which the consumer has an easement or right to pass electricity, including: (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</i>.
Contractor	A contractor means anyone who has been certified and approved by Powerco to undertake works on Powerco's electricity network in accordance with Powerco's <i>Approved Contractor Status Agreement</i> .
Connection charge	For the purposes of 393S007 a connection charge is the charge payable by a customer for connection to the distributor's network, determined in accordance with Powerco's published Guide to electricity connection charges
Customer Selected Enhancement	For the purposes of 393S007 a customer requested enhancement is any upgrade to the existing network requested by a customer that exceeds the requirements of the minimum scheme, including (but not limited to) increased capacity, redundancy, or provision for future load growth.
Data Logger (Data recorder)	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 logger's memory can be downloaded either locally or remotely.
De-energise (disconnect)	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	the distribution system controlled by Powerco and includes the HV portions of this system (i.e., 22 kV, 11 kV, 6.6 kV) and LV portions of this system. It does not cover the sub-transmission portions of Powerco networks.
Distributor of Electricity	as defined in the <i>Electricity Act</i> and means "...a person who supplies line function services to any other person or persons." The term "Distributor" when used in 393S007 shall mean Powerco.
Electrical Installation (Installation)	(a) Means (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

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Term	Term Meaning
	(b) Does not include any of the following: (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. (the above is an <i>E(S)R</i> and <i>Electricity Act</i> definition)
Electric Line (also commonly referred to as "Service Main").	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: (a) the incoming terminals of another building, enclosure, or other 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. (the above is an <i>E(S)R</i> definition)
Electrical safety Certificate (definition as from 1/7/2013)	a certificate, issued under <i>E(S)R</i> regulation 74A <i>Electrical Safety Certification</i> regarding the electrical safety of an installation or part installation that is connected to a power supply (the above is an <i>E(S)R</i> definition)
Electrically Safe	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 (the above is an <i>E(S)R</i> definition)
Electrically Unsafe	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. Refer to <i>E(S)R</i> for a definition of things that are deemed to be electrically safe and unsafe.
Embedded Network	an embedded network is an electricity distribution network that is owned by someone other than the local network owner (i.e., a 3rd party owned network), where: • consumers connected to the embedded network have ICP's allocated and managed by the embedded network owner (or another distributor appointed for that purpose) • the electricity traded is reconciled at the point of connection between the embedded network and the local network. • the embedded network owner is liable for any faults, claims or losses that arise out of incidents that occur on their network.

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Term	Term Meaning
	<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 (i.e., a 3rd party owned network), 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 / Trader. <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 / Trader.
Energising	defined in the SM-EI and includes the process of electrically livening, and/or energising an Installation to the network.
Exclusive Fittings	fittings used or intended to be used for the purpose of supplying electricity exclusively to that property (the above is an <i>Electricity Act</i> definition).
E(S)R	is an abbreviation that refers to the New Zealand Electricity (Safety) Regulations
Fittings	everything used, or designed or intended for use, in or in connection with the generation, conversion, transformation, conveyance, or use of electricity (<i>Electricity Act 1992</i> definition).
Feeder	a high voltage circuit served by automatic HV switchgear
Generator	any person that has assets that have the capability to generate electricity
GXP	is an abbreviation of the term grid exit point which is a point of connection onto the national New Zealand electricity grid at a point where electricity may flow out of the grid
HV (high voltage)	are the HV distribution network systems owned and/or controlled by Powerco that are operating at 6.6 kV, 11 kV and 22 kV voltages. HV has the same meaning as defined in the <i>E(S)R</i>
Installation Control Point (ICP)	an installation control point being 1 of the following: - a point of connection at which a customer installation is connected to a network other than the grid: - a point of connection between a network and an embedded network: - a point of connection between a network and shared unmetered load. (the above us an <i>Electricity Industry Participation Code 2010</i> definition)
Line Owner	a person that owns works that are used or intended to be used for the conveyance of electricity.
Lines	works that are used or intended to be used for the conveyance of electricity Lines include Powerco's overhead and underground networks. (the above is an <i>Electricity Act</i> definition).
Load	"Load" means an installation: - An electrical impedance connected to the network - The total electrical demand for electrical energy on Powerco's network

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Term	Term Meaning
Load Control Equipment	as defined by the <i>Electricity Commission - Model Use of System Agreement – Interposed (December 2005)</i> and 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 <i>Electricity Commission - Model Use of System Agreement – Interposed (December 2005)</i> and means a "load management service" which is used for 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 / Trader. In 393S007 this means a Powerco approved "suitable interruptible load".
Load Control Ripple Receiver or Relay	a device used to decode a signal injected onto the network by the <i>Load Control System</i> . 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)	are the LV distribution network systems owned and/or controlled by Powerco that are operating at 230/400 volts. LV has the same meaning as defined in the <i>E(S)</i>
LV Cabinet (Pillar box)	an LV cabinet contains fuses and links and provide multiple alternative feeds. Predominantly located in central business district (CBD) areas, cabinets are generally larger than LV service boxes or LV link boxes. Cabinets approved for use on Powerco's networks are listed in 393S107B
Mains	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 (the above is an <i>E(S)R</i> definition).
Metering Equipment	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.
MEN	is an abbreviation of the term Multiple Earthed Neutral (MEN) and means a system of earthing in which the earthing conductor within an electrical installation is connected to the neutral as well as to an earthing electrode. In this system, the distribution system neutral is earthed at the point of supply at a distribution center, and at one or more points along the distribution or service mains and provides a continuous electrical path between the consumer and the distribution center earthing point. (the above is an <i>NZEC35</i> definition).
Minimum scheme	For the purposes of 393S007 a minimum scheme is the lowest cost technically acceptable solution to connect a customer to the network that meets the distributor's connection and operation standards, determined in accordance with the Electricity Industry Participation Code.
Minimum flexibility scheme	For the purposes of 393S007 a minimum flexibility scheme is a connection option that allows for a lower-cost solution by incorporating agreed flexibility in the level or reliability of supply, as defined under the Electricity Industry Participation Code.

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Term	Term Meaning
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)	a collective term commonly used as an abbreviation to mean the whole of the electricity distribution system - i.e., HV or LV delivery systems. In 393S007 the network is taken to mean Powerco's electricity distribution network(s) (or Powerco's Works as defined in the <i>Electricity Act</i>)
Normal Operating Conditions	For the purposes of 393S007 normal operating conditions refers to system normal state, i.e not in a backfeeding situation or during an unusual spike
Distributor (Powerco) Enhancement	For the purposes of 393S007 a Distributor (Powerco) Enhancement is any upgrade to the existing network requested by Powerco that exceeds the requirements of the minimum scheme, including (but not limited to) increased capacity, redundancy, or provision for future load growth. Such enhancements are not required to meet the agreed level of service and shall be treated separately from connection works.
Network User	an electricity generator or Retailer / Trader who has a valid <i>Use Of System Agreement</i> with the distributor; or a consumer who has a valid <i>Network Connection Agreement</i> with Powerco.
Paralleling	For the purpose of 393S007, 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	Point of common coupling of the consumer. Refer to AS/NZS 61000.3.6 for guidance on determining this point.
Pioneer scheme	For the purposes of 393S007 a pioneer scheme is a cost-sharing mechanism used where a connection involves investment that may benefit future customers, allowing costs to be recovered from those future connections, as per Powerco's published Pioneer Scheme Policy.
Point of Connection	a point at which electricity may flow into or out of a network and, for the purposes of the <i>Technical Code A of Schedule 8.3</i> , means a grid injection point or a grid exit point (the above is an <i>Electricity Industry Participation Code 2010</i> definition).
Point of Isolation	In 393S007 the point of isolation refers to the physical location of a device (For example: switch, fuse or link) which enables disconnection (de-energisation) of the connection from the network.

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Term	Term Meaning
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: a) If there are both HV 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. (the above is an <i>Electricity Act</i> definition)
Power Supply	a supply of electricity (definition copied from <i>Electricity Act</i>)
Premises	For the purposes of 393S007 means an installation.
Price Category/Tariff Option	the charges levied by the distributor on the Retailer / Trader for distribution services provided by the distributor.
Principal	a person who or that engages any person (otherwise than as an employee) to do any work for gain or reward.
Residential	areas that are zoned residential in the local authority district plan.
Retailer / Trader (of Electricity)	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 / electricity trading” has a corresponding meaning.
Rights of Access	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 the consumer and ordinarily used in association with the distributor’s equipment at the consumer’s premise.
Ripple Receiver	see 393S007 definition above for load control ripple receiver or relay.
Road	For the purposes of 393S007 “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). (the above is a <i>National Code of Practice for Utility Operators’ Access to Transport Corridors</i> definition).
Rural	Areas zoned rural in the local authority district plan.

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Term	Term Meaning
Service Box	is a facility that is designed to allow access to the underground LV network for the connection of service-cables. Service boxes that are approved for use on Powerco's networks are listed in 393S107B Note: Service boxes are also commonly known as service pillars, pillar boxes and pods (as defined in <i>Powerco's 393S107A Low-Voltage Service and Link Boxes and Cabinets - Part A - Specification</i>). 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 sixty (60) amps.
Service Main	Refer to 393S007 definition of "Electric Line"
Service Boxes (Service Pillar)	a facility that is designed to allow access to the underground LV network for the connection of service cables. A service box is a point of supply, usually fused, to a customer's service main Note: Service boxes are also commonly referred to as service pillars, pillar boxes and pods.
System Operator	the System Operator appointed pursuant to the <i>Electricity Industry Participation Code 2010</i> including any codes of practice issued pursuant to the <i>Electricity Industry Participation Code</i>
Temporary Supplies	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	is an abbreviation of the words "time of use"
Urban	are areas that are not zoned rural in the local authority district plan
Use of System Agreement	is a written agreement that exists between Powerco Limited and each individual energy Retailer / Trader. The agreement can be based on the Electricity Authority Default Distributor Agreement" or as agreed in writing between Powerco and each individual energy Retailer / Trader
Work	For the purposes of 393S007, 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 (the above is an <i>Electricity Act</i> definition)
Subterranean Vault	is a facility that is designed to allow access to the underground LV network for the connection of service-cables. It serves the same purpose as a LV service box. Vaults that are approved for use on Powerco's networks are listed in 393S107B
Sub-transmission	are the network systems owned and/or controlled by Powerco and are operating at 33 kV, 66 kV and 110 kV

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1.5 Health and Safety Hazard Identification and Management

Contractors shall obey the requirements of Powerco's *392S002 Health And Safety and Environmental Management System Requirements Powerco For Contractors*.

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)*.

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's *150S016 Selection Use and Maintenance of Safety Equipment* which prescribes where and when staff and contractors alike should be wearing personal protective equipment (PPE).
- Electricity Safety Manual – Electricity Industry (SM-EI).

When working with materials such as insulating oils, gases and other hazardous substances (e.g., Asbestos, Mercury, Synthetic Material Fibres, PCBs etc.), the requirements 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 Framework*. Appropriate risk mitigation or reduction methods shall then be implemented before work commences on any network asset.

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2. Contractor Responsibilities

2.1 Working on the Network(s)

All parties working on Powerco's electricity distribution network shall:

- a. Be certified and approved by Powerco to undertake the types of works that they are doing or are intending to do
- b. Be responsible for ensuring that all installations that are connected to Powerco's network(s) fully comply with the requirements of 393S007 plus all other relevant Powerco standards and processes
- c. Not connect; any new Installation that does not comply with the requirements of 393S007, or where the connection has not been approved for connection by Powerco.
- d. Ensure that the requirements of the *E(S)R* are complied with, including (but not 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.
Powerco's polarity testing requirements shall be completed as prescribed in Powerco's 393S011 *Underground Network Construction Standard* particularly (but not limited to) 393S011 section 18.1 *Powerco's Requirements for Testing and Commissioning* so that the installation can be safely connected to Powerco's networks
 - E(S)R Regulation 38 Testing Works Before Connecting to Supply
- e. Comply with the requirements of Powerco's commissioning standards:
 - 220S007A Network Equipment Commissioning Standard -- Process - Part A
 - 220S007B Network Equipment Commissioning Standard – Part B – Technical Policies
- f. Ensure that permanent disconnections of installations comply with the requirements of Powerco's 170S001 Permanent Disconnections – Electricity Network
- g. Ensure that Powerco has been provided with all relevant information relating to the connected consumer installation, including all as-built information as required by 393S007 section 3.11 As-built Process
- h. Ensure that the work is completed in a neat workmanlike manner in accordance with Powerco's standards independent of the condition of the network before the work started.

2.2 Connection Prerequisites

All connections to Powerco's electricity HV and LV networks shall comply with the requirements prescribed in (but not limited to) the following Powerco's standards:

- 393S010 *Overhead Network Construction Standard* – in particular section 2 *Connections To Powerco's Electricity Network*
- 393S011 *Underground Network Construction Standard* – in particular section 2 *Connections To Powerco's Electricity Network*

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All connection proposals shall comply with the requirements of the Electricity Industry Participation Code (Part 6B).

