



Western Australian Service and  
Installation Requirements | April 2023



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## Document Control

### Endorsement/Approvals

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### Record of revisions

Revision no.	Application Date	EDM pdf Version	Revised by	Description
Initial	June 2010	8022821	R Hale	The Distribution Connection Manual supersedes the Transitional Connection Manual.
Version 2	February 2011	27130164	R Hale	Various Amendments. Refer to the WADCM Appendices.
Version 3	March 2012	27130164	R Hale	Various Amendments. Refer to the WADCM Appendices.
Version 4	June 2013	27130164	B Blechynden R Hale	Various Amendments. Refer to the WADCM Appendices.
Version 5	January 2015	27130164	R Hale	Various Amendments. Refer to the WADCM Appendices.
Version 6	March 2015	27130164	R Hale	Consolidated edition incorporating addendum 1 . Refer to the WADCM Appendices.
	December 2015	27130164	R Hale	Consolidated edition incorporating addendum 2. Refer to the WADCM Appendices.
Version 7	October 2016	27130164	R Hale	Consolidated edition incorporating addendum 3. Refer to the WADCM Appendices.
Version 8	May 2019	27130164	A Seneviratne R Hale	Consolidated edition incorporating addendum 4. Refer to the WADCM Appendices.
Version 9	February 2020	27130164	R Hale	Consolidated edition incorporating addendum 5. Refer to the WADCM Appendices.
Version 10	August 2021	27130164	A Nguyen R Hale	New edition
	November 2021			Consolidated edition incorporating addendum 1. Refer to the WASIR Appendices
	June 2022			Consolidated edition incorporating addendum 2. Refer to the WASIR Appendices
	April 2023			Consolidated edition incorporating addendum 3. Refer to the WASIR Appendices

**Documents referenced in this document**

EDM #	Title of document
	Refer to Section 1

**Other documents that reference this document**

EDM #	Title of document
	Refer to Section 1

**Reference groups**

Internal Sections Horizon Power / Western Power	Reference groups
Connections (Energisation)	Australian Institute of Architects
Design Engineering	Consult Australia
Customer Solutions	Building & Energy (DMIRS)
Operations	Housing Industry Association
Metering and Inspection	Master Builders Association
Network Operations	Master Electricians Association
Training Services Section	National Electrical Communications Association
Primary Response Teams	National Electrical Switchboard Manufacturers Association
Safety Compliance and Investigations	Training providers
WA Electrical Inspectors (WAEI)	

**Notification list**

Position/title
Reference groups
Document subscribers
Relevant training bodies

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## Foreword

Welcome to this Sixth edition 3<sup>rd</sup> revision of the WA Distribution Connections Manual, now known as the **Western Australian Service and Installation Requirements (WASIR)**.

The document has been rebadged and restructured to align with a changing energy distribution and regulatory environment, encompassing both consumption and generation *network connection requirements*.

The intended purpose of these *requirements* is to provide a comprehensive point of reference for industry and the community, where an electrical connection of a *consumer's installation* is required to the *distribution networks* of:

- Horizon Power's Pilbara Grid and Non-Interconnected Systems (NIS).
- Western Power's South West Interconnected System (SWIS).

Western Power and Horizon Power recognised that a consolidated document was needed to provide a clear unambiguous understanding of the connection *requirements* in a format and language familiar to *electrical consulting/contracting* industries, builders, *architects*, and *consumers*.

The content is intended to:

- Provide the necessary information to enable users to comply with both statutory/*network requirements* and obligations;
- Incorporate commonly understood and universally accepted language;
- Consolidate all the connection reference material into a single document; and
- Provide a format that is easily accessible for all users.

The document has been constructed using both technical and non-technical sections including diagrams and flow charts to aid the reader in achieving the required connection outcome. This edition supersedes all previous versions of the WADCM, the Transitional connections manual and Horizon Power/Western Power material contained within the redundant WA Electrical Requirements section 13.

Horizon Power and Western Power would like to acknowledge the valuable support and contribution made during the development of this document by officers and personnel from industry, the community and both *network operators*.

The authors hope you find these revised *requirements* informative and easy to read. Feedback on any aspect of the following content is welcome and valued. We look forward to your support and involvement in the development of future editions of this document.

**Engineering & Project Delivery**  
**Horizon Power**

**Grid Transformation**  
**Western Power**

## Quick reference guide

These *requirements* provide relevant and related information associated with a *consumer's* residential or commercial connection to a *network operator's distribution network*.

It is understood that not all users of this document will have an electrical background therefore the content has been constructed in such a way so as to assist and guide both technical and non-technical readers to those [sections](#) of specific or relevant interest.

Although the following groupings have been provided to assist the reader, all [sections](#) of the document *shall* be considered and addressed to obtain a *network* connection.

### ➤ For all users

[Sections 1 to 3](#) contain definitions, document management processes and relevant legislation specific to industry and the community.

### ➤ Architects, Builders, Consumers and Designers.

[Sections 4, 5, 6, 7, 9](#), and parts of [section 11](#), provide specific detailed information on electrical safety together with guidance on how *consumers* are to be metering (location, tariffs etc.), what the connection should look like and what needs to be completed by the various parties to achieve that connection.

### ➤ Electrical Consultants, Contractors, Designers and Workers

[Sections 8, 10, 11, 12, 13, 14](#) and [15](#) contain specific technical content describing the *requirements* that *must* be satisfied before a *network operator* will permit a connection to their respective *distribution networks*. Additional information is also provided on *consumer* obligations to achieve and maintain a connection.

### ➤ Hyperlinks

**Section 1 [Definitions and abbreviations](#)** - contains definitions and explanations of commonly used terms, phrases and references contained throughout the document.

**Section 2 [Document management](#)** - provides detail on the date of application, together with instructions on how to provide feedback.

**Section 3 [Introduction \(scope and legislation\)](#)** - summarises the various pieces of State and Commonwealth legislation that underpin both *network* and industry activity.

**Section 4 [Roles and responsibilities](#)** - describes the regulatory, contractual and practical roles that exist and to be fulfilled by each party to ensure the effective connection, supply, distribution, consumption and generation of electricity throughout the electricity supply chain.

**Section 5 [Contact details](#)** - is a useful summary of contact details for both Horizon Power and Western Power.

**Section 6 [General requirements](#)** - contains information on general safety, clearances from overhead and underground electrical cables, *site* preparation, easements, *network* equipment and industry connections programs.

**Section 7 [Connection and disconnection applications](#)** - contains guidance on applicable processes for either a new or upgraded connection or the removal of an existing *network* connection. Content covers both *low and high voltage* installations as well as renewable energy connections.

**Section 8 [Notices and notification of electrical work](#)** - outlines the statutory obligations and notices used by the electrical industry prior to and on completion of electrical work. These processes form the basis of the regulatory system and the foundation of the industry safety and compliance structure.

**Section 9 [Charging policies](#)** – provides guidance on the applicable *network operator* policies.

**Section 10 [Supply characteristics](#)** - summarises the operational characteristics of both Horizon Power and Western Power's *distribution networks* including information on power quality, system *voltages*, fault levels, harmonics, flicker and *consumer* related information on sensitive supplies and disturbing *loads*.

**Section 11 [Metering](#)** - provides information on the various *metering installation* (systems) on offer to *consumers* and *generators* including both informative and technical information on metering types, locations, connection methods for whole current, current transformer, remote reading and renewable systems.

**Section 12 [Low voltage distribution systems](#)** - specifies the *requirements* for the connection of a *consumer's low voltage electrical installation* via either an overhead or underground *network connection service*. Includes detail on connection policy; number, type, and location of connection equipment; poles; *pillars*; *pits*; temporary builders supplies; and unmetered connections.

**Section 13 [High voltage distribution systems](#)** - details the *requirements* for the connection of a *consumer's large scale and high voltage electrical installations* including available *voltages*, submission processes, connection methods and arrangements, inspection, testing, switching, access and maintenance.

**Section 14 [Substation installation requirements](#)** - describes the *requirements* and *consumer* responsibilities for new and upgraded *substation* installations and connections including information on *substation* types, and locations.

**Section 15 [Alternative & supplementary systems \(Generation\)](#)** - summarises the *requirements* for *stand-alone*, standby, emergency or renewable *generation systems*, inclusive of summarised information on *distributed energy resource* systems, *safety requirements*, switching and *consumer* responsibilities. Specific technical detail on *network operator embedded generation requirements* is contained within their subject specific guidelines.

**Note:** It is the hope of participating *network operators* that this document assists both *consumers* and industry gain a better understanding of the roles, responsibilities, processes, and *technical requirements* to facilitate and maintain a **safe, reliable** *consumer* connection.

## Table of Contents

<b>1</b>	<b>Definitions and abbreviations</b> .....	<b>35</b>
1.1	Definition (origin) key .....	35
1.2	Definitions .....	35
1.3	Abbreviations .....	43
1.4	References .....	45
1.4.1	Acts and Regulations .....	45
1.4.2	Codes and guidelines published by DMIRS (Building and Energy) .....	46
1.4.3	Codes and guidelines published by DMIRS (Worksafe) .....	46
1.4.4	Guidelines published by others .....	46
1.5	Documents published by Standards Australia .....	47
1.6	Technical requirements.....	48
1.6.1	Horizon Power’s published technical requirements .....	48
1.6.2	Western Power’s published technical requirements .....	49
<b>2</b>	<b>Document management</b> .....	<b>51</b>
2.1	Disclaimer .....	51
2.2	Document ownership and administration .....	51
2.3	Copyright .....	51
2.4	Application .....	51
2.5	Publication .....	52
2.5.1	Application date .....	52
2.5.2	Printing and updates .....	52
2.6	Enquires and contacts .....	52
2.6.1	Horizon Power .....	52
2.6.2	Western Power .....	52
2.7	Review and updates .....	52
2.7.1	Seeking assistance with these requirements .....	53
2.7.2	Consideration and assessment.....	54
2.7.3	Website for (FAQs) .....	54
2.7.4	Amendments and consultation.....	54
2.7.5	Approval and consolidation .....	54
2.7.6	Publication and notification of changes .....	54
2.8	Amendment information .....	54
2.9	WASIR Management committee .....	54
2.10	Reference groups .....	55
<b>3</b>	<b>Introduction</b> .....	<b>57</b>
3.1	Purpose .....	57

3.2	Scope of these requirements .....	57
3.3	Users .....	57
3.4	Compliance with these requirements .....	58
3.5	Innovation and variations .....	58
3.5.1	Horizon Power .....	58
3.5.2	Western Power .....	58
3.6	Compliance with Acts and Regulations .....	58
3.6.1	Electricity Corporations Act 2005 .....	59
3.6.2	Electricity Act 1945 .....	59
3.6.2.1	Electricity (Licensing) Regulations 1991 .....	59
3.6.2.2	Electricity (Network Safety) Regulations 2015 .....	59
3.6.2.3	Electricity Regulations 1947.....	60
3.6.3	Electricity Industry Act 2004.....	60
3.6.3.1	Electricity Networks Access Code 2004.....	60
3.6.3.2	Small User Customer Code .....	60
3.6.3.3	Electricity Industry (Obligation to Connect) Regulations 2005.....	60
3.6.3.4	Electricity Industry Metering Code 2012.....	61
3.6.4	Energy Coordination Act 1994 .....	61
3.6.5	Energy Operators Powers Act 1979.....	61
3.6.6	Work Health and Safety Act 2020 .....	61
3.6.6.1	Work Health and Safety Regulations 2022 .....	62
3.6.7	National Standard for Construction Work.....	62
3.7	Necessity for employing a licensed person .....	62
3.8	Offences .....	62
3.9	Testing.....	63
3.10	Access.....	63
3.11	Inspection of a consumer's premises .....	63
<b>4</b>	<b>Roles and responsibilities.....</b>	<b>65</b>
4.1	Energy reform (disaggregation).....	65
4.2	Regulatory, contractual and practical relationships .....	65
4.3	Electricity supply chain.....	66
4.3.1	Generators.....	66
4.3.2	Network Operators.....	66
4.3.3	Retailers .....	66
4.3.4	Consumers .....	67
4.3.5	Consumer's agent / representative .....	67
4.3.6	Electrical contractors.....	67

4.3.7	Department of Mines, Industry Regulation and Safety .....	68
4.3.7.1	Building and Energy .....	68
4.3.7.2	Energy Policy WA.....	68
4.3.7.3	WorkSafe.....	68
4.3.8	Economic Regulation Authority (ERA) .....	68
4.3.9	Australian Energy Market Operator (AEMO) .....	69
4.4	Contestable accounts .....	69
4.4.1	Pilbara Grid and NIS networks (Horizon Power) .....	69
4.4.2	SWIS distribution areas (Western Power) .....	69
4.4.2.1	Non-contestable accounts .....	69
4.4.2.2	Contestable accounts .....	69
4.5	Dispute resolution .....	70
4.5.1	Horizon Power .....	70
4.5.2	Western Power .....	70
4.5.3	Unresolved issues .....	70
4.5.4	Distribution connection resolution pathway .....	71
<b>5</b>	<b>Contact details .....</b>	<b>73</b>
5.1	Horizon Power contact details.....	73
5.1.1	West Pilbara Head office .....	73
5.1.2	Bentley Office .....	73
5.1.3	Other Regional offices .....	73
5.1.4	Complaints.....	74
5.1.5	Feedback.....	74
5.2	Western Power contact details.....	74
5.2.1	Head Office.....	74
5.2.2	Postal addresses .....	74
5.2.3	How to report a problem .....	75
5.2.4	Calls from mobile phones.....	75
5.3	General contacts.....	75
5.3.1	Dial Before You Dig .....	75
5.3.2	Electricity retailers.....	75
5.3.3	Electrical industry licensing.....	75
5.3.4	Energy and Water Ombudsman.....	75
<b>6</b>	<b>General requirements.....</b>	<b>77</b>
6.1	Introduction.....	77
6.2	Safety policy statement.....	77
6.3	Safe operational procedures .....	77

6.3.1	Consumer installations and non-network infrastructure .....	77
6.3.2	Safety in design .....	78
6.3.3	Network operational clearances .....	78
6.3.3.1	Horizon Power safety guidelines.....	78
6.3.3.2	Western Power safety guidelines.....	78
6.3.4	Blasting near overhead/underground network infrastructure .....	78
6.4	Underground (excavation).....	79
6.4.1	Horizon Power guidelines .....	79
6.4.2	Western Power guidelines .....	79
6.5	Overhead powerlines .....	79
6.5.1	Horizon Power guidelines .....	79
6.5.2	Western Power guidelines .....	79
6.5.3	Building and structural clearances near powerlines .....	80
6.5.3.1	Building/structural encroachment.....	80
6.5.4	Vegetation .....	80
6.6	Road reserve allocation .....	81
6.7	Private property .....	82
6.7.1	Survey levels and pegs.....	82
6.8	Easements and covenants.....	82
6.8.1	Easements.....	82
6.8.1.1	Section 167 of the Planning and Development Act 2005 .....	83
6.8.1.2	Section 136C of the Transfer of Land Act 1893 .....	83
6.8.1.3	Section 33 of the Strata Titles Act 1985.....	83
6.8.1.4	Section 144 of the Land Administration Act 1997 (Crown Land) .....	83
6.8.1.5	Energy Operators (Powers) Act 1979 (Easement in Gross).....	84
6.8.2	Restrictive covenants.....	84
6.8.2.1	Section 129BA of the Transfer of Land Act 1893 (Fire/noise zones).....	84
6.8.3	Notifications Section 70A of the of the Transfer of Land Act 1893.....	84
6.8.3.1	Multiple points of connection (supply) .....	84
6.8.3.2	No network supplies .....	84
6.8.4	Assistance with easements, notifications and restrictive covenants .....	85
6.9	Strata schemes.....	85
6.9.1	Dispute negotiation and mediation .....	85
6.10	Cable ducts.....	86
6.10.1	Materials .....	86
6.10.2	Installation .....	86
6.10.3	Supervision of installation .....	87

6.11	Removal and reinstatement .....	87
6.12	Existing consumers and affected parties.....	87
6.13	Environmental, heritage and safety requirements .....	88
6.13.1	SWIS network extensions .....	88
6.13.1.1	Pilbara Grid / NIS network extensions .....	89
6.13.2	Applicant's project.....	89
6.14	Equipment .....	89
6.14.1	Distribution Design Catalogue (DDC).....	90
6.14.2	Non-standard equipment .....	90
6.14.3	Equipment sold by Western Power .....	90
6.15	Artwork on network assets.....	90
6.15.1	Horizon Power equipment.....	90
6.15.2	Western Power equipment.....	90
6.16	Decorative fixtures, signs and banners on assets .....	91
6.16.1	Horizon Power equipment.....	91
6.16.2	Western Power equipment.....	91
6.17	Labelling .....	91
6.18	Locks .....	91
6.19	Industry self-connection programs .....	92
6.19.1	Horizon Power .....	92
6.19.2	Western Power .....	92
6.20	Subdivisions .....	92
6.20.1	Horizon Power UDS requirements .....	92
6.20.2	Western Power UDS requirements .....	92
6.21	Asbestos products .....	93
6.21.1	General.....	93
6.21.2	Safety precautions .....	93
6.21.3	Panels.....	93
6.21.4	Asbestos fibre pillars.....	94
6.21.5	Disposal.....	94
<b>7</b>	<b>Connection and disconnection applications .....</b>	<b>97</b>
7.1	General.....	97
7.2	Conditions of connection.....	97
7.3	Connection capacity availability .....	97
7.4	When to contact the network operator.....	98
7.5	Contract administration .....	98
7.5.1	Appointment of electrical consultant/contractor .....	98

7.5.2	Project management.....	98
7.5.3	Timing and scheduling.....	98
7.5.4	Warranty of applicant work.....	99
7.5.5	Documentation requirements.....	99
7.6	Standard connection service (supply).....	99
7.6.1	Three-phase supply availability.....	100
7.6.1.1	Horizon Power.....	100
7.6.1.2	Western Power.....	100
7.6.2	Horizon Power systems.....	100
7.7	Distribution connection applications.....	102
7.7.1	Residential.....	102
7.7.1.1	Standard residential applications.....	102
7.7.1.2	Non-standard residential applications.....	102
7.7.2	Commercial, industrial and primary production.....	102
7.7.2.1	Non-standard commercial applications.....	103
7.7.3	Rural and semi-rural connections.....	103
7.7.3.1	Horizon Power country and rural applications.....	103
7.7.3.2	Western Power country and rural applications.....	103
7.7.4	Temporary supplies.....	103
7.7.4.1	Temporary supply applications.....	104
7.7.5	Unmetered supply.....	104
7.7.5.1	Unmetered supply applications.....	104
7.8	Distributed energy resources (DER).....	104
7.8.1	Embedded generation (EG) installations.....	104
7.8.1.1	Embedded generation applications.....	105
7.8.1.1.1	Horizon Power application process.....	106
7.8.1.1.2	Western Power application process.....	106
7.8.1.2	Non-approved systems.....	106
7.8.1.3	Metering requirement applications.....	106
7.8.2	Generation installations.....	107
7.8.2.1	Horizon Power application process.....	107
7.8.2.2	Western Power application process.....	107
7.8.3	Stand-alone power supply connections.....	107
7.8.3.1	Horizon Power applications.....	107
7.8.3.2	Western Power applications.....	107
7.9	Transmission connections.....	108
7.9.1.1	Horizon Power application process.....	108

7.9.1.2	Western Power application process .....	108
7.10	Types of connection methods .....	108
7.10.1	Underground network connection arrangements.....	108
7.10.2	Overhead network connection arrangements.....	110
7.11	Types of disconnections applications .....	111
7.11.1	Account termination .....	111
7.11.2	Disconnection arrangements .....	111
7.11.2.1	Applications .....	111
7.11.3	Temporary disconnections .....	111
7.11.3.1	Disconnection process.....	112
7.11.3.2	Connection process .....	112
7.11.3.3	Connection .....	113
7.11.3.4	Missing disconnection tags .....	113
7.11.4	Demolition disconnection .....	113
7.12	Supply upgrades.....	114
7.13	Conversion to underground power .....	114
7.14	Relocations.....	115
7.15	Subdivisions .....	115
7.16	Network and equipment locations .....	115
7.17	Transmission connections.....	115
7.18	Horizon Power applications.....	116
7.18.1	General.....	116
7.18.2	Applications .....	116
7.19	Western Power applications.....	117
7.19.1	General.....	117
7.19.2	Applications .....	117
7.19.3	Processing applications .....	117
<b>8</b>	<b>Notices and notification of electrical work .....</b>	<b>119</b>
8.1	Statutory notices .....	119
8.1.1	Notifiable work .....	119
8.1.2	Preliminary notice .....	119
8.1.3	Completion notice .....	120
8.1.4	Electrical safety certificate.....	120
8.2	Lodgement of notices.....	121
8.2.1	Connected to a network .....	121
8.2.2	Not connected to a network .....	121
8.3	'eNotice' lodgement system .....	121

8.4	Date of initial energisation.....	121
8.5	Notices and tags.....	121
8.5.1	Inspector’s advisory note.....	122
8.5.2	Inspector’s order.....	122
8.5.3	Defect notification.....	122
8.5.4	Consumer fault reports and service calls.....	123
8.5.5	Temporary disconnect tag.....	123
<b>9</b>	<b>Charging policies.....</b>	<b>125</b>
9.1	Introduction.....	125
9.2	Network fees.....	125
9.2.1	Design fees.....	125
9.2.1.1	Horizon Power design and quotation.....	125
9.2.1.2	Western Power design and quotation.....	126
9.2.2	Re-Quote fees.....	126
9.3	Charging policies.....	126
9.3.1	Subdivisions.....	127
9.3.2	Individual consumer (standard connection service).....	127
9.3.3	Individual consumer (non-standard service or non-primary producer).....	127
9.3.4	Non-urban resident and primary production consumers.....	127
9.3.5	Overhead to underground conversions (pole to pillar).....	128
9.3.6	Builders and temporary supplies.....	128
9.3.7	Network relocations.....	129
9.3.8	Stand-alone power supplies.....	129
9.3.9	Unmetered supplies.....	129
9.3.10	Electric vehicle chargers.....	129
9.4	Equipment hire or sale.....	129
9.5	Payment and refunds.....	130
9.6	Charges and conditions.....	130
<b>10</b>	<b>Supply characteristics.....</b>	<b>133</b>
10.1	Introduction.....	133
10.1.1	Horizon Power electricity network.....	133
10.1.2	Western Power electricity network.....	133
10.2	Electricity network.....	133
10.3	Supply.....	133
10.3.1	Nominal voltage.....	134
10.3.2	Nominal frequency.....	134
10.4	Network performance parameters.....	134

10.4.1	Horizon Power .....	135
10.4.2	Western Power .....	135
10.5	Supply loading .....	135
10.5.1	Obligations.....	135
10.5.2	Maximum demand and generation.....	135
10.5.3	Noncompliance .....	136
10.6	Prospective short circuit current.....	136
10.6.1	Horizon Power fault levels.....	137
10.6.2	Western Power fault levels.....	137
10.6.2.1	Western Power fault levels for LV supplies > 800 Amps .....	137
10.7	Balanced electrical connections.....	137
10.8	Power factor .....	137
10.8.1	Horizon Power - power factor limits.....	138
10.8.2	Western Power - power factor limits.....	138
10.8.3	Ripple control and blocking systems .....	138
10.9	Voltage fluctuations.....	138
10.9.1	Voltage transients .....	139
10.9.2	Flicker .....	139
10.9.3	Harmonics .....	139
10.9.4	Volt drop .....	140
10.9.5	Neutral voltage rise .....	140
10.9.6	Horizon Power voltage fluctuations limits .....	141
10.9.7	Western Power voltage fluctuations limits .....	141
10.10	Supply reliability.....	141
10.10.1	Planned supply interruptions.....	141
10.10.2	Unplanned supply interruptions.....	141
10.10.3	Emergency response processes.....	142
10.10.3.1	Horizon Power .....	142
10.10.3.2	Western Power .....	142
10.11	Consumers' responsibilities .....	142
10.11.1	General.....	142
10.11.2	Using equipment from outside Australia.....	142
10.11.3	Purchasing and protection of sensitive equipment .....	142
10.11.4	Consumer with disturbing loads .....	143
10.11.5	Starting currents .....	143
10.11.5.1	Single-phase (240V).....	143
10.11.5.2	Three-phase (415V).....	143

10.11.5.3	Single-phase appliances.....	143
10.11.5.4	Rural single/split-phase loads (at 240 or 480V).....	144
10.11.6	Electric vehicle supply equipment (EVSE) .....	144
10.11.7	Insurance and warranty .....	144
10.12	Consumer supply critical installations .....	145
10.12.1	Residential life support sensitive consumers.....	145
10.12.1.1	Horizon Power operated networks .....	145
10.12.1.2	Western Power operated networks .....	145
10.12.2	Commercial/industrial sensitive consumers .....	145
10.12.2.1	Horizon Power operated networks .....	145
10.12.2.2	Western Power operated networks .....	145
10.13	Manufacturers' responsibilities .....	146
10.14	Claims against a network operator.....	146
10.14.1	Horizon Power claims .....	146
10.14.2	Western Power claims .....	146
<b>11</b>	<b>Metering.....</b>	<b>149</b>
11.1	General metering arrangements .....	149
11.1.1	Metering obligations.....	149
11.1.2	Alterations and additions.....	150
11.1.2.1	Existing consumer rewirable fuses.....	150
11.1.3	Whole current meter neutral reference link .....	150
11.1.4	Maintenance, repairs and replacement .....	151
11.1.5	Metering installation .....	151
11.1.6	Installing metering equipment .....	151
11.1.7	Unauthorised access to metering equipment .....	151
11.1.8	Responsibilities.....	152
11.1.8.1	The consumer.....	152
11.1.8.2	The electrical contractor .....	152
11.1.8.3	The network operator.....	152
11.2	Tariffs and metering.....	153
11.3	Meter panels.....	153
11.3.1	Size .....	153
11.3.2	Installation .....	153
11.3.3	Materials .....	153
11.3.4	Wiring holes.....	153
11.3.5	Wiring .....	154
11.3.5.1	Magnetic Screening.....	154

11.3.6	Panel arrangements.....	155
11.3.7	Fixing and sealing.....	155
11.3.8	Labelling .....	155
11.4	Metering equipment/protection switchboards and enclosures. ....	156
11.4.1	General.....	156
11.4.2	Surrounds .....	156
11.4.3	Enclosures/cubicles .....	157
11.4.4	Switchboard assemblies .....	157
11.4.5	Clearances .....	158
11.4.6	Installation .....	158
11.4.7	Earthing .....	158
11.4.8	Locks, locking systems and viewing windows .....	159
11.4.9	Labelling .....	159
11.4.9.1	Single dwelling.....	159
11.4.9.2	Multiple dwelling .....	159
11.5	Metering equipment location .....	160
11.5.1	General.....	160
11.5.2	Access requirements .....	161
11.5.2.1	Single domestic/commercial lots.....	161
11.5.2.2	Battle-axe block lots.....	162
11.5.2.3	Strata developments.....	162
11.5.2.4	Multiple domestic/commercial lots .....	162
11.5.2.5	Large commercial/industrial lots .....	162
11.5.2.6	Semi-rural and rural lots .....	162
11.5.2.7	Remotely located.....	162
11.5.2.8	Public open space and road reserves.....	163
11.5.2.9	Rail corridors/reserves.....	163
11.5.3	Unacceptable locations.....	164
11.5.4	Examples of acceptable locations .....	164
11.6	Equipment .....	167
11.6.1	Prohibited connections.....	167
11.6.2	On panels and within enclosures .....	167
11.6.3	Links .....	168
11.6.3.1	Active and neutral service link(s) .....	168
11.6.3.2	Neutral reference link(s) (NRL) .....	168
11.6.4	Metering protection and main switch or switches .....	168
11.6.4.1	Service protection device.....	169

11.6.4.2	Meter protection device .....	170
11.6.4.3	Installation main switch.....	170
11.6.4.4	Additional requirements for sole use and district substations .....	171
11.6.4.5	Additional requirements for LV connections.....	171
11.6.4.6	Additional requirements for HV connections .....	171
11.6.5	Sealing of meter equipment .....	171
11.6.5.1	Horizon Power reporting .....	171
11.6.5.2	Western Power reporting .....	171
11.7	Fault current levels for metering equipment .....	171
11.8	Mixed metering installation (systems) and arrangements.....	171
11.8.1	General metering types.....	172
11.8.1.1	Horizon Power metering types.....	172
11.8.2	Un-acceptable metering types .....	173
11.8.3	Existing meter locations .....	173
11.9	Whole current metering.....	173
11.9.1	General.....	173
11.9.2	Meter panels.....	173
11.9.3	Panel wiring configurations .....	174
11.9.4	Protection .....	175
11.9.5	Conversion of subsidiary meters to master meters .....	175
11.10	Load and generation control .....	175
11.11	Multiple master metering.....	175
11.11.1	General.....	175
11.11.2	Installation requirements.....	175
11.11.3	Panels.....	176
11.11.4	Meters.....	176
11.11.5	Wiring configurations .....	176
11.11.6	Protection .....	179
11.11.7	Commercial installations .....	180
11.11.8	Alternative metering arrangements for ancillary accommodation .....	181
11.12	Distributed master metering .....	181
11.12.1	General.....	181
11.12.2	Installation requirements.....	181
11.12.3	Panels.....	182
11.12.4	Wiring configurations .....	182
11.12.5	Protection .....	184
11.12.6	Converting to HV meter reading.....	185

11.13	LV current transformer (CT) metering .....	185
11.13.1	General.....	185
11.13.2	Sourcing of materials .....	186
11.13.3	Meter panels.....	186
11.13.4	Wiring configurations .....	186
11.13.5	Communications equipment for LV CT meter installations .....	187
11.13.6	Protection .....	187
11.13.7	Current transformers.....	189
11.13.7.1	Current transformer mounting and access.....	190
11.13.7.2	Current transformer removable busbar links insert .....	190
11.13.8	Voltage circuit protection.....	190
11.13.8.1	Fault current limiters .....	191
11.13.8.2	Potential fuses .....	191
11.13.9	Safety .....	191
11.13.10	Conversion of whole current meters to CT metering .....	191
11.13.10.1	Load increase .....	191
11.13.10.2	No load increase .....	192
11.13.11	Multiple master CT metered installations .....	192
11.14	Automated meter reading systems.....	193
11.15	HV metering.....	194
11.15.1	High Voltage metered installations.....	194
11.15.2	Meter installations.....	194
11.15.3	HV communication links.....	194
11.15.4	High Voltage master metering installation (system) .....	195
11.16	Metering for inverter energy systems .....	195
11.17	Subsidiary metering guidelines .....	195
11.17.1	Installation and maintenance .....	196
11.17.2	Purchasing and supply.....	196
11.17.3	Sub meter reading .....	196
11.18	Relocation of existing metering point .....	196
11.19	National meter identifier (NMI) .....	197
11.20	Meter and installation energisation.....	197
11.21	Meter interference.....	197
11.22	Meter distribution .....	198
11.22.1	Horizon Power .....	198
11.22.2	Western Power .....	198
11.23	Emergency conditions.....	198

<b>12</b>	<b>Low voltage distribution systems .....</b>	<b>201</b>
12.1	Services .....	201
12.2	Type of connection .....	201
12.2.1	Network operator connection policy .....	201
12.2.1.1	Horizon Power policy .....	201
12.2.1.2	Western Power policy .....	202
12.2.1.3	Lots created during or after 2001 .....	202
12.2.2	Definition of city, metropolitan area or town .....	203
12.2.3	Connection of services.....	203
12.2.4	Number of connections .....	203
12.2.4.1	Per lot (Parcel of Land).....	203
12.2.4.2	Per underground service .....	203
12.2.4.3	Easements and restrictive covenants .....	204
12.2.5	Overhead point of supply (connection).....	204
12.2.6	Underground point of supply (connection).....	205
12.2.7	Location .....	205
12.2.8	Access .....	206
12.3	Multiple points of connection (supply) .....	206
12.3.1	Consumer responsibilities .....	207
12.3.2	Zone diagrams.....	207
12.4	Overhead distribution systems.....	208
12.4.1	General.....	208
12.4.2	Point of attachment (PoA).....	209
12.4.3	PoA suitability .....	209
12.4.4	PoA access.....	209
12.4.5	PoA location .....	210
12.4.5.1	Service cables crossing an adjoining property .....	212
12.4.5.2	Encroachment .....	212
12.4.5.3	PoA position on structures .....	212
12.4.5.4	PoA on poles .....	214
12.4.6	Service brackets .....	214
12.4.6.1	Standard service bracket (Example 1, 2, and 3) .....	214
12.4.6.2	Long span raiser bracket .....	215
12.4.6.3	ABC universal brackets .....	215
12.4.7	Consumer poles.....	215
12.4.7.1	Location.....	216
12.4.7.2	Construction .....	216

12.4.7.3	Horizon Power requirements .....	218
12.4.7.4	Western Power requirements .....	218
12.4.7.5	Common consumer poles.....	218
12.4.8	Equipment on poles .....	218
12.4.9	Corrosion resistance.....	219
12.4.10	Point of supply (connection).....	219
12.4.10.1	Mains connection boxes .....	219
12.4.10.2	Boundary fuses.....	220
12.4.11	Prevention of conductor insulation damage .....	221
12.4.12	Spans and clearances .....	221
12.4.13	Disconnections, repairs, replacement, or upgrades .....	221
12.4.13.1	Application.....	221
12.4.13.2	Compliance costs .....	222
12.4.14	Temporary disconnections .....	222
12.4.15	Swimming pools, spas and water features .....	223
12.4.16	Temporary arrangement in the event of a failed service.....	223
12.4.17	Existing consumers and affected parties.....	223
12.4.18	Service cable replacement program.....	223
12.5	Underground distribution systems.....	224
12.5.1	General.....	224
12.5.2	Point of supply (connection) (PoS).....	224
12.5.3	Location .....	225
12.5.3.1	Encroachment, consumer non-compliant installations .....	226
12.5.3.2	Utility providers code of practice .....	226
12.5.3.3	Horizon Power policy .....	226
12.5.3.4	Western Power policy .....	226
12.5.4	Incorrect point of supply (connection) .....	227
12.5.5	Access.....	227
12.5.5.1	Exclusion zones.....	227
12.5.5.2	Excavation near transformers .....	228
12.5.5.3	Minimum separation of services .....	228
12.5.6	Network identification.....	228
12.5.7	Pillar or pit not installed.....	229
12.5.7.1	Connections in overhead areas .....	229
12.5.7.2	Connections in new underground strata subdivisions .....	229
12.5.7.3	Connections in new underground freehold subdivisions .....	229
12.5.8	Network equipment not energised.....	230

12.5.8.1	Existing overhead areas .....	230
12.5.8.2	New underground subdivisions.....	230
12.6	Consumer mains cable .....	230
12.6.1	General.....	230
12.6.2	Consumer mains cable sizes .....	230
12.6.2.1	Paralleling of conductors .....	231
12.6.3	Voltage drop/rise.....	231
12.6.4	Acceptable wiring systems.....	231
12.6.4.1	Connected to overhead distribution system .....	231
12.6.4.2	Existing overhead installations.....	232
12.6.4.3	Connected to underground distribution system.....	232
12.6.4.4	Connections within substations or switchrooms .....	233
12.6.4.5	Consumer mains cable upgrade minimum requirements .....	233
12.6.5	Location .....	233
12.6.6	Separation from other services .....	234
12.6.7	Identification of consumer's mains .....	234
12.6.7.1	Neutral identification .....	234
12.6.7.2	Active identification .....	234
12.6.7.3	Phase identification .....	234
12.6.7.4	Underground locations.....	235
12.6.7.5	Labelling .....	235
12.6.8	Jointing consumers mains.....	235
12.6.9	Termination of consumers mains .....	235
12.6.9.1	Balanced loads .....	235
12.6.9.2	Single-phase pillar connection formula .....	236
12.6.9.3	Connection authorisation .....	236
12.6.9.4	Tunnel terminations .....	237
12.6.9.5	Parallel terminations .....	237
12.6.9.6	Horizon Power termination references.....	237
12.6.9.7	Western Power termination references.....	237
12.6.9.8	Insufficient terminals .....	237
12.6.9.9	Testing .....	237
12.6.10	Minimum insulation resistance .....	238
12.6.11	Notification .....	238
12.7	Protection .....	238
12.7.1	Service and meter protection devices .....	238
12.8	Cable ducts and conduits.....	238

12.9	Labelling .....	238
12.10	Underground conversion.....	238
12.11	Other LV supply arrangements .....	239
12.11.1	Distributed energy resource systems .....	239
12.11.2	Standby/emergency supply.....	239
12.11.3	Common loads.....	239
12.11.4	Short term events .....	239
12.11.5	Builders supplies.....	239
12.11.5.1	Builder's supply (stub) pole.....	240
12.11.5.2	Temporary, independent switchboards .....	240
12.11.5.3	Use of permanent installation .....	241
12.11.5.4	Consumer pole and switchboard in an overhead area .....	241
12.11.5.5	Temporary low voltage frame connections.....	241
12.11.6	Un-metered supplies.....	242
12.11.6.1	Horizon Power requirements .....	242
12.11.6.2	Western Power requirements .....	242
<b>13</b>	<b>High voltage distribution systems.....</b>	<b>245</b>
13.1	Scope .....	245
13.2	Responsibilities and contractual arrangements.....	245
13.3	Consumer expenditure.....	246
13.4	Supply parameters.....	246
13.4.1	Individual network parameters .....	246
13.4.1.1	Horizon Power .....	246
13.4.1.2	Western Power.....	247
13.5	Connection arrangements.....	247
13.5.1	Control of incoming HV supply .....	247
13.5.1.1	Paralleling of HV supplies .....	248
13.5.1.2	Back-feeds .....	248
13.5.2	Power factor correction .....	248
13.5.2.1	Fault isolation .....	249
13.5.2.2	Resonance mitigation .....	249
13.5.2.3	Switching steps.....	249
13.5.2.4	Labelling .....	249
13.6	Connection conversion from low to high voltage .....	249
13.7	Installation design and submissions.....	249
13.7.1	Preliminary information .....	250
13.7.2	HV submission and design ("submission") .....	250

13.7.3	Standard format for submission of a HV proposal .....	250
13.7.3.1	Option one electronic submission .....	251
13.7.3.2	Option two hardcopy submission .....	251
13.7.4	HV submission outline .....	251
13.7.4.1	Site plan .....	251
13.7.4.2	Single line diagram .....	251
13.7.4.3	Load, generation and energy storage details .....	251
13.7.4.4	Protection, control of incoming & embedded generation/energy storage supplies .....	252
13.7.4.5	Next line of protection .....	253
13.7.4.6	Voltage transformers .....	253
13.7.4.7	Current transformers.....	253
13.7.4.8	Switchboard and metering .....	253
13.7.4.9	Earthing system.....	253
13.7.4.10	High voltage motors.....	254
13.7.4.11	Transformers .....	254
13.7.4.12	Distributed energy resources and generation .....	254
13.7.4.13	Underground Cables.....	254
13.7.4.14	Overhead lines and supports .....	255
13.7.4.15	Communication systems.....	255
13.7.4.16	Conforming technical standards .....	255
13.7.4.17	Commissioning of protective device.....	255
13.7.4.18	Installation commissioning and supply availability.....	255
13.7.4.19	Environmental.....	255
13.7.4.20	Operational procedures and equipment maintenance.....	256
13.8	Applications and connection process .....	256
13.9	Equipment .....	256
13.9.1	Equipment requirements .....	256
13.9.2	Substation installation requirements .....	256
13.9.3	Main switch or switches .....	256
13.9.4	Circuit breakers.....	257
13.9.5	Protection settings .....	257
13.9.6	Cabling .....	258
13.9.6.1	Underground .....	258
13.9.6.2	Overhead lines .....	258
13.9.6.3	As constructed drawings.....	258
13.9.7	Earthing systems .....	258
13.9.7.1	Communication equipment .....	259

13.9.7.2	HV power lines, cables and earths in proximity of metallic pipes .....	259
13.9.7.3	Metallic fences.....	259
13.9.8	High voltage metering .....	259
13.10	Consumer's electrical installations on public land .....	259
13.11	Inspection, testing and commissioning.....	259
13.11.1	Horizon Power .....	260
13.11.2	Western Power .....	260
13.12	Safety .....	260
13.12.1	HV operation manuals and safety management plan .....	260
13.12.2	Access .....	261
13.12.3	Operating equipment .....	261
13.12.4	Operational diagram .....	261
13.12.5	Consumer operation (switching) protocol/agreement .....	262
13.12.6	High voltage switching .....	262
13.12.6.1	Horizon Power .....	263
13.12.6.2	Western Power .....	263
13.12.7	Safety signs .....	263
13.13	Final connection requirements .....	263
13.14	Maintenance .....	264
13.15	Consumer HV installation audits .....	265
<b>14</b>	<b>Substation installation requirements .....</b>	<b>267</b>
14.1	General connection requirements .....	267
14.2	Substation types .....	267
14.2.1	District substation .....	268
14.2.2	Sole use substation.....	268
14.2.3	Consumer owned substation.....	268
14.3	Substation arrangements .....	269
14.3.1	Modular package substation (MPS) .....	269
14.3.2	Non modular package substation (non-MPS).....	269
14.3.3	Selecting MPS or non-MPS arrangements.....	270
14.3.4	Consumer-owned substation arrangements.....	270
14.3.4.1	HV indoor ground mounted switchgear .....	270
14.3.4.2	HV outdoor ground mounted switchgear.....	271
14.3.4.3	HV outdoor aerial mounted switchgear .....	272
14.4	Common installation conditions for substations.....	272
14.4.1	Application .....	272
14.4.2	General conditions .....	272

14.4.3	Substation enclosures.....	273
14.4.4	Hazardous areas .....	274
14.4.4.1	Storage of flammable material .....	274
14.4.4.2	Fire hydrant installations.....	274
14.4.4.3	Separation from petroleum and gas installations .....	274
14.4.5	Alarm systems .....	275
14.4.6	Substation site requirements and preparation.....	275
14.4.7	Access.....	276
14.4.7.1	Site.....	276
14.4.7.2	Pits and cover access.....	276
14.4.7.3	Equipment .....	276
14.4.7.4	Personnel .....	276
14.4.8	Sizing of transformers .....	277
14.4.9	Point of supply (connection) and consumer mains cable.....	277
14.4.9.1	District substations .....	277
14.4.9.2	Sole use substations.....	277
14.4.10	General earthing requirements .....	278
14.4.10.1	General conditions.....	278
14.4.10.2	System testing and commissioning.....	278
14.4.10.3	Metallic screens and fencing.....	278
14.4.10.3.1	Horizon Power .....	278
14.4.10.3.2	Western Power .....	278
14.4.11	Vegetation screens .....	279
14.4.12	Metering.....	279
14.4.12.1	Low voltage metering.....	279
14.4.12.2	High voltage metering.....	279
14.4.13	Requirement for a contiguous switchboard .....	280
14.5	Conditions non fire rated substation enclosures.....	280
14.5.1	Application .....	280
14.5.2	Substation site requirements and preparation.....	280
14.5.3	Earthing requirements for non-fire rated substations.....	280
14.5.4	Screening .....	280
14.6	Conditions for fire rated substation enclosures.....	281
14.6.1	Application .....	281
14.6.2	General construction requirements .....	281
14.6.3	Earthing requirements for fire rated substations.....	282
14.6.3.1	District and sole use substations .....	282

14.6.3.2	Consumer owned substations.....	282
14.6.4	Fire alarms and extinguishing systems .....	282
14.6.5	Oil containment.....	282
14.6.6	Doors and locks .....	283
14.6.7	Ventilation .....	283
14.6.8	Ducts, trenches and other penetrations.....	284
14.6.9	Light and power .....	284
14.6.10	Wiring .....	284
14.6.11	Fire rated certification .....	285
14.6.12	Network section references.....	285
14.6.12.1	Horizon Power summary .....	285
14.6.12.2	Western Power summary .....	285
<b>15</b>	<b>Alternative &amp; supplementary systems (Generation) .....</b>	<b>287</b>
15.1	Introduction.....	287
15.2	Language.....	287
15.2.1	Network power supply (normal) .....	287
15.2.2	Stand-alone power supply (SPS) (normal).....	287
15.2.3	Alternative energy generation system(AE) .....	288
15.2.4	Supplementary supply .....	288
15.2.5	Uninterruptible power supply (UPS) .....	288
15.2.6	Parallel generation system or private parallel generator (PPG).....	288
15.2.7	Distributed energy resource (DER) .....	288
15.2.8	Embedded generation system (EG) .....	288
15.3	Generation categories.....	288
15.3.1	Horizon Power categories.....	289
15.3.2	Western Power categories.....	289
15.3.3	Notes to tables.....	290
15.4	Consumer/agent responsibilities .....	290
15.4.1	Installation .....	290
15.4.2	Compliance and monitoring .....	291
15.4.3	Connection applications.....	291
15.4.3.1	Installation restrictions .....	291
15.4.4	System changes or alterations.....	291
15.5	Consumer equipment and appliances.....	292
15.6	System designers and installers.....	292
15.7	Generation licence requirement .....	292
15.8	Connection arrangements.....	292

15.8.1	Connection .....	292
15.8.2	Isolation and main switch .....	293
15.8.3	Switching and fuse devices.....	293
15.8.4	Residual current devices (RCDs).....	293
15.8.5	Security of operational settings .....	293
15.9	Fault Protection.....	293
15.10	Interlocks and change over .....	293
15.11	Islanding prevention and protection schemes .....	294
15.12	Metering, monitoring, control and data-acquisition .....	295
15.13	Power quality .....	295
15.13.1	Network connection limits .....	295
15.13.2	Voltage-drop .....	296
15.13.3	Voltage rise.....	296
15.13.4	Power factor .....	296
15.14	Labelling .....	296
15.15	Commissioning and maintenance .....	297
15.15.1	Commissioning .....	297
15.15.2	Operational manual.....	297
15.15.3	Shut down procedure.....	297
15.15.4	Maintenance .....	298
15.16	Additional requirements - Parallel connected generation .....	298
15.16.1	Application and connection .....	298
15.16.1.1	Horizon Power .....	298
15.16.1.2	Western Power .....	298
15.16.2	Design and installation.....	299
15.16.3	Multiple generation units .....	299
15.17	Additional requirements - Inverter connected systems .....	299
15.17.1	Technical requirements.....	299
15.17.1.1	Horizon Power .....	299
15.17.1.2	Western Power .....	300
15.17.2	Energy exporting.....	300
15.17.3	Approved inverters.....	300
15.17.4	Compliance.....	300
15.17.5	Inverter energy system capacity.....	300
15.17.6	Connection and wiring .....	300
15.17.6.1	Connection .....	301
15.17.6.2	Consumer mains cable .....	301

15.17.6.3	Array and sub array .....	301
15.17.6.4	Earthing arrangements .....	301
15.17.6.5	Wiring segregation and identification .....	301
15.17.7	Schematic diagram .....	301
15.17.8	Isolation and protection .....	301
15.17.8.1	Over-current protection .....	302
15.17.8.2	Isolation .....	302
15.17.8.3	PV array switching and fuse devices .....	302
15.17.9	Safety .....	302
15.17.9.1	Restricted access to PV arrays .....	302
15.17.9.2	Fire safety .....	302
15.17.10	Commissioning .....	302
15.17.11	Labelling and signage guide .....	302
15.17.12	Shut down procedure .....	302
15.18	Additional requirements - Portable generation systems .....	303
15.19	Additional requirements - Transmission generation systems .....	303
15.19.1	Horizon Power .....	303
15.19.2	Western Power .....	303
15.19.3	Applications and connections .....	303

## Figures

<b>Figure 1:</b>	WASIR management flow chart .....	53
<b>Figure 2:</b>	Consumer, industry and regulatory relationships.....	65
<b>Figure 3:</b>	Flow chart for resolution of distribution disputes.....	71
<b>Figure 4:</b>	Responsibilities for vegetation control. ....	81
<b>Figure 5:</b>	Cable alignment and depth for greenfield sites.....	81
<b>Figure 6:</b>	Mini pillars.....	108
<b>Figure 7:</b>	Universal pillar .....	108
<b>Figure 8:</b>	Below ground UMS pit .....	109
<b>Figure 9:</b>	Below ground network pit.....	109
<b>Figure 10:</b>	100A/200A cut out box.....	109
<b>Figure 11:</b>	MPS substation.....	109
<b>Figure 12:</b>	Non MPS (cluster) substation.....	109
<b>Figure 13:</b>	Rural/SPUD transformer supply (1 phase) .....	110
<b>Figure 14:</b>	Standard overhead connection and PoA.....	110
<b>Figure 15:</b>	Domestic aerial service cable connection (3 phase).....	110
<b>Figure 16:</b>	Pole to pillar .....	110
<b>Figure 17:</b>	Commercial 3 phase 4 single core connection .....	110
<b>Figure 18:</b>	Commercial 3 phase cable connection.....	111
<b>Figure 19:</b>	Disconnection for demolition notice.....	113
<b>Figure 20:</b>	Magnetic screening.....	155
<b>Figure 21:</b>	Typical meter panel mounting heights.....	161
<b>Figure 22:</b>	Typical multiple meter panel mounting heights.....	161
<b>Figure 23:</b>	Typical earthing arrangement for remote metering.....	163
<b>Figure 24:</b>	Freehold (Single) residential lot meter location example .....	164
<b>Figure 25:</b>	Freehold (Single) residential battle axe lot meter location example .....	165
<b>Figure 26:</b>	Freehold (Single) residential (>2500sqm) lot meter location example .....	165
<b>Figure 27:</b>	Strata (2 lot Duplex) residential lot meter location example .....	166
<b>Figure 28:</b>	Strata (Duplex) residential lot meter location example.....	166
<b>Figure 29:</b>	Strata (Multi) residential lot meter location example .....	167
<b>Figure 30:</b>	Generic single-phase whole current layout and wiring diagram.....	174

<b>Figure 31:</b>	Generic split/three-phase whole current layout and wiring diagram.....	174
<b>Figure 32:</b>	Generic multiple master meter layout under 100A.....	177
<b>Figure 33:</b>	Generic multiple master metering wiring diagram under 100A .....	178
<b>Figure 34:</b>	Generic multiple master metering layout over 100A .....	178
<b>Figure 35:</b>	Generic multiple master metering wiring diagram over 100A.....	179
<b>Figure 36:</b>	Generic alternative multiple master metering layout over 100A.....	180
<b>Figure 37:</b>	Generic Western Power distributed master metering layout.....	183
<b>Figure 38:</b>	Generic Western Power distributed master metering wiring diagram .....	183
<b>Figure 39:</b>	Generic Western Power distributed master metering wiring diagram .....	184
<b>Figure 40:</b>	Generic CT metering layout .....	188
<b>Figure 41:</b>	Generic CT metering and sub-board layout.....	188
<b>Figure 42:</b>	Generic MSB with CT metering on the sub-board arrangement .....	189
<b>Figure 43:</b>	Generic multiple master CT metering and sub-board layout.....	192
<b>Figure 44:</b>	Generic WP distributed master CT metering and DB layout.....	193
<b>Figure 45:</b>	Generic sub meter wiring diagram (domestic) .....	196
<b>Figure 46:</b>	Sample zone diagram .....	208
<b>Figure 47:</b>	Typical overhead supply arrangement example 1 .....	211
<b>Figure 48:</b>	Typical overhead supply arrangement example 2 .....	211
<b>Figure 49:</b>	Typical overhead supply arrangement example 3 .....	211
<b>Figure 50:</b>	Extract from AS/NZS 7000.....	213
<b>Figure 51:</b>	Typical service brackets.....	214
<b>Figure 52:</b>	Typical ABC universal bracket .....	215
<b>Figure 53:</b>	Typical Consumer pole layout.....	217
<b>Figure 54:</b>	Pillar location and exclusion zone requirements.....	225
<b>Figure 55:</b>	Modular package substation .....	269
<b>Figure 56:</b>	Non modular package (cluster) substation arrangement .....	270
<b>Figure 57:</b>	HV outdoor ground mounted switchgear & transformer.....	271
<b>Figure 58:</b>	HV outdoor aerial mounted equipment.....	272

## Tables

<b>Table 1:</b> Horizon Power contact details .....	73
<b>Table 2:</b> Western Power contact details.....	74
<b>Table 3:</b> Horizon Power Towns and networks maximum allowable supply.....	101
<b>Table 4:</b> Network utilisation.....	134
<b>Table 5:</b> Starting currents single-phase (240V).....	143
<b>Table 6:</b> Starting currents three-phase (415V).....	143
<b>Table 7:</b> Inrush currents rural single/split-phase loads (240 or 480V) .....	144
<b>Table 8:</b> Minimum spacing for unscreened meter enclosure .....	154
<b>Table 9:</b> Direct wired meter panel arrangements .....	173
<b>Table 10:</b> Operating range and accuracy of current transformers .....	189
<b>Table 11:</b> Size and maximum number of busbars.....	190
<b>Table 12:</b> Extract from AS/NZS 7000.....	213
<b>Table 13:</b> Type of boundary fuse .....	220
<b>Table 14:</b> Western Power indoor boundary fuses .....	220
<b>Table 15:</b> Consumer mains cable ratings .....	231
<b>Table 16:</b> Example single phase pillar connection formula .....	236
<b>Table 17:</b> Horizon Power categories.....	289
<b>Table 18:</b> Western Power categories.....	289

## Appendices

<b>Appendix A.</b> Document amendments .....	305
<b>Appendix B.</b> Horizon Power's Pilbara Grid and NIS regional networks.....	319
<b>Appendix C.</b> Western Power's SWIS distribution network .....	320

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# **Service and Installation Requirements**

## **Section one**

### **Definitions and abbreviations**

# 1 Definitions and abbreviations

## 1.1 Definition (origin) key

These *requirements* use standard industry terminology wherever possible to match the document's language with that used in legislation, frequently referenced industry standards and *network operator* documents. Where a common definition, phrase or term is drawn from another document, the origin or source used, has been identified by the following key:

Key	Origin or definition source (at the time of review)
1	Electricity Act 1945 a. Electricity (Licensing) Regulations 1991 b. Electricity (Network Safety) Regulations 2015 c. Western Australian Electrical Requirements 2021
2	Electricity Industry Act 2004 a. Metering Code 2012
3	Electricity Networks Access Code 2004 Pilbara Networks Access Code
4	Energy Operators (Powers) Act 1979
5	Work Health and Safety Act 2020
6	Industry Standard a. AS/NZS 3000 b. AS 2067 c. AS/NZS 4777 parts 1 & 2 d. AS/NZS 7000 e. AS/NZS 5139
7	Landgate
8	Western Australian Planning Commission (WAPC)
9	WA Service and Installation Requirements
*	Contains a variation to the original definition, represent by the underscoring.

## 1.2 Definitions

In this document, unless the contrary intention appears, the definition, term and phrase used has the meaning as given by the following:

<b><i>The Act</i></b>	(9)	The Western Australian Electricity Act 1945 <u>and all subsequent revisions.</u>
<b><i>access contract</i></b>	(2)	The meaning as given in the <u>Electricity Industry Act 2004.</u>
<b><i>Access Code</i></b>	(3)	Electricity Networks Access Code 2004 or Pilbara Networks Access Code
<b><i>alteration (alter)</i></b>	(6a)*	A modification to part(s) of an electrical installation. (Clause 1.4.8 AS/NZS 3000). (See also WAER Section 6). <u>Note includes both low and high voltage consumer electrical installations.</u>
<b><i>alternative energy (AE)</i></b>	(6a)*	A supply system intended to maintain the functionality of an electrical installation or a part or parts thereof, in the event of an interruption of the normal supply. (Clause 1.4.118 AS/NZS3000)
<b><i>applicant</i></b>	(9)	The party that applies to the network operator for a new, relocated or upgraded electrical connection to an individual green title, or strata lot development. The applicant may be the owner or, with prior written approval, an agent or individual acting on behalf of the owner.

<b>architect</b>	(9)	A qualified person who is registered with the Architects Board of Western Australia and is entitled to be described as such and may be engaged by the consumer to prepare drawings to comply with the National Construction Code and Local Government Authority requirements.
<b>augmentation (augment)</b>	(3)	An increase in the capability of the network to provide services, including by the development, construction, acquisition, or commissioning of new network assets.
<b>battery energy storage system</b>		Refer to “energy storage system”
<b>carry over pole</b>	(9)	A network operator supplied support pole installed in the road reserve to provide ground clearance for an overhead service cable.
<b>community layout plan</b>	(9)	A plan recorded and registered in the Department of Planning Lands and Heritage that records the boundaries of lots within an Aboriginal Community where no registered individual lots exist.
<b>community title scheme</b>	(7)	A community titles scheme is either a community titles (building) scheme or a community titles (land) scheme depending on how the lots are defined. Refer to the Community Titles Act 2018
<b>connection agreement</b>	(9)	An agreement or other arrangement between the network operator and a consumer(s), which may form part of or include an access contract that specifies the technical requirements that apply in relation to the connection of a consumer’s equipment to the network operator’s distribution or transmission system.
<b>connection point</b>	(9)	That point defined in an access contract or, where there is no specific access contract, the point where the consumer’s electrical installation connects to the network operator’s distribution network. Note may include but is not limited to the network operator nominated: <ul style="list-style-type: none"> <li>I. load terminals of an overhead consumer mains connection box</li> <li>II. load terminals of a network ground mounted pillar or below ground pit</li> <li>III. LV terminals of a network protection device within a substation transformer or kiosk</li> <li>IV. HV terminals of a network metering unit or protection device within a substation.</li> </ul>
<b>connection service (network)</b>	(9)	The installed electricity infrastructure rated in accordance with the connection agreement to facilitate the transfer of electricity to or from the network operators electricity network.
<b>consumer(customer)</b>	(9)	A person or enterprise with an existing connection or seeks a connection to a network operator’s distribution network for the purposes of consuming (importing) and or generation (exporting) electricity from and or to that network
<b>consumer mains cable</b>	(6a)*	Those conductors between the point of supply (connection) and the main switchboard. (Clause 1.4.37 AS/NZS 3000).
<b>contract</b>	(9)	The formal agreement between the network operator and all or either the consumer, owner, developer and the electrical contractor for the execution of the works.
<b>developer</b>	(9)	A party that applies for an electrical supply for a development.
<b>development</b>	(9)	A single green title lot(s) with one or more consumers, a single green title lot where provision has been made for a future consumer(s) or a clearly identifiable group of one or more premises or structures making up a single development complex spread over a number of strata lots.

<b><i>distribution system (network)</i></b>	(2)*	Electricity infrastructure used, or to be used, for, or in connection with, or to control, the transportation of electricity at nominal voltages of less than 66 kV, forming part of Horizon Power's Pilbara Grid and NIS or Western Power's SWIS.
<b><i>distributed energy resource (DER)</i></b>	(9)	<p>Power generation or storage units that are connected to the distribution network</p> <p>A general description for the range of distributed energy devices such as dispersed power generation (including solar PV), energy storage, demand management and smart inverters located at consumer premises or connected directly to a distribution network.</p> <p>Note: Whilst DER is often used to refer to renewable generation sources, it also includes dispersed non-renewable generation sources.</p>
<b><i>distribution substation</i></b>		See substation.
<b><i>electrical consultant (consultant)</i></b>	(1c)	A qualified person or organisation as defined by the WA Electrical Requirements Section 9, engaged by the consumer to advise or design the consumer's electrical installation, project or works.
<b><i>electrical contractor</i></b>	(1a)	A qualified person or organisation as prescribed by the "Electricity (Licensing) Regulations 1991" Part 4, engaged by the consumer to design and execute the requested electrical installation project or works.
<b><i>electrical engineer</i></b>	(1a)	See Professionally qualified electrical engineer
<b><i>electrical equipment</i></b>	(6a)	Wiring systems, switchgear, control gear, accessories, appliances, luminaires and fittings used for such purposes as generation, conversion, storage, transmission, distribution or utilisation of electrical energy. (Clause 1.4.50 AS/NZS 3000).
<b><i>electrical installation (consumer)</i></b>	(1c)*	<p>An assembly of electrical wiring, components and equipment downstream from the point of supply (connection), excluding the network operator's metering equipment, and including all types of assemblies, such as those in domestic residences and commercial, industrial and institutional premises where persons use electricity in appliances and electrical equipment.</p> <p>Note includes both consumption and generation infrastructure forming part of a consumer's electrical installation at both low and high voltages. Refer also to clause 1.4.52 AS/NZS 3000.</p>
<b><i>electrical licensing area boundary</i></b>	(2)	A defined region, area, city, town, community where a network operator has a licence to operate as an approved supplier of electricity.
<b><i>electricity infrastructure</i></b>	(2)	<p>(a) Wires, apparatus, equipment, plant or structures used, or to be used, for, or in connection with, or to control, the transportation of electricity; and</p> <p>(b) includes electrical equipment used, or to be used, to transfer electricity to or from an electricity network at the relevant point of supply (connection) including any transformers or switchgear at the relevant point or that is installed to support, or to provide backup to, that electrical equipment as is necessary for that transfer.</p>
<b><i>embedded generator (generation)</i></b>	(9)	Any electrical energy source that can connect to the distribution network.
<b><i>embedded network</i></b>	(9)	An embedded network is a distribution network which has a connection point to another distribution network and does not have a connection point to a transmission network.
<b><i>energy storage system (battery) (BESS)</i></b>	(6e)	Consists of power conversion equipment (PCE), battery system(s), and isolation and protection devices. May also include auxiliary equipment, cables, battery management module(s) and battery management system. (Clause 1.3.13 AS/NZS 5139)

<b><i>enterprise</i></b>	(9)	An owner, operator, business, company or corporation governed by a single administrative body or entity.
<b><i>generator</i></b>	(9)	Either an individual person or entity that in part or collectively owns, controls, or operates a generation system that self-consumes or supplies electricity to a distribution or transmission system.
<b><i>generation system</i></b>	(9)	A system or method of generating electricity comprising one or more generating units.
<b><i>generating unit</i></b>	(9)	The equipment used to generate electricity inclusive of all related equipment essential to its functioning as a single entity.
<b><i>headworks</i></b>	(9)	Prior installation/augmentation of network infrastructure to enable an installation connection to that network.
<b><i>industry best practice</i></b>	(3)	The meaning given in the Access Code for good electricity industry practice
<b><i>inverter</i></b>	(6c)	A device that uses semiconductor devices to transfer power between a d.c. source(s) or load and an a.c. source(s) or load. Note: For the purposes of these requirements, a.c. to a.c. convertors transferring power between non-grid energy sources and an a.c. source or load that uses semiconductor devices are inverters. (Clause 4.7 AS/NZS 4777).
<b><i>inverter energy system (IES)</i></b>	(6c)	A system comprising one or more inverters together with one or more energy sources (which may include batteries for energy storage) and controls, where the inverter(s) satisfies the requirements of AS/NZS 4777.2. (Clause 4.8 AS/NZS 4777).
<b><i>Islanding (island)</i></b>	(6c)*	Any situation where the electricity supply from the network operator's distribution network is disrupted or fails and one or more inverters or generators maintains any form of electricity supply, be it stable or not, to any section of that network or within the consumer's electrical installation. Note: Prevention of the injection of energy and prevention of an unintentional island within the network or part thereof when supply is disrupted is key to maintaining safety on that network and within electrical installations.
<b><i>Landgate</i></b>	(9)	<a href="#">Landgate</a> is the Statutory Authority responsible for Western Australia's land and property information.
<b><i>Large scale consumer installation</i></b>	(1c)	Section 7 of the WA Electrical Requirements classifies a large scale consumer installation as a network or stand-alone connected: <ul style="list-style-type: none"> <li>• high voltage installation (exceeding 1000 Volts);</li> <li>• Solar photo-voltaic installation exceeding the 200kVA and 240 kW capacity ranges specified in AS/NZS 4077.1 and AS/NZS 5033;</li> <li>• Battery energy storage system (BESS) installation exceeding the 200 kWh capacity range specified in AS/NZS 5139; and</li> <li>• Wind turbine installation exceeding 200kW capacity</li> </ul>
<b><i>lot</i></b>	(9)	May be also known as freehold or green title lot. A defined portion of land depicted on a plan or diagram and for which a separate Crown Grant or Certificate of Title has been or can be issued or depicted on a diagram or plan of survey of a subdivision approved by the WA Planning Commission but does not include a lot in relation to a strata scheme, a lot in relation to a survey strata scheme or a lot shown as common property on a survey strata plan as defined by the Strata Titles Act 1985.
<b><i>licensed person</i></b>	(1a)	A person described and defined by the Electricity (Licensing) Regulations 1991.

<b>load</b>	(9)	<p>Either</p> <ul style="list-style-type: none"> <li>a) the electrical power at a point on either the consumer's installation or distribution network; or</li> <li>b) the amount of electric power transferred at a defined instant at a specific point on the transmission or distribution system;</li> </ul> <p>as the case requires. Refer to respective Technical Rules.</p>
<b>main switchboard</b>	(6a)	A switchboard from which the supply to the whole electrical installation can be controlled. (Clause 1.4.122 AS/NZS 3000).
<b>major regional centres</b>	(9)	<p>Horizon Power - Broome, Carnarvon, Esperance, Karratha, Kununurra and Port Hedland.</p> <p>Western Power - Albany, Bunbury, Geraldton, Kalgoorlie and Mandurah.</p>
<b>metropolitan area</b>	(9)	As defined in section 12 of this document.
<b>metering equipment</b>	(2a)	<p>A part of a metering installation and includes a meter and protection device.</p> <p>Note 1: Metering equipment may include manual reading facilities, clocks and, where required, CTs and VTs, meter protection device(s) and computing or communications devices designed to facilitate electronic access and the connections between these items. The communications link is metering equipment.</p> <p>Note 2: Metering and service equipment has the same meaning.</p>
<b>metering installation</b>	(2a)*	<p>The devices and methods used for the purpose of metrology which lie between:</p> <ul style="list-style-type: none"> <li>(a) at one boundary, a metering point; and</li> <li>(b) at the other boundary, either: <ul style="list-style-type: none"> <li>(i) if a telecommunications network is used for the delivery of energy data from the metering point — the point of supply (connection) to the telecommunications network; or</li> <li>(ii) if there is no such telecommunications network — the interface port of either the meter or data logger or both.</li> </ul> </li> </ul>
<b>meter protection device (MPD)</b>	(9)	A protection device forming part of the metering installation. For an individual metered installation, the SPD need not be duplicated by a meter protection device.
<b>metering point</b>	(2a)	<p>For a connection point of Type 1 to Type 6 — a point at which a revenue meter measures electricity production or consumption for the connection point; and</p> <p>For a connection point of Type 7 — the connection point.</p>
<b>multiple earthed neutral</b>	(9)	Multiple Earthed Neutral network installation. Note the network neutral may be earthed at numerous points within the network but must be earthed at the consumer's main switchboard.
<b>network</b>	(2)	The electricity distribution and transmission system within either Horizon Power's Pilbara Grid, NIS networks or Western Power's SWIS.
<b>network designer</b>	(9)	The officer appointed by the network operator to negotiate with the applicant on all matters relating to design and quotation.
<b>network operator</b>	(2&4)*	Means either Horizon Power or Western Power as the entity defined by Electricity Industry Act 2004 and the Energy Operators (Powers) Act 1979 that lawfully operates the distribution and transmission systems within Horizon Power's Pilbara Grid, NIS networks or Western Power's SWIS.

<b><i>offer (quote)</i></b>	(9)	Means an offer by the network operator to the consumer or consumer's representative setting out the costs, terms and conditions upon which the electricity infrastructure or connection of a consumer's installation will be provided, as described by the network operator's design.
<b><i>overhead service cable</i></b>	(6d)	An overhead line operating at a voltage less than 1000V generally located between the electricity overhead distribution network line and the point of supply (connection) to an electrical installation. (Clause 1.4.51 AS/NZS 7000).
<b><i>parallel generation</i></b>	(9)	The operation of a generation system in parallel with the normal operation of the distribution network supply (could be continuous or occasional).
<b><i>planning schemes</i></b>	(8)	As referred to by the Western Australian Planning Commission. (WAPC)
<b><i>Pilbara Grid</i></b>	(9)	The interconnected network located in the Pilbara region of the state of Western Australia. (Formerly known as the North West Interconnected System, NWIS)
<b><i>pillar (pit)</i></b>	(9)	A low voltage distribution enclosure owned by the network operator, installed on the consumer's property, to provide a point of supply (connection) on that distribution network for connection of the consumer's installation.
<b><i>point of attachment (POA)</i></b>	(1c)*	The point at which aerial conductors of an overhead network service cable is secured on the consumer's structure. Note: There is no POA for an underground network connection service
<b><i>point of supply (connection) (POS)</i></b>	(9)	The junction of the consumer mains cable with: – a) conductors of the network operator's distribution or transmission systems; or b) output terminals of a network operator's stand-alone power supply. or c) output terminals of electricity generating system within a premises that is not network connected.
<b><i>point of common coupling</i></b>	(9)	As prescribed by the network operator. Refer to the respective network Technical rules.
<b><i>photovoltaic (PV) array</i></b>	(9)	Assembly of electrically interconnected PV modules, PV strings or PV sub-arrays comprising all components up to the d.c. PV port of the inverter or other power conversion equipment or d.c. loads. Refer to clause 1.3.20 AS/NZS 4777.
<b><i>practical completion</i></b>	(9)	The completion of works at the site such that the installation can be used for the purpose for which it was designed, constructed and commissioned, without restriction.
<b><i>professionally qualified electrical engineer</i></b>	(1a)	Has the same meaning as professional qualified engineer given in Part 3 of the Electricity (Licensing) Regulations 1991, being a person who: (a) holds a power electrical engineering specialisation; and (b) is, or is eligible to be, a member of the body known as Engineers Australia other than at the grade of student.
<b><i>premises</i></b>	(1)	Means any land, structure, or other place, and may include a vehicle or other thing in or in connection with which electricity is or is to be supplied.
<b><i>property boundary</i></b>	(9)	A surveyed line or boundary of a lot, strata plan or survey strata or community layout plan.
<b><i>repair</i></b>	(6a)	The work to restore the electrical installation to safe and sound working condition after deterioration or damage has occurred. (Clause 1.4.101 AS/NZS 3000).
<b><i>retailer</i></b>	(2)	A body holding a retail licence or integrated regional licence under the Electricity Industry Act 2004.