3. GENERAL Technical Requirements

3.1 General

Connection designs shall be based on the minimum scheme unless additional capacity, redundancy, or flexibility has been requested by the customer or where Powerco enhancements are applicable.

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 393S007 and the following:

- All applicable electricity acts and regulations
- AS / NZS 3000
- 393S008 Overhead Line Design Standard
- 393S010 Overhead Network Construction
- 393S009 Underground Network Design Standard
- 393S011 Underground 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 / Trader is deemed to supply electricity to the consumer.

The network point of isolation is determined by the distributor to ensure disconnection (isolation by 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 reconnected (energised) or disconnected (de-energised and isolated from the network).

The examples provided in 393S007 *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 from **1 September 2008**, there is no singular point of isolation, the distributor will agree to an alternative measure for an agreed time-period. 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.

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Each new ICP created:

- Before 7th October 2002 shall be grandfathered by Powerco in agreement with the consumer to upgrade the point of isolation to comply with Powerco's requirements
- After 7th October 2002 shall be able to be disconnected (de-energised) without disconnecting of any other ICP, as determined by the distributor so as to ensure that the consumer supply can be 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 393S007 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 provided in 393S007 *Appendices A to L*.

3.4 Requirements for Connection of Installations to the Network

New electric lines shall meet the requirements of 393S007 and the associated standards referred to in 393S007.

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

- Either, Powerco will be responsible for grandfathering them into compliance as prescribed in 393S007 section 3.2 Network Point of Isolation.
- Or, the consumer is responsible.

Rights of access shall be allowed to Powerco's equipment installed on the consumer's premises (this is a requirement prescribed in the consumers choice of Retailer / Trader who must have a *Use Of System Agreement* with Powerco).

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* (this is a requirement prescribed in the consumers choice of Retailer / Trader who must have a *Use Of System Agreement* with Powerco).

3.4.1 Unmetered Connections

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

Typically, these types of connections are supplies to council owned power supply outlets - e.g., Telco cabinets and council flow meter sites.

Each supply shall comply with the requirements of 393S007 section 2.2 *Connection Requirements* and supplied by a thirty (30) amp HRC type fuse carrier loaded with a ten (10) amp fuse (i.e., supplied the same way as water heating pilots – see Powerco's 393S008 *Overhead Line Design Standard* section 13.9.2 *Water Heating Pilots*).

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Notes: All streetlighting and under veranda lighting loads shall comply with the requirements of 393S007
Error! Reference source not found. 7 Streetlighting and Under-Veranda Lighting

Temporary supplies shall not be connected as unmetered connections – refer to 393S0073.4.4
Temporary Supplies.

3.4.2 Urban Areas

Connection capacities up to 3-phase sixty-three (63) 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 that are between 100 amps and 400 amps may require the installation of a transformer(s) located on the consumers property for their exclusive supply.

For more information refer to 393S0070.3.4.7 *Customer Dedicated Transformer Connections.*

3.4.3 Rural Areas

In some rural areas the network distribution system consists of two (2) wire HV. In those instances, only LV 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.

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 sixty-three (63) 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 economical solution is usually the installation of an HV line across the consumer's property to a transformer close to the main switchboard.

3.4.4 Temporary Supplies

Temporary supplies (commonly called *Builders Temporary Supplies*) shall be treated as being a consumer's installation so they shall be located on property owned by the consumer.

They shall be allocated an ICP and metered in accordance with the requirements of 393S007 section 2.2 *Connection Prerequisites* and 393S007 section 6 *Criteria For Metering Equipment.*

The connection between a temporary supply outlet and Powerco's LV service box, cabinet or subterranean vault or pole shall be by means of an electric line (that meets the requirements of 393S007 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 supplies provided from (but not limited to):

- LV service boxes, link boxes, cabinets our sub-terranean vaults (often called pillar boxes)
- HV underground networks
- Overhead supplies provided from a HV or LV distribution pole.

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

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The sketches in 393S007 Appendices A, B, C, and D show connection examples for LV supplies.

Sites where multiple temporary LV Supplies are needed require separate ICP's to be established. The sketches in 393S007 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 393S007 section 2 *Contractor Responsibilities*.

3.4.5 Periodic Inspection of HV Installations.

E(S)R regulation 62 *High Voltage Installations* requires that HV installations are to be subject to a safety checking system as detailed in E(S)R regulation 40 *Safety Checks of Works*.

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

If the consumer does not comply with E(S)R Regulation 62 *High Voltage Installations* and is not able to provide Powerco with acceptable suitable documentation on request then the consumers installation shall be deemed to be "electrically unsafe" and shall be disconnected from the network in accordance with the processes prescribed in 393S007 section 3.4.6 *Electrically Unsafe Installations*.

3.4.6 Electrically Unsafe Installations

E(S)R Regulation 15(1) Using Works, Installations, Fittings, Appliances, and Associated Equipment states:

"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."

All disconnections from Powerco's electricity HV and LV networks shall comply with the requirements prescribed in (but not limited to) the following Powerco's standards:

- 170S002 *Guide To Permanent Disconnection Process - Electricity*
- 170S001 *Permanent Disconnections - Electricity Network*
- 170S007 *Temporary Isolations And Disconnections Of Electricity Installations*
- 393S010 *Overhead Network Construction Standard* – in particular section 2.2.3 *Disconnection Prerequisites*
- 393S011 *Underground Network Construction Standard* – in particular section 2.2.4 *Disconnection Prerequisites*

Powerco will contact the Retailer / Trader to authorise the disconnection of an electrically unsafe installation from the network if the owner fails to do so.

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3.4.7 Customer Dedicated Transformer Connections

A *Customer Dedicated Transformer* is a classification given to a transformer that is intended to be used exclusively by the Customer to whom it is dedicated and no one else shall receive a supply from that transformer(s).

Classifying a transformer as being customer dedicated, allows an installation owner certain configuration options that would not be otherwise available to them. Those configuration options can (amongst other things) involve the use of permanent earthing arrangements alternative to those prescribed in Powerco's 393S017A *Permanent Earthing - Part A – Design Requirements*.

Powerco's requirements for a *Customer Dedicated Transformer* are prescribed in Powerco's:

- 393S008 *Overhead Line Design Standard* section 15.16 *Customer Dedicated Transformers*
- 393S009 *Underground Network Design Standard* section 7.10 *Customer Dedicated Transformers*

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 shall be rated to carry the overload.
- The loading on the transformer shall not exceed the appropriate values for normal cyclic duty. In instances where this persistently occurs then Powerco's Planning Team shall be asked to investigate.
- Any installation connected to Powerco's electricity network shall be protected against short circuits or earth faults as per E(S)R and AS / NZS 3000.

3.5.2 HV Network Protection

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

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.

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3.6 Multiple Connections and Isolation

3.6.1 General Requirements for Multiple Connections

If there is more than one 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 *Technical Advisory Manager*.

In all cases, each ICP shall be able to be separately disconnected (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.

The requirements of the *Fire Safety and Evacuation of Buildings Regulations Act* should also be considered when making multiple connections to consumer premises.

Where a consumer's premise has made more than one point of supply to the network (i.e., more than one ICP) then each connection point shall have a separate isolation point so that each Installation can be disconnected (de-energised).

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

- a. 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 prescribed in 393S007 *Appendix E- LV 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 393S007 section 3.6.2 *Multiple Tenancy Installations*.
- b. Greater than five (5) tenancy connections per lot, building or apartment, shall have a fused LV service box (or LV cabinet if not enough space in a service box 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 shall be submitted in writing to Powerco Connect, with the following information:

- The capacity of each tenancy (number 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 contractor will be verifying the internal fusing capacity and isolation points arrangement prior to livening

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- For commercial / industrial sites, the capacity at the Powerco network connection point shall not be greater than the net sum of the individual tenancies. This applies to sites connected to the LV network and those connected to a transformer that is dedicated to that site.

3.7 HV Connections

Connection of any HV installation to Powerco's electricity networks shall comply with the requirements of the *E(S)R* 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 HV, but it is generally only economic for capacities in excess of one (1) MVA 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 393S007 section 3.6 *Multiple Connections And Isolation* for details.

3.8 Earthing

The installation's earthing system shall be designed to comply with:

- the relevant regulations of the *E(S)R* and associated *Electrical Codes of Practice* - in particular (but not limited to) *NZEC 35 Power Systems Earthing*
- The requirements of Powerco's 393S017A *Permanent Earthing – Part A – Design Requirement* and 393S017B *Permanent Earthing – Part B – Construction Requirements*

Deviations from these requirements require prior written approval from Powerco's *Technical Advisory Manager*. Note however that some sites may use alternative earthing arrangements – refer to 393S007 section 3.4.7 *Customer Dedicated Transformer Connections* for more details.

3.9 Fault Level Considerations

3.9.1 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 LV may consider 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.

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3.9.2 Consumer Contribution to Fault Levels

The design of the network may need to consider the contribution to fault level by the consumer's apparatus such as large motor loads or generation.

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

3.10 Trees Near Lines

For safety reasons, consumers shall 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 and contact the consumer's electricity Retailer / Trader to follow up on remedial actions that ensure the long-term durability of Powerco's network.

Powerco's website (<https://www.powerco.co.nz/safety/trees-and-power-lines/>) provides guidance on how to avoid power outages through the management of trees near power lines. The site also provides a list of Powerco approved tree contractors.

3.11 As-built Process

All additions, deletions, and modifications to Powerco's network assets shall be provided to Powerco's *Network Information Team* in accordance with the provisions prescribed in Powerco's:

- 360S014 *As Built Reporting Standard*
- 360S016 *Guide to Recording Electricity Assets* (contains the forms).
- And / or the use any other system agreed to within *Services Agreement Contracts* (e.g. MyPM tablet)

3.12 Embedded Networks

The definition of an embedded network is prescribed in 393S007 section 1.4 *Definitions*

Powerco's 393S097 *Connection of an Embedded Network To Powerco's Network* defines the types of embedded networks and the process for consumers to connect a privately owned electricity network onto Powerco's electricity network(s). Powerco deems those types of networks as being an "Embedded Network" for identification and billing purposes.

393S097 specifically covers the following matters:

- The process for application
- The technical criteria for connecting embedded networks, including metering
- Other requirements such as public liability and the operation of embedded networks.

3.13 Utilising Existing Network

Connection designs shall utilise existing network architecture, including existing assets and equipment, where it is reasonable.

In this regard, where more than one technically feasible option is identified, the option which minimises the whole lifecycle cost assessment should be selected, and the basis for the selection must be

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documented for the purpose of peer review. This assessment **may** consider (as relevant and where reasonable to consider):

- upfront capital cost,
- maintenance and operational costs,
- societal cost associated with component failure (value of lost load, safety),
- environmental impacts,
- end-of-life replacement, decommissioning, and disposal costs,
- customer-side costs and risks (where known and relevant at time of design),
- standardisation benefit,
- and any other costs, benefits, or risks considered relevant.

For avoidance of doubt, where standards allow discretion or are unclear: safety, reliability, standardisation, and good electricity industry practice should be prioritised over cost.

3.14 Applying Minimum Scheme

The proposed connection design shall identify and document a minimum scheme for a new connection or capacity upgrade quotation. A minimum scheme, as defined by the Electricity Authority, is the least-cost technically acceptable solution for a connection or upgrade.

The least-cost solution shall be reasonably identifiable. This means a competent Powerco representative, applying applicable standards and good electricity industry practice, would be able to follow the options considered and understand why the option has been selected as the minimum scheme.

Any Customer Selected Enhancement works must be separately identified and costed. In some situations, enhancements might represent an alternative solution (rather than additional components), and the incremental cost is then the difference between the cost of the alternative solution and the minimum scheme.

Any Distributor (Powerco) Selected Enhancement works shall be separately identified and clearly distinguished from the minimum scheme.

3.15 Pioneer Scheme

A Pioneer scheme may be established where electricity network infrastructure is required to enable the connection of one or more customers in an area where the existing network does not have sufficient capacity or capability to support the requested connection.

The purpose of the Pioneer scheme is to allow the first connecting customer to fund network augmentation works that may subsequently benefit future customers connecting within the same area.

A Pioneer scheme may be applied where:

- The requested connection requires upstream network reinforcement or extension beyond standard connection works;
- The augmentation provides additional capacity beyond the immediate needs of the Pioneer customer;
- The augmentation is expected to enable future customer connections; and
- The cost of the augmentation would otherwise unfairly burden the Pioneer customer relative to future beneficiaries.

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Powerco reserves the right to determine whether a Pioneer scheme is appropriate. Refer to Powerco's Pioneer Scheme Policy for further information.

Works that may be included within a Pioneer scheme include, but are not limited to:

- New feeders or overhead line/cable extensions;
- Transformer upgrades or installations;
- Switchgear or protection upgrades;
- Voltage regulation equipment;
- Distributed generation hosting capacity upgrades;
- Network reinforcement required to support future growth and security of supply

All network assets constructed under a Pioneer scheme shall become the property of Powerco unless otherwise agreed in writing. The assets shall be designed, constructed, operated and maintained in accordance with Powerco standards and regulatory requirements.

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 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

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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*.

Note: Voltage variations at PCC shall comply with Electricity (Safety) Regulations, which permit a voltage range $\pm 10\%$ of nominal 230V in steady state. Motor starting and fluctuating loads must remain within irritability thresholds defined in EEA PQ guidelines."

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 393S007 are those recommended in the EEA publication *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
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 that exceed the ratings specified in 393S007 *Table 1 Schedule of Exempt Motor Sizes* shall be approved by a Powerco Connections & Low Voltage Planning Engineer prior to connection.

The criteria used for approval is that the relative voltage changes on motor start-up shall not exceed the values in the following table.

Table 2 - Schedule of Allowable Relative Voltage Change

Frequency of Starting	At PCC	At Zone Substation HV Bus
In excess of ten (10) starts per hour	1%	0.5%
In excess of three (3) starts per day but not more than ten (10) starts per hour	3%	1.0%
Not more than three (3) starts per day including not more than one (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%

Note: PCC = Point of Common Coupling as defined in 393S007 section 1.4 Definitions

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Additional Guidance

Common motor starting methods include:

- Direct-On-Line (DOL): Highest inrush current ($6-8 \times$ full load current), most likely to cause voltage dips.
- Star-Delta: Reduces starting inrush current to $\sim 33\%$ of DOL starting.
- Soft Starter: Limits inrush current and smooth torque acceleration.
- Variable Speed Drive (VSD): Provides controlled start with minimal voltage disturbance.

Applicants should select starting methods that maintain voltage dips within the allowable limits in Table 2 and comply with irritability thresholds defined in EEA Power Quality Guidelines.

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 as a worst-case to determine the voltage dip magnitude.

4.4 Harmonic Disturbances

Harmonics shall be managed in accordance with the EEA publication *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: E(S)R Regulation 31 Requirements Related to Quality of Supply.

4.5 Radio and Television Interference

Consumers' installations and appliances shall not impose interference on the network that affects the operation of radios, televisions, and / or other communication systems as prescribed in all current *New Zealand Radio Interference Noise Regulations* and any other standard New Zealand industry radio interference requirements.

4.6 Consumer Disturbances

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

4.7 Signalling

The network shall not be used for the purpose of conveying signals unless express and prior written approval is given by Powerco's *Technical Advisory Manager* prior to the transmission of any signals.

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Should the consumer 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 Voltage unbalance

Load and phase distribution shall be designed to achieve balanced loading across all phases of the reticulation system. The design shall ensure equitable load sharing to optimise voltage performance and individual circuit efficiency.

Under normal operating conditions at peak load, the maximum low-voltage phase-to-phase voltage imbalance shall not exceed 5% at the LV terminal of the transformer to be connected to.

Connections that may cause voltage disturbance outside of network limits, Powerco may require additional works to maintain compliance.

4.9 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 or amplification 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 two percent (2%) of connection kVA capacity.

Note: For 3-phase connections the maximum kVAR per phase is one-third (i.e., 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 interference. Electronic fluorescent lighting ballasts do not require capacitors for power factor correction; hence they also will not absorb ripple control signals.

4.10 Load Control Policies

The purpose of controllable load is to minimise constraints on Powerco's distribution system and the electricity transmission system.

The system relies on consumers electing to connect some types of load in exchange for a cheaper electricity rate. Load control equipment permits Powerco to respond to system emergencies as and when they arise on Powerco's distribution network and / or on Transpower's grid by controlling that connected load.

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Since 1st September 2008, Powerco's preference is to move away from using water heating circuits (sometimes also called water heating pilot systems) and instead replace those pilot systems with individual decabit receivers – that process is prescribed in Powerco's *370S017 Load Control Channel Standard*.

4.10.1 New Connections to Powerco's Network

All new installations that use control load systems shall be fitted with individual decabit receivers that are capable of being controlled by Powerco's load control system by means of an approved ripple receiver (i.e., relay).

Notes: Powerco is progressively decommissioning its existing water heater pilot systems in favour of a decabit system that uses load control receivers complying with the requirements of Powerco's *370S017 Load Control Channel Standard*. Guidance on the process is provided in Powerco's *393S008 Overhead Line Design Standard* – section 15.21 *Water Heater Pilot Systems – Decommissioning Process*.

Therefore, the need for the continued existence of a water heater pilot wire should be considered during the design stage. Liaison with Consumers by the receiver owner will be needed to ensure that they agree with the replacement process is necessary because they will need to give permission for a relay to be placed on their property.

In this regard "controlled" means switched on or off. The purpose of the relay is to allow Powerco to interrupt that load.

4.10.2 Existing Connections to Powerco's Network

All existing installations comprising suitable interruptible loads - as prescribed in 393S007 section 4.10.3 *Suitable Interruptible Loads* - shall continue to be capable of being controlled by Powerco's load control system by means of an approved ripple receiver (i.e., relay) – refer to the "Notes" in 393S007 section 4.10.1 *New Connections To Powerco's Network*.

In this regard "controlled" means switched on or off. The purpose of the relay is to allow Powerco to interrupt that load.

This policy applies to both commercial and residential installations.

4.10.3 Suitable Interruptible Loads

All interruptible loads should be able to deliver satisfactory service when being controlled under Powerco's normal load management 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 1.2 kW or more.
- Electric storage heaters (non water) fitted with a heating element of 3 kW or more.
- ICP's with a total irrigation load capacity above 50 kW.
- 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).

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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 / Trader.

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 shall 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 / Trader. Where a consumer elects an uncontrolled tariff, the “controllable load” will be controlled in emergency situations only – Powerco being placed under system operator-initiated emergency instructions if a local or national system emergency arises.

5. Technical Criteria – Electric Line

5.1 LV 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:

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

Streetlighting is normally owned by the local council but determining ownership can often be problematic. Powerco's 310S067 *Streetlight Supply, Control and Ownership – Policy* can provide useful guidance on this topic.

LV 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.

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

- a. Streetlighting Pilot Wires - The design of pole mounted streetlighting systems that use pilot wires is prescribed in Powerco's 393S008 *Overhead Line Design Standard* in particular, section 3 *Streetlighting Pilots*.
- b. Water Heating Pilot Wires - Powerco is progressively decommissioning its existing water heater pilot systems in favor of a decabit system that uses load control receivers complying with the requirements of Powerco's 370S017 *Load Control Channel Standard*. In areas where

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ripple control signals are unavailable a pilot wire for water heating/space heating/night supply control shall be included in the service / distribution main provided that the network area concerned already has a pilot control system. Contact *Powerco Connect* to assist in determining the best connection methodology. Fusing and supply requirements are prescribed in Powerco's *393S010 Overhead Network Construction Standard* and *393S011 Underground Network Construction Standard*.

5.1.3 Isolation Points

Isolation of each individual electric line shall be possible and will generally be carried out using the LV fuses.

Contractors shall ensure that when removing electric line fuses to disconnect one consumer that it will not also isolate another consumer.

5.1.4 Structural Requirements

An overhead 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 Overhead LV Electric Line

All overhead lines shall maintain the safe distances as required by (but not limited to) the requirements of *E(S)R Regulation 17 Maintaining Safe Distances*.

Where open pair overhead lines are permissible the phase conductors shall be covered with black PVC and the neutral conductor shall be bare – as prescribed in Powerco's *393S133 Overhead Aerial Conductors Specification – Part A – Specification and Part B - Application Rules*.

The consumer is responsible for providing solid supports for conductor insulators and terminations for their installation.

It is recommended where possible that a neutral screened cable is used for aerial electric lines due to the enhanced safety this provides, for all parties. Powerco's *393S133 Overhead Aerial Conductors Specification – Part A – Specification and Part B - Application Rules* prescribes aerial electric lines that are approved for use on Powerco's networks.

5.3 LV Underground Electric Line

5.3.1 General

Underground service cables may share the same trench as other services. Clearances to services owned by other organisations shall be as prescribed in Powerco's *393S011 Underground Distribution Network Construction*.

Cables laid in road reserves (the national transportation corridor) 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 requirements of *393S007* section 3.11 *As-built Process*.

Powerco does not keep any records of service/distribution main cable routes on consumer owned (i.e., private) property. It is recommended that contractors either provide details to the consumer and/or

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encourage the consumer to make their own records. Both Powerco and other infrastructure service providers (e.g., Spark, Ultra Fast Fibre) operate cable locating services.

Powerco's own practice and recommendation is that all service/distribution electric lines shall be buried to the depths prescribed in Powerco's *393S011 Underground Network Construction Standard* for works in the road reserve and to the requirements of *AS/NZS 3000* where the electric line is laid within the consumers property.

Clearances of overhead electric lines run in the road reserve shall comply to the heights prescribed in Powerco's *393S010 Overhead Network Construction Standard* and to the requirements of *AS/NZS 3000* where the electric line runs above the consumers property.

Both ends of each phase conductor of an underground service/ distribution main shall be colour coded in accordance to the colour/s stated on the wiring application and as prescribed in Powerco's *393S011 Underground Network Construction Standard*.

5.3.2 LV Underground Electric Line in LV Underground Network 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 LV 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 LV 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 (2) consumers.

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

Note: LV service boxes shall be of a type approved for use on Powerco's networks as prescribed in *393S107B Low-Voltage Service and Link Boxes and Cabinets – Part B – 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 contractor.

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 two (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 shall be laid as prescribed in Powerco's 393S011 Underground Network Construction Standard. The cable on the consumers property 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 and Powerco's 393S011 Underground Network Construction Standard.
6. The cable shall be appropriately mechanically protected above the ground level in accordance with the requirements of Powerco's 393S011 Underground Network Network Construction Standard.
7. The cable length shall allow for the length of cable up the pole.
8. Where connection to a pole mounted fuse is being made, the connection shall utilise the methods prescribed in Powerco's 393S010 Overhead Network Construction Standard 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 the requirements of 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 LV service box located in the road reserve.

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5.5 HV Electric Line and Substations

When it is necessary to install a transformer 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. Powerco's equipment accommodation requirements are prescribed in the below mentioned design and construction standards.

The consumer shall also grant an easement in Powerco's favour to facilitate its unrestricted access to all of the equipment and fittings that are associated with the conveyance of electricity to both the consumer and any other consumers. All easements shall comply with the requirements of 392S011 *Powerco Networks Land Access and Easement Policy*. Powerco's legal team shall always be involved in the preparation of those agreements.

Substations shall comply with the requirements of Powerco's 393S009 *Underground Network Design Standard* and in particular (but not limited to) section 15 *HV Distribution Substations*.

All substations and HV circuits on the consumer's property shall be designed and constructed in accordance with the requirements of (but not limited to) the following Powerco documents:

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

In addition to any requirements prescribed in the above mentioned Powerco standards, the connection of any HV installation to Powerco's Electricity Networks shall also 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 / Trader, and:

- a. Powerco's preference is that the metering arrangement shall not rely on summated meter readings from multiple meters on the consumer's premises. However, in some cases summated reading can be allowed provided that it has been agreed to in writing by Powerco's *Electricity Commercial and Retailer Manager*
- b. Load and generation flow volumes shall be measured and reported separately – i.e., net metering is not acceptable
- c. Metering by subtraction is not permitted
- d. Must comply with the protection and isolation requirements of 393S007
- e. Where associated with an embedded network (refer to 393S007 section 1.4 Definitions), comply with the *Electricity Commissions Guidelines for Metering, Reconciliation and Registry Arrangements for Embedded Networks*
- f. Installed in accordance with the drawings contained within the 393S007 Appendices as they relate to connection and metering (see notes below)
- g. 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
- h. All connections over 3000 kWh shall be metered.

Notes:

- a. Multiple use of an installation is the responsibility of the installation owner.
- b. Metering will also need to be installed, inspected, and approved by the meter owner once the installation has been connected to Powerco's networks.

Facts relevant to metering include (but not limited to) the following:

- All Powerco polarity testing requirements as prescribed in Powerco's 393S011 *Underground Network Construction Standard* and in particular, (but not limited to) 393S011 section 18.1 *Requirements for Testing and Commissioning* shall be completed so that the installation can be safely connected to Powerco's networks without the meters installed.
- Meet the relevant standards determined with good industry practice.
- Designs of HV switchgear shall be done in such a way that if a consumer adds generation or additional connection points (transformers) then metering can be easily configured to only meter exported electricity that enters the wider network. This will normally involve locating the metering system upstream of any transformers. This requirement is outlined in an *Electricity Authority* memo dated 8th January 2021 - a copy of which is provided in 393S007 section 0 Appendix M – *Electricity Authority Memo Considering Future Generation Requirements in Design of Substation Switchgear and Network Connections*

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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 shall provide appropriate space within their premises to accommodate Powerco's metering equipment.