<b>requirement (require)</b>	(9)	A mandatory obligation or action to confirm compliance or to facilitate an outcome.
<b>responsible person</b>	(5)	The person responsible for the ongoing health and safety of persons and property in relation to the management and conduct of undertakings at those premises. The Electricity Act 1945 and the Work Health and Safety Act 2020 establishes duties upon persons in respect to workplaces
<b>service apparatus</b>	(1)	Any works, apparatus or system which is or is capable of being or is intended to be used for the purpose of conveying, measuring, or controlling electricity supplied from any distribution works to the position on any premises at which delivery of the electricity is, is capable of being, or is intended to be, made to the consumer, and includes any part of the service apparatus, and any other equipment or plant used in conjunction therewith, whether or not the property of a network operator.
<b>service protection device (SPD)</b>	(6a)	A fuse, circuit breaker or other device installed as required by the network operator for interrupting the supply to an electrical installation on a consumer's (customer) premises from the supply main. (Clause 1.4.106 of AS/NZS 3000).
<b>site</b>	(9)	The consumer's workplace, which includes all parts of the installation that are the subject of the offer and acceptance between the network operator and the consumer for the provision of electricity infrastructure and or connection.
<b>standard connection service (supply) Horizon Power</b>	(9)	<p>Standard supply is defined as 240 volt single-phase (+/- 6%) or 415 volt three-phase (+/- 6%) for:</p> <p>a new or altered network connection service from and within Horizon Power's service area:</p> <p>Supply capacity requirements and limits are dependent on regional specific criteria. For Horizon Power serviced areas and regional specific criteria refer to Section 7 Table 3 – Horizon Power Towns and networks maximum allowable supply per installation.</p> <p>Notes:</p> <ol style="list-style-type: none"> <li>1. Subject to service availability</li> <li>2. Is not applicable for network stand - alone power supply systems.</li> <li>3. For network connection generation capacity limits, refer to Section 15 and Horizon Power's embedded generation requirements.</li> </ol>
<b>standard connection service (supply) Western Power</b>	(9)	<p>Standard supply is defined as 240 volt single-phase (+/- 6%) or 415 volt three-phase (+/- 6%) for:</p> <p>a new or altered network connection service from and within the SWIS:</p> <ul style="list-style-type: none"> <li>• 63 amps single-phase (240 volts); or</li> <li>• 32 amps per phase, three-phase (415 volts) (Note1); or</li> <li>• 32 amps per phase, split-phase, (480 volts) (Note1); and</li> </ul> <p>to maximum size of consumer mains/submain cable not exceeding 35 mm<sup>2</sup>.</p> <p>Notes:</p> <ol style="list-style-type: none"> <li>1. Subject to service availability.</li> <li>2. Is not applicable for network stand - alone power supply systems.</li> <li>3. For network connection generation capacity limits, refer to Section 15 and Western Power's embedded generation EG technical requirements.</li> </ol>

<b>strata plan (built)</b>	(7)	Strata plans define the lots in a strata scheme (areas owned individually) and common property (areas owned jointly by all lot owners in the strata scheme). Strata lots are limited in height and depth (the stratum of the lot). Strata plans show a building on at least one lot of the strata plan and stratum of the lots is always linked to buildings shown on the plan.
<b>strata title</b>	(7)	A certificate of title for a lot in a strata scheme created under, and subject to the provisions of the Strata Titles Act 1985 as amended. Strata titles specify the ownership of the lot, and the lodged and registered interests and claims (encumbrances) against that ownership.
<b>stand - alone power supply (system)</b>	(6e)*	A network or private system that is not connected to a network operator's primary electricity distribution system. A stand-alone power supply is a system, supplying electricity from one or more sources of energy including but not limited to, a photovoltaic array, energy storage system, and or wind turbine; micro-hydro; engine driven generation arrangement. (AS/NZS 4509 and AS/NZS 5139)
<b>structural engineer</b>	(9)	A National Engineering Registered (NER) qualified structural engineer who is engaged by the consumer to design and prepare structural documentation for the substation enclosure to resist loads and forces as outlined in AS1170 where relevant.
<b>subdivision</b>	(7)	The total area of land to be developed, including all stages. It includes the amalgamation of lots.
<b>substation (distribution)</b>	(6a)*	An assembly of electrical equipment at one place, including any appropriate housing, for the conversion or transformation of electric energy or for connection between two or more circuits. (A substation may or may not require consumer supplied and maintained screening or enclosures). (Clause 1.4.117 AS/NZS 3000). Note: <ul style="list-style-type: none"> <li>I. District - Network operator owned low voltage distribution equipment incorporating LV connections to the network street mains.</li> <li>II. Sole use - Network operator owned low voltage distribution equipment with no LV connections to the street mains, established for a single consumer.</li> <li>III. Consumer owned - A high voltage installation where the consumer owns and is responsible for all electrical equipment downstream of the network operator's HV metering equipment.</li> </ul>
<b>survey - strata plan</b>	(7)	Survey-strata plans define the lots in a survey-strata scheme, which are the areas in the scheme owned individually. Common property areas owned jointly by all lot owners may or may not exist in survey-strata schemes and are defined as "common property lots". Survey-strata lots may be limited in height and depth but generally are not. No buildings are shown on survey-strata plans.
<b>survey - strata title</b>	(7)	A certificate of title for a lot in a survey-strata scheme created under, and subject to the provisions of the Strata Titles Act 1985 as amended. Survey-strata titles specify the ownership of the lot, and the lodged and registered interests and claims (encumbrances) against that ownership.
<b>technical requirements</b>	(9)	Network operator documentation as listed at clause 1.6
<b>Technical rules</b>	(9)	The "Technical Rules for the Pilbara Grid (formerly known as the North West Interconnected Network)" and Non Interconnected Systems", as published by Horizon Power.  The "Technical Rules for the South West Interconnected Network", as published by Western Power and approved by the Economic Regulation Authority.

<b>transmission system (network)</b>	(9)	Any apparatus, equipment, plant or structures used, or to be used for, or in connection with, the transportation of electricity at nominal voltages of 66 kV or higher that forms part of Horizon Power's Pilbara Grid, NIS networks or Western Power's SWIS.
<b>voltage (general)</b>	(6a)	Differences of potential normally existing between conductors and between conductors and earth as follows: <ul style="list-style-type: none"> <li>(a) extra-low voltage: Not exceeding 50V ac or 120V ripple free dc.</li> <li>(b) low voltage: Exceeding extra-low voltage but not exceeding 1000V ac or 1500V dc</li> <li>(c) high voltage: Exceeding low voltage.</li> </ul>
<b>voltage (distribution)</b>	(9)	Exceeding extra-low voltage but not exceeding or including 66kV.
<b>voltage (transmission)</b>	(9)	Including 66kV and above.
<b>Western Australian Planning Commission</b>	(9)	A statutory authority with state-wide responsibilities for urban, rural and regional land use, planning and land development matters.
<b>working day</b>	(1a)	Any day from Monday to Friday excluding Public Holidays in Western Australia.

### 1.3 Abbreviations

The following abbreviations are used in this document:

<b>AMR system</b>	Automated meter reading system, also known as a remote reading system.
<b>AMEO</b>	Australian Energy Market Operator.
<b>AMI</b>	Advanced metering infrastructure (AMI)
<b>BESS</b>	Battery energy storage system
<b>CP</b>	Circuit Protection
<b>DER</b>	Distributed energy resource
<b>DERMS</b>	Distributed energy resource management systems
<b>DMIRS (Building and Energy &amp; WorkSafe)</b>	Operational sections within the <a href="#">Department of Mines, Industry Regulation and Safety</a> .
<b>DAO (Previously DQA)</b>	Design and Access Offer application. Used to apply for supplies greater than standard.
<b>DCS</b>	Distribution construction standard (Horizon Power)
<b>DCSH</b>	Distribution construction standards handbook (Western Power)
<b>DCCR</b>	Distribution customer connection requirements (Western Power)
<b>DDC</b>	Distribution design catalogue
<b>DDR</b>	Distribution design rules (Horizon Power)
<b>DSM</b>	Distribution substation manual
<b>DSPM</b>	Distribution substation plant manual (Western Power)
<b>EG</b>	Embedded generation
<b>EPWA</b>	Energy Policy WA (previously known as Public Utilities Office),
<b>ERA</b>	<a href="#">Economic Regulation Authority</a> .
<b>ESS</b>	Energy storage system
<b>EVSE</b>	Electric vehicle supply equipment

<b>HV</b>	High Voltage (See definition for voltage)
<b>IES</b>	Inverter energy system
<b>kA</b>	Kilo Amps
<b>kVA</b>	Kilo Volt Amps
<b>LV</b>	Low Voltage(See definition for voltage)
<b>MEN</b>	Multiple earthed neutral
<b>MPD</b>	Meter protection device
<b>MPS</b>	Modular package substation.
<b>MSB</b>	Main switchboard
<b>NCC</b>	National Construction Code (NCC) – formerly the Building Code of Australia (BCA)
<b>NER</b>	National Engineering Register (NER). A directory of Australian engineers who satisfy specific industry qualifications and standards.
<b>NIS</b>	Non Interconnected System. The transmission and distribution electricity network owned and operated by Horizon Power in towns and communities outside those areas covered by the Pilbara Grid and or Western Power's SWIS.
<b>NMI</b>	National meter identifier.
<b>NWIS</b>	North West Interconnected System. (Now known as Pilbara Grid). The transmission and distribution electricity network owned and operated by Horizon Power in the Pilbara Region extending from Karratha to Port Hedland in the North West of Western Australia.
<b>PoA</b>	Point of attachment.
<b>PoS</b>	Point of supply (connection).
<b>PUO</b>	Public Utilities Office. (See EPWA)
<b>RESP</b>	The Regional Electricity Supply Policy developed by Horizon Power for consumers requesting supplies that are located outside the Electrical Licensing Area Boundary.
<b>SPS</b>	Stand-alone power supply (system)
<b>SWIS</b>	South West Interconnected System The transmission and distribution electricity network owned and operated by Western Power in the South West corner of Western Australia.
<b>SPD</b>	Service protection device
<b>SPUD</b>	Single-phase underground distribution. Network reticulation system for a subdivision.
<b>SPURS</b>	Single-phase underground rural supply for an individual consumer.
<b>UCIM</b>	Underground cable installation manual
<b>UDS</b>	Underground distribution schemes manual
<b>UMS</b>	Un-metered supply standard
<b>WAER</b>	Western Australian Electrical Requirements as published by DMIRS.
<b>WAPC</b>	<a href="#">Western Australian Planning Commission</a>
<b>WADCM</b>	Western Australian Distribution Connections Manual (superseded by The WASIR)
<b>WASIR</b>	Western Australian Service and Installation Requirements

## 1.4 References

These *requirements shall* be read in conjunction with but not limited to the following:

### 1.4.1 Acts and Regulations

The WA State Government publishes the following Acts and Regulations via its website [State Law Publisher](#):

- Aboriginal Heritage Act 1972
- Biodiversity Conservation Act 2016
- Biodiversity and Agriculture Management Act 2007
- Community Titles Act 2018
- Electricity Act 1945
  - Electricity (Licensing) Regulations 1991
    - WA Electrical Requirements 2015
  - Electricity Regulations 1947
  - Electricity (Network Safety) Regulations – 2015
- Electricity Corporations Act 2005
- Electricity Industry Act 2004
  - Code of conduct for the supply of electricity to small use customers 2018
  - Electricity Industry (Metering) Code 2012
  - Electricity Network Access Code 2004
    - Network Operator Technical Rules
  - Network Quality & Reliability of Supply Code 2005
    - Wholesale Electricity Market Regulations 2004
- Electricity Industry (Obligation to Connect) Regulations 2005 Electricity Transmission and Distribution Systems (Access) Act 1994
  - Electricity Distribution Regulations 1997
- Energy Coordination Act 1994
- Energy Operators (Power's) Act 1979
  - Energy Operator Regulations 2016
- Environmental Protection Act 1986
- Environmental Protection and Biodiversity Act 1999
  - Environmental Protection (Noise) Regulations 1997
- Fair Trading Act 2010
- Land Administration Act 1997
- Planning and Development Act 2005
- Strata Titles Act 1985
  - Strata Titles (General) Regulations 2019
- Transfer of Land Act 1893
  - Transfer of Land Regulations 2004
- Metropolitan Water Supply, Sewerage, and Drainage Act 1909
  - Metropolitan Water Supply, Sewerage and Drainage By-laws 1981
- Work Health and Safety Act 2020 (previously Occupational Safety and Health Act 1984)
  - Work Health and Safety (General) Regulations 2022
  - Work Health and Safety (Mines) Regulations 2022
  - Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022

**Note:** The Competition and Consumer Act 2010 (Australia) (previously Trade Practices Act 1974) may be access via this site.

#### **1.4.2 Codes and guidelines published by DMIRS (Building and Energy)**

- [Code of practice “Safe low voltage work practice by electricians”](#)
- [Code of practice for “Persons working on or near energised electrical installations”](#)
- [Guidelines for the management of vegetation near powerlines](#)
- [Guidelines for safe management of private power poles and lines \(commerce.wa.gov.au\)](#)
- [Guidelines for the safe management of high voltage electrical installations](#)
- [Guidelines for the safety of buildings near network operator electrical assets private power poles and lines](#)
- [WA Electrical Requirements](#)

#### **1.4.3 Codes and guidelines published by DMIRS (Worksafe)**

- [Guidelines for work in the vicinity of overhead power lines](#)
- [WorkSafe’s danger zones](#)

#### **1.4.4 Guidelines published by others**

- [Utility providers code of practice](#) published by Dial Before You Dig
- [Guidelines for restoration and reinstatement following work in road reserves](#) published by Western Australian Local Government Association (WALGA)

## 1.5 Documents published by Standards Australia

A sample of documents that may be accessed via Standards Australia:

- **AS/NZS 1026**:- Electric Cables - Voltages up to and including 33 kV
- **AS 1033**:- High Voltage Fuses
- **AS 1214**:- (Hot-Dip Galvanised Coatings for Threaded Fasteners – ISO Metric Coarse Thread Series
- **AS 1243**: - Voltage Transformers
- **AS 1319**: - Safety signs for occupational environment
- **AS 1359**: - Motors and Generators
- **AS/NZS 1429**: - Electric Cables - Voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV
- **AS 1767**: - (Series) - Insulating oil for transformers and switchgear.
- **AS 1940**: - The storage and handling of flammable and combustible liquids.
- **AS/NZS 2053**: - Parts 1–8 Conduits and fitting for electrical installations.
- **AS 2067**: - Substations and high voltage installations exceeding 1 kV a.c.
- **AS 2467**: - Maintenance of electrical switchgear
- **AS 2709**: - Electricity generating sets—Transportable (Up to 25 kW)
- **AS/NZS 3000**:- Wiring Rules.
- **AS/NZS 3008**: - Electrical Installations - Selection of Cables.
- **AS 3010**: - Electrical installations—Generating sets
- **AS/NZS 3011**: - Electrical Installations – Secondary batteries installed in buildings
- **AS/NZS 3012**: - Electrical installations - Construction and demolition sites
- **AS/NZS 3013**: - Electrical installations – Classification of the fire and mechanical performance wiring system elements.
- **AS/NZS 3017**: - Electrical installations – Testing Guidelines
- **AS/NZS 3100**: - Approval and test specification - General requirements for electrical equipment
- **AS 3439 (AS/NZS 61439)**: - Low-voltage switchgear and control gear assemblies – (General rules)
- **AS/NZS 3845**:- Road safety barrier systems
- **AS 4086**: - Secondary batteries for use with stand-alone power systems
- **AS/NZS 4509**:- Stand-alone power systems
- **AS 4680**: - Hot Dipped Galvanised (Zinc) Coatings on Fabricated Ferrous Articles
- **AS/NZS 4741**:- Testing of connections to low voltage electricity networks
- **AS 4791**: - Hot Dipped Galvanised (Zinc) Coatings on Open Section Ferrous Articles
- **AS 4792**: - Hot Dipped Galvanised (Zinc) Coatings on Hollow Section Ferrous Articles
- **AS/NZS 4777**: - (parts 1 & 2) - Grid connection of energy systems via inverters.
- **AS/NZS 5000**: - Electric cables - voltages up to and including 0.6/1 (1.2) kV
- **AS/NZS 5033**: - Installation of photovoltaic (PV) arrays
- **AS/NZS 5139**: - Electrical installations - Safety of battery systems for use with power conversion equipment
- **AS 5577**: - Electricity network safety management systems
- **AS/NZS 7000**: - Overhead line design - Detailed procedures
- **AS/NZS 60076.1**: - Power transformers - General
- **AS 60947.6.2**: - Low-voltage switchgear and control gear Multiple function equipment
- **AS/NZS 61000**: - (SA/SNZ / TS IEC / TR IEC) - Series - Refer to the *network operators technical requirements*.
- **AS/IEC 62196**: - Plugs, socket-outlets, vehicle connectors and vehicle inlets
- **AS/IEC 62619**: - Safety Requirements for lithium cells and batteries
- **AS 62271**: - (Series) - Switchgear and Control gear.
- **IEC 60255**: - (Series) - Relays and Protection Equipment
- **IEC 61230**: - Ed 2.0 - Live Working - Portable equipment for earthing or earthing and short-circuiting
- **IEC 62052**: - Parts 11, 21 and 31 – Electricity Metering Equipment
- **IEC 62109**: - (all parts) Safety of Power Converters for use in Photovoltaic Power
- **IEC 62116**: - Utility-Interconnected Photovoltaic Inverters – Test Procedure of Islanding Prevention Measures
- **SA/SNZ HB 331**: - Overhead Line Design

## **1.6 Technical requirements**

### **1.6.1 Horizon Power's published technical requirements**

The following documents may be accessed through the [Manual and standards](#) section of the public website:

- Basic micro EG connection technical requirements
- Decorative fixtures, signs, banners and artwork of Horizon Power assets
- Distribution equipment labelling standard
- Distribution construction standard
- Distribution design catalogue
- Distribution design rules
- Distribution pole to pillar guidelines
- Electrical safety standards
- Environmental conditions
- Guideline for excavation work near Horizon Power networks
- Low voltage embedded generation connection technical requirements
- Network testing and commission standards
- Transfer of customer load between embedded generators and the distribution network
- Underground cable installation manual
- Underground distribution schemes manual
- Un-metered supply policy

The following document may be accessed by activating the relevant hyper link or main public website:

- [Technical rules](#)
  - Pilbara Grid (formerly known as the Horizon Power North West Interconnected System, NWIS); and
  - Non Interconnected Systems
  - Pilbara Harmonised Technical Rules

### 1.6.2 Western Power's published technical requirements

A sample of the documents that may be accessed through the "[Manuals, guides & standards](#)" section of the public website:

- Artwork on Western Power assets
- Basic embedded generator (EG) connection technical requirements
- Decorative fixtures, signs, banners and artwork on our power assets
- Distribution customer connection requirements
- Distribution construction standards handbook
- Distribution commissioning manual
- Distribution design catalogue
- Distributed energy resource management - Validation principles
- Distribution overhead to underground conversion standard (previously P2P policy)
- Distribution substation plant manual
- Generator and load model guideline
- Generator commissioning test guideline
- Generator compliance monitoring program requirements
- Generator performance standards
- HV (MV) EG connection technical requirements
- Locating ground mounted equipment
- LV EG connection technical requirements
- Metro & rural overhead LV connection guideline- 01
- Network testing and commissioning standard
- Noise compliance requirements for distribution transformers
- Small generator user guide (Connection of generators up to 10 MW)
- Switchboard arrangement for small strata lot developments guideline-02
- Underground cable installation manual
- Underground distribution schemes manual
- Un-metered supply standard

The following documents may be accessed by activating the relevant hyper link or main public website :

- Environmental conditions and policy
- Working safely around the Western Power network
- [Technical rules](#)

# **Service and Installation Requirements**

## **Section two**

### **Document management**

## 2 Document management

### 2.1 Disclaimer

These *requirements* have been compiled and published by Horizon Power and Western Power using definitions, drawings, guidelines, standards, electricity supply publications and information consistent with the relevant Acts and Regulations of the State of Western Australia at the date of publication.

Users are responsible for determining the relevance and applicability of the reference material, to their specific circumstances.

Standards and energy supply publications are revised periodically. The content of this document may at times not align with referenced externally published material, therefore users *shall* make their own inquiries in terms of any referenced content.

### 2.2 Document ownership and administration

This document is and remains the property of the copyright owners, Regional Power Corporation and Electricity Networks Corporation, who reserve the right to develop, administer, publish and revise the edition, in their absolute discretion.

### 2.3 Copyright

Copyright on these *requirements* resides with Regional Power Corporation trading as Horizon Power and Electricity Networks Corporation trading as Western Power. Any use of this material, except for the educational purposes by Western Australian based registered training organisations (RTOs) or as permitted by written agreement from the copyright owners, is prohibited.

This document includes material reprinted with the permission of Victorian SIR Management committee. Western Australian participating *network operators* wish to acknowledge and thank the Victorian SIR Management committee for its support and assistance during the creation of the initial version of this document.

### 2.4 Application

This edition supersedes all previous versions of the WADCM, the Transitional connections manual and Horizon Power/Western Power material contained within the redundant [WAER](#) section 13 (2008).

The application of the information within this document and subsequent amendments is not retrospective unless an existing *consumer electrical installation* or part thereof is *altered*, modified, upgraded or constitutes a safety issue as determined by an authorised inspector under the Energy Coordination Act 1994 or the Energy Operators Power Act 1979.

These *requirements* are to be applied to all new *consumer electrical installations* as soon as practical but no later than six months from the date of publication.

Validation of compliance *shall* be based on the lodgement and receipt of notices as required by the Electricity (Licensing) Regulations 1991.

Where work on a *consumer electrical installation* has commenced or formal *contracts* to undertake electrical work were signed prior to the publication of these *requirements*, the *network operator* may grant permission, on receipt of an application, for exemption from these *requirements*. Where exempt the *electrical installation shall* be completed in accordance the previously published *network operator requirements*.

An exemption will not be granted where there is a safety concern.

Additionally, there may be connection *requirements*, configurations or unusual situations that are not covered by these *requirements*. In such circumstances the *network operator must* be advised and consulted before any design or installation work is commenced. Refer to [clause 3.5](#).

## 2.5 Publication

### 2.5.1 Application date

These *requirements shall* apply from the date shown in the “record of revisions” located at the rear of this document.

### 2.5.2 Printing and updates

This is an electronic media based document and is therefore uncontrolled when printed or copied. To ensure you are using the most current version, it is essential that the web based document is referenced.

## 2.6 Enquires and contacts

Participating *network operators* welcome comment on these *requirements* and application. Where a specific trend in questions is received, a “frequently asked question” (FAQ) response may be issued and amendment considered as a part of the next review. For questions, commentary or queries, contact the relevant *network operator*.

### 2.6.1 Horizon Power

- Residential account and general enquiries - 1800 267 926
- Business account and general enquiries - 1800 737 036
- On-line: Horizon Power: [Contact enquiries](#)
- In writing to:  
Horizon Power Engineering Services Manager  
PO Box 1066, Bentley DC, WA 6983

### 2.6.2 Western Power

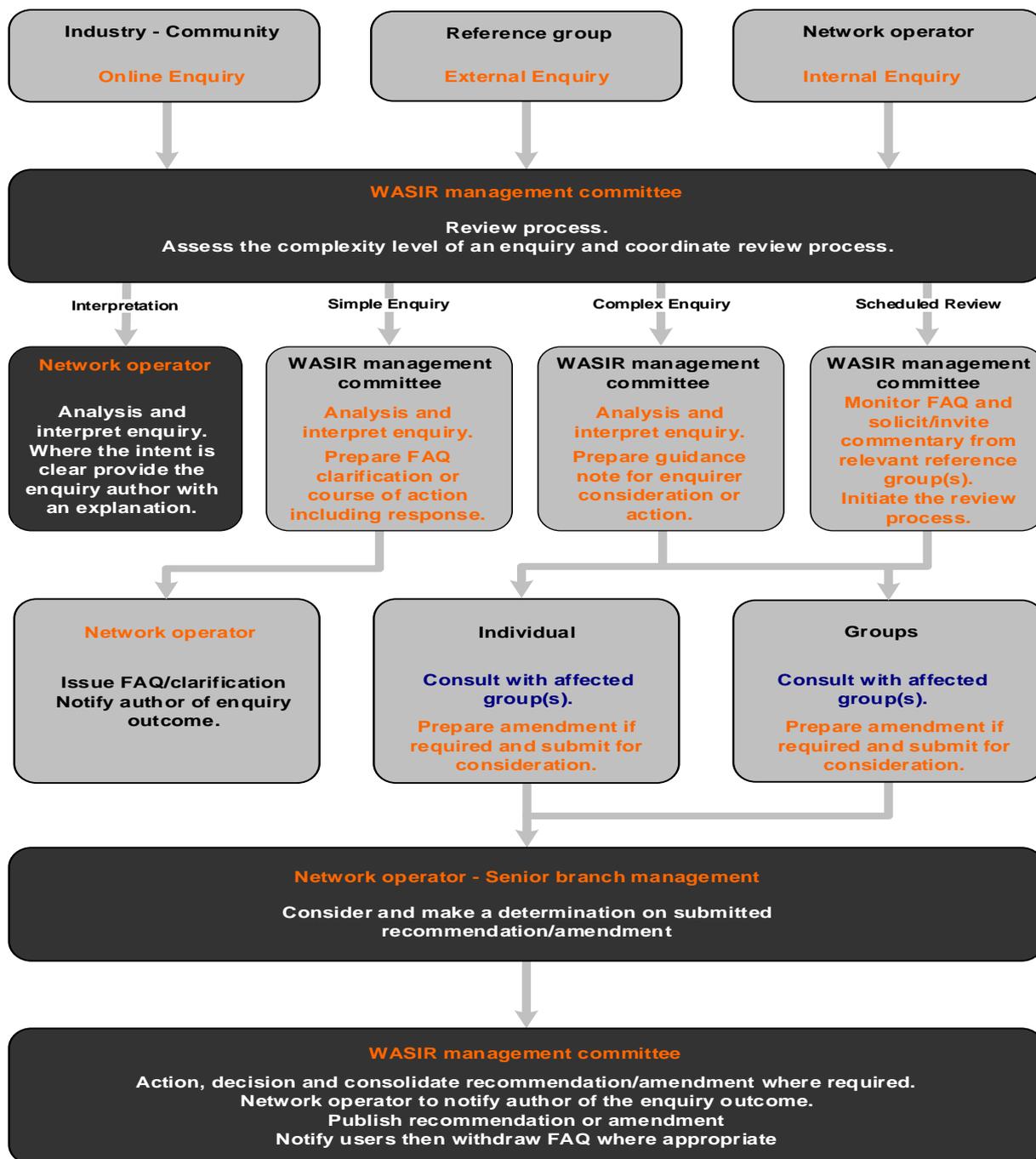
- Customer service centre on 13 10 87:
- On-line:  
Western Power [Contact enquiries](#).
- In writing to:  
The Manager Distribution Grid Strategy,  
Grid Transformation,  
GPO Box L921 Perth WA 6842.

## 2.7 Review and updates

This document is intended to translate and interpret changes in legislation; regulations; technology and work practices into readily understandable *requirements* and instructions resulting in a safe, reliable connection to the *network operator’s distribution system*.

These *requirements* are reviewed regularly by the WASIR Management committee in conjunction with relevant users as part of the ongoing development of the document. Commentary and proposed changes to the content should be forwarded via the mechanism described at [clause 2.6](#).

The flow chart (**figure 1**) depicts the process to be adopted in the management of reviews, enquiries and potential amendments:



**Figure 1:** WASIR management flow chart

### 2.7.1 Seeking assistance with these requirements

To address questions, comments or proposed changes to the *requirements*, written feedback should be directed to the WASIR Management committee. Feedback can then be logged and outcomes recorded for the benefit of all users. Any one of the following methods may be utilised:

- Via a participating *network operator* [clause 2.6](#).
- Through an industry association. Refer to [clause 2.10](#) for contact details.
- Via direct contact from members of the public and non-association industry operatives.
- For *network operator* staff, via an Area manager/Team leader.

### **2.7.2 Consideration and assessment**

On receipt of a formal enquiry, the WASIR Management committee will assess the feedback. Where the meaning of the *requirement* is clear, an explanation may be provided. Where there may be broader industry/community interest in the enquiry, an FAQ may be posted on the *network operator's* website. Should the *requirement* necessitate modification, the Management committee may consult with other affected parties. In all cases a response will be provided through the relevant *network operator* to the author of the enquiry, on any relevant outcome(s)/action(s).

### **2.7.3 Website for (FAQs)**

FAQs may be posted on the *network operators'* websites. Where a clarification of the *requirements* is given in the form of FAQ the response will be included in the regular review process to determine if an amendment to the *requirements* is required. If a change is made, the specific FAQ will be deleted from the website and users advised of the amendment.

### **2.7.4 Amendments and consultation**

Where an enquiry results in a clarification, is intricate or may have the potential to trigger an amendment to the *requirements*, the issue will be categorised as either simple or complex:

**Simple enquiry** - an enquiry that impacts on only one sector of the industry.

**Complex enquiry** - an enquiry that may impact multiple sectors of the industry.

Where the Management committee considers an amendment is necessary, draft wording will be prepared. In the case of a simple enquiry only the affected party(ies) will be consulted and the outcome/change forwarded for comment.

If the issue be considered complex or may have major consequences, a more extensive consultation with affected users may occur followed by a submission to senior management within each *network operator* for final consideration and determination.

### **2.7.5 Approval and consolidation**

Based on review recommendations, *network operator* senior management will determine an appropriate course of action(s) pertaining to any amendment or modification of the *requirements*. The Management committee will then be advised and directed to implement any changes. Such actions *shall* be regarded as final and accepted by all affected parties.

### **2.7.6 Publication and notification of changes**

The WASIR Management committee will post any revision(s) on the *network operators'* websites and notify all users of the changes or amendments. [See clause 2.6](#)

## **2.8 Amendment information**

A list of amendments and changes made to this document will be maintained in the Appendices and supporting documentation to assist industry comply with these *requirements*.

## **2.9 WASIR Management committee**

The WASIR Management committee is a flexible representative group made of participating *network operator* personnel with appropriate skills and knowledge pertinent to the specific subject matter contained within the document.

## 2.10 Reference groups

Feedback on the *requirements* may be provided through one of the following government agencies, reference groups or industry organisations:

- Australian Institute of Architects - [AIA](#)
- [Consult Australia](#) (formerly Association of Consulting Engineers Australia)
- Department of Mines, Industry Regulation and Safety ([Building and Energy](#))
- Housing Industry Association - [HIA](#)
- Horizon Power - [Horizon Power](#)
- Master Builders Association - [MBA](#)
- Master Electricians Australia [MEA](#)
- National Electrical Communications Association (WA Chapter) - [NECA](#)
- National Electrical Switchboard Manufacturers Association – [NESMA](#)
- Western Power - [Western Power](#)

# **Service and Installation Requirements**

## **Section three**

### **Scope and legislation**

## 3 Introduction

### 3.1 Purpose

The purpose of these Western Australian Service and Installation Requirements:

is to provide industry and the community with uniform conditions and information on participating *network operator* connection *requirements* applicable to all *consumer electrical installations* that are connected or that are to be connected to that *network operator's distribution system* or *network stand-alone power supply*.

The *requirements* are applicable to the specific *network operator's distribution network(s)*. Maps depicting *network operator* coverage are shown in the Appendices. For information on connection requirements in locations outside the identified *electrical licensed area boundaries*, refer to the relevant network operator in that area.

If unknown, refer to the WA Electrical Requirements [WAER](#) or the Economic Regulation Authority's website for *network operator* licensing details, operational maps and reports - [ERA](#) - Electricity licensing - licence holders.

### 3.2 Scope of these requirements

These Service and Installation Requirements (Rules) are in addition to the *requirements* prescribed within the [WAER](#) and applicable Australian standards including but not limited to AS/NZS 3000.

The *requirements shall* be applied to all new *electrical installations and alterations, modifications* or additions to existing *electrical installations, where* a new, *altered*, or upgraded connection, to the *network operator's distribution system, micro-grid, stand-alone and embedded generation networks* is required, to Horizon Power's Pilbara Grid, NIS *network* or Western Power's SWIS.

In summary, these *requirements* cover:

- *Consumer* connection/generation supply and connection arrangements.
- Connection *requirements* in addition to those prescribed in WA legislation.
- Types of available supply and connection arrangements.
- Advice on application processes.
- Service (overhead and underground) arrangements.
- Metering *requirements* (including multiple and distributed master metering).
- *Consumer distributed energy resource* infrastructure connected to the *network*.
- Reference material and contact details.

These *requirements* do not cover the *network operator's requirements* for:

- *Subdivisions*.
- The *consumer's* general *electrical installation* downstream of the *point of supply (connection)*.
- Matters relating to electrical licensing.

Content coverage does not apply to existing unaltered or unchanged connections completed prior to publication of the WASIR, as long as that connection is safe and was compliant with the relevant *requirements* at the time of energisation.

### 3.3 Users

Unlicensed individuals may use this document for information purposes only. It should be noted that it is unlawful and dangerous for unlicensed individuals to perform electrical work, as such actions may place themselves or others at risk of harm or prosecution, or both. Refer to [clause 3.7](#).

### 3.4 Compliance with these requirements

A *network operator* will not connect a non-compliant *consumer's electrical installation*, until it is made compliant by the *applicant*.

A *network operator* may disconnect a non-compliant or unsafe *consumer electrical installation* until such time as the non-compliance or safety issue is made compliant with the *network operator's requirements* inclusive of but not limited to those listed at [clauses 1.6.1](#) and [1.6.2](#)

Re-inspection of the *consumer's electrical installation* may be required for reasons of non-compliance. In such cases a *network operator* reinspection fee may apply.

### 3.5 Innovation and variations

These *requirements* do not preclude the use of other methods, innovation, or technologies that achieve the same or better outcome(s) as that prescribed within this document.

Should a *consumer* or their agent wish to propose an alternative supply or connection configuration, then a formal application to substitute that option is required and *must* be submitted to the *network operator* for evaluation and acceptance, accompanied by:

- a detailed statement of the reasons why non-compliance with these *requirements* is sought or cannot be achieved; and
- the owner or controlling body of the installation *shall* provide a “statement of consent” in the form of a signed affidavit acknowledging and approving the application for exception.

Until such time as a formal response, either accepting or rejecting the application, is received from the *network operator*, the *applicant* or their agent *shall* not commence any work or take any action on the project/installation that is the subject of the application.

Applications pertaining to exceptional circumstances *shall* be addressed to:

#### 3.5.1 Horizon Power

For further information and guidance on Horizon Power's *requirements* for a connection to the Pilbara Grid or NIS *network*, phone 1800 737 036 or e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

#### 3.5.2 Western Power

**Area manager - Customer connections services**

Western Power, Locked bag 2511 Perth 6001

### 3.6 Compliance with Acts and Regulations

*Applicants* and industry participants seeking a connection *must* ensure that the *consumer's electrical installation* is electrically safe and compliant with these *requirements* and with all applicable legislation.

This requirement also applies where an existing *consumer electrical installation* is *altered*, in that the *applicant* and their agent *must* ensure that the *altered* portion of the installation is electrically safe and compliant when reconnected.

Non-compliance may result in action being taken against the offending party(s) by the responsible governing agency or the installation not being connected, disconnected or the electricity connection delayed.

The following legislative overview has been provided as a guide to assist readers gain an awareness of the regulatory framework within the building and construction environment. The following references should not be construed as a full or complete list of all statutory requirements:

### 3.6.1 Electricity Corporations Act 2005

This governing Act, establishes and sets out the functions and powers of each of the following organisations:

- Horizon Power.
- Synergy (Merged Electricity Generation and Retail Corporation).
- Western Power.

### 3.6.2 Electricity Act 1945

This Act:

1. provides for the examination and licensing of persons who carry out work related to electricity;
2. specifies supply authorities and *network operator's* powers and duties; and
3. regulates the approval and prohibition of electrical appliances.

The Act requires *network operators* to:

4. maintain their equipment installed on the *consumer's* property in a safe and fit condition;
5. take all reasonable steps to avoid the risk of fire or damage to a *consumer's* property from *network operator's equipment*; and
6. maintain the system pressure and frequency of electricity supply to the *consumer* within prescribed limits.

The Act also makes provision for the following Regulations:

#### 3.6.2.1 Electricity (Licensing) Regulations 1991

These Regulations make provision for the:

1. scope of work required to be performed by *licensed persons*;
2. licensing of *electrical workers and contractors*;
3. duties and responsibilities of *licensed persons*;
4. regulation of electrical work and the application of applicable industry standards;
5. notification of the commencement and completion of electrical work;
6. reporting of defective installations or work;
7. prohibits work on energised *consumer electrical installations*; and
8. reporting of electrical accidents and incidents.

These provisions also require electrical work to be carried out in accordance with specific *requirements* including but not limited to the:

9. Wiring Rules AS/NZS 3000; and
10. WA Electrical Requirements.

Where any code or standard identified within the Regulations is inconsistent with the [WAER](#), the WAER *shall* prevail to the extent of that inconsistency.

#### 3.6.2.2 Electricity (Network Safety) Regulations 2015

These Regulations provide for the safe operation of the electricity *networks*.

### 3.6.2.3 Electricity Regulations 1947

These Regulations govern the actions of *network operators* in relation to the supply of electricity to *consumers*. They also stipulate the:

1. general safety requirements for electrical work including notification and inspection systems;
2. *electrical contractor* responsibilities for the submission of notices and certification of work;
3. energy efficient labelling obligations;
4. provision for the approval of electrical appliances; and
5. employer responsibilities to supply electrical safety equipment and implement safety procedures.

### 3.6.3 Electricity Industry Act 2004

This Act:

1. creates the wholesale electricity market;
2. implements a licensing regime for the ERA;
3. provides for a *network electricity infrastructure Access Code*;
4. creates a tariff equalization fund;
5. provides for a Code of Conduct and an Ombudsman to protect small use *consumers* (up to 160 MWh per year); and
6. allows for the preparation and submission of policies to the Coordinator of Energy governing extension, expansion and connection to the *transmission* and *distribution systems*.

The Act also provides a framework for the ERA to govern matters such as:

7. the administration of electricity licensing (not worker licensing);
8. energy metering;
9. transfer of *consumers* between *retailers*;
10. electricity quality and reliability standards;
11. compensation payable if a licensee fails to meet electricity quality and reliability standards; and
12. access to certain public and private electricity *networks* for parties who are not owners or operators of a *network*.

#### 3.6.3.1 Electricity Networks Access Code 2004

This Code establishes the framework for third party access to electricity *transmission and distribution system networks*. Its objective is to promote economically efficient investment in operation and use of *networks* and services of *networks* in Western Australia.

#### 3.6.3.2 Small User Customer Code

This Code is administered by the Economic Regulation Authority. Its purpose is to regulate and control the conduct of electricity marketing agents, *retailers* and distributors by:

1. defining standards of conduct in the supply and marketing of electricity to *consumers*; and
2. protecting *consumers* from undesirable marketing conduct.

#### 3.6.3.3 Electricity Industry (Obligation to Connect) Regulations 2005

These Regulations make provision for the placement of an additional condition on *network operators* in relation to an obligation to connect where the *premises* is:

1. not already attached to a *distribution system*;
2. attached to a *distribution system* but is not energised; and
3. within a specified distance from a functional *distribution network*.

### 3.6.3.4 Electricity Industry Metering Code 2012

This Code relates to:

1. supply, ownership, installation and maintenance of *network* meters and *metering installations*;
2. accuracy and specification of *metering installations*;
3. revenue *metering installations* and check *metering installations* used for the measurement of active energy and where appropriate, reactive energy;
4. the metering database, including registry requirements;
5. provision of and charges for metering services provided by a *network operator*;
6. collection, processing and provision of energy data and standing data;
7. security of, ownership and rights of access to energy data and standing data; and
8. documents under this Code including model service level agreements and communication rules for the transfer of energy data and standing data to the relevant parties.

### 3.6.4 Energy Coordination Act 1994

The Act provides the infrastructure for inspectors to be appointed and for the establishment of their powers for the purposes of but not limited to:

1. entering upon land where electricity is generated, transmitted, distributed, is supplied or used;
2. inspecting plant, *works*, apparatus and installations;
3. determining whether the Act or any other conditions are being complied with;
4. investigating and reporting on the cause of any:
  - a. electricity related failure or damage;
  - b. death, injury, or property damage;
5. serving written orders on a person(s) who controls or is responsible for an electrical related danger to be mitigated or remove that danger; and
6. inspecting electricity related work practices and serve written orders on the person who is responsible prohibiting that work practice or ordering that work practice to be modified.

Any person who fails to comply with an inspector's order commits an offence.

### 3.6.5 Energy Operators Powers Act 1979

This Act provides energy utility companies with the legal authority required to ensure an energy supply can be maintained throughout their network.

Sections 46, 48 and 49 of the Act provides the *network operator* with powers of access and entry for construction/maintenance purposes, though only when prior notification has been given. Where the situation is considered an emergency, notification is not required prior to entry.

### 3.6.6 Work Health and Safety Act 2020

The objectives of the WHS Act are to:

1. protect the health and safety of workers and other people by eliminating or minimising risks arising from work or workplaces
2. ensure fair and effective representation, consultation and cooperation to address and resolve health and safety issues in the workplace
3. encourage unions and employer organisations to take a constructive role in improving work health and safety practices
4. assist businesses and workers to achieve a healthier and safer working environment
5. promote information, education and training on work health and safety
6. provide effective compliance and enforcement measures
7. deliver continuous improvement and progressively higher standards of work health and safety.

The WHS 2020 Act replaces in part or in full the following legislation:

- Occupational Safety and Health Act 1984
- the work health and safety elements of the following Acts, covering mining and petroleum:
  - Mines Safety and Inspection Act 1994
  - Petroleum and Geothermal Energy Resources Act 1967
  - Petroleum (Submerged Lands) Act 1982
  - Petroleum Pipelines Act 1969.

### **3.6.6.1 Work Health and Safety Regulations 2022**

1. Work Health and Safety (General) Regulations 2022
2. Work Health and Safety (Mines) Regulations 2022
3. Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022

In general, the WHS Regulations replace the Occupational and Safety Regulations 1996.

### **3.6.7 National Standard for Construction Work**

Developed by the National Occupational Health and Safety Commission (now the Australian Safety and Compensation Council) to provide a nationally consistent approach to managing OSH in the construction industry.

This national standard has been adopted throughout Australia and in Western Australia via Part 3 Division 12 of the OSH Regulations 1996. The new standard covers high-risk activities including but not limited to work:

1. where there is a risk of falling more than 2 metres;
2. excavations to a depth of more than 1.5 metres; and
3. on or near energised *electrical installations* and lines (whether overhead or underground).

### **3.7 Necessity for employing a licensed person**

In Western Australia, legislation does not permit unlicensed persons to work on *electrical installations*. Additional conditions apply to the licensing of *electrical contractors* including advertising as or contracting to perform such work.

For enquiries regarding licensing, the qualifications to work, to undertake work, and/or to *contract* to perform electrical work on *electrical installations* should be referred to:

The Manager Electrical Licensing Board  
Department of Mines, Industry Regulation and Safety (Building and Energy)  
303 Sevenoaks St, Cannington WA 6107

**Phone** 08 6251 2000. **Fax** 08 6251 1902.

**Email:** [energylicensing@dmirs.wa.gov.au](mailto:energylicensing@dmirs.wa.gov.au)

### **3.8 Offences**

A person other than those legally entitled and endorsed to carry out electrical work *shall* not insert or remove or operate a *network operator's* fuse/link/circuit breaker or operate a *service protection device*, tamper with or *alter* any meter measuring equipment including *metering service equipment*, make or break any electrical connection (including seals and locks), dismantle any component part of a *network operator's* equipment or detach such equipment from its fixings.

Additionally, obtaining electricity by any means other than by an approved method is classified as theft.

Where a person is found guilty of such offences, it may result in the imposition of substantial penalties together with an order for damages to compensate the *network operator* for any loss or rectification inclusive of court costs.

### 3.9 Testing

All *electrical installation* work including minor and maintenance work *must* be checked and tested by the installing *electrical contractor* prior to it being connected to the *network* or where permitted energised. In addition to these *requirements* the *network operator* may require testing and reporting as part of its installation and commission processes.

The nature and type of testing required will depend on both the type of installation and the *voltage* configuration. Further information on the *network operator's requirements* is contained within the relevant technical [sections](#) of this document.

### 3.10 Access

*Network operator* personnel, including but not limited to emergency service crew, maintenance and construction staff, meter readers and inspectors, *require* 24 hour / 7 day access to *network electricity infrastructure* and elements of the *consumer's electrical installation* inclusive of switchboard and *metering equipment* to perform their duties and comply with their responsibilities.

*Network operators* generally do not require access to the *consumer's* installation downstream of the installations main switch(es).

Wherever possible *network operator* staff will seek to arrange a convenient time or schedule an appointment to meet on *site* if access to private property is required, however there are circumstances and times when this may not be possible.

*Consumers* need to be aware that *network operators* have the legal right to enter or gain access to private property. For more information on energy utility company's access rights refer to [clause 3.6.5](#)

### 3.11 Inspection of a consumer's premises

*Network operators must* ensure that before electricity is supplied to the *consumer's premises*, the installation has been checked, tested, is safe and ready to connect to their network.

A *network operator's* inspection plan provides for a sample audit of all notifiable electrical work. As such not all *electrical installations* or electrical work is required to be inspected. The need to inspect is determined by but not limited to the:

- Nature and complexity of *electrical installation*.
- Skills and experience of the *electrical contractor* and their employees.
- Type of licence held by the *electrical contractor*.
- Type of *network operator* connection authorisation held by the *electrical contractor*.

For more information on the roles of Inspectors refer to [clause 3.6.4](#)

# **Service and Installation Requirements**

## **Section four**

### **Roles and responsibilities**

## 4 Roles and responsibilities

### 4.1 Energy reform (disaggregation)

In April of 2006 Western Power Corporation, as it was known, was divided into four operational entities, each with specific responsibilities. In 2014 the *retailer* (Synergy) and *generator* (Verve) were merged, to operate under the Synergy banner.

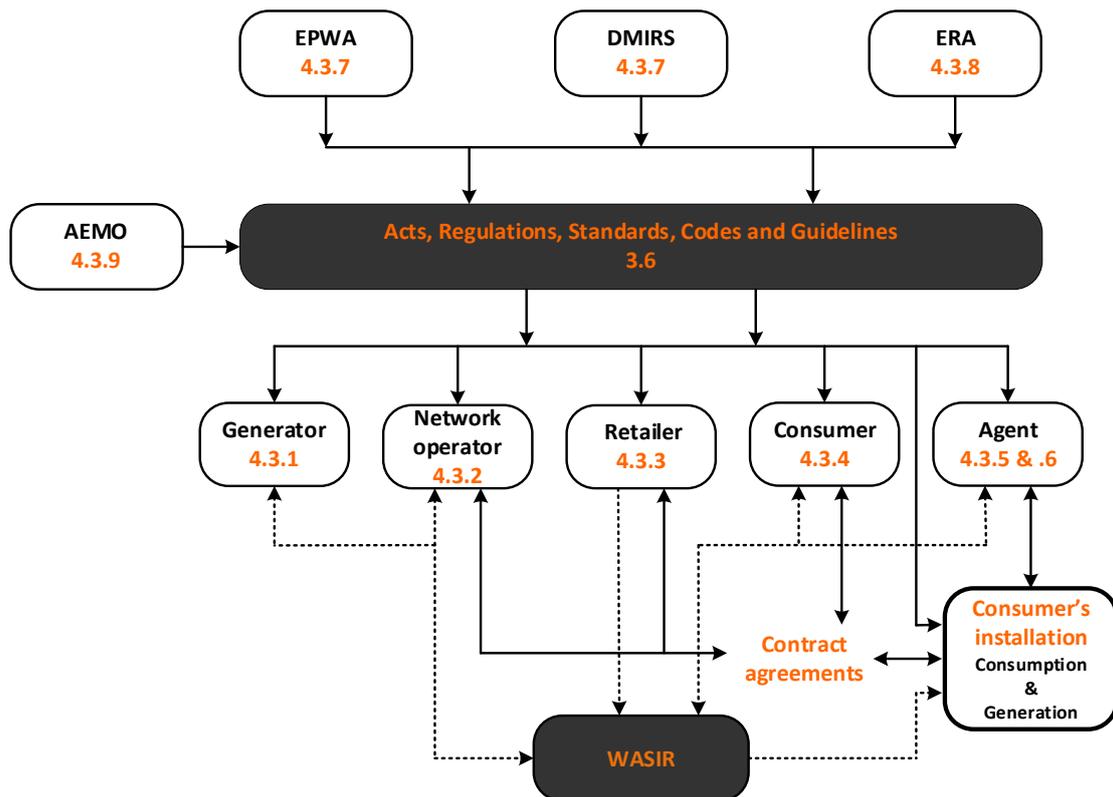
- **Horizon Power** - *Generator, retailer and network operator* (North West and Regional WA).
- **Synergy** - *Generator and retailer* (Merged Electricity Generation and Retail Corporation).
- **Western Power** - *Network operator* (South West Interconnected System).

The changes were part of the State Government's reform of the electricity generation, distribution and retail market in Western Australia.

This [section](#) provides an overview of the roles and responsibilities of the various entities operating within the energy market and supply chain.

**Note:** With the rapid growth and integration of *distributed energy resources* (renewable energy) this structure and associated responsibilities will continue to evolve and change.

### 4.2 Regulatory, contractual and practical relationships



**Figure 2:** Consumer, industry and regulatory relationships

**Note:** Number references relate to the following clauses

## 4.3 Electricity supply chain

**Figure 2** together with the following descriptions, depict the regulatory, contractual, functional relationships and roles for each party within the distribution energy, generation and supply chain.

### 4.3.1 Generators

A *generator* may be either an individual or entity that in part or collectively owns, controls, or operates a *generation system* that self-consumes or supplies electricity to a *distribution or transmission system*.

Owners of such systems can be either domestic, commercial, industrial, public or private and may include mainstream or *alternative energy generation systems* including but not limited to *stand-alone or embedded generation, photovoltaic*, storage, wind or hydro systems.

### 4.3.2 Network Operators

*Network operator* responsibilities include the transportation and delivery of electricity produced either by others or their organisation which is subsequently purchased through *retailers* for sale to *consumers*. These include:

- Maintaining, up to the *connection point, distribution and transmission network systems* for the conveyance of electricity.
- Where permitted, provide distributed energy inclusive of renewable, *stand-alone* or storage.
- Negotiating the provision and type of *consumer* supply.
- Provision of a *network connection point* to facilitate a *consumer's* connection.
- Provision of *metering equipment* for the measurement of electricity consumption/generation and billing by *retailers*.
- Administration of “national metering identifier” (NMI) systems and procedures.
- Providing an inspection regime to validate *electrical installation* work.
- Maintaining the reliability and quality of the supply.

**Note:** A *consumer* is required to establish an account with a *retailer* before a *network operator* can energise an installation.

### 4.3.3 Retailers

*Retailer* responsibilities are predominately associated with the purchase and sale of electricity to and from *generators* and *consumers* including:

- The purchase of electricity from *generators*.
- Sale (retail) of electricity at nominated tariffs (usage charges) to *consumers*.
- Establishing and administering *generator/consumer contracts* and accounts.
- Creating “customer reference numbers” (CRN) for the administration of *consumer's* accounts.
- Confirming with the *network operator*, the electrical connection parameters in accordance with the *consumer's contract* including:
  1. the metering arrangement;
  2. type of connection; and
  3. date of connection or disconnection.

It should be noted that electricity accounts are categorised as contestable and non-contestable. For more information refer to [clause 4.4](#).

#### 4.3.4 Consumers

A *consumer's* key obligations are to:

- Apply to a *network operator* for a *distribution* or *transmission network* connection.
- Establish an electricity account with a *retailer*.
- Ensure their *electrical installation* is used in the manner for which it is intended, regularly maintained, hazard free and compliant.
- Engage the services of an *electrical contractor*, either directly or via an agent, to undertake electrical work.

#### 4.3.5 Consumer's agent / representative

An agent represents the *consumer* in the processes of design, manufacture, construction, connection of and delivery of the *consumer's electrical installation* in accordance with the *consumer's* instructions or direction. Such parties may include:

- *Architects*.
- *Electrical consulting engineers*.
- Builders.
- *Developers*.
- Registered *electrical contractors* and their electrical workers.
- Equipment manufacturers.

Where a *consumer* chooses to place the responsibility of their project under the control of an agent that entity is accountable for ensuring the *consumer's* obligations, to those parties are fulfilled in accordance with these *requirements*.

#### 4.3.6 Electrical contractors

*Electrical contractors* are responsible for undertaking requested electrical work and where approved the *network* connection. *Electrical contractors* maybe contracted directly by the *consumer* or via an agent. Regardless of the contractual arrangement the *electrical contractor* must:

1. consider, in consultation with the *consumer* or agent, the type of connection required (i.e., consumption and or generation);
2. determine the amount of electricity required for current and future use;
3. advise the *network operator* or Regulator of the intention to commence *electrical installation* work "preliminary notice";
4. complete the installation to the required standard(s);
5. where approved, install and connect the *metering and service equipment*;
6. test, commission and if approved, energise the installation;
7. obtain and provide the *consumer* account details (CRN number) to the *network operator*;
8. advise the *network operator* via a "completion notice" that the electrical work is complete and ready for connection or is complete and has been connected/energised; and
9. provide the *consumer* with an "electrical safety certificate".

## **4.3.7 Department of Mines, Industry Regulation and Safety**

### **4.3.7.1 Building and Energy**

A Division of the Western Australian Department of Mines, Industry Regulation and Safety responsible for the technical and safety regulation of the State electrical industry and elements of the gas industry. Responsibilities include:

- Safety standards and standards of workmanship.
- Safety and energy efficiency of appliances and certain types of equipment.
- Ensuring *network operator, generator*, industry and community compliance with applicable legislation.
- Administration of occupational licensing of *contractors* and workers.
- The promotion of electrical and gas safety.

For more information about [Building and Energy](#) refer to their website.

### **4.3.7.2 Energy Policy WA**

Energy Policy WA (previously known as PUO), established in September 2019 is a standalone section of the Department of Mines, Industry Regulation and Safety.

The Department is responsible for supporting the delivery of Government's "Energy transformation strategy" by the Energy transformation taskforce, and the statutory functions of the Coordinator of Energy, as set out in the Energy Coordination Act 1994, including the management of fuel, gas and electricity supply disruptions.

For more information about [Energy Policy WA](#) and the DER roadmap refer to their website.

### **4.3.7.3 WorkSafe**

A Division of the Department of Mines Industry Regulation and Safety, responsible for the administration of the occupational work, health and safety legislation throughout the state.

The principal objective of the Western Australia's Work Health and Safety Act 2020 is health and safety within the workplace.

For more information about [WorkSafe](#) refer to their website.

## **4.3.8 Economic Regulation Authority (ERA)**

A Western Australia independent economic regulator, responsible for issuing and regulating performance of electricity licenses to entities generating, transmitting, distributing or retailing electricity in Western Australia that are not exempt from the requirement to hold a licence.

### **Note:**

- A licence can apply to a party involved in one or more of the above activities.
- The agency is also responsible for the application of and compliance with the WEM (Wholesale Electricity Market) rules, applicable to the South West Interconnected System.

For more information about the [ERA](#) refer to their website.

### 4.3.9 Australian Energy Market Operator (AEMO)

AEMO is tasked with managing the day-to-day operations of several electricity and gas markets and information services, as well as providing strategic forecasting and planning advice on the WEM rules in Western Australia. These responsibilities include:

- Administering the wholesale market rules.
- Operating the wholesale electricity market.
- Facilitating the provision of sufficient generation capacity and demand side management to meet expected demand.

For more information on [AEMO and the WEM](#) refer to their website

## 4.4 Contestable accounts

Generally, *network operators* are not permitted to sell electricity or establish and administer *consumer* electricity accounts unless they are the holder of a retail licence issued by the ERA. This is a primary function of electricity *retailers*.

**Note:** Horizon Power is the holder of a retail licence.

To establish an electricity account a separate application *must* be made to either a designated *retailer* for non-contestable accounts or to a market *retailer* for *consumers* where the account is deemed to be contestable.

A **non-contestable account** is determined by the amount of electricity consumed being less than 50 MWh a year or approximately 137 units per day.

**Contestable accounts** are also determined by the amount of electricity used.

Where consumption exceeds 50 MWh a year the account holder may choose an electricity *retailer* and negotiate the purchase tariff/price for electricity.

### 4.4.1 Pilbara Grid and NIS networks (Horizon Power)

Contestable *consumers* should contact Horizon Power for additional information on electricity accounts in their designated distribution area. All Horizon Power *consumers* are deemed contestable.

Website [www.horizonpower.com.au](http://www.horizonpower.com.au) or call 1800 267 926 (Residential) or 1800 737 036 (Business).

### 4.4.2 SWIS distribution areas (Western Power)

*Consumers* connected to Western Power's SWIS *network* may elect to choose a *retailer* where the contestability criterion has been satisfied.

#### 4.4.2.1 Non-contestable accounts

For non-contestable accounts, Synergy is the only designated electricity *retailer* within the SWIS distribution area.

Website [www.synergy.net.au](http://www.synergy.net.au) or online support

Call 13 13 53 (Residential) 13 13 54 (Business).

#### 4.4.2.2 Contestable accounts

For contestable account *retailer* availability details refer to the [ERA](#)'s website.

## **4.5 Dispute resolution**

*Network operators* have formal disputes resolution mechanisms designed and established to resolve issues relating to the distribution connection process.

Where contact has been established at the operation level, ongoing communication is encouraged with that *network operator* representative to address unresolved issues. Should the *consumer* or their agent not have an initial point of contact then the matter should be referred to the applicable *network operator's* "customer services centre".

### **4.5.1 Horizon Power**

Residential enquiries call 1800 267 926 and business enquiries call 1800 737 036.

### **4.5.2 Western Power**

All enquiries contact Western Power on 13 10 87.

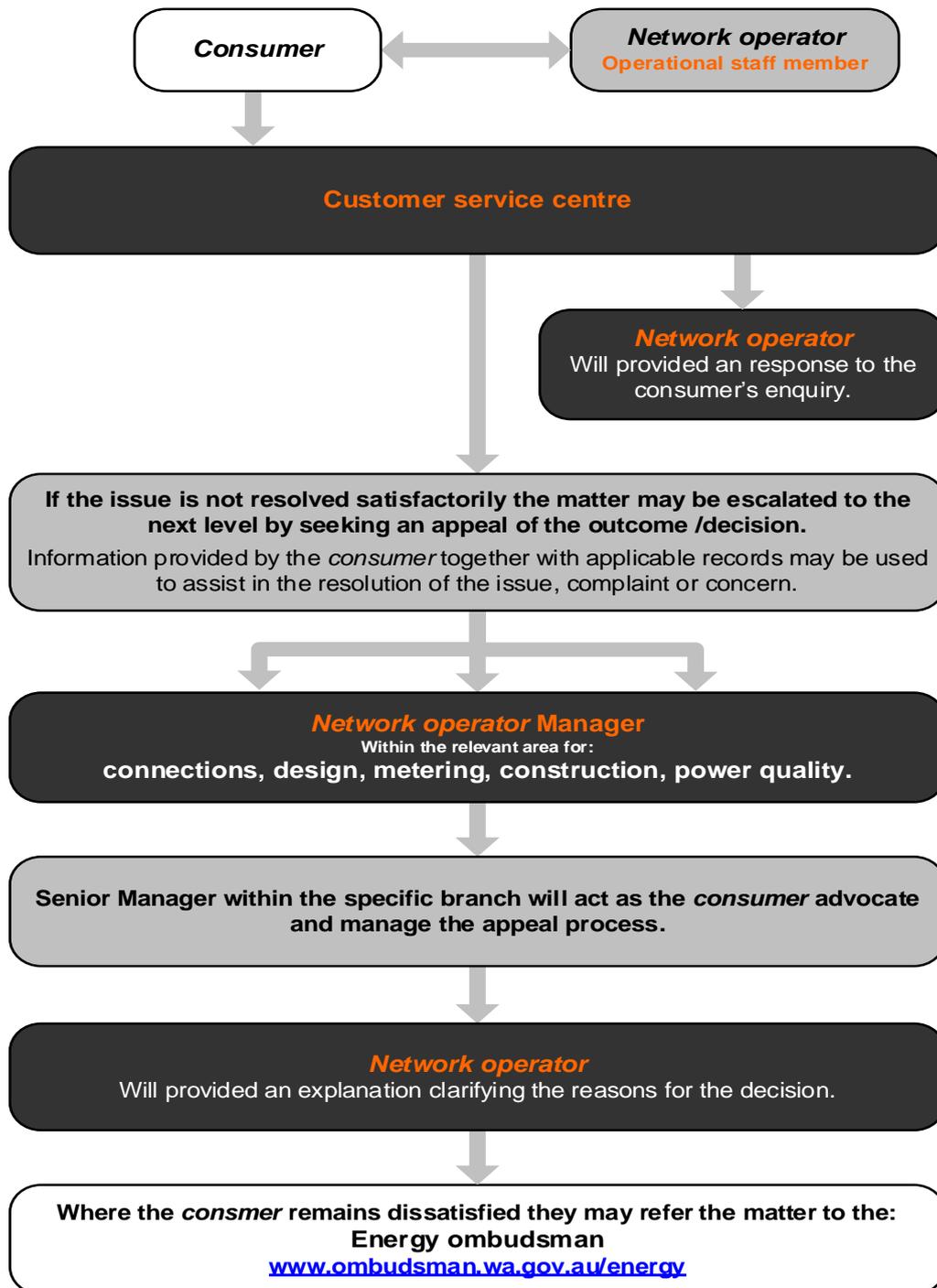
### **4.5.3 Unresolved issues**

If it is perceived by one or more of the affected parties that the issue has not been addressed satisfactorily then the party(ies) may choose to escalate the issue (via the *network operators* "customer services centre") to the next level by seeking an appeal of any outcomes/decisions made by operational staff. *Network operator* senior management will conduct a review of the issue/complaint.

Where a *consumer* remains dissatisfied with the review and response from the *network operator* regarding their complaint or should the *consumer* disagree with the action taken or decision made then the matter may be referred to the Energy Ombudsman. Refer to [clause 5.3.4](#) for contact details.

#### 4.5.4 Distribution connection resolution pathway

The following flow chart (figure 3) depicts the process for resolution of *consumer* concerns or disputes:



**Figure 3:** Flow chart for resolution of distribution disputes

# **Service and Installation Requirements**

## **Section five**

### **Contact details**

## 5 Contact details

### 5.1 Horizon Power contact details

Contact reason	Contact number
Emergency or supply interruptions.	13 23 51 (24 hours)
Faulty streetlights and poles	<a href="#">Online form</a> or 1800 264 914
Residential account enquiries	1800 267 926
Business account enquiries	1800 737 036
Account enquiries - Fax	1800 420 998
Media (only) enquiries	1800 799 745
TTY (Speech or Hearing Difficulties)	1800 461 499
Interpreter Service	13 14 50
Enquiry form	<a href="#">Online form</a>

**Table 1:** Horizon Power contact details

#### 5.1.1 West Pilbara Head office

Lot 1966 Stovehill Road Karratha, Western Australia 6714

PO box 817 Karratha WA 6714 Australia

Phone: (618) 9159 7250 or email: [karratha@horizonpower.com.au](mailto:karratha@horizonpower.com.au)

Online: [Contact Us](#)

#### 5.1.2 Bentley Office

18 Brodie Hall Drive Bentley, Western Australia 6102

PO box 1066 Bentley DC WA 6983 Australia

Phone: (618) 6310 1000 or email: [enquires@horizonpower.reply.com.au](mailto:enquires@horizonpower.reply.com.au)

#### 5.1.3 Other Regional offices

**Note:** Regional offices should not be contacted regarding faults or *consumer* account enquiries.

##### West Kimberley Regional Office

2-4 McDaniel Rd Broome WA 6725

Ph: (08) 9192 9900

Email: [broome@horizonpower.com.au](mailto:broome@horizonpower.com.au)

##### Goldfields Esperance Regional Office

143 Sims St, Esperance, WA 6450

Ph: (08) 9072 3400

Email: [esperance@horizonpower.com.au](mailto:esperance@horizonpower.com.au)

##### East Kimberley Regional Office

Messmate Way & Victoria Hwy Kununurra  
WA 6743

Ph: (08) 9166 4700

Email: [kununarra@horizonpower.com.au](mailto:kununarra@horizonpower.com.au)

##### Gascoyne Mid-West Regional Office

Robinson St & Iles Rd Carnarvon WA 6701

Ph: (08) 9941 6299

Email: [carnarvon@horizonpower.com.au](mailto:carnarvon@horizonpower.com.au)

##### Onslow Regional Office

Unit 1 Second Avenue Onslow, WA 6710

Ph: (08) (08) 6310 1029

Email: [onslowsolar@horizonpower.com.au](mailto:onslowsolar@horizonpower.com.au)

##### East Pilbara Regional Office

18 Anderson St Port Hedland WA 6721

Ph: (08) 9173 8281

Email: [portheadland@horizonpower.com.au](mailto:portheadland@horizonpower.com.au)

### 5.1.4 Complaints

Horizon Power customer service representatives are available to assist *consumers* with matters relating to their power supply ([Complaints](#)).

### 5.1.5 Feedback

Horizon Power welcomes all feedback so that they can further improve their services. ([Horizon Power feedback](#))

## 5.2 Western Power contact details

Contact reason	Contact number
Faults and emergencies, fallen power lines, estimated restoration times (24/7) <a href="#">Faults and emergencies</a>	13 13 51
<a href="#">Power Quality</a> (lights flickering, appliances fail or television and radio interference)	<a href="#">Online form</a> or 13 13 51
Streetlight faults (off during the night or on all day)	<a href="#">Online form</a> or 1800 622 008
Graffiti (24 hours a day, 7 days a week)	<a href="#">Online form</a> or 1800 622 008
General and technical enquiries (No fault information)	13 10 87 <a href="mailto:enquiry@westernpower.com.au">enquiry@westernpower.com.au</a>
Pillar and Pit energisation enquiries	13 10 87
<a href="#">Trees that are close to powerlines</a> . (No fault information)	Online form or 1300 368 733
Media enquiries (No fault information)	<a href="mailto:media@westernpower.com.au">media@westernpower.com.au</a>
<a href="#">Complaints and feedback</a>	<a href="#">Online form</a> or 13 10 87
Western Power administration - head office (No fault information)	08 9326 4911
Website feedback - missing pages, positive or negative feedback	<a href="#">Email us</a>
TTY (Speech or Hearing Difficulties)	1800 13 13 51
Interpreter Service	13 14 50

**Table 2:** Western Power contact details

### 5.2.1 Head Office

363 Wellington street, Perth WA Australia 6000  
<https://westernpower.com.au/contact-us/>

### 5.2.2 Postal addresses

Main Western Power mailing address  
**GPO Box L921, Perth, WA 6842**

Customer service and complaints  
**Locked Bag 2520, Perth, WA, 6001**

Meter reading services (Self-read meter cards)  
**Reply Paid 8285, Perth BC, 6849**

### 5.2.3 How to report a problem

All cases of emergencies, faults, power interruptions, and estimated restoration times (24 hours) should be referred to the Western Power call centre on 13 13 51. More information regarding what to do can be found at [how to report it](#).

### 5.2.4 Calls from mobile phones

Calls from mobile phones may incur a higher charge. It is suggested that *consumers* maintain a standard (non-cordless) telephone at their *premises*, as these devices will generally function even when the power has been disrupted.

## 5.3 General contacts

### 5.3.1 Dial Before You Dig

For information on existing gas, water, communications and electricity underground *networks*. **Call 1100** or [Dial Before You Dig](#)

### 5.3.2 Electricity retailers

Electricity can be purchased from an electricity *retailer* who are responsible for managing and administering electricity accounts. For additional information to [clause 4.4](#).

**Note:** Horizon Power is a registered *retailer* of electricity within their respective *networks* whereas Western Power is not.

### 5.3.3 Electrical industry licensing

Enquiries regarding licensing, qualifications to work, to undertake work, and/or to *contract* to perform electrical work on *electrical installations* should be addressed to:

The Manager,  
Electrical Licensing Board,  
Building and Energy  
303 Sevenoaks street, Cannington WA 6107  
**Phone** 08 6251 2000. **Fax** 08 6251 1902.  
**Web:** [energylicensing@dmirs.wa.gov.au](mailto:energylicensing@dmirs.wa.gov.au)

### 5.3.4 Energy and Water Ombudsman

Where an issue cannot be resolved with a *network operator* the matter may be referred to the Ombudsman. Enquiries regarding the resolution of complaints can be addressed to:

[Compliant form](#)

or

Energy and Water Ombudsman  
Level 2 Albert Facey House  
469 Wellington street Perth WA 6000  
**Phone:** 08 9220 7588 **Fax:** (08) 9220 7599  
**Email:** [energyandwater@ombudsman.wa.gov.au](mailto:energyandwater@ombudsman.wa.gov.au)

# **Service and Installation Requirements**

## **Section six**

### **General requirements**

## 6 General requirements

### 6.1 Introduction

Every person has both a direct and indirect responsibility for their own safety and the safety of others regardless of whether they are a *network*, or industry operative, property owner or a member of the public.

Each person *must* take all reasonable steps to ensure their own health and safety while actively seeking to avoid adversely affecting the health and safety of others due to any act or omission on their part.

### 6.2 Safety policy statement

Safety and health is central to everything Horizon Power and Western Power does. No activity or task is considered to be that important that it will be permitted to compromise safety. Work *must* cease if safety cannot be assured.

The provision, connection and use of electricity requires the highest standards of health and safety. Horizon Power and Western Power are committed to the prevention of injury and harm and therefore strive to continuously improve health and safety across their respective *networks*.

### 6.3 Safe operational procedures

Any entity or individual working on or near a *distribution network* or a *consumer's electrical installation*, *must* manage their health and safety obligations in accordance with *industry best practice*, applicable legislation, codes, industry standards and the *network operator's* safety, operational and *technical requirements*.

*Distribution networks, consumer electrical installations, service apparatus*, equipment and appliances *shall* be regarded as live until effectively isolated, proven to be de-energised and where required earthed or short circuited.

Work on *network electricity infrastructure, consumer installations* and non-network related infrastructure *shall* not commence until the required work permissions/permits have been issued; appropriate safety protocols, isolation and notifications implemented; and placement/fitting of operational locks/tags have been completed, all in accordance with *industry best practice* and procedures.

The *network operator shall* be contacted at the earliest opportunity where isolation of supply is required to enable work to be performed safely. Refer to the relevant *network operator* for details of their *network* access procedures.

#### 6.3.1 Consumer installations and non-network infrastructure

In addition to [clause 6.3](#), persons working on a *consumer's electrical installation* and non-network related infrastructure *shall*, apply and observe the *requirements* of:

- Work Health and Safety Regulations 2022 – inclusive of but not limited to Part 4.7; and
- The Electricity Act and Electricity (Licensing) Regulations 1991 – Part 5 Regulation of electrical work.

In summary the identified legislation states that where work is required on or near an energised part of an *electrical installation*, that installation is to be, in a proven de-energised state.

**Note:** *Network operators* deem private *generation* and *DER systems*, where installed to be and form a part of a *consumer's electrical installation*.

Additional information and direction can be obtained from DMIRS - (Building and Energy) Code of practice entitled - [Persons working on or near energised electrical installations](#).

### 6.3.2 Safety in design

Under the Work Health and Safety Act 2020 DMIRS (WorkSafe) *developers*, designers, *electrical engineers/consultants/contractors* and owners have specific responsibilities to, as far as practicable, eliminate or control hazards as a part of the design, construction and functional phases for *premises* or structures, under their control. This “duty of care” is to ensure that, as far as practicable, persons are not exposed to hazards or risks associated with such *premises* or structures.

Designated or *responsible persons shall* give due consideration to the “safety in design principles” to enable *network operator* personnel to establish appropriate safety processes in the identification and management of hazards, when carrying out *network* operational and maintenance functions.

### 6.3.3 Network operational clearances

It is the responsibility of the *site* owner, or responsible company or contractor to ensure that any work undertaken near overhead or underground services can be carried out safely.

Before any work associated with *network* underground or overhead powerlines is commenced permission *must* be obtained from the relevant *network operator*. At all times during the planned work, operational clearances *shall* be maintained at all times in accordance with the *network operator’s* instructions and *requirements*.

Where the required clearances cannot be maintained, the *network operator must* be contacted to arrange for the appropriate isolation of or alteration to the *distribution network* to achieve the required level of operational safety and clearances.

Adequate clearances *must* also be maintained from privately owned overhead and underground *distribution systems*.