6.3 Metering of Powerco Assets

Electricity consumed by Powerco owned buildings – which include (but are not limited to): zone substation control buildings, offices, depots, SCADA and radio huts. Those sites 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 energy Retailer / Trader.

Notes:

- a. Electricity consumed by Powerco equipment for the purposes of distributing and operating Powerco's electricity network's – i.e., Works - shall be exempted from this requirement.
- b. The testing and inspection requirements prescribed in 393S007 section 6.1 *Metering Requirements* shall also be applied for all Powerco metering installations.

7. Streetlighting and Under-Veranda Lighting

7.1 General Streetlighting Requirements

Streetlighting and under-veranda luminaires are normally owned by and are the responsibility of the local council but determining ownership can at times be difficult. When determining who the actual owner is refer to Powerco's 310S067 *Streetlight Supply, Control and Ownership – Policy*. Powerco's 370S006 *Powerco Predecessors - Electricity and Gas Networks* can also provide insights into the organization that owned these systems prior to the existence of Powerco.

Each supply shall comply with the requirements of 393S007 section 2.2 *Connection Requirements*.

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*
- *E(S)R*
- *AS/NZS 3000 Wiring Rules*
- Applicable Electrical Codes of Practice (ECP's)

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7.2 Connection of Streetlight to the Networks

Connection of streetlights to Powerco's electricity networks shall only be undertaken by Powerco contractors who have been approved of by Powerco to do those works.

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. Streetlight cable sizes approved for use on Powerco's networks are prescribed in Powerco's 393S079B *Network Underground Cables – Part B - Approved Cables and Manufacturers List*.

Each individual streetlight luminaire shall be supplied from a dedicated streetlight circuit protected by its own fuse holder fitted with an HRC fuse (maximum of forty (40) amps per phase) that can supply a highly inductive/capacitive load. The HRC fuse holder shall be approved for use on Powerco's networks as prescribed in Powerco's 393S109B *High Voltage and Low Voltage Fuse Equipment - Part B - Approved Fuses List*.

Where more than one (1) 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 – Powerco's requirements are prescribed the standards listed in 393S011 *Underground Network Construction Standard section 3 General Technical Requirements*.

7.3 Under-Veranda Lighting Connections

The connection of under-veranda lighting to Powerco's electricity networks shall only be undertaken by Powerco contractors who have been approved of by Powerco to do those works.

Under-veranda lighting shall be supplied by a suitably rated fuse (maximum of forty (40) amps per phase) that can supply a highly inductive/capacitive load. Each supply shall comply with the requirements of 393S007 section 2.2 *Connection Requirements*. Also refer to Powerco's 310S067 *Streetlight Supply, Control and Ownership Policy* for guidance on ownership details.

7.4 Streetlight Column Wiring and Earthing

A switchboard shall be installed inside the streetlight column 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.

The neutral and earth bar shall be linked with a removable link.

Wiring connections shall be as shown in 393S007 section 7.4.3 *Diagram – Streetlight Earthing*.

7.4.1 Streetlight Earthing

Each streetlight pole / column shall be earthed by means of a 6mm² copper insulated earthing conductor connected to an earth electrode. The earth electrode shall be 13mm diameter copper clad steel.

The earthing conductor shall be connected to the earth electrode in accordance with Powerco's 393S017B *Permanent Earthing – Part B - Construction Requirements*.

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7.4.2 Streetlight Luminaires mounted on Powerco Poles

Where streetlight luminaires 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.

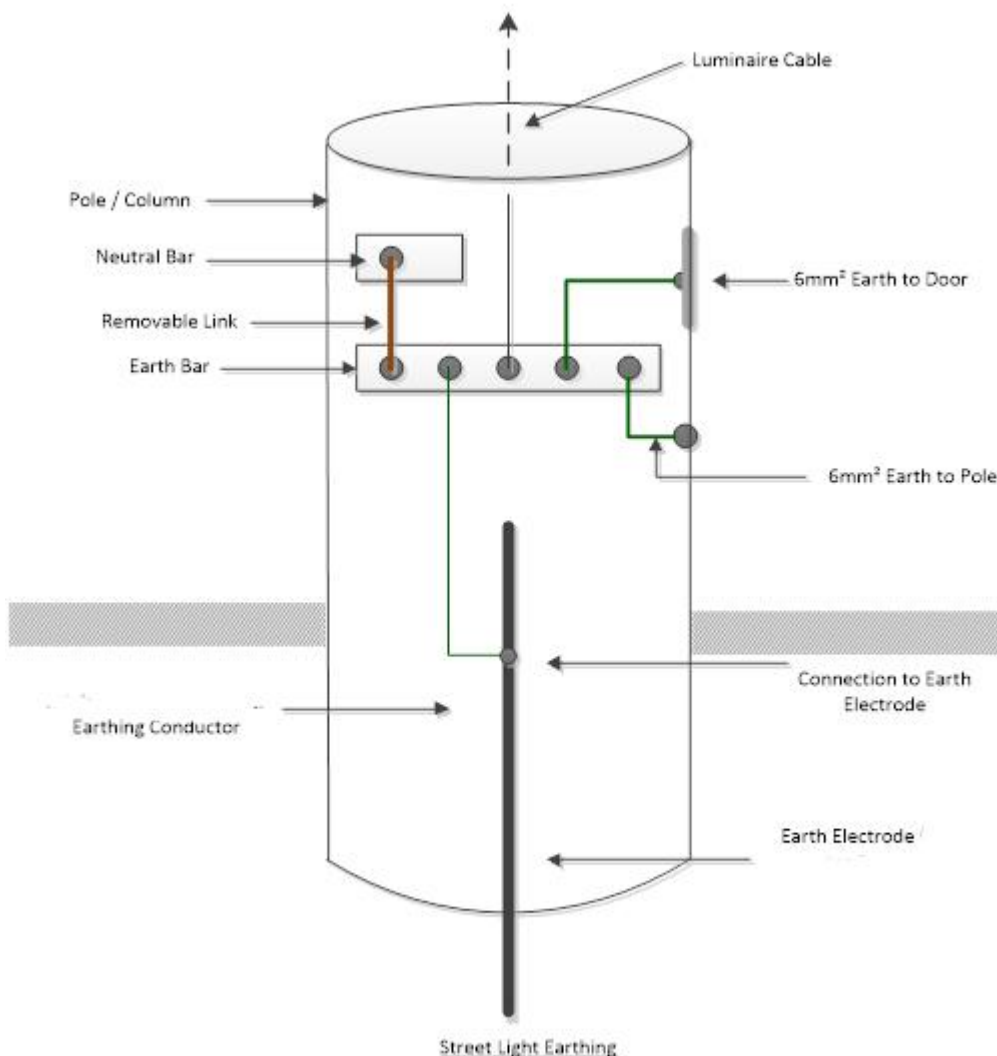
Fuse protection shall be in accordance with Powerco's 393S024 *Network Fuse Protection Standard*.

The HRC fuse link shall be six (6) amps with utilisation category gG (General Purpose) with rupturing capacity of 120 kA.

The fuse carrier shall be thirty (30) amp (minimum, preferably 100 amp rated) rated and mounted on the cross arm.

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

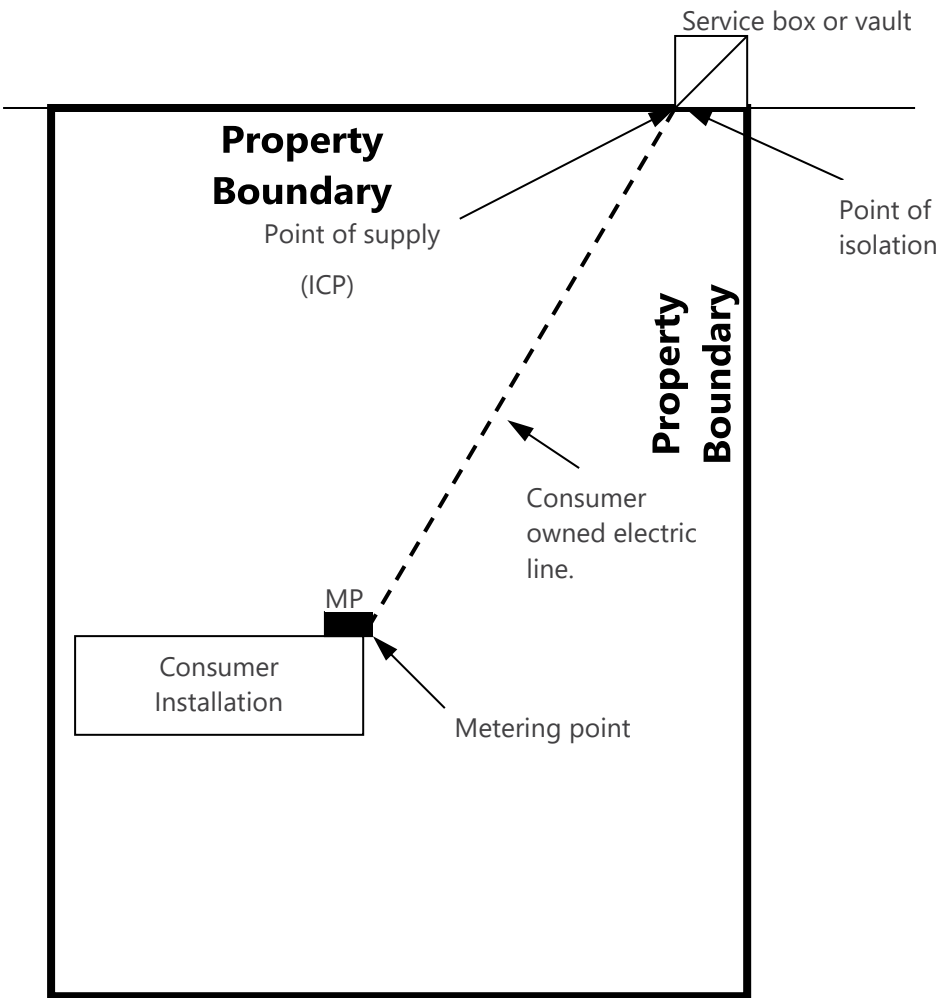
7.4.3 Diagram – Streetlight Earthing



Appendices – Network Connection Examples

Appendix A - LV Supply to One Consumer from Service Box Located on Property Boundary

Road / Road Corridor / ROW

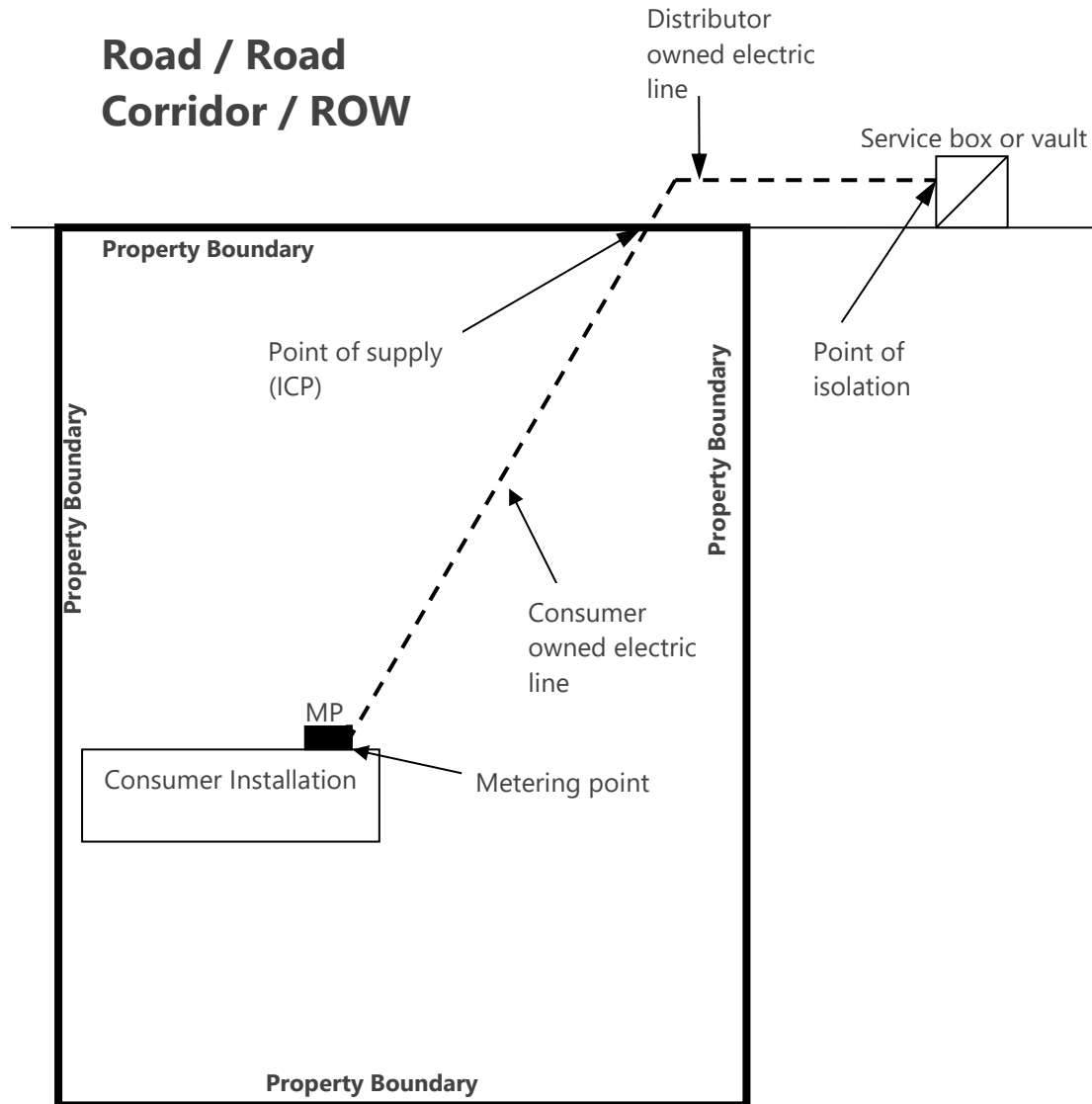


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Appendix B - LV Underground Cable to One Consumer From Service Box Not Located On Property Boundary

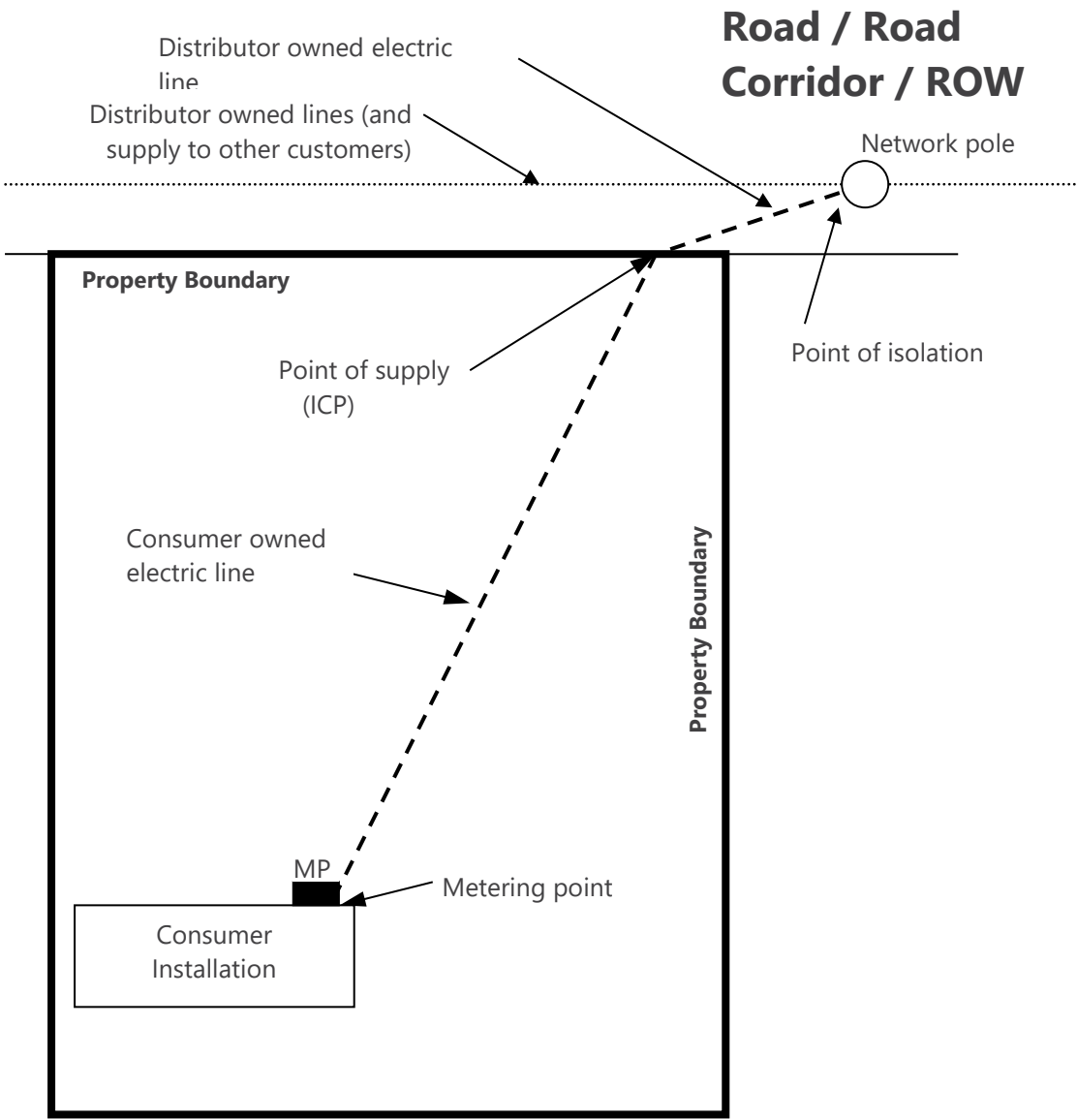


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Appendix C - LV Underground Cable to One Consumer From Overhead Network Pole Not Located On Property Boundary

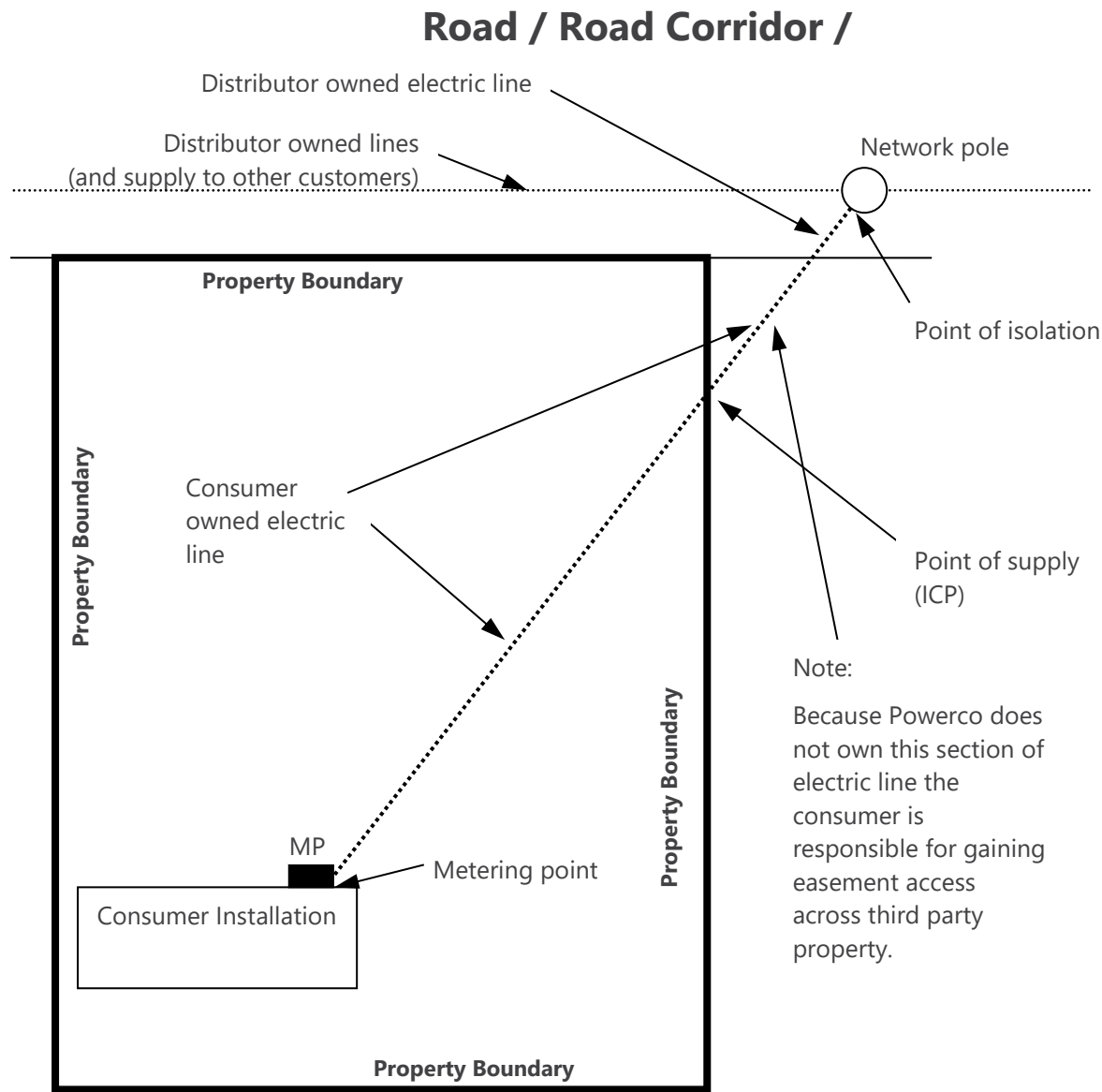


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Appendix D - LV Overhead Connection to Overhead Network Supplied Across Third Party Owned Property



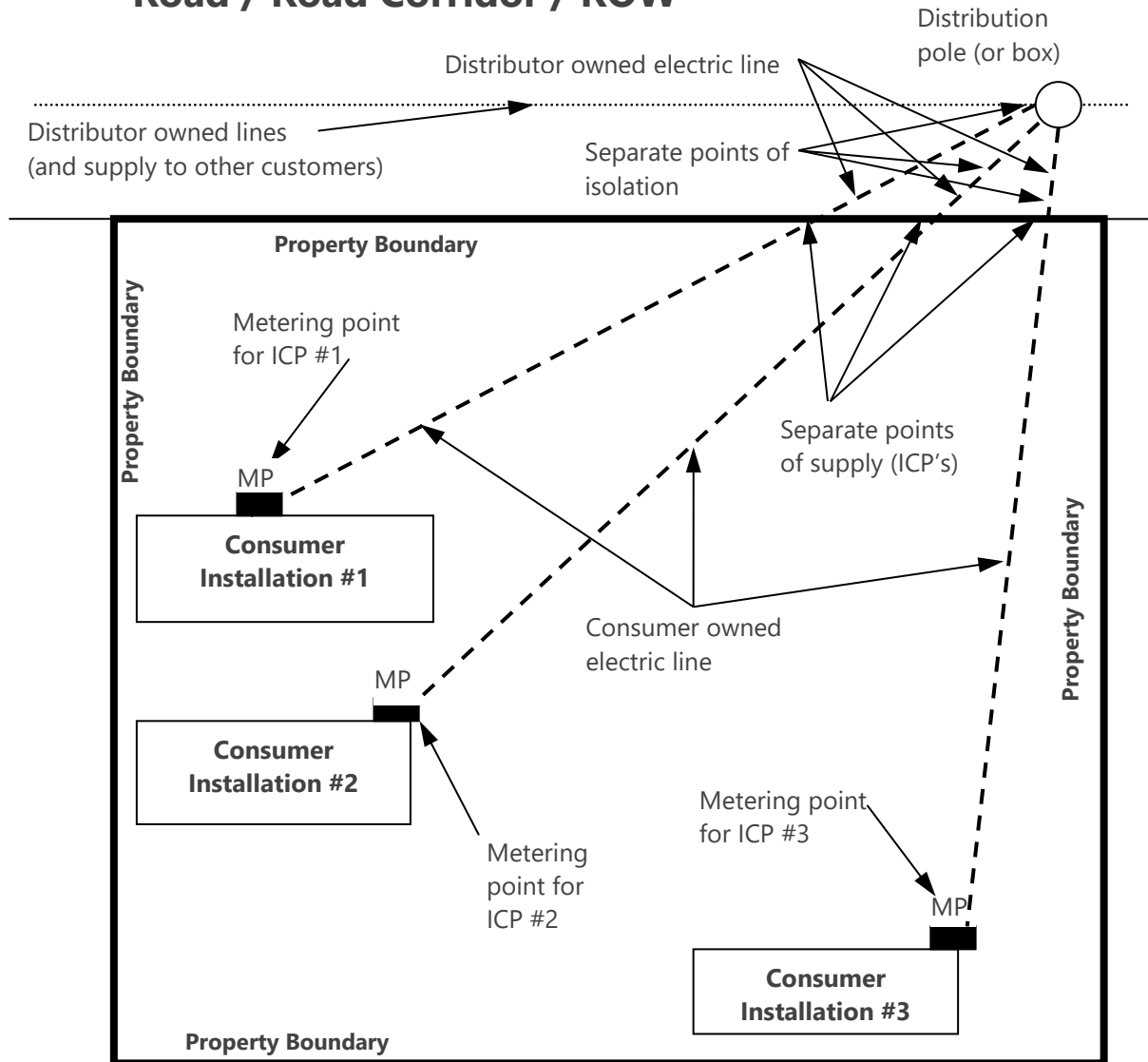
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Appendix E - LV Multiple Connections From The Network To Multiple Installations All Located On Common Property