#### 6.3.3.1 Horizon Power safety guidelines

For additional guidance on *network* powerline clearances within the Pilbara Grid or NIS network:

- Refer to [Horizon Power’s Contractor occupational safety and health guidelines](#); or
- Phone 1800 737 036 or e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au).

#### 6.3.3.2 Western Power safety guidelines

For additional information on *network* clearances within the SWIS:

- Refer to the [Working safely around the Western Power network](#) guideline.
- [Electrical system safety rules](#) for *requirements* and procedures governing *network* access.

### 6.3.4 Blasting near overhead/underground network infrastructure

Prior to the transportation, storage or use of blasting initiation systems or explosives in the vicinity of a *network operator’s distribution and transmission system*, confirmation of use and clearances *shall* be obtained from that *network operator*.

In summary explosives *shall* not be used within 5m of cables/conduits, and 30m from overhead lines unless an engineering report is provided indicating that no damage will be sustained.

For specific detail on *network* operational *requirements* refer to the relevant *network operator’s* safety procedures, regional office or specific *contract* management team.

## 6.4 Underground (excavation)

Excavation in undeveloped, built up areas, road reserves or public open space may only commence after all buried services are physically identified and located.

Registered services such as high-pressure gas mains, *consumer* underground distribution cabling, water, gas or telecommunications services may also exist within easements on private property.

Utility services located within road reserves and public open spaces are registered with the Dial Before You Dig (DBYD) service. To prevent damage or disruption to essential services, *developers* or their agents are required to contact DBYD to confirm the existence of services within the vicinity of the proposed excavation, prior to work commencing.

DBYD is a free national referral service, supported by both Horizon Power and Western Power, through the provision of plans depicting the location of underground *network* services. Enquiries generally take two *working days* to process.

Caution and contact with local government agencies is recommend prior to excavation commencement as underground services provided by such agencies may not be recorded by the DBYD service.

*Responsible persons* need to be aware that in the event of a service being damaged, an insurance claim may not be accepted. Financial penalties may also apply for negligent behaviour if the DBYD system was not utilised. For more information refer to [Dial Before You Dig](#)

### 6.4.1 Horizon Power guidelines

For further information and guidance on Horizon Power's *requirements* for excavation works within the Pilbara Grid or NIS *network*, phone 1800 737 036 or e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

### 6.4.2 Western Power guidelines

Additional information is available on excavation *requirements*, via the [Electrical system safety rules](#).

## 6.5 Overhead powerlines

Working near, or in close proximity to overhead powerlines is hazardous if appropriate precautions are not implemented.

Physical contact with a powerline is not a prerequisite to endanger life or cause damage to property given that electrical energy can arc across an air gap where clearances are not sufficient.

Consequently, it is important to maintain appropriate distances when work is carried out near powerlines such as new *premise* construction, restoration/renovation work, installation of advertising equipment or the erection of scaffolding.

DMIRS WorkSafe legislation sets clearance boundaries, known as danger zones, around overhead powerlines which *shall* always be maintained. Zones range from 6m down to 500mm from overhead lines, dependent on the *voltage* and type of conductor used.

For more information on [WorkSafe's danger zones](#) (regulation 3.64) and related work *requirements*, refer to their brochure.

### 6.5.1 Horizon Power guidelines

For further information and guidance on Horizon Power's operational *requirements* near overhead infrastructure within the Pilbara Grid or NIS *network*, phone 1800 737 036 or e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

### 6.5.2 Western Power guidelines

For more information refer to the [Working safely around the Western Power network](#) guideline.

### 6.5.3 Building and structural clearances near powerlines

As is the case for safe working distances, there are minimum clearances from *network* assets that *must* be maintained for private/public structures, *premises*, roads, paths, and access ways etc.

In addition to the *network operator's* specific policies for conductor clearances, AS/NZS 7000 "Overhead line design detailed procedures" provides information on the structural clearances required from overhead *transmission* and *distribution network* infrastructure.

AS/NZS 3000 table 3.8 also contains minimum aerial conductor clearance *requirements* for a range of situations over or near which private *consumer* aerial conductors may pass including structures such as access ways, *premises*, roofs, antennas, and swimming pools.

Where there is an inconsistency in the minimum clearance *requirements* between AS/NZS 7000 and AS/NZS 3000, the more stringent *requirement shall* be applied.

It is the property owners' responsibility to determine whether their structure is at a safe distance from *network* overhead *distribution/transmission* lines, poles, and *overhead service cables*.

Where there is doubt as to the *requirements*, professional advice *must* be sought from a qualified *electrical engineer*, *electrical contractor*, DMIRS or relevant *network operator*.

#### 6.5.3.1 Building/structural encroachment

Encroachment to *network operator* assets is a significant issue, especially for *high voltage* infrastructure. The danger justifies stringent safety design criteria for *premises* and structures to prevent injury to persons and major damage to *electrical installations*.

DMIRS under section 33AA of the Electricity Act 1945 has published a "[Safety of buildings near network operator electrical assets guideline](#)".

The guideline is directed at property owners, surveyors, planners, *architects*, builders and local government agencies to ensure due consideration is given to safe clearances from *network operator* overhead and underground *electricity infrastructure* when designing and planning *premises*, signs and other structures.

### 6.5.4 Vegetation

Two criteria *must* be considered when determining vegetation clearances from powerlines. The first relates to persons working in close proximity to powerlines, and the second deals with the maintenance and control of vegetation near overhead lines and *network* ground mounted assets.

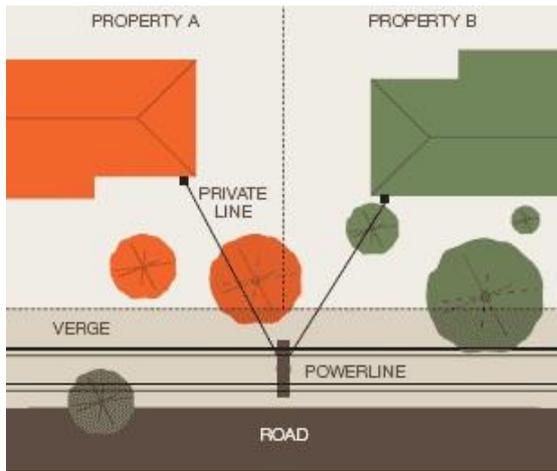
WorkSafe regulations, specifically regulation 3.64, describes the *requirements* and sets the boundaries pertaining to danger zones around and within overhead powerlines.

These zones restrict entry of persons, plant or material used by or controlled by those persons in addition to operational obligations if work is required within the zone. Further information on WorkSafe's *requirements* is contained in their "[Overhead powerlines](#)" brochure.

Vegetation control and maintenance of powerline clearances is essential to ensure community and property safety and to avoid damage to the electricity *distribution* and *transmission networks*.

DMIRS's (Building and Energy) "[Guidelines for the management of vegetation near powerlines](#)" provides additional information on vegetation clearances and *requirements* for certification as a vegetation control person.

Contact details for approved companies are listed on the [Tree Guild website](#).



**Note:** The diagram to the left illustrates responsibilities for trimming trees: The orange trees inside the boundaries of 'Property A' are the responsibility of the occupier of Property A; while the green trees inside the boundaries of 'Property B' are the responsibility of the occupier of Property B. Trees planted on verges are the responsibility of the local council.

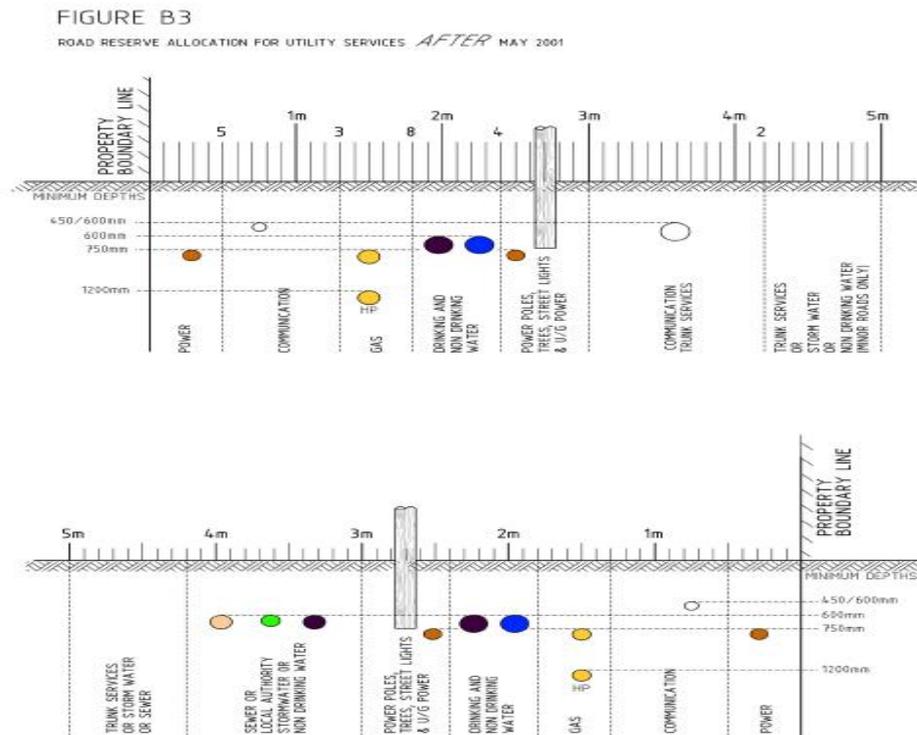
**Figure 4:** Responsibilities for vegetation control.

**6.6 Road reserve allocation**

To ensure the efficient use of limited space in road reserves and public open spaces, the Utility Providers Services Committee (UPSC) coordinates the allocation of alignments and space for services within road reserves, via the development and publication of the ["Utility providers code of practice"](#).

This Code refers to road reserves in urban and town site areas. Application of the Code applies to standard service alignments and common trenching. For rural reserves outside urban and town site areas, reference is to be made to either Main Roads WA or the relevant local government entity, as urban allocations may not apply.

**Figure 5** and associated notes provide a typical but not definitive layout of services in road reserves. For detailed information including drawings of road reserves and emergency procedures refer to "Utilities Providers Code of Practice".



**Figure 5:** Cable alignment and depth for greenfield sites

**Note: (1)** Minimum depth of cover over cables should be a minimum 750 mm. However, the depth of cover over cables in nominal alignments may be increased as required so that cables joints have the necessary depth of cover.

**(2)** The width of the power allotment shown above as 500 mm may vary up to 600 mm

The Code also provides diagrams for *lot* entry arrangements indicating each utility service entry location provision from the road reserve to the adjacent lots.

## 6.7 Private property

There is no single set of rules governing the installation of essential services such as electrical, water, gas, communications, and sewage within a private property.

The Energy Operators (Powers) Act 1979, inclusive of but not limited to s28, makes provision for the acquisition and or use of private land, by a *network operator* for the purposes of installing and operating a *transmission* and or *distribution network*. Refer also to [clause 3.6.5](#).

The [WAER](#) and AS/NZS 3000 determine the installation methods to be observed by *electrical contractors* when installing electrical services including those to be enclosed within a common services trench.

The location of underground services may vary dependent on the *consumer's* requirements or a builder's works program. Although it is common practice to locate essential services within the same *premises, structure* alignment or easement, extreme care *must* be exercised prior to and during excavation works.

### 6.7.1 Survey levels and pegs

*Consumers* and their agent are responsible for surveying, pegging and accurately defining the project's *property boundaries/levels*, inclusive of cable routes and the position of any *network* equipment, *substations, pillars* and *pits* to be located within their property.

The *consumer* is responsible for replacing any missing pegs and *shall* ensure that before any *distribution network* work begins, the project's finished ground levels have been established and all pegs are in place.

The *consumer* will be charged for any additional costs incurred by the *network operator* where cable routes or property, road reserve boundaries have not been or are incorrectly pegged.

## 6.8 Easements and covenants

Restrictions on land, generally referred to as 'easements' or 'covenants' are placed on a property title to ensure that the land to which the restriction applies is used in a specific way or *premises/structures* conform to specific requirements.

An easement is the legal term for a right or rights of way, which a third party other than the owner, has over the use of that land. Whereas a covenant is a legal restriction, placed on land whereby the owner's use of that property may be limited in certain circumstances.

The *consumer* is required to assist the *network operator* with document preparation and the registration processes and is responsible for all costs associated with the creation of easements or covenants.

For specific detail on their particular processes and *requirements* **contact the relevant *network operator*** . Refer to [section 5](#).

### 6.8.1 Easements

Easements are an "interest in land" that provides an individual, company or entity, "rights, obligations and restrictions" in regard to the use of land owned by another. Where an easement interest in land is required to be registered on a third party's property, the *applicant (consumer)* *must* negotiate with all affected parties and obtain written consent for the easement to be created in accordance with the relevant State/Federal legislation, the *network operator* and relevant government agencies.

The *consumer* is also responsible for advising all potential land users or purchasers of the existence of any easement interest, its application and any applicable rights, obligations or restrictions.

The extent of the easement *shall* be depicted on a “deposited plan, *survey-strata plan* or *strata plan*” with the easement registration number and/or statutory reference being recorded on the “certificate of title”.

The creation of common property or an interest over private property, public open space (POS), or public access way (PAW) may be required to ensure:

1. access to a *network pillar/pit*, LV frame or *substation* for the purposes of installing and connecting *consumer mains cable* or sub-mains *cables* to a *site main switchboard* where there is more than one *consumer’s premises* on a lot; and or
2. for the erection and installation of overhead or underground power systems including supplementary equipment as a part of the *network* connection to a *consumer(s)*.

Restrictions would generally include but not limited to:

1. no *premises* or structure is allowed over or within the designated/defined area;
2. *Network operator requirement* for unimpeded access at all times; and
3. no cultivated vegetation allowed over or within the designated/defined area.

The minimum width of an easement for the installation of underground cables *shall* be one (1) metre.

Easements may be created in various formats, with the following examples being the most common.

#### **6.8.1.1 Section 167 of the Planning and Development Act 2005**

This is an easement created automatically for new *subdivisions* under section 167 of the 2005 Act (previously known as section 27A of the Town Planning and Development Act 1928) to facilitate the installation of and ongoing access for roads and utility services including *network operator distribution systems*.

#### **6.8.1.2 Section 136C of the Transfer of Land Act 1893**

An easement may be created on an existing freehold title including “*survey strata schemes* and deposited plans”, under section 136C of the 1893 Act, to provide for *consumer/utility* owned services such as electrical, gas, plumbing or communication services to the requisite utility *network*.

#### **6.8.1.3 Section 33 of the Strata Titles Act 1985**

Similar in function to a 136C, of the 1985 Act, this option provides a short form version for the creation of easements and or restrictive covenants. This form of easement comes into force when the scheme plan, or an amendment of the scheme plan, for the strata titles scheme containing the easement or the restrictive covenant is registered.

A short form easement may be discharged by the registration of an amendment of the scheme plan to give effect to the discharge or termination of the strata titles scheme.

#### **6.8.1.4 Section 144 of the Land Administration Act 1997 (Crown Land)**

Under part 8 of the 1997 Act, the Minister may grant an easement over crown land to permit works on the land to allow for the passage of persons or provision of services such as electricity.

The *consumer must* obtain written consent from any, and all interested parties registered over the crown land parcel including management authorities. Approval *must* then be obtained from the Department of Planning, Lands & Heritage (DPLH) to the registration of the required easement.

Once approved, the *consumer* is required to engage a licensed surveyor to create the “interest only deposited plan” depicting the extent of the easement interest.

The *consumer* is then required to provide the detail to the *network operator* for the preparation and registration of the required crown easement documentation.

### **6.8.1.5 Energy Operators (Powers) Act 1979 (Easement in Gross)**

An easement may be created on an existing freehold title including “survey strata schemes, strata schemes and deposited plans” under this 1979 Act to provide for *network operator* owned services such as overhead and underground *distribution infrastructure* to the requisite utility *network*.

### **6.8.2 Restrictive covenants**

Restrictive covenants are legal restrictions which can be placed on a property whereby the owner’s use of the property may be limited in certain circumstances.

Covenants are common in new *subdivision developments* where the *developer* in order to maintain uniformity, may impose certain restrictive covenants on land use to prevent certain owner actions such as parking trucks, storing boats on driveways, *premises/sheds* above a certain size/height, prohibiting the installation of satellite antennas.

### **6.8.2.1 Section 129BA of the Transfer of Land Act 1893 (Fire/noise zones)**

Section 129BA of the 1893 Act, permits the creation of restrictive covenants for the benefit of a public utility/authority or local government. A restrictive covenant, places limitations on the use of either the whole or part of a property.

### **6.8.3 Notifications Section 70A of the of the Transfer of Land Act 1893**

Section 70A of the Transfer of Land Act 1893 permits “notifications” to be placed on a property’s “certificate of title” by a local government or public authority, which in this case is the *network operator*. The “notification” advises prospective buyers of potential circumstances that may impact the enjoyment of that property.

The *consumer* is required to assist the *network operator* in the document preparation and registration process and is responsible for all costs associated with its creation. The completed “notification” shall be lodged with *Landgate* who will provide the lodging party, being in this case the *network operator*, with a lodgement receipt. This receipt is considered, by the *network operator*, proof of lodgement and compliance with any *requirement* of the electrical design conditions. Refer to [clause 6.8](#).

#### **6.8.3.1 Multiple points of connection (supply)**

Where a multiple *points of supply (connection)* application has been approved by a *network operator*, the *consumer* shall conform with [WAER](#) section 3, *network connection agreement* and these *requirements*, inclusive of the 70A notification, zone diagram and labelling *requirements*.

Refer to [clause 12.3](#) for specific detail on the *requirements* for multiple *points of connection (supplies)*.

It is the *consumer’s* responsibility through their agent to ensure compliance with the *requirements* of this clause. This is an essential safety *requirement* as the existence of a second or multiple *points of supply (connection)*, creates electrical hazards where not correctly managed and maintained by the *consumer*.

#### **6.8.3.2 No network supplies**

As a condition of *subdivision* and or land *development*, a *network operator* may apply a 70A “notification” on a property within their respective *electrical licensing area boundary* to advise prospective buyers/users, that the property to which the covenant applies, does not have a *network* supply and connection.

#### 6.8.4 Assistance with easements, notifications and restrictive covenants

The application for and the granting of an easement, notification or restrictive covenant can be a complex matter therefore it is recommended that before any action is taken, advice is sought from the *network operator* in regard to their particular process and *requirements*. Refer to [section 5](#) for contact details.

#### 6.9 Strata schemes

There are generally two types of schemes permitted under the [Strata Titles Act 1985](#), being:

- **Strata Schemes** are the original form of "*strata scheme*", or "*strata plan*", commonly known as "building or *built strata*". At least one building *must* be shown on the *strata plan* with the boundaries of the *strata lots*, including the height of the *strata schemes* (stratum) defined by reference to the building. Prior to June 1985, *strata schemes* could only be within a building. After that date, part of the *scheme* can also include land outside the building and parts of the building structure.
- **Survey-Strata Schemes** were introduced in 1995 and commonly known as a "survey-strata scheme". The boundaries of *survey-strata schemes must* be surveyed by a licensed surveyor and may include common property but not shown buildings. The lots on a *survey-strata plan* can have a similar appearance and look to lots shown on surveys (deposited plans, plans and diagrams) for non-strata freehold titles.

**Community Title Schemes** are being introduced to Western Australia through the Community Titles Act 2018. A community scheme is a form of land tenure that enables the *subdivision* of a single parcel of freehold land into multiple schemes, called a "*community title*" or tiered schemes. These schemes are designed to facilitate the creation and management of mix use developments such as retail outlets, commercial offices, recreational facilities, residential properties or a combination of the above. Further information is available from [Landgate](#)

WAPC's model conditions and associated advisory notes include model condition E3, relating to "service access rights" for *strata schemes*. This condition is designed to ensure that each *strata lot* has access to essential service *connection points* via an implied or section 136C easement or via the use of common property.

**Note:** There may be undeveloped subdivided *strata and survey strata* schemes that predate this process or fall outside the jurisdiction of the WAPC and therefore may have unidentified access/rights issues.

In such cases it is the responsibility of the affected landowner(s) to negotiate and secure appropriate access for the installation and connection of their essential services, including *consumer mains cable* to the designated *network pillar* by their *electrical contractor*.

##### 6.9.1 Dispute negotiation and mediation

The resolution of disputes relating to *strata titles*, easements and access rights may cause unwanted legal/construction costs, protracted building timeframe delays, with possible long-term discontent between affected parties. Where an access dispute arises, affected landowner(s) need to resolve their differences by implementing an affirmative course(s) of action.

One or more of the following options may be considered appropriate:

- Initiate dialogue between the affected parties to seek resolution of the dispute.
- Apply to the strata company (where applicable) for a determination in accordance with the strata company by-laws.
- Refer the dispute to an independent mediation service.
- Seek guidance from *Landgate* through their strata advice service.
- Refer the matter to the Strata Titles Referee and the State Administrative Tribunal (SAT).
- Seek individual legal advice or direction for resolution of the dispute by the courts.

**Note:** Access disputes are outside of the scope of *network operator* operations.

One on one dialogue or private mediation between the affected parties allows for an appreciation of the disputed issues, with the potential to decrease the likelihood of ongoing conflict between affected parties.

Before an application can be lodged with SAT, the *applicant must* have complied with any strata company by-laws or procedures for dispute resolution. SAT may only make an order if satisfied that specified circumstances exist.

Reference to the [State Administrative Tribunal Act 2004](#) by the *applicant* is essential; to understand the circumstances which *must* exist before an “order” may be made by the Tribunal.

Before choosing to pursue a legal action or approach to the courts the affected parties should consider the possible outcomes and financial implications for all concerned.

## **6.10 Cable ducts**

*Consumers* are responsible for supplying and installing underground power cable conduits and ducts on their property, at the *applicant's* cost. The size and number of ducts will be detailed in *network operator's* design drawing(s). Ducts are required where *network operator* cable(s) are installed on the *consumer's* property, regardless of whether they are shown on the drawing(s) or not.

### **6.10.1 Materials**

Unless specified otherwise by the *network operator*, ducts *shall* be heavy duty, rigid, orange UPVC conduit complying with AS/NZS 2053: *Parts 1 – 8 “Conduits and fitting for electrical installations.”*

### **6.10.2 Installation**

In general, cable ducts *shall* have a minimum cover of 750 mm to the top of the duct and bedded in clean sand for a minimum distance of 150 mm below the lowest duct, and 150 mm above the highest duct.

Additional ducts *shall*:

1. be installed and laid in accordance with the *network operator's technical requirements* for horizontal and tiered formations;
2. have sufficient length to achieve specified clearances beyond property boundaries and kerb lines;
3. be plugged with suitable end caps or where required fire seals;
4. contain individual non-metallic draw wires; and
5. have protective marker tape (danger tape) installed above the duct as prescribed by AS/NZS 3000 or as directed by the *network operator*.

Duct locations *shall* be identifiable, above ground by marker tape and a marker peg at one end. For specific information on *network installation requirements*, refer to the relevant *network operator's technical requirements*:

- **Horizon Power:** [\(clause 1.6.1\)](#)
  - Distribution design rules (DDR).
  - Distribution construction standard (DCS).
  - Underground cable installation manual (UCIM).
  - Underground distribution scheme manual (UDS).
- **Western Power:** [\(clause 1.6.2\)](#)
  - Distribution construction Standard Handbook (DCSH).
  - Distribution substation plant manual (DSPM).
  - Underground cable installation manual; (UCIM)
  - Underground distribution scheme manual (UDS).

### 6.10.3 Supervision of installation

The *applicant* accepts full responsibility for the supervision of the duct installation and *shall* contact the *network operator's* local or regional office or where nominated the *construction project manager* before any back filling of the installation occurs to allow time for the *network operator* to inspect the installation where required.

Any remedial works requested by the *construction project manager* *must* be carried out promptly. Any costs incurred by the *network operator* due to such remedial works will be charged to the *applicant*.

### 6.11 Removal and reinstatement

The *developer* or *applicant* is responsible for the removal and reinstatement of all non-natural surface coverings on the *consumer's* property, inclusive of coverings that may or will inhibit the installation of any equipment associated with the works. This includes but is not limited to roads, driveways, concrete, paving and footpaths.

The *applicant* is also responsible for obtaining applicable project environmental, heritage, native title, vegetation, and fire/noise clearance approvals from the relevant authorities, to meet associated statutory *requirements*, before any *site* works are to begin. Refer to [clause 6.13](#). The *applicant* *must* also refer any initial vegetation clearing enquiries to the relevant local council.

**Note:** Western Australian Local Government Association (WALGA) has published the local government "[Guidelines for restoration and reinstatement following work in road reserves.](#)"

The intent of the guideline is to ensure a consistent approach to reinstatement and restoration *requirements* where work is undertaken within road reserves or on any other property under the care and control of local government.

### 6.12 Existing consumers and affected parties

The *applicant* is responsible for notifying all parties (inclusive of the *network operator* and other *consumers*) affected by the *applicant's* proposed undergrounding *works*.

Where an existing overhead *distribution network* is to be removed as part of undergrounding *work*, the *applicant* is responsible for the reconnection of any existing *consumers* to the installed underground system.

The *applicant* *shall* engage the services of an *electrical contractor* to undertake these reconnections. All reconnection works *must* be completed before the redundant overhead *distribution network* is de-energised and removed.

Options for reconnection of services to existing affected *consumers* may include:

1. Where there is sufficient space to establish a 1m by 1m exclusion zone at the front boundary of the affected property to install a service *pillar*, the existing *network* overhead services *shall* be replaced by underground services. The *pillar shall* be in an accessible location, free of other services, installed by the *network operator* at the *applicant's* cost. The *applicant shall* be responsible for installing the underground service from the *network pillar* to the existing *consumer*.
2. Where there is insufficient space to install a service *pillar*, a wall-mounted unit box may be considered. The unit will be supplied to the *applicant*, who will be responsible for having it installed on their *premise's* facade in an accessible location. A minimum of 4 weeks' notice is necessary to enable supply of the equipment.

The *network operator* will supply and install the underground service cable up to the facade of the *premise*, allowing sufficient cable length to reach the wall mounted box.

The *applicant shall* arrange to have the cable fixed to the facade of the *premise*, up to the wall-mounted box. The *network operator* will undertake the final connection of the underground service to the wall-mounted box, in conjunction with the *applicant's electrical contractor*.

In options 1 and 2 above, the *applicant shall* inform existing affected *consumers*, that cabling downstream of the *network operator's point of supply (connection)* is the *consumer's* responsibility. That is, if the *electrical installation* is damaged, the existing *consumer* is responsible for *repairs*.

The *applicant shall*, at their cost, make arrangements for the removal of redundant *network* and *consumer electrical equipment* in accordance with both regulatory and the *network operator's technical requirements*.

### **6.13 Environmental, heritage and safety requirements**

Environmental heritage and safety impacts *shall* be investigated and managed by the *applicant* and or their agent. This may include but not limited to the following:

- Aboriginal heritage sites and objects of suspected aboriginal origin.
- Acid sulphate soils.
- Bio-security - weeds, pests and disease spread (e.g. dieback disease).
- Declared rare flora and threatened ecological communities.
- Dust.
- Erosion.
- Land entry permits.
- Native title.
- Fire and noise.
- Protected wetlands and water reserves, inclusive of flood and water table factors.
- Vegetation clearing permits.
- Waste management including controlled waste.

#### **6.13.1 SWIS network extensions**

Western Power, when planning an extension of the *distribution network* for and on behalf of the *consumer (applicant)*, will conduct a preliminary environmental, heritage and safety assessment of any crown land, public open space, road reserve, or any privately owned property beyond the *applicant's property boundary* that may be affected by the proposed *works*.

This forms part of the process of providing an indicative budget estimate of the *network* extension costs.

Where the preliminary assessment reveals environmental or heritage concerns pertaining to the affected parcel(s) of land, further evaluation of *network* extension costs will be suspended. The *applicant* will be formally advised and provided with a specific estimate of costs to address the identified issues.

Where the *applicant* elects to proceed, payment of the estimated assessment costs is required before the *network operator* will begin a detailed environmental and heritage assessment. The *applicant* is responsible for reimbursing the *network operator* for all costs incurred in relation to the assessment and acquisition by the *network operator* of any required approvals or clearances.

**Note:** The outcome of the assessment may result in the *network* extension work not proceeding.

Once the environmental, heritage and safety issues have been satisfactorily determined and it is deemed that the works can proceed, an indicative budget estimate of the *network* extension costs will be prepared and provided to the *applicant*. Dependent on the *site* location and applicable environmental *requirements*, a *developer* or landowner may be permitted to undertake *site* clearing and or vegetation control.

### **6.13.1.1 Pilbara Grid / NIS network extensions**

Within Horizon Power's *electrical licensing area boundary*, the *developer/applicant* is responsible for obtaining all environmental heritage and safety approvals. A budget estimate and quote maybe issued to the *consumer*, however ordering of materials and construction of the project will not commence until the *developer/applicant* has provided proof of environmental heritage and safety clearances. Where these clearances are not available at the time of payment then the *network operator* reserves the right to revise the quote at the time the proof of clearances are provided and invoice the *consumer* for the difference and for doing additional quotes.

### **6.13.2 Applicant's project**

Where the *network operator* is required to undertake work related to the *augmentation* or extension of the *network* that may or is located within the boundaries of the *applicant's* property, the *applicant shall* evaluate, manage and complete all statutory environmental, heritage and safety assessment(s), unless advised otherwise in writing by the *network operator*. The *applicant shall* provide the *network operator* with copies of documentation discharging their assessment responsibilities.

Where the assessment(s) confirms a *requirement* for environmental heritage and safety approvals or clearances, the *applicant shall* apply for and obtain, at no cost to the *network operator*, such approvals and clearances and *shall* provide copies to the *network operator* before any work is commenced.

The *applicant shall* advise the *network operator* of any issues either pending or real that may affect the project or the extension of the *network* at the earliest possible opportunity. Failure to do so may result in significant variation to the costs of the *network* extension work or may prevent the project from proceeding.

For additional information on the *network operator's* environmental policy refer to:

- **Horizon Power** : [Environmental policy](#)
- **Western Power** : [Environmental policy](#)

## **6.14 Equipment**

Equipment used to interface with the *network operator distribution* and *transmission network* must comply with the *network operator's requirements* and be operationally compatible with those *networks*.

In addition to the need to be operationally compatible a *network operator* may also require *network* and or *consumer* equipment to be appropriately rated in accordance with environmental / climatic conditions applicable to the specific operational region or regions. For example, cyclonic conditions experienced in the north west of Western Australia.

### 6.14.1 Distribution Design Catalogue (DDC)

Each *network operator* offers a Distribution design catalogue containing details of their approved standard equipment assemblies for the design of underground and overhead *distribution networks* within their respective *networks*. The DDC does not encompass construction standards and therefore needs to be read in conjunction with the *network operator's* relevant design and construction publications.

- **Horizon Power** - [Distribution design catalogue](#)
- **Western Power** - [Distribution design catalogue](#)

### 6.14.2 Non-standard equipment

Only approved equipment/product(s) as prescribed within *network operator's* distribution design catalogues *shall* be used when completing a connection to their *distribution networks*. For more information on standard equipment, refer to the relevant DDC or to their external websites for direction on the use of non-standard equipment.

### 6.14.3 Equipment sold by Western Power

Western Power supplies a range of industrial *electrical equipment* (distribution and transmission) including but not limited to cable, transformers, switchgear, line hardware, underground power accessories, streetlights and general hardware. New equipment is sold subject to the [Terms and conditions of sale of material](#) at the time of sale.

Second-hand equipment may be sold by Western Power to a third party on an 'as is, where is' basis.

## 6.15 Artwork on network assets

Under specific conditions, a *network operator* may permit the application of artwork to elements of their *distribution network* such as ground mounted kiosks/transformers, or a wall used to enclose ground mounted *network* equipment. Prior approval *shall* be obtained for each and every piece of artwork prior to being applied to the asset.

Artwork applied to a *network* asset without formal approval will be classified as graffiti and dealt with in accordance with the applicable laws. Furthermore, participating *network operators* do not guarantee the permanency of the artwork as the asset concerned may be replaced or *repaired* without notice rendering the artwork lost or incomplete.

Costs associated with the *repair/replacement* of applied artwork or for the removal of artwork as instructed by the *network operator* or local government authority *shall* be borne by the party responsible for its application or maintenance.

Where the artwork is removed from the *network operator's* asset the equipment *shall* be reinstated in accordance with the *network operator's* instructions and *requirements*.

### 6.15.1 Horizon Power equipment

For further information refer to [Decorative, fixtures, signs, banners and artwork](#) on Horizon Power's assets.

### 6.15.2 Western Power equipment

For information on Western Power's *requirements* refer to NS 21-2006 [Artwork on Western Power assets](#)

## 6.16 Decorative fixtures, signs and banners on assets

Written approval *shall* be obtained from the *network operator* for each attachment type and location within the scope of an application prior to its attachment to the *network asset(s)*.

Additionally, there may be other *site* related factors that are not covered by the *network operator's* general policies which may preclude the attachment of fixtures, fittings, signs or banners to the *network operator's* poles, streetlight columns or assets. It is therefore imperative that the *applicant* liaises with the *network operator* prior to making any financial commitment or project decision.

Where the fixture, fitting, sign or banner requires connection to a supply of electricity, the *network operator* will not guarantee continuity of that supply.

Additionally, the owner of any fixture, fitting, sign or banner *shall* accept full responsibility for ensuring that all the relevant statutory obligations and *network operator technical requirements* pertaining to that installation are met and maintained.

### 6.16.1 Horizon Power equipment

For further information refer to [Decorative, fixtures, signs, banners and artwork](#) on Horizon Power's assets.

### 6.16.2 Western Power equipment

[Network standard NS 10-2006.1](#) defines the *requirements* for attachment of fixtures, fittings, signs and banners on Western Power assets.

## 6.17 Labelling

There are several different statutes that stipulate the need and under what specific circumstances *electrical equipment* requires to be labeled. Labelling serves multiple purposes but is primarily for identification, safety, isolation or a combination of the above.

The following is a guide to the *requirements* for labelling and hierarchical structure:

- [WAER](#).
- Australian standards AS/NZS 3000 and AS 1319.
- *Network operator* standards including:
  - Horizon Power's standard on [Distribution equipment labelling](#); and
  - Western Power's [network standard NS 05](#).

*Network* distribution infrastructure *must* be labelled in accordance with the *network operators' technical requirements*. Additionally, *electrical equipment* or installations were, located in public open spaces or road reserves *shall* be labelled to clearly identify the installation or equipment and its relationship to the *network asset*.

Labelled equipment *shall*, as a minimum, include the source of supply, name of the responsible organisation, together with contact information.

## 6.18 Locks

*Network operators* may permit meter enclosures and access areas to be locked, provided that a standard approved master key locking system is fitted to the door of the meter enclosure. 7-day 24-hour access to metering and protection equipment *must* be provided and maintained for access by *network operator* personnel. *Metering equipment shall* not be located within a *consumer's premise* without prior *network operator* approval.

If in the event that a private locking system is damaged, keys lost or access to the enclosure is unattainable the *consumer* is to contact a licensed locksmith as *network* personnel are unable to provide this service for reasons of *consumer* and *network* security.

For specific information on approved *network* security and access arrangements or if guidance is required refer to the specific *network operator*.

- Horizon Power - [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)
- Western Power - [contact us - Western Power](#)

## 6.19 Industry self-connection programs

*Network operators* may have industry-based schemes designed to streamline the connection process. These schemes are available to the electrical contracting industry where the individual company can demonstrate an ability to provide the designated *network connection service* to a standard acceptable to the *network operator*, DMIRS and the community.

### 6.19.1 Horizon Power

Industry self-connection programs do not apply to Horizon Power's service areas. For full details of Horizon Power's connection *requirements* refer to Horizon Power's main website or the relevant regional office.

### 6.19.2 Western Power

For more information on Western Power programs for *network connection services*, refer to Western Power's main website, under the heading [Connection schemes](#).

## 6.20 Subdivisions

*Network* underground distribution schemes are not covered by these *requirements*.

Both Horizon Power and Western Power provide specific information via separate publications known as [Underground distribution schemes](#) (UDS) manuals.

These documents provide land *developers*, designers and installation contractors with the policies, processes, practices, *requirements* and equipment relating to the provision of electricity services in all new *subdivisions* connected to a *network*.

The *network operator's* UDS manual covers the relationship between the:

1. *network operator*, whose *network* a UDS will become a part of; and
2. *developer*, as the proponent of a *subdivision*, who requires a UDS to provide a reticulated supply of electricity to the *lots* in a *subdivision*.

The manuals may also include explanations on the administrative, design and installation *requirements* for the provision of *electricity infrastructure* in *subdivisions* works consisting of but not limited to the following:

- *Low voltage* electricity reticulation within a *subdivision*.
- *High voltage network* extension within a *subdivision*.
- Streetlights within a *subdivision*.
- *Distribution substations* within a *subdivision*.
- *High voltage headwork* extension outside a *subdivision*.
- *Low voltage headwork* extension outside a *subdivision*.
- Upgrade of existing *distribution substations* outside a *subdivision* for that *subdivision*.

### 6.20.1 Horizon Power UDS requirements

For further information and guidance applicable to the Pilbara Grid or a NIS *network*, refer to the [UDS manual](#) website.

### 6.20.2 Western Power UDS requirements

For full details and information relating to *subdivision requirements* within the SWIS refer to the [UDS manual](#) website.

## 6.21 Asbestos products

### 6.21.1 General

There are existing electrical products still in service, including meter panels, *low voltage pillars*, cable ducts/lagging and porcelain fuse holders which may contain asbestos material. Before commencing any work on *electrical equipment* containing or suspected of containing asbestos material, a hazard risk assessment is recommended to confirm the presence or otherwise of asbestos.

### 6.21.2 Safety precautions

Any assessment or activity carried out on equipment suspected of containing asbestos products or material, *must* be undertaken using control measures specified by [DMIRS \(WorkSafe\)](#) and the [Australian Safety and Compensation Council](#).

This would include, but is not limited to the following to minimise the release of and possible exposure to asbestos fibres:

- [“Code of practice for the safe removal of asbestos 2<sup>nd</sup> edition”](#)
- [“Code of practice for the management and control of asbestos in workplaces”](#)

If asbestos contamination is confirmed, the person(s) responsible for the work *site* and task *shall* ensure that appropriate personal protective equipment (PPE), handling procedures and work practices are in accordance with the identified guidelines and individual company procedures.

At all times when work is carried out on suspected contaminated products and material, warning signs *must* be displayed: “Asbestos Related Work in Progress”

### 6.21.3 Panels

The installation and maintenance of meter enclosures and panels is the responsibility of the property owner. Where a meter panel requires upgrading in association with construction works or wiring upgrades, this work is also the responsibility of the property owner including the supply and installation of new meter panels.

*Network operators* do not record asset information relating to privately owned equipment, therefore reporting of meter panel (material) information to a *network operator* is not required.

Switchboard and connection upgrades may require the attendance of a service crew for temporary isolation of supply to allow an *electrical contractor* to undertake the work safely including where required the relocation of revenue meters.

Until July 1988 panels containing asbestos known as Miscolite, Zelemite, Lebah or Asbestos were used. These panels could generally be identified by their appearance; black in colour, approximately 12 mm to 30 mm thick, with the brand name (in most cases) displayed or stenciled on the back.

The asbestos material contained within the panel remains passive until the meter panel is either cut, drilled or damaged in some way. Modification, replacement or removal of asbestos panels *must* be carried out in accordance with OHS operation procedures.

#### 6.21.4 Asbestos fibre pillars

Low voltage white asbestos fibre underground distribution uni-pillars (commonly known as URD *pillar*) were introduced during the mid to late 1970's as a part of *distribution system* for new underground sub-division *developments*.

The chemical makeup of the material used to construct these *pillars* was a form of asbestos known as chrysotile. These *pillars* are substantially heavier than the current polyurethane *pillars* and are easily identified by their light grey cement coloured appearance.

The asbestos material remains passive unless the pillar has deteriorated through age, weather, or sustained some form of damage. Where the pillar, especially the corners of the cover, have deteriorated an asbestos exposure risk may exist.



Only authorised electrical personnel are permitted to work on or within a *network operator's pillar* including cement fibre and polyurethane types for the purposes of connecting *consumer mains cable*.

Prior to commencing any work on a fibre *pillar*, an *onsite* hazard risk assessment and visual inspection is required to determine the structural integrity of the equipment.

If there is a risk of fibres breaking away or becoming airborne, work must not to proceed and the *network operator* advised so that arrangements can be implemented to have the *pillar repaired* or replaced.

#### 6.21.5 Disposal

Contaminated materials and safety equipment *shall* be disposed of in accordance with applicable Safety standards and the *network operator's safety requirements*.

For specific information on the steps to be followed when working on equipment that contains, or is suspected of containing, asbestos materials including advice on working with fibreglass to ensure exposure standards are not exceeded, refer to the specific industry and *network operator's requirements*.

- **Horizon Power –**
  - [Occupational health and safety handbook](#)
  - Instructions manual
- **Western Power – [Work instructions](#)**

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# **Service and Installation Requirements**

## **Section seven**

### **Connection and disconnection applications**

## 7 Connection and disconnection applications

### 7.1 General

The process of obtaining a connection to the *network operator's distribution or transmission network* may take a number of different forms inclusive of a new, *altered*, or upgraded connection or a *requirement* to reconfigure, modify or remove existing infrastructure or a connection.

This [section](#) provides an overview of the processes applicable to acquiring either a connection or disconnection to the *network*.

### 7.2 Conditions of connection

*Network operator connection requirements* as contained within this document are the technical conditions of supply and connection. These conditions are in addition to those prescribed by one or more of the following:

- Access agreement, *contract* or Code;
- Legislation including the [WAER](#);
- Australian standard, *network operator Technical rules* or *technical requirement*;
- *Connection agreement*, application; and where applicable a ETAC (electricity transfer access contract).

Conditions of connection may include responsibilities, type, capacity, appropriately rated environmental / climatic equipment, *connection point* location, standards, timeframes or costs to be met. It is a prerequisite that to obtain and retain a connection to the *network*, the *network operators' requirements* are to be complied with.

### 7.3 Connection capacity availability

Prior to purchasing *electrical equipment*, such as motors, air-conditioning, automated/industrial plant, three-phase devices/appliances or *distributed energy resource* (DER) systems, *consumers* need to confirm that the existing or intended *connection point* for their *premises* has the capacity and ability to service the required *load* or generation capacity or if it is a new connection that there is *network infrastructure* available to service their proposed *electrical installation*.

Connection capacity is also dependent on the location of the *consumer's electrical installation* in relation to the *network operator's* infrastructure and distinct areas of responsibility as defined by the *electrical licensed area boundaries* for those areas.

Refer to the [Appendices](#) for details of *network operator's* operational areas and definitions for a *standard connection service* provided by the applicable *network operator*. Refer to [clause 1.2](#) for definitions and [clause 7.6](#) for addition information :

- [standard connection service \(supply\) Horizon Power](#)
- [standard connection service \(supply\) Western Power](#)

## 7.4 When to contact the network operator

It is important that early advice and sufficient time is allowed by the *consumer* or their agent to consult with and conclude negotiations on connection criteria with the *network operator* and to plan and implement the necessary actions to facilitate the connection.

This criteria may affect the configuration or design of the connection, in terms of the determination of a point(s) or type/size of connection; the position of *metering equipment*, overhead *point of attachment* or underground service point of entry; or *substation* position on or within the *premise/property*.

Adequate written notice of the *consumer's* requirements *must* be submitted at the earliest possible opportunity with arrangements made by the *consumer* for payment of costs associated with the connection and associated application.

Prospective *consumers* and their agents *must* not automatically assume that a connection to satisfy their expectations is available, nor sanction or initiate any expenditure or *works*, until all negotiations with the *network operator* have been concluded.

## 7.5 Contract administration

The *consumer* is responsible for and *shall* ensure that all works which form a part of their *contract*, connection arrangement responsibilities are carried out in accordance with the *network operator's* design and *technical requirements* as specified in this document and any associated publications, relevant regulatory *requirements* and industry codes/standards.

### 7.5.1 Appointment of electrical consultant/contractor

The *consumer* is encouraged to enlist the services of a competent *electrical consultant* or *electrical contractor* to ensure that the necessary documentation and associated work is carried out in accordance with the *network operator's requirements*.

### 7.5.2 Project management

A *network operator* will assign an appropriate level of management for each *consumer* connection, ranging from a connection team for standard installation to the appointment of a specific *construction project manager* (CPM) for complex or larger connection applications.

Contact information will be forwarded to the *consumer* or their nominated agent to facilitate the connection. Where the connection is complex or larger, the *network operator* may elect or nominate a *network designer* as their representative to whom all project technical and contractual matters are to be referred during the design and quotation phase of the work.

Once the contractual and technical connection arrangements have been finalised and payment for the work has been received, the administration of the connection may be passed to a nominated *site construction project manager*. The *construction project manager* will be responsible for scheduling, construction and contractual matters during the construction phase of the *work*.

### 7.5.3 Timing and scheduling

On completion of the preliminary project/contractual requirements and fulfilling of the financial obligations by the *consumer* to the *network operator*, the installation of the required *network infrastructure* and *point of supply (connection)* can generally be expected to occur within 4 weeks for small use *consumers*.

For complex/larger connections, the *consumer* should allow a minimum of 12 weeks from the receipt of payment by the *network operator* to the commencement of *work*. Where the *consumer* has a shorter timeline the *network operator* will endeavour to meet the requested time frames, subject to material availability, workload schedules and equipment accessibility.

Installation delays may occur where access to *site* is limited by regional/remote location, adverse seasonal conditions, environmental restrictions or as a result of delays beyond the *network operators'* control. Where delays are anticipated, the *network operator* will liaise with the *consumer* to manage and resolve any issues as soon as is practical.

#### **7.5.4 Warranty of applicant work**

There may be cases where the *consumer* has undertaken work associated with the installation or engaged an agent or contractor to complete work on their behalf (e.g. duct installation or trenching). Where future warranty or remedial work be required, it is the *consumer's* responsibility to arrange for any required corrective work. The *consumer* will need to liaise directly with the contractor and any other parties involved or affected by the work.

#### **7.5.5 Documentation requirements**

For all work requests, the *network operator* will *require* the completion of an appropriate *network* application before any instruction, action or quotation can be issued.

The *network operator* may ask for further documentation in relation to a specific project including but not limited to:

- Written permission to act on the *consumer's* behalf, where the *applicant* is not the *consumer* or owner.
- A single line diagram of the installation.
- *Load*, generation or *energy storage system* details (existing and new).
- *Network* protective devices including protection setting data.
- Estimated date for connection.
- Locality plan, including architectural drawings.
- Detailed submission for *high voltage* connections or large/fluctuating *loads*.

Failure to provide any element of the application may result in a processing delay or rejection of all or part of the *consumer's* application.

#### **7.6 Standard connection service (supply)**

All new connections are based on the principle of providing a minimum “*standard connection service* (supply)” as defined in [section 1](#). Where there is an existing connection, it *must* not be assumed that there is additional available capacity to *augment* that supply or connection, beyond a “*standard connection service*”.

Where a *consumer* requires addition peak *load* or generation capacity exceeding that deemed as a *standard connection service*, then that additional capacity or higher *voltage* may require *network* modification/*augmentation* to facilitate the additional demand. The costs associated with providing that additional capacity will be charged to the *consumer*. The *consumer's* contribution will be dependent on the level of energy transfer.

The determination of whether or not a *consumer electrical installation* can be serviced by a *standard connection service* is calculated by the *electrical contractor* in accordance with the *requirements* of AS/NZS 3000, *embedded generation* criteria and nominated via the submission of a “preliminary notice” to the *network operator* by the *electrical contractor*.

Communication with the *network operator* is essential to determine the capability of the connection where a larger supply/generation arrangement or *high voltage* configuration is requested.

**Note:** Where the *load* or generation capacity exceeds the *consumer's electrical installation standard connection service*, that *network* connection *shall* be upgraded or protected by an appropriately rated *consumer* fault and *load* limiting protection device(s) in addition to the SPD. Refer to [clause 11.6.4.3](#) for addition information.

### 7.6.1 Three-phase supply availability

In addition to [clause 7.6](#) it *must* not be assumed that a three-phase connection is readily available at all existing or new *lots* or *strata scheme developments*. A *subdivision* may only have a single-phase *network* or connection configuration due to *network* availability or limitations.

In areas zoned “rural” greater than 4 hectares or “special rural” *lots* sizes of between 1 and 4 hectares the installed *network* infrastructure may be a “single-phase underground *distribution system*” (SPUDS) or a “single-phase underground rural supply system” (SPURS).

Additionally, regional rural *distribution systems* may consist of a single or split-phase *distribution network* with limited individual connection capacity. It is therefore essential that the type and capacity of the *network* connection be determined before equipment is purchased or installation work commences.

#### 7.6.1.1 Horizon Power

Refer to [clause 7.6.2](#), [table 3](#) for *network* capacity information.

#### 7.6.1.2 Western Power

**Note:** SPUD and SPUR systems are not restricted to SWIS country *networks* as such systems have also been installed within fringes of the Perth *metropolitan* area and other *major regional centres*.

### 7.6.2 Horizon Power systems

Horizon Power has remote towns supplied by a single power station. It is important that *loads* and *embedded generation systems* connected to these power stations are balanced. In some locations there are specific restrictions on the size of an installation’s total *load* and for any individual motors that may be connected to the local *distribution network*.

**Table 3** depicts the maximum *load/motor* size per installation within the Pilbara Grid and NIS *networks* (Non-Interconnected systems).

For further information and guidance on Horizon Power’s *requirements* for connecting large sized motors within the *network* refer to the [Technical rules](#) or email [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au).

**Note:** The same applies for *embedded generation* connections to Horizon Power *networks*. It is therefore essential to seek approval before connecting any DER system.

Location	Maximum single phase supply	Maximum three phase supply (per phase)	Maximum motor size (3 phase DOL)
Ardyaloon	63A	32A	3kW
Beagle Bay	63A	32A	3kW
Bidyadanga	63A	32A	3kW
Broome	63A	32A	
Camballin / Looma	63A	32A	3kW
Point Samson <sup>1</sup>	63A	32A	
Carnarvon	63A	32A	
Coral Bay	63A	32A	3kW
Cue	63A	32A	3kW
Dampier <sup>1</sup>	63A	32A	
Denham	63A	32A	3kW
Derby	63A	32A	3kW
Esperance Town	63A	32A	
Esperance Rural	Refer to the Esperance district office <sup>2</sup>		
Exmouth	63A	32A	
Fitzroy Crossing	63A	32A	3kW
Gascoyne Junction	63A	32A	3kW
Halls Creek	63A	32A	3kW
Hopetoun	63A	32A	3kW
Hopetown Rural	Refer to the Esperance district office <sup>2</sup>		
Kalumburu	63A	32A	3kW
Karatha <sup>1</sup>	63A	32A	
Kununurra	63A	32A	
Lake Argyle	63A	32A	3kW
Laverton	63A	32A	3kW
Leonora	63A	32A	3kW
Lombadina/Djarindjin	63A	32A	3kW
Marble Bar	63A	32A	3kW
Meekatharra	63A	32A	3kW
Menzies	63A	32A	3kW
Mount Magnet	63A	32A	3kW
Norseman	63A	32A	3kW
Nullagine	63A	32A	3kW
Onslow	63A	32A	3kW
Port and South Hedland <sup>1</sup>	63A	32A	
Roebourne <sup>1</sup>	63A	32A	
Sandstone	63A	32A	3kW
Warmun	63A	32A	3kW
Wiluna	63A	32A	3kW
Wyndham	63A	32A	3kW
Yalgoo	63A	32A	3kW
Yungngora	63A	32A	3kW
<b>Note 1</b> Indicates Pilbara Grid connections	<b>Note 2</b> For supplies to be connected to areas immediately outside the town boundaries or the 33kv network		

**Table 3:** Horizon Power Towns and networks maximum allowable supply

## 7.7 Distribution connection applications

The process for making an application for a connection is a distinct and separate process from that required for an electricity account. For an electricity account the *consumer must* contact their *retailer* as described in [clause 4.3.3](#).

For a connection to the *network* the *consumer* or their agent *must* formally apply to the *network operator* regardless of whether it is an underground or overhead *distribution network* and irrespective of the availability of an existing *point of supply (connection) (pillar)* on either the property or an adjacent property.

It is recommended that the assistance of an *electrical consultant* or contractor is enlisted when completing and submitting connection applications.

Generally, all new connections will be via an underground *network connection service* as a new overhead *network connection service* for *lots* less than 50 hectares are generally not permitted within Horizon Power's Pilbara Grid, NIS *networks* and Western Power's SWIS. For a detailed explanation of the *network operator's* underground policies refer to [clause 12.2.1](#)

### 7.7.1 Residential

For connections that are categorised as a *standard connection service* including underground connections that do not require a *network* extension, the completion of the *network operator* online application [clause 7.7.1.1](#) is required.

If a *consumer's premise* requires a large electrical connection or has three-phase equipment installed, it is recommended that assistance be sought from an *electrical consultant* or contractor to determine the installation's energy needs. For non-standard electrical supply the online application prescribed in [clause 7.7.1.2](#) is required.

#### 7.7.1.1 Standard residential applications

- Horizon Power – [clause 7.18](#)
- Western Power – [clause 7.19](#)

**Note:** A Western Power application may be used when requesting or applying for a *pillar* installation/connection applicable under the "Overhead to underground conversion scheme".

#### 7.7.1.2 Non-standard residential applications

- Horizon Power – [clause 7.18](#)
- Western Power – [clause 7.19](#)

**Note:** A non-standard residential connection includes: a new, additional or *altered* supply greater than a *standard connection service*, 5 or more connections on an existing or new *lot* or *strata scheme*.

### 7.7.2 Commercial, industrial and primary production

For commercial, industrial and primary production *distribution network* connections up to and including 33 kV inclusive of *network* extensions, an application ([clause 7.7.2.1](#)) is required.

These types of connections can be complex therefore it is recommended that the application is completed and submitted following consultation with either an *electrical consultant* or an *electrical contractor*. This ensures that the connection is compliant with the *network operator's requirements* as well as statutory regulations and codes.

### 7.7.2.1 Non-standard commercial applications

- **Horizon Power** – [clause 7.18](#)
- **Western Power** – [clause 7.19](#)

Applications will be allocated a *network operator* project number which can be used as a point of reference throughout the project period. For Horizon Power the prefix will be either EP, PP or KP and for Western Power the prefix will be either MP, MT, NP, NT, SP or ST.

### 7.7.3 Rural and semi-rural connections

It *must* not be assumed that all parts of a *network operator's distribution system* are serviced by a three-phase *distribution network*.

Due to either regional vastness or the isolated nature/location of the community, fringe or regional portions of Horizon Power's Pilbara Grid, NIS *networks* or Western Power's SWIS, may be reticulated by either a single-phase 240V or an existing split-phase 480V *distribution system*.

Where a *consumer* can demonstrate a specific need, a sole use connection may be permitted subject to the availability of an appropriate *point of supply (connection)* and *network* capacity. Upgrades of existing 480V connections may also require an upgrade of the *network* supply arrangement therefore the *consumer must* consult with the *network operator* to consider alternative options.

Country or rural *consumers* classified as non-residential or primary producers may be eligible to apply for a connection as a part of the *network operator's* individual "Supply extension scheme" (SES). It is therefore recommended that an *electrical consultant* be utilised to determine the installations electricity needs, type of connection required and to complete/submit the appropriate application.

An individual or group of *consumers* may seek to apply or join an existing SES or create a new scheme. It is recommended that the relevant *network operator* be contacted to determine the feasibility or available of such schemes.

#### 7.7.3.1 Horizon Power country and rural applications

Supply Extension Schemes operate in numerous regional areas therefore *consumers* purchasing property in a rural area need to confirm if the property being purchased has an annual charge applicable under a Scheme.

To determine if this policy applies to the *site* in question, contact the relevant Horizon Power regional office for assistance (See [clause 7.18](#) for details)

#### 7.7.3.2 Western Power country and rural applications

To apply for a connection complete and submit the applicable application ([clause 7.19](#)) or contact "customer services centre" on 13 10 87.

### 7.7.4 Temporary supplies

The Work Health and Safety Regulations 2022 (Regulation 163) requires a person conducting a business or undertaking that includes construction work, to comply with the *requirements* of AS/NZS 3012. That work may require the provision of a temporary power supply before construction, on the *site*, has reached plate height or the equivalent. Where required the electricity supply *shall* be via a *network connection service* by way of either a temporary or permanent connection.

As a substantial amount of new construction occurs within new sub-division *developments* it is important to give as much notice as possible as the infrastructure to provide the temporary connection may also be under construction.

Dependent on the nature of the connection, required duration, and the builder's method of construction there are a range of temporary connection options available to the *consumer*.

Therefore prior to making an application for a temporary connection, it is recommended that the *consumer* seek the assistance of their builder or *electrical contractor* to determine the most effective option and appropriate application for connection.

Where required by the *consumer*, a single account may be created so that the *electrical installation's* permanent meter may be used as a temporary connection. On completion of the *consumer's installation* the meter and the connection can be transferred to the permanent position.

Dependent on the scheme and accreditation status of the *electrical contractor*, the contractor can transfer the meter to the permanent position or arrange for the disconnection of the temporary supply and the transfer of the meter by the *network operator*.

#### **7.7.4.1 Temporary supply applications**

- **Horizon Power** – [clause 7.18](#)
- **Western Power** – [clause 7.19](#)

#### **7.7.5 Unmetered supply**

Unmetered supplies are generally available only to local government authorities, government agencies or *network operator* approved providers of specialist services, located within road reserves.

Examples of unmetered supplies include connections for traffic signals, streetlights, illuminated street signs, railway crossing boom gates, bus shelters and communication services.

The supply configuration is limited to 240V single-phase supply up to a maximum *load* of 4.8KW (20A). Approved entities may seek a connection via the following online application:

#### **7.7.5.1 Unmetered supply applications**

- **Horizon Power** – [clause 7.18](#)
- **Western Power** – [clause 7.19](#)

### **7.8 Distributed energy resources (DER)**

*Distributed energy resources* (DER) refers to the range of devices including but not limited to dispersed power generation units, including solar, *energy storage systems*, demand management and *inverters* located within a *consumer's premises/business*, or connected directly to a distribution *network*.

Whilst the term DER is often used to refer to renewable generation sources, it may also include a dispersed non-renewable generation sources, such as engine or thermal driven *generation systems*.

Refer to [section 15](#) for specific information pertaining to each *network operators embedded generation* categories and to their *technical requirements*.

#### **7.8.1 Embedded generation (EG) installations**

For the purposes of these *requirements* a:

- *Inverter energy system* (IES) installation is defined as an *embedded generation* installation with one or more energy sources, incorporating *inverters* complying with the *requirements* of AS/NZS 4777; and
- *Energy storage system* (ESS) installation is defined as a system comprising one or more batteries which store/discharge energy generated by a DER system or public grid. ESS *shall* comply with AS/NZS 5139.

Systems that are to be connected to a *network operator's distribution network*, must comply with both statutory and the *network operator's technical requirements* as confirmed prior to the commencement of installation and shall:

1. incorporate industry approved IES equipment and Metering Code compliant bi-directional *metering and service equipment* installed before the system is connected to the *network*; and
2. not be energised unless the *network operator* has provided formal authority to do so.

It is recommended that:

3. given the technical nature of the equipment and the application processes, that the involvement of an approved system designer, *electrical consultant/contractor* be sought; and
4. *consumers* evaluate State and Federal government financial assistance towards to the cost of purchase/installation of a renewable energy systems available to qualifying *applicants* who satisfy specific eligibility criteria.

All *distribution energy resource* system connections must be co-ordinated through the *consumer's energy retailer*. Energy buyback schemes can be accessed through participating Western Australian electricity *retailers* and selected regional *network operators*. For specific information on programs, rebates and other incentive schemes refer to the [Energy Policy WA](#) or electricity *retailer* websites.

Systems that are to be *stand-alone* with no *network operator distribution system* interconnection, must comply with the applicable industry and regulatory *embedded generation requirements* with relevant notifications submitted to [Building and Energy](#).

#### **7.8.1.1 Embedded generation applications**

*Consumers* through their agent are required to validate their *inverter energy system* against specific *network operator* criteria and national register of type tested and approved *inverters*.

Unapproved equipment and systems are not to be connected to *network* infrastructure.

**Note:** A *network operator* may choose to disable or disconnect such equipment or systems until the system has been made compliant with these *requirements* regardless of the duration of that disconnection.

Applications are assessed, with large systems subjected to a desk top examination or technical assessment by the *network operator* against specific *network* operational criteria. The *network operator* will advise the *consumer* either electronically or by written notification of the process outcome.

Dependent on the type and intended use of the system the *network operator* may accept, reject or specify particular operational or installation conditions relating to the installation and use of the system which shall be adhered to by the *consumer* and their agent/installer.

Any application that is deemed to be indecipherable, misleading or incomplete will not be accepted or processed until such time as the required information and any supporting documentation has been provided to the satisfaction of the *network operator*.

Where an application has been approved, the *metering and service equipment* will be modified/upgraded by the *network operator* and the *consumer's* agent may proceed with the installation of the system.

**Note:** Where a system is installed within an existing *consumer electrical installation*, the connection is deemed to be a new connection, requiring the associated *consumer* electrical protection and connection infrastructure to comply with current industry and *network operator technical requirements*.

The *consumer's embedded generation* capacity and IES/ESS system data may be recorded by the appropriate *network operator* for the purposes of *network* control and power quality management.

Where any part of the system equipment changes or output capacity increases, approval *must* be first sought from the *network operator*. (*Altered* or modified systems and *network* connections *shall* be treated as a new connection).

Existing systems that are relocated to new *premises shall* be treated as a new installation configured and installed to these current *requirements* by an authorised and competent installer following submission and approval of the formal connection application.

#### **7.8.1.1.1 Horizon Power application process**

For specific information on Horizon Power's connection arrangements including information and guidance on [Energy buy-back schemes](#) and connection applications refer to the [Solar and battery](#) section of their website.

#### **7.8.1.1.2 Western Power application process**

For additional information refer to Western Power's [Solar, batteries & electric vehicles](#), section of their website.

#### **7.8.1.2 Non-approved systems**

Connection applications that incorporate *inverters* which have not been approved and registered will not be accepted for processing by the *network operator* until such time as the *consumer's* agent can either substantiate or verify that the *inverter* has been assessed and certified in accordance with the *network operator's embedded generation* criteria. Refer to [section 15](#).

Where a non-approved *inverter* has been connected to a *distribution network* it *shall* be disconnected and remain so until such time as the system has been technically assessed by the relevant government agency and the *network operator* has been formally advised that the system is safe to connect.

#### **7.8.1.3 Metering requirement applications**

The *consumer* is responsible for submitting a separate application to the relevant energy *retailer* before installing and connecting their system to the *distribution network*. This action is required to facilitate the alteration or installation of Metering Code compliant import/export *metering equipment*.

The Code requires that a newly installed IES/ESS systems *must* not be connected to the *network* until approved *metering service equipment* has been installed by the *network operator*.

This *requirement* does not prevent an approved system from being installed prior to the *metering service equipment* being changed or reconfigured **provided that the system remains disconnected**.

It is therefore recommended that systems remain physically disconnected until compliant *metering equipment* is in place however where this is deemed impractical, the *network operator* may, subject to approval, accept isolation and tagging of the system's isolation devices to ensure complete disconnection from the *network*.

## 7.8.2 Generation installations

For the purposes of these *requirements*, a general *embedded generation* installation is defined as: All other *embedded generation* installations not covered by the *requirements* of AS/NZS 4777. This definition may include but is not necessarily limited to:

- Synchronous *generating units* driven by gas engines, gas turbines or petrol/diesel engines.
- Fuel-cell installations.
- Wind turbine *generating units*.
- Synchronous and asynchronous *generating units* driven by hydro turbines.

Medium and *Large system* connections are complex and as such *network operators* will not accept a connection application unless the *consumer* has utilised the services of a *professionally qualified electrical engineer* to aid the *consumer* with the technical details and completion of the application.

It is important that an application is submitted to and approved by the *network operator* prior to the purchase of equipment or commencement of preparation or installation work.

### 7.8.2.1 Horizon Power application process

For further information and guidance on *network requirements* applicable to large EG connections to the Pilbara Grid or a NIS *network*, phone 6310 1000 or e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au).

### 7.8.2.2 Western Power application process

For information on connection *requirements* for *large scale consumer installations* or *generation systems* refer to Western Power's website [Transmission loads and large generators](#)

## 7.8.3 Stand-alone power supply connections

A *stand-alone power supply* (SPS) is an electricity generation and supply system, typically comprising of a renewable energy supply, *battery energy storage system* and a backup *generation systems*, operating independently of the *network operator's* primary *distribution system*. Systems are sized to match the energy usage requirements of the *consumer* to ensure it is fit for purpose.

SPS also known as remote area power supply (RAPS), are an alternative *network* connection arrangement for end of line remote locations or areas not serviced by the *network operator's* *distribution network*.

Both *network operators* offer subject to the *applicant* satisfying specific criteria, a *stand-alone power supply* system supply to replace either an existing *network* connection or for a new connection requiring a *network* extension.

### 7.8.3.1 Horizon Power applications

*Consumers* located within Horizon Power's *electrical licensing area boundaries* who satisfy the technical, operational, land and economic criteria may be connected to an SPS which may include a *main switchboard* for the *consumer's* *installation*.

*Consumer* applications should be forwarded by email to [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au) with an accompanying expression of interest.

### 7.8.3.2 Western Power applications

Additional information on Western Power's SPS program is available via their energy evolution section of the website or via their "customer services centre" 13 10 87

## 7.9 Transmission connections

If the *consumer's* operation or *site* requires a connection to the *network operator's* transmission network, at 66kV or more, it is essential that the *consumer* secures the services of a *professionally qualified electrical engineer* to determine the technical terms and conditions of that connection.

### 7.9.1.1 Horizon Power application process

For further information and guidance on *requirements* applicable to *networks* within the Pilbara Grid or a NIS *network*, phone (618) 6310 1000 or e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

### 7.9.1.2 Western Power application process

For information on connection *requirements* for *generation* systems refer to [Transmission loads and large generators](#)

## 7.10 Types of connection methods

*Network operators* utilise various methods to connect a *consumer's* installation to their *distribution networks*.

The type and configuration of the connection will depend upon the available capacity and configuration of the *network* infrastructure. **Figures 6** through **18** are examples of standard connection arrangements:

### 7.10.1 Underground network connection arrangements



**Figure 6:** Mini pillars



**Figure 7:** Universal pillar



**Figure 8:** Below ground UMS pit



**Figure 9:** Below ground network pit



**Figure 10:** 100A/200A cut out box



**Figure 11:** MPS substation



**Figure 12:** Non MPS (cluster) substation



**Figure 13:** Rural/SPUD transformer supply (1 phase)

### 7.10.2 Overhead network connection arrangements



**Figure 14:** Standard overhead connection and PoA



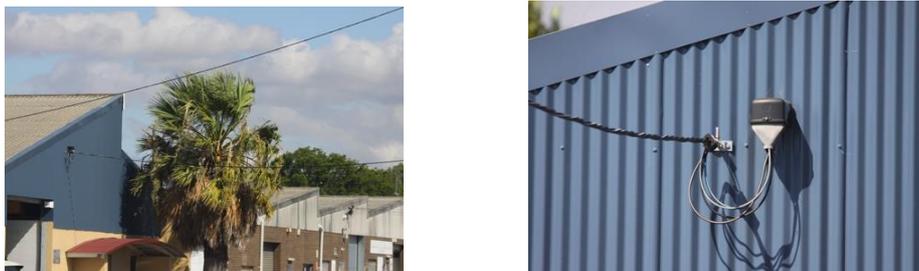
**Figure 15:** Domestic aerial service cable connection (3 phase)



**Figure 16:** Pole to pillar



**Figure 17:** Commercial 3 phase 4 single core connection



**Figure 18:** Commercial 3 phase cable connection

## 7.11 Types of disconnections applications

### 7.11.1 Account termination

*Consumers* wishing to terminate their electricity account with an electricity *retailer* are required to contact the *retailer* who will arrange for a final reading to be made at the *premises* and an account forwarded for the power consumed at the *premises*.

The closure of an electricity account with a *retailer* does not automatically trigger the removal of the *network connection service* and *network operator metering equipment*. In most cases the *overhead service cable* or underground *consumer mains cable* to the *premises* or installation will remain energised and in a state of readiness for the next account holder.

Where a complete de-energisation of an installation is required either a temporary or demolition disconnection application, (as detailed by the following [sections](#)) *shall* be made.

For more information about deactivating an electricity account, contact the relevant *network operator* and electricity *retailer*.

### 7.11.2 Disconnection arrangements

Disconnections are categorised by *network operators* to streamline and ensure that applications are processed in accordance with the *consumer* requirements together with the allocation of appropriate *network* resources. To ensure that applications are correctly processed with required arrangements and appointments scheduled, a minimum of five *working days* is to be allowed for the application to be processed. *Network* charges will be applied in accordance with the *network operator's* charging policies.

#### 7.11.2.1 Applications

To apply for a disconnection or reconnection of an overhead or underground *network connection service*, the following *network operator* information and online application can be downloaded from:

- **Horizon Power** – [clause 7.18](#)
- **Western Power** – [clause 7.19](#)

### 7.11.3 Temporary disconnections

There are two classifications used by *network operators* to process temporary disconnections:

1. **Planned work** is generally a *consumer* scheduled non-electrical or electrical activity requiring the disconnection of the *network connection service*. Typically includes:
  - a. **Non-electrical:**
    - i. Construction work, painting or swimming pool installations
    - ii. Clearing, pruning trees or vegetation
    - iii. *Site* access for high loads or vehicles.

- b. **Electrical:**
  - i. Relocation or upgrade of *consumer mains cable*, switchboards or the *point of supply (connection) / point of attachment*.
- 2. **Un-planned work** requiring the disconnection of the *network connection service* may include:
  - i. Fire damage to *consumer's premises*;
  - ii. *Consumer* equipment faults (E.g. main switch(es) or mains connection boxes);
  - iii. Damaged *consumer mains cable*; or
  - iv. Defective *consumer's poles* or *point of attachment*.

### 7.11.3.1 Disconnection process

On receipt of a disconnection application or notification of a fault, a *network operator* will, in conjunction with the *applicant* or property owner, disconnect the *network connection service* from either the overhead or underground *distribution network*. The upper section of the "disconnection/caution tag" will be completed by the designated *network operator* representative and placed inside the *consumer's main switchboard*. The "tag" will show *site* details, meter number, contact details and reasons for the disconnection.

It is the *consumer's* responsibility to engage the services of an *electrical contractor* to complete any required permanent work or *repairs* within the specified time and to notify the *network operator*.

### 7.11.3.2 Connection process

**Planned non-electrical work** – Where the *network* connection is disconnected to accommodate a non-electrical planned activity, the *applicant* or *site responsible person* shall arrange for the supply to be reconnected by:

1. confirming that the work is complete, the installation is safe and ready for reconnection and formally advising all affected parties that the *site* is about to be reconnected and energised;
2. completing the details in the "non-electrical work" section of the "disconnection tag"; and
3. contacting the *network operator's* representative nominated on the "tag" or the *network operator's* "customer services centre" advising that the work is complete, safe and ready for reconnection.