Road / Road Corridor / ROW

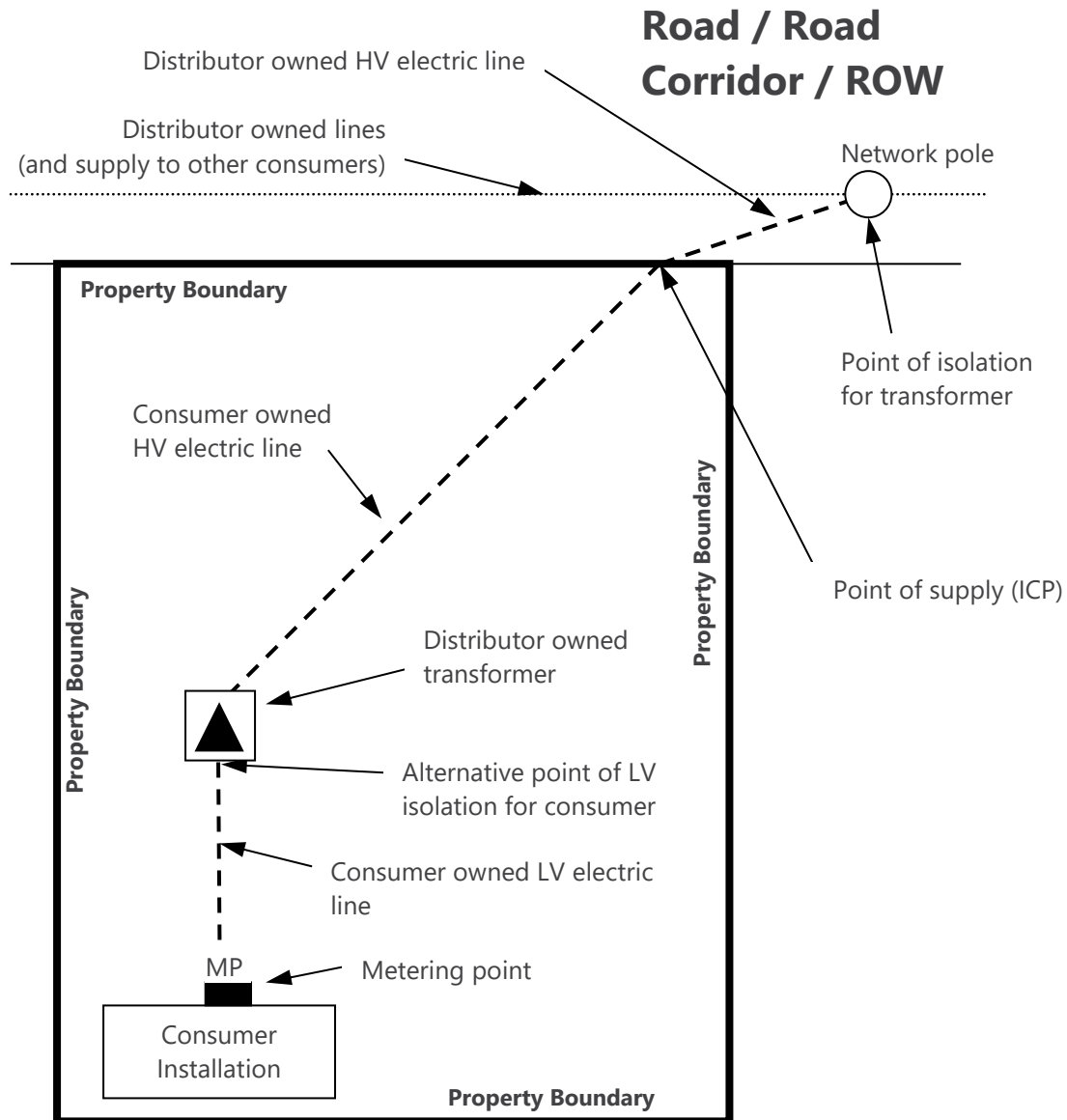


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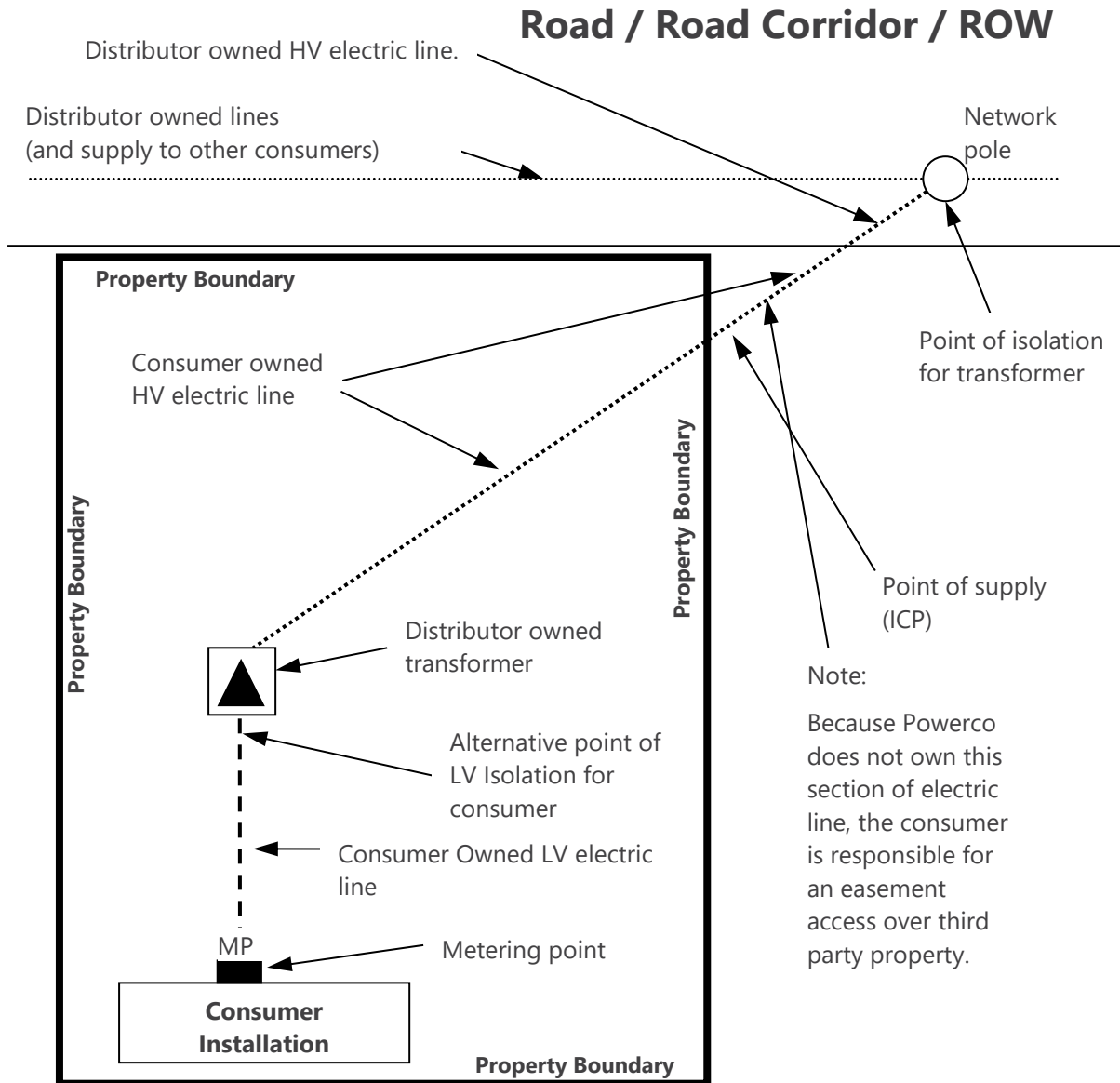
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Appendix F – HV Underground Cable Connected to Overhead Network Supplying One Consumer



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Appendix G - HV Overhead Connection to Overhead Network Supplied Across Third Party Owned Property



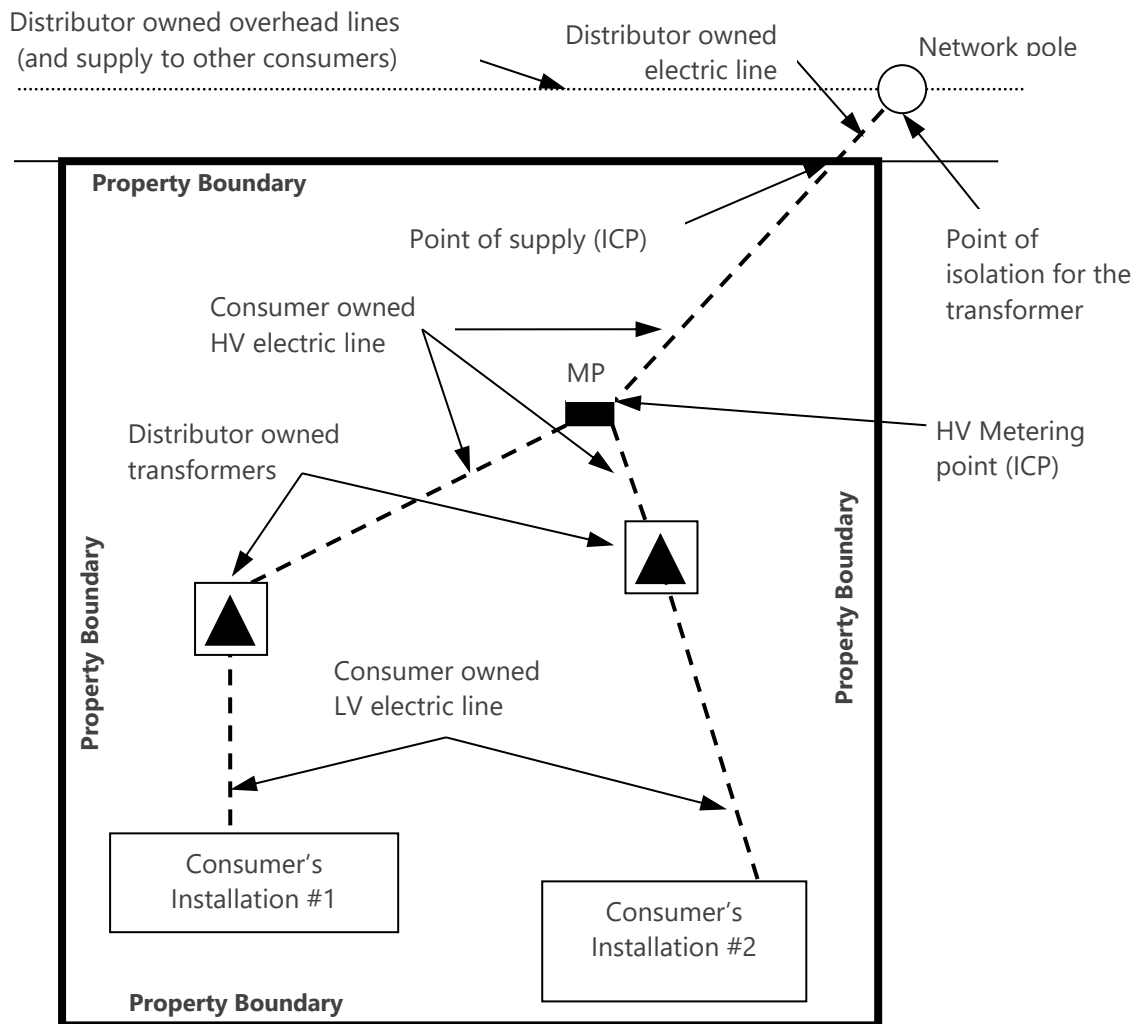
Note: This situation covers a single transformer located on a single property on which single or multiple installations are located, each of which are individually metered. The same situation can be applied to multi-story buildings (e.g., apartments, offices, etc.).

If a metered installation has multiple tenants then isolation of these supplies and revenue collection, is the building owners' responsibility).

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Appendix H – HV Consumer Owned Supply with Multiple Transformers Located on Common Property Owned by the Same Consumer

Road / Road Corridor / ROW



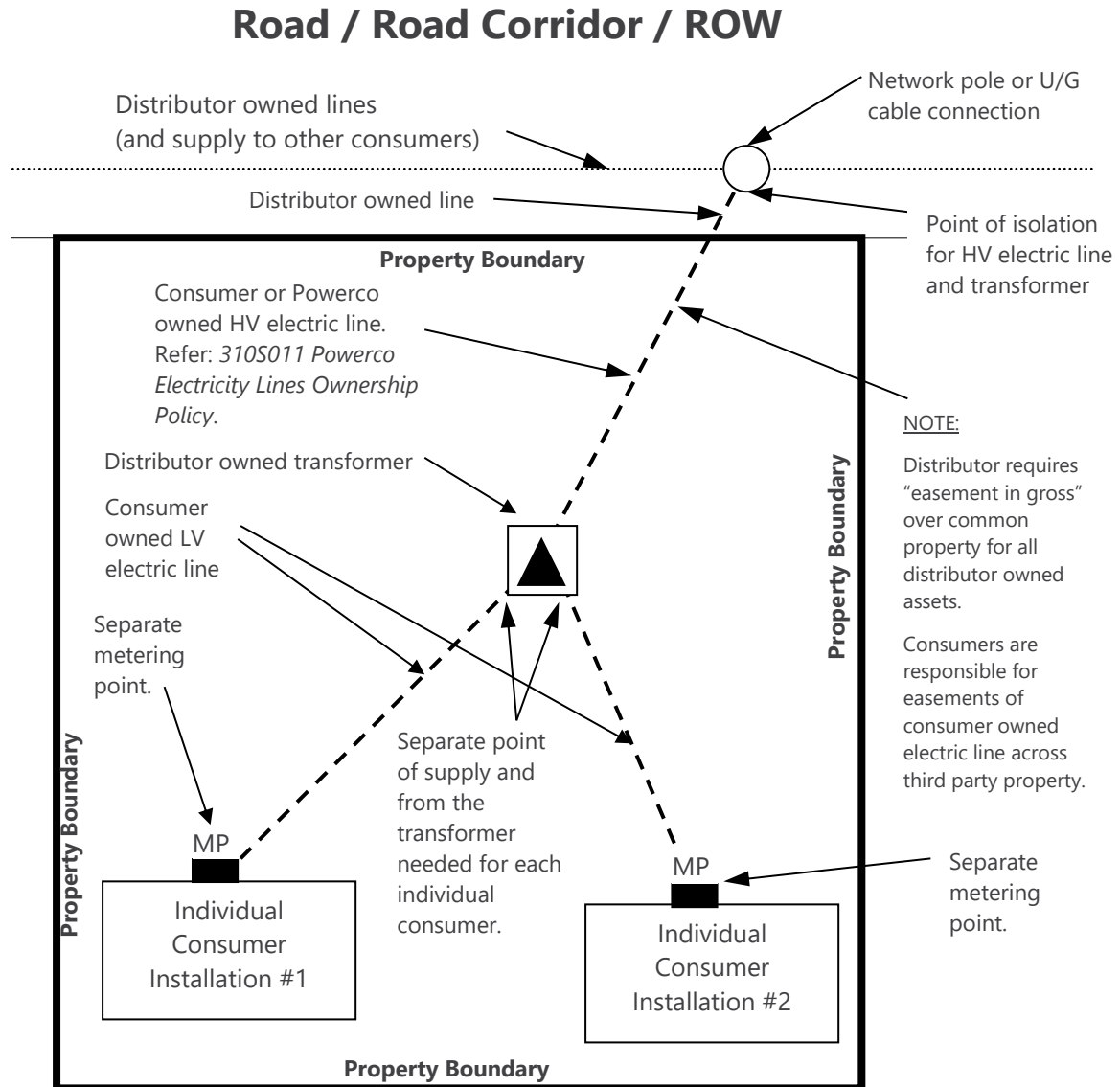
Note: This situation covers multiple transformers located on a single property on which multiple installations are located but they are collectively metered at a common HV metering point. The same situation can be applied to multi-story buildings (e.g., apartments, offices, etc.).

Note: it is the metering point owner's 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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Appendix I – HV Supplied Connection to Single Transformer Supplying Multiple Consumers on Same Common Property



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.

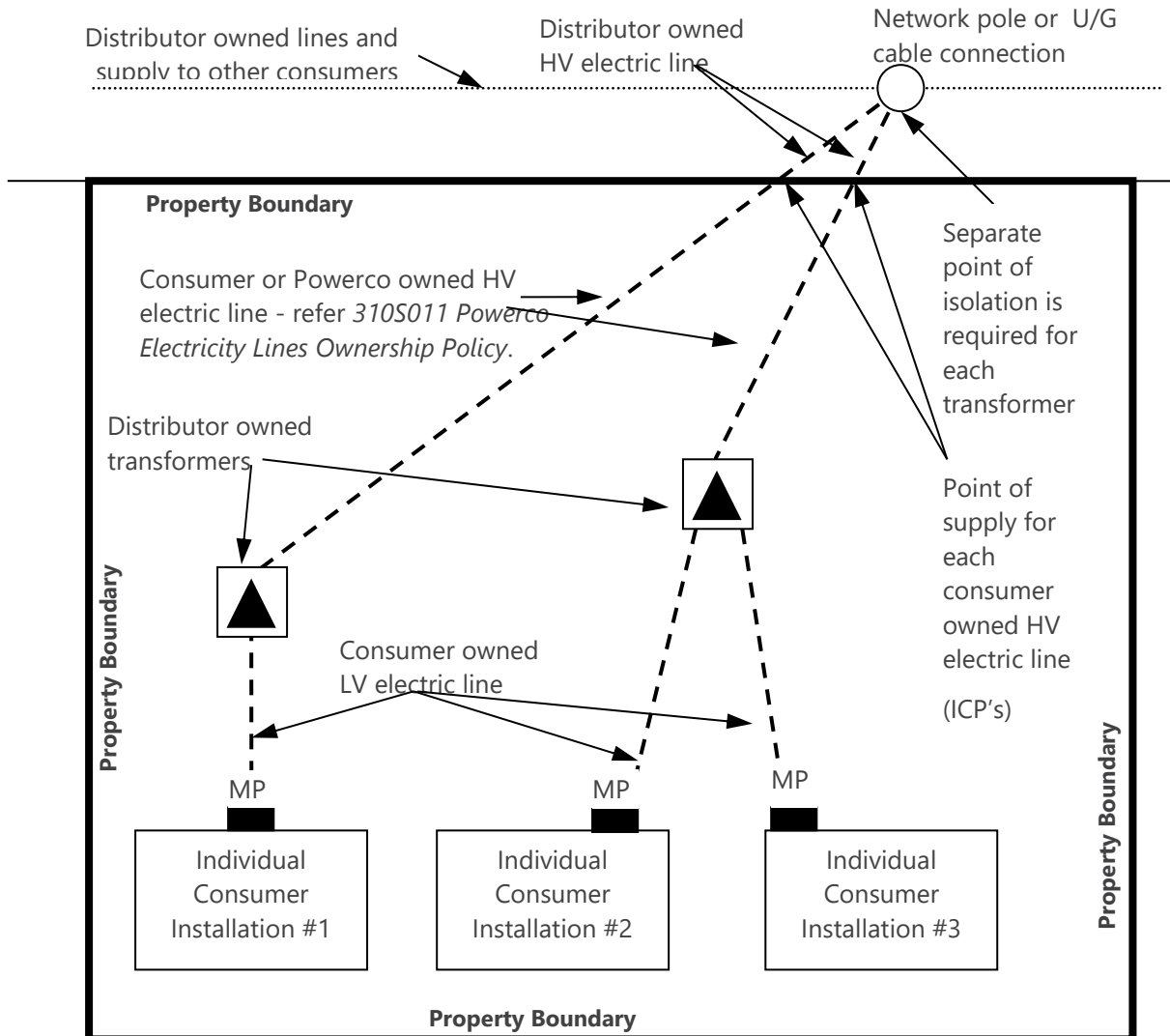
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Appendix J - HV Supplied Connections with Multiple Transformers on Same Common Property with Multiple Consumers

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.

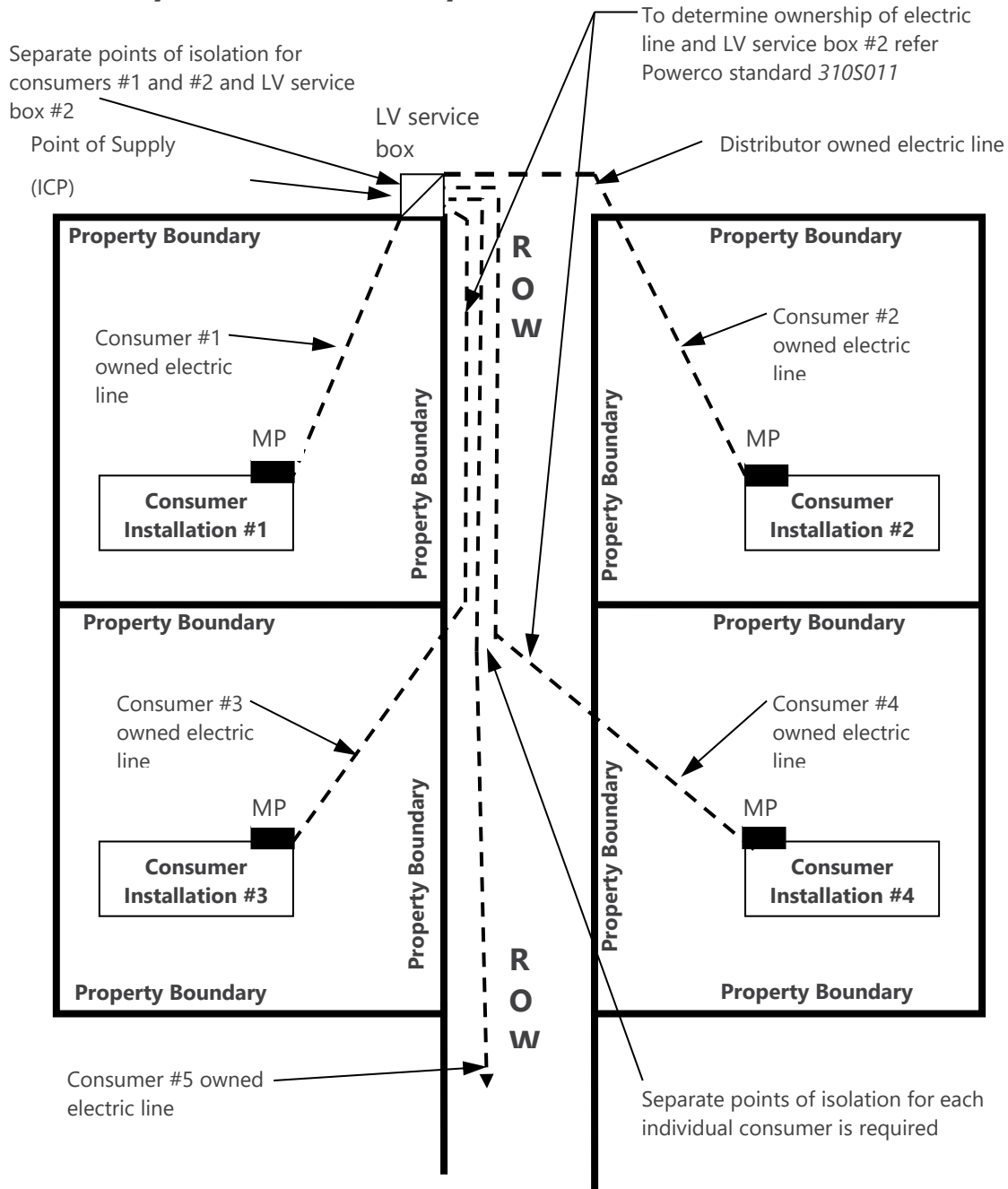
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Appendix K - Multiple LV Connections to the Network, Through a Single Point of Connection (More than two Connections, Right of Way)

Road / Road Corridor / ROW



- NOTE:
- (a) Distributor requires "easement in gross" over length of its cable
 - (b) MP = Metering Point
 - (c) Powerco's preference is not to install LV service boxes in ROW