**Planned electrical work** - If the disconnection of supply was to facilitate *consumer* requested planned electrical work, the *electrical contractor* shall arrange for the supply to be reconnected by:

4. confirming that the work is complete, the installation is safe and ready to reconnect and formally advising any affected parties that the *site* is to be reconnected and energised;
5. completing the "electrical work" and "E-notice" sections of the "disconnection tag";
6. contacting the *network operator's* representative nominated on the "tag" or the *network operator's* "customer services centre" advising that the work is complete, safe and ready for reconnection;
7. on completion of the work submit a "notice of completion" (within 3 days) to the *network operator*; and
8. provide the *consumer* with an "electrical safety certificate" (within 28 days).

**Un-planned work-** In the event that an installation is disconnected from the supply to permit the rectification of either damaged or faulty equipment associated with the *network* connection, the *electrical contractor must* arrange for the supply reconnection by:

9. completing permanent *repairs*; confirming the installation is safe and ready to reconnect and formally advising any affected parties that the *site* is to be reconnected and energised;
10. completing the “electrical work” and “E-notice sections of the “disconnection tag”;
11. contacting the *network operator* “faults and emergencies team”:
  - a. Quote the “incident report number” and *site* address details; and
  - b. State that the fault has been rectified and that a reconnection is required;
12. on completion of the work submit a “notice of completion” (within 3 days) via a “eNotice” to the *network operator*;
13. provide the *consumer* with an “electrical safety certificate” (within 28 days).

**7.11.3.3 Connection**

On receiving advice that the *site* is ready to reconnect, the *network operator* will return to *site*, confirm the “disconnection tag” details and the work has been completed, then reconnect and energise the *network* connection.

Where there are difficulties, the attending *network operator* crew may contact the nominated person identified on the tag. Failure to complete the details on the “tag” may result in connection delays.

**Note:** *Electrical contractors* are reminded that unobstructed access to the mains connection box is essential for the reconnection of an *overhead service cable*. In some cases, this may require the removal or modification of one or more steel roofing sheets.

**7.11.3.4 Missing disconnection tags**

Where a “tag” or fault note has been misplaced or lost, an *electrical contractor* may submit a “preliminary notice” and a “notice of completion” as an alternate method of requesting a reconnection. In such cases a copy of the notice is to be left in the *main switchboard* for the attending the *network operator* crew.

**7.11.4 Demolition disconnection**

Before arranging a demolition disconnection, the *consumer* in whose name the electricity account is held, *must* contact the relevant [electricity retailer](#) to finalise and close the account.

The *retailer* will provide advice as to the steps required to arrange for the disconnection and removal of *network operator’s connection service* (cable) and *metering equipment*.

For example if Synergy is the account *retailer* then they will arrange for the disconnection and removal on receipt of a completed “[Removal of a service and meter](#)” notification from the *network operator*

(Network Operator Name) wishes to advise that the electrical meter number:

has been removed, and the electricity supply at:

**Example Only**

has been disconnected from (Network Operator) network.

It is the owner’s responsibility to arrange for an electrical contractor to check the property has no other electrical supply and it is safe to proceed with the proposed demolition.

Dated completed: Time:

(Network Operator) Contact

Name: Employee ID:

Telephone: Mobile:

Signature:

**Figure 19:** Disconnection for demolition notice

No demolition work can be commenced until the *network operator* has completed the disconnection and a “**Disconnected for demolition notice**” has been placed in the *consumer’s main switchboard*.

Once the *site* has been disconnected the *consumer must* engage the services of an *electrical contractor* to confirm that the *site* has no other electrical supply sources. Relocation of *network metering and service equipment shall* be treated as a new *network connection*.

In overhead areas, disconnection for demolition includes removing the meter and the *overhead service cable*. In underground areas the *network operator* will disconnect the *consumer mains cable* at the *pillar* however will not remove the underground *consumer mains cable* between the *pillar* and the installation, as this remains the property and responsibility of the owner.

Some commercial *premises*, especially those in Perth/Fremantle CBD’s and larger non interconnected towns within a Horizon Power NIS *network*, may be fed via an underground cable directly from the *distribution network* in the street. If there is any doubt as to the type of connection, the *consumer shall* make an online enquiry or contact the *network operator* in that area.

## 7.12 Supply upgrades

Supply/connection upgrades can be generally classified or grouped into one of the following:

1. Increase in capacity above a *standard connection service*
2. Conversion of a *standard connection service* from single to three-phase
3. Conversion of a non-*standard connection service* connection from single to three-phase
4. Conversion from whole current metered to a CT metered service
5. Increase in capacity of the CT connected service
6. Conversion from a *low voltage* to *high voltage* connection.

Item 2 above requires no increase beyond a *standard connection service* therefore an application to the *network operator* can be made using the online process referenced at [clause 7.7.1.1](#).

For items 1,3,4,5 and 6 the submission of an application referenced at [clause 7.7.1.2](#) is required in each case, which will initiate a detailed analysis of connection requirement and costs.

Unless authorised by the relevant *network operator* to undertake changeovers associated with LV underground non CT metered connections, the *network operator* will supply and install the *metering equipment*, complete all *network connections* and energise the *consumer electrical installation*.

*Consumers* need to make themselves aware that with an increase in energy consumption they may become eligible, due to the contestability rules, to choose an electricity *retailer*. Refer to [clause 4.4](#) for more information.

## 7.13 Conversion to underground power

The state government, through participating *network operators* is progressively working towards converting existing overhead *distribution networks* to underground.

Underground power systems provide a range of benefits including a more reliable electricity supply and a *network* that enhances the appearance of the community and environment.

Overhead to underground conversions (pole to *pillar*) is the primary method of connection for new connections within existing overhead areas throughout the *metropolitan area*, *major regional centres* and towns within the *network operator’s electrical licensed area boundary*.

*Pillar* installations in residential areas are generally such that one *network pillar* is shared between adjoining properties. For commercial/industrial properties each freehold title *lot* will generally be provided with an individual *network connection service*.

The final location of a *consumer’s connection point* is governed by the arrangement of the local *distribution network* and the *network operator’s technical requirements*. However, there may be some latitude for a *consumer* (at the *consumers cost*) to choose an alternative location.

**Note:** Only one *point of supply (connection)* is permitted to a freehold title *lot or strata scheme*. Provision of additional or multiple *points of supply (connection)* are subject to *network operator* approval.

Retention of an overhead service to a *lot or strata scheme* creates a second *point of supply (connection)* and a possible electrical hazard for both the electrical industry and emergency services personnel. As a part of the conversion and connection to underground power, all existing overhead services *must* be removed or where approved converted to underground.

For all online applications go to [clauses 7.18](#) for Horizon Power or [7.19](#) for Western Power

## 7.14 Relocations

*Network* equipment and *network connection service* relocations are permitted subject to *network operator* approval. Each request is quoted individually, and costs can vary considerably depending on circumstances.

To apply, completion of the following *network operator* online application is required:

- **Horizon Power** – [clause 7.18](#)
- **Western Power** – [clause 7.19](#)

**Note:** Some elements of the *distribution network* are shared with other *consumers*. Therefore, consent from all affected parties is required and additional costs may be incurred to relocate *consumer* equipment such as *consumer poles, consumer mains cable* and *overhead service cables*.

## 7.15 Subdivisions

The infrastructure and capacity *requirements* for *subdivisions* will vary dependent on the nature and configuration of the proposed *development*. For example, the *distribution system* for a residential *development* will differ to that required for a commercial or industrial *development*. For full details relating to *subdivisions* refer to:

- **Horizon Power** – [Underground distribution schemes \(UDS\) manual](#).
- **Western Power** - [Underground distribution schemes \(UDS\) manual](#).

## 7.16 Network and equipment locations

For detailed information pertaining to the location of *network* equipment and infrastructure, refer to [sections 12](#) through to [15](#) for specific detail.

## 7.17 Transmission connections

*Transmission* power systems are complex. Proponents wanting to connect to the *transmission system* will *require* the advice and services of specialist designers and power system analysis engineers in order to design and provide required information to meet the *network operator's requirements* for connection.

For additional detail on the rules governing *transmission* connections to a *network operators' system* the *applicant* is to contact the applicable *network operator* via their respective "customer services centre".

## 7.18 Horizon Power applications

### 7.18.1 General

The following applications are applicable for new connections, underground conversions, upgrades to existing connections, relocations and large connections to the Pilbara Grid or NIS *network*. The amount of information required, and the time taken to process an application will depend on the *consumer's* requirements (based on calculated capacity).

The following applications can be downloaded or completed online. If unsure about which process to use, further information is available via [enquiries](#) or calling Horizon Power's head office on (08) 6310 1000.

### 7.18.2 Applications

Connection applications are designed to assist Horizon Power understand the *consumer's* connection needs and to assess *network* infrastructure *requirements*.

For [new energy and meter connections](#) use the attached application. This application can also be used to apply for a [temporary](#) connection.

Before you purchase solar, *consumers* need to apply for approval to connect to the electricity *network*. The following link provides process information and required applications for [solar connections](#).

To arrange for a [disconnection or demolition](#) of service to the *consumer's* property use this link.

Connection applications for [commercial or industrial properties](#) connection, and *sites* with more than three domestic dwellings on a single freehold title *lot*, a business with new disturbing *loads* or a business requiring a CT metering connection.

The [Application for CT metering works](#) is required to arrange for current transformer (CT) metering when there will be no increase in demand, e.g. replacement of existing switchboard or metering and disconnection and reconnection of CT metering. See application for connections requiring new CT installation.

[Application for underground supply in an overhead area](#) is required when requesting service *pillar*

Requests to [relocate distribution equipment](#) such as *substations*, *pillars* and overhead lines, *must* use and complete this application. Relocation is subject to a suitable alternative location and will be chargeable to the *applicant*.

[Unmetered electricity supply application](#) is required for unmetered electricity supply connections in public places. E.g. traffic-lights, illuminated street signs, local government owned streetlights, telecommunication equipment, etc.

Operators of high or wide loads *must* apply for a high load permit to ensure safety precautions are observed in proximity to powerlines [permit for oversized loads](#)

Working near Horizon Power overhead and underground electrical *networks* [\(Work in the vicinity\)](#) requires planning and *network* approval. Refer to the application.

A [Supply extension scheme](#) may operate in several regional areas. If the *consumer* is purchasing a property in a rural area, it may be that the property has an annual charge applicable under an existing "scheme". To find out if a policy applies to the *site* in question, contact the relevant Horizon Power regional office for assistance.

## 7.19 Western Power applications

### 7.19.1 General

The following applications can be completed online. If unsure about which process to use, further information is available via [enquiries](#) or through Western Power's "customer services centre" on 13 10 87.

### 7.19.2 Applications

For a new distribution business or residential power connection, to modify an existing connection or to apply for disconnection or isolation from the *network* the required applications can be accessed via the following links:

- [New connections](#)
- [Modified connections](#)
- [Disconnections](#)
- [Overhead to underground power conversions](#)
- [Temporary supply connections](#)

Connection process information and applications for large commercial, *transmission* and generation installations can be access via the following links:

- [Large commercial connections, large generator connections and transmission loads](#)

The following links provide information and applications for [solar power system, electric vehicle or energy storage system](#) connection:

[Unmetered electricity supply application](#) is required for unmetered electricity supply connections in public places. E.g. traffic-lights, illuminated street signs, local government owned streetlights, telecommunication equipment, etc.

For requests to [relocate distribution equipment](#) such as transformers, *pillars* and overhead lines, use and complete this application. Relocation is subject to the availability of a suitable alternative location and chargeable to the *applicant*.

[Subdivision and development](#) information and applications

The [High load movement authorisation application](#) is required when moving loads higher than 4.3 metres (4.6 metres for livestock vehicles) or wider than 5.5 metres on WA roads.

The [Working near underground and overhead powerlines](#) is required when seeking to work on or near underground or overhead *network* infrastructure.

### 7.19.3 Processing applications

Western Power will process applications in accordance with the Applications and queuing policy. *Consumers* may be required to contribute to the costs of any works undertaken by Western Power to provide the new/upgraded connection in line with the [Contributions policy](#).

To find out if a "Supply extension scheme" or policy applies to a specific *site*, contact Western Power's "customer services centre" on 13 10 87 for assistance.

# **Service and Installation Requirements**

## **Section eight**

### **Notices and notification**

## 8 Notices and notification of electrical work

### 8.1 Statutory notices

The Electricity (Licensing) Regulations 1991 places a range of [statutory obligations](#) upon *electrical contractors* and their electrical workers, inclusive of the responsibility to submit, prior to and on completion of electrical work applicable notices to the relevant *network operator* and the *consumer*. These notices form the basis of the regulatory system and the safety and compliance structure for the electrical industry in Western Australia. The regulations make provision for:

- “preliminary notices”
- “completion notices”
- “electrical safety certificates”

The primary function of these notices is to ensure that electrical work is installed and certified to the required standard, the *consumer’s electrical installation/connection* is safe and the *network* is not adversely affected.

The notices also enable other functions that facilitate *site* energisation; inspection; *metering and service equipment* installation; energy account management and compliance certification for *consumers*.

Failure to submit a notice at the allotted time may result in the required connection to the *network* being delayed, refused or disconnected.

The preferred method of notice lodgment for both the “preliminary” and “completion” notices to a *network operator* is electronically via an electronic system known as “eNotice”.

The use of paper notices has been progressively phased out. As of the 1<sup>st</sup> July 2020 this form of notification is no longer acceptable as determined by DMIRS through participating *network operators*.

For electrical work on mine sites or undertaken as a part of “In house” structured system, refer to [DMIRS \(Building & Energy\)](#) for specific details.

#### 8.1.1 Notifiable work

“Preliminary” and “completion” notices are required for work that is classified as notifiable. The Electricity (Licensing) Regulations 1991, defines notifiable work as:

“*electrical installing work other than -*

- (a) maintenance work, unless that work requires the disconnection and reconnection of the supply of electricity to the electrical installation concerned or the replacement of service apparatus; or*
- (b) the addition or alteration of 1 final sub-circuit including the addition or alteration of its protective device; or*
- (c) the alteration of 1 or more final sub-circuit;”*

**Note:** Where the *alteration* or modification of a *consumer’s electrical installation* is such that the maximum demand for that installation is increased, the *electrical contractor shall* advise the *network operator* accordingly.

#### 8.1.2 Preliminary notice

“Preliminary notices” detailing the extent of electrical work to be undertaken are required to be submitted to the *network operator* prior to commencement of any notifiable work within Horizon Power’s Pilbara Grid, NIS *network* or Western Power’s SWIS, unless exempt by Regulation 51 of the Electricity (Licensing) Regulations 1991.

Where a ruling (clarification of *network requirements*) is required by an *electrical contractor*, the relevant *network operator* is to be contacted directly prior to lodging the notice.

“Preliminary notices” *must* be submitted 3 *working days* before the proposed work is to begin. Where the connection configuration or supply arrangement is complex or non-standard, the *electrical contractor must* allow sufficient time, prior to submitting the notice, for a detailed evaluation of the *consumer* connection to ensure that a practical, effective solution can be achieved.

The other key element of a “preliminary notice” is the inclusion of the *retailer’s* “customer reference number” (CRN) on the notice. This number is the vital link between the *consumer’s retailer* and the *network operator*.

Energisation of the installation will not be permitted where a valid *retailer* account has not been established and confirmed by the conveyance of the CRN.

### 8.1.3 Completion notice

A “notice of completion” *must* also be submitted to the *network operator* for notifiable work within Horizon Power’s Pilbara Grid, NIS *network* or Western Power’s SWIS, within 3 *working days* of completing the work unless exempt by Regulation 51 of the Electricity (Licensing) Regulations 1991.

The “completion notice” validates information submitted on the “preliminary notice” (including CRN) and confirms that the work is complete, has been tested, and is ready and safe to energise.

The “completion notice” also indicates to the *retailer* that the connection is complete or initiates the final stage of the connection process, which in both cases activates the *consumer’s* electricity account.

**Note:** It is essential that the installation, checking and testing results associated with work described within the submitted “notice of completion” are recorded and retained as required by Regulation 52 of the Electricity (Licensing) Regulations 1991.

### 8.1.4 Electrical safety certificate

*Electrical contractors* who carry out or causes electrical work to be carried out, *shall* within 28 days of completing the electrical work, prepare and deliver to the *consumer* for whom the work was performed an “[electrical safety certificate](#)”, certifying that the work has been checked and tested, is safe, compliant and completed to a trade finish.

“Electrical safety certificates” are required for all electrical work including new connections, general *electrical installation* work, single circuits and maintenance except where exempt by the Electricity (Licensing) Regulations 1991 for the following types of electrical installing *work*:

- Maintenance work.
- Temporary builders’ supplies.
- In House or mine site electrical work.

**Note:** *network operators* and DMIRS (Building & Energy) **do not require a copy of this “certificate”**.

**Note:** Where a *premises* / property has been disconnected for a period longer than 6 months, Horizon Power requires an electrical *site* inspection of the *premises* / property and provision of a “electrical safety certificate” prior to the *site* being reconnected to the associated *network*.

The certificate is the *consumer’s* guarantee that the electrical work has been carried out by a *licensed electrical contractor*, to the appropriate standard and is safe.

*Electrical contractors must* retain a copy of the issued “certificate” for a minimum of 5 years as the work may be the subject of an audit or be requested as part of an inspection investigation.

Where a *consumer* has not received a “certificate” within the allotted timeframe, they should, in the first instance contact the responsible *electrical contractor*. Should this action not produce the required outcome, it is recommended that Building & Energy be contacted on (08) 9422 5200 so that the matter can be considered for further investigation.

The “electrical safety certificate” is provided to the *consumer* electronically wherever possible or where there is no legitimate e-mail address offered to the client prior to leaving the work *site* or delivered via registered post.

## **8.2 Lodgement of notices**

### **8.2.1 Connected to a network**

Where there is a *requirement* to lodge notices for notifiable work carried out within Horizon Power’s Pilbara Grid, NIS *network* or Western Power’s SWIS and that work is to be connected to the *network operator’s distribution network* then the required notices *shall* be lodged by the “eNotice” system.

### **8.2.2 Not connected to a network**

Where a notice is required by the regulations but the installation is not to be connected or the *electrical contractor* is unsure as to whether the installation will be connected to a *network operator’s network*, then the *electrical contractor must* lodge the required notices via the “eNotice” system to Building & Energy.

Typical examples may include a private *stand-alone power supply systems*, transportable homes or mining equipment, which has been manufactured in the *metropolitan* area but is to be installed outside the *electrical area licence boundaries* for the Horizon Power or Western Power.

## **8.3 ‘eNotice’ lodgement system**

“eNotice” is a web based facility for the electronic lodgement or delivery of “preliminary notices”, “notices of completion” and “electrical safety certificates” for electrical work.

The “eNotice” system replaced the paper notice and E-TIC electronic ticket lodgement systems.

Further information on the electronic notice system can be sourced from [Building & Energy](#).

## **8.4 Date of initial energisation**

On completion of a new installation or unmetered supply service, the responsible electrical worker *must* test, check and commission the *electrical installation* to confirm compliance and ensure electrical safety.

The electrical worker *must* verify the installation is ready for energisation in accordance with the notification *requirements* as shown and prescribed on the “notice of completion”.

Where the electrical worker is authorised to energise the *consumer’s electrical installation*, they *shall* record the date of initial energisation of the *consumer’s* installation (refer to AS/NZS 3000 clause 8.4) at the *site*, within the test report and on the “notice of completion”. The *onsite* energisation date *must* be in a clearly visible position within the *main switchboard* enclosure, not obscured or obstructed, be legible and permanent for the life of the installation.

**Note:** A *network operator* may require a copy of this certificate where the work is specifically for that *network operator* (for example, *substation* light & power).

## **8.5 Notices and tags**

In addition to the required statutory notices, *network operators* may have other communication portals and systems to communicate with the industry and the public. Each has a specific task and in some cases the notice has a compliance element created by law.

### 8.5.1 Inspector's advisory note

An advisory note may be issued in response to a request for clarification from an *electrical contractor* on the *requirements* or parameters relating to a *network* connection. For example, an *electrical contractor* may require clarification on the configuration of the installation's *metering and service equipment* connection or application of a specific industry standard.

This system may be used to convey information of a general nature or an instruction from the *network* inspectorate to either an industry operative or a *consumer*. The content of the advice may relate to all or part of the *consumer's* installation downstream from the *point of supply (connection)*. Dependent on the nature of the notification, compliance with the instruction is mandatory.

### 8.5.2 Inspector's order

Where, during the course of an inspection, a *network* inspector identifies that a *consumer's electrical installation* is not compliant with statutory obligations, these *requirements* and or relevant industry standards, an "inspector's order" specifying the nature of that non-conformance, may be issued to the *electrical contractor* or *responsible person* in control of the installation.

When the defect/non-compliance has been rectified, the *electrical contractor* must validate and return the completed "order" to the nearest *network operator* connection or inspection office. Where the non-compliance is categorised as a serious defect, the installation will be re-inspected and a reinspection fee may be applied by the *network operator*. Compliance with an "inspector's order" is mandatory.

### 8.5.3 Defect notification

*Network operators* will investigate confirmed incidents of dangerous work or unsafe *consumer electrical installations*. This may include defective or unsafe *consumer electrical installations*, poles, *overhead service cables*, damaged underground *consumer* services or unapproved modifications to the *network metering and service equipment*.

Where an installation is found to be non-conforming and or unsafe the following action(s) may be initiated:

1. **Where the installation is connected to electricity supply:**

- a. the affected equipment or circuit is to be isolated and tagged;
- b. a defect notification will be issued to the property owner, resident or *responsible person*;
- c. the affected element of the installation *must* be rectified by an *electrical contractor* within 14 days (21 days for country areas); and
- d. on correction of the defect the *electrical contractor* is to advise the nearest *network* connection or inspection office.

2. **If the installation is not connected to supply:**

- a. a defect notification is issued to the property owner or resident if known; and
- b. appropriate action taken to ensure that the installation cannot be connected to the electricity supply.

Refer to the relevant *network operator* for additional information and specific detail.

#### **8.5.4 Consumer fault reports and service calls**

Where a member of the public or a property owner/*consumer* has reported a fault or loss of supply to their installation and a *network operator's* representative is required to attend, the outcome of the investigation may be recorded on a "fault" or "service call".

This outcome provides for a number of communication options including actions taken by the *network operator* to restore supply or instructions to the caller/owner for additional actions to be taken if in the event the fault is within the *consumer's installation*.

"Faults" and "service calls" are logged with a unique "incident reference number" so that the caller can contact the *network operator* for further assistance where required.

#### **8.5.5 Temporary disconnect tag**

"Temporary disconnect tags" are used where coordination is required between the *network operator* and the *consumer, electrical contractor, or developer* to effectively manage disconnections and reconnections.

Such situations may include but not limited to, *repairs* to *consumer's* equipment, *consumer mains cable* or mains connection box or where an incoming *network connection service* requires disconnection to allow a building activity to be safely completed.

In such cases the *network operator* will isolate the supply and "tag" the installation at the *consumer's* point of isolation. The "tag" provides contact and validation information to facilitate the reconnection of the installation once the electrical *repairs* or building activities are complete. Refer to [clause 7.11.3](#).

# **Service and Installation Requirements**

## **Section nine**

### **Charging policies**

## 9 Charging policies

### 9.1 Introduction

This [section](#) provides an overview of *network* charging policies for the various connection categories. The policies are applicable to those *consumers* seeking a connection to the *network operator's distribution system*. Charging policies applicable for *transmission system consumers* are not covered by these *requirements*.

### 9.2 Network fees

Fees and charges are applied to a range of specific applications or general situations including but not limited to new connections, *network augmentation/installation*, project administration and or *subdivision design/development* information packages.

*Network* costs are charged to the person, entity or agent submitting the service application. Further information and detail of each *network operator's* fees and charges can be viewed via the respective website hyperlinks or by direct contact with the identified *network operator*:

- [Horizon Power.com.au](http://Horizon Power.com.au) - contact us
- [Western Power.com.au](http://Western Power.com.au) - contact us

Refer to [section 5](#) for specific regional and *metropolitan* contact information.

#### 9.2.1 Design fees

The initial stage in the design process does not generally include a *site* visit. Estimates are based on information provided by the *consumer* and, where available, stored electronic data of the existing *distribution network*. The estimate is an indicative financial guide, with a validation period declared by the *network operator* as a part of their access *offer* terms and conditions. This information should not be used for detailed financial planning.

Costs associated with environmental, heritage, restrictive covenants or native title assessments are not considered as a part of this process.

*Network operators* recommend that the *consumer* undertake a detailed independent analysis of this aspect of their project as it may have a significant impact on the final outcome of the connection and *network* extension.

The second stage of the process is the preparation of a *consumer* requested design and access *offer* which may incur the payment of additional up front design fees where the requested works require a more detailed analysis than that covered by the standard application process. The design fee is applied to cover the preparation of a full and final design and quotation. The following sub-clauses summarise how each *network operator* may apply their design charges.

##### 9.2.1.1 Horizon Power design and quotation

Where the *consumer* agrees to proceed beyond the estimate stage, payment of design fees is required prior to the preparation of a formal design and quotation.

Horizon Power will prepare a formal design and quotation with an *onsite* survey and evaluation of existing *network* capacity to determine ability to provide the required *load*. Quotation may vary +/- from estimate. If the formal quote is more than 30% above the estimate, the *consumer* is entitled to withdraw and have the design fees returned. If the formal quote is within 30% of the estimate and the *consumer* withdraws Horizon Power will return the fees less any administration costs incurred.

**Note:** "Horizon Power classifies *consumers* into segments based on criteria such as annual energy consumption and maximum power demand. Horizon Power is not obliged to connect new *consumers* to their *networks*."

For specific information refer to or contact Horizon Power for clarification on applicable segment criteria and pricing."

### 9.2.1.2 Western Power design and quotation

Where the *consumer* elects to proceed to the preparation of a detailed design and access *offer* by selecting the appropriate check box on the application form, Western Power may apply a design fee which is dependent on the complexity of the project. In most cases a standard fee will apply. In all cases the fee is limited to an amount not exceeding the *consumer's* contribution towards the final value of connection.

Western Power will prepare a detailed access *offer* (quotation), including but not limited to an *onsite* survey and evaluation of existing *network* capacity to determine ability to provide the required connection.

**Note:** An access *offer* may vary from estimates and the quotation is subject to *network* terms and conditions which can be viewed online. Refer to relevant application process or [clause 7.7](#)

Following the detailed design, if it is determined that the design fee paid exceeds the amount the *consumer* is required to pay as a contribution toward the final cost of connection, Western Power will refund the difference.

### 9.2.2 Re-Quote fees

*Offers* provided in response to a *consumer's* application have, unless stated otherwise, a validity period as stated in the terms and conditions, based on the date of the *network operator's* formal correspondence. Where the validity period expires or the *applicant* requests a variation to the scope of works or an appraisal of the project costs, additional fees may be levied.

## 9.3 Charging policies

The following is a summary of charging policies applicable to the various *consumer* categories.

Policy charges are generally applicable for standard services, as defined in [sections 12](#) and [13](#). Where a nonstandard service is required, costs associated with the alternative arrangement or *network augmentation* will generally be charged at full cost.

*Consumer* policy categories include but are not limited to:

- *Subdivisions*.
- Individual *consumer* (Standard services ).
- Individual *consumer* ( Non-standard services and non-primary producer).
- *Consumer* more than 25 km from a zone *substation*.
- Non-urban resident and primary production *consumers*.
- Overhead to underground conversions (Pole to *pillar*).
- Builder and temporary supplies.
- Asset relocations *alterations* or upgrades.
- *Stand-alone power supplies*.
- Unmetered supplies (Telephone, street lighting, traffic lights etc.).
- Electric vehicle chargers.
- Equipment hire or sale.

In addition to the *requirements* of this document, *consumers* and their agents need to make themselves aware of the *network operators'* policies, inclusive of associated terms and conditions.

- **Horizon Power:** - [Connections](#)
- **Western Power:** - [Connections](#).

### 9.3.1 Subdivisions

Charging policy for *subdivision* work within the respective *distribution networks* is covered by the following:

- **Horizon Power:** [Underground distribution schemes manual](#)
- **Western Power:** [Underground distribution schemes manual](#)

### 9.3.2 Individual consumer (standard connection service)

In accordance with the *requirements* of the Electricity Industry (Obligation to Connect) Regulations a *network operator* will make provision for a *point of supply (connection)* on or adjacent to a *lot/strata title*, within their respective *distribution networks*, where the requested connection is for less than 50 MWh per annum at the *premises* and within 100m of their existing *distribution network*.

Where the *network operator* is required to provide additional services such as connections or disconnections, additional charges may apply.

### 9.3.3 Individual consumer (non-standard service or non-primary producer)

Should a *consumer* require a supply or generation connection greater than a *standard connection service*, or the proposed connection is more than 100m from the existing *distribution network*, the *network operator* may seek compensation for any additional costs incurred for the connection and installation of related *network* infrastructure and *metering equipment*.

Information on non-contestable *consumers* and the availability of *network* metering options should be sourced from the relevant *retailer* websites.

### 9.3.4 Non-urban resident and primary production consumers

“*Network* supply extension schemes” (SES) enable individual or multiple *consumers*, requiring a *network* connection, to share the cost of a *network* extension provided *Access Code* and *network operator* criteria is satisfied.

An individual or group of *applicants*, may be eligible to apply to join an established scheme or where available, initiate a new scheme should no active scheme exist, for the purposes of extending that section of the *network* to facilitate a connection to:

- primary production *premises*; or
- domestic residential *premises* on a property to which a pole to *pillar* connection is not applicable.

The following summary of the Income Tax Assessment Act 1997 defines “primary production” as:

- the cultivation of land
- the maintenance of animals for the purpose of selling them for their bodily produce, including natural increase
- fishing operations
- forest operations; or horticulture

and includes the manufacture of dairy produce by the *consumer* who produced the raw material used in that manufacture.

This definition does not include any business that is involved in the secondary processing of primary produce such as:

- Canning of fruit and making wine (as opposed to grape growing)
- Wood chipping or grain handling, and
- Processing of fish, poultry, and meat and dairy products (where different from primary milk production)

*Consumers* that satisfy scheme eligibility criteria, will be charged in accordance with *network operator* policy criteria.

*Consumer(s)* connecting to an existing scheme as a new member may be required to contribute to the cost of their connection and any rebate due to the existing scheme member(s). *Consumers* who utilise *network* “contribution policy” criteria are not eligible to receive future rebates from *consumers* connected to the same *network* extension.

SES schemes have a life of 10 years. Requested connections to an existing scheme after the scheme life has elapsed will be treated as a new connection/scheme. It should be noted that there are older schemes known as the “contributory extension schemes” (CES).

CES ceased to operate in the early 1990’s however new connections may still be permitted to existing *network* extensions based on the scheme a life span of 30 years.

Charges associated with scheme connections will be determined by the *network operator*. In addition to the cost of a connection/extension to the *network* and existing schemes rebates, the *consumer* may also be required to contribute to the “*headworks*” charges.

**Note:** *Consumers* that fall outside either policy will be assessed under the individual *consumer* policy described in [clause 9.3.3](#) or considered for a *stand-alone power supply* subject to eligibility criteria.

### **9.3.5 Overhead to underground conversions (pole to pillar)**

An overhead conversion to an underground supply for domestic *premises*, which does not form part of a sub-division, may be charged at a fixed rate where the work request satisfies the *network operator’s* eligibility criteria as contained within their respective overhead to underground conversion policies.

The final location of the *point of supply (connection)* is governed by the arrangement of the existing *distribution network* and the *network operator’s requirements*. There may be some latitude for a *consumer* to choose an alternative location for a *network connection service*.

Should a non-preferred position be required and agreed to by the *network operator*, the full cost of the *network connection service* at *consumer’s* alternative location *shall* be borne by the *consumer* inclusive of removal and or relocation of any encroachment or obstruction of the connection asset exclusion zone. This includes where the *consumer* is unable to facilitate the location of the connection asset including but not limited to the following: vegetation, landscaping, fencing, below ground footings, and retaining walls.

**Note:** The *consumer* is responsible for the installation or upgrade of the *consumer’s mains cable* and any *alterations* to the *main switchboard*.

Refer to [clause 9.3](#) for additional information and *network* website details.

### **9.3.6 Builders and temporary supplies**

Builders and temporary supplies are charged at the full cost to install and remove the connection.

Temporary and builder supplies are only available for *low voltage* connections. Refer to [clause 9.3](#) for applicable direction to the *network operator’s* website details.

### 9.3.7 Network relocations

A *consumer* may seek to have a *network* asset relocated. The relocation of equipment may include infrastructure such as overhead lines, transformers, poles, cables, stay wires, service *pillars/pits*, etc.

The cost to relocate the equipment may vary significantly dependent on the nature of the infrastructure to be moved and its operational *voltage*. In general, relocation costs are fully recoverable from the *consumer*.

Costs associated with relocating *transmission systems* are generally much higher therefore it is important to understand the difference between *transmission and distribution system networks*.

For related information, refer to [section 10](#) or download the (*transmission or distribution system*) information sheets available from the *network operator's* associated websites.

### 9.3.8 Stand-alone power supplies

To improve *consumer* connectivity, reliability and quality of supply, participating *network operators* are utilising *stand-alone power supply* system (SPS) to replace existing *network infrastructure* within their respective *distribution networks*.

The use of SPS supply arrangements also provides an opportunity to remove aging *electricity infrastructure* from *consumer* properties resulting in enhanced safety and property utilisation.

Refer to [section 15](#) or the *network operators'* respective public websites.

### 9.3.9 Unmetered supplies

Unmetered supplies are available for *loads* up to 4.8kW single-phase. Traffic signals, streetlights, signs, railway crossing boom gates, bus shelters, and communications equipment are generally suited to this type of connection. Installation and connection costs are fully recoverable from the *consumer* and assessed individually on application.

Suitable applications for unmetered supplies are given [section 7](#).

### 9.3.10 Electric vehicle chargers

With the transition of energy availability and consumption, the use of electric vehicles and associated electric vehicle supply equipment (EVSE) will impact *network operator distribution networks*. Refer to the [clause 10.11.6](#) for addition information on EVSE or the following *network operator's* websites:

- **Horizon Power** - Refer to: [electric vehicles and charging stations](#)
- **Western Power** - Refer to: [connections/solar-batteries-electric-vehicles/electric-vehicle-to-grid-systems](#)

**Note:** The installation of EVSE *alters* the *consumers site* maximum demand and potentially the associated *network* supply and connection arrangement requiring additionally or upgraded infrastructure protection. (For additional information refer to the relevant *network operator* and [clause 11.6.4](#).)

## 9.4 Equipment hire or sale

In some situations, due to changes to the *network* configuration or operation, a *consumer* may wish to purchase existing as installed *network operator* infrastructure or equipment. The feasibility, cost and purchase of this equipment is considered on a case by case basis.

For further information, contact the relevant *network operator*.

## **9.5 Payment and refunds**

Generally, only a single payment option is available to *consumers*. This consists of a full up-front payment of applicable fees and charges when the access *offer* is accepted by the *applicant*.

If a project is cancelled at the *applicant's* request before completion, project refund conditions may apply, less non-recoverable costs (including design, environmental/heritage assessments, material and/or labour) incurred by a *network operator* and associated related agencies. Refer to the access *offer* terms and conditions.

Once a project has been completed, full or part payment is non-refundable. That is, no refund is available to the *applicant* if other *consumers* connect to equipment at some future date.

## **9.6 Charges and conditions**

Charges are calculated on the basis that the *applicant* has provided all the necessary information to determine the actual cost of the connection or *network augmentation*. The *network operator* may choose to nominate specific terms, conditions or qualifications applicable to the *consumer* connection application and project via formal correspondence.

Additional costs arising from incomplete *consumer* information or noncompliance with the *network operator's* terms and conditions will be charged to the *consumer*.

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# **Service and Installation Requirements**

## **Section ten**

### **Supply characteristics**

## 10 Supply characteristics

### 10.1 Introduction

Horizon Power and Western Power are both Western Australian statutory corporations and major distributors of energy through meshed and *stand-alone power supply* systems within Western Australia. Unless otherwise advised the *network electrical licensing area boundaries* of each entity can be defined by the following:

#### 10.1.1 Horizon Power electricity network

Horizon Power owns and operates both *distribution and transmission system networks* inclusive of the Pilbara Grid and a number of non-interconnected (NIS) systems (or microgrids), servicing isolated towns and communities not connected to the South West Interconnected System (SWIS).

The Pilbara Grid extends from Karratha to Port Hedland.

The non-interconnected systems (microgrids) are located in the regions of Esperance and Hopetoun in the south, through the eastern Goldfields (excluding Kalgoorlie), to the Midwest, Gascoyne and Kimberley with some microgrids also in the Pilbara region.

Energy supplied to the isolated towns and communities in these areas is obtained from private *generators* (IPPs) and *network owned generation systems* with Horizon Power being the primary and only *retailer* of electricity associated with these *distribution and transmission systems*.

The extent of the areas covered by Horizon Power's *networks* can be viewed in the appendices.

#### 10.1.2 Western Power electricity network

Western Power owns and operates an interconnected *distribution and transmission system network* known as the South West Interconnected System (SWIS), servicing communities in the south west of Western Australia, stretching from Kalbarri in the north to Kalgoorlie in the east and Albany in the south.

The SWIS is *augmented* by a range of *distributed energy resources* and *stand-alone power supplies* to deliver or support the transportation of energy across its *network*. Western Power is distributor of, not a *retailer* of energy.

The extent of the area covered by Western Power's *networks* can be viewed in the Appendices.

### 10.2 Electricity network

Energy received from electricity *generators*, is fed into the *transmission system* or directly into the *distribution network*. *Substations* transform generated energy into suitable *voltages* for consumption by *consumers* at a range of different *voltage* levels. Large industrial *consumers* may take a supply at *voltages* up to 330kV on the Western Power *network* and 220kV on the Horizon Power *network* while the typical domestic/commercial *consumers* are supplied at 240V or 415V.

### 10.3 Supply

Electricity distributed by *network operators* is in the form of alternating current (AC) at predetermined nominated *voltages* and frequencies as prescribed by The Electricity Act 1945. In summary, *the Act* requires a *network operator* to nominate an operational system *voltage* and/or a system frequency at which electricity will be provided to the *premises* of a *consumer*. The system supply is to function within the limits of  $\pm 6$  percent of the nominated *voltage* and where nominated, within the limits of  $\pm 2\frac{1}{2}$  percent of the system frequency.

*Voltage* levels specified in this document are the average values measured at the *consumer's point of supply (connection)*, as prescribed by the *network operator's Technical rules*. Refer to [clause 10.4](#)

In addition to *the Act*, participating *network operators* are required to ensure that where electricity supplied to a *consumer's electrical installation*, as measured at the *point of supply (connection)*, that electricity supply is to comply with the standards as prescribed by the Electricity Industry (Network Quality and Reliability of Supply) (NQRS) Code 2005. Refer to [clause 10.4](#).

### 10.3.1 Nominal voltage

**Distribution low voltages** - Is generally provided via a three-phase four wire system at a pressure of 240V single-phase/415V three-phase. In some country, rural/semi-rural and *metropolitan* fringe areas, only a single or split-phase system may be available delivering 240V or 480V. Refer to [clause 7.7](#).

**Note:** A 480V supply arrangement will only be *offered* where there is a specific commercial need. This supply arrangement *shall* not be classified or treated as two 240V connections.

**Distribution high voltages** - *Distribution system voltages* include LV *voltages* and: 6.6kV, 11kV, 22kV and 33kV.

**Transmission voltages** – *Transmission system voltages* include 66kV, 132kV, 220kV, 330kV.

Voltage	Network utilization examples (For specific details refer to the relevant network operator)
240/ 415V	LV distribution to residential, commercial and industrial installations. Typically, less than 500m in length from the distribution transformer.
6.6/ 11kV	Limited to 6.6kV in Kalbarri and the Murchison radio-astronomy observatory with 11kV in and around the Perth/Fremantle CBD's and Geraldton/Kalgoorlie town sites.
22kV	The current standard HV distribution network within the SWIS with limited use in and around regional towns.
33kV	The current standard HV distribution network for less densely populated country areas.
66kV	Transmission voltage to distribute power from terminals to substations.
132kV	Transmission voltage to distribute power from terminals to substations.
220kV	Transmission voltage.
330kV	Transmission voltage.

**Table 4:** Network utilisation.

### 10.3.2 Nominal frequency

The nominal frequency of supply is 50Hz. (Hz = 1 Hertz or 1 cycle per second) for both *network operators*. Frequency tolerance limits are dependent on the *consumer's* geographical location, nature of the supply (either a grid or generation connection) and the operating condition of the supply which may include a lower limit if operating under emergency conditions.

## 10.4 Network performance parameters

The *network operator's* objective is to provide *consumers* with a safe, reliable and high quality electricity supply within the limits: of the *network operator's* *Technical rules*. Refer to [clauses 1.6.1](#) and [1.6.2](#).

Operational limits may vary or be modified subject to negotiation on an individual basis. Factors to be considered may include the *consumer's* load/generation capacities, reliability *requirements*, geographic location and or other usage factors. It should also be noted that these limits can be affected by a range of factors outside the control of the *network operator*.

Quality limits are defined in terms of the magnitude of the *voltage*, deviation from the sinusoidal waveform, magnitude of each phase *voltage* in comparison to the other phase *voltages*, the magnitude and frequency of *voltage* surges, spikes and sags and any harmonic distortion of the *network*.

Awareness of *network* power quality inconsistencies is normally detected through system monitoring and *consumer* contact. *Consumers* may utilise a percentage of the permissible harmonic distortion for their application subject to *network operator* approval.

#### **10.4.1 Horizon Power**

For additional information refer to the *network operator's* [Technical rules](#) or contact [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

#### **10.4.2 Western Power**

For full details, refer to the *network operator's* [Technical rules](#) or website section on [Power Quality](#).

### **10.5 Supply loading**

*Consumers must* ensure that each facility or *electrical installation* that is connected to a *network operator's transmission or distribution network*, and for which they are responsible, is capable of operation within the performance parameters and standards as set out in these *requirements* and the *network operator's*:

- **Horizon Power** - [Technical rules](#)
- **Western Power** [Technical rules](#)

**Note:** Dependent on *network* capacity and *consumer* requirements, the *network operator* may nominate variances to these limits to assist the *consumer* comply with operational parameters.

#### **10.5.1 Obligations**

*Consumers* are obliged to ensure that the operation of their *electrical installation* and the usage of electricity ensures the:

1. protection equipment installed in the *consumer's installation* is at all times effectively coordinated with the *distribution and transmission network*; and
2. *distribution and transmission network*, inclusive of the quality of supply to other *consumers* is not adversely affected by the actions of the *consumer* and their *electrical installation* operation.

#### **10.5.2 Maximum demand and generation**

The maximum demand in a *consumer's electrical installation* including *consumer mains cable*, sub-mains cables and final sub-circuits, taking into account the physical distribution and intended usage of *electrical equipment* in the *electrical installation*, shall be determined using the methods set out in AS/NZS 3000 clause 2.2.2 (a) to (d).

The determination of a *consumer's* maximum demand shall not take into consideration the delivery or support of any *onsite embedded generation* or *energy storage system* capacity.

The *consumer* shall ensure that their *electrical installation's* maximum demand and *embedded generation* capacity does not exceed the quantum nominated within the "preliminary notice" or as stated within the *consumer's connection agreement* unless prior approval has been formally granted by the *network operator*.

The *consumer* and their agent(s) shall not submit multiple notices relating to the same *electrical installation* for the purposes of deliberately understating the *electrical installation's* total demand or generation requirements. Where such actions are detected, the *network operator* may choose to re-evaluate the *consumer's* energy consumption, generation and *network infrastructure requirements*.

Any costs associated with either *network* modification or reinforcement may be recovered from the *consumer*.

The size and type of a *consumer's* connection arrangement directly affects the configuration of the supply arrangement and therefore the service provided by the *network operator*. Being the key parameter, it *must* be determined before the *network* design process can proceed.

A *network operator* may elect to seek additional information from the *consumer's* agent, *electrical consultant* or *contractor* to verify that the requested calculated *load* and generation requirements are realistic.

Where the requested parameters are classified as “unrealistic” the *network operator* may elect not to connect or at the *consumer's* expense, install *network* equipment appropriate for the requested *network connection service* type and size.

Additionally, where the actual *consumer* connection exceeds the capacity of the installed equipment, the *network operator* will review the supply arrangement and where required install additional *network* equipment or *consumer* protection to accommodate the assessed operational constraints of the connection. Recovery of costs may be sought where the connection is deemed non-compliant, has been subsequently *altered* without notification or where the connection information provided is determined as misleading.

### 10.5.3 Noncompliance

Where a *consumer* installs or operates any apparatus or equipment the *network operator* considers does or may interfere with the electricity quality of supply to others, the *network operator* may require the *consumer* to make appropriate adjustments or *alterations* to the equipment to remove or sufficiently abate the interference.

This includes unauthorised adjustment of the *service protection device* (SPD) settings where the SPD rating exceeds the permissible connection rating. The *network operator* will issue orders for the *consumer* to reset the SPD and or rectify the *consumer's installation*.

The *network operator* may specify a period of time for correction and may disconnect the *consumer* if the adjustments or *alterations* are not carried out within the timeframe specified. This *requirement* applies on initial connection of an installation to the *network*, and at any time thereafter.

## 10.6 Prospective short circuit current

AS/NZS 3000 requires a *consumer electrical installation* to be designed with consideration given to the prospective short-circuit current conditions within that installation and up to the *point of supply (connection)*.

The prospective short-circuit current at the *point of supply (connection)* will vary dependent on the geographical location of the *consumer's electrical installation* in relation to the *distribution system* to which it is connected. Factors that affect this variance include the size and impedance of *network* transformers and the length, size and impedance of *network* and *consumer mains cable* and submain cables supplying the installation.

[WAER](#) section 6 specifies uniform fault levels for *consumer* connections and makes provision for lower fault ratings for *service protection devices* (SPD), subject to that device satisfying specific *network operator* criteria. For *high voltage* connections the *network operator* may also require the *consumer's* agent to confirm *network* minimum fault levels at the *connection point* to ensure protection reach and effective grading with upstream *network* devices.

For detailed information on *network operator* declared LV fault levels refer to their [Technical rules](#) and where relevant *connection agreement*.

### 10.6.1 Horizon Power fault levels

For further information regarding Horizon Power's fault limit *requirements* within the Pilbara Grid, and NIS *networks*, refer the [Technical rules](#) or contact [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

### 10.6.2 Western Power fault levels

Additional information on SWIS fault limits and maximum fault currents refer to the [Technical rules](#).

#### 10.6.2.1 Western Power fault levels for LV supplies > 800 Amps

AS/NZS 3000 states in part that a *consumer's* switchboard protection equipment *must* be able to detect and clear arc fault currents for switchboards with a *load* capacity of 800A or more.

Switchboards with this capacity are typically supplied from either a 630 or 1000kVA *network* transformer. The minimum fault levels recommended to ensure appropriate operation of protection equipment is 30% for three--phase faults within 30 km's of a *zone substation*.

Where this cannot be achieved the *consumer's* agent *must* seek an alternative protection arrangement with the *network operator* in accordance with AS/NZS 3000 clause 2.5.5

### 10.7 Balanced electrical connections

*Distribution networks* are designed to deliver a supply to *consumers*, via either a single or three-phase supply arrangement as defined in [clause 7.6](#). The process of balancing both *load* and generation capacity on the *network* is an important reliability and quality factor in the delivery of a functional supply to all *consumers*.

Unbalanced *consumer electrical installations* adversely affect both *consumer* and *network* infrastructure including the operation of protection and service devices, *voltage* regulation equipment, transformers, cabling, and in some cases may generate non-characteristic *voltage* fluctuations/transients or harmonics.

Where the *consumer's installation* is serviced by a single, split or three-phase supply it is important that the *electrical installation* is balanced equally over all phases. The intent of balancing is to minimise the differences between the phase-to-phase supply *voltages*. Given that most *electrical installations* are not equipped with voltmeters, it is acceptable to measure current.

Out-of-balance current can be defined as the average difference between the currents in any two active conductors (excluding the neutral conductor).

The *consumer must* therefore ensure for LV connections, the current in each phase of their multi-phase *electrical installation* does not deviate beyond acceptable limits from the average of the phase currents, measured under both normal and peak operational conditions, by more than:

- a) 5 percent for a standard nominal *voltage* up to and including 1kV; and
- b) 2 percent for a standard nominal *voltage* above 1kV.

Out of balance current deviations are permissible for periods of less than two minutes by up to:

- a) 10 percent for a standard nominal *voltage* up to and including 1kV; and
- b) 4 percent for a standard nominal *voltage* above 1kV.

As a part of the *electrical installation* commissioning process, regardless of whether it is a new connection or an *alteration* to the installation's existing electrical arrangement, the *consumer shall*, through their agent, ensure that their connection complies with this *requirement*.

### 10.8 Power factor

A *consumer*, unless exempted, *shall* ensure that the power factor of their *electrical installation*, measured at the *point of supply (connection)*, is not less than the values provided herein or as agreed with the *network operator*. Dependent on the *consumer's* contractual agreement, financial penalties may also be applied by a *retailer* where the *consumer* does not achieve agreed power factor limits.

### 10.8.1 Horizon Power - power factor limits

Horizon Power's [Technical rules](#) provides further information on power factor *requirements* within the Pilbara Grid, and NIS *networks*. For specific details e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

### 10.8.2 Western Power - power factor limits

The [Technical rules](#) describes the power factor range for *loads* of less than 1MVA connected to the *distribution system* to be 0.8 lagging to 0.8 leading. Where necessary to ensure the satisfactory operation of the *distribution system*, a different power factor range may be specified in the relevant *connection agreement*.

For further information on power factor *requirements* within the SWIS refer to the [Technical rules](#) or contact Western Power on 13 10 87.

### 10.8.3 Ripple control and blocking systems

Ripple control signals may be used by a *network operator* as a *load/generation control system* for the switching of various devices, such as *metering and service equipment, consumer equipment*, or street lighting.

Where it is agreed that power factor correction capacitors are to be installed and the *network operator* uses ripple control, the *consumer shall* cover any costs of installing additional equipment to block the *network operator's* ripple control signals from either affecting the capacitor banks or reducing the strength of the ripple control signal.

The areas where ripple control is used or is planned to be used, and their operational frequencies, can be made available by the *network operator*.

## 10.9 Voltage fluctuations

*Consumers must* take all reasonable precautions to prevent adversely affecting the reliability and quality of supply to other *consumers* supplied from the same *network operator's distribution network*. As a minimum the *consumer's electrical installation shall* meet the *requirements* of the *network operator's* [Technical rules](#) and AS/NZS 61000 including but not limited to:

- AS/NZS 61000.3.5: "Electromagnetic compatibility (EMC): Limits – Limitation of voltage fluctuations and flicker in consumer's mains power supply systems for equipment rated greater than 75A
- AS/NZS 61000.3.6 "Electromagnetic compatibility (EMC): Limits - Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems "
- AS/NZS 61000.3.7: "Electromagnetic compatibility (EMC): Limits – Assessment of emission fluctuating loads in MV and HV power systems"

The *network operator* may require the *consumer's electrical consultant or contractor* to submit a statement verifying that the installation complies with AS/NZS 61000.3.11, AS/NZS 61000.3.14 and the applicable [Technical rules](#). Where a "statement of compliance" is provided, the *network operator* will *require* evidence of compliance prior to energisation of the *consumer's installation*.

Additionally, the *consumer's* equipment *must* not introduce harmonic levels in the *network supply voltage* in excess of those specified in AS/NZS 61000.3.6.

Where two or more *consumer' electrical installations* are connected at the same *point of common coupling* on the *distribution network*, the maximum permissible contribution to *voltage* fluctuations allowable from each *consumer shall* be determined in proportion to their respective maximum demand, unless otherwise agreed.

Restrictions or special provisions may be imposed for apparatus or equipment which has or may cause adverse power quality issues such as *voltage* fluctuations or harmonic affects due to a large or fluctuating demand. (E.g. Non-linear *load* control of variable speed motors, gas discharge lighting, arc furnaces, welding machines, x-ray units or frequently started large motors).

Similar conditions may be applied to equipment which may cause excessive distortion of the wave shape of the *network system voltage* such as rectifiers, frequency converters and *load control* devices using thyristors or saturable reactors.

**Note:** Where it was accepted or agreed to connect *consumer* apparatus, equipment or their *electrical installation* which is later found to be the cause of interference, *shall* not exempt the *consumer* from complying with these *requirements*.

If instructed by the *network operator*, the *consumer shall* arrange for the modification or removal of any apparatus or equipment to eliminate identified disturbances on the *network*. The *network operator* may disconnect the electricity supply if in the event the *consumer* fails to take corrective action(s).

### 10.9.1 Voltage transients

Transients are short term variations in the supply *voltage* caused by temporary disturbances within the *consumer's installation* or on the *network operator's transmission or distribution networks*. These variations are best described as excursions from the ideal or perfect sine wave shape, lasting for either a very short duration or for several cycles (1 cycle = 20 milliseconds).

Swells and spikes are often referred to as "surges". Swells are temporary moderate increases in *voltage* usually lasting from one to several cycles. Spikes are very high magnitude *voltage* impulses lasting generally for microseconds. Sags or dips are decreases in the peak value of the *voltage* waveform, usually lasting from one to several cycles.

Transients are often produced within a *consumer's electrical installation*. The level of occurrences will depend largely on the nature of *consumer* activity. The addition of an air-conditioning, starting of large motors or the introduction of large electrical *loads* to a local *network* can have an adverse effect on the quality of supply to all users of that *network*. However, transients can also be introduced through lightning strikes, acts of vandalism or *network* faults and switching.

Transient *voltages* may cause disruptions to process-type industries by causing motor contactors to 'drop-out'. Transient impulses can also affect computers and industrial control systems and may have a potentially harmful effect on equipment such as electronic communication and entertainment equipment.

It is therefore important that the connection, control and operation of *consumer electrical equipment* is closely coordinated with the *network operator* for the benefit of all users. *Network operators* will not accept responsibility for power quality where a transient is created as a result of causes outside of their control such as *consumer load/generation* infrastructure or severe environmental factors.

[Clause 10.11](#) provides further information and suggests possible measures to reduce the risk of disruption to plant processes or damage to *consumer's* equipment.

### 10.9.2 Flicker

Large *consumer electrical equipment* that either vary or are switched regularly may cause *voltage* variations on the local *network*. The effects of these variations may be noticed by the illumination levels of incandescent lamps.

*Consumer* supply and connection arrangements *shall* comply with the *network operator's* [Technical rules](#).

### 10.9.3 Harmonics

Harmonics are sine waves having frequencies which are integer multiples of the fundamental sinusoidal waveforms at a supply frequency of 50 Hz. Harmonics can cause the ideal or perfect *voltage* sine wave shape to be distorted and typically affect sensitive communication systems and electronic equipment.

Harmonics can be produced by industrial *loads* such as rectifiers (which convert AC power to DC), *inverters* (which convert DC power to AC) and non-linear *consumer* equipment such as electric vehicle chargers, welding sets and arc furnaces all of which can contribute harmonic problems to the *network*. Modern "transformer-less" power supplies used in computers, electronic light ballasts, variable frequency drives can also produce this effect.

Symptoms of harmonic issues may include:

- Computer malfunctions.
- Interference with communication systems.
- Malfunction of UPS systems and *generation systems*.
- Metering problems.
- Nuisance tripping of circuit breakers.
- Overheated conductors.
- *Overvoltage* problems.
- Reduced performance and operation of transformers.

The prolonged presence of harmonics currents if left uncorrected will shorten the operational life of sensitive equipment and in some circumstances, cause fires due to the temperature rise in conductors with specific reference to the neutral conductors.

*Consumer* supply and connection arrangements shall comply with the *network operator's* [Technical rules](#).

#### **10.9.4 Volt drop**

*Voltage* drop downstream of the *point of supply (connection)* shall be in accordance with the requirements of the AS/NZS 3000.

#### **10.9.5 Neutral voltage rise**

Within a *consumer's electrical installation* that incorporates a *MEN* earth system it is possible for the *voltage* in the neutral conductor to rise above earth potential, even though the neutral conductor is earthed at various points. The latent effect of this condition may produce a situation where an individual may receive an electrical shock from metal water pipes/fixtures or metal structures within the installation. Generally, causes of this type of fault can be found within a *consumer's* switchboard, earth or *consumer mains cable* installation or may be due to:

- *Voltage* drop in the neutral.
- Heavy current in the neutral conductor due to unbalanced multi-phase connections.
- High resistance contact of the earth electrode to the surrounding ground.
- A high resistance contact in a neutral connection in a neutral conductor used as an earth bonding conductor.
- High resistance in the neutral conductor back to the source (i.e. small conductor).

Neutral *voltages* should be as close to zero as possible. *Voltages* up to 6V may be considered acceptable while those above this range *require* immediate corrective action.

Any occurrence of an electrical shock *must* be reported to the *network operator* or DMIRS (Building & Energy). The services of an *electrical contractor* *must* be obtained to investigate and rectify the problem. Where a fault remains after a full examination of the *consumer's electrical installation* the fault should then be reported to the relevant *network operator* as the fault origin may reside within an adjacent property or the local *distribution network*.

### 10.9.6 Horizon Power voltage fluctuations limits

Horizon Power's [Technical rules](#) provides further information on fluctuation limits within the Pilbara Grid, and NIS *networks*. For assistance e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

### 10.9.7 Western Power voltage fluctuations limits

For information on operational parameters refer to sections 2 and 3 of the [Technical rules](#)

### 10.10 Supply reliability

*Network operators* endeavour to provide a continuous supply of electricity. On occasions supply to some *consumers* may need to be disconnected for planned maintenance, *network* alteration or *augmentation* activities. At other times unplanned outages may occur resulting in loss of supply to *consumers*.

#### 10.10.1 Planned supply interruptions

To maintain the level of reliability and performance expectations, various items of *electrical equipment* which make up the *distribution network* must be maintained on a regular basis. Additionally, *network* alterations are carried out to connect new *consumers* to the *network* or to enhance the quality of supply to existing *consumers*.

During these activities supply may need to be interrupted for the safe completion of the *work*. Where possible, the *network operator* may provide a backup supply, but this will depend on the nature of the *work*, and if provided, only to the capacity limits of the supplementary system.

*Network operators* will plan all non-urgent supply interruptions so that *consumers* are fully informed of the intended interruption at least 72 hours prior to the commencement of *work*. The notification will provide information on the supply interruption time, duration and any actions required to be taken.

Shutdowns affecting large commercial and industrial *consumers*, heavy industry, process industry or mining operations will be negotiated on an individual basis. Wherever practicable, shutdowns will be planned to take place at times which will cause minimal disruption to normal business activities.

#### 10.10.2 Unplanned supply interruptions

Unplanned supply interruptions can be caused by events such as *consumer* or *network* equipment failure, storms, vandalism, vegetation and *overloads*. *Network* field personnel will restore supplies to all *consumers* as soon as possible. Depending on the nature and severity of the outage, restoration times can range from a few minutes, hours or days. When supply is lost, the *network operator* will utilise a clearly defined set of strategies to determine the order of *repairs* and manner in which supplies will be restored.

This process considers both public and crew safety. Faults affecting essential services such as hospitals, and faults affecting the greatest number of *consumers* are given priority.

The following is an example of the prioritisation process used to restore supply:

1. hazardous situations to public safety including fallen or arcing overhead lines and services to critical facilities such as hospitals;
2. *high voltage transmission system* lines servicing the *network* and *substations*;
3. *substation* sites servicing *distribution networks*;
4. distribution lines and transformer installations;
5. localised distribution lines supplying clusters of *consumers* or businesses; and
6. services to individual *consumers*

The outages and duration for *transmission system consumers* are generally less than those for *low voltage* and *high voltage* distribution *consumers*. The level of reliability required by a *high voltage consumer* is negotiated on an individual basis.

### **10.10.3 Emergency response processes**

#### **10.10.3.1 Horizon Power**

Horizon Power is well practiced and equipped to respond to extended outages stemming from storms and cyclones with contingency plans in place for the community and individual *sites* to obtain emergency generation capacity where required. For more information on [faults and emergencies](#) or contact the relevant head or regional offices. Refer to [section 5](#) for contact details.

#### **10.10.3.2 Western Power**

Western Power has a fleet of emergency response *generation systems* (ERG) designated to support compatible *distribution network* transformers for the purposes of providing back-up power during planned or emergency power interruption. Dependent on the type of fault or supply interruption these ERG units can be utilised to reduce the length of the interruption and minimise the level of *consumer* inconvenience.

For more information on emergency response ERG units or for information on [Public interruption information](#) download the document via the identified link or contact the “customer services centre” on 13 10 87.

### **10.11 Consumers’ responsibilities**

#### **10.11.1 General**

A *consumer’s* responsibility is to ensure that the equipment they intend to use is correctly rated for the supply *voltage* and that it has the tolerances suited to the *network operator’s* supply limits. If there is any doubt, the *consumer must* refer to the specific equipment instruction manual or product information guide for that piece of equipment, contact the manufacturer, supplier, their *electrical contractor* or *electrical consultant* for assistance.

#### **10.11.2 Using equipment from outside Australia**

*Consumers* intending to purchase or use equipment manufactured from outside Australia on Western Australian *distribution networks must* first confirm with the manufacturer that the equipment complies with the *network operator’s* minimum supply *requirements* and the applicable Australian standard for that equipment.

#### **10.11.3 Purchasing and protection of sensitive equipment**

Computers, electronic communication and entertainment equipment, including some white and brown goods can be susceptible to damage caused by transients and *voltage* fluctuations in the power supply. *Consumers* intending to purchase this type of equipment should first confirm with the manufacturer that it is capable of satisfactory operation without additional protection.

Should the equipment be incapable of operating within the required limits of the *distribution network* without additional protection, or the *consumer* has concerns, then the installation of appropriate *voltage* conditioning devices and surge protection is advised. This may reduce the risk of damage from any *voltage* variations in the power supply.

### 10.11.4 Consumer with disturbing loads

*Consumers* intending to install electrical or electronic equipment which is likely to cause unacceptable disturbances on the *network operator's distribution network* must advise the *network operator* prior to installation. Examples of disturbing loads include:

- Arcing devices (e.g. arc furnaces, discharge lamps, welding equipment, etc.).
- Electric vehicle chargers .
- Magnetic core equipment (e.g. *voltage* regulating transformers, large motors, etc.).
- Power converters (e.g. rectifiers, *inverters*, variable motor speed drives etc).
- Power factor correcting equipment (e.g. capacitors, reactors, etc.).

The *network operator* will advise on any remedial action required before installation or negotiate a special agreement for the supply. This *requirement* applies to all users including residential, commercial and industrial *consumers*.

### 10.11.5 Starting currents

Unless authorised, equipment *shall* be of a type provided with a suitable current-limiting device so that the maximum inrush current complies with **tables 5 & 6**. Maximum allowable inrush currents (A):

#### 10.11.5.1 Single-phase (240V)

Starting currents single-phase (240V)	
Cities and major regional centres:	45A
Other locations (SWIS)	18A
Note for Horizon Power refer to section 7.6.2 table 3	

**Table 5:** Starting currents single-phase (240V)

#### 10.11.5.2 Three-phase (415V)

Starting currents three-phase (415V)		
<i>All areas:</i>	13A	Up to 1.5kW
	8.6A Per kW	1.5 - 6.0kW
	33A	Plus 3.2A per kW greater than 6.0kW
Note for Horizon Power refer to section 7.6.2 Table 3		

**Table 6:** Starting currents three-phase (415V)

Inrush current means the peak instantaneous value of current drawn by the equipment when energised. A *network operator* may consider and connect equipment rated above these limits following formal application by the *consumer*.

The *consumer* must liaise with the relevant *network operator* to confirm the conditions for connection of any installation where any item of *electrical equipment* exceeding 60kW demand on Horizon Power's Pilbara Grid / NIS *network* or 75 kW demand on the SWIS *network*.

#### 10.11.5.3 Single-phase appliances

Appliances with a rating exceeding 5kW (20A) (or 13.5kW for ranges, ovens, and hotplates) *shall* not be connected unless:

1. switching arrangements are incorporated preventing the *load* of anyone switching operation exceeding 20A and imposing a minimum 20mS delay between successive switching operations (on or off); or
2. as approved by the *network operator*.

#### 10.11.5.4 Rural single/split-phase loads (at 240 or 480V)

Special restrictions apply to the size of motors and other devices that produce inrush currents when energised and connected to rural *networks*.

240V single-phase motors may be started “direct online” (DOL) and 480V split-phase motors up to 7.5kW may be started DOL where the installation is served by a sole use transformer 25kVA or larger.

This is provided that the inrush current does not exceed the values given below in **table 7**:

Voltage	Maximum Inrush
Single-phase 240V	40A
Single-phase 480V (50kVA supply)	85.25A

**Table 7:** Inrush currents rural single/split-phase loads (240 or 480V)

#### 10.11.6 Electric vehicle supply equipment (EVSE)

Electric vehicle supply equipment (EVSE) and associated EV plugs/connectors *shall* comply with relevant industry standards and the *network operators technical requirements*.

The installation of EVSE equipment or system, will likely *alter* the *consumers site* maximum demand and potentially the associated *network* supply/connection arrangement, requiring additional or upgraded infrastructure and installation protection.

The rated current of EVSE *shall* not cause the total *load* limits specified:

1. in clause 7.6.2, **table 3** for equipment to be connected to a Horizon Power *distribution network*; or
2. for a *standard connection service* connected to Western Power’s *distribution network*; to be exceeded.

**Note:** [clause 11.1.2](#), classifies the installation and connection of *consumer* DER and EVSE equipment to an existing *network* connection or *metering equipment* as an *alteration*.

In determining the *requirements* for the connection of EVSE equipment, evaluation of the *consumer’s electrical installation* calculated maximum demand in accordance with AS/NZS 3000 clause 2.2.2 and these *requirements* is essential, together with formal *network operator* notification prior to equipment connection / activation.

For additional information refer to the relevant *network operator* and [clause 11.6.4](#)

#### 10.11.7 Insurance and warranty

Insurance companies may provide cover against damage to electrical and electronic equipment due to storms, fires or motor fusion. *Consumers* are advised to check the extent of cover of their individual policies.

*Consumers* are also advised to check the conditions of the manufacturer’s warranty when purchasing new equipment. For example, some computer or business equipment, the warranty may only be valid if the power to the equipment is provided via an approved power conditioner.

## 10.12 Consumer supply critical installations

*Consumers* who have *electrical installations*:

1. where momentary or prolonged loss of supply would jeopardise the health, safety or security of one or more persons or may cause damage to equipment, commercial processes, food, or loss of revenue; or
2. susceptible to disruptions or damage caused by transients, fluctuating *voltage* levels, *voltage* unbalance levels or harmonic levels;

are encouraged to seek professional advice from an *electrical consultant* or *contractor* on the need to install equipment to minimise disturbances such as uninterruptible power supplies, under-*voltage* motor protection, powerline conditioners, harmonic filters, or similar.

This would typically apply to *consumers* with critical plant processes, large computer or control systems, medical equipment (including home dialysis machines) or bulk cold food storage facilities.

### 10.12.1 Residential life support sensitive consumers

Where there is a reliance on a continuous supply of electricity to support critical medical equipment such as dialysis, heart/lung or life support machines, both *network operators* encourage users to register with their designated *retailer* as a "life support *consumer*".

It is also recommended that the *applicant* discusses and implements an appropriate secondary backup plan with their doctor or medical service provider to deal with any extended power interruption should it occur. Additional information can be obtained from:

#### 10.12.1.1 Horizon Power operated networks

Register as a [life support consumer](#) for Horizon Power's services or e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au).

#### 10.12.1.2 Western Power operated networks

Register as a [life support consumer](#) for Synergy services or for further information refer to Western Power's [life support](#) website.

### 10.12.2 Commercial/industrial sensitive consumers

Commercial and industrial *consumers* may apply to become a "sensitive *consumer*" where there is a high risk that an extended power interruption would result in adverse economic, health, environmental or public safety consequences.

*Network operators* will evaluate each application based on the Risk Management standard AS 4360. *Applicants* are required to complete a risk matrix as part of their application.

For specific information refer the following website links:

#### 10.12.2.1 Horizon Power operated networks

[Critical load application for business](#)

#### 10.12.2.2 Western Power operated networks

[Business consumers with sensitive loads](#).

### 10.13 Manufacturers' responsibilities

Manufacturers and suppliers of equipment intended for the Australian market *must* as a minimum ensure that their organisation and equipment, conform to the relevant State and national *requirements*, including but not limited to *these requirements* and those listed in [section 1](#).

Additionally, electrical/electronic equipment falling within the prescribed list of items as defined by the [Department of Mines, Industry Regulation and Safety](#) *shall* be tested and approved in accordance with the DMIRS *requirements* and *shall* bear the designated approval number.

Manufacturers or suppliers of electrical/electronic equipment *must* inform prospective buyers of the *requirement* for further protection where such equipment may be susceptible to damage caused by *voltage* variations and transient impulses normally encountered in a *network operator's distribution system*.

### 10.14 Claims against a network operator

In general, a *network operator* is not liable for any damage to *consumer's* equipment or consequential loss if:

- There has been no negligence on the *network operator's* part.
- Events or circumstances were beyond *network operator* control.
- The damage or loss was caused by:
  - the *consumer's installation/equipment* being defective, not operating in accordance with manufacturers specifications or non-compliant with recognised standards; and or
  - misuse, wear and tear, lack of maintenance, improper installation or similar.
- Third party interference to the electricity system including motor vehicle collisions with power poles or *network* equipment.
- Environmental or weather-related causes.
- The *consumer* has failed to meet specific *network operator requirements* and obligations conferred to them as part of the *connection agreement*.

Each claim will be investigated to determine the cause of the damage or loss. For full information including the *network operator's* terms and conditions applicable to assistance options, refer to the respective network websites.

#### 10.14.1 Horizon Power claims

For further information regarding Horizon Power's claims processes refer to their [Power outage](#) section of their public website.

#### 10.14.2 Western Power claims

For further information regarding Western Power's claims processes refer to their [Faults and outage](#) section of their public website.

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# **Service and Installation Requirements**

## **Section eleven**

### **Metering**

## 11 Metering

### 11.1 General metering arrangements

This [section](#) specifies the *network operators' requirements* for the supply, installation and maintenance of *metering equipment*. It is to be read in conjunction with the [Electricity Industry \(Metering\) Code](#) and the [WAER](#).

**Note:** The rapid uptake and integration of both *network* and privately owned “*distributed energy resources*” (DER), connected in front and behind *network metering equipment*, requires the implementation of appropriate solutions to monitor and manage the import and export of energy to and from *consumers*.

Effective energy flow management is essential to ensure the economically efficient, safe and reliable production and supply of electricity.

End-to-end integration of aggregated DER into the *network* system management and energy markets is an evolving process, which will directly impact, industry and *network* roles and responsibilities, together with the way *consumer electrical installations* will be connected over the next 3 to 5 years.

It is therefore expected that the introduction and use of “*distributed energy resource management systems*” (DERMS) to monitor and manage *network* connected assets, ranging from power stations to *photovoltaic* installations, will become common place to coordinate and balance energy generation and the storage mix across coordinated systems within the State.

As such it is envisaged that this [section](#) of the *WASIR requirements* will continue to evolve in support of the transforming nature of energy production, distribution and use.

#### 11.1.1 Metering obligations

As prescribed by the Metering Code, *network metering equipment must* be installed at every *connection point* on a *network operator's distribution network* excluding those *connection points* (Code type 7) which are classified as un-metered supplies.

*Metering equipment and metering installations must* be suitable for the range of operating conditions to which it will be exposed and operate within the defined limits for that *metering equipment* as specified in the approved metrology procedure.

Except for un-metered supplies, the *metering point* for a revenue *metering installation must* be readily accessible and located as prescribed by the Code and *these requirements*. Compliance ensures accessibility for *network operator* personnel when ascertaining performance of the *metering equipment*.

The *consumer shall* provide and maintain facilities to accommodate the *network metering installation*, in a manner that ensures the correct operation, functionality, security, and maintenance of that equipment. The Metering Code at sub-clause 3.5(3)(c) in part states:

“without limiting clause 3.5(3)(a) ensures that the metering equipment in the metering installation:

- I. is suitable for the range of operating conditions to which it will be exposed (e.g. temperature, impulse levels); and
- II. operates within the defined limits for that metering equipment as specified in the approved metrology procedure.”

Therefore, the *consumer shall* ensure that their *electrical installation's* maximum demand does not exceed the quantum nominated within the “preliminary notice” or as stated within the *consumer's connection agreement* unless prior approval has been formally granted by the *network operator*.

*Network operators* are not “required to maintain any metering equipment owned by the user or the user’s consumer. For example, equipment owned by the user or its consumer might include CTs, meter panels and secondary wiring installed as part of a switchboard.” For more information refer to clause 3.5(7) of the [Metering Code](#).

### 11.1.2 Alterations and additions

Where a *consumer* initiates an *alteration*, addition, or relocation of an existing *network* connection or *metering equipment*, the *altered* arrangement *shall* be classified as a new installation and upgraded to comply with:

1. these *requirements* inclusive of but not limited to this [section](#);
2. [WAER](#) inclusive of section 6;
3. Metering Code in its entirety;
4. *network embedded generation technical requirements*; and
5. applicable regulatory *requirements* and industry standards.

The *consumer* through their *electrical contractor* will need to provide evidence that compliance with the above *requirements* has been achieved.

Connection of *embedded generation*, *energy storage systems (Distributed Energy Resources)* and or vehicle charging/connection facilities to an existing *network* connection or *metering equipment* is for the purposes of these *requirements*, classified as an *alteration*.

Refer to [clause 7.6](#) for additional *requirements* pertaining to increases in *load* or generation capacity above a *standard connection service*.

The *electrical contractor shall* ensure that the earthing system of the *electrical installation* complies with the current edition of the [WAER](#), these *requirements* and the AS/NZS 3000. The operational existence of the installation’s *MEN* connection at the *consumer’s* neutral link *shall* be confirmed before the *consumer’s electrical installation* is reenergised. The preferred method, to confirm the connection of *MEN* is by way of an earth loop impedance test.

*Network metering equipment* forming all or part of a *consumer’s* switchboard installed on un-enclosed or asbestos panels supported by timber frames or surrounds *shall* be upgraded to current *requirements*.

Where existing asbestos meter panels are upgraded or removed, the *consumer shall* ensure that the existing asbestos material is removed in accordance with WorkSafe’s guideline “[Asbestos Code of Practice](#)”. No asbestos material *shall* remain in the vicinity of the *network metering installation*.

#### 11.1.2.1 Existing consumer rewirable fuses

Where a *consumer’s* supply arrangement and or switchboard is upgraded, any existing rewirable fuse protection assemblies on that switchboard, *shall* be replaced with protection devices complying with AS/NZS 3000 and these *requirements*.

### 11.1.3 Whole current meter neutral reference link

The integrity and continuity of the incoming neutral to the *consumer’s electrical installation shall* be maintained at all times. Where the *electrical installation* has or is to have multiple *network* whole current *metering equipment* installed, neutral reference links, with accompanying neutral reference cables are to be installed to prevent unsafe disconnections and crossed *load* meter neutral connections.

Each whole current meter installation forming part of a multiple whole current *network* metering arrangement, *shall* be connected to a dedicated terminal of the neutral reference link via individual minimum 2.5 (7.067)mm<sup>2</sup> meter neutral reference cable from the link(s). Soldered connections are not permitted.

Each reference cable *shall* be tagged with an indelible permanent label that clearly define its function and associated meter.

Where a multiple metered supply arrangement is *altered*, modified or upgraded any existing meter neutral loop in, loop out wiring configurations *shall* be removed and replaced with, meter neutral reference links and individual meter neutral reference cables installed by the *consumer's electrical contractor*. Refer to [clause 11.3.5](#).

#### **11.1.4 Maintenance, repairs and replacement**

Where items of equipment (other than the *network operator's metering installation*) identified at [clause 11.1.8](#), for which the *consumer* has responsibility, becomes damaged, defective or unserviceable, the *consumer shall* initiate the appropriate action(s) to have the item(s) of equipment *repaired* or replaced.

Should the work necessitate the disconnection and reconnection of supply, the *consumer* through their *electrical contractor shall* coordinate the required activities with the *network operator*. [Clause 4.3.6](#) provides additional information on levels of responsibilities for authorised *electrical contractors* including those *electrical contractors* authorised to carry out *network* disconnections and reconnections. *Electrical contractors must* have *network operator* approval as a part of an accredited scheme before accessing *distribution network* equipment.

*Network operators* have a regulatory obligation to test and report on performance of their *metering equipment* to the ERA which may require a shutdown where necessary to fulfil this *requirement*.

#### **11.1.5 Metering installation**

Facilities and associated equipment *shall* be provided for the *network operator's metering installation and equipment* as prescribed in these *requirements* and *shall* be of a type and in a location, accessible and prepared for the *metering equipment* installation in accordance with:

1. Metering Code and relevant electricity regulations;
2. AS/NZS 3000 and relevant Australian standard(s) (or IEC equivalent where no Australian standard exists) applicable at the time of manufacture;
3. [WAER requirements](#);
4. *network operator requirements* applicable at the time of connection to the *distribution network*; and
5. be suitable for use under normal service conditions at the nominated operational *voltage*.

#### **11.1.6 Installing metering equipment**

A person *must* not install *metering and protection equipment* or connect *metering equipment* to a *distribution network* unless that person is a:

1. *network operator* authorised employee; or
2. registered *electrical contractor*, authorised to undertake this type of work as prescribed by a *network* authorised connection scheme.

#### **11.1.7 Unauthorised access to metering equipment**

Each *metering installation* connected to the *network shall* be secured by means of devices or methods which, when installed, *shall* hinder unauthorised access to the *metering installation* and enable unauthorised access to be detected. All locks and locking systems utilised *must* be of a master key type as approved by the *network operator*.

It is an offence to *alter*, tamper or interfere with *metering equipment* as detailed in [clause 3.8](#). This includes unauthorised connection of meter and/ or *service apparatus* and acts of vandalism.

Where a person(s) has evidence or concerns in relation to the above activities they should immediately report their concerns to the relevant *network operator* via their "customer services centre". Refer to [section 5](#) for contact details.

### 11.1.8 Responsibilities

In summary the *consumer* is responsible for the supply and installation of *service protection device(s)* equipment, switchboards, meter panels, enclosures etc. The *network operator* will supply the revenue *metering equipment* which remains the property of that *network operator*.

#### 11.1.8.1 The consumer

Shall supply, install and maintain:

1. service protective and meter protective devices, including circuit breakers, fuse bases/holders and where permitted protective fuse cartridges;
2. boundary fuse bases/holders and fuse cartridges;
3. current and *voltage* transformers as required by the *network operator*;
4. service neutral/active links including those for master metered panels;
5. meter enclosures, cubicles and panels;
6. switchgear enclosures;
7. *consumer mains cable*;
8. associated *consumer* equipment, apparatus, wiring and connections (inclusive of the overhead *mains connection box*); and
9. labelling and identification.

**Note:** Installation and maintenance of electrically energised equipment requires the assistance of technically competent and authorised persons. Regular inspections ensure ongoing functionality and safe operation of the connection arrangement.

#### 11.1.8.2 The electrical contractor

Shall:

1. assess the maximum demand to determine the correct selection of *metering equipment*, service protection and *consumer mains cable*;
2. where accredited by a *network operator*, obtain, install and connect whole current *metering equipment* for supplies up to and including 80A actual *load* per phase;
3. where the maximum demand consistently exceeds 80A actual *load* or exceeds 100A calculated *load* per phase for separately metered parts of the *consumer's installation*:
  - a. supply and install the current/*voltage* transformers; and
  - b. arrange for the installation and commissioning of *network metering equipment* by the *network operator*.

**Note:** *Network* whole current *advanced meter infrastructure* (AMI) has a maximum operational limit of 80A which may impact the functional criteria for existing *consumer installations* stated above.

#### 11.1.8.3 The network operator

Shall supply, maintain and, where engaged, install:

1. revenue *metering equipment* but not the panels, wiring or enclosures;
2. where required supply and install *consumer* whole current *metering equipment*; and
3. supply and install *consumer* CT *metering equipment*.

**Note:** The *network operator* is responsible for CT meters and regulatory obligations. In accepting the use of *network* meters, the *consumer* agrees to provide access to and isolation of the equipment for the purposes of obligatory testing.

## 11.2 Tariffs and metering

The *consumer* or their agent *must* consult with their *retailer* at the earliest opportunity, and prior to connection, to establish an account and “account reference number” for their specific *electrical installation*. Evidence of the *retailer* agreement *shall* be provided to the *network operator* via the submission of a “preliminary notice” or such other mechanism as endorsed by the *network operator*.

Refer to the relevant [electricity retailer](#) website for account details, and charges.

## 11.3 Meter panels

### 11.3.1 Size

Meter panels *shall*, unless formally advised otherwise by the *network operator*, be sized to accommodate the required *metering equipment* that is to be installed upon it as prescribed by these *requirements* inclusive of [clauses 11.9.2](#) and [11.13](#).

### 11.3.2 Installation

Meter panels *shall* be installed:

1. within a suitable metering enclosure adjacent to or forming a part of the specific *consumer's* switchboard; or
2. within a suitable meter only enclosure or cubicle; or
3. on facilities that are acceptable to the *network operator*; and

where located within an enclosure or cubicle, the lid or door *shall* be capable of being opened to an angle of not less than 105 degrees from the closed position with all *metering equipment* installed.

### 11.3.3 Materials

Meter panels *shall* be constructed of insulating material:

1. to an equal or better standard than that required by AS/NZS 3439 (AS/NZS 61439) for switchboards;
2. constructed of material that will maintain a structural and dimensional fit after the *metering equipment* has been installed; and
3. suitable for its intended use and environment, including exposure to weather and ultraviolet light if exposed during daylight hours.

### 11.3.4 Wiring holes

Wiring holes manufactured in meter panels *shall* be prepared to:

1. suit each *metering installation* or as prescribed within this [section](#);
2. accommodate the *network operator's* *metering equipment* and *service/meter protection devices*; and
3. enable free movement of cables through the panel and termination of the conductor/s without damage to the cable insulation or equipment.

Meter panels *shall* have no exposed holes, other than those required for mounting of meters, protection devices, communication/antenna devices and cable access. Any un-used holes in existing panels *must* be sealed if there is a likelihood of either direct or indirect contact with live parts as defined by AS/NZS 3000. Refer also to [clause 11.4](#).

### 11.3.5 Wiring

Cables *shall* be manufactured in accordance with AS/NZS 5000. Meter panel wiring *shall* be installed in accordance with these *requirements* or to the metering provider specifications and to Australian Standards AS/NZS 3000, AS 3008 and AS/NZS 3439 (AS/NZS 61439).

Hard drawn copper, aluminium, braided or neutral screened cables for meter panel wiring ***shall not be used***.

The use of insulated flexible cables is subject to *network operator* approval. Where approved the cable *shall* be copper, provided with un-insulated bootlace pins (end sleeves), securely crimped around the conductors using an appropriate tool. The bootlace pin *shall* be at least 25mm in length to ensure effective clamping under *network meter equipment* terminal screws.

Wiring *shall* be designed and installed to withstand any thermal and magnetic effects on the conductors.

Where provision is made to hinge or remove a panel, conductors connected to *electrical equipment* on the panel *shall* be:

1. of sufficient free length to allow the panel to be moved into an inspection or workable position;
2. suitably fixed or otherwise retained in position to avoid undue movement or stress on *electrical equipment* at equipment terminals;
3. arranged to prevent undue pressure on *electrical equipment* mounted behind the panel; and
4. appropriately secured and protected when installed on hinged panels.

Wiring not intended to be connected to *metering equipment* *shall* not enter the area directly behind the meter panel(s) unless contained within a physically separate wiring duct or conduit located in a rear corner of the enclosure or surround such that it does not obstruct the meter wiring space.

Unused meter panel wiring *must* be removed or, where this is not possible, terminated in accordance with AS/NZS 3000. Acceptable methods include the fitting of intended *metering equipment* to the panel at the same time, or ensure unused wiring is appropriately insulated and terminated at the rear of the panel or within a junction box.

Example wiring diagrams for whole current and CT metered arrangements have been included within this [section](#) for guidance.

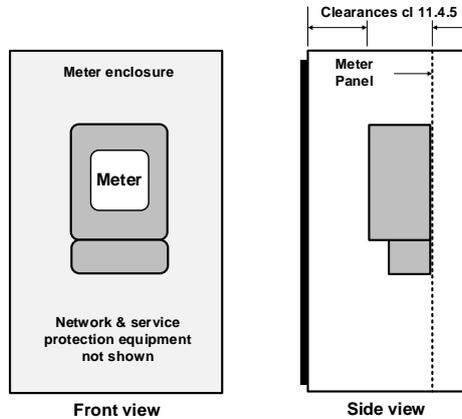
#### 11.3.5.1 Magnetic Screening

To avoid the adverse effect on *metering equipment*, from magnetic fields, adequate spacing is required between the meters and large current-carrying conductors as shown in **table 8**.

*Maximum Current in Conductor Nearest to Meter (Amps)	Minimum Spacing between Conductor and Meter (mm)
150	Nil
200	100
400	500
600	700
1000	900
1500	1200
2000	1400
3000	1700
4000	2000

**Table 8:** Minimum spacing for unscreened meter enclosure

Where spacing cannot be achieved magnetic screening *shall* be installed around the *metering equipment*. Screening *shall* be of a ferrous material, not less than 0.76 mm thick. The meter enclosure *must* be totally enclosed around the *meter equipment*, e.g. enclosed top, bottom, sides and back extending level with the front of the meter and provide a space behind the meter panel in accordance with [clause 11.4.5](#). It is important that the enclosure is in one piece. See **figure 20**.



**Figure 20:** Magnetic screening

A bushed 32 mm minimum diameter hole is required to provide access for CT secondary wiring.

### 11.3.6 Panel arrangements

Standard meter panel arrangements for whole current meters are as detailed in [clause 11.9.2](#).

### 11.3.7 Fixing and sealing

Meter panels *shall* be:

1. mounted to the enclosure by the vertical edges of the panel;
2. equipped with hinges where the panel size exceeds;
  - a. 450 mm by 450 mm;
  - b. 600 mm by 400 mm for CT metering; and
3. secured in the closed position by suitable non-corroding fasteners which require the use of a tool to release the panel. Refer to [clause 11.6.2](#).

### 11.3.8 Labelling

Labelling *shall* be in accordance with the *requirements* of [clause 11.4.9](#).

## 11.4 Metering equipment/protection switchboards and enclosures.

### 11.4.1 General

Switchboard assemblies, meter enclosures and surrounds, installed to support or house *network metering equipment* shall be constructed, and designed:

1. to ensure that under normal operation, contact cannot be made with live parts;
2. to prevent the entry of water and minimise spread of fire;
3. with sufficient stability and strength to withstand distortion and contain any mechanical or electrical energy which may be produced under both normal and fault conditions;
4. to ensure compliance with operational, functional and regulatory clearances of the electrical and *metering equipment* to the switchboard assembly or enclosure;
5. in a manner and mounted in a position that does not permit exposure of the *metering equipment* to direct sunlight, weather, salt or dust-laden air, corrosive atmospheres or adverse environment conditions;
6. to ensure that switchboard and *metering equipment* and devices are protected from mechanical damage and vandalism;
7. so that any hinges or fixings used to support the meter panel(s) will be of adequate strength to support the weight of the panel(s) and equipment thereon when in either the opened or closed position;
8. to ensure that the movement of the meter panel is not obstructed in any way by the switchboard assembly or enclosure or by the fixings/device(s) used to retain the panel when in the opened and closed positions; and
9. where the meter panel is hinged, the fixings or the device(s) used to retain the panel shall be aligned to ensure the operational correctness of the equipment mounted on the panel.

### 11.4.2 Surrounds

Where an existing switchboard and or metering panel is fixed to a timber or similar surround, or located on a *premise* external wall, it is permissible to retain this configuration as long as:

1. the installation's *metering equipment* and or *consumer mains cable* are not to be modified, *altered*, upgraded, relocated or converted to an underground supply;
2. the location of the *metering equipment* complies with these *requirements*;
3. the installation is safe and does not expose the user or others to hazards;
4. the following elements of the installation's earthing system shall comply with current industry standards including the:
  - a. main earth conductor, earth stake and MEN connection;
  - b. bonding of both plumbing systems and any exposed metal;
  - c. system and equipment earths; and
5. the required clearances as prescribed by these *requirements*, AS/NZS 3000 and AS/NZS 3439 (AS/NZS 61439) are maintained as a minimum.

The installation of *metering equipment* on unenclosed panels fixed to surrounds is **not permitted** for new, *altered* upgraded or modified connections.

**Note:** It is both *network operator's* preference, that all existing *metering equipment*, communications equipment and network control devices, be upgraded and installed within an appropriate enclosed metering enclosure.

### 11.4.3 Enclosures/cubicles

Meter enclosures/cubicles *shall* take the form of a fully enclosed cabinet/compartment, to accommodate the meter panel, *metering equipment* inclusive of measurement, monitoring, protection, control and communications devices. The enclosure may also contain a separated compartment for the *consumer's* switchboard equipment.

Where *metering equipment* is installed in an enclosure externally on a *premises* or pole in an isolated and unattended location, the enclosure *must* be constructed of material of sufficient strength to achieve protection against vandalism, weather and other external factors.

**Note:** The *network operator* may require a larger than standard enclosure to accommodate *distributed energy resource* management systems inclusive of the associated communication equipment. Installed DERM systems will also *require* a pathway for the antenna cable and bracket mounting for the antenna. Specific location, application and installation *requirements* such as installation details for RFI CSM 700 antennas are available from the relevant *network operator*.

Enclosures *shall* be manufactured and fabricated in accordance with the *network operator's technical requirements* and treated to protect against the effects of construction, operation and environment for the life of the installation. The enclosure *shall* be free from sharp edges and corners.

The enclosure *shall* be constructed and mounted to provide a minimum degree of protection of IP24 for normal operational and climatic conditions or as prescribed by the *network operator*.

Where the enclosure is free standing or fixed to a pole the combined structure *shall* be firmly located on a foundation that is supportive, secure and where in unstable soils secured with the aid of concrete base. The following additional measures *shall* also be taken to ensure the integrity of the IP rating.

Cable access between a:

1. circular pole and the enclosure *shall* be via a robust conduit coupling or nipple; and
2. square pole and the enclosure *shall* be via a bushed and sealed aperture. The use of sealant or adhesive style productions will not be permitted as a means of establishing a permanent seal between the enclosure and the pole.

Where required the switchboard *shall* make provision for:

1. fluctuations in temperature and humidity;
2. moisture build up within an enclosure; and
3. restricting insect and vermin infestations.

**Note:** Alternative meter enclosure construction may be considered by the *network operator* through their engineering division subject to a detailed review, analysis and assessment.

### 11.4.4 Switchboard assemblies

A switchboard frame, compartment or cabinet may take the form of open, dead front or enclosed assembly designed and constructed to support or house network metering/protection and *consumer electrical equipment* in accordance with AS/NZS 3000, AS/NZS 3439 (AS/NZS 61439) and *these requirements*.

### 11.4.5 Clearances

Clearances *shall* be sufficient to ensure adequate:

1. space for the installation of equipment and associated wiring; and
2. safe access to *network* metering/protection equipment

In addition to the *requirements* of AS/NZS 3000 and AS/NZS 3439 (AS/NZS 61439) the following minimum clearances *shall* be maintained from the :

1. front of the meter panel to the inside of the door in the closed position *shall* be a minimum of 175 mm; and
2. back of the meter panel to the rear of the surround, enclosure or assembly *shall* be a minimum of 75 mm minimum.

When determining clearance *requirements*, cable bending radiuses as prescribed in AS 3008.1 and AS/NZS 3000 *shall* be considered to ensure that the cables are not under stress when installed, fixed in place and terminated.

**Note:** For Horizon Power *metering installations*, the clearance from the back of the meter panel to the rear of the enclosure *shall* be at least 150 mm for conductors greater than 16 mm<sup>2</sup> up to 35 mm<sup>2</sup>.

### 11.4.6 Installation

The enclosure *shall* be securely mounted and fixed in accordance with the [WAER](#), AS/NZS 3000, AS/NZS 3439 (AS/NZS 61439) and these *requirements*.

Where an enclosure is to be:

1. recessed or built into a wall, it *must* be designed and constructed to support the surrounding wall without distortion. For walls of brick construction, the enclosure *shall* suit standard brick courses; and
2. externally wall/pole mounted or free standing, the enclosure *must* be installed and mounted to provide a minimum degree of protection of IP24 for normal operational and climatic conditions. Conduits or cable entries *must* not enter the enclosure from the top.

Fixings used to secure the enclosure *shall* ensure that the enclosure cannot be dislodged from its supporting structure by any reasonable force and where located externally will prevent the entry of water or moisture.

All enclosures *shall* be fitted with a hinged door, catch and retainer. A minimum of two (2) hinges *shall* be fitted, consisting of a robust lift type, constructed from a non-corroding material.

The door catch *shall* retain the door in the closed position under all conditions that can reasonably be expected and a retainer *shall* be fitted, securing the door in an open position, enabling work to be performed on the meter panel and *metering equipment* safely, without interference.

Panel supports *shall* be provided in all enclosures presenting a full 25 mm clear surface for the purpose of fixing the panel(s) along each vertical edge.

### 11.4.7 Earthing

The earthing system for *electrical installations* *shall* be the *Multiple Earthed Neutral* (MEN). Unless otherwise permitted by the *network operator*, systems *shall* comply with but not limited to AS/NZS 3000, AS 2067, AS/NZS 3439 (AS/NZS 61439) and the *network operator's technical requirements* .

Earthing facilities *shall* be fitted to surrounds and enclosures, behind the *consumer's* switchboard panel providing as a minimum a:

1. 6 mm non-corrosive stud welded in position and complete with a nut, flat and spring washers; or
2. 6 mm captive nut and bolt complete with flat and spring washers: or
3. earth bar/link secured to the enclosure.

### **11.4.8 Locks, locking systems and viewing windows**

Where *metering equipment* is located within a locked cabinet / enclosure / cubicle or enclosed area, an approved *network operator* master locking system *must* be fitted, allowing network personnel access to the *metering equipment* and *service protection device* at all times. Where an approved *network operator* locking system is fitted a viewing window is optional. Refer to [clause 6.18](#).

The disengaging of electronic security systems or *consumer* provision of mechanical aids to obtain access or read meters is not deemed acceptable.

### **11.4.9 Labelling**

Labelling *shall* be in accordance with the *requirements* of [clause 6.17](#), [WAER](#) section 3, AS/NZS 3439 (AS/NZS 61439) section 5, and as prescribed by AS/NZS 3000, AS/NZS 4777 and AS/NZS 5033. Labelling including manufacturer's details *shall* be clearly visible and remain legible for the life of the equipment and the installation.

Labels *shall* not be located or inscribed into meters or meter covers. Labelling located or scribed directly onto meters damage the external surfaces of the meter and therefore render it unserviceable for relocation or exchange.

#### **11.4.9.1 Single dwelling**

In addition to the *requirements* of [clause 11.4.9](#), every single dwelling switchboard *shall* be labelled in accordance [WAER](#) section 3 and *shall* clearly identify the board's *point of supply (connection)*.

#### **11.4.9.2 Multiple dwelling**

In addition to the *requirements* of [clause 11.4.9](#), each dwelling switchboard in a multiple installation *shall* be labelled in accordance with these *requirements*, *which shall* clearly identify the *premises*, *service/meter protection device* and *meter installation* for that dwelling inclusive of that board's *point of supply (connection)*.

Corresponding labelling *shall* be installed on the *consumer mains cable* and submain *cables* for each dwelling, at each junction and meter panel locations, to enable present and future identification of conductors.

## 11.5 Metering equipment location

### 11.5.1 General

A *network operator* is required to read and monitor the performance of their *metering equipment* for the purposes of operation and maintenance. Right of access provisions are prescribed in the Metering Code and the Energy Operators (Power's) Act 1979. Refer to section 43 (1).

Unless specified otherwise by these *requirements* or the *network operator*, *network metering equipment* shall be located:

1. not more than 30 metres (route length) from the *point of supply (connection)* where the *consumer mains cable* is electrically unprotected;
2. in a position that clearly relates to *consumer's premises* and *point of supply (connection)*;
3. on the principal frontage of the *premises* (but not more than 1 metre down any side wall);
4. facing a road, laneway or access way, gazetted or classified as the official address for that *premise or structure* (not located on or adjacent to a non-gazetted access way);
5. so that *network* and first response emergency services personnel have clear identifiable unimpeded access (24 hours 7 days per week);
6. accessible without having to enter the dwelling or traverse areas not normally open to the public, refer to [clause 11.5.3](#);
7. in a non-hazardous accessible external area, refer to [clauses 11.5.3](#) and [11.5.4](#);
8. outside areas enclosing animals/livestock, and not behind gates/fences/barriers or in front of stiles; and
9. in an accessible area within multiple domestic/commercial/industrial installations when the *premises/structure* is locked. Refer also to [clauses 11.11](#) and [11.12](#).

*Metering equipment* shall be accessible from the street level of the *premise* or one floor above or below street level for multi-storey *premises*.

The *service protection device* shall be located in a position that ensures uninhibited access for *network operator* and emergency services (first responder) personnel. Refer to [clause 11.5.3](#) for information on unacceptable locations.

Grouping of individual *metering equipment* is not permitted except where prescribed by [clauses 11.11](#) and [11.12](#). Mechanical jointing, bolting or interlocking of individually constructed enclosures is deemed "grouping" and as such not an acceptable method of switchboard construction.

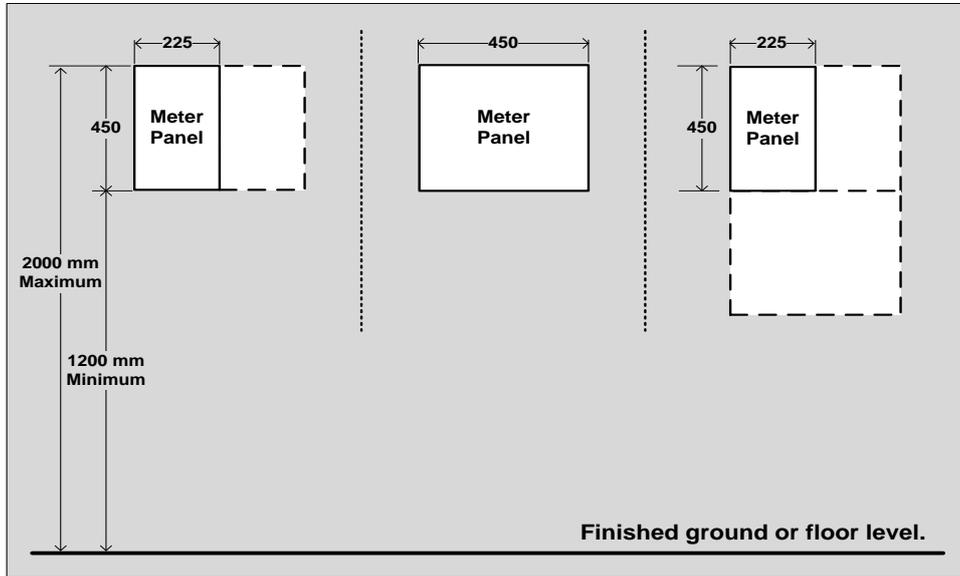
Adequate space shall be provided and maintained in the enclosure to enable the *metering equipment* to be operated, maintained or replaced. The space shall:

1. provide minimum horizontal and vertical clearances as prescribed by AS/NZS 3000 clause 2.10.2 and AS 2067;
2. enable the door or panel to be fully opened or removed safely;
3. ensure that the *service/meter protection device(s)*, *metering equipment* and *consumer main switch* are mounted as prescribed by AS/NZS 3000 clause 2.3.3.4, (refer to [clause 11.6.4](#) for additional information on the installation SPD), and
4. ensure metal meter enclosures are located so that contact with adjacent conductive surfaces inclusive of metal posts, bollards or fencing are avoided which may constitute an earth (touch *voltage*) hazard for persons approaching or required to work on the enclosure.

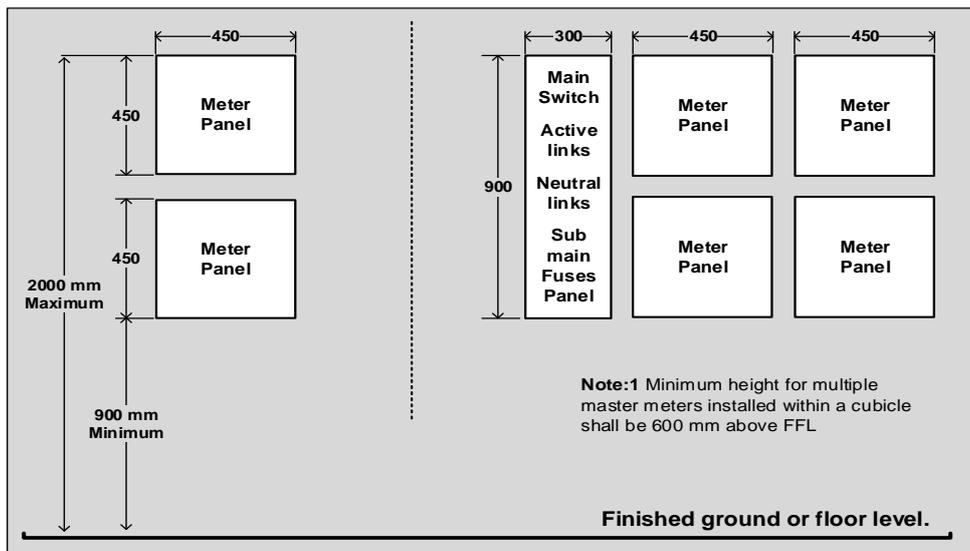
Distances shall be as prescribed by AS/NZS 3000 and AS 2067 with a recommended minimum separation distance of 2.5m for residential.

As shown in **figures 21** and **22** the height of meter panels from the immediate finished floor or ground level to the bottom edge of the panel *shall* not be less than:

1. 1200 mm for a single whole current and gas/electrical combo metering arrangement;
2. 900 mm for multiple master metering arrangement (minimum height of 600 mm); and
3. 900 mm in all other cases.



**Figure 21:** Typical meter panel mounting heights



**Figure 22:** Typical multiple meter panel mounting heights

### 11.5.2 Access requirements

In addition to [clause 11.5.1](#) consumers and their agents *shall* make themselves aware of local government requirements pertaining to design setbacks and local area aesthetics, noting that these *requirements* for switchboard heights are the minimum mandatory *network* and industry criteria for safety and access.

#### 11.5.2.1 Single domestic/commercial lots

*Metering equipment* for a single *lot*, with a gazetted frontage and *lot* area up to 2500m<sup>2</sup> *shall* be located as prescribed by [clause 11.5.1](#). For *lots* larger than 2500m<sup>2</sup> refer to [clause 11.5.2.6](#).

### 11.5.2.2 Battle-axe block lots

*Metering equipment* for a battle-axe lot with:

1. a gazetted frontage *shall* be as prescribed by [clause 11.5.1](#); or
2. has no gazetted frontage, other than a driveway or part thereof, *shall* be located in accordance with [clause 11.5.1](#) in a position on the gazetted frontage as close as practical to the entry of the *premises or lot* so that the *metering equipment* location is readily identifiable and accessible. Refer to [clause 11.5.2.6](#).

### 11.5.2.3 Strata developments

As of the 1 February 2020 all *strata developments* created within the SWIS *shall*, unless approved otherwise by the *network operator*, have a single *network point of supply (connection)* and *consumer site main switchboard* to service all *lots* within that *development*. Refer to Western Power's [Underground distribution schemes manual \(UDS\)](#) and [Guideline for small strata developments](#) for specific detail of the *requirements*.

The use of remote metering arrangements is not permitted for *strata developments*

### 11.5.2.4 Multiple domestic/commercial lots

Multiple occupancy *lots shall* have the *metering equipment* readily accessible at all times and be located as prescribed by [clauses 11.5, 11.11](#) and [11.12](#).

*Metering equipment shall* be so arranged to allow the supply to an individual *premises* and the combined installation to be de-energised at any time. This *requirement* may be varied by agreement with the *network operator* where the property has more than one *point of supply (connection)*.

### 11.5.2.5 Large commercial/industrial lots

The *network operator shall* determine the location of the *metering equipment* in accordance with *site specific conditions* and these *requirements*.

### 11.5.2.6 Semi-rural and rural lots

*Metering equipment shall* be located as prescribed by [clause 11.5.1](#). Where these *requirements* cannot be achieved, the *metering equipment shall* be located adjacent to the *point of supply (connection)*:

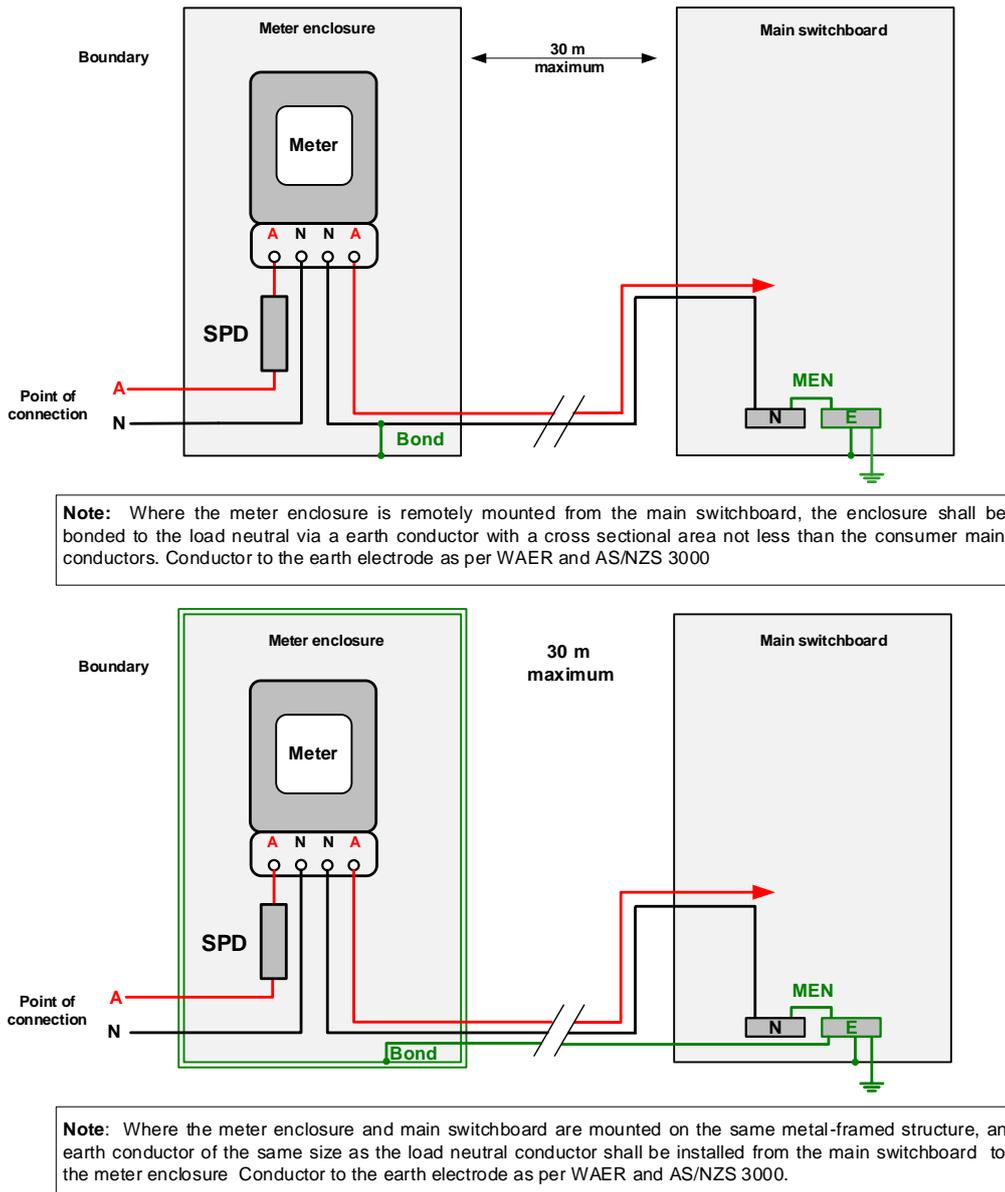
1. inside and on the *consumer's property boundary* where the *distribution network* is situated within the road reserve; or
2. in a position acceptable to the *network operator* where the *distribution network* traverses the *consumer's rural property*. Refer to [section 12](#).

### 11.5.2.7 Remotely located

Individual *metering equipment* inclusive of the *service protection device* may be located on an urban front *property boundary* where the *consumer's main switchboard* is not more than 30 metres (*consumer mains cable route length*) from that *metering equipment*. Remote located *metering equipment* is limited to an installation consisting of a single self-contained separate domestic *premises*.

This metering arrangement *shall* not be used for multiple/distributed master *metering installations*.

Earthing of a remote metering enclosure *shall* be in accordance with the [WAER](#), AS/NZS 3000 and these *requirements*. Refer to **figure 23**.



**Figure 23:** Typical earthing arrangement for remote metering

**11.5.2.8 Public open space and road reserves**

As prescribed by the [WAER](#) and the [Utility providers code of practice](#), no part of a *consumer’s electrical installation* or associated *network metering equipment* shall be located within public open space or a road reserve, unless approved by the applicable state or local government agency(ies) and the relevant *network operator*.

**11.5.2.9 Rail corridors/reserves**

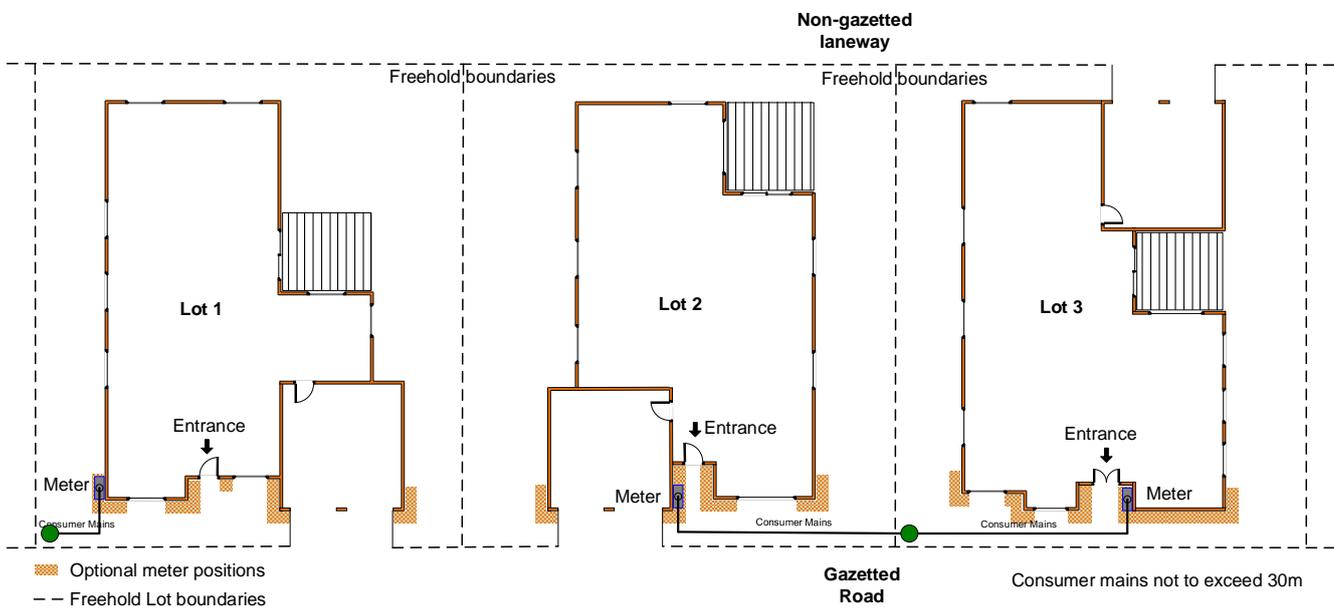
The Rail Freight System Act 2000 prohibits a person or company constructing anything on rail corridor land unless the Authority formally agrees, or the regulations state that the Authority’s agreement is not required. The Government Railways Act 1904 defines the ‘Authority’ as the Public Transport Authority (PTA) of Western Australia. If approved, placement of services shall be coordinated by the PTA with the relevant *network operator*.

### 11.5.3 Unacceptable locations

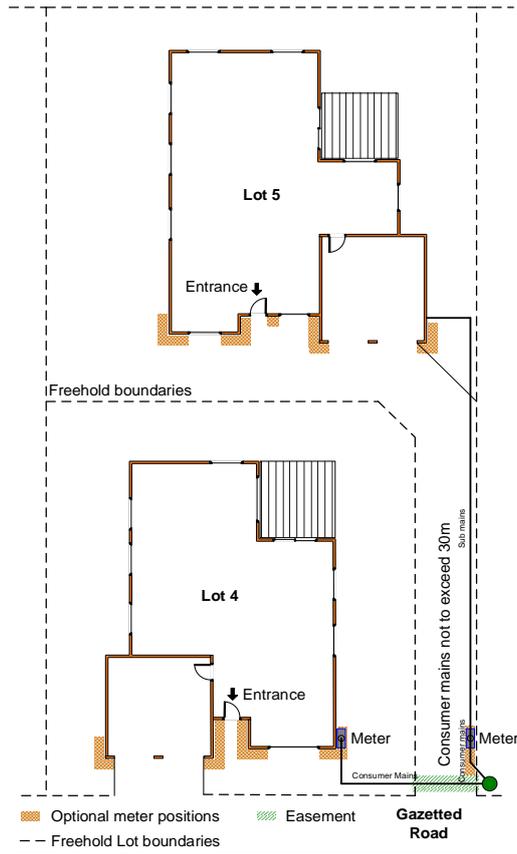
Switchboard-mounted *metering equipment* and protective devices *shall* not be located:

1. within a *premises*, or structure with restricted access;
2. over stairways or ramps, in passageways or corridors, confined spaces, or in fire-isolated stairways;
3. in vehicle docks, driveways or accessways where the equipment or a person(s) working on the equipment would not be effectively protected;
4. in locations subject to flooding, fumes, vibration, dampness, or dust, which may cause deterioration of equipment or unsatisfactory working conditions;
5. in hazardous or prohibited locations as defined in the AS/NZS 3000;
6. in close proximity to, or over, machinery or open-type switchgear;
7. where the normal ambient temperature exceeds 70 degrees C;
8. where there is insufficient light;
9. where the equipment would be exposed to direct sunlight;
10. where surrounding structures are a hazard or access is restricted by vegetation;
11. in pool or spa areas or areas containing water features;
12. in enclosed carports, verandas or areas exposed to high traffic movement;
13. in areas to which access is normally restricted – for security, health or other reasons (this would include areas in which animals are kept for security reasons);
14. in areas enclosing animals;
15. behind a fence, unless with an unlocked, suitably positioned gate;
16. near gas cylinders, Refer to AS/NZ 2430.3.4, or gas services;
17. where the use of a ladder is necessary to access *network* equipment; and
18. above or in close proximity to work benches with high volume work activity.

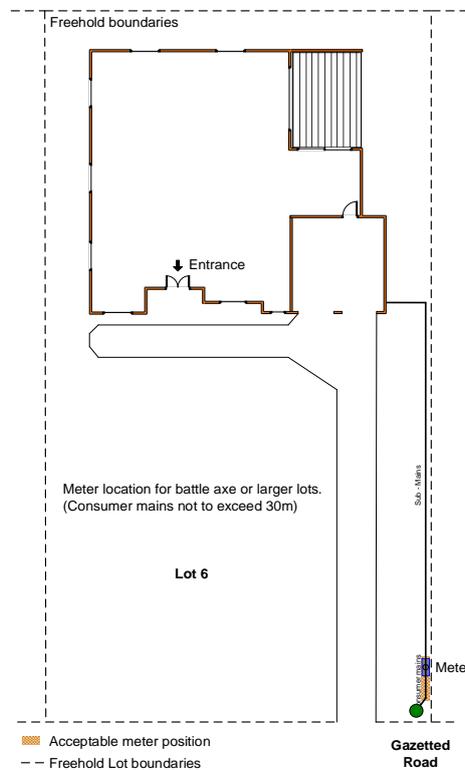
### 11.5.4 Examples of acceptable locations



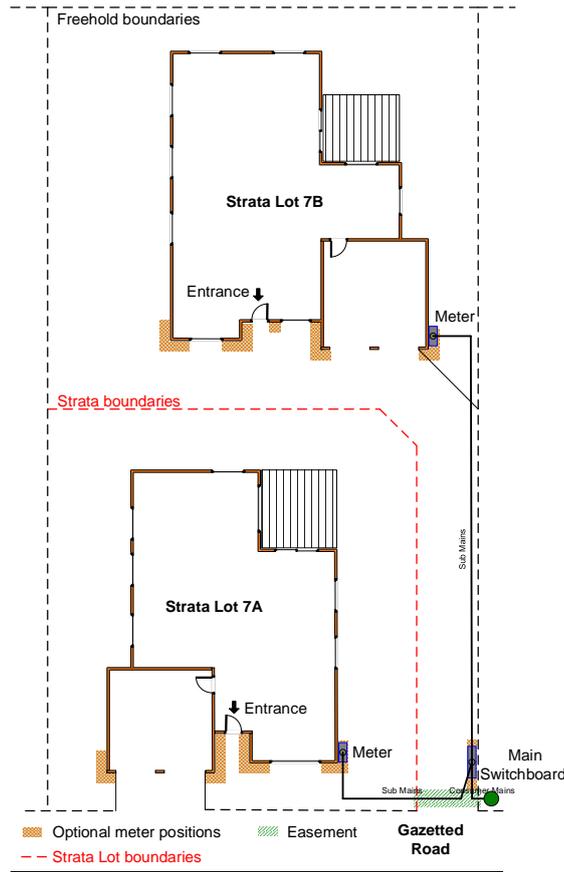
**Figure 24:** Freehold (Single) residential lot meter location example



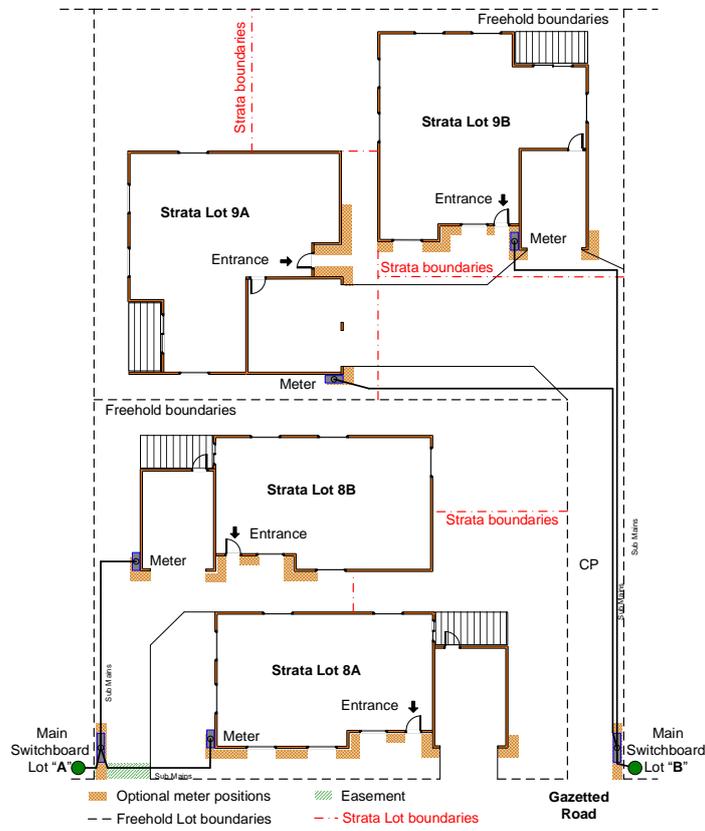
**Figure 25:** Freehold (Single) residential battle axe lot meter location example



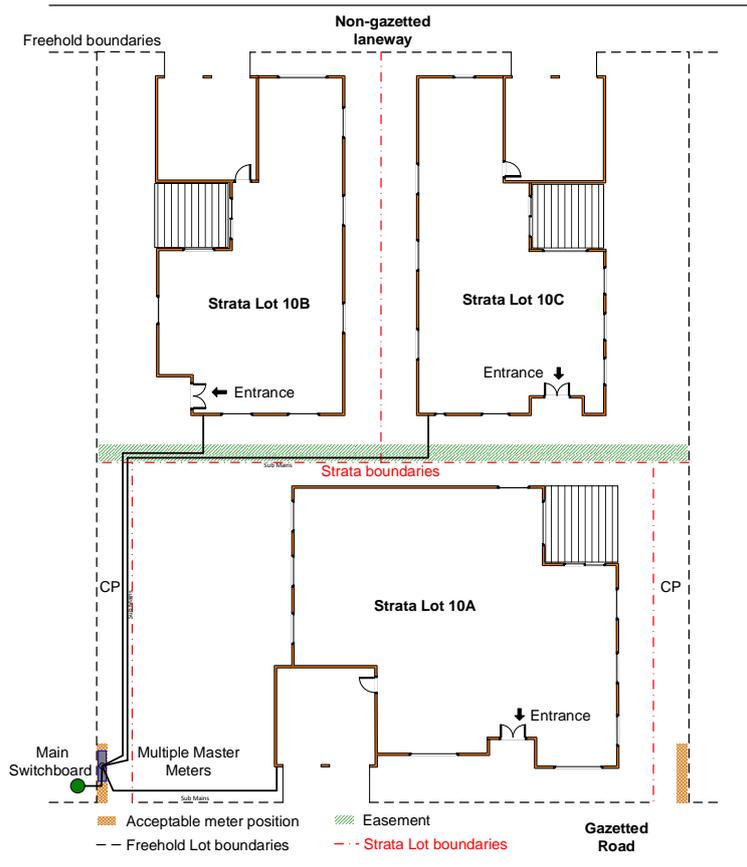
**Figure 26:** Freehold (Single) residential (>2500sqm) lot meter location example



**Figure 27:** Strata (2 lot Duplex) residential lot meter location example



**Figure 28:** Strata (Duplex) residential lot meter location example



**Figure 29:** Strata (Multi) residential lot meter location example

## 11.6 Equipment

### 11.6.1 Prohibited connections

*Consumer* equipment including *load*, generation or ancillary equipment associated with the *consumer's* installation or devices that consume or measure electricity *shall* not be connected on the line (upstream) side of the *consumer's* main switch or switches unless the connection is for:

1. for safety services as defined and prescribed by AS/NZS 3000 section 7; or
2. is formally approved by the *network operator* for the purposes of data collection, protection or control.

Refer to AS/NZS 3000 and AS/NZS 4777 for additional guidance.

*Consumer* electrical apparatus/equipment *shall* not be installed on a meter panel or within the boundaries of *network operator's* CT metering panel where this type of metering is installed. This does not include *metering equipment* supplied by or measuring equipment formally approved by the *network operator*.

### 11.6.2 On panels and within enclosures

Equipment *must* be securely fixed to meter panels in accordance with AS/NZS 3439 (AS/NZS 61439) and the AS/NZS 3000.

Fixing screws and fasteners *shall* be as short as practical and not protrude through the rear of the panel in a manner that could damage conductors or create un-earthed condition. Fixings with a self-drilling needle point tip are not permitted. The use of silicone based adhesive or other such material to insulate fixings or equipment supports is not permitted.

### 11.6.3 Links

Service and reference links for both active and neutral conductors *shall* comply with these *requirements* and AS/NZS 3000.

#### 11.6.3.1 Active and neutral service link(s)

Where required links *shall* be:

1. *consumer* panel mounted, insulated from earth, fitted with sealable colour coded covers;
2. easily accessible to facilitate connection/disconnection, testing and commissioning;
3. current rated at not less than the capacity of the incoming conductor with separate terminals for all incoming and outgoing conductors;
4. where active links are mounted on the rear of a panel, the panel *shall* be hinged in accordance with AS/NZS 3000; and
5. labelled to identify the links function in a legible and durable manner.

#### 11.6.3.2 Neutral reference link(s) (NRL)

Reference link(s) *shall* be:

1. meter panel mounted, insulated from earth, fitted with sealable colour coded covers;
2. current rated with separate terminals for each conductor, clamped by no less than two screws;
3. located in an accessible position to facilitate connection/disconnection, for testing and commissioning;
4. identified as “Neutral Reference Link”, in a legible and durable manner; and
5. able to accommodate:
  - a. connection to the *consumer’s* neutral service link and associated reference links; and
  - b. individual neutral conductors to each meter.

In accordance with [clause 11.1.3](#) all multiple whole current *network* metered *sites shall* have individual neutral reference cable connection to facilitate the disconnection/reconnection of *metering equipment* neutrals without disturbing the integrity of the *electrical Installation’s* incoming main neutral. .

Additional sealable links *shall* be provided where the neutral reference link cannot terminate all neutral reference conductors. Meter neutral connections *shall* be made using a minimum 2.5mm<sup>2</sup> copper conductor. Looping of neutral conductors between terminals of *network metering equipment* is no longer permitted.

### 11.6.4 Metering protection and main switch or switches

Both a “*service protection device*” (SPD) and an “*installation main switch*” are required for all *consumer installations* inclusive of both whole current and *low voltage* current transformer (CT) connected *metered installations*.

Installation main switch(es) *shall*, in addition to the *requirements* of the [WAER](#), AS/NZS 3000, AS 2067 and AS/NZS 4777, comply with these *requirements* and the *network operator’s embedded generation (EG) technical requirements*.

Service protection and *meter protection devices* (SPD/MPDs) *shall* comply with the *requirements* of [WAER](#) section 6 and these *requirements*.

The SPD and or MPD does not replace the installation main switch and *shall* not be deemed as *overload* circuit protection for the *consumer’s electrical installation*, equipment, *consumer mains cable* and or circuitry. *Network operators* will not accept *service/meter protection devices* located under or through an escutcheon cover or grouped together where not adjacent to each individual meter.

An SPD used in LV installations and a main switch used in HV installations *shall* be a fault current limiting device with an interrupting capacity adequate for the prospective short circuit current of the installation.

### 11.6.4.1 Service protection device

The SPD *shall* be installed on the unmetered side of all whole current and LV CT *metering equipment* and be located within the *main switchboard* mounted on the meter panel or in a prominent position directly adjacent to the *metering equipment* dependent on *metering equipment* configuration and location.

This device is in addition to the *consumer* main switch(es). The purpose of the *service protection device* (SPD) is to provide:

1. an *electrical installation* point of isolation;
2. *metering equipment* overload/short circuit protection;
3. safe replacement of *metering equipment*; and
4. short circuit protection in accordance with AS/NZS 3000.

The mounted height of an SPD within the *main switchboard* *shall* not exceed that prescribed by AS/NZS 3000 for main switch(es) and be no lower than that prescribed for residential switchboard panels.

The SPD *shall* grade with the *network operator's* upstream protective device. *Consumers* through their agent are responsible for determining the appropriate setting for the SPD. The *network operator* will on request provide time-current curves for the upstream *network* protection device with the quotation to allow the *consumer's* agent to determine the SPD settings.

For CT metered *sites* with a calculated maximum demand *load* exceeding 100A, the *consumer* *shall* provide the *network operator* with the following information on the SPD intended to be used. The protection settings data sheet (see appendices) is to be used for this purpose.

The information is required to validate grading with the *network operator's* upstream protection:

5. SPD type and rating;
6. protective device types and setting ranges;
7. current transformer class and tapping ratios;
8. proposed SPD settings; and
9. time current curves showing protection grading with the upstream protection device.

A *service protection device* with adjustable settings *shall* be calibrated and tested by a suitably *professionally qualified electrical engineer or contractor* to ensure correct functionality of the SPD protection device.

A grading margin (operating time interval) is required between the minor relay/circuit breaker (closest to the fault) and the major relay/circuit breaker (next relay to minor relay on the source side of the fault) to ensure discrimination. I.e. that only the minimum number of circuit breakers operate to clear a fault.

The minimum protection grading steps are 0.2 seconds for LV. For HV connections the following *shall* apply:

Where there are no constraints, fixed grading margins can be used. e.g. For minor relay,  $T_1$  and major relay,  $T_2$ , grading margin =  $(T_2 - T_1)$ :

$$T_1 \leq 0.75\text{sec}, \text{grading margin} = 0.30\text{sec [ie. } T_2 \geq (T_1 + 0.30)\text{sec]}$$

$$0.75\text{sec} < T_1 \leq 1.50\text{sec}, \text{grading margin} = 0.40\text{sec [ie. } T_2 \geq (T_1 + 0.40)\text{sec]}$$

$$1.50\text{sec} < T_1 \leq 2.00\text{sec}, \text{grading margin} = 0.50\text{sec [ie. } T_2 \geq (T_1 + 0.50)\text{sec]}$$

Where these grading margins cannot be achieved, protection settings *shall* be agreed in consultation with the *network operator* protection group.

On completion of testing and commissioning, the *consumer* *shall* return the "protection settings data sheet" to the *network operator's* construction project Manager.

Where an SPD has an adjustable protection range, the device *shall* be calibrated to comply with the *network operator's requirements* and *shall* not be adjusted subsequently without the *network operator's* approval. Refer to [WAER](#) section 6.

The *consumer* (or their agent) *shall* provide photographic evidence to the *network operator* of the commissioned SPD settings as evidence of compliance and confirmation the device has been set in accordance with the agreed protection parameters.

#### 11.6.4.2 Meter protection device

*Consumer electrical installations* with more than one whole current metered installation, *shall* in addition to the SPD and installation main switch have individual *meter protection devices* (MPD) for each metered connection. The MPD fuse *shall* be located at the meter position and connected on the un-metered side of each whole current *metered installation*.

The purpose of a *meter protection device* (MPD) fuse(s) is to provide:

1. individual *meter* point of isolation;
2. *metering equipment* overload/short circuit protection; and
3. safe replacement of *metering equipment*.

*Meter protection devices* *must* have a fuse base and carrier rated to a minimum of 100A. The fuse assembly *must* accept a 25kVA rated, type 11b 80A current limiting (HRC) fusible link, manufactured in accordance with AS 60269.3.0 and AS 60269.3.1. Unless directed by the *network operator* the installed fuse link *shall* not exceed a maximum rating of 80A.

For a single *consumer network connection service* up to a calculated maximum demand of 100A, with an actual total *load* of 80A, the service protection and *meter protection devices* can be the one physical device where the functionality of the SPD is satisfied.

#### 11.6.4.3 Installation main switch

A *consumer's electrical installation* *shall* have an installation main switch or switches installed as prescribed by AS/NZS 3000, the [WAER](#), these *requirements* and the *network operators*:

- *Technical rules* at [clauses 1.6.1](#) and [1.6.2](#); and
- Embedded generation (EG) and Electric Vehicle (EV) *technical requirements*. at [clauses 1.6.1](#) and [1.6.2](#).

Where required by the *network operator*, the *consumer's* main switch(es) *shall* be a circuit breaker with visible and lockable isolation facilities, and where:

1. a single main switch is installed, it *shall* be rated to the lesser value of the *network connection service* or the *consumer's* requested and agreed allocated capacity for the *consumer's electrical installation*; or
2. multiple main switches are installed and the *service protection device* (SPD) is a fuse(s), the sum of the current ratings of the individual main switches, *shall* not exceed the lesser value of *network connection service* or the *consumer's* requested and agreed allocated capacity for that *consumer's electrical installation*; or
3. multiple main switches are installed and the *service protection device* (SPD) is a circuit breaker, the agreed allocated *network* capacity across the individual main switches, *shall* not exceed the lesser value of *network connection service* or *service protection device* SPD rating.

#### Notes:

- a. This is a mandatory *requirement* for all connections to Horizon Power and Western Power *distribution networks*.
- b. The combined rating of the *consumer's* protection *shall* not exceed the installed capacity of the *consumer's electrical installation* to the *point of supply (connection)*.

For additional guidance refer to AS/NZS 3000 clause 2.5.1

#### **11.6.4.4 Additional requirements for sole use and district substations**

In addition to the *requirements* of this [section](#) and [section 14](#) the SPD *shall*:

1. be located within the *consumers site main switchboard*;
2. conform with the *network operator's* connection and supply arrangements;
3. be a circuit breaker or combined switch-fuse (CFS) unit of a type acceptable to the *network operator*; and
4. for *consumer* connections to a sole-use *substation*, the *network* transformer *low voltage* protection is not required where permitted by the *network operator* and where the *consumer's installation* is protected by the SPD and contiguous with the *substation* .

#### **11.6.4.5 Additional requirements for LV connections**

The *consumer shall* install mechanical interlocking to prevent paralleling of 2 MVA transformer groups via the *consumer's* LV switchboard(s).

#### **11.6.4.6 Additional requirements for HV connections**

Where the *consumer* has a HV supply, the control of the *high voltage* installation incoming *point of supply (connection)* *shall* comply with the fault level for the appropriate *voltage*, as prescribed in [section 13](#) of these *requirements*.

The control and protection of outgoing *high voltage* circuits *shall* comply with the *network operator's* specific *network* supply arrangements and applicable industry standards including but not limited to AS/NZS 3000 and AS 2067.

### **11.6.5 Sealing of meter equipment**

*Metering equipment* including meters, service links, *service and meter protection devices* installed on the line side of the main switch(es) *shall* be provided with robust sealing facilities for fitting seals. Only persons authorised to do so by the *network operator* may fit or remove seals to *network metering equipment*, using *network operator* approved sealing cord and crimp seals. Removed seals *shall* not be reused.

Should any person suspect or have evidence that *metering equipment* has been tampered with they should immediately advise the *network operator's* Metering technical services or "customer services centre".

#### **11.6.5.1 Horizon Power reporting**

For reporting assistance [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

#### **11.6.5.2 Western Power reporting**

For reporting assistance contact 13 10 87 or email: [Western Power enquiries](#).

### **11.7 Fault current levels for metering equipment**

In all cases the *metering equipment shall* be designed, selected and installed to comply with the [WAER](#), these *requirements*, the *network operator's* [Technical rules](#) to accommodate the maximum permissible fault current from within that installation.

### **11.8 Mixed metering installation (systems) and arrangements**

The installation of mixed *metering installations (systems)* such as combinations of multiple master and distributed master metering on the same *site is not permitted*.

Unapproved hybrid arrangements create confusion and potential hazardous situations for *network* employees, service crews and emergency services, first responder personnel.

### 11.8.1 General metering types

There are several different metering configurations and types that can be utilised by the *consumer* including both LV and HV *metering installations* (systems). Subject to approval the maximum *load* that can be LV-metered, is 2 MVA. *Consumer* assistance from their *retailer, electrical consultant* or *electrical contractor* is essential prior to applying for a metered *network* connection.

In accordance with the Metering Code only *metering equipment* programmed for import/export metering are to be installed where bi-directional (consumption & generation) flow occurs at the *connection/metering point*. Bi-directional metering *shall* be in place prior to the connection and energisation (commissioning) of *embedded generation* and *energy storage systems* (DER).

Examples of metering systems include:

- **Whole current metering-** The most common form of metering for single and three-phase *loads* up to 80A actual, 100A calculated per phase. Generally used in residential and small commercial installations and available for *voltages* including 240V and 415V.
- **Remotely located whole current metering-** Restricted use for single residential installations where security is deemed an issue.
- **Multiple master metering-** Where there is a requirement to measure and record multiple *loads* such as residential units on a single *lot*. Meters are to be grouped and may be either multiple whole current *loads* or CT metered systems. Remote reading facilities *shall* be provided where prescribed within [clause 11.11](#)
- **Distributed master metering-** Applies to whole current master meters and CT connected meters, distributed throughout an installation. The meters *shall* not be grouped. Remote reading facilities *shall* be provided where prescribed within [clause 11.12](#)  
**Note:** Distributed master metering- **Not available within Horizon Power's Pilbara Grid, or NIS networks.**
- **Current transformer (CT) connected metering-** Commonly used in most commercial and industrial installations. Used whenever the installation is connected at *low voltage* for *loads* exceeding 100A calculated maximum demand up to 2700A per phase
- **High voltage metering-** Used where the LV current exceeds 2700A or the *consumer* supplies their own transformer(s) and associated HV switchgear.
- **High voltage transmission metering-** Used in situations where the installation *load* is connected at *transmission voltages*
- **Supply quality monitoring-** A *consumer* may request the installation of a functionality metering system to monitor the quality of the electricity supply to an installation. Arrangements for this type of metering system may include provision of power quality reporting. System installation is subject to *network operator* negotiation with associated costs for this service borne by the *applicant*.
- **Pre-paid metering-** This type of metering system, where approved, is available to *consumers* who wish to pay upfront for their energy consumption. The prepayment function is a function of the standard meter type.

#### 11.8.1.1 Horizon Power metering types

- **Sub metering-** A master metering system provided to a metered *consumer* directly billed by Horizon Power. Sub meters are installed by the *consumer* to record consumption and on charge individual downstream users beyond Horizon Power's supply meter. Sub meters are maintained and read by the *consumer*. Under suitable *contracts* Horizon Power can install and maintain sub meters.

**Note:** Distributed master metering- **Not available in Horizon Power networks.**

### 11.8.2 Un-acceptable metering types

The following metering systems are no longer acceptable:

- **Whole-of-site metering** – The combination of a *site* master meter, upstream of multiple individual *consumer* meters and unmetered house services.
- **Plug-In meters** - used as a master meter option (Effective from the 1 January 2007).

### 11.8.3 Existing meter locations

A *network operator* may have, under certain previous supply arrangements, permitted the installation of *metering equipment* at the rear of a *premise* or in a nonstandard location. The *network operator* may allow this equipment to remain in its current location providing the equipment is accessible and can read in accordance with the Metering Code.

## 11.9 Whole current metering

### 11.9.1 General

For *loads* less than or equal to 80A actual per active conductor, a whole current *metering installation* shall be used. When using a whole current *metering installation*, the *consumer* shall arrange for the installation and termination of the revenue meter. Refer to clause 11.1.8.2

### 11.9.2 Meter panels

The standard panel sizes acceptable for direct wired meters shall be as shown in **table 9**:

1. 450 mm high by 225 mm wide with a minimum thickness of 6 mm; or
2. 450 mm high by 450 mm wide with a minimum thickness of 6 mm.

Number of meters	Number and size of meter panels	Meter phase link	Meter neutral reference link (NRL)	Meter protection (MPD)	Service protection (SPD)
1 x 80A	1 x (450 x 225 x 6)	Not required	Not required	Not required	Required
2 x 80A	1 x (450 x 450 x 6) or 2 x (450 x 225 x 6)	3 x 165A <sup>2</sup>	1 x 165A	Required	Required
3 x 80A	1 x (450 x 450 x 6) 1 x (450 x 225 x 6) or 3 x (450 x 225 x 6)	3 x 165A	1 x 165A	Required	Required
4 x 80A	2 x (450 x 450 x 6) or 4 x (450 x 225 x 6)	3 x 165A	2 x 165A	Required	Required
5 x 80A	2 x (450 x 450 x 6) 1 x (450 x 225 x 6) or 5 x (450 x 225 x 6)	3 x 165A	2 x 165A	Required	Required
> 5 x 80A	Multiples of previous sizes				Required
<b>Note</b>	Notes (Refer to Clause 11.3 for specific <i>network operator requirements</i> ) 1. Maximum conductor size is 35 mm 2. Dependant on cable size				

**Table 9:** Direct wired meter panel arrangements

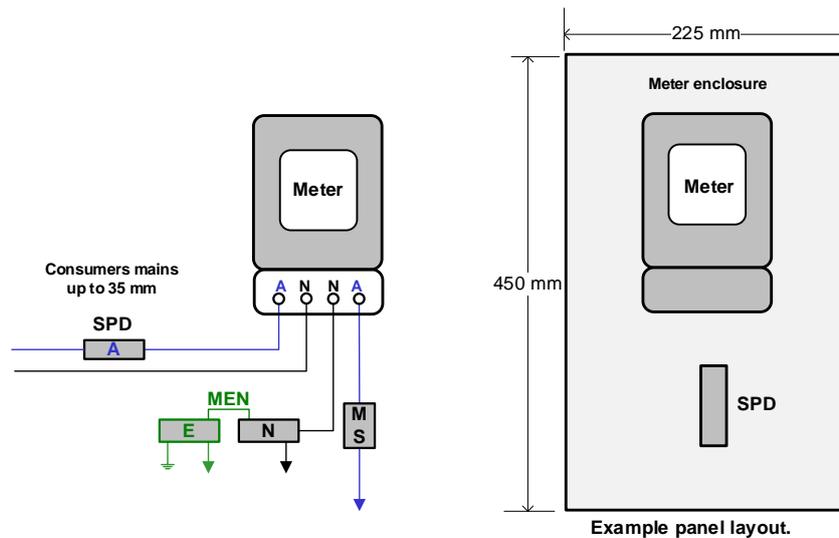
Due to problems experienced with various tariff meters being of different physical sizes and *consumers* requiring metering upgrades, meters located behind or through escutcheon cover panels will **not** be accepted.

### 11.9.3 Panel wiring configurations

Cables *shall* be of stranded copper conductors and be:

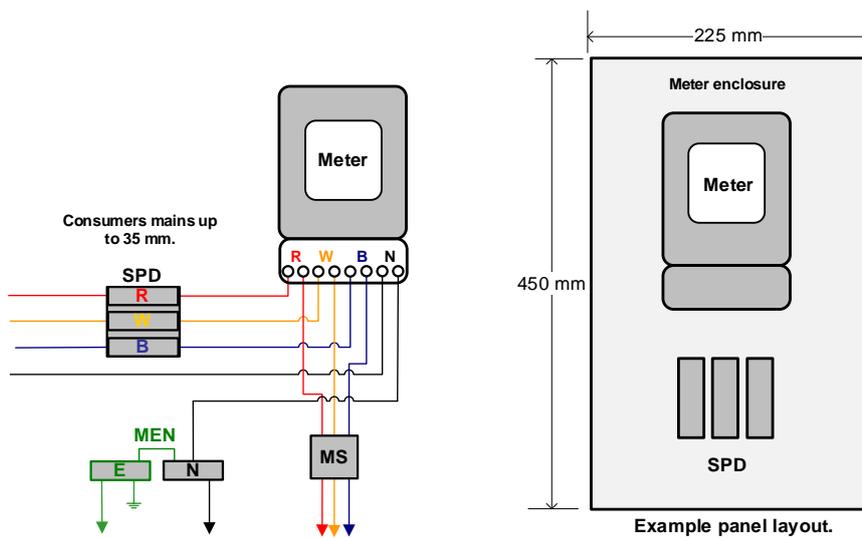
1. not less than 16 mm<sup>2</sup> (7/1.70) for meters with a maximum current limited by an SPD or MPD with a rating of up to 80A ;or
2. not less than 25 mm<sup>2</sup> (19/1.35) for meters with a maximum current limited by an SPD or MPD with a *network* rating up to 100A; and
3. for multiple master metering and house services metering arrangements, a neutral reference meter cable system *shall* be installed. The neutral reference cable *shall* be not less than 2.5 mm<sup>2</sup> (7/0.67) stranded cable.

In multiple-meter installations, it *must* be possible to remove any meter without interrupting the continuity of the installation’s neutral connection or supply continuity to other *consumers*.



Note: Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 30:** Generic single-phase whole current layout and wiring diagram.



Note: Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 31:** Generic split/three-phase whole current layout and wiring diagram.

#### **11.9.4 Protection**

Each whole current meter *shall* have individual meter protection as prescribed by these *requirements* and the [WAER](#). For a single metered installation, the SPD *shall* provide meter protection.

Where there are multiple meters downstream of the SPD, individual meter protection via a specific *meter protection device* (MPD) *shall* be provided.

**Note:** SPD's with an adjustable protection range, *shall* be calibrated to comply with the *network operator's requirements* and ***shall not be adjusted*** subsequently without the *network operator's* approval. The *network operator* may request evidence of conformance to authenticate settings.

#### **11.9.5 Conversion of subsidiary meters to master meters**

On confirmation of the *retailer* conversion consent, the *electrical contractor* is to submit a "preliminary notice" to the *network operator*, detailing the work to be completed. New *consumer* connection application forms *must* be submitted with the "preliminary notice" for each new master metered account. A changeover appointment will be coordinated via the *network operator* with the *electrical contractor*.

#### **11.10 Load and generation control**

With the evolution of *consumer* consumption and generation expectations future *network* individual control of the *network* supply arrangement and *consumer* connection will *require* the integration and installation of meter control devices to monitor and control energy flow at the *consumer's point of supply* (*connection*).

#### **11.11 Multiple master metering**

##### **11.11.1 General**

A multiple master *metering installation* **figures 32** through **36** provides metering options for domestic and commercial *consumers* in single/multi-storey *developments* regardless of whether the units have ground level access. *Metering equipment* *shall* be housed collectively as prescribed by [clause 11.11.4](#).

##### **11.11.2 Installation requirements**

Where the units are for domestic use, they *shall* be self-contained with facilities for maintenance and fault finding incorporated into the installation, to provide security of supply for each and every *consumer*.

The *site main switchboard/multiple master metering enclosure* *shall* be installed in a common area not more than 30 metres (*consumer mains cable route length*) from the *point supply* (*connection*).

The enclosure *shall* not be installed within the wall(s) of one or more of the individual units.

The *site main switchboard* and *metering equipment* *shall* be mounted and be accessible 24 hours 7 days per week. Access to the *metering equipment* *must* not be hindered by a locked gate or other barrier. Refer to [clause 11.5](#).

It is essential that each unit in the installation be legibly labelled at the unit and at each associated segment of the *electrical installation*. The numbering *shall* correspond with the layout plan of the *development*. This *requirement* is to avoid discrepancies due to units being re-numbered after energisation.

Connection of supply *must* not proceed until the numbering system is in place. Before submitting the “completion notice” the *electrical contractor shall* confirm that:

1. labels are on all main switch(es), sub-main protection, distribution boards and unit numbers (at unit main entrance) and that labelling corresponds with each other and the *site* plan; and
2. each sub-main supplies the correct unit as shown on the *site* plan.

### 11.11.3 Panels

Meter and link panels *shall* be supplied and installed by the *consumer’s electrical contractor* in accordance with these *requirements*. A link panel *shall* be provided where the main switch is installed on the line side of the *metering equipment* and there are more than 6 meters. The link panel may accommodate the SPD, main switch, active and neutral links and sub-main protection.

### 11.11.4 Meters

It is preferred that the *site main switchboard* and the complete master *metering installation* be sited at the same location. Where the *site main switchboard* and master *metering equipment* is located at same position all associated equipment *shall* be housed in the same enclosure.

Where the master *metering equipment* is to be located away from the *main switchboard*, the following conditions *shall* be applied:

1. all master *metering equipment shall* be located collectively and housed in the same enclosure;
2. where more than one master meter location is required, the number of master meters at each location *shall* not be less than 4 (four). Each group of meters *shall* be housed in the same enclosure;
3. for individual free standing or fire divided multi-ownership properties, the master meter position(s) *shall* be in common property, accessible to *network operator* personnel;
4. switch/meter equipment enclosure(s) *shall* not be mounted on the outside of any *premises* unless separated by a fire wall;
5. in multi-storey installations, master meters *shall* be grouped either on each or alternate floors or in the *premise’s* common area or foyer accessible to *network operator* personnel; and
6. unless approved by the *network operator* only one common-service account will be permitted for each complete multiple master *metering installation*.

The common (house) services meter *shall* be located in either the first or last position on the meter panel, with the common (house) services main switch located in a corresponding position on the *site main switchboard*.

### 11.11.5 Wiring configurations

*Consumer mains cable* and sub-main cables (metered or unmetered) *shall* be installed in accordance with these *requirements*, [WAER](#) and AS/NZS 3000.

Cabling to those portions of the installation and each individual unit that have a ground floor *shall* be installed underground via conduits or where in multistorey *premises* via fire isolated ducts. Underground un-metered sub-mains *shall* be appropriately rated in accordance with the AS/NZS 3000, have circuit protection, and be installed:

1. directly from the *main switchboard* or from a distribution board(s), in accordance with AS/NZS 3000 and AS/NZS 3439 (AS/NZS 61439);
2. parallel to and within 1 metre of the *property boundary*, to a point level with the *premises* alignment. At this point the mains are to be installed directly to the *premises or structure*;
3. to ensure security of supply to all tenancies; and
4. complete with permanent and legible identification at all points within the *distribution system*.

If distribution boards are used, they *shall* be suitably located in common property and physically protected.

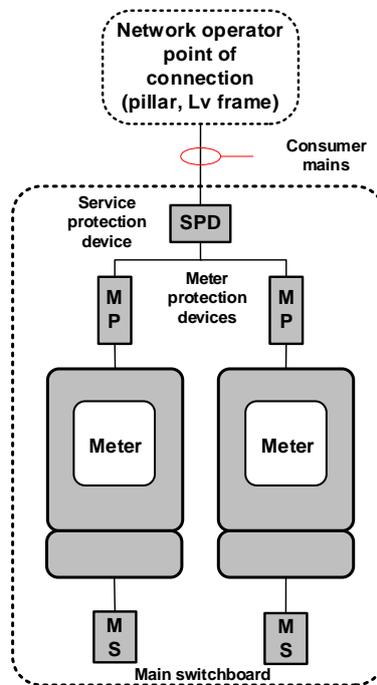
In addition to the above, sub-main cables installed in multistorey *premises* comprising of installations at different levels *shall* be appropriately rated in accordance with the AS/NZS 3000, have short circuit protection, and be installed:

5. to each installation in suitable fire isolated ducts, located in the common area(s);
6. together with other metered or unmetered sub-mains within a common enclosure;
7. where required have a suitable means of riser teeing off to each tenancy; and
8. in a manner that allows the cables to be readily replaced.

Unmetered switchboard wiring *must* be segregated from the metered wiring so that the metered and unmetered sections can be clearly distinguished.

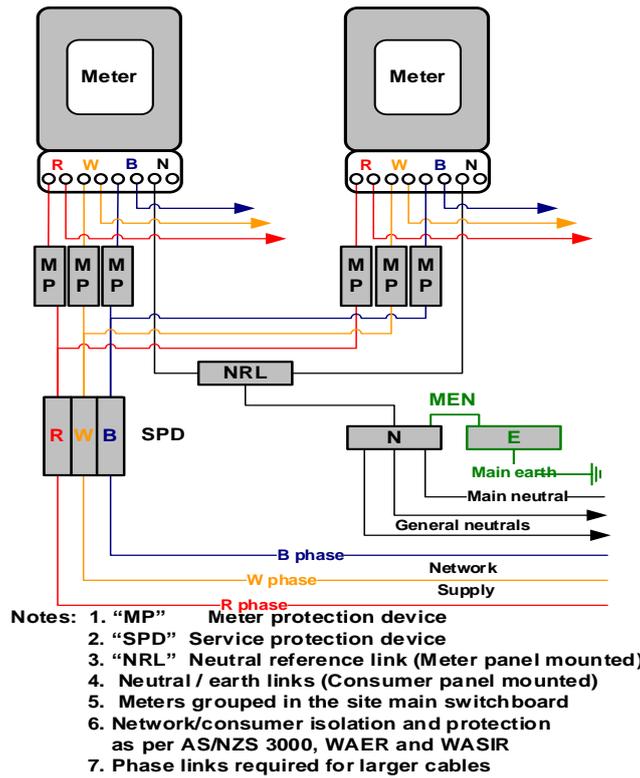
Throughout the entire installation, all terminations or points of origin for sub-mains *shall* be accessible and readily available for testing and isolation. Underground joints or junctions are not permitted. All terminations *shall* be suitably labelled to clearly identify the unit/s served and the origin of the supply.

**Note:** Unmetered aerial supplies are not permitted.

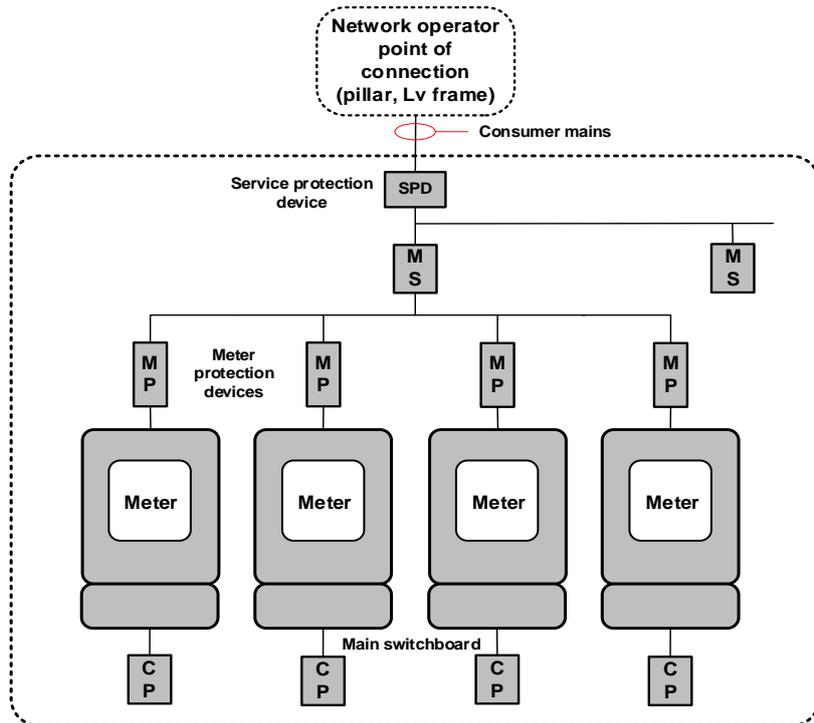


**Note:** Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 32:** Generic multiple master meter layout under 100A

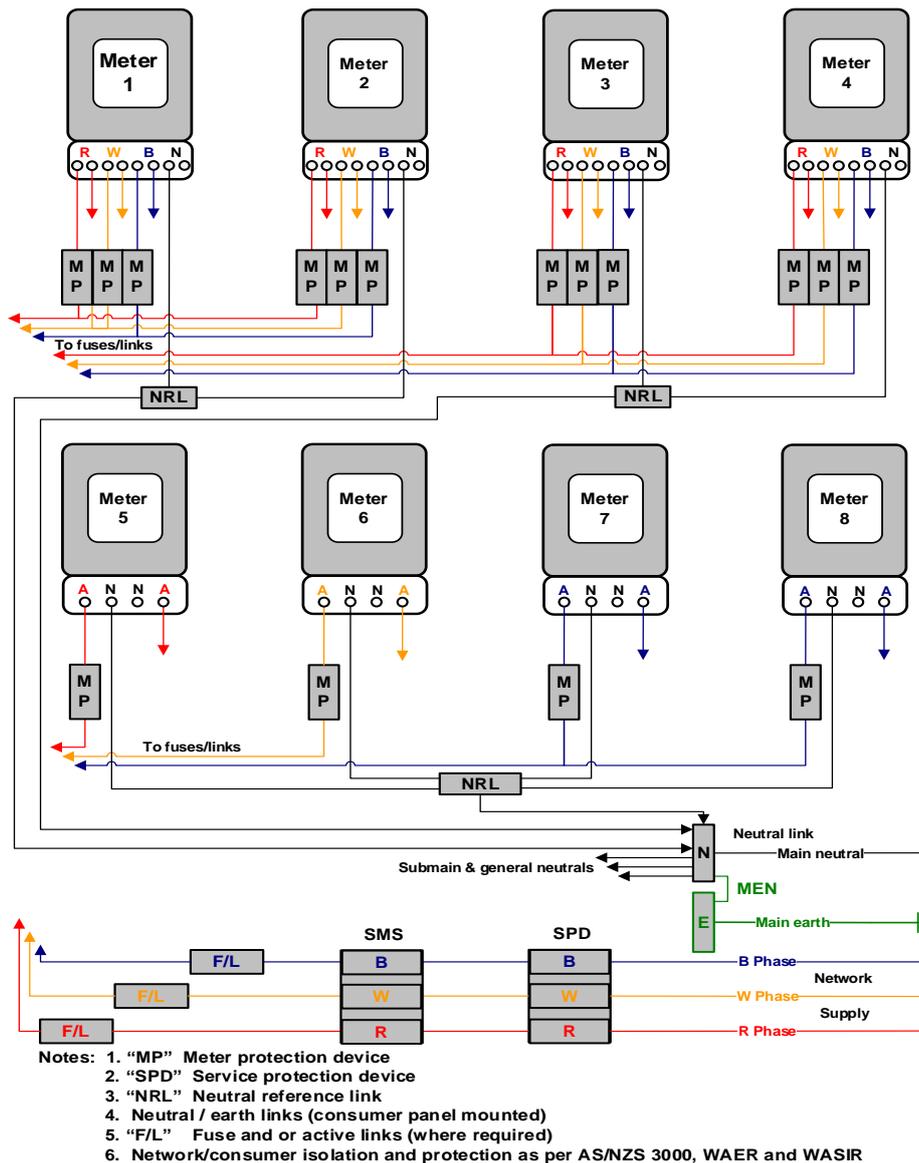


**Figure 33:** Generic multiple master metering wiring diagram under 100A



**Note:** Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 34:** Generic multiple master metering layout over 100A



**Figure 35:** Generic multiple master metering wiring diagram over 100A

### 11.11.6 Protection

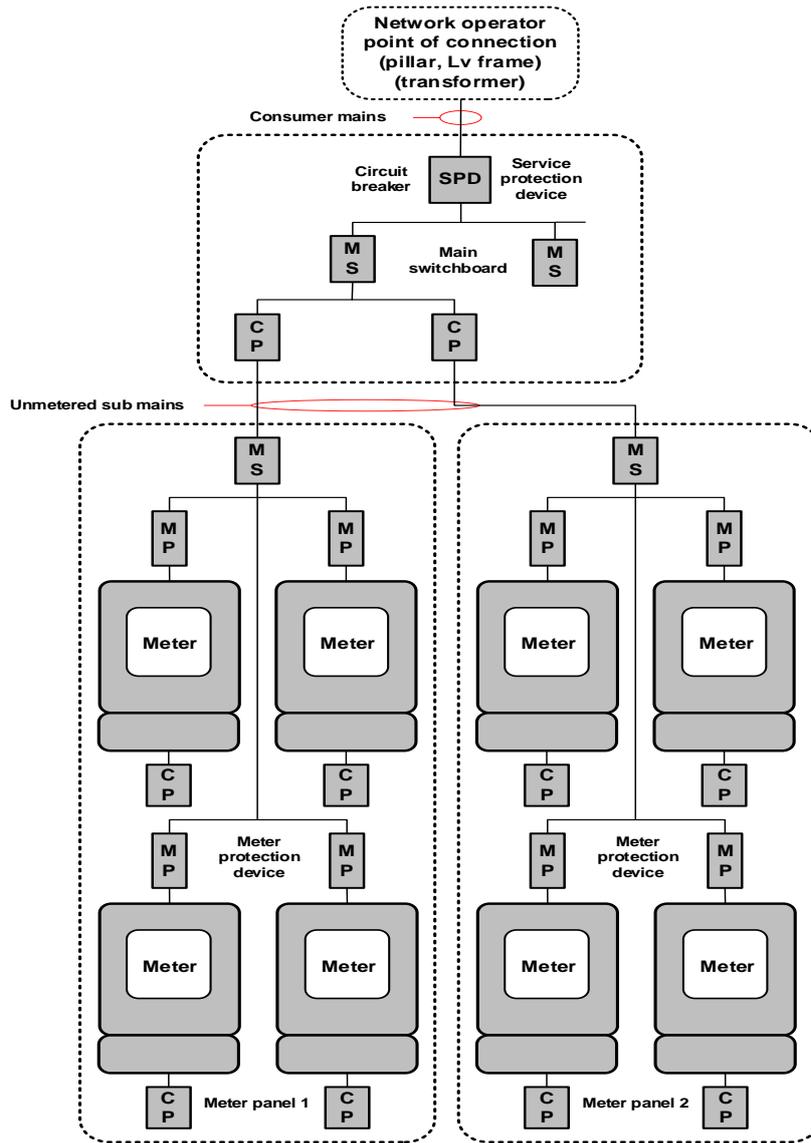
The *electrical installation shall have a service protection device(s)* as prescribed by [WAER](#), AS/NZS 3000 and these *requirements*. Where the *electrical installation's* maximum demand exceeds 100A the SPD shall be a circuit breaker rated to accommodate the demand.

Refer to [clause 11.6.4](#) for main switch *requirements*.

Each un-metered sub-main shall be protected at its origin by an approved type of enclosed (HRC) fuse or circuit breaker as required by the AS/NZS 3000. Each individual meter shall be protected with an approved enclosed 80A MPD (HRC) fuse element.

Sub-mains to distribution boards or a riser tee-off shall have protection rated to ensure effective discrimination when in series with other protective devices. As a guide satisfactory discrimination may be achieved when the current rating of the downstream device is no larger than half the rating of the preceding device.

A set of spare fuse cartridges shall be provided at each point of protection for restoration of the power supply. This shall apply regardless of whether the *point of supply (connection)* of the individual unit sub-main is at a switchboard, sub-board or riser tee-off.



**Note:** Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 36:** Generic alternative multiple master metering layout over 100A

### 11.11.7 Commercial installations

Paralleling links are an arrangement of links that connect *load* conductors between the meter and *consumer's main switchboard*. This arrangement enables *network operators* to meter adjacent tenancies either separately or in parallel and may be suitable in *premises* where:

1. partitions are not permanent and therefore relocated to cater for the tenant requiring additional floor space; and
2. the likelihood that suites may be re-arranged, (two suites initially separately metered and occupied, are taken over by a single tenant).

Where installed, paralleling links are to be provided by the *consumer* but only on approval of the *network operator*.

Links *shall* be located behind a removable panel and provided with sealing facilities. Cables between the meter, the paralleling links and the *consumer's main switchboard* *shall* be either double insulated or enclosed in conduit or ducts.

### 11.11.8 Alternative metering arrangements for ancillary accommodation

Should the *consumer* require a *network* metering arrangement, a multiple master *metering installation* shall be installed subject to all the following criteria being satisfied:

1. there is only one *point of supply (connection)* to the parent *lot* (single green title or strata *development*);
2. the *point of supply (connection)* is preferably underground;
3. the *load* (total calculated maximum demand) for all proposed and existing metered installations does not exceed *standard connection service*. (A *consumer* application is required);
4. the combined output capacity of all installed renewable energy infrastructure is in accordance with the *network operators' requirements* including [sections 7](#) and [15](#);
5. a readily accessible multiple master metering *site main switchboard* is installed in accordance with [clause 11.11](#). (Distributed master metering arrangement is not permitted);
6. each *metered installation* has its own unique registered address;
7. each meter has its own *retailer* account applicable to that registered address; and
8. the new and *altered* installations are compliant with the Metering Code, [WAER](#), these *requirements*, AS/NZS 3000 and relevant legislation and Standards.

Alternatively the *consumer* may choose to install a privately owned sub meter as prescribed in [clause 11.17](#).

### 11.12 Distributed master metering

Distributed master metering connection and metering arrangements are **not permitted** to be connected to Horizons Power's Pilbara Grid or NIS *networks*.

#### 11.12.1 General

Distributed master metering **figures 37 to 39** allows for each *consumer* to have their own master meter located at their respective unit within a group of units. This form of metering applies only to units with an effective fire division from the other units of the installation.

This *metering installation (system)* is not available for:

1. multi-storey *developments* where all the units do not have ground level access. Where there are single-storey units in the *development* the single storey units may be metered by distributed master metering and the multistorey units by multiple master metering ;and
2. ancillary accommodation. Refer to [clause 11.11.8](#).

#### 11.12.2 Installation requirements

A distributed master metered installation shall have only one *point of supply (connection)*. The *site main switchboard* shall be located not more than 30 metres (*consumer mains cable* route length) from the *point of supply (connection)*.

*Metering equipment* shall be located in accordance with [clause 11.5](#) in a position on the principal frontage as close as practical to the entry of each *premise* so that the *metering equipment* is readily identifiable and accessible. Where the installation cannot satisfy these *requirements*, refer to [clause 11.11](#) for meter location details.

Grouping of individual distributed master meters and their enclosures in either a single or multiple location(s) is not permitted. Refer to [clause 11.11](#) Multiple Master Metering. Only one distributed master metering meter enclosure is permitted per single *premise* or common wall face.

The *site main switchboard* and individual *metering equipment* shall be accessible to *network operator* personnel without the necessity to traverse property occupied by others or hindered by a gate or other barrier. Refer to [clause 11.5](#).

If a common service is required (e.g. water reticulation pumps, lighting circuits) it *must* originate from and be metered at the *site main switchboard*, unless a prior alternative arrangement has been sought and approved by the *network operator*.

The *electrical installation* associated within one dwelling *shall* not extend into the area of another dwelling.

Where the units are for domestic use, they *shall* be self-contained. Facilities for maintenance and fault finding *shall* be incorporated in the installation, to provide security of supply for each and every *consumer*.

Permanent identification of each unit *must* be clearly displayed and be readily identifiable from the common access way. At the construction stage, the *electrical contractor* is required to label the *lot* and unit number of each dwelling inside the respective meter enclosure.

### 11.12.3 Panels

Meter panels *shall* be supplied and installed by the *consumer's electrical contractor* in accordance with these *requirements*. The *consumer's* switchboard for each unit may be located within the meter enclosure at the respective *premises/dwelling/unit*.

### 11.12.4 Wiring configurations

The installation of *consumer mains cable* and sub main cables both metered and unmetered *shall* be installed in accordance with these *requirements*, [WAER](#) and AS/NZS 3000. Cabling *shall* be:

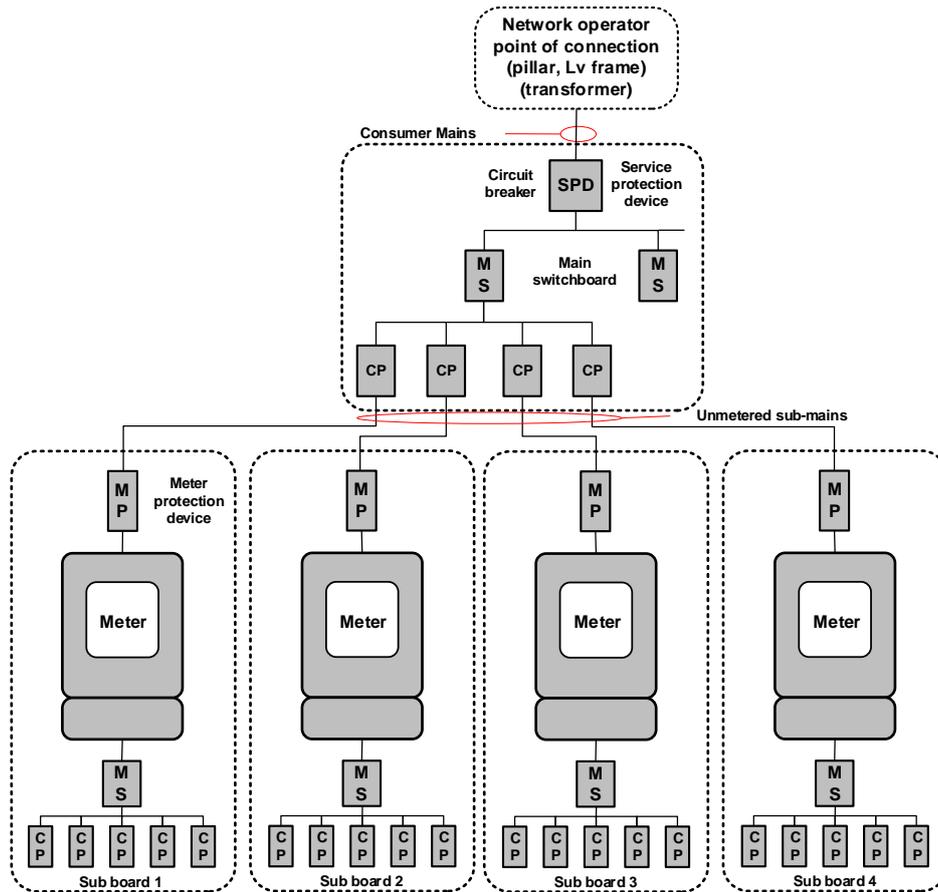
1. be appropriately rated in accordance with AS 3008, installed underground and provided with circuit protection;
2. installed directly from the *site main switchboard* or via a distribution board(s);
3. parallel to and within 1 metre of the *property boundary*, to a point level with the *premises* alignment. At this point the mains are to be installed directly to the *premises*;
4. so as to ensure security of supply to all parts of the installation;
5. installed so as to allow the cables to be readily replaced; and
6. complete with permanent and legible identification at all points within the *distribution system*.

Where distribution boards are used, they *shall* be suitably located in common property and physically protected.

Unmetered switchboard wiring *must* be segregated from the metered wiring so that the metered and unmetered sections can be clearly distinguished.

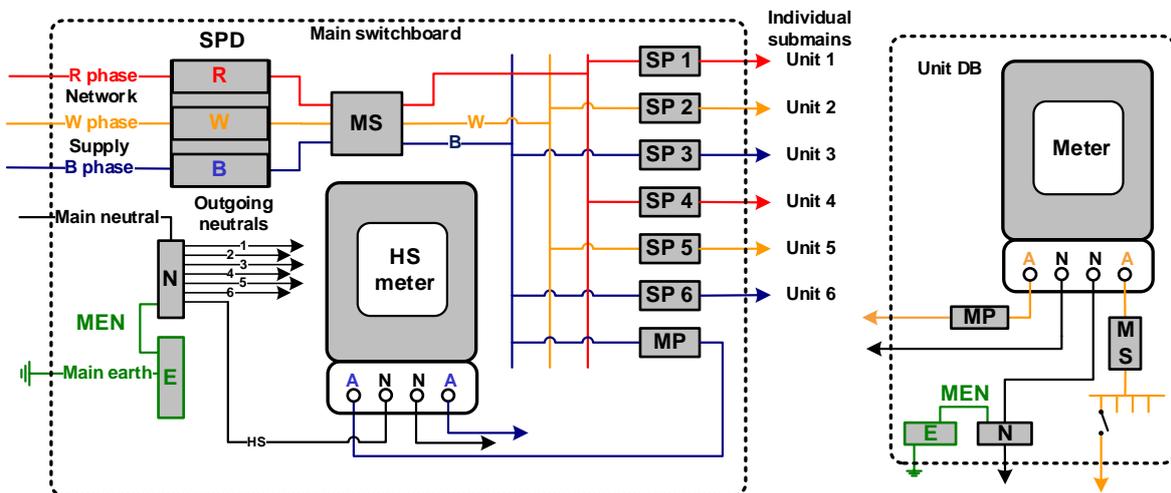
Throughout the entire installation, all terminations or points of origin for sub-mains *shall* be accessible and readily available for testing and isolation. Underground joints or junctions are not permitted. All terminations *shall* be suitably labelled to clearly identify the unit/s served and the origin of the supply.

Unmetered aerial supplies are not permitted.



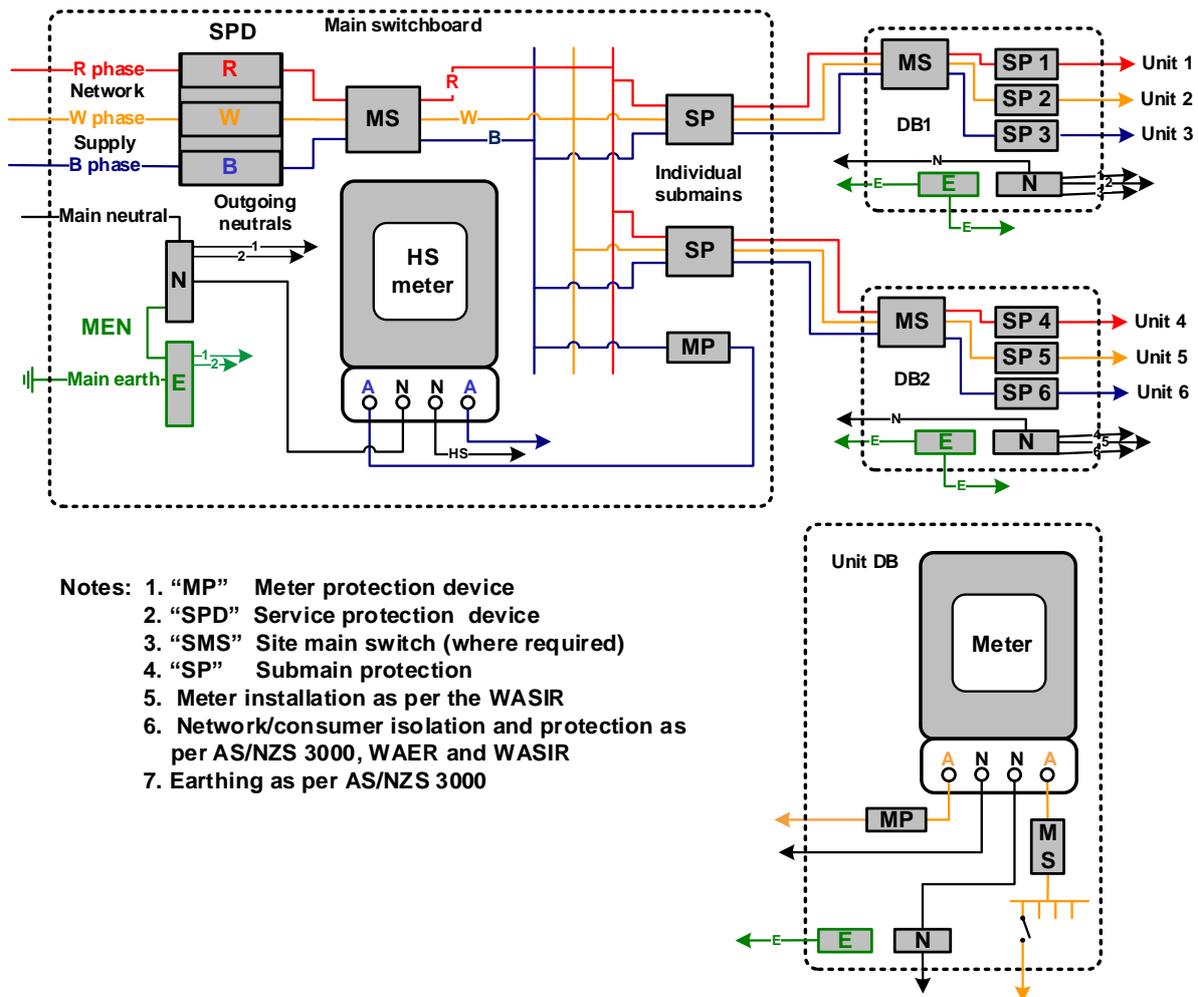
**Note:** Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 37:** Generic Western Power distributed master metering layout



- Notes:**
1. "MP" Meter protection device
  2. "SPD" Service protection device
  3. "SMS" Site main switch (where required)
  4. "SP" Submain protection
  5. Meter installation as per the WASIR
  6. Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR
  7. Earthing as per AS/NZS 3000

**Figure 38:** Generic Western Power distributed master metering wiring diagram



**Figure 39:** Generic Western Power distributed master metering wiring diagram

**11.12.5 Protection**

The *electrical installation shall have a service protection device as prescribed by the WAER, AS/NZS 3000 and these requirements. Where the electrical installation's maximum demand exceeds 100A the SPD shall be a circuit breaker rate to accommodate the demand. Refer to clause 11.6.4. for main switch requirements.*

Each un-metered sub-main *shall be protected at its origin by an approved type of enclosed (HRC) fuse or circuit breaker as required by the AS/NZS 3000.*

Each individual meter *shall be protected with an approved type of enclosed MPD (HRC) fuse.*

Sub-mains to distribution boards *shall have protection rated to ensure effective discrimination when in series with other protective devices. As a guide satisfactory discrimination may generally be achieved when the current rating of the downstream device is no larger than half the rating of preceding device.*

A set of spare fuse cartridges are to be provided at each point of protection for restoration of the power supply. This *shall apply regardless of whether the point of supply (connection) of the individual unit sub-main is at a switchboard or sub-board.*

### 11.12.6 Converting to HV meter reading

Distributed-master *metering installations* allows each *consumer* within a collective environment, to have an individual master meter located at the respective unit within that group of units. Common examples of such arrangements include apartment *premises*, retirement villages or a shopping centre. Billing arrangements in such instances are undertaken by the electricity *retailer* direct to each individual *consumer*.

An alternative arrangement for larger installations is a single *high voltage* (HV) master *metering installation* with privately owned and read LV sub meters located at each *consumer* installation. In such cases, the electricity *retailer* will provide a single account to the responsible administrative body or representative group.

Where a *consumer* wishes to upgrade the electricity supply arrangements and convert the *metering installation* to a single master (HV) metering configuration, a number of factors *must* be considered and implemented to ensure an effective transition of the metering *requirements*.

The new HV metering arrangement will have little in common with the redundant *metering installation* (system) including account/*consumer* names and National Metering Identifier (NMI) numbers. It is therefore imperative that the HV metering *applicant (consumer)* and their *electrical contractor* ensures that:

1. a single new *consumer* account is created, and all affected parties advised;
2. all existing billing accounts are closed with respective electricity *retailers*;
3. any renewable energy buy back scheme operators are advised;
4. all existing redundant meters are disconnected and returned to the relevant *network operator*; and
5. existing and new wiring arrangements are compliant with current *requirements*.

### 11.13 LV current transformer (CT) metering

Where the *low voltage* (LV) calculated maximum demand of any separately metered portion of a *consumer's electrical installation*, consistently exceeds actual *loads* greater than 80A per phase or exceeds 100A calculated *load* per active conductor (for both single and three-phase installations), current transformer (CT) *metering equipment* protection is required. See **figures 40, 41 and 42**.

The design of the *consumer's installation* shall ensure that switchboards, switchrooms, metering arrangements and electrical layouts meet the *network operators* and *consumer's* present and foreseeable future requirements.

The following criteria and procedures are to be implemented when determining the metering and protection *requirements*, for new, *altered* or modified *consumer installations*. For detailed *site* specific information refer to:

- **Horizon Power** – Metering technical services - [Section 5](#).
- **Western Power** – Metering technical services [Section 5](#).

Where *high voltage* (HV) metering is required, the supply and installation of the *metering equipment* will be as specified in the *connection agreement*. Refer to [clause 11.15](#).

#### 11.13.1 General

The consumer is required to provide and install, fit for purpose, CT metered switchboards, complete with meter panels and equipment mounting facilities, *network operator* approved current transformers, meter *voltage/control* circuitry, appropriate *site/meter equipment* protection together with facilities to accommodate *network* communications equipment inclusive of but not limited to links, wiring, ancillary apparatus and antenna housings for either internal or external *onsite* mounting.

The *network operator* will install, terminate commission and energise the *onsite meter(s)* and *communications equipment* following completion of the *consumers' portion* of the installation works.

For *low voltage* CT metered installations, the *consumer shall*, prior to construction commencement, submit their proposed *metering installation requirements* and drawings to the *network operator* for their consideration and comment.

Where *high voltage* metering is required, the supply and installation of the *metering equipment* will be as specified in the *connection agreement*.

For LV and HV CT metered installations, the *consumer shall* provide the *network operator* with copies of all CT test reports, prior to a permanent supply being made available. CT type tests and routine test reports for the unit/s installed *shall* confirm compliance with current standards and *network operator's technical requirements* and *shall* be traceable to either a NATA or ILAC accredited laboratory.

The switchboard owner (*consumer*) is responsible for the ongoing care and maintenance of the switchboard and *metering equipment*, except for the *network meter and communication equipment* installed by the *network operator*.

*Meter(s) and installed communications equipment* remain the property of the *network operator*.

Switchboard manufacturers are reminded of their obligation to inform the *consumer* (switchboard purchaser) of the *consumer's* ownership and maintenance responsibilities.

### 11.13.2 Sourcing of materials

The switchboard manufacturer may purchase the relevant materials from any supplier. However, the materials *must* be in accordance with the *technical requirements* of the *network operator*. If during *onsite* commissioning of the *metering installation (system)*, it is found that inferior components have been used, the connection of the *premise* to the *distribution network* may be delayed until appropriate replacement components have been installed in accordance with the *network operator*.

### 11.13.3 Meter panels

In general, the *consumer's electrical installation shall* incorporate an enclosure, with vertical panel supports, suitable to accommodate a meter panel area of 600 mm high by 600 mm wide.

Provision is also required for the separate mounting and connection of current transformers, communication equipment, antenna and ancillary equipment. The *metering installation shall* be on two panels consisting of a:

1. foot panel, 600 mm wide by 200 mm high, containing the terminations for the current transformers and the potential wires; and
2. meter panel, 600 mm wide by 400 mm high to mount one meter.

The *network operator's* drawings show the hole locations for drilling purposes. The meter panel material *shall* comply with Australian Standards AS/NZS 3000 and AS/NZS 3439 (AS/NZS 61439). For installations that are fitted with 'S', 'T' and 'W' type current transformers, a meter panel with provision for a single meter shall be used.

Nothing in this clause, limits the ability of the *network operator* to seek, at their absolute discretion, an alternative arrangement for the *metering installation* as required by the *network operator*.

### 11.13.4 Wiring configurations

Panel wiring *shall* be in accordance with the *network operator's technical requirements* as detailed by

- **Horizon Power** – Metering technical services drawing series - HPA-MT-E-4001 - 01 to 04.
- **Western Power** – Metering technical services drawing series - M98 - 2000 to 2006.

**Note:** Refer the relevant Metering technical services ([Section 5](#)) for specific detail or *requirements*.

The conductors *shall* be installed and cabled using cable ties with each conductor routed through its appropriate hole within each panel.

The cables *shall* be of stranded copper conductors and for the current transformer, wiring *shall* be 4 mm<sup>2</sup> (7/0.85 mm) cross sectional area; for the potential wiring *shall* be a minimum 2.5 mm<sup>2</sup> (7/0.67 mm) cross sectional area.

Unterminated cable ends *shall* not be stripped until the meter is fitted to the panel. The insulation of any cable *shall* not be removed further than is necessary to enter and extend to the full length of the hole and to be firmly connected into the “test block”. Each cable *shall* be labelled with a ferule as prescribed by the applicable drawing. Unless ferruled correctly, acceptance may be denied.

A minimum 32 mm conduit *shall* be provided to convey the current transformer and potential cabling between the current transformer chamber and the meter foot panel position. The *network operator* drawings show the electrical schematic of the connections between the current transformers and potential wires and the meter panel.

Meters may be installed in an enclosure separate from the switchboard containing the current transformers provided the secondary wiring does not exceed 10 metres from the CT terminals to the meter terminals.

### **11.13.5 Communications equipment for LV CT meter installations**

All *consumer* supplied CT meter panels *shall* make provision for the mounting of *network operator* metering communications equipment and for the installation of an external antenna. To meet the *network operator's* antenna requirements the following preferential location order *shall* be observed:

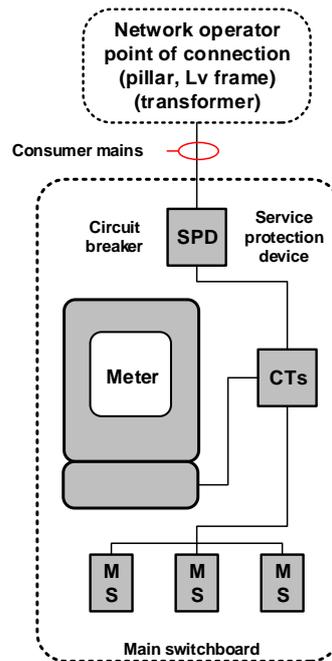
1. external to the meter enclosure and mounted on the meter enclosure. Antenna installation and associated cabling *shall* be mounted such that it does not alter the integrity or IP rating of the meter enclosure; or
2. where the external antenna is to be mounted on the top, bottom or sides of the meter enclosure, the enclosure *shall* not be fully recessed, by installing the enclosure 75 mm proud from the external surface of the wall into which it is installed; or
3. where the meter enclosure is to be fully recessed, and the antenna is to be installed on the door, the enclosure *shall* be modified to ensure the door cannot be removed.

Antennae, mounting brackets and cabling *shall* be installed using fixings, fastenings and supports of adequate strength and durability. The penetration of the meter enclosure for the installation of an external antenna *shall* be such that it does not affect the IP rating of the enclosure.

### **11.13.6 Protection**

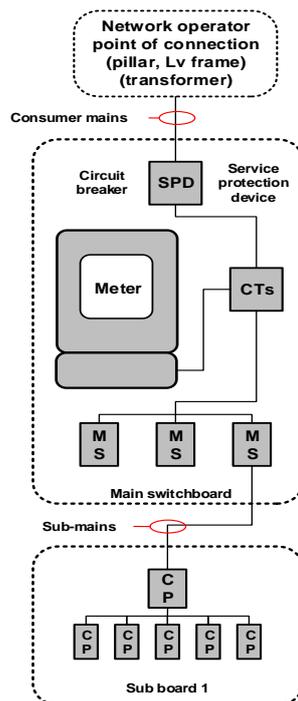
The *service protection device* (SPD) *shall* comply with *these requirements* and [WAER](#) section 6 comprising of a circuit breaker(s) of appropriate rating for single or three-phase configurations installed by the *consumer's electrical contractor*. Refer to [clause 11.6.4](#) for main switch requirements.

Where there are two or more transformers in parallel, the *consumer's overload* protection *must* be set to prevent damage to the *network operator's* upstream *metering equipment* in the event of one device tripping or being switched off in error.



**Note:** Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 40:** Generic CT metering layout

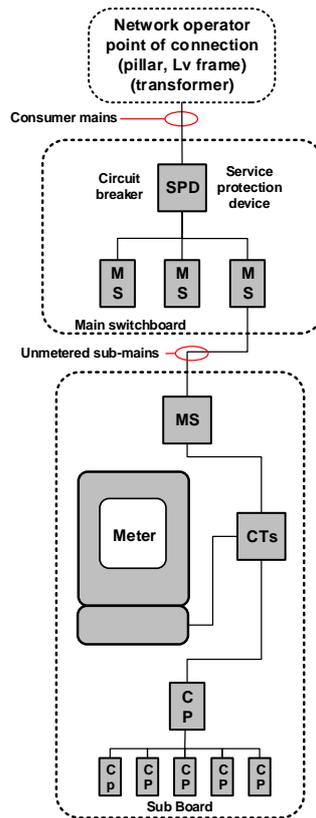


**Note:** Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 41:** Generic CT metering and sub-board layout

It should be noted in the **figure 41** above, that grading and effective discrimination may prove problematic between the SPD and the *consumer's* main switch(es) where the latter is fitted with over-current and short-circuit sub main protection.

Where this issue is evident, the design *shall* be such that the SPD grades and discriminates against the *network operator's* protection equipment. Main switch protection may be set to values similar to SPD if discrimination with downstream *consumer* switchboards cannot be achieved.



**Note:** Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 42:** Generic MSB with CT metering on the sub-board arrangement

It is recommended that consideration be given to placing the SPD, *metering equipment* and main switch(es) on the upstream *main switchboard* as an alternative to this arrangement. This negates the *requirement* for an additional switchboard.

**11.13.7 Current transformers**

Current transformer types, ‘S’, ‘T’ and ‘W’ may be used for *low voltage* current transformer metered installations where coverage of *loads* from 80A to 2700A is required.

These CT’s are a single tap arrangement with a permissible range of 5 to 175% of their accuracy rating. **Table 10** shows the operating range and accuracy of class ‘S’, ‘T’ and ‘W’ current transformers.

CT Type	CT Ratio	Class (AS 60044)	Accuracy Range (A)	3 Ø Max load (kVA)	1 Ø Max load (A)
S	200/5	0.5S ext 200%	2 - 400	250	350
T	800/5	0.5S ext 200%	8 – 1600	1000	1400
W	1500/5	0.5S ext 200%	15 - 3000	2000	2700

**Notes.**  
 1. CT in accordance with AS60044 / IEC61869 Extended Range 200% Class 0.5S.  
 2. The minimum *requirements* as prescribed in this table *shall* be on the CT level/name plates.

**Table 10:** Operating range and accuracy of current transformers

The CT secondary terminals *shall* be short-circuited to prevent inadvertent damage and electric shock. *Network operator* personnel will remove the short circuit bridges when commissioning the *metering installation*.

As stated in [clause 11.13.1](#) the *network operator* requires the *consumer* to provide CT type test reports, together with traceable NATA or ILAC test certificates from the manufacturer for each current/voltage transformer prior to commissioning.

### 11.13.7.1 Current transformer mounting and access

Adequate clearances are to be provided to allow access for the mounting of the current transformers. Data sheets for each of the current transformers used by the *network operators* are included in drawing sets shown at [clause 11.13.4](#). The mounting plate *shall* be:

1. fitted with 6mm or 8mm captive nuts; or
2. at least 5mm thick and be drilled and tapped to suit 6mm or 8mm screws.

Current transformers *shall* be mounted so that the secondary terminals are always accessible to the *network operator* staff while the switchboard is energised. The CT's *shall* be mounted with the polarity marks P1, L or the red spot on the current transformer always facing the incoming supply.

A minimum clearance of 12mm *shall* be maintained between the secondary terminal cover of the current transformer and the inside of the cubicle door or removable panel. Any escutcheon cover with *metering equipment* behind *must* not be obstructed by a switch that has to be operated before the cover can be removed.

The equipment *shall* be installed and mounted, such that the equipment name plates are clearly visible under normal inspection and maintenances conditions.

**Note:** Current transformers associated with *consumer* measuring / protection equipment *shall* not be mounted upstream of the *consumer* main switch(es) (refer to AS/NZS 3000) or the *network operator's* *metering equipment* or within the boundaries of *network* CT meter panels.

### 11.13.7.2 Current transformer removable busbar links insert

Removable busbar links are to be provided to enable the current transformers to be installed or changed. The busbars each side of the removable links *must* be firmly supported on suitable insulators capable of withstanding the stress from prospective fault currents. Where multiple busbars are used, a suitable arrangement of the current transformers is required to facilitate the removal of the busbars.

The *network operator* drawings ([clause 11.13.4](#)) shows typical current transformers layouts. **Table 11** (below) shows the size and maximum number of busbars that will fit through the 'S', 'T' and 'W' type transformers. The busbars *must* be of adequate size to accept the full surface area of the terminating lug.

Current Transformer Type	Busbars Maximum Size of Removable Busbar Links
S	2 x 25 mm x 6 mm
T	2 x 64 mm x 6 mm
W	4 x 100 mm x 6 mm

**Table 11:** Size and maximum number of busbars

### 11.13.8 Voltage circuit protection

The *consumer shall* provide and install the potential fuses and fault limiters, which *shall* be either:

1. a current limiting (HRC) type NS to AS 60269.1 2005 'Low voltage fuses – uses with enclosed fuse-links' Parts 1 and 30, in an enclosure with class IP2X to AS 1939 'Degrees of protection provided by enclosures for *electrical equipment* (IP Code)', or
2. class G current limiting (HRC) fuse links in a modular fuse holder complying with IEC 60269 – Part 2.

Fuses *shall* be installed so that they are extracted away from the face of the panel and towards the operator with a clearance of between 100mm (minimum) to 300mm (maximum) between the panel and the enclosure door.

#### **11.13.8.1 Fault current limiters**

A set of fault current limiters *shall* be installed and:

1. mounted directly on the busbar on the supply side of the current transformer;
2. terminal connected from the busbar to the supply side of the fuse-bar;
3. suitable for the fitting a 32A HRC cartridge;
4. fused by switchboard manufacturer before leaving the workshop; and
5. capable of being sealed by the *network operator*.

Refer to *network operator* drawings, [clause 11.13.4](#) for layout details of the fault current limiters.

#### **11.13.8.2 Potential fuses**

A suitable mounting bracket for the potential fuses *shall* be provided within the vicinity of the metering current transformers, in an accessible and safe position. The fuses are to be clear of all cable and terminations, with adequate clearance from busbars to enable sealing to be carried out safely.

HRC fuses *shall* be:

1. installed by the switchboard manufacturer and used as potential fuses;
2. fused with links rated for 10A in each potential fuse; and
3. have an assembly capable of sealed by the *network operator*.

Refer to *network operator* drawings, [clause 11.13.4](#) for the fuse potential assembly arrangement.

#### **11.13.9 Safety**

Unless formally authorised by the *network operator*, no *consumer* switchboard installed *onsite* *shall* be energised before the *network operator* has completed the installation of their *metering equipment*. Following completion of the switchboard fabrication and construction, the following checks of the installed *metering equipment* in the switchboard *shall* be carried out for reasons of safety:

1. no fuse cartridges/link elements are fitted to fuse carriers;
2. all current transformer links on the test block are shorted; and
3. all potential links on the test block are open.

**Note:** The *network operator* will fit as required, seals on completion of *onsite* commissioning.

#### **11.13.10 Conversion of whole current meters to CT metering**

When the *load* at an existing installation or separately metered part of that installation consistently exceeds 80A actual or exceeds 100A calculated, the *metering* arrangement together with the associated *consumer electrical installation* *shall* be converted from whole current to a current transformer (CT) metering configuration.

##### **11.13.10.1 Load increase**

On confirmation of the *retailers* consent, the *electrical contractor* is to submit to *network operator* a "preliminary notice" together with a *network* connection application ([clauses 7.18](#) and [7.19](#)) detailing the work to be completed and the parameters of the *load* increase. The *network operator* will review the capacity of the available *network* and advise the *electrical contractor* what (if any) upgrade or *augmentation* is required. This may include the installation of a sub-station.

**11.13.10.2 No load increase**

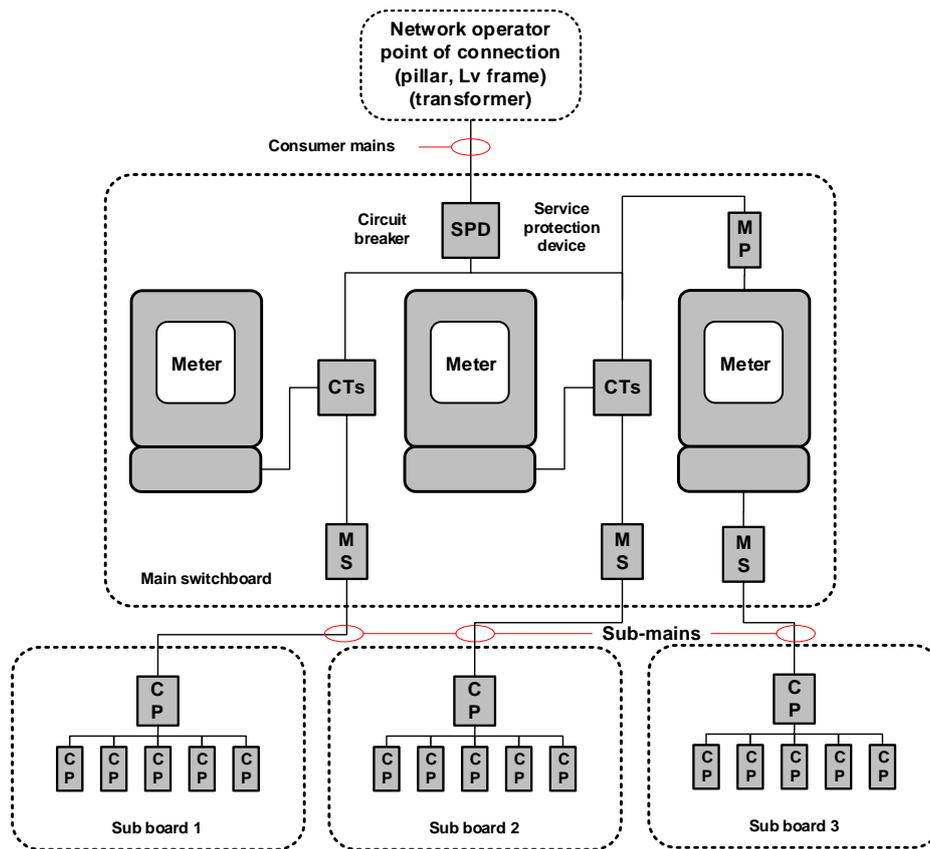
When there is no increase in assessed *load* at an installation, the *electrical contractor* is to submit a “preliminary notice” to the *network operator* detailing the work to be completed. Where the CT configuration requires upgrading (tariff purposes) a *network connection application form* (clauses 7.18 and 7.19) is to be completed and submitted to the *network operator* together with the “preliminary notice”.

**11.13.11 Multiple master CT metered installations**

Multiple master current transformer metered installations figures 43 and 44, shall have facilities to isolate the supply to each individual *consumer*. The main switch(es) shall be capable of being locked and sealed in the open (off) position by the *network operator*.

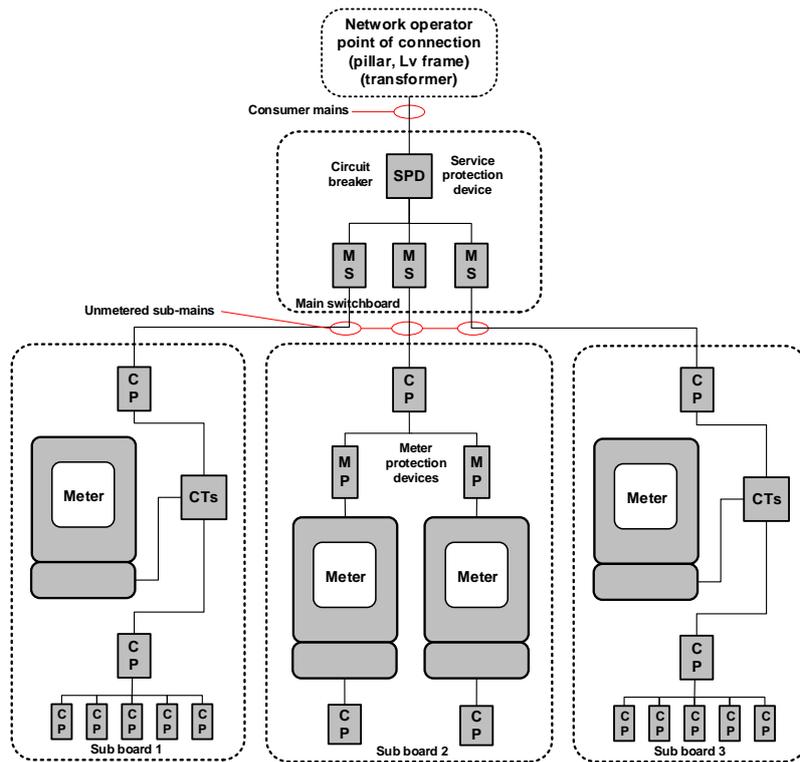
Where air circuit breakers (ACB’s) with the locking mechanisms are incorporated into the switchboard escutcheon plate, the *consumer’s* switchboard manufacturer shall ensure that affected ACB’s can be secured in the open position with escutcheon panels both removed or in place. These arrangements do not preclude the application of an alternative method of isolation, subject to approval of the *network operator*.

A separate meter panel is required for each current transformer operated meter. This may also necessitate separate applications for magnetic screening between the kWh meter and active conductors with current carrying capacity of 150A or greater.



**Note:** Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 43:** Generic multiple master CT metering and sub-board layout



**Note:** Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 44:** Generic WP distributed master CT metering and DB layout

### 11.14 Automated meter reading systems

Automated meter reading systems (AMR) enable *network operators* to remotely read multiple revenue meters throughout a property via a *network* data collection system. These metering arrangements are being phased out therefore the installation of new AMR systems is no longer permitted.

Existing systems *shall* remain compatible with the automated reading technology provided by the *network operator* and remain compliant with their operational and *technical requirements*.

The installed AMR systems are the property of the *consumer* with revenue meters installed throughout the *premises* remaining the property of the *network operator*.

It is the responsibility of the *consumer* to maintain the installed AMR system and associated equipment and to ensure that the system is functioning correctly with the provision of accurate meter data.

The *network operator* reserves the right to upgrade its data collection system and technology as required. In such cases, the *consumer shall* at its cost, upgrade or replace their AMR system to ensure compatibility with the *network operator* data collection system or return the property to a manual visual meter reading system.

For specific information pertaining to AMR systems contact the relevant *network operator* Metering technical services team or for tariff information the *consumer* should contact their energy *retailer*.

- **Horizon Power** e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)
- **Western Power** e-mail [westernpower.com.au/contact-us/](http://westernpower.com.au/contact-us/)

## 11.15 HV metering

### 11.15.1 High Voltage metered installations

Where high *voltage* metering is required, the *network operator* will provide a quotation, inclusive of the costs to provide, install and commission the *network metering equipment* as a part of the *consumer's installation*.

To expedite a *large scale* or HV connection, an online connection application and design submission is required, as specified by [WAER](#) section 7 and [section 13](#) of these requirements.

Design submissions are essential for all *large scale* and intended *high voltage* installations and *shall* be certified by a *professionally qualified electrical engineer*. The required metering arrangement *must* be formalised with the *network operator* at the project design stage before any equipment is purchased or construction commenced. Failure to engage early with the *network operator* may result in the installation failing to pass an electrical inspection and subsequently remain de-energised until rectified.

For HV metered installations, the *consumer shall* also provide the *network operator* with copies of all CTs and VTs, measurement error tests, type tests, routine test reports / certificates, prior to a permanent supply being made available. Tests and reports for the unit/s installed *shall* confirm compliance with current standards and *network operator requirements* and *shall* be traceable to either a NATA or ILAC accredited laboratory.

For design and testing *requirements* refer to the relevant *network operator* for their specific *requirements*. The *network operator's* Metering team *must* either be on *site* to conduct the required compliance tests or witness the prescribed tests as prescribed by the Metering Code. Refer to [section 13](#) for additional information.

### 11.15.2 Meter installations

For indoor HV metered installations, the *network* metering unit houses the *voltage/current* transformers and associated infrastructure therefore the *consumer shall* install a meter cubicle and appropriately sized PVC ducts between the *high voltage* metering unit to the meter cubicle within the *substation* switchroom.

For outdoor HV *metering installation*, the *network operator* will install the *metering equipment* within the metering kiosk for ground mounted HV switchgear, or in the metering unit for overhead HV switchgear. For additional detail refer to:

- **Horizon Power's:** - [Distribution construction standard](#) – section "G" drawings.
- **Western Power's:** - [Distribution substation plant manual](#) – section 3 drawings.

**Note:** Unless approved by the *network operator* access to and use of *network metering equipment* for consumer monitoring, data collection or control of the *consumer's electrical installation* is not permitted inclusive of use of the *network voltage* transformer (VTs) second core windings.

### 11.15.3 HV communication links

HV-metered *consumers* are required to install communication equipment to allow the tariff meters to be read remotely.

Where the *site* is within the range of the mobile telephone network or the *network operator's* meter radio network, then this technology is to be used. The *network operator* will arrange for the installation of the necessary equipment at the *consumer's* cost. Where a mobile or radio network is not available, the *applicant* will be responsible for arranging the installation of a direct dial, two-pair telecommunications line at the *substation* for remote reading of the meters.

#### **11.15.4 High Voltage master metering installation (system)**

Only one *high voltage point of supply (connection)* will be provided for a *development* or integral *development*. An integral *development* can be a *development* with multiple green titles but cannot be a *development* divided by a gazetted road.

Separate HV feeders within the *development* or integral *development* can be individually master metered at the *point of supply (connection)*. Distributed HV master metering is **not permitted** in a *development* or integral *development*.

Individual HV master metered installations *must* not be interconnected in a *development* or integral *development*. Appropriate electrical separation and fire segregation *must* be maintained between each master metered HV installation.

HV equipment, including *metering equipment*, not at the *point of supply (connection)* is considered a private network, with the *consumer* being responsible for operating and maintaining that private network.

#### **11.16 Metering for inverter energy systems**

*Consumers* are required to make provision for the measurement of both energy consumed, where connected to a *distribution network* (imported) and energy generated by their renewable energy system (exported) through the installation of an electronic bi-directional metering. Refer to [sections 7](#) and [15](#) for additional connection information.

Installations with mechanical style meter(s) *shall* be upgraded in accordance with the Metering Code and *these requirements*.

Enquiries on existing *meter installations* (meter type(s)) and costs associated with meter upgrades, installation and programming should be directed to the *consumer's electricity retailer*.

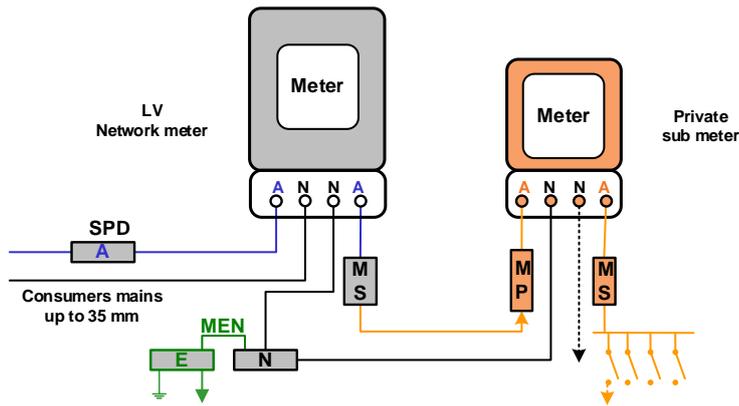
#### **11.17 Subsidiary metering guidelines**

Subsidiary meter (sub meter) is the common term used for a private electricity meter installed downstream of the *network revenue meter*. These sub meters do not form part of the regulated electricity industry in WA.

The Electricity Industry (Metering) Code provides for the rights, obligations and responsibilities for Code participants and rules relating to revenue *metering installations*. Sub meters are not covered by the Metering Code however their installation is regulated by the principles of *electricity industry best practice* and installation standards established by the Electricity Act 1945.

The [WAER](#) states in part, that the revenue *metering equipment shall* comply with the relevant *network operator's requirements*. These *requirements* stipulate the boundaries, within the *electrical installation* that defines the *network operators'* responsibility and that of the *consumer*. There are several situations where the use of private metering arrangement could be considered, including:

- Ancillary accommodation (commonly known as granny flats).
- Apartments & shopping centres.
- Non *network* connected private *stand-alone power supply*.



Note: Network/consumer isolation and protection as per AS/NZS 3000, WAER and WASIR

**Figure 45:** Generic sub meter wiring diagram (domestic)

### 11.17.1 Installation and maintenance

The installation of private metering arrangements is classified as electrical work and as such *shall* be installed by an *electrical contractor* in accordance with the applicable regulations, codes and standards.

The *consumer* is responsible for the care, maintenance and accuracy of any private *metering installations*. Sub meter owners may engage the services of an *electrical contractor* or metering vendor to maintain the sub meters. They may also engage the services of an independent testing laboratory to test and calibrate the sub meters.

### 11.17.2 Purchasing and supply

*Network operators* do not supply or provide private sub meter equipment to *consumers*.

Where a *consumer* has a requirement for a new or replacement sub meter, this may be obtained from an appropriate supplier or manufacturer of such equipment.

### 11.17.3 Sub meter reading

*Network operators* do not read sub meters. *Consumers* with sub meters requiring sub meter reading *must* engage the services of a private meter reader if they are not able to read the equipment themselves.

## 11.18 Relocation of existing metering point

*Electrical contractors* are required to submit a “preliminary notice” to the *network operator*, detailing the work to be completed. A changeover appointment will be coordinated by the *network operator* with the *electrical contractor*.

Alternatively, a *network operator* authorised *electrical contractor* can relocate whole current *metering equipment* as a part of the “meter change over scheme”, where supply is via an underground *network connection service*. This option is not available for partial or complete demolition *sites*. For more information on a *network operator’s* changeover schemes refer to [clause 6.19](#).

### 11.19 National meter identifier (NMI)

A National Meter Identifier (NMI) number provides a unique identifier for each *connection point* within the Wholesale Electricity Market (WEM). It also provides an index against which essential data can be managed and is considered crucial to the accurate management of:

- *Consumer* registration.
- *Consumer* transfer.
- *Connection point* or change of control.
- Data aggregation.
- Data transfer.

*Network operators*, as the “local *network* service provider”, are responsible for allocating NMIs within their respective *distribution networks* to *consumer connection points* and for maintaining a register of those allocations in the WA market. The NMI *must* be associated with a transmission node identity (TNI). The TNI is a four digit alphanumeric code, which starts with a W for Western Australia.

As an example, the Western Australian NMI range (8001000000 to 8020999999) allocation will be applied in accordance with the Australian Energy Market Operator (AEMO), NMI procedures and guidelines as authorised by the “National electricity rules”.

Once a NMI number has been allocated to a *connection point* the number will not change with a change of *consumer* or registration details.

### 11.20 Meter and installation energisation

An authorised *electrical contractor* or their approved electrical worker may operate an SPD to check the operation of a *consumer’s electrical installation* where a whole current meter is installed. On completion of this work, either the fusible element(s) *shall* be removed, or the circuit breaker(s) returned to the “off” position and tagged.

A “disconnection/caution tag” *shall* be attached to the SPD that indicates only the *network operator’s* authorised representative may remove the “tag” and energise the installation. This will be done on receipt of the “notice of completion” from the *electrical contractor*.

*Electrical contractors* accredited as a part of a *network* “contractor connect scheme” may leave an installation energised on completion of the required commissioning processes.

### 11.21 Meter interference

Should anyone suspect or have evidence that *network metering equipment* has been tampered with, the concern should be immediately reported to the relevant *network operator* via their “customer services centre” online contact facilities

- **Horizon Power** – [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au) or refer to [section 5](#) for details
- **Western Power** – email: [western power enquiries or](#) refer to [section 5](#) for details

## **11.22 Meter distribution**

### **11.22.1 Horizon Power**

For new installations and exchanges where Horizon Power is the *network operator*, all *metering installations* will be completed by authorised personnel of the *network operator*.

### **11.22.2 Western Power**

For new installations, where Western Power is the *network operator*, authorised *electrical contractors* may obtain whole current meters from approved meter distribution outlets located throughout Western Australia. Where six or more meters are required, a *network operator* may choose to arrange alternative delivery of the equipment. Meters cannot be collected directly from the *network operator* offices.

Existing meters can only be changed by a *network* accredited *electrical contractor*.

Details of the [meter distribution points](#) and access to [meter order form](#) can be obtained from Western Power's website.

## **11.23 Emergency conditions**

Under emergency conditions, an *electrical contractor* may operate the SPD or otherwise isolate the installation from the *low voltage* electricity supply to ensure their own, occupants' and the public's safety. Care *shall* be exercised not to unnecessarily isolate any emergency equipment such as fire-fighting services or evacuation aids. Refer to [WAER](#) section 8 for additional information.

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# **Service and Installation Requirements**

## **Section twelve**

### **Low voltage distribution systems**

## 12 Low voltage distribution systems

### 12.1 Services

The *network operator* shall determine how a *consumer's electrical installation* is to be connected to their *network* including the location of the *point of supply (connection)* and, where required, the *point of attachment*. Availability of a particular supply arrangement or *network connection service* may be restricted by the capacity of the *network* or by conditions at or near the *site*.

The *network connection service* provided will be designed to accommodate the requested *consumers'* calculated maximum demand and generation limits at the time of application and, unless requested otherwise, will be a *standard connection service* as described in [clause 7.6](#).

In accordance with these *requirements*, the *network operator* may require the *consumer* to provide, at their expense, facilities for the installation, mounting and accommodation of *network* equipment and or infrastructure including but not limited to ducts, conduits, cables anchorage points, supports, equipment enclosures, structures, *substations*, *site* works and associated equipment. The *network operator* may, at its absolute discretion, choose to *offer* or provide a *network connection service* via a *stand-alone power supply* or *distributed energy resource* supply arrangement.

The *consumer* and their agent shall inform themselves of the *network operator's* terms and conditions relating to and associated with the installation of a *point of supply (connection)* and the *technical requirements* for a connection to the *network operator's distribution network*. The *network operator* reserves the right to use the *point of supply (connection)* for the provision of a *network connection service* to an adjacent property(ies).

### 12.2 Type of connection

In general, new *network connection services* provided from a *low voltage distribution network* will be underground. Retention of an existing overhead supply may be permitted where the overhead *distribution network* is appropriate. Retention of an existing or provision of a new or upgraded overhead connection is subject to *network operator* approval.

#### 12.2.1 Network operator connection policy

##### 12.2.1.1 Horizon Power policy

The following statement provides guidance on the application of Horizon Power's policy for the provision of a connection within both the Pilbara Grid and NIS *networks*:

1. All new connections shall be underground within a:
  - a. *Western Australian Planning Commission (WAPC) subdivision*;
  - b. town as depicted in the Pilbara Grid and NIS *network* map (**appendix "B"**); and
  - c. farming land and or /paddocks, crown land, main road verge where the supply originates from a *substation* installed within these areas.
2. New overhead connections will only be permitted to existing *lots*:
  - a. in areas other than identified at point 1 above;
  - b. or where the ground conditions (i.e. rock) are such that or the remoteness of the connection makes the installation of an underground connection commercially unviable; and
  - c. by mutual agreement between the *network operator* and the *consumer*.
3. An upgraded overhead connection will not be permitted. Where electrical work is required to the existing supply to the *premises*, the existing overhead service may remain where approved and where the:
  - a. PoS or PoA is not required to be relocated; and
  - b. capacity is not *altered* or upgraded requiring a new service cable i.e. 6 to 150 mm<sup>2</sup> ABC, with *voltage/operational* parameters attained and current safety *requirements/clearances* achieved.

### 12.2.1.2 Western Power policy

The following statement provides guidance on the application of Western Power's policy for the provision of a connection within the SWIS:

1. All new connections *shall* be underground within a:
  - a. *Western Australian Planning Commission (WAPC) subdivision;*
  - b. city, *metropolitan* area or town as defined at [clause 12.2.2](#); and
  - c. paddock where the supply originates from a transformer installed within the paddock.
2. A new overhead connection will only be permitted to existing *lots* in small country towns where:
  - a. the capacity of the connection is limited to a *standard connection service* as defined by [clause 7.6](#);
  - b. there are no safety concerns and all operational clearances are achieved;
  - c. geographical and environmental conditions are such that the installation of an underground connection is technically or commercially unviable;
  - d. connection is not within the boundaries of a city, *metropolitan* area or town as defined by [clause 12.2.2](#);
  - e. area is reticulated by an existing overhead *network*; and
  - f. the *lot* was created prior to 2001. Refer to [clause 12.2.1.3](#).
3. An upgraded overhead connection will only be permitted where the:
  - a. installation has an existing overhead connection;
  - b. capacity of the upgrade does not exceed *standard connection service* as defined by [section 1](#) and [clause 7.6](#);
  - c. existing overhead *network* can facilitate the requested *consumer load* and generation limits; and
  - d. *network voltage* parameters, operational constraints and clearances are achieved.
4. An existing overhead connection may be retained where the property is renovated provided the connection capacity is not *altered*, *voltage*/operational parameters are attained and current overhead safety *requirements/clearances* are achieved. Existing *network* connections consisting of bare aerial conductors *shall* be converted to underground or where approved covered aerial conductors. Refer to [clause 12.4.6](#).
5. Upgraded or new connections and supply arrangements conform with:
  - a. property amalgamation and or *subdivision requirements* as prescribed by the [UDS manual](#); and
  - b. multiple *points of connection (supply) requirements* as detailed at [clause 12.3](#).

### 12.2.1.3 Lots created during or after 2001

2001 saw the introduction or extension of mandatory underground connections within the SWIS for residential, commercial and industrial overhead reticulated areas in:

- the greater Perth *metropolitan* area, applied whenever new construction occurred or an existing *site* was redeveloped or a new *lot* was created; and
- regional towns and country areas whenever a new *lot* was created.

In 2002, mandatory underground connections for overhead reticulated areas within the SWIS were extended to include rural non town areas and applied whenever a new construction occurred or an existing *site* was redeveloped and or a transformer was required on the *lot*.

## 12.2.2 Definition of city, metropolitan area or town

The “Code of Conduct for the Supply of Electricity to Small Use Customers” (the Code) defines a *metropolitan* area as the:

1. region described in Schedule 3 of the Planning and Development Act 2005 (This refers to the Perth *metropolitan* area);
2. local government district of Mandurah;
3. local government district of Murray; and
4. town sites, as constituted under section 26 of the Land Administration Act 1997, of: Albany, Bunbury, Geraldton, Kalgoorlie, Karratha, Port Hedland and South Hedland.

In addition to the above, Horizon Power deems the following towns to be covered by the same definition: Broome, Carnarvon, Derby, Esperance and Kununurra.

Horizon Power and Western Power define a small country town as being one which is outside the boundaries of the above definition.

## 12.2.3 Connection of services

*Consumer mains cable* required to be connected to a *service protective device, point of supply (connection) or metering equipment* shall be of a size, type and material compatible with the *network operator's* equipment and associated terminals.

*Network metering equipment* rated up to 80A actual *load* or 100A calculated maximum *load* is designed to terminate and accommodate cables in accordance with these *requirements*. Refer to [clause 11.3.5](#).

For CT metered supply and connection arrangements refer to [clause 11.13](#)

*Network distribution system* equipment such as *pillars, pits, wall units, streetlights, transformers, switchgear* and *distributed energy resources* have been designed to specific operational and functional criteria based on the capacity of that equipment.

In addition to [section 11](#), reference shall be made to the *network operator's technical requirements* to determine acceptable compliant connection arrangements and methods. Only compliant *consumer* equipment and conductors shall be connected to a *distribution network*. The *network operator* shall be consulted where the suitability of the proposed connection is unknown or in doubt.

Segregation of electrical services shall comply with these *requirements*, [WAER](#) sections 3 and 9, AS/NZS 3000 and the [Utility providers code of practice](#).

## 12.2.4 Number of connections

### 12.2.4.1 Per lot (Parcel of Land)

The *network operator* will generally provide only one *point of supply (connection)* to an individual freehold *lot, strata or survey strata development*, unless specific circumstances justify more than one and safety concerns have been satisfied. For more information refer to [clause 12.3](#) and [WAER](#) section 3.

### 12.2.4.2 Per underground service

A maximum of two freehold *lots* may be connected to a single underground *network pillar or pit*.

Where an existing freehold title *lot* is subdivided into *strata lots (built or survey)*, the *network operator* may require in accordance with their respective [UDS manual](#) *requirements*, the installation of a *main switchboard (MSB)* to service all *strata lots* within the *development*.

For all *developments* within the SWIS, commenced after the 1 February 2020 this is a mandatory *requirement* to ensure adequate *network distribution system* protection and termination capacity for *strata* users both current and future.

### 12.2.4.3 Easements and restrictive covenants

The creation or application of easements, restrictive covenants or notifications may be necessary to facilitate a safety obligation or ensure access to *electricity infrastructure* for *network* personnel, or to a *network point of supply (connection)* for *consumers* and their industry representatives. Refer to [clause 6.8](#) for specific information on the use and application of easements and restrictive covenants.

### 12.2.5 Overhead point of supply (connection)

The *consumer* shall provide a *point of supply (connection)* (PoS) and a *point of attachment* (PoA) located either on the *premises* or a *consumer pole* to accommodate the installation and termination of an *overhead service cable* extended from the *distribution network*. The *consumers' point of supply (connection)* shall mean the terminals nominated by the *network operator* on a:

1. Pole or *premises* mounted *consumer* supplied “*mains connection box*” for:
  - a. single or multicore *consumer mains cable*, sized up to 35mm<sup>2</sup> with a minimum of three layers of non-metallic insulation;
  - b. insulated, *overhead service cables*, sized up to 16mm<sup>2</sup> copper; and
  - c. where the calculated maximum demand does not exceed 100A and the *electrical installation* is not CT metered.
2. Pole or *premises* mounted *consumer* supplied “boundary fuses” for:
  - a. single insulated *consumer mains cable* installed in metallic enclosures; and
  - b. where the calculated maximum demand exceeds 100A and the *electrical installation* is CT metered.
3. Pole mounted transformer arrangement for 240/415V rural supplies. (**Note:** A *network operator* may elect to install a ground mounted *substation* or *pillar* for a 240/415V connection).
4. Pole mounted transformer arrangement for 480V rural supplies. (**Note:** A *network operator* may elect to install a ground mounted *substation* or *pillar* for a 480V connection).

**Note:** Where ground mounted *network* equipment is provided the *consumer's point of supply (connection)* will be as prescribed by [clause 12.2.6](#).

### 12.2.6 Underground point of supply (connection)

The *point of supply (connection)* for an underground connection *shall* mean the terminals nominated by the *network operator* contained within the *network distribution* equipment. For

- Freehold residential *lots* requiring a *standard connection service*, the *point of supply (connection)* will generally be a *network pillar* or *pit*, located in a position that allows for a single connection to the property and to the adjoining freehold title or *survey strata development*.
- Industrial and commercial *lots* a *point of supply (connection)* will be a universal *pillar*, kiosk, frame or *substation*.
- Parcel of land (reserve, park, public open space, etc) as determined by the relevant *network operator* in consultation with the *applicant* and in accordance with the [WAER](#), [UPCoP](#) and *these requirements*.

The *point of supply (connection)* within a:

- a. standard *pillar* or *pit* is the *load* side 35mm<sup>2</sup> tunnels within the unit;
- b. universal *pillar* (uni-*pillar*) being the *load* side of the 35mm<sup>2</sup> tunnels or the designated bus bar for larger *consumer mains cable* up to a maximum size of 1 x 185mm<sup>2</sup> per phase (Fuse protection is generally not provided at a uni-*pillar* unless it is deemed necessary by the *network operator*);
- c. wall mounted cut out box, being the *load* side terminals of the fuse unit for *consumer mains cable* up to a maximum size of 35mm<sup>2</sup> to a 100A unit and 120mm<sup>2</sup>(Western Power) or 185mm<sup>2</sup>(Horizon Power) to a 200A unit;
- d. UMS *pillar/pit*, being the *load* side of the 20A red spot fuse in a *pillar* or the *load* side of the 20A inline fuse kit in a *pit*. *Consumer mains cable shall* not exceed 16mm<sup>2</sup>;
- e. LV frame or kiosk, being the *load* terminals of the fuse switch, LV link, or disconnect device for the *consumer mains cable* up to a maximum size of 630mm<sup>2</sup> dependent on size, level of protection and type of *network* equipment (The maximum size cable that can be connected to a PENDA unit is 400mm<sup>2</sup>); or
- f. *substation* transformer or switchgear terminals as specified in [clause 14.4.9](#).

### 12.2.7 Location

On receipt of a connection application as described in [section 7](#), the *network operator* will nominate in accordance with these *requirements* the location of the *point of supply (connection)*. Where the location of the *point of supply (connection)* is not acceptable to the *consumer*, an alternative location may be negotiated with the *network operator* subject to satisfying *network* compliance and financial *requirements*.

Where it is agreed to provide the *point of supply (connection)* in an alternative location for a residential connection, the cost of that alternative arrangement as determined by the *network operator shall* be borne by the *consumer*.

For commercial and industrial connections, all costs incurred by the *network operator* to supply and install the agreed alternative arrangement *shall* be borne by the *consumer*.

The *consumer* is responsible for consulting with all affected parties including owners of adjoining properties where an alternative or modified connection arrangement is sought and that arrangement may or will affect those parties.

The *consumer shall* obtain formal consent and approval from each party affected by the alternative arrangement prior to finalising their connection application with the *network operator*. Consent or approval *shall* not take precedence over any *network operator* decision or action with respect to the placement of *network infrastructure* that facilitates the requested connection.

### 12.2.8 Access

The *network operator's point of supply (connection)* and the *consumer's point of attachment* shall be readily accessible to the *network operator's* operational personnel with unimpeded access 24 hours and 7 days a week.

Where access to a *network operator's point of supply (connection)* is restricted, obstructed or not available the *network operator* shall be advised. Refer to encroachment [clauses 12.4.5.2](#) and [12.5.3.1](#)

- **Horizon Power** calls should be directed to 1800 267 926
- **Western Power** calls should be directed to 13 10 87.

### 12.3 Multiple points of connection (supply)

[WAER](#) section 3 states in part that “a *network operator* will provide only one *point of supply (connection)* to an individual freehold lot, crown land title or survey strata plan unless circumstances justify more than one and safety concerns are satisfied”.

Both *network operators* prefer not to create an environment where a *site* would be supplied from more than one *point of supply (connection)*. *Consumers* may apply to the *network operator*, for consideration of a second or multiple *points of connection (supply)*, which on receipt, will be assessed against safety, operational, *network* design and compliance *requirements*.

Where the request is deemed compliant, improves safety and *network/connection* functionality, the *network operator* may approve a multiple *points of connection (supply)* application. Formal advice will be provided to the *consumer* on the connection and supply *requirements* and or any conditions additional to those specified by [WAER](#) that *must* be met by the *consumer*.

On receipt of that advice the *consumer* shall:

1. confirm acceptance of and a commitment to comply with the *requirements* of [WAER](#) section 3 and the additional conditions specified by the *network operator*;
2. where the *consumer* is not the sole user of the *premises* or the landowner, the *consumer* shall formally advise all affected parties of the need to comply with the statutory obligations and installation specific *requirements* ;
3. the *consumer* shall obtain from and provide to the *network operator*, formal confirmation that those affected parties are accepting of the multiple *points of connection (supply)* terms and conditions; and
4. ensure that the *electrical consultant, electrical contractor* and affected parties are aware of the proposed multiple *points of connection (supply)* arrangement and that they are aware of their obligations to ensure compliance with multiple *points of connection (supply)* *requirements*.

The *network operator* will not issue a quotation to the *consumer* until confirmation of the aforementioned items has been provided including lodgement and acceptance of *Landgate* documentation.

The *network operator* may impose a limit on the number of *points of connection (supply)* that will be permitted on a parcel of land inclusive of but not limited to freehold *lots, strata developments lots, reserves, parks* etc.

Any requests for multiple *points of connection (supply)* where there are already existing connections may be denied and the *applicant* obligated to consolidate the existing arrangements to the acceptance of the *network operator*.

**Note:** The use of a *network operator's distribution network* as a substitute internal *consumer* network is classified as being multiple *points of connection (supply)*.

### 12.3.1 Consumer responsibilities

It is the *consumer's* responsibility through their agent to ensure compliance with *these requirements*. This is an essential safety *requirement* as the existence of a second or multiple *points of supply (connection)* has the potential to create an electrical hazard when not correctly managed and maintained by the *consumer*. In summary the *consumer must* ensure that:

1. all new and existing *consumer electrical installations* and infrastructure are fit for the purpose and safe;
2. the low and *high voltage electrical installations* within each zone are contained within that zone;
3. zone boundaries are clearly and easily identifiable;
4. updated zone diagrams and labelling are placed in every switchboard in every zone within the property;
5. copies of the zone diagrams are provided to the relevant authorities and *network operator*;
6. each *point of supply (connection)* and source of supply bears sufficient indelible labelling to clearly identify the location and means of isolation to the whole and each part of the property to enable rapid and precise disconnection of supply; and
7. appropriate easements and restrictive covenants are registered on the "certificates of titles" inclusive of but not limited to a 70A notification. Refer to [clause 6.8](#).

The *network operator* may require proof that these *requirements* have been finalised with the respective agencies prior to energisation. Where it is found that the appropriate notice(s) have not been attached to the property title, the *network operator* may initiate disconnection proceedings against the *consumer* to correct the discrepancy.

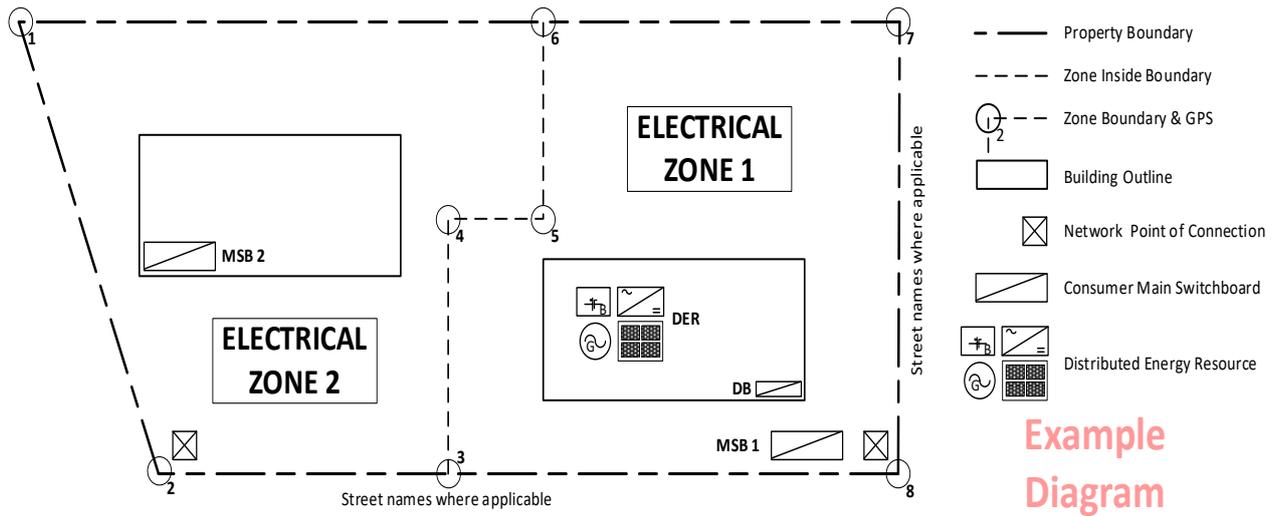
### 12.3.2 Zone diagrams

As stated, the *consumer* is required to prepare, post and maintain zone diagrams that depict the electrical, geographical boundaries of each zone and associated zone *electrical equipment* in relation to the whole *site*. Zone diagrams *shall* be prepared by a competent person and contain as a minimum those items specified in [WAER](#) including but not limited to details of all *network points of connection (supply)*, switchboards, *distributed energy sources* and information on the electrical relationships of that equipment within the zones.

**Figure 46** depicts a typical example of a layout and information deemed as the minimum acceptable standard for zone diagrams. It is recommended that a draft of the zone diagram be provided to the designated *network operator designer* for information before seeking to progress to the next stage of the application and lodgement process.

**Note:** Incomplete and or hand drawn diagrams will not be considered as compliant with these *requirements*.

Copies of the final *consumer* endorsed diagram *shall* be forwarded by the *consumer* to the relevant local authorities/state government agencies. The *consumer* is responsible for maintaining and updated zone diagram(s) in the specified locations.



Example Diagram

<b>Zone boundary GPS coordinates.</b>  1 N__ 5 N__ E__ E__  2 N__ 6 N__ E__ E__  3 N__ 7 N__ E__ E__  4 N__ 8 N__ E__ E__	<b>Mandatory notes</b> 1. Zone diagrams shall comply with the WAER and the network operator requirements. 2. Diagrams shall in accordance with Note 1, define the site electrical zones and equipment associated with each point of connection (supply). 3. Permanently fixed legible and indelible copies of this diagram shall be installed by the consumer in each electrical main switchboard, sub-board and energy generation source. 4. Zone and structural clearances shall be maintained for the life of the installation.	<b>SAFETY ALERT</b>  <b>Project name</b> # _____ <b>Address (inc) both Lot/Street</b> # _____ <b>Surveyor Company</b> # _____  <b>Date #</b> _____  <b>Network Ref #</b> _____  <b>Title</b> Western Australian Electrical Requirements Zone Diagram
	<b>Information to consumers</b> 5. The (insert name) <i>network operator</i> does not confirm the location and configuration of the consumer equipment including generation/storage systems. 6. The diagram is indicative only and should not be relied on as electrical configurations may or have subsequently changed. 7. The consumer is responsible for maintaining and displaying updated zone diagram(s) in the locations prescribed by the Western Australian Electrical Requirements. (WAER)	

Figure 46: Sample zone diagram

## 12.4 Overhead distribution systems

### 12.4.1 General

These requirements shall apply to all overhead network connection services provided to a consumer's electrical installation from a network operator's overhead distribution network where:

1. network approval has been given for a new or upgraded overhead network connection service;
2. the route of the overhead service cable, point of attachment position or consumer pole is altered, modified or ungraded; and
3. work is required due to:
  - a. a consumer's electrical installation failure or action that results in the replacement of the overhead service cable or consumer equipment;
  - b. a failure of the service cable or distribution network equipment; and
  - c. clearance non-compliances, operational issues, or safety concerns. A typical example would be the erection of a structure or carport under the overhead service.

Should there be an inability to achieve operational clearances, the provisions of these *requirements* are such that if the *consumer* seeks an *alteration* or upgrade of their existing connection arrangement beyond that deemed as *standard connection service*, the overhead connection to the *distribution network* shall be converted to underground. The replacement or relocation of an *overhead service cable* is subject to agreement with the *network operator*.

A *network operator* will maintain an existing *overhead service cable* and *network* connection where:

1. the area is serviced by overhead *distribution network*;
2. *network* capacity is available to suit the *load* and generation limits and the connection does not exceed the rating of *service cable*;
3. the position and type of the PoS and PoA used is acceptable to the *network operator*;
4. cable spans do not exceed those specified within these *requirements* or as approved by the *network operator* in accordance with AS/NZS 7000; and
5. clearances are achieved and maintained.

*Consumers* and their agents shall not access, climb *network equipment* or permit persons, material or equipment involved in the performance of a work activity to enter the 'danger zone' around powerlines at any time. Any works carried out in the vicinity of overhead lines or poles shall be carried out in accordance with the *requirements* prescribed in [section 6](#).

#### **12.4.2 Point of attachment (PoA)**

The *consumer* is responsible for provision, installation and maintenance of all equipment associated with the establishment of the PoA. The *network operator* may specify conditions for the position of the PoA where there are safety or compliance concerns.

#### **12.4.3 PoA suitability**

The PoA, be it a bracket attached to a *premises*, structure, or a *consumer pole*, shall be of sufficient strength to support the physical and environment *load* applied by and on the *overhead service cable*.

*Network operator technical requirements* specify the criteria for cable supports, struts, structural extensions, and poles used to support overhead *network* conductors.

#### **12.4.4 PoA access**

The *consumer* shall provide and maintain un-obstructed safe access to the PoA/PoS to facilitate the installation and maintenance of *overhead service cable(s)*:

1. from a vehicle mounted telescopic elevated work platform of a type that can traverse domestic driveways where practical; and
2. in all cases for a person standing on a portable extension ladder or scaffolding located upon the ground in an area that is both stable and free from obstructions.

Access shall not be restricted by any portion of the *consumer's premises* or require *network/electrical* personnel to climb over or onto a roof or other structure to gain access to the PoA/PoS. Access shall be in accordance with the [WAER](#), the Work Health and Safety legislation and these *requirements*.

### 12.4.5 PoA location

The position of a *consumer's* PoA for an *overhead service cable* shall:

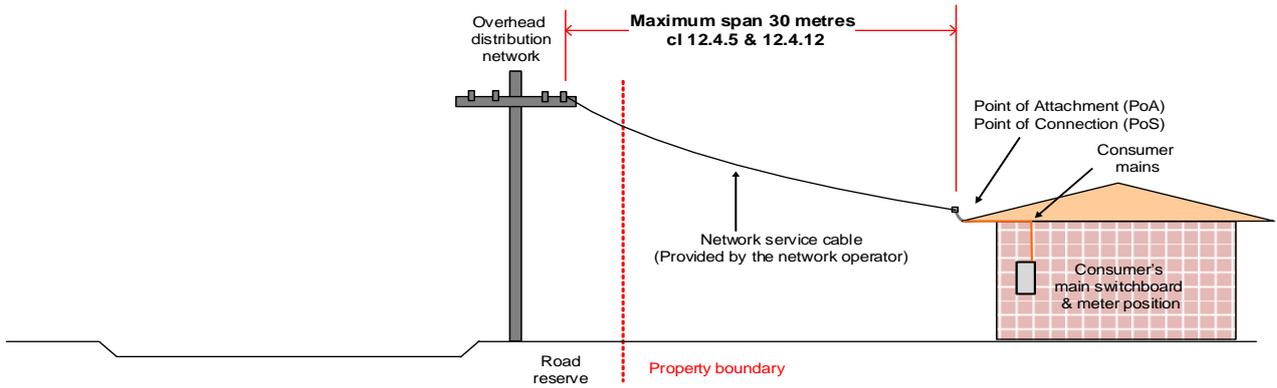
1. ensure compliance with these *requirements* inclusive of [clauses 12.4.5.3, 12.4.7](#) and [12.4.12](#) (spans and clearances);
2. limit the length of a standard *overhead service cable* from the overhead LV *distribution network* to the PoA where it is located on the consumer's:
  - a. *premises*, or structure to maximum length of 30 metres for connections within Horizon Power's Pilbara Grid, NIS *network* or Western Power's SWIS; or
  - b. *consumer pole*, positioned not more than 18 metres inside the *consumer's* property, measured from the *front property boundary* for connections within the SWIS *network*:

**Notes:**

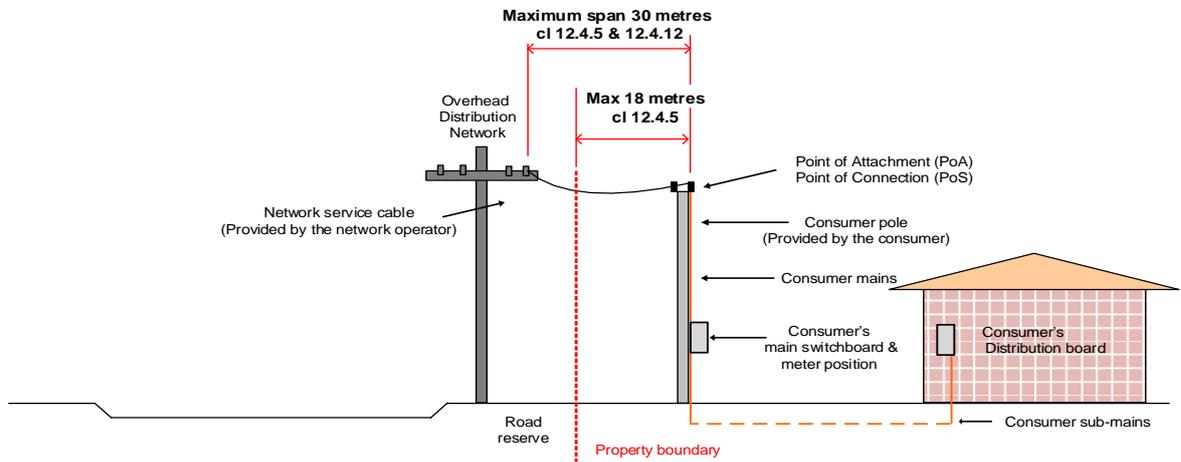
- i. Where a *network operator's distribution system* is on or traverses the *consumer's* property (common rural occurrence) the line of demarcation (*point of attachment/supply (connection)* (PoA/PoS)) between the *network* and the *consumer's* equipment shall be determined by the length of the *overhead service cable* from that *network* which shall not exceed 30 metres:
- ii. In areas serviced by an *overhead distribution system*, a *network operator designer* may exercise discretion on the 30 metre maximum length where:
  - a. the street mains are on the opposite side of the road to the property being serviced;
  - b. the *consumer pole* is located just inside the *property front boundary*; and
  - c. *voltage*, functional and safety parameters are satisfied; and
3. the sag of the *overhead service cable* does not exceed allowable clearances is in accordance with the [WAER](#), AS/NZS 7000 and where applicable AS/NZS 3000;
4. be within 100 metres of a suitable LV overhead *distribution network*;
5. ensure the *overhead service cable* does not cross over or enter a hazardous zone(s) of swimming pool, spas or water feature as defined by the [WAER](#); and
6. maintain prescribed clearances as defined by these *requirements* from and over:
  - a. trafficable areas, *premises*, structures, roofs, verandas, sheds, household equipment;
  - b. vegetation; and
  - c. other utility services including telecommunication conductors and equipment.

In all cases the PoA shall be located to achieve or exceed the minimum *overhead service cable* clearances as detailed in this [section](#), the [WAER](#), AS/NZS 7000 and where applicable AS/NZS 3000.

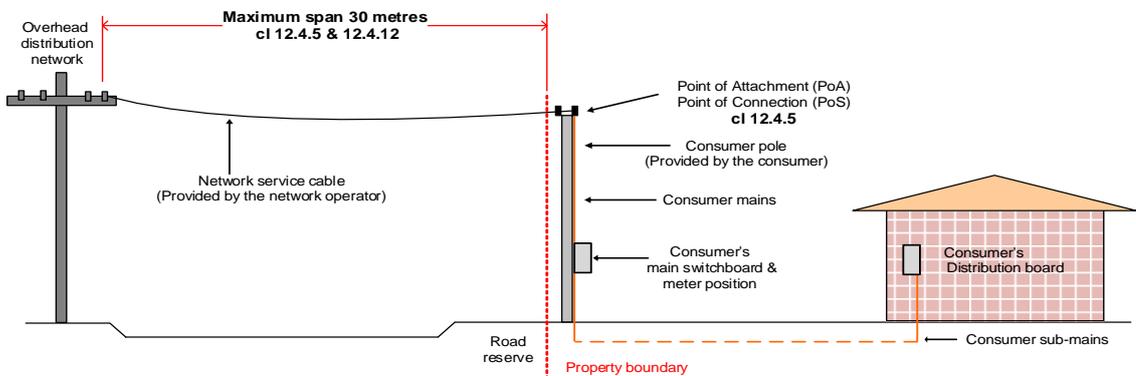
Where clearances cannot be achieved through the use of an alternative route or *consumer pole* location on the *consumer's* property to divert or raise the *overhead service cable* away from the hazard, the supply arrangement shall be converted to underground.



**Figure 47:** Typical overhead supply arrangement example 1



**Figure 48:** Typical overhead supply arrangement example 2



**Figure 49:** Typical overhead supply arrangement example 3

### 12.4.5.1 Service cables crossing an adjoining property

An *overhead service cable* shall not cross over or into an adjoining property unless a suitable easement is obtained by the *consumer* over such property or it is for the purposes of attachment to a common use *consumer pole*. Refer to [clause 12.4.7](#) for additional information on common use *consumer poles*.

### 12.4.5.2 Encroachment

The *consumer*, property owner or *onsite responsible person* is required to maintain uninhibited access to the *point of supply (connection)*.

*Network distribution system* equipment shall be accessible 24/7, free from encroachments and obstructions. Refer to [clause 12.2.8](#).

Safe operational clearances shall be established and maintained at all times from, *premises*, structures and vegetation, forming part of or integrated into the *consumer's premises* or *development*, inclusive of appropriate setbacks of sufficient dimensions to allow safe access to *network* equipment inclusive of but limited to connection devices, cables, poles and *network* infrastructure.

Where *network* equipment is obstructed or safety of *network* personnel may be comprised, the *consumer*, property owner or *onsite responsible person* shall, as directed by the *network operator*, implement the required actions to correct the identified encroachment or obstruction.

Should *network* personnel in the delivery of their responsibilities, be obstructed, impeded or placed at risk, they will where that action is in response to an urgent or emergency occurrence, remove without liability to the *network operator*, the obstruction, impediment or unsafe condition.

Where in the course of general *network* activities an encroachment, obstruction, impediment or non-compliance is identified, the *network operator* may issue a correction notice to the *consumer*, property owner or *onsite responsible person* to address the *requirement* of that notice.

The *consumer*, property owner or *onsite responsible person* is responsible for the restoration, reinstatement or rectification of the correction notice *requirement*, at no cost to the *network operator*.

### 12.4.5.3 PoA position on structures

The location of a PoA shall be along the principal frontage of the *premises* or structure, as close as practical to the nearest corner facing the overhead *distribution network* pole from where the *overhead service cable* is to originate.

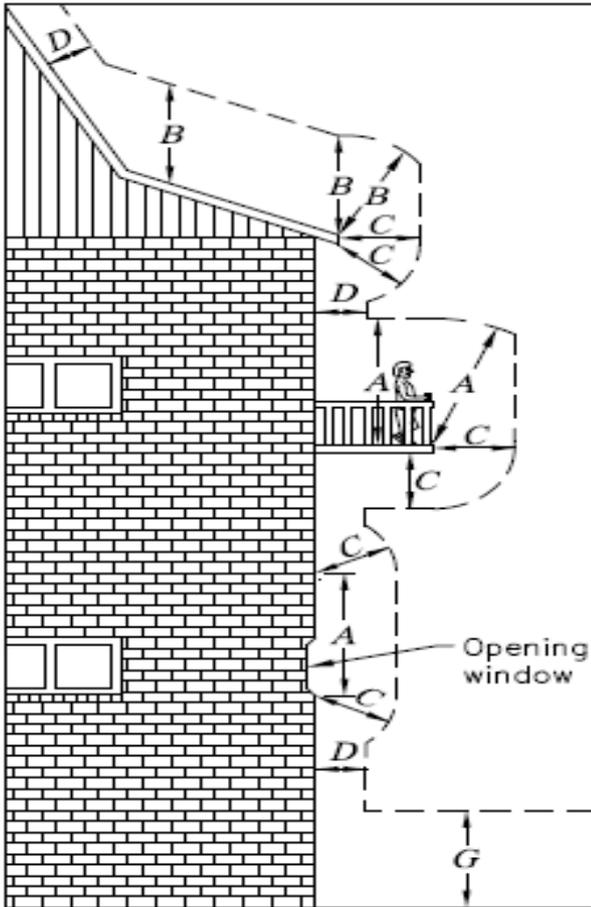
The PoA shall be positioned to ensure a minimum ground clearance of 2.5 metres, is maintained between the finished ground or floor level and the *mains connection box* or the lowest point of the *overhead service cable* drop loop but no higher than 7 metres from the finished ground or floor level. Refer to [clause 12.4.10](#).

A minimum clearance of 1 metre shall be maintained where the *overhead service cable* passes near the corner of the *premises*, structure or guttering. *Overhead service cables* shall not be within 1 metre of a non-opening window or area accessible from the boundary of the balcony measured radially up to a height of 2.5 metres above the surface normally accessible for pedestrian activity.

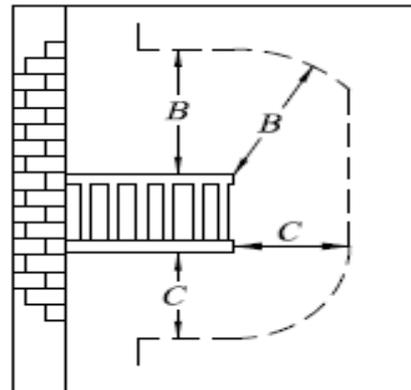
For opening windows and doorways where the top of window/door is:

- Less than 2.5 metres above floor level the PoA shall not be within an area 1 metre from bottom and sides of window/door and extending to 3 metres above floor level
- Greater than 2.5 metres above floor level and under 3 metres from floor level, PoA shall not be within 1 metre from sides and bottom of window/door
- Greater than 2.5 metres above floor level and above 3 metres from floor level, PoA shall not be within 1 metre from sides and top of window/door.

**Figure 50** and **table 12** are extracts from AS/NZS 7000 depicting the clearances for *overhead service cables* and structures.



**Note:**  
Illustration (b) applies if the height of the railing (or similar) plus distance B is greater than distance A.



**Figure 50:** Extract from AS/NZS 7000

Clearance		Under < 1000v			U > 1000v		1000v <U< 33kV	33kV <U< 132kV
		Insulated	Bare Neutral	Bare Active	Insulated with earthed screen	Insulated no earthed screen	Bare or covered	Bare
Vertically <sup>2</sup> above those parts of any structure normally accessible to persons	A	2.7	2.7	3.7	2.7	3.7	4.5	5.0
Vertically above those parts of any structure not normally accessible to persons but on which a person can stand.	B	2.0	2.7	2.7	2.7	2.7	3.7	4.5
In any direction (other than vertically above) from those parts of any structure normally accessible to persons, or from any part not normally accessible to persons but on which a person can stand.	C	1.0	0.9	1.5	1.5	1.5	2.1	3.0
In any direction from those parts of any structure not normally accessible to persons.	D	0.1 <sup>3</sup>	0.3 <sup>3</sup>	0.6 <sup>3</sup>	0.1	0.6	1.5	2.5
In any direction from the ground.	G	Refer to Table 3.5.AS/NZS 7000			Refer to Table 3.5.AS/NZS 7000		Refer to Table 3.5.AS/NZS 7000	
<p><b>Note</b> <sup>1</sup> For information pertaining to voltages above 132 kV refer to table 3.7 of AS/NZS 7000.  <sup>2</sup> This should not be taken as meaning only literal vertical. The actual clearance may also extend outwards in an arc until it intersects with the relevant "C" dimension.  <sup>3</sup> This clearance can be further reduced to allow for termination at the <i>point of supply (connection)</i>.</p>								

**Table 12:** Extract from AS/NZS 7000

*Network* street pole locations and other *consumer poles* supplying adjacent properties *shall* be considered when determining the route of an *overhead service cable* together with the need for service protection, especially for rural supplies. Refer to [clause 6.5.3](#).

#### 12.4.5.4 PoA on poles

The maximum height permitted for a *point of attachment* on a pole is 7 metres from the finished ground level and positioned so as to ensure that the minimum ground clearances as specified in [clause 12.4.5](#) are achieved.

A maximum of two PoA are permitted on a single *consumer's pole*. If the destination of the *overhead service cable(s)* is unclear, both PoA are to be permanently and indelibly labelled to identify the *electrical installation* being serviced. The *point of supply (connection)* *shall* be located as prescribed by [clause 12.4.10](#).

#### 12.4.6 Service brackets

The *consumer shall* make structural provision for the installation and maintenance of a rigid accessory (service bracket) for attaching the *overhead service cable* onto their *premises* or structure.

Service brackets *shall* be installed in accordance with the manufacturer's instructions. Brackets *shall* be securely fixed to the structure by means of nuts and bolts. The use of fixings such as coach screws or nails in timber and loxins, tiger bolts or similar masonry anchors in brick or concrete are not an acceptable means of fixing given the potential to become dislodged due to deterioration of the fixing and or building material.

The part of the structure used to attach the service bracket *shall* be of sufficient strength for the additional load (minimum 2250N (Western Power) and 2400N (Horizon Power) applied at the pin and where necessary reinforced to support the load of a standard *overhead service cable* under expected climatic and where applicable cyclonic conditions. The use of any extension or part of a *premises* or structure as a substitute for the purposes of providing a PoA is deemed not acceptable. Additional measures may be required for non-standard overhead installations.

Unless using a long span raiser bracket specifically designed for the purpose, PoA fixtures *shall* be designed and manufactured for the most direct *overhead service cable* take off to the overhead *distribution network*. A PoA should not be subjected to a side pull angle of more than 30 degrees.

Service brackets *shall* be designed, dimensioned and manufactured in accordance with the *network operator's technical requirements* (Examples shown in following [figure 51](#)). Alternative arrangements may be considered by the *network operator* engineering and design services.

##### 12.4.6.1 Standard service bracket (Example 1, 2, and 3)

These types of brackets generally attach directly to a *premises* or structure, providing a *point of attachment* for an *overhead service cable* at the point where the bracket is fixed.



**Figure 51:** Typical service brackets

### 12.4.6.2 Long span raiser bracket

A long span raiser bracket (not shown) may be required to be attached to a *premise* or structure to achieve a higher *point of attachment* for an *overhead service cable*. Refer to the *network operator* engineering and design services for structural details.

### 12.4.6.3 ABC universal brackets

Where a LV aerial bundle cable (ABC) is used in lieu of open aerials as the *network connection service*, the *consumer* will be required to install a universal bracket similar to that shown in **figure 52**. These brackets *shall* be bolted or welded to a substantial structural member of the *consumer's premises*, structure or *consumer pole*. The *overhead service cable* clamp and wedge combination or insulator *shall* be securely fixed in place by a split pin or similar device.



**Figure 52:** Typical ABC universal bracket

### 12.4.7 Consumer poles

*Consumer poles* and private power lines located within the *consumer's* property are the responsibility of the property owner or occupier. *Consumer* and private poles/lines *shall* be constructed, installed and maintained in accordance with the [WAER](#), applicable industry standards, *network operator technical requirements* and these *requirements*.

Proactive maintenance programs *shall* be initiated by the property owner or occupier to prevent power interruptions, bushfires/accidents and potential compensation liabilities in the event of *consumer* infrastructure failure.

Where a common *consumer pole* is installed, both *consumers* using the pole *shall* be jointly accountable for the continuing care and maintenance until such time as either or both *consumers* convert their connection(s) arrangement to underground.

For additional information refer to Building and Energy's brochure entitled "[Private power poles and lines](#)"

### 12.4.7.1 Location

The *consumer* shall install a pole at no cost to the *network operator* where:

1. *overhead service cable* ground clearances as specified by AS/NZS 7000 and AZ/NZS 3000 cannot be achieved or maintained; or
2. *loads* on fittings exceed equipment specifications and capabilities; or
3. *overhead service cable* spans exceed acceptable limits, refer to [clauses 12.4.5](#), [12.4.7](#) and [12.4.12](#); or
4. the *overhead service cable* crosses an adjoining *property boundary* or passes within a hazard zone such as a pool, water feature or other *premises*, structure; or
5. a *network operator* fault note has been served on the *consumer* or *premises* owner.

*Consumer poles* shall be located:

6. on the *consumer's* property, generally as close as practical to the *property boundary* (front street alignment) in accordance with the *requirements* of [clauses 12.4.5](#); [12.4.7](#) and [12.4.12](#); and
7. so that the *consumer's mains cable* does not encroach into the road reserve or neighbouring properties; and
8. where servicing a battle axe *lot*, just inside the *consumer* front boundary on the gazetted road servicing the property; or
9. by mutual formal consent, adjacent property owners may share a purpose built *consumer pole*. Refer to [clause 12.4.7](#).

### 12.4.7.2 Construction

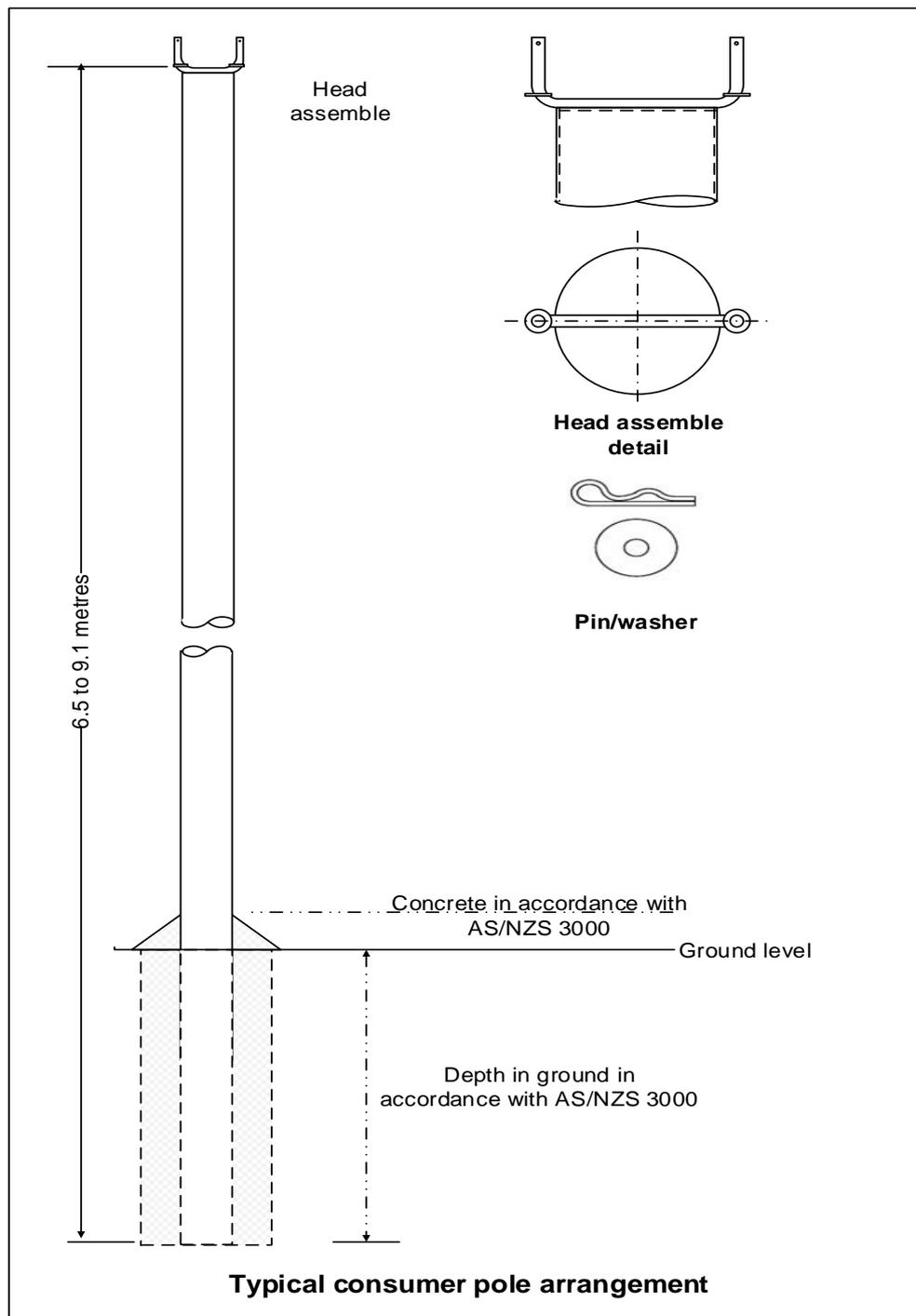
*Consumer poles* shall be:

1. constructed of robust materials, capable of withstanding the *loads* imposed by the attached *overhead service cable(s)* for the life of the installation;
2. treated to protect against the effects of climate, infestation and fauna which *shall* include hot-dip galvanising for poles constructed of steel;
3. where a cylindrical configuration be:
  - a. capped and sealed;
  - b. have manufactured entry/exit holes for cables constructed and sealed to prevent the ingress of moisture; and
4. have a head assembly consisting of hooks and locating pins to secure the *overhead service cable*; and
5. securely embedded in an appropriate foundation designed to prevent deflection from the vertical caused by unbalanced forces inclusive of that exerted by the *overhead service cable(s)*. For concrete pole foundations, quickset concrete *shall* not be used. Refer to example [figure 53](#).

Where installed in non-cyclonic areas *shall* comply with AS/NZS 3000, the *network operator's technical requirements* and be capable of withstanding the specified horizontal force applied 5.2 metres above ground without deflection at the point of application exceeding 230 mm with no permanent deformation.

The specified horizontal force for poles used to support a standard *network overhead service cable* within:

- **Horizon Power's** *electrical licensing area boundary* shall be 2400N or 4800N for a shared pole
- **Western Power's** *electrical licensing area boundary* shall be 2250N



**Figure 53:** Typical Consumer pole layout

*Consumer poles* installed to support *network* aerial conductors larger than 16mm<sup>2</sup> shall be designed and manufactured in accordance with AS/NZS 3000 and the *network operator's technical requirements*. Where a cross arm is required, the pole shall be fitted with a collar which shall:

1. Prevent the cross arm from slipping; and
2. Permit rotation of the cross arm to align with the take off point from the overhead distribution network.

The *consumer* remains responsible for the continuing care and maintenance of the *consumer pole* for the life of the installation.

### 12.4.7.3 Horizon Power requirements

In addition to the *requirements* of [clause 12.4.7.2](#) *consumer poles* used in areas subject to cyclonic weather conditions *shall* comply with and satisfy the following minimum dimension *requirements*:

- Full length = 6780.0 mm
- Height above ground = 5500.0 mm
- Overall diameter = 168.3 mm
- Wall thickness = 6.4 mm

In all cases the *consumer* or their agent *must* confirm with the *network operator's* local district office located with the respective Pilbara Grid or NIS *network* area to ensure the proposed pole conforms to local requirements before installation.

### 12.4.7.4 Western Power requirements

In addition to the *requirements* of [clause 12.4.7.2](#) *consumer poles* *shall* be made of steel in accordance with the *network operator's technical requirements*.

### 12.4.7.5 Common consumer poles

When a *consumer pole* is used to service adjoining *lots*, the following additional conditions shall apply:

1. a maximum of two *consumer mains cable* will be permitted;
2. the pole *shall* be positioned as close as practical to the common boundary of the two adjacent *lots* at the boundary junction with the road reserve;
3. the capacity of each connection *shall* not exceed that of a *standard connection service*;
4. the route length of each *overhead service cable* shall conform with the *requirements* of [clause 12.4.5](#) ;
5. each *mains connection box* *shall* be indelibly labelled to identify the *electrical installation* being serviced; and
6. refer to [clause 12.4.7.2](#) for pole ratings.

Formal written consent should be obtained from the owner of a *consumer pole*, where joint or shared use is proposed, acknowledging and permitting joint use of and access to the common use pole. A copy of the acknowledgement should accompany the connection application when forwarded to the *network operator*.

Location, access to, use of and maintenance of a *consumer pole* is the responsibility of the *consumer(s)* to determine. Any disputes arising out of use, access to or location resides with the affected *consumer(s)*.

### 12.4.8 Equipment on poles

*Consumer poles* and *network carry over poles* are specifically designed for the purposes of conveying and supporting an *overhead service cable* from the overhead *distribution network* to the *consumer's premises*.

Modification through the placement, attachment or *alteration* of the pole to accommodate unrelated items may change the pole's engineering parameters, thereby adversely affecting the poles integrity, structure and strength. Examples of such equipment may include:

- Lighting and light sensing or switching equipment.
- Signage, banners and related fixtures, fittings or supports.
- Fencing, letter boxes or other *consumer* owned structures with the exception of *consumer* owned switchboards.
- Vegetation or supports.

Consumer owned equipment not associated with the *overhead service cable* must not be installed or fixed to any *network operator carry over pole*. This *requirement shall* also apply to a *consumer pole* unless the pole has been engineered accordingly and the installer is confident that there are no safety issues. The *network operator* may require evidence to substantiate that the structural integrity of a modified pole has not been compromised.

Decorative fixtures, signs, banners or artwork may under certain limited circumstances be attached to a *network operator's* street distribution poles, streetlight poles or applied to other distribution assets. For further information on the *requirements* refer to [clauses 6.14 and 6.15](#).

### 12.4.9 Corrosion resistance

The corrosion resistance of *consumer* overhead components inclusive of steel service brackets and *consumer poles* shall be not less than that prescribed by the *network operator's technical requirements*. In the absence of such technical detail, components shall be protected in accordance with:

- AS 4680 Hot Dipped Galvanised (Zinc) Coatings on Fabricated Ferrous Articles
- AS 4791 Hot Dipped Galvanised (Zinc) Coatings on Open Section Ferrous Articles
- AS 4792 Hot Dipped Galvanised (Zinc) Coatings on Hollow Section Ferrous Articles
- AS 1214-1983 (Hot-Dip Galvanised Coatings for Threaded Fasteners – ISO Metric Coarse Thread Series).

### 12.4.10 Point of supply (connection)

The *consumer* shall provide, adjacent to and as close as is practical to the *point of attachment* (PoA), a *point supply (connection)* (PoS) suitable for the purposes of securely terminating both the *overhead service cable* and the *consumer mains cable* in a form acceptable to the *network operator*.

No temporary or permanent structure shall be erected (such as a carport or veranda) beneath the PoS which may prevent access from a location on the ground immediately beneath the PoS. The PoS shall be such that it:

3. provides *consumer* terminals with an electrical rating as prescribed by these *requirements* or the installed *consumer mains cable*, whichever is the greater;
4. is a size and type compatible with both the incoming *overhead service cable* and outgoing *consumer mains cable*;
5. has terminals in fixed positions to accept both incoming and outgoing cables in individual tunnels or lugs;
6. provides adequate insulation and protection against direct contact with live parts in accordance with AS/NZS 3000;
7. is positioned to allow for the safe removal of covers, links, fuses or cables without risk to the *network* personnel; and
8. is located as close as practical to but not exceeding 500 mm from the PoA.

The *consumer* is responsible for providing and maintaining the PoS and the consumer's mains cable together with any related equipment downstream from the *point of supply (connection)* to the *consumer's main switchboard* as specified at [section 11](#).

#### 12.4.10.1 Mains connection boxes

Where the *consumer* installs a *mains connection box* to establish the PoS, unobstructed access to the device shall be provided for disconnection/reconnection of the *overhead service cable*. In some cases, this may require the modification to the roof line especially where steel sheeting is used.

Manufacturer supplied shrouds shall be fitted to all *mains connection boxes* to reduce moisture and dust built up associated with pollution and environmental conditions inclusive of those experienced in coastal areas.

### 12.4.10.2 Boundary fuses

Boundary fuses where installed are provided, installed and maintained by the *consumer*.

Unless approved by the *network operator* new or upgraded overhead *network connection services* are no longer permitted. The following content has been retained within this document for historical purposes as there are a number of existing connections still in service. Dependent on the type, size, and location of an existing connection the *network operator* may require the connection to be converted to underground.

The table below and the associated footnotes indicate where boundary fuses were required and what type were to be used:

Type of Supply System	Type of Boundary Fuse	See Note
Aerial	Outdoor	1 & 2
Aerial	Indoor	3
Underground	Indoor	3

**Table 13:** Type of boundary fuse

#### Footnotes to table 13

1. Outdoor boundary fuses were required for:
  - a. single insulated *consumer mains cable* in metallic enclosures including conduits poles and goose necks; and
  - b. installations that are CT metered or which have a calculated maximum demand exceeding 140A connections.
2. The enclosed fuse-link size for outdoor boundary fuses to be suitable for approximately twice the current carrying capacity of the *consumer's mains cable*.
3. Boundary fuses not required if the *consumer mains cable* emanate from:
  - a. a *service protection device* within a *substation* and the main switch was a CFS unit or a moulded case ACB; or
  - b. an isolator, removable link or LV transformer terminals within the *substation*. Where this occurs, the *consumer mains cable* was to be as short as practical and the *main switchboard must* be contiguous within the *substation*. The type of main switch to be discussed with the *network operator*.

**Note:** Removable links or an isolator may have been required within the *main switchboard* preceding the main switch.

Indoor boundary fuse types and fuse link sizes *shall* comply with the following **table 14**:

Installation calculated maximum demand	Fuse type
<b>CMD not more than 63A</b>	100A GEC back connected RS 100 fuse holder with a type "T" 100/150 or 160 motor start fuse link or similar, to AS 2005 or BS 88.
<b>CMD between 63A and 100A</b>	200 A GEC back connected RS 200 fuse holder with a type "T" 200 fuse link or similar, to AS 2005 or BS 88.

**Table 14:** Western Power indoor boundary fuses

Where the *consumer* supplied boundary fuse protection, the *consumer shall* provide a full set of spare fuses in a location accessible to both the *consumers' electrical contractor* and *network* personnel.

### 12.4.11 Prevention of conductor insulation damage

*Overhead service cable* or *consumer mains cable* shall be protected from sharp edges or projections on external or internal surfaces. Where *mains connection box* or boundary fuse protection is mounted on a plate(s) that plate shall not protrude beyond the edge of the *mains connection box* or fuse.

The clearances shall permit equipment covers or fuses to be removed safely without the necessity to remove equipment fixings or supports.

### 12.4.12 Spans and clearances

As prescribed at [clause 12.4.5](#), the height of supports shall be adequate to ensure *network overhead service cables* can be installed and maintained at the heights defined by the *network operator*, in accordance with the [WAER](#), AS/NZS 7000 and where applicable AS/NZS 3000.

Unless specified to the contrary, clearance *requirements* for *consumer* owned aerial electrical infrastructure including aerial sub-mains and supports shall comply with AS/NZS 3000.

*Overhead service cables*, PoS and PoA shall be installed so that a clearance of 600mm or more is maintained from any overhead telephone, cable television or other telecommunication service, where present.

Unless specified otherwise by the relevant *network operator*, the maximum permitted length (span) for a standard *network overhead service cable* is:

- 30 metres for 6mm<sup>2</sup> 2 & 4 core and 16mm<sup>2</sup> 2 core cables; and
- 18 metres for 16mm<sup>2</sup> 4 core cable.

**Note:** One (1) span is deemed to be a standard service cable length.

This ensures operational parameters of length, strength and conductor sag are not exceeded under normal operational conditions.

Where conditions warrant, (e.g. widening of a gazetted road) a *network operator designer* may approve the extension of the length (span) subject to the:

1. span distances do not exceed *industry best practice* standards;
2. required clearances are achieved and maintained;
3. where required, supports and anchorage points are confirmed adequate to support the additional *load*; and
4. the sag of the *overhead service cable* does not exceed allowable clearances in accordance with the [WAER](#), AS/NZS 7000 and where applicable AS/NZS 3000.

The *network operator* will determine the final location of all *network* poles and supports in coordination with other relevant government agencies and affected parties.

### 12.4.13 Disconnections, repairs, replacement, or upgrades

#### 12.4.13.1 Application

**New and upgraded installations-** Generally no new or upgraded overhead connections greater than a *standard connection service* will be permitted within the SWIS. Connections of this type in the Pilbara Grid and NIS *network* regions are to be converted to underground.

**Installation alterations-** The retention of an existing overhead connection will be permitted if the *electrical installation's* calculated maximum demand is not increased, the installation's *consumer mains cable* and *main switchboard* comply with current standards and there are no issues of safety.

**Consumer instigated actions-** Reinstatement or replacement of an *overhead service cable* due to a *consumer's electrical installation* fault, negligence or damage will, wherever possible, be initiated if the connection operational parameters remain unchanged and it is safe to do so.

Where a condition, fault or hazard is present or identified within the *consumer's electrical installation* that would render the installation unsafe if reconnected to the *distribution network*, the *connection service* will not be re-established until rectification has occurred.

This *requirement shall* also apply to applications for a temporarily disconnection of an *overhead service cable*, regardless of the reasons stated for that temporary service.

**Network operator instigated actions-** *Overhead service cables* that are rendered unserviceable due a *distribution network* fault, deemed defective or requiring replacement will be replaced by the *network operator* in accordance with current standards. A *consumer* may be required to supply and install a new PoA and or *consumer pole* to achieve required clearances or where avoidance of existing hazardous zone is necessary.

**New pools, spa or water feature installations-** *Consumers* wishing to install or request a temporary disconnection of an *overhead service cable* to facilitate the installation of a pool, spa or water feature *shall* ensure that the route and location of the reinstated *overhead service cable* complies with current standards and clearances.

*Service cables shall* not enter, cross or pass over restricted zones or within 3.5 metres of the water measured outwards from the edge of the pool, spa or water feature. Refer to [WAER](#) section 4.

#### **12.4.13.2 Compliance costs**

Work related to the *repair*, replacement, relocation, upgrade or reinstatement of an *overhead service cable* and/or associated *consumer* equipment may incur costs of varying degrees for either or both the *consumer* and the *network operator*. Costs *shall* be attributed to the party that instigated or requested the work in accordance with the following principles:

**Consumer** - The *consumer shall* be responsible for all costs incurred including those of the *network operator* as a result of any modification or *alteration* (including temporary disconnection) made to the *electrical installation* or due to any structural change to the *consumer's installation* that renders the installation non-compliant with current standards.

Where the *overhead service cable* requires *repair* or replacement due to or caused by the *consumer* or the *consumer's* equipment, or event/action on the *consumer's* property, the *consumer shall* cover all costs pertaining to that work including any costs for work and equipment required to upgrade the *electrical installation* to comply with current standards.

**Network operator-** *Overhead service cables* requiring *repair*, replacement or upgrade due to either cable failure or as a part of a scheduled maintenance will be installed or reinstated by the *network operator*. *Consumer* equipment compliance costs associated with the work *shall* be borne by the *consumer*.

#### **12.4.14 Temporary disconnections**

The *network operator's* temporary disconnection notification and tagging system may be applied where a disconnection/reconnection of *overhead service cable* or underground *consumer mains cable*, is required to facilitate *consumer* planned maintenance/construction work or in response to unplanned fault rectification. For full details of the system refer to [section 7](#).

This system is designed to assist the electrical and construction industries safely manage *consumer* requested or fault related disconnections and reconnections of *electrical installations* from the *low voltage distribution network*.

### **12.4.15 Swimming pools, spas and water features**

*Overhead service cables* connecting a *consumer's electrical installation* to a *distribution network* shall not be installed, reinstated or remain in place where that *service cable* enters or crosses over a pool, spa or water feature zone as defined by AS/NZS 3000. Refer to [WAER](#) section 4.

This regulatory *requirement* applies to all existing *electrical installations* and where the *overhead service cable* and associated *consumers* equipment requires *repair*, replacement, relocation, upgrading or temporary disconnection/reconnection.

*Consumer's* equipment includes *consumer mains cable*, *mains connection box*, *point of attachment*, poles and those actions including replacement, relocation or upgrading of the *consumer's main switchboard*.

### **12.4.16 Temporary arrangement in the event of a failed service**

The *network operator* may install or the *consumer* may be required to arrange for the installation of a temporary supply in the event of a failed connection service. In such cases the supply *shall* be installed in accordance with the *requirements* of [WAER](#) section 8.

If it is deemed by *network* personnel that the reinstatement of a permanent connection or temporary supply to the *distribution network* re-establishes a hazard or creates additional safety concerns, the *network operator* may elect to leave the *consumer's electrical installation* disconnected until such time as the hazard is removed or rectified.

### **12.4.17 Existing consumers and affected parties**

Where an existing overhead service or aerial sub mains cables are to be removed as part of an upgrade or *subdivision* work, the *developer* is responsible for the reconnection of existing *network operator* aerial-connected *consumers* to the *distribution network* at the *developers* cost. Refer to the relevant *network operator* [UDS manual](#) *requirements* for complete details.

### **12.4.18 Service cable replacement program**

Both Horizon Power and Western Power have "overhead replacement programs" implemented to ensure *consumer electrical installations* that have not been scheduled for a *network* upgrade have an appropriate overhead service.

This may require the replacement of the *overhead service cable*, PoS/PoA where deemed defective or unserviceable. The installation of a *network carry over* or *consumer pole* may be required to ensure the *overhead service cable* is compliant above trafficable areas or structures or diverted away from identified hazards.

Where an unsafe or non-compliant *consumer's electrical installation* is identified, the *network operator* may issue a hazard or defective equipment notification to the *consumer*, who will be required to undertake the necessary rectification/modifications.

Alternatively, the *consumer* may choose to convert their overhead connection to underground at their cost as a part of this program. *Consumers* will be formally advised in advance of any supply or service interruption.

## 12.5 Underground distribution systems

### 12.5.1 General

Except in circumstances prescribed in [clause 12.2](#) of these *requirements*, all *consumer* connections to *low voltage distribution networks*, will be via an underground *network connection service* and *point of supply (connection)*.

These *requirements* shall apply to all underground *network connection services* provided to a *consumer's electrical installation* from an underground *distribution network* or from an overhead *network* via an underground *network connection service* where:

1. the connection to either an existing overhead or existing/new underground *distribution network* has *network* approval;
2. an overhead *network connection service* is to be converted to underground; and
3. an existing underground connection and associated equipment requires maintenance, rectification, *alteration*, modification or an upgrade.

The *network operator* will provide and maintain a *point of supply (connection)* for an underground connection to a *consumer's premises* or installation where:

4. the area is serviced by either an overhead or underground *distribution network* physically capable of servicing the requested connection;
5. there is sufficient capacity within the *network* to accommodate the *consumer's* requested calculated maximum demand and or generation output;
6. the position and type of the connection is acceptable to the *network operator*;
7. there are no operational issues, hazards or safety concerns that may or will adversely affect either the *consumer's electrical installation* or the *network* including members of the public and operational personnel; and
8. the installation and connection complies with the relevant codes, standards and these *requirements*.

Any work carried out in the vicinity of underground cables in road reserves, public open space or crown land, *must* be completed in accordance with [section 6](#) "Dial Before You Dig" (Telephone 1100) provisions. The location of any underground assets *shall* be determined before any works involving excavations are commenced.

### 12.5.2 Point of supply (connection) (PoS)

Where approved, the *network operator* will arrange for the installation of or grant access to an appropriate *point of supply (connection)* from either a *network* ground/wall mounted equipment or *substation* to facilitate the connection of a *consumer's electrical installation*.

The *consumer* is responsible for providing and maintaining the *electrical installation* downstream from the *point of supply (connection)* (excluding *network metering equipment*) to the *consumer's main switchboard* and beyond as specified in [section 11](#).

The *network operator* will provide one *point of supply (connection)* to service two adjacent freehold residential *lots*. *Pillars* are the preferred method and solution for residential and standard connections.

Industrial or commercial *lots* will be provided with an individual supply, either from a universal *pillar* or *substation*.

It is acknowledged that the use of an above ground *point of supply (connection)* may not be appropriate, in certain circumstances, due to limited space, unstable environmental conditions or to do so would present a hazard either to pedestrians or traffic. In such cases the *network operator* may choose to install a ground level *pit* or wall mounted frame or box.

Where a *network connection service* is required to equipment located within a reserve, park or public open space the *network operator* will determine the method of connection.

### 12.5.3 Location

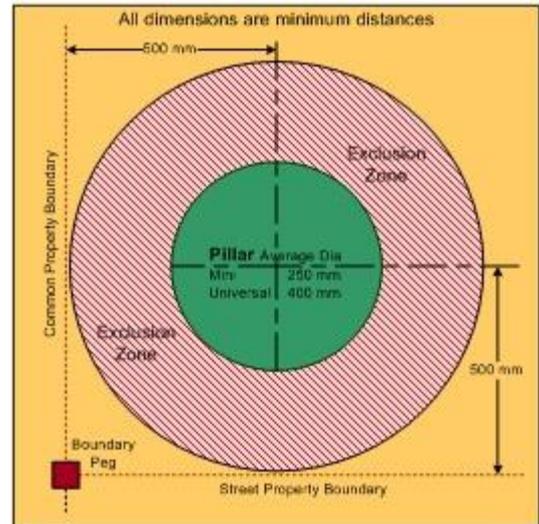
The *network operator* will determine the location of the *point of supply (connection)* which shall be located at the *network operators* preferred position, which for *pillars* and *pits*, being the junction of the principal street front and common *property boundaries*.

Above ground assets including *pillars*, kiosk, frames and *substations* shall be located on flat level terrain, at ground level 300mm above 100 year flood level, on the low side of any boundary retaining wall in a safe, accessible position.

*Pillars* and *pits* shall be located so that the centre of the *pillar* or *pit* is within an area (exclusion zone) not more than 500mm inside the front *property boundary* and from the common *property boundary* of the adjacent property. Refer to **figure 54** and [clauses 12.5.3.1, 12.5.5](#).

A *network operator* may choose to locate a *pillar* or *pit* in a gazetted laneway where there are no other roads in the vicinity, or it is necessary due to high front *property boundary* retaining walls preventing safe access for operational and maintenance purposes.

*Network connection service* above and below ground equipment shall not be installed within water feature hazardous zones as defined by section 6 of AS/NZS 3000 or behind retaining walls.



**Figure 54:** Pillar location and exclusion zone requirements.

A *network operator* may consider an alternative *pillar/pit* location where a low retaining wall (up to 300mm in height) does not interfere with *network* equipment or impede *network* 24/7 access.

Heavy-duty PVC conduits shall be provided by the *consumer* in accordance with the *network operator's technical requirements* to facilitate future *consumer mains cable* and *network* street cable installation into *distribution network* connection equipment.

Specific attention shall be paid to current and future *network* and *consumer* cable access requirements where the equipment is or may be located within or near multiple level developments or trafficable areas.

*Pillars* or *pits*, may subject to approval, be located to the side of a shared driveway servicing a multiple battle axe freehold lot(s). Easements shall be created to ensure access is available to the *point of supply (connection)* for all affected lots. Refer to [clause 6.8](#).

Where required a 100A or 200A single *consumer* wall mounted box, shall be located and mounted in accordance with *network* technical drawing(s) or as directed by the *network operator*. *Electrical contractors* shall ensure that there is clear unobstructed access provided to safely remove the box cover and to operate link(s)/fuse(s) contained within the unit.

Recessed mounted panels may be approved for use as a *point of supply (connection)* in lieu of *pillars* where a *consumer's premises* is built out to the street boundary or the structure incorporates parapet walls or high frontal retaining walls across the entire *property front boundary*. The location of the panel(s) shall be in accordance with the *network* technical drawings, with heavy-duty PVC conduits of sufficient diameter, length and number installed to enable the installation of *distribution network* cables and the *consumer mains cable* for all associated properties.

The location of kiosks, frames and *substations* shall be as prescribed in [section 14](#) of these requirements and the *network operator's technical requirements*.

*Network and consumer equipment shall not be placed in locations where there is an impact potential or may create a hazard or impede, interfere with general pedestrian and vehicle movements as well as visual line-of-sight obstructions to vehicular traffic’.*

Where located near or adjacent to trafficable areas the position *shall* be as prescribed by the *network operator*. *Network* equipment, where required, *shall* be protected by approved robust bollards with non-corrosive outer surfaces or other protection devices such as high integrity concrete or steel crash barriers. Rope barriers are not deemed adequate protection. Refer to AS/NZS 3845: “Road safety barrier systems” for additional information. For specific information refer to the *network operator’s technical requirements* for ground mounted equipment.

Consideration *shall* be given to the configuration and prevention of installation step/touch *voltage* hazards with specific attention given to *substation* arrangements.

### **12.5.3.1 Encroachment, consumer non-compliant installations**

The *consumer*, property owner or *onsite responsible person* is required to maintain uninhibited access to the *point of supply (connection)*, *easements* and other land tenure notifications (e.g. 70A, 129BA etc). *Network distribution system* equipment *shall* be accessible 24/7, free from encroachments, obstructions and at ground levels appropriate for the installed equipment, associated cables and accessories. Refer to [clause 12.2.8](#). Incorrect ground surface treatments or ground levels (too high/low), is for the purposes of this *requirement*, also deemed to be a non-compliance.

Boundary fences, retaining walls and other *consumer* above and below ground structures, forming part of or integrated into the *consumer’s premises* or *development*, *shall* incorporate a setback of sufficient dimensions to allow safe access to *network* equipment inclusive of but not limited to cables *pillars*, *pits*, poles and *substation* infrastructure.

Where *network* equipment is obstructed or safety of *network* personnel may be comprised, the *consumer*, property owner or *onsite responsible person shall*, as directed by the *network operator*, implement the required actions to correct the identified encroachment or obstruction.

Should *network* personnel in the delivery of their responsibilities, be obstructed, impeded or placed at risk, they will where that action is in response to an urgent or emergency occurrence, remove without liability to the *network operator*, the obstruction, impediment or unsafe condition.

Where in the course of general *network* activities an encroachment, obstruction, impediment or non-compliance is identified, the *network operator* may issue a correction notice to the *consumer*, property owner or *onsite responsible person* to address the *requirement* of that notice.

In both cases the *consumer*, property owner or *onsite responsible person* is responsible for the restoration, reinstatement or rectification of the correction notice *requirement*, at no cost to the *network operator*.

### **12.5.3.2 Utility providers code of practice**

The [Utility providers code of practice](#) provides additional information on utility service provider *lot* entry arrangements inclusive of indicative drawings of utility service provisions from road reserves to *lots* without retaining walls or with retaining walls less than 1.1 metres high at the service location.

### **12.5.3.3 Horizon Power policy**

For further information and guidance on Horizon Power’s *requirements* phone 1800 737 036 or e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

### **12.5.3.4 Western Power policy**

For additional information relating to the installation of or location of ground mounted equipment, refer to [Locating ground mounted equipment](#) or contact the relevant Project construction manager.

### 12.5.4 Incorrect point of supply (connection)

Final *pillar*, *pit* and *substation* positions are determined by the *network operator*. Prior to the installation of the *consumer mains cable*, the *consumer* through their *electrical contractor* shall confirm the:

1. *point of supply (connection)* location;
2. requested *load* and generation limitations can be accommodated by the *network*;
3. submission of a connection application;
4. payment of all fees and charges; and
5. *point of supply (connection)* is compliant with these *requirements* and the [WAER](#).

Where an incorrect connection has been made, or encroachment has been identified, the installation shall be disconnected, the *consumer mains cable* re-routed and terminated to the correct position. For additional information refer to [WAER](#) section 3.

Failure to take remedial action may result in connection scheme *electrical contractor* being delisted and remedial actions instigated against the offending party(ies).

### 12.5.5 Access

In addition to the *requirements* of [clause 12.2.8](#), the *point of supply (connection)* must not be located behind a locked security fence or gate unless the *consumer* has installed an approved *network* master key system. The *consumer* shall ensure their security arrangements do not impede the *network operator's* access *requirements*.

*Consumers* and their agents must not enter a *substation*, open *network* equipment or enclosures, without the appropriate *network* access authorities and prior approvals from the *network operator*.

For specific information refer to the *network operator's* "safety, training and environment teams".

- **Horizon Power** - Refer to [Section 5](#)
- **Western Power** – Refer to [Section 5](#)

#### 12.5.5.1 Exclusion zones

Exclusion zones shall be maintained around *network* equipment to allow *network* staff, emergency personnel and *electrical contractors* sufficient room to access, remove/replace *network* equipment covers, and to provide a safe working environment while operating switches/links/fuses, connecting/disconnecting services and carrying out routine maintenance functions.

The zone shall be maintained free from structures, obstructions and hazards including but not limited to *consumer* walls, fences, barriers, letter boxes, structures, pools, water features, vegetation, garden features, ornamental paths, or any other item that may restrict access to or hinder the safe operation of the equipment.

The exclusion zone created around *pillars* and *pits* shall include a radial area extending 500mm in the horizontal plain from the centre of the *pillar* or *pit* and extend uninhibited above and below ground in the vertical plain. Refer to [WAER](#) and [figure 54](#).

Additionally zones in and around *network* equipment and *substations* shall make provision for operational, environmental clearances and hazard *requirements* as prescribed in [section 14](#) and relevant legislation, Australian standards and the National Construction Code (NCC).

Failure to maintain the required clearances and operational *requirements* may result in the *network operator* issuing correction notices to the *consumer*, property owner or *onsite responsible person* to rectify the non-conformance.

### 12.5.5.2 Excavation near transformers

Where underground services are to be installed near or in a *substation* or *network* enclosure, excavation work greater than 300mm in depth within 3 metres of that *network* infrastructure *substation* or enclosure *shall* not commence before the service route has been reviewed by the *network operator's* project construction Manager to determine the impact on the *network* equipment and earthing system.

*Network infrastructure* not installed on culverts *shall* be stabilised during any excavation works to prevent equipment movement. In such cases the *network operator shall* be contacted for advice on how to proceed.

### 12.5.5.3 Minimum separation of services

The Western Australian Building Commission guideline "[Separation of common services \(above and below ground\)](#)" and AS/NZS 3000 clause 3.11.5 and table 3.7, detail the *requirements* for minimum separation of services and clearances including the electrical and mechanical protection clearances from electrical cables and earthing electrodes.

In summary, other utility services *shall* not pass through or be located within the exclusion zone for *network pillars* and *pits*. A 500mm separation and service exclusion zone *shall* be created and maintained around *low voltage* earthing electrodes from other services including water services, sanitary drainage and gas. This zone *shall* be extended to 600mm for stormwater drainage services. Refer also to [clause 12.6.6](#).

Fire and noise restricted zones, where established by the *network operator*, in and around *network* equipment and *substation* installations, *shall* be adhered to and maintained for the life of that installation. Where required clearances cannot be achieved, appropriate mitigation measures *shall* be adopted by the *consumer* in accordance with the *network operator's technical requirements*.

Due consideration *shall* also be given to effective clearances of *network distribution system* infrastructure from conductive above/below ground fittings and structures. For additional information refer to [section 14](#) EPR *requirements*.

### 12.5.6 Network identification

*Network operators* utilise distinctive security systems such as triangular keyed cover locking bolts and embossed logos of the *network operator* equipment, to identify and confirm the equipment forms a part of that *network operator's distribution network*.

These features identify and distinguish *network distribution systems* from private/non network systems.

Equipment tagged or bearing *network* logos or which utilise a *network* locking system, inclusive of *pillar(s)* for private distribution systems, compromises *network/public* safety and therefore *shall* not be used for or as a part of a private/non-network distribution systems.

Where such equipment has been used for a private installation, the logos and other identify features *shall* be removed with the security system changed to a non-network key or bolt system.

Where in the course of general *network* activities a non-compliance is identified, the *network operator* may issue a correction notice to the *consumer*, property owner or *onsite responsible person* to address the *requirement* of that notice. The notice recipient is responsible for the restoration, reinstatement or rectification of the correction notice *requirement*, at no cost to the *network operator*.

### **12.5.7 Pillar or pit not installed**

Common reasons for a *network pillar* or *pit* not having been installed can be attributed to a delay or failure to submit a connection application, *site(s)* not pegged, encroachment or the construction of a *consumer's premises* proceeding more quickly than the surrounding *network* infrastructure and services.

#### **12.5.7.1 Connections in overhead areas**

In areas reticulated with an overhead *distribution system* the *electrical contractor* must confirm with the *developer*, builder or property owner to verify that a connection application has been submitted. If confirmed, the *electrical contractor* shall note the *network operator's* reference or project number and submit a "preliminary notice", then proceed once the *pillar* location is known.

Where no application has been made, the *responsible person* or their agent must complete the appropriate application forms. Successful submission will generate an electronic receipt number which can be used as a point of reference for all future matters associated with the connection.

On receipt of an application, the *network operator* will arrange for the installation and energisation of *network* equipment, including provision to the *applicant* of the relevant installation information and contact details for the designated *network* installer.

The *applicant* should confirm the *point of supply (connection)*, *pillar* location with the *network operator* and the *electrical contractor* before the *consumer mains cable* are installed. The *network operator* will liaise with and notify the *applicant* when the *network* installation is complete.

Where the *electrical contractor* has the appropriate connection approvals, they can connect the *consumer mains cable*, fit the *metering equipment*, complete the installation, including testing and submission of the relevant notices. If not approved the *network operator* will complete the connections and energise the *site*. Charges may be applied where the *network operator* is required to fit the *metering equipment* and complete the connection of the *consumer mains cable*.

#### **12.5.7.2 Connections in new underground strata subdivisions**

The installation of a *development connection point (pillar)* is undertaken by the *network operator*, with the *internal subdivision switchboards* and distribution infrastructure the *developers'* responsibility. Where the *pillar* is either not installed or not energised, the *consumer* or their agent is to liaise with the *developer* to determine why and to confirm the location of the *pillar*, installation timeframe and date of energisation.

Once connection detail is known, it is the *developers'* responsibility to notify the *consumer* so that the installation can be connected via *strata* distribution infrastructure to the *network*.

#### **12.5.7.3 Connections in new underground freehold subdivisions**

The installation of *pillars* and *network distribution infrastructure* in new *subdivisions* is the *developers' responsibility*. That infrastructure is generally then transferred to the *network operator*. If a *pillar* is either not installed or not energised, the *consumer* or their agent is to liaise with the *developer* to determine why and to confirm the location, installation timeframe and date of energisation.

Once the *pillar* is installed and or energised, it is the *developers'* responsibility to notify the *consumer* or their agent so that the installation can be connected to the underground *network*. Refer to the *network operator's* [UDS manual](#).

## 12.5.8 Network equipment not energised

To prevent a *consumer's electrical installation* becoming unknowingly energised when the *network operator* activates the *point of supply (connection)*, *electrical contractors must not connect consumer mains cable* into un-energised *network equipment*. The *electrical contractor* through their client *shall* determine who is responsible for the *pillar* installation and then take the appropriate course of action.

### 12.5.8.1 Existing overhead areas

The owner or their agent *must* obtain from the *network operator*, if unknown, the reference, project number applicable to the connection application and confirm a timeframe or date for energisation which they *must* convey to all affected parties.

The *network operator* will notify the owner or their agent when the equipment has been energised. Following energisation confirmation, the *electrical contractor shall* complete the connection process in accordance with their level of connection authorisation.

### 12.5.8.2 New underground subdivisions

The owner or their agent *must* liaise with the *developer* of the *subdivision* to determine why the equipment has not energised. The *developer* is to arrange for the equipment to be energised then notify the owner or their agent.

The *electrical contractor* on confirmation of energisation *shall* complete the connection process in accordance with their level of connection authorisation.

## 12.6 Consumer mains cable

### 12.6.1 General

Electrical work associated with the installation and maintenance of *consumer mains cable shall* be carried out in accordance with the [WAER](#), AS/NZS 3000, AS/NZS 3008 and these *requirements*. Un-metered sub-main cables *shall* be considered as *consumer mains cable* for the purposes of this [section](#).

The *network operator* reserves the right to determine the location of the *consumer's point of supply (connection)* (PoS), and the method for termination of *consumer mains cable* to that PoS where the *requirements* are not specified.

Where an *electrical installation* is connected to an overhead *network distribution system* via an *overhead service cable* the connection *shall* be deemed to be unprotected for the purposes of determining compliance with AS/NZS 3000 clause 3.9.7.1. PVC/PVC cable installed in HD conduit is deemed to satisfy this *requirement*.

### 12.6.2 Consumer mains cable sizes

The size of *consumer mains cable shall* be selected in accordance with the *requirements* of the [WAER](#), AS/NZS 3000, AS/NZS 3008 and these *requirements* inclusive of [clause 12.6.3](#).

Subject to the *requirements* of [clause 11.9.3](#), (which permits a larger conductor for pre-wired panels), the size of *consumer mains cable shall* be constant from the *point of supply (connection)* as nominated by the *network operator* to the line terminals of the *consumer's main switch(es)*.

[WAER](#) section 9 specifies the minimum current carrying capacities and conductor sizes for *consumer's mains cable* being not less than 10mm<sup>2</sup> for single-phase and 6mm<sup>2</sup> for three-phase with minimum per phase ratings, as shown in the following table:

Single domestic installations	
Single-phase	63 A
Split/multi-phase	32 A
Multiple installations which incorporate a domestic installation	
Single-phase	63 A
Multi-phase	63 A

**Table 15:** Consumer mains cable ratings

For the purpose of calculating wiring system current-carrying capacity installed in roof spaces, it *shall* be assumed that thermal insulation, if not installed, will be installed at some point in the future.

Cables installed within a *consumer pole shall* be classified as being enclosed in air.

### 12.6.2.1 Paralleling of conductors

It is permissible to convert a three-phase *consumer mains cable* to single-phase by connecting the conductors in parallel. The cable *shall* be de-rated for two circuits in parallel with the appropriate coloured sleeving fitted over the outer sheath of the conductors at each end as a means of phase and neutral identification.

**Note:** The use of earthing conductors as either an active or neutral conductor is strictly forbidden regardless of the circumstance.

### 12.6.3 Voltage drop/rise

For the purposes of calculating *voltage* drop/rise, the assessed component across *the consumer's mains cable shall* be calculated in accordance with AS/NZS 3000 and 3008.1. Refer to [clause 5.13](#) for additional information on *voltage* rise.

### 12.6.4 Acceptable wiring systems

#### 12.6.4.1 Connected to overhead distribution system

The *consumer's* (PoS) and (PoA) may be located either on a *consumer pole* or on the principal frontage of *consumer's premises* or structure. The *consumer's main switchboard* (MSB) may be located adjacent to or remote from the *point of supply (connection)*. The *consumer mains cable* or sub-main cable may be installed:

- Internally or externally on the *consumer pole*
- Unenclosed in air at the *point of supply (connection)* if UV stabilised
- Where approved underground from the pole to the MSB
- Internally within *premises* roof space, brick cavity, cladding or stud wall
- Externally on a *premises* wall

Prior to the release of the 2007 edition of AS/NZS 3000, *network operators* accepted unprotected double PVC insulation wiring systems as a means of connection from the overhead PoS to the MSB where the cable was not installed underground or in metal conduit. Single insulated cables in metal conduits may have been used as *consumer mains cable* where rated service fuses were installed and maintained by the *consumer*.

These installations are no longer permitted for new connections or where maintenance, replacement is required. It is recommended that such wiring systems be replaced and upgraded to conform to the current industry and *network operator technical requirements*.

In all cases the *electrical contractor shall* assume that, unless formally advised otherwise, an incoming *overhead service cable* is not protected by an upstream *network service protection device*.

### 12.6.4.2 Existing overhead installations

Single insulated unsheathed cables *shall* not be installed in steel conduit, *consumer poles* or unenclosed in air at the *point of supply (connection)*. Double insulated PVC cables are acceptable within steel *consumer poles* where the cable entry and exit points are appropriately bushed and sealed.

Existing single insulated cables fixed in PVC conduit externally on a pole, within a *premises*, structure or roof space are permitted to remain in service if the installation satisfies the applicable standards when first installed and are confirmed as being operationally safe.

Where *repairs* are required on existing *consumer mains cable* installations the *electrical contractor shall* ensure that the following *requirements* have been implemented:

1. cables are identified “electrical orange” either by enclosure colour, cable sheath or by permanent banding at each termination point and at intervals of 2m along the cable route where it is accessible;
2. all conductors forming a part of the *consumer mains cable* installation *shall* be enclosed within one sheath or specific enclosure;
3. the *consumer mains cable* is fixed and retained in a permanent position in accessible parts of the installation; and
4. both single and double insulated *consumer mains cable shall* be enclosed in UV stabilised conduit and fittings, free from mechanical damage where the cables:
  - a. enter the *mains connection box* mounted on a raiser bracket;
  - b. are within 2.5 metres of the finished ground level or open to view;
  - c. are installed on the exterior of a *premises*, structure or under open eaves; and
  - d. are installed on the outside of the *consumer’s pole*.

**Note:** Where an existing *consumer mains cable* consists of single insulated cables enclosed in UV stabilised conduit the supply arrangement *shall* be protected upstream by a *network* service fuse and downstream by an SPD.

Where single insulated cables were installed in steel conduit goose necks, they *shall* be protected by *network* service fuses or preferably upgraded to comply with current *network operator technical requirements*. Where extensive maintenance/renovation is required the *network operator* may require the *consumer* to convert the connection to underground.

### 12.6.4.3 Connected to underground distribution system

The *consumer’s point of supply (connection)* will be located within a *pillar, pit, wall mounted unit, frame/kiosk or substation*. For overhead systems the *consumer’s main switchboard (MSB)* may be located adjacent to or remote from the *point of supply (connection)*. The configuration of underground *consumer mains cable* is dependent on whether the:

- Cable(s) are protected/unprotected at the *point of supply (connection)*.
- Size, type and method of the connection.
- Location of the MSB.

Underground *consumer’s mains cables shall* be selected and installed in accordance with the *requirements* of the [WAER](#), AS/NZS 3000 and AS/NZS 3008. Steel wire armoured cable, category “B” systems as defined by the AS/NZS 3000 and the use of multi-stranded braided cable as *consumer mains cable* are not permitted under any circumstances. The use of flexible cable is subject to *network operator* approval. Refer to [clause 11.3](#).

The use of quick set or drying concrete to encase or protect electrical conduits as a part of a category “C” wiring system shall not be used, given the detrimental effect of such products on *electrical installations*.

#### 12.6.4.4 Connections within substations or switchrooms

In addition to the *requirements* of this [section](#) the *consumer mains cable* shall be supplied and installed by the *consumer* in accordance with the *requirements* of [clause 14.4.9](#) and any additional *network operator requirements* forming part of the *connection agreement*. Excavation and installation of the *consumer mains cable* within the *network* equipment site footprint shall be coordinated with the *network operator*.

#### 12.6.4.5 Consumer mains cable upgrade minimum requirements

The following minimum *requirements* are to be completed when initiating an upgrade of a *consumer mains cable* installation. This includes retro-undergrounding work, single to three-phase conversions and *consumer mains cable* replacements:

1. the MEN connection shall be located and confirmed at the *consumer's* main neutral link;
2. the main earth conductor is upgraded in accordance with AS/NZS 3000;
3. the continuity and condition of the main earth conductor to the installation water pipe and earth electrode, is proven;
4. minimum rear meter panel clearances shall be confirmed, refer to [clause 11.4.5](#);
5. *service/meter protective device* complies with these *requirements*;
6. existing metal work associated with the installation is bonded to earth;
7. all metallic switchboards and meter enclosures are bonded to earth with a bonding conductor not less than the size of the incoming neutral conductor. (The *load* neutral conductor *must* be the same size as the incoming line neutral conductor; and
8. *consumer* DIN kits are to be bonded to earth.

#### Note:

- Upgraded *consumer mains cable* and the associated *electrical installation* work shall comply with the current versions of AS/NZS 3000, the [WAER](#) and these *requirements*.
- The *point of attachment* (PoA) shall be in accordance with this [section](#).
- Any existing internal electrical work, other than that listed above, is deemed to comply, provided it is in accordance with the minimum wiring standards applicable at the time of installation and deemed safe to remain connected.
- *Network metering equipment* has been phased out (sequence) prior to *site* re-energisation.
- *Load* and earth loop impedance tests are completed to confirm continuity and effectiveness of the connection arrangement.
- Phase rotation checks both prior to and after the installation upgrade confirm correct equipment functionality.
- Labelling complies with [WAER](#) section 3 including house, unit or *lot* numbers.
- *Site* plans with cable locations are placed in the *consumer main switchboard*.

#### 12.6.5 Location

The *consumer* is responsible for the ensuring common property and or easements are created to facilitate installation and connection of *consumer mains cable* to the *point of supply (connection)* and/or sub-main cable installation and connection to the *site main switchboard*. Refer to [clause 6.8](#).

*Consumer mains cable* associated with one *lot* shall not extend into an adjacent *lot* except where required to be connect into the PoS located on the adjacent *property boundary*. Refer to [WAER](#) section 9.

*Consumer mains cable* may only cross into a road reserve when required to be connected to a *point of supply (connection)* or *substation* located within that reserve or where a local government agency (LGA) or relevant road authority grants approval for the installation of an unmetered supply.

*Consumer mains cable* shall not be installed in or across a gazetted roadway.

Underground cables *shall* run parallel to or perpendicular to *property boundaries* and *shall* be within 1 metre of those boundaries. For multiple unit *developments* underground cables may be installed immediately alongside or under access ways or driveways servicing the associated *electrical installation*.

The *consumer* is responsible for locating all underground services prior to the installation of the *consumer's mains cable* and for costs associated with any rectification works required, resulting from or due to the nature of that work.

Prior to the installation of any underground cable the *consumer shall* confirm all final finished ground levels to ensure that cables are buried to the correct depth. Failure to do so may result in reworking of the installation to the required standard at the *consumer's* cost.

### **12.6.6 Separation from other services**

As prescribed at [clause 12.5.3](#) *low voltage* underground wiring systems *shall* be spaced in accordance with AS/NZS 3000 table 3.7 and clauses 3.9.8.4 and 3.11.5. Where utility cables are installed in road reserves, separation for other services *shall* be in accordance with the [Utility providers code of practice](#). Refer to [clause 6.6](#) for details.

The installation of gas metering equipment *must* not be installed in:

1. a room primarily designed to house *network metering equipment, distribution system equipment* and or *consumer* electrical infrastructure; or
2. a position:
  - a. within 1 metre of *electrical equipment* capable of providing a source of ignition; or
  - b. to *metering equipment*, unless the gas/electrical meters, are installed in separate and adequately ventilated housings/compartments.

For detailed information on the requirements refer to or contact Building and Energy.

### **12.6.7 Identification of consumer's mains**

In addition to the *requirements* of the [WAER](#) and AS/NZS 3000, all conductors terminated to *consumer* and *network equipment* *shall* be colour coded to permanently identify each active conductor and neutral conductor. The use of Insulation tape is not an accepted means of identification.

**Note:** Sleeved earth conductors *shall* not be used as either active or neutral conductors.

#### **12.6.7.1 Neutral identification**

In all cases the neutral conductor *shall* have black insulation or a conductor with black sleeve. Where sleeving is required, it is to extend for single core cables, 300mm back from the termination point and for multiple core cables from the glove to the termination point within the connection facility.

#### **12.6.7.2 Active identification**

In all cases the active conductor *shall* have active colour insulation or a conductor sleeved with an active colour as required by AS/NZS 3000. Where sleeving is required, it is to extend for single core cables 300mm back from the termination point and for multiple core cables from the glove to the termination point within the connection facility.

#### **12.6.7.3 Phase identification**

In the case of polyphase supplies, the *consumer mains cable* shall be permanently identified to confirm individual phase colours. Where the active conductors as described in [clause 12.6.7.2](#) are not the correct phase colours, a minimum length of 100mm sleeving in the correct phase colour *shall* be used to identify the conductor at the termination point.

### 12.6.7.4 Underground locations

Underground cables *shall* be marked and recorded in accordance with AS/NZS 3000 and the [WAER](#).

### 12.6.7.5 Labelling

*Consumer mains cable shall* be labelled as prescribed in [clause 12.9](#). A *network operator* may accept marking the outer sheath of *consumer mains cable* with an indelible marker where there is insufficient space within a *pillar* or *pit* to fit a durable tag. The label *shall* be clearly visible and positioned so as to be legible without having to manipulate the cable.

### 12.6.8 Jointing consumers mains

Joints in *consumer mains cable* are not permitted unless approved by the *network operator*, subsequent to the submission of a “preliminary notice”.

If jointing is unavoidable and approval has been granted, the *electrical contractor* may join a *consumer mains cable* by means of a full enclosed cast resin or a gel design jointing kit that ensures the same level of protection as that prescribed by WAER Section 5 and AS/NZS 3000.

The joint *shall* be located in a position that ensures unrestricted access, for the life of the *electrical installation*, within a *pit* or similar appropriate enclosure. Where the depth of the joint would exceed the confines of the enclosure (E.g. > 600mm over the entire cable route length) it may be direct buried.

The joint location *shall* be clearly identified and recorded on the *site* “as installed” drawings, in accordance with the *requirements* of AS/NZS 3000 and any addition specified *network operator* conditions. A “notice of completion” *shall* be submitted to the relevant *network operator* as required by the Electricity (Licensing) Regulations 1991.

### 12.6.9 Termination of consumers mains

All cables, terminals and equipment *shall* be treated as “LIVE” until such time as each individual person required to work on that part of the *consumer’s electrical installation* has personally confirmed the de-energised status of the installation. Only those persons authorised by the *network operator* to terminate cables to *distribution network* equipment *shall* do so.

*Low voltage consumer cable* entry points into *distribution network* equipment *shall* be supplied from underneath either via a conduit, service duct or steel/concrete base or culvert. No entry holes, unless approved by the *network operator*, *shall* be made in the bases or housings of *network* equipment.

*Consumer mains cable shall* be enclosed in rigid or flexible heavy duty conduit at the point of entry into a *network pillar, pit* or *substation*. Where the final connection is completed by the *network operator*, the cable and conduit tail *shall* be installed alongside the *network* equipment with sufficient length to enable installation and allow the wiring system to be positioned as required to suit connection conditions.

All cable and duct entry points *shall* be sealed to prevent the spread of liquids and vermin through the conduit or ducting system into *network* equipment.

*Consumer’s mains cable shall* be of sufficient continuous length to effect a connection between the *consumer’s main switchboard* and the *point of supply (connection)* without the need for joints or undue stress being placed on the cable and terminations.

#### 12.6.9.1 Balanced loads

*Consumer electrical installations* serviced by either a split or three-phase *connection service shall* be electrically balanced over all phases in accordance with the *requirements* of [clause 10.7](#) and [section 15](#).

### 12.6.9.2 Single-phase pillar connection formula

*Network operators* encourage the use of the following formula to determine the appropriate phase within *network distribution pillars* and *pits* for a single-phase *consumer's mains cable* connections:

Divide the street/lot number by 3 to determine the phase connection (result). Where the street/lot number is less than 3 treat the number as the result.

- Equal division 0 = Red Phase
- Remainder of 1 = White Phase
- Remainder of 2 = Blue Phase

St/lot#	Division	Result	Phase	St/Lot#	Division	Result	Phase
30	3	0	Red	31	3	1	White
32	3	2	Blue	33	3	0	Red
34	3	1	White	35	3	2	Blue
36	3	0	Red	37	3	1	White
38	3	2	Blue	39	3	0	Red
40	3	1	White	41	3	2	Blue
<b>Note:</b> For higher numbers the same applies. E.g. 220 Red – 221 –White – 223 Blue							

**Table 16:** Example single phase pillar connection formula

### 12.6.9.3 Connection authorisation

Subject to meeting specific eligibility criteria, a *network operator* may authorise an *electrical contractor* to terminate a *consumer mains cable* at a *point of supply (connection)* within a *pillar* or *pit*, where the connection is for a whole current metered installations up to and including 100A.

**Note:** Contractors authorised to terminate *consumer mains cable* on Horizon Power *networks* may only do so when directed to by Horizon Power. Every termination *must* be preceded by an instruction from Horizon Power.

If the *electrical contractor* is not authorised to terminate *consumer mains cable* at the *point of supply (connection)* the final connection *shall* be completed by the *network operator* (fees may apply). For *pillar* or *pit consumer mains cable* terminations, tails of sufficient length (approximately 1m) *shall* be located adjacent to the *pillar* or *pit*.

The cable *shall* be marked as specified. Cable ends at the *point of supply (connection)* shall be sealed and protected by means equivalent to double insulation and in accordance with AS/NZS 3000 to prevent inadvertent contact with live parts.

The *consumer mains cable* at the *consumer's* switchboard *shall* be terminated with both the SPD and the *consumer's* main switch(es) tagged and locked in a de-energised state (OFF position) before the connection application is made.

All *consumer mains cable* terminations at the *point of supply (connection)* for installations above 100A including all CT *metering installations*, will be completed by *network operator* personnel in conjunction with the *consumer's electrical contractor*. The *electrical contractor shall* provide sufficient personnel to assist with the termination process and *shall* provide suitable cable lugs and associated ancillary equipment including crimping tools at no cost to the *network operator*.

#### **12.6.9.4 Tunnel terminations**

Where a multi-point terminal block is provided in *network* equipment, only one wire of a *consumer mains cable* shall be terminated in each tunnel of the terminal block. If there is insufficient vacant tunnels to complete the termination the *electrical contractor* shall complete the connection as detailed in [clause 12.6.9.8](#).

When completing a connection at a *mains connection box, service and meter protection devices, metering* or related service equipment, stranded cables ends shall be, where able, twisted and doubled before insertion into the terminal. Terminal screws shall be tight with the cable pull tested to prove a secure connection has been made. Flexible control and metering cables shall be lugged in accordance with [clause 11.3.5](#).

#### **12.6.9.5 Parallel terminations**

Doubling up of *consumer mains cable* cores in one terminal tunnel is not permitted as it is deemed unsafe with potential consequences for other *consumers*. Where unavoidable it is permissible to double up streetlight circuit conductors but not for conductors associated with a *consumer premises connection*.

#### **12.6.9.6 Horizon Power termination references**

For further information and guidance on Horizon Power's termination *requirements* phone 1800 737 036 or e-mail [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

#### **12.6.9.7 Western Power termination references**

Cable entry and termination details can be obtained from Western Power's [Distribution construction standards handbook](#) or the [Distribution substation plant manual](#).

#### **12.6.9.8 Insufficient terminals**

Where an *electrical contractor* is authorised to carry out connections within a *pillar*, the contractor shall confirm that there is adequate termination capacity for the *consumer's main cable*. [WAER](#) section 5, requires that each cable core is terminated in an individual tunnel of the terminal block.

Where there is an insufficient neutral terminals, the authorised *electrical contractor* shall install an additional Alstom CB6 neutral terminal block. The *network operator* will, on application, fit additional neutral terminals for non-approved *electrical contractors*.

Where there is insufficient active terminals, *electrical contractors* shall in all cases notify the *network operator* to arrange for the installation of additional terminals to facilitate the connection of the *consumer mains cable* by either the approved *electrical contractor* or the *network operator*.

Only *network* approved equipment is permitted for use in *pillars* and *pits*. Under no circumstances shall an *electrical contractor* install circuit breakers or fuses within a *network pillar* or *pit*. Additional active terminals shall only be fitted by *network operator* personnel.

#### **12.6.9.9 Testing**

*Consumer electrical installation* connections to a *network operator's distribution network* shall be tested in accordance with the *requirements* of AS 4741, with the test results recorded prior to that portion of the *network* or *consumer's installation* being energised.

Dependent on the specific *requirements* of an individual *network operator*, testing of connections completed by non-network personnel *must* be either witnessed or the test results logged using data recording instruments as specified by that *network operator*. For specific *requirements* pertaining to *network* "Service Apparatus Connections Scheme" and "Contractor Connect" Schemes refer to the *network operator's* website.

### 12.6.10 Minimum insulation resistance

The insulation resistance between conductors and between conductors and earth of *consumer's* mains *shall* comply with the minimum *requirements* of AS/NZS 3000.

### 12.6.11 Notification

Where an *electrical contractor* or their authorised representative completes the termination of *consumers mains cable*, the contractor *shall* where required provide the *network operator*, with details of the *point of supply (connection)*, location of the *pillar* or *network pole*, meter numbers and the installation address.

## 12.7 Protection

### 12.7.1 Service and meter protection devices

For specific information regarding the installation *requirements* for *meter protection* and *service protection devices*, refer to [sections 11](#) and [14](#) of these *requirements* and the [WAER](#).

### 12.8 Cable ducts and conduits

Ducts and conduits installed for the purposes of providing access for *consumer* or *network* equipment, dependent on the cable's function and location *shall* be installed in accordance with the relevant *network operator technical requirements*. Refer to [clause 6.9](#).

### 12.9 Labelling

[WAER](#) section 3 specifies that in addition to the *requirements* of AS/NZS 3000, *consumer mains cable*, switchboards and external *consumer electrical equipment* *shall* be labelled to identify the origin or destination of its supply source.

Labels *shall* be made of non-conducting material, able to withstand ultraviolet radiation, extreme weather and vandalism. They *shall* be indelible, durable, legible and suitably secured for the life of the installation.

### 12.10 Underground conversion

To minimise delays when seeking a changeover or conversion of an overhead *connection service* to an underground connection, it is recommended that the following steps are taken:

1. the *consumer* or agent *shall* confirm the submission of a valid connection application and *network operator*, application reference/project number;
2. the *consumer's* agent *shall* liaise with the *network operator* to confirm timeframes for the installation of the *point of supply (connection)* and energisation date;
3. on program confirmation the *electrical contractor* *shall* submit a "preliminary notice", for the overhead to underground conversion. (The reference number *must* be noted on the "preliminary notice");
4. the *network operator* will coordinate the changeover or conversion arrangements;
5. prior to the allotted date the *electrical contractor* *shall* install the new *consumer mains cable* and associated equipment, refer to [clause 12.6.9](#);
6. the *electrical contractor* in conjunction with the *network* crew *shall* facilitate the changeover inclusive of:
  - a. existing *overhead service cable* removal by the *network operator*; and
  - b. dependent on authorisation levels, the *electrical contractor* *shall* install the *metering equipment*;
7. on energisation of the underground *point of supply (connection)* the *electrical contractor* *shall* complete the connection process in accordance with their authorisation level and then submit the relevant notices; and
8. fees may apply where the *network operator* is required to fit the *metering equipment* and complete the *consumer mains cable* connection.

**Note:** Retention of the overhead service and connection after the installation and connection of the underground *network* service creates an unacceptable multiple *points of connection (supply)* arrangement.

Any overhead *network connection service* retained for a period exceeding 3 months following the installation of the underground *network connection service* may be disconnected and removed by the *network operator* at the *consumer, developer or contractor's* cost.

## **12.11 Other LV supply arrangements**

### **12.11.1 Distributed energy resource systems**

*Consumers* may supplement their *network connection service* with a privately owned *embedded generation* and or *energy storage system* forming part of a *distributed energy resource (DER)*, *alternative energy (AE) consumer electrical installation*. Refer to [section 15](#).

### **12.11.2 Standby/emergency supply**

*Consumers* may install a temporary standby/emergency power supply subject to compliance with these *requirements* and the [WAER](#).

### **12.11.3 Common loads**

*Adjacent consumers* may provide separate supplies to a common *load* such as a bore installed on the *property boundary*. Wiring *shall* be arranged so that only one supply can service the *load* at any one time and the two supplies cannot be interconnected. Refer to [WAER](#) section 9 for further information.

### **12.11.4 Short term events**

On application to the *network operator* a temporary supply arrangement for a fete, concert, exhibition or similar open-air short-term event, may be provided via a *network* connection subject to that *distribution network* having sufficient capacity.

The organiser *shall* arrange for an *electrical contractor* to assess the calculated maximum demand and submit a "preliminary notice" to the *network operator*.

If the demand is such that the requested capacity cannot be provided from the permanent network property supply, the "preliminary notice" should request a short-term supply, indicate the estimated calculated maximum demand and state the period for which supply is needed.

If it is proposed to use temporary *onsite generation systems*, either to supply the entire demand or to supplement a *network operator* supply, this *shall* be noted on the "preliminary notice".

If the event is held outside an area served by a *network operator*, a "preliminary notice" *must* be submitted to Building and Energy.

The *electrical installation shall* comply with these *requirements*, [WAER](#), AS/NZS 3000, AS/NZS 3002, applicable legislation, codes and related Australian Standards.

Care *shall* be taken not to create a multiple *point of supply (connection)* electrical hazard at one location/site. Where two or more *points of connection (supply)* are present, the *requirements* of [WAER](#) section 3 *shall* be applied.

### **12.11.5 Builders supplies**

The Work Health and Safety regulations 2022 (Regulation 163), specify the *requirements* for work carried out on construction *sites*.

In addition to these *requirements* temporary power supplies *shall* be installed in accordance with the relevant legislation, standards and codes including but not limited to [WAER](#), AS/NZS 3000 and AS/NZS 3012.

Subject to the availability of suitable *network distribution system* near the construction *site* and any specific *connection service requirements*, a *consumer* may request a temporary power supply connection via one of the following options:

- Underground builder's supply pole and switchboard.
- Temporary independent construction switchboard.
- Permanent switchboard and meter position.
- Overhead *consumer pole* and switchboard.
- Temporary *low voltage* frame connection.

The use of electricity on construction *sites* *must* comply with statutory *requirements* administered by Building and Energy and WorkSafe WA including but not limited to the protection of circuits by RCDs, testing of protective devices and tagging of *electrical equipment*.

Only one temporary power supply connection may be made to a *point of supply (connection)* on a *lot*. Multiple temporary *points of connection (supply)* are not permitted. All *site* power *shall* originate from the one *consumer* switchboard (MSB) connected to the *point of supply (connection)* and *shall* not cross into an adjoining *lot*. A *network* connection asset is not permitted to be located in the road reserve where it supplies more than one *consumer*.

To avoid the existence of multiple *points of connection (supply)* to a *site* the temporary supply *shall* be disconnected at the time of connection of the permanent supply unless prior arrangements have been made by the *consumer* for the retention of the supply and appropriate safety procedures as specified by [WAER](#) in section 3 and these *requirements* are implemented.

Temporary or permanent alternative/*distributed energy resources* *shall* not be used or connected to a *consumers' electrical installation* that is either supplied by or connected to a temporary builders or non-permanent electricity supply.

#### **12.11.5.1 Builder's supply (stub) pole**

This type of supply generally consists of *network connection service* and *metering equipment*, together with *consumer* equipment and power outlets, installed in an enclosure mounted on a steel post. The pole and enclosure *shall* be located inside the *consumer's property boundary*, adjacent to a *network pillar*, outside and away from the exclusion zone.

##### **Note:**

- *Network metering equipment* is no longer transferable from one *site* to another.
- "Portable builder's supply schemes" were closed in December 2015 with all related *metering equipment* having been returned to the relevant *network operator*.

#### **12.11.5.2 Temporary, independent switchboards**

Where one or more temporary switchboards are installed for the purposes of supplying temporary construction power, the switchboards *must* be physically independent of the *premises* or structures under construction. Construction energy from the *network* *shall* supply the first and nearest *site* switchboard to ensure multiple *points of connection (supply)* are not created.

Care *must* be taken with regard to the position, physical protection, and identification of the switchboard(s) and supply cables to ensure and avoid the creation of electrical hazards or damage during the construction phases of the project.

No part of the permanent *electrical installation* *shall* be used for this type of temporary power arrangement or energised prior to the:

1. completion of the *premise's* structure including roof, ceiling and walls;
2. a "notice of completion" being submitted for that portion of the work which is to be energised; and
3. the temporary supply has been disconnected.

### 12.11.5.3 Use of permanent installation

Elements of the permanent *electrical installation* may be used to provide a temporary electrical supply for construction purposes, subject to fulfilling the regulatory and *network* conditions as specified in these *requirements*. In summary those conditions require:

1. permanent *consumer mains cable* and *main switchboard*, including meters to be installed;
2. Service and *consumer mains cable* routes identified in accordance with these *requirements* and AS/NZS 3000;
3. *point supply (connection)* and *main switchboard* to be clearly identified as being “Live”
4. individual construction supplies *shall* originate from one or more socket outlets installed in the *main switchboard*;
5. use of permanent *electrical installation* and circuits to supply temporary power is not permitted however it is acceptable to install a temporary sub-main to an external temporary construction switchboard from the permanent *main switchboard*;
6. any temporary wiring to be physically and electrically isolated from the permanent *electrical installation*;
7. any exposed portion of the live permanent *electrical installation* to be protected from the adverse effects of construction activity and environmental influences (enclosed);
8. any electrical work either temporary or permanent *shall* be carried out with the supply switched off and secured;
9. permanent *electrical installation* is not energised until the building work reaches *practical completion* or is secure and has been checked and tested; and
10. submission of a “notice of completion” for the portion of the work to be energised in accordance with the Electricity (Licensing) Regulations 1991.

### 12.11.5.4 Consumer pole and switchboard in an overhead area

In limited situations the *network operator* may provide a temporary overhead connection to a temporary *consumer pole* for the purposes of providing a temporary power supply. The pole and switchboard construction and installation *shall* be as prescribed in these *requirements*.

### 12.11.5.5 Temporary low voltage frame connections

Subject to receipt of a *consumer’s* formal application, a *network operator* may permit the connection of a temporary power supply to a *low voltage network* distribution frame for the purposes of supplying temporary power to a construction *site*.

The temporary supply *shall* be:

1. as prescribed by the appropriate standards including but not limited to [WAER](#), AS/NZS 3000, AS/NZS 3012 and these *requirements*;
2. via a *consumer mains cable* rated to the connected LV frame circuited protection and AS 3008;
3. through an SPD with a kA rating equal to or greater than the *network* fault rating for single *network* transformer configuration;
4. connected (disconnected) to the LV frame by *network operator* personnel; and
5. such that no second or multiple *point(s) of supply (connection)* are created to the *lot*.

### 12.11.6 Un-metered supplies

An un-metered connection and supply is available to specific *consumers* subject to the conditions and *technical requirements* as detailed by the *network operator*.

The *consumer* is responsible for ensuring that the *network operator's* criteria are met and for providing formal acknowledgement of their compliance and acceptance of the *network operator's* terms and conditions.

An un-metered supply (UMS) may be provided for *consumer's electrical equipment* or device where the following criteria are satisfied:

1. the energy usage is consistent and can be readily estimated;
2. the *consumer's* equipment or device requires a single-phase connection where the calculated maximum *load* does not exceed the *network operator* limits for either 1.0kW (HP) or 4.8kW (WP);
3. the *load* is not subject to *consumer* control variations (i.e. water pumping or air conditioning);
4. the required supply is not of a short duration (i.e. fetes, fairs and festive lighting);
5. the *point of supply (connection)* for the *consumer's* equipment/device is installed on public land or within a road reserve;
6. the *consumer's* equipment/device is on the same side of the road, visible from and no more than 30 metres from the designated *point of supply (connection)*;
7. the *consumer's mains cable* supplying the *consumer's* equipment/device is installed underground;
8. each un-metered supply is effectively labelled in accordance with the *requirements* of [WAER](#), AS/NZS 3000 and the *network operator's technical requirements*; and
9. it is not physically practical or commercially viable to install a metered connection (optional).

#### 12.11.6.1 Horizon Power requirements

For further information and guidance on Horizon Power's *requirements*, refer to the [Unmetered supply standard](#).

#### 12.11.6.2 Western Power requirements

Western Power has published the [Un-metered supply standard](#) which outlines the criteria to be met and defines the required *network* standard together with supply terms and conditions.

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# **Service and Installation Requirements**

## **Section thirteen**

### **High voltage distribution systems**

## 13 High voltage distribution systems

### 13.1 Scope

This [section](#) details the *requirements* for the connection of *consumer's* three-phase *electrical installation* at *distribution voltages* up to and including 33kV. These connections types are dependent on a range of factors including but not limited to operational tariffs, *network* availability/access, and *consumer load*, *embedded generation*, *energy storage system* characteristics/requirements.

The intent of this [section](#) is to ensure that each *consumer's high voltage* installation:

- Utilises equipment fit for the purpose.
- Is safe for operational personnel and not hazardous to members of the public.
- Operates in a manner that does not adversely affect the *distribution network* or other users connected to that *network*.
- Is maintained in accordance with the Building and Energy's [Safety guideline](#) and these *requirements*.

The *consumer shall* appoint appropriately qualified and skilled person(s) who *shall* be responsible for the design, HV submission lodgement, construction, commissioning, operation and maintenance of the HV installation.

The provision of an appropriate HV submission to the *network operator* is required prior to any works commencing. Refer to [clause 13.7](#).

Switching and maintenance of *high voltage* installations *must* only be undertaken by persons trained, qualified and skilled to do so. Refer to [clause 13.12.6](#).

*Consumers* connections at *transmission voltages* of 66kV and above are outside the scope of these *requirements*. The relevant *network operator* is to be contacted for assistance and specific information applicable to their connection at *transmission voltages*.

This [section](#) is to be read in conjunction with the [WAER, Guidelines for the Safe management of high voltage electrical installations \(Safety guideline\)](#), AS/NZS 3000, AS 2067, these *requirements*, *network operator's technical requirements* and *shall* be applied to all *altered* or modified existing and new installations. Elements of this [section](#) *shall* also apply to *large scale consumer electrical installations* as prescribed in [section 15](#)

### 13.2 Responsibilities and contractual arrangements

*Consumers* seeking to *alter* an existing connection or require a new, *high voltage* or *large scale network connection* are required to enter into a:

1. formal *contract* or agreement with the *consumer's* electricity *retailer*; and
2. specific *connection agreement/contract* and operating agreement/protocol with the relevant *network operator*.

The provision of a *high voltage* or *large scale* connection will depend on:

1. *network* availability and constraints;
2. compliance by the *consumer* with:
  - a. regulatory *requirements* including but not limited to the [WAER](#) and [Safety guideline](#); and
  - b. the *network operator's technical requirements*, operational procedures and applicable management plan(s);
3. generation capacity at stations within the Horizon Power's Grid or NIS *network*;
4. the location of the connection in relation to an *electrical licence area boundary* (ELB);

5. acceptance by the *consumer* of any direct, indirect or ongoing costs associated with:
  - a. fees, deposits, charges or capital contributions as required by the *network operator*;
  - b. transformer energy losses;
  - c. purchase of *high voltage* operational, testing and maintenance equipment that ensures the safety of personnel and the installation;
  - d. provision of spare equipment;
  - e. insurance, interest and depreciation; and
  - f. the *consumer's electrical installation* being adequately maintained to safeguard against the creation of safety hazards or interference with the *network operator's distribution network*.

Where the proposed new or *altered* supply arrangement includes *embedded generation*, co-generation or *energy storage systems*, a separate application for the generation/storage component is required inclusive of protection arrangements, connection, operational detail and *contract* conditions.

For existing supply arrangements an application is required where:

1. a *load, generation* increase is proposed or the existing *load* exceeds the *contract* or agreed limits;
2. a *consumer's electrical installation* is proposed that incorporates the addition of *embedded generation*, grid connected *inverter*, co-generation, *energy storage system* or *alternative energy source/ point of supply (connection)*;
3. supply negotiated and allocated to a *developer* is less than the proposed *load*; and
4. extra phases or capacity to an *electrical installation* is sought or the proposed type of supply is not available.

### **13.3 Consumer expenditure**

A *consumer* should not initiate any equipment procurement, construction or installation expenditure until an application has been lodged and formal response received from the *network operator* advising on the availability of a suitable HV, *point of supply (connection)* together with details of applicable conditions relating to the provision of that connection.

This *requirement* also applies to existing installations where *alterations* or additions dictate, *augmentation* of the *distribution network* or modification of the *point of supply (connection)*.

### **13.4 Supply parameters**

The *network operator* will negotiate the type of connection and *voltage* of that supply arrangement with regard to the proximity of its *low/high voltage distribution network* to the *consumer's* requested *point of supply (connection)* and the nature of the *consumer's load*, generation configuration. The *network operator* will nominate the connection *voltage* as a part of the *contract* negotiations.

Where *consumer* supplied transformer(s) are connected to the *network operator's distribution system*, the transformer's *voltage* tap settings *shall* be determined by the *network operator* in consultation with the *consumer*.

#### **13.4.1 Individual network parameters**

##### **13.4.1.1 Horizon Power**

Connections to Horizon Power's *high voltage distribution networks* will be either at 11kV, 22kV, 33kV at 50 Hertz (cycles per second). - *High voltage distribution networks* at 6.6kV are semi-redundant and are limited to the MRO system at the Murchison Radio-astronomy Observatory.

No new connections are available at 6.6kV. The *consumer* is required to contact the local regional office to determine the configuration of the supply arrangement.

### 13.4.1.2 Western Power

Connections to Western Power's *high voltage distribution network* will be at either 22kV or 33kV at a nominal frequency of 50 Hertz (cycles per second).

*High voltage distribution networks* at 6.6kV and 11kV are limited to systems in and around the Perth/Fremantle CBDs, Geraldton/Kalgoorlie town sites and Kalbarri. Connections in these areas are subject to prior approval.

## 13.5 Connection arrangements

The normal supply arrangement will be via a single *high voltage* feeder and *point of supply (connection)* to the *consumer's* installation/property including *consumer developments* across on one or more adjacent titles or a multi-tenanted *developments*, whether it be a staged *development* or not.

Property owners or *consumers* with multiple *point of supply (connection)* (PoS), unless approved otherwise will be required to rationalise these PoS to one point when a major upgrade or addition to the installation is undertaken. This also applies where properties with individual PoS are combined into one *development*.

**Note:** Multiple PoS where permitted *must* be at the same system *voltage*.

The *consumer* is required to pay all costs associated with the provision of the *point of supply (connection)* PoS. Agreement *shall* be reached on the PoS arrangements with the *network operator* prior to any work commencing.

The *consumer's high voltage* installation *shall* commence at the *point of supply (connection)*, which will be the agreed *connection point* between the *consumer* and the *network operator*.

Typically, the *point of supply (connection)* may be taken as being one of the following:

- Bus sectionaliser or isolator *load* terminals within a *network operators* HV switchgear assemble for an indoor ground mounted *substation*.
- Isolator *load* terminals within the *network operators* HV switchgear and *network metering* unit for outdoor ground mounted *substation*.
- *Load* terminals of the *network operator's* overhead switch and *network metering* unit
- HV terminals as nominated in the access agreement.
- As otherwise determined by the *network operator*.

Dependent on the nature of the *consumer's* supply arrangement and security levels, the *network operator* may provide an additional *high voltage* feeder to the *point of supply (connection)*. Provision of an additional feeder to the PoS is subject to:

1. magnitude of the *consumer's* load/generation requirements;
2. position/location of the *distribution network* in relation to the *consumer's* connection;
3. access arrangements for *network* and *consumer* personnel;
4. there being no operational and safety concerns; and
5. appropriate electrical and mechanical systems being implemented to ensure compliance with the *network operator's technical requirements* for paralleling of *high voltage* feeders.

### 13.5.1 Control of incoming HV supply

As a minimum, the *consumer's electrical installation* *must* have a single main switch for each incoming supply. The main switch *shall* be fitted with a protection system which is compatible with the *network operators* HV protection system. Refer to [clause 13.9](#) for details of equipment requirements.

### 13.5.1.1 Paralleling of HV supplies

Paralleling of *high voltage* feeders is not permitted on Horizon Power or Western Power *distribution networks*.

Western Power has a minor number of legacy large *consumer* arrangements that permitted paralleling of *high voltage* feeders to facilitate the transfer of the *consumer's network* connection without interruption.

New connection arrangements *shall* be designed and constructed to ensure paralleling is not required.

### 13.5.1.2 Back-feeds

Where the possibility exists within a *consumer's electrical installation* for a back-feed into the *distribution network* or for earth potential rise, then appropriate steps *shall* be taken by the *consumer* to prevent such occurrences. The *consumer shall* provide detailed information in the *consumer's* "submission" as to how it is proposed to prevent such occurrences.

## 13.5.2 Power factor correction

A *consumer*, unless exempted, *shall* ensure that the power factor of their *electrical installation*, as measured at the *point of supply (connection)*, is not less than the values prescribed in clause 10.8 or as agreed with the *network operator*.

Effective power factor control reduces energy costs, increased plant capacity and utilisation including improved *voltage* regulation.

Compliance is required with the relevant parts of AS/NZS 61000 Electromagnetic Compatibility (EMC) with respect to harmonic limits and *voltage* fluctuation limits during steady state operation and switching conditions. Refer to [section 10](#) and [clause 10.9](#) for additional information

The *consumer* should allow for power factor correction equipment in the initial design to ensure correct power factor is attained at all *metering points*

Power factor correction proposals *shall* include a single line diagram, calculations and documentation to demonstrate compliance with these *requirements*. The information submitted *must* include but not limited to:

- Equipment ratings.
- Capacitor switching step sizes.
- Harmonic current and *voltage* content at the *point of supply (connection)*.
- Natural resonant frequency of the installation.
- Magnitude and duration of inrush currents and transient *voltages* during switching.
- Details of any capacitor protective devices.

All power factor correction equipment *shall* comply with relevant Australian standards with appropriate allowances for over *voltage* and overcurrent due to harmonics and resonance.

Switching and fault isolation equipment *shall* operate on all phases simultaneously.

Power factor correction installation designs *shall* ensure motor self-excitation and reverse generation into the HV *network* does not occur. All capacitors *shall* have independent self-discharging facilities (not via fuses), with appropriate earthing arrangements in accordance with AS 2067 or as directed by the *network operator*.

Switchgear used for capacitor bank fault breaking/making, switching and isolation may have more onerous duty cycles than that used on general circuits, and therefore *shall* be suitably rated for capacitive currents, fault levels, and any associated over *voltages*.

Designers of the power factor correction equipment should also consider harmonic levels created with the *consumer's installation* or which may exist in the *distribution network*.

### 13.5.2.1 Fault isolation

Protection schemes that rapidly detect and isolate faults in the power factor correction installation so as not to adversely impact on the *network* should be used. Phase *voltage* imbalance protection across the capacitors *shall* also be provided.

### 13.5.2.2 Resonance mitigation

Appropriate measures *shall* be employed to avoid resonance within the *network* and to limit in-rush currents. These measures may include de-tuning reactors and resistors. The impedance values of this equipment *shall* be provided with sufficient adjustment capability (for example,  $\pm 20\%$ ) to cater for future *network* impedance changes that may arise from transformer tap changes or *network* feeder changes.

To prevent ferro-resonance, all HV switching *must* incorporate three-phase ganged switches.

### 13.5.2.3 Switching steps

On LV circuits, automatic control of capacitors *shall* not exceed 50kVAr steps. On HV circuits the allowable step size will depend on compliance with power quality limits.

### 13.5.2.4 Labelling

Prominent labels advising *consumer* and *network operator* personnel of the correct application method and discharge time duration to avoid electrical hazard *shall* be provided.

## 13.6 Connection conversion from low to high voltage

*Consumers* wishing to convert a *low voltage* supply arrangement to *high voltage* *must* negotiate the terms, conditions and method of connection with the *network operator* before finalising the installation's design, "HV submission", equipment purchases or commencement of construction.

The conversion of a *consumer's* connection to *high voltage* may also involve the transfer of ownership of *network* assets or may require the modification of existing HV equipment to comply with current *network operator's technical requirements* and safety standards. Matters to be considered *shall* also include:

- Replacement of the *network operator's* *substation* and other assets or purchase of this equipment, and
- Costs associated with converting the installation for compliance with applicable standards
- Where multiple *point of supply (connection)* exist, the conversion *must* occur for all PoS. Refer to [clause 13.5](#).

## 13.7 Installation design and submissions

Where a new, *altered* or upgraded *high voltage* connection is proposed, the *network operator* will need to assess the *augmentation*, extension impact on their *distribution system* with particular attention given to large, remote connections or un-reticulated locations.

A HV submission ("*submission*") notification is required when:

1. a new HV connection is required;
2. a connection of *large scale* plant/equipment is proposed or required;
3. changes in the calculated or *contract* maximum demand are requested which may require modification of the connection and or supply arrangement;
4. changes to the consumer main switch, protection settings or earthing configuration are required/requested; and or
5. potential disturbing *loads/generation* inputs are or may be introduced.

### 13.7.1 Preliminary information

The *consumer*, at the earliest possible opportunity, *shall* provide the following preliminary information to the *network operator* and advise their nominated *retailer* of their intent to seek, *alter* or upgrade a *high voltage* connection:

- A single line diagram of the proposed installation.
- An overall *site* plan showing the location of the HV equipment with zone diagrams where multiple *point of supply (connection)* are permitted.
- The preferred *point of supply (connection)* (in the case of a new installation).
- Existing point(s) of supply (in the case of an *altered* or upgraded installation).
- The anticipated cumulative maximum demand (MVA) required for the whole installation inclusive of all new or upgraded elements of the connection.
- Cumulative capacity and type of all proposed *onsite* generation.
- Any disturbing *loads* (e.g. large motors, arc furnaces, etc.).

Before preparing a full “submission” the *consumer’s* agent should obtain from the *network operator*, details of the availability and electrical characteristics of the *network* including generation capacity limits, to avoid issues arising from designs or equipment being found by the *network operator* to be unsuitable for connection.

### 13.7.2 HV submission and design (“submission”)

Where the *network operator* has agreed in principle to supply a new, *altered* or upgraded *high voltage* or *large scale installation* and or connection, the *consumer’s* agent is required to lodge a detailed HV design proposal, commonly called an “HV submission”. The “submission” *shall* contain detailed information for the complete HV installation both new and existing so that a comprehensive understanding of the *consumer’s* requirements can be evaluated.

The following sub-clauses are provided to assist and guide *electrical consultants* and industry through the submission process. These *requirements* are applicable for all *large scale installations* and 1kV to 33kV connection applications. For supply connections at *voltages* greater than 33kV inquiries are to be directed to the *network operator* via their “customer services” portals.

### 13.7.3 Standard format for submission of a HV proposal

In general, the following standard information is required for all “submissions”.

- **Cover page** incorporating project name, *network operator* reference number, name of the person preparing the “submission” and personal membership details (number) of the *professionally qualified electrical engineer* certifying the “submission”.
- **Synopsis of the project** including description of the project inclusive of proposed *load* and generation requirements.
- **Body of the “submission”**, addressing all items identified in this clause. Should an item be not relevant (e.g. fuse protection where a circuit breaker is used) then this *must* be explicitly noted in the “submission”.
- **Appendices** including operational procedures, maintenance schedules, drawings, zone diagrams (where applicable), protection grading curves and equipment data sheets.

It is a *network operator requirement* that a *consumer’s* “submission” be submitted using one of the following two methods. Option 1 is the preferred method for delivery and lodgement.

The “submission” *must* be forwarded in its entirety as certified by the *professionally qualified electrical engineer*. All documents *must* be certified and submitted collectively even if previously supplied to the *network operator*.

### 13.7.3.1 Option one electronic submission

The completed “submission”, including related appendices is to be lodged with the relevant *network operator* via their designated portal. The following file formats are the only acceptable methods for “submission”.

- Acrobat (PDF).
- MS Office compatible.

Unless prior approval has been granted by the *network operator*, any “submission” that does not comply with these formats will not be accepted or assessed.

### 13.7.3.2 Option two hardcopy submission

Where the *consumer’s* agent elects to prepare a hardcopy “submission”, it is to be lodged in the following format:

- Submit three (3) copies of the proposal to the *network operator*.
- The entire “submission” *must* be securely fastened and suitable for scanning.
- Unless otherwise approved, maximum page size *shall* not exceed A3.

**Note:** Hardcopy “submissions” may take longer to process and assess than “submissions” submitted electronically.

### 13.7.4 HV submission outline

The following outline is to be read in conjunction with the [WAER](#) section 7 and the [Safety guideline](#). A *consumer’s* HV installation *must* be designed by persons with engineering competence and qualifications with a practical understanding of the effects of *voltages* in excess of 1kV, high *load* implications and fault currents.

The “submission” *shall* as certified be submitted to the *network operator* for consideration before equipment is purchased and any construction commenced. The following details are to be included in the “submission”.

#### 13.7.4.1 Site plan

A locality plan *shall* be included, specifying the address of the installation and a geographic layout of major plant items including main switchroom, *metering equipment*, *generating units* and *points of connection (supply)* (zone diagrams where applicable).

#### 13.7.4.2 Single line diagram

A single line diagram showing all principal components, detailed information on *voltage* levels, protection devices, earth switches, switching operations (including interlocking sequencing), winding configurations and fault level gradients. The diagram *must* show the delineation between *network operator* equipment and the proposed *consumer’s* equipment.

#### 13.7.4.3 Load, generation and energy storage details

The “submission” *must* include system *voltages*, *load* details, maximum demand, *load* characteristics, power factor correction measures, large motor starting information and details on other disturbing *loads* or special *requirements*.

The “submission” *must* also include information on duty cycles for large items of plant and the expected operating regime for the installation. Details of disturbing *loads must* be shown including calculations for *voltage* fluctuations and total *voltage* harmonic distortion caused by the *consumer’s* installation.

Any disturbance to the *network must* meet the standards stipulated by the *network operator* including but not limited to power quality and general operational conditions for individual *consumers*.

This *requirement* incorporates but is not limited to the following *embedded generation* and *energy storage systems*:

1. solar photo-voltaic installations exceeding the 200kVA and 240kW capacity ranges specified in AS/NZS 4077.1 and AS/NZS 5033;
2. *battery energy storage system* (BESS) installations exceeding the 200kWh capacity range specified in AS/NZS 5139; and
3. wind turbine installations exceeding 200kW capacity.

#### **13.7.4.4 Protection, control of incoming & embedded generation/energy storage supplies**

The design “submission” *must* include details of fault levels assigned throughout the installation with calculations of the protection relay settings. General information on the protection equipment to be installed *shall* include but not limited to:

1. a control and protection schematic diagram of the circuit protection(s);
2. proposed location;
3. type of protection including make and model number;
4. rated *voltage* and current;
5. rated insulation level (lightning impulse withstand level);
6. minimum clearances in air - between phases and to earth;
7. type of closing mechanism:
  - a. whether trip free or fixed trip and with lock-out preventing closing;
  - b. rated supply and /or pressure of closing mechanism; and
  - c. details of any interlocking systems.

In addition to the general detail *requirements*, if the main switch is one or more HV switch-fuse units the “submission” *must* confirm:

8. rated short circuit making and breaking current of the fuses; and
9. current-time characteristic curves.

In addition to the general detail *requirements* if the main switch is a circuit breaker or re-closer the “submission” *must* include:

10. details of protection relays used, including:
  - a. make and type;
  - b. setting range;
  - c. characteristic curves drawn for the selected settings;
  - d. thermal ratings of input circuit; and
  - e. tripping and control supply details.
11. protection current transformer details including:
  - a. make and type;
  - b. primary and secondary current rating;
  - c. CT class; and
  - d. short time rating.
12. length and size of secondary circuit wiring or confirmation that total secondary impedance (including wiring impedance) does not go above the maximum secondary impedance that can be driven at the stated CT accuracy.

Where batteries are used to operate the circuit breaker’s trip mechanism, details *shall* also be provided on:

13. automatic charging equipment;
14. battery-condition indicators; and
15. under *voltage* alarm.

**Note:** CTs which utilise primary *voltage* tapping for ratio changes or CTs located within a transformer tank or bushings are not accepted. It is preferred that CT for overcurrent protection are located on the supply side of the circuit breaker.

The “submission” *must* also demonstrate safe grading with the *network operator’s* upstream protection as per [clause 11.6.4](#). Both the *network operator* and the *consumer* protection equipment time current curves *shall* be plotted and show that grading is achieved.

#### **13.7.4.5 Next line of protection**

The “submission” *must* include all protection details inclusive of the *network operator’s* settings for their protective equipment which is available from the Project manager assigned to the project. Both the *network operator* and the *consumer’s* time current curves *must* be shown to illustrate that upstream and downstream grading can be and is achieved. Refer to [clause 11.6.4](#)

**Note:** Protection settings *shall* be provided to the *network operator* before energisation. Any subsequent change *must* be provided to the *network operator* before the change is implemented.

#### **13.7.4.6 Voltage transformers**

*Voltage* transformer “submission” details *shall* include:

1. purpose - protection or metering;
2. make and type;
3. rated transformation ratios;
4. primary and secondary *voltage* rating(s);
5. type classification and category of performance;
6. rated output and burden;
7. accuracy class or classification;
8. rated *voltage* factor and rated duration; and
9. primary connections and secondary winding configuration.

#### **13.7.4.7 Current transformers**

Current transformer “submission” details *shall* include:

1. purpose - protection or metering;
2. make and type;
3. rated transformation ratios;
4. primary and secondary current rating (s);
5. type classification and accuracy classification;
6. accuracy limit factor;
7. rated burden; and
8. primary connections and secondary winding configuration.

#### **13.7.4.8 Switchboard and metering**

Switchboards, *metering installation* and connection arrangement is to be discussed with the *network operator* with details of the *network operator’s requirements* included in the “submission”.

**Note:** Access to the *network operators metering installation* second core for the purposes on *augmenting the consumers installation* is generally not permitted.

#### **13.7.4.9 Earthing system**

The *consumer’s* earthing system *must* be designed and installed in a manner that ensures compliance with the *network operator’s technical requirements* and where specified the relevant Australian standards including but not limited to AS 2067 and AS/NZS 3000. The “submission” *must* provide details of *consumer’s installation* earthing system with accompanying schematic arrangements.

#### **13.7.4.10 High voltage motors**

“Submission” details *shall* include:

1. manufacturer;
2. type of motor(s) and if induction type motor – cage or wound rotor;
3. rated power (kW or HP), *voltage* and current;
4. method of starting to be employed;
5. frequency of starting;
6. starting torque in terms of the rated load torque and the maximum starting current which may be taken from the supply with the starting apparatus in the circuit;
7. if thyristor control equipment is proposed, details relating to the harmonic current generation *shall* be provided. (for large LV and all HV motors); and
8. rated insulation level (impulse withstand).

#### **13.7.4.11 Transformers**

Power transformers *shall* be in accordance with the *network operator* specifications to ensure compatibility with *network operator’s* HV equipment. “Submissions” *shall* detail the following:

1. manufacturer;
2. rated *voltages* and tapping range;
3. oil capacity;
4. noise rating (db);
5. rating (kVA);
6. lightning impulse withstand level;
7. vector group symbol;
8. insulating medium;
9. *voltage* winding and earthing configuration; and
10. types of connection.

#### **13.7.4.12 Distributed energy resources and generation**

The “submission” *shall* include a copy of the separate generation/DER application as submitted to the *network operator*, *together with* details where relevant of the following:

1. manufacturer, equipment specifications, and associated hazards;
2. type of DER system, *generation system* including rated output, *voltage and* current;
3. synchronous, transient and sub transient reactance. (if connected to the supply system through a solid state *inverter* indicate three-phase short circuit current at output side of *inverter*);
4. details of neutral earthing system;
5. type of generation excitation; and
6. *voltage* and speed regulation.

#### **13.7.4.13 Underground Cables**

“Submission” details *shall* include:

1. manufacturer;
2. *voltage* designation;
3. number of cores;
4. conductor material, size of all active and neutral conductors;
5. type of insulation;
6. construction details;
7. type of terminations proposed;
8. fault withstand rating of core and screen;
9. proposed method of installation including mechanical protection; and
10. earth screen details for each end of any incoming supply cable.

#### **13.7.4.14 Overhead lines and supports**

Overhead lines and their supports *shall* be designed and constructed in accordance with AS/NZS 7000 and the *network operator's technical requirements*. Details in the "submission" *shall* include:

1. asset design life;
2. wind region;
3. selected line security;
4. ambient temperature and maximum operating temperature;
5. type of conductor;
6. conductor's stringing tension;
7. ground line profile;
8. loading versus capacity assessment on overhead line components;
9. line simulation (i.e. ground clearance, phase-to-phase clearance, etc); and
10. equipment and pole labelling conventions.

#### **13.7.4.15 Communication systems**

The "submission" where applicable *shall* describe how the *consumer's installation* will interface with the *network operator's distribution system* supervisory control and data acquisition *requirements* for the purposes of visibility, monitoring and control of *site* services and devices.

#### **13.7.4.16 Conforming technical standards**

Contained within the "submission" *must* be a complete list and description of the specific technical standards to which the installation and associated equipment will conform.

As a part of the "submission" the certifying *professionally qualified electrical engineer shall* certify that the HV design and proposed installation conforms and complies with the applicable *regulations, codes, standards and network operator requirements*.

#### **13.7.4.17 Commissioning of protective device**

The *consumer shall* provide an estimated date for the preliminary commissioning of the protection devices.

#### **13.7.4.18 Installation commissioning and supply availability**

The *consumer shall* provide an estimated timeframe and date for connection and energisation of installation including an indication of the nature (temporary or permanent) of the supply arrangement. If the connection is temporary, the "submission" *shall* indicate the size of the temporary supply arrangement (where less than the permanent supply) and the date the permanent connection is required. The permanent connection date is to be realistic and cognisant of the connection configuration and work required for its provision.

#### **13.7.4.19 Environmental**

The *consumer* is responsible for undertaking environmental impact studies and implementation of control and containment measures. The placement of *network* equipment *shall* be in accordance with:

- These *requirements* and applicable *network operator technical requirements* for *substations* and underground *distribution schemes* including:
  - **Horizon Power's**: - [Distribution design rules](#) (DDR); and
  - **Western Power's**: - [Distribution substation plant manual](#) (DSPM).
- [Underground distribution schemes manual](#) (UDS).
- Applicable legislation, relevant state and local government authorities.

**Note:** For specific *network* environmental mitigation *requirements* refer to the relevant *network operator*.

### **13.7.4.20 Operational procedures and equipment maintenance**

The “submission” *shall* include the name of the *responsible person* for the operation of the installation together with a synopsis of how the *consumer* intends to prepare, deliver, implement and maintain the required operational procedures.

The *consumer* is required to establish detailed operational and maintenance manual(s) in accordance with the [WAER](#), the [Safety guideline](#) and the relevant Australian standards (refer to AS 2467). For additional information refer to [clause 13.12](#)

## **13.8 Applications and connection process**

Typically, a *network* impact assessment of an electronic “submission” takes approximately four weeks from the date of lodgement. Cost estimates will depend on the complexity of the project, installation, construction schedules and the type of equipment to be installed. For further information pertaining to the connection process and for details of the required application forms. Refer also to [section 7](#) of this document.

## **13.9 Equipment**

### **13.9.1 Equipment requirements**

The connection and supply type, *voltage*, protection, earthing and *metering installation* arrangements of a *consumer's high voltage* installation *must* comply with the applicable *regulations*, codes of practice, guidelines relevant standards and aligned with the *network operator's connection requirements*. Prior to placing orders for equipment, the *consumer must* discuss the installation's protection *requirements* with the *network operator*. The short-circuit current which may occur in an installation is dependent upon:

- The prospective fault level at the *point of supply (connection)*.
- Any contribution which may be made by *embedded generation, energy storage systems* or large rotating electrical plant connected within the installation.
- Impedances within the installation.

Unless otherwise advised in writing, the *consumer shall* install *high voltage* switchgear, transformers, conductors, associated equipment and earthing systems that satisfy minimum fault level *requirements* and be capable of withstanding the maximum fault current which may be imposed for the duration of at least one second and in some instances for three seconds. Refer to [clause 10.6](#) for fault level details.

The protection equipment and control schemes associated with the *consumer's* installation *shall* be maintained and tested for correct operation in accordance with the [WAER](#), the [Safety guideline](#) and the *network operator's technical requirements* and instructions.

### **13.9.2 Substation installation requirements**

The *network operator's technical requirements* and *substation* manuals provide layout and equipment detail for both low and *high voltage network distribution installations*. [Section 14](#) of these *requirements* describes the *consumer* responsibilities applicable to the installation of new or modified/upgraded *substations*.

### **13.9.3 Main switch or switches**

The *consumer's electrical installation shall* have a single main control for each incoming supply.

The main switch at the *main switchboard shall* isolate both the *consumer's electrical installation* and the generation supply(s) from the *network operator's high voltage distribution system*.

As a minimum the main switch *shall* consist of an automatic circuit breaker capable of making and breaking the minimum and maximum prospective fault currents on all three-phases and equipped with earth-fault and overcurrent protection.

The main switch *shall* be:

1. located in accordance with the *network operator's technical requirements* and as near as possible to the *consumer's point of supply (connection)*;
2. positioned after the *network metering installation* transformers;
3. readily accessible to the *network operator* and *consumer responsible person/personnel*;
4. able to operate simultaneously in all active conductors;
5. include an integrated earth switch to earth any incoming cables; and
6. able to be locked in the open position. (The locking device(s) *shall* be capable of accepting the *network operator's* locking system).

The *consumer's* protection device and HV main switch *shall* be fitted with a protection system, compatible with the HV *network* protection system and grade with the *network operator's* protection device(s).

Where more than one *high voltage* supply is provided to a *consumer's installation*, the main switches *shall* be interlocked in such a manner that paralleling of the *high voltage* supplies *shall* not be possible unless agreed to by the *network operator*.

Single or multiple switch fuses, fitted with three-phase tripping and operating in all phases simultaneously, may be used to protect and isolate individual transformers where the transformer rating does not exceed 1MVA.

Alternatively, the *network operator* may approve the use of single or multiple switch fuses, reclosers or pole-top switch(es) with fuses for smaller HV installations subject to *network* compatibility and appropriate fault level limitations.

#### **13.9.4 Circuit breakers**

Circuit breakers *shall* be fitted with at least three-phase overcurrent and earth-fault protection that incorporates three-phase tripping (lockout) as a minimum. The *network operator* may require more complex protection arrangements, in particular cases to meet acceptable protection performance criteria and required protection performance levels. It is preferred that current transformers for overcurrent protection be located on the supply side of the main circuit breaker.

#### **13.9.5 Protection settings**

The *consumer's* protection systems *shall* be designed to coordinate with *network* HV feeder protection. The settings applied to the protection relays *shall* discriminate with the *network operator's* protective equipment to ensure that, for faults in the *consumer's electrical installation*, the *consumer's* circuit breaker operates before the HV *network* protective equipment. The *consumer* is required to contact the relevant *network operator* for the required settings.

Feeder protection settings may be changed from time to time. It is the *consumer's* responsibility to ensure that correct coordination with HV feeder protection settings is maintained where advised of changes by the *network operator*. The *network operator* will not be responsible for any costs incurred in making such changes.

Any modification or change to the agreed *consumer* installation protection settings or equipment *shall* be subject to the acceptance of the *network operator* prior to any change, and protection setting points *shall* be labelled accordingly.

Protection settings and equipment *shall* be subject to the acceptance of the *network operator* prior to commissioning.

The *consumer shall* test the main protection system at the time of commissioning the installation and certify that the performance and protection settings, meet the design parameters. Details of the current HV feeder protection settings can be obtained from the *network operator*. Refer to [clause 11.6.4](#)

## 13.9.6 Cabling

### 13.9.6.1 Underground

Selection of cable sizes, types and termination methods *shall* be undertaken in consultation with the *network operator*. Cable selection should take into account the possibility of future *load*, generation growth and be adequate for the maximum prospective fault levels. The *high voltage* underground cables *shall* be installed in accordance with the *network operator's technical requirements*.

- **Horizon Power** cable installations - Cables installed within Pilbara Grid and NIS *network* regions *shall* be termite protected and *shall* comply with [Underground cable installation manual](#).
- **Western Power** cable installations - Underground cable installations within the SWIS *shall* comply with the [Underground cable installation manual](#).

After installation and before activation, the cables *shall* be tested in accordance with the relevant industry standards/ *network operator technical requirements* and certified by the *consumer's* agent for service.

### 13.9.6.2 Overhead lines

Overhead lines and their supports *shall* be designed and constructed in accordance with AS/NZS 7000 and the *network operator's technical requirements*.

### 13.9.6.3 As constructed drawings

On completion of the *consumer cable network*, the *consumer shall* prepare and make available detailed "as constructed" drawings recording the route, depth of laying/height above ground, type of supports, cable type, *voltages* and other relevant information for the use by all persons concerned with the operation of the installation and property.

Where there is a proposed variation to the construction of the HV installation a revised HV 'submission' *shall* be prepared and submitted to the *network operator* prior to the *alteration* of the construction programme to ensure any issues are identified and addressed before the 'as-constructed' phase of the project, due to out-dated HV 'submission' documentation.

## 13.9.7 Earthing systems

Installations required to be earthed *shall* conform to the *technical requirements* as prescribed by the *network operator*.

The preferred earthing arrangement is the "combined earthing system" where the *high voltage* and *low voltage* equipment are earthed to a common terminal bar. If the requirements of the combined earthing system cannot be achieved, then separate earthing systems may be considered following consultation with and approval by the *network operator*.

Earthed primary neutral windings are not permitted on any transformer of the nominal supply *voltage*. It is recommended that the *consumer* use delta–star transformers to comply with this *requirement*.

Attention should be given to the management of "step and touch" potentials that may occur under earth-fault conditions associated with any earthing system installed within a *consumer's installation