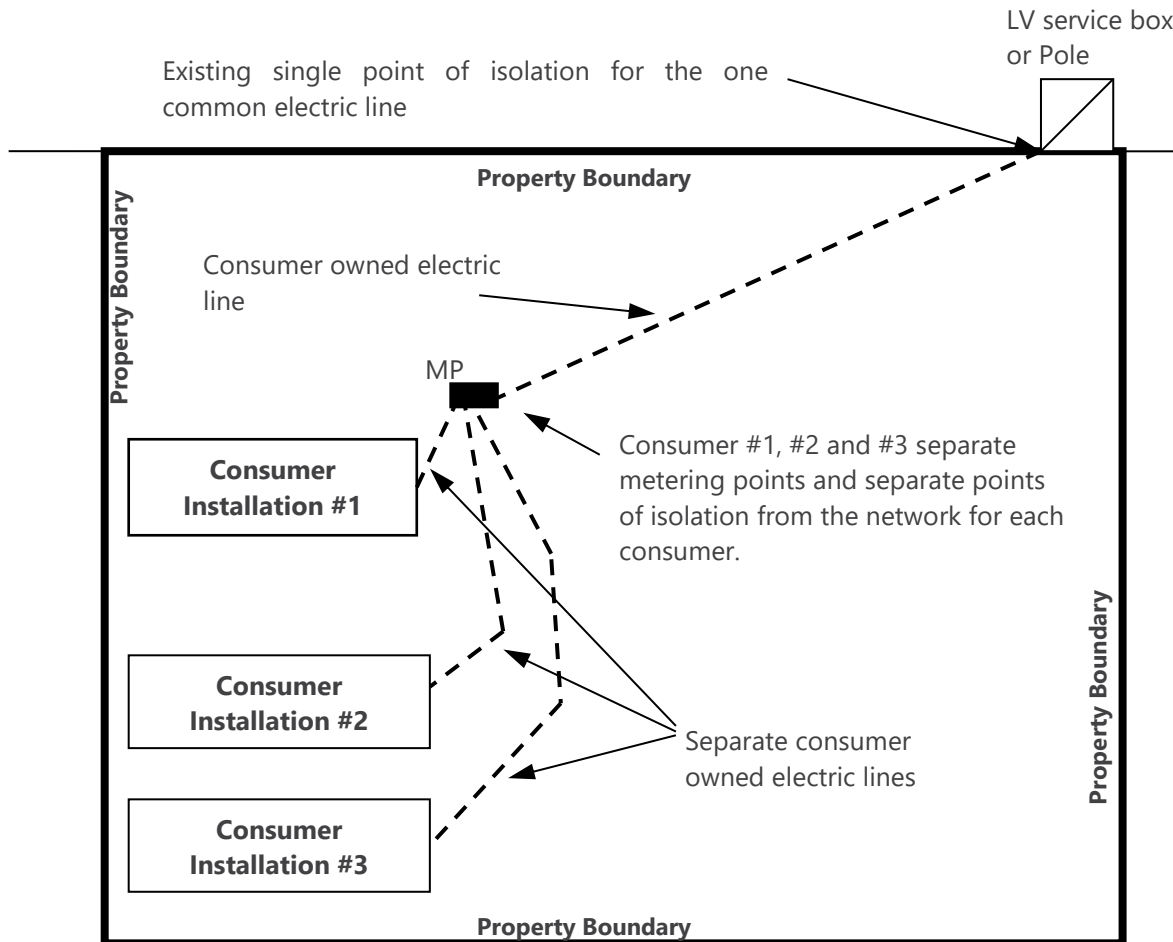
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Appendix L - LV - Single LV Connection to the Network Supplying Multiple Existing Installations on a Common Property.

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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Appendix M – Electricity Authority Memo Considering Future Generation Requirements in Design of Substation Switchgear and Network Connections.

Memo

To Distributors

Copies Reconciliation participants
Metering Equipment Providers
Approved Test Houses

From Grant Benvenuti

Date 8 January 2021

Subject Considering future generation requirements in design of substation switchgear and network connections

For your information

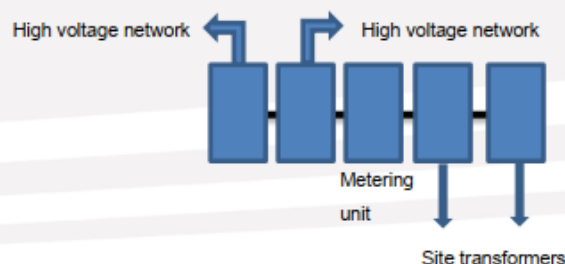
Reminder to consider future generation at sites with multiple connections to the network

Distributed generation (especially solar) is becoming more common on large sites. Many large sites have dedicated transformers with two or more connections to the network. When generated electricity flows out one transformer, through the high voltage buswork and back into the site through another transformer self-consumption can be recorded as electricity flowing both to and from the network, (unless the metering and substation is designed so that these flows are all on the metered side of the high voltage metering unit). This disadvantages the consumer who may end up paying network and retailer charges for electricity that is self-consumed onsite.

The cost of remediating these kinds of network design issues are borne by consumers and can greatly exceed the cost of installing or relocating meters.

Substation and high voltage switchgear configuration

We strongly recommend distributors design high voltage switchgear in such a way that if the consumer adds generation or additional connection points (transformers), metering can be easily configured to only meter exported electricity that enters the wider network. This will normally involve locating the metering upstream of any site transformers. An example configuration would be:



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Making future costs explicit

If a consumer does not wish to install high voltage metering at the time of the switchgear design, then we strongly recommend participants (retailers, distributors, metering equipment providers) ensure the customer is aware of the limitations of low voltage metering when exporting from one connection (transformer) to another within the same site. By making these costs explicit, including the costs of inserting a high voltage metering unit in the future, the consumer will be able to assess the benefits of making this change now or in the future.

We have recently granted an exemption for this issue, however, are unlikely to grant similar exemptions in the future

The Authority has recently granted an exemption to enable volumes at an installation that did not consider the possibility of generation to be calculated via subtraction and avoid the need to reconfigure the network connection.

Configuration of the connection to the network meant that generation transported within the site was metered on the low voltage side of the transformers and is measured as import and export from one transformer to the other on the same site. It was not practical to install high voltage metering upstream of the tie between the two transformers within the consumer premises because of the design of the high voltage switchgear.

With forward planning this issue could have been addressed as part of the design of the network connection.

As participants have now been made aware of the need to consider future generation when connecting to the network, we do not expect similar exemptions will be necessary in the future.

Exemptions are designed to support participants when there are exceptional short-term situations

An exemption is a temporary release from an obligation in the Code. It is intended, for example, to provide the participant time to become compliant with the Code, or to suggest a Code amendment.

Exemptions are time bound and even exemptions due to physical network configurations will have an expiry.

Further information about exemptions is available on the Authority [website](#).



Grant Benvenuti

Manager Market Operations

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8. Document Review History

Version	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 393S007 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 393S011 Underground Line Construction standard
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 393S011 Underground Line Construction standard. 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	Amended definitions of: Certificate of Compliance, Installation, Installation Control Point, Point of Connection. 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. Delete definition of 'Service Mains' (refer 'Electric Line'). Reference to 'Pillar Box' amended to 'Service Box' throughout the document. 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>. 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>. 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). 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. Section 2 title changed to 'Contractor Responsibilities'. Sections: 2.1, 2.2, 3.8, 5.2, Reference to Electricity (Safety) Regulations and associated requirements. Reference to Electricity Industry Participation Code 2010 – section 2.2. Section 3.3 title changed to Consumers Point of Connection. Additional section 3.4.8 Periodic Inspection of HV Installations. Additional requirements included in section 3.8 Altered <i>Section 3.4 Connection Requirements</i> to redefine Powerco's requirements for Temporary Supplies, and Unsafe Installations. 3.6 <i>Multiple Connections and Isolation</i> – permission of Chief Engineer now required. 3.8 Compliance with Regulations and EEA Guide. 4.4 Compliance with Regulations and EEA Guide. 4.6.4 <i>Ripple Receivers</i> – changed frequency for Hawera to 615Hz (not 283Hz). 4.7 <i>Signalling</i> – now requires permission of Chief Engineer to change. Remove section 5.1 General. 5.2 Compliance with Regulations and EEA Guide.
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Version	Reviewed By.	Review Date	Reason
			5.2.2 Colour code for pilot conductors. 5.4.1 <i>General</i> – requires cables to be laid in accordance with <i>CoP for Transportation Corridors</i>. 5.4.3 <i>Pillar Boxes</i> – must comply with 393S107. 5.4.4 Reference to LV Network Operating Procedures standard. 5.5.1(8) <i>Pole Top Supply</i> – labelling must comply with 393S004. 5.6 <i>Compliance with EEA Guide</i>. 6.1 <i>Metering Requirements</i>- altered to require compliance with requirements of 393S007. Deleted clause 6.3 <i>Privately Owned Streetlighting</i> – requirements already prescribed in 3.4.2 <i>Streetlighting Connections</i>. New clause 6.4 <i>Metering Of Powerco Assets</i> added. Points of Supply and Connection changed in <i>Appendix's D and G</i>. Amended diagrams in the Appendices to align with terminology from the Electricity Act, Electricity Regulations and Electricity Industry Participation Code. Various references to 'Point of Connection' changed to 'Point of Supply' or 'Point of Isolation' (Sections: 3.2, 3.3, 3.6).
8	S. Corbitt	18/11/2014	Changes requested by CIW to clarify multiple connections on common parcel of land. s1.3.2 added AS/NZS 61000.3.6 s1.4 <i>Definitions</i> added Berm, Carriageway, Multiple Tenancy Installation, PCC added 61000.3.6, Road, Road Corridor. s3.6 <i>Multiple Connections and Isolation</i> split into two Subsections: s3.6.1 <i>General Requirements for Multiple Connections</i> (additional information added), <i>NEW</i> s3.6.2 <i>Multiple Tenancy Installations</i> added. s4.4 <i>Harmonic Disturbances</i>, additional reference to AS/NZS 61000.3.6:2012 <i>Electromagnetic Compatibility</i>. s4.9 AS/NZS 61000.3.6: <i>referenced</i> s6.1 <i>Metering Requirements</i> additional note regarding multiple use of an installation. <i>NEW</i> s7 <i>Streetlighting</i> section added. Appendix I and L, additional note regarding multiple installations and tenancy. s8 <i>Appendices</i> - changes made to sketches by altering terminology and adding Notes. s8, Appendix G, H, I, J and L note added regarding multiple installations and tenancy.

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Version	Reviewed By.	Review Date	Reason
9	R. Coleman	31/ 3/2021	Scheduled routine BMS review. Contents also aligned with contents of <i>393S010 Overhead Network Construction Standard</i> and <i>393S011 Underground Network Construction Standard</i>. Changes made of significance included: s1.1 things not covered in 393S007 added (e.g., DG) s1.2 referenced <i>370S006 Powerco Predecessors</i>, deleted references to parts 1 to 3 of SM-EI (updates for online version), referenced EA Memo s1.3 updated lists of referenced Acts and documents s1.4 some definitions updated / tweaked for clarity s2.1 updated requirements to be same as 393S010 and 393S011 (especially the testing and commissioning requirements) s2.2 connection prerequisites are as prescribed in 393S010 and 393S011 (393S007 (v8) requirements have been deleted) s3.2 new ICP before 7/10/2002 will now be grandfathered s3.4.1 fuse sizes prescribed for unmetered connections s3.4.7 disconnections shall be as prescribed in <i>170S002</i>, <i>170S002</i>, <i>170S007</i> and 393S010 and 393S011 NEW 3.4.8 Customer Dedicated Transformer Connections added. 393S007 points to requirements stated in in 393S008 and 393S009 s3.7 DG <i>deleted this section is not covered in this standard</i> s3.9 earthing systems shall comply with requirements of <i>393S017B Permanent Earthing – Part B – Construction Requirements</i> NEW 3.12 As-built processes prescribed NEW 3.13 Embedded Networks clause added that references <i>393S097 Connection Of An Embedded Network To Powerco's Network</i> s4.5 noise must comply with New Zealand statutes s4.6 referenced move to Decabit receivers and requirements of <i>370S017 Load Control Channel Standard</i> s4.6.4 deleted tables and referenced <i>370S017</i> s4.10.1 process to move to decabit system outlined s5.1.2 added requirements for streetlight and water heater pilots, referenced move to decabit receivers and <i>370S017</i> s5.3.1 clearances and depths are to be as stated in 393S011 s5.5 easements shall comply with <i>392S011 Powerco Networks Land Access and Easement Policy</i> s6.1 testing shall be undertaken as prescribed in 393S011. Powerco's required metering arrangements stated. HV switchgear design requirements stated s7.1 referenced <i>370S006 Powerco Predecessors - Electricity and Gas Networks</i>

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			s7.2 referenced 393S079B and 393S109B plus aligned with requirements of 393S010 and 393S011 s8.11 removed LV service box located in the ROW s8.12 adjusted consumer supplies to come from standalone MP s8.13 Electricity Authority Memo dated 8Jan2021 added
10	G Lim B Wykes V Hirani	23/12/2025	Update Powerco-approved Contractors to be simply called Powerco contractors as part of the new Customer Delivery Service model. Remove reference to Chief Engineer as the role no longer exists. s3.11 As built process – standard updated s4.2 voltage fluctuation – added the new regulatory voltage range of 230v +/- 10% s4.8 voltage unbalance – added the requirement for voltage unbalance at LV not to exceed 2%
11	G Lim B Wykes V Hirani D Garner C Nisbet	12/05/2026	New additions to comply with the Code changes introduced by Electricity Authority's Network Connections and Connection Pricing projects. s1.1 Scope - expanded scope to cover the changes introduced in Part 6B of the Code, and the application of the new connection pricing tiers. s1.4 Definitions - expanded to cover new terms introduced by connection pricing tiers, and part 6B. s3.13 Utilising existing network - New section added encouraging maximising the use of existing assets to support customer connection, ensuring the process for an option's selection is clearly documented. s3.14 Applying minimum scheme - Introduces the requirements of establishing a minimum scheme option for a connection. s3.15 Pioneer scheme - Introduces the requirements of establishing a Pioneer scheme to enable a customer connection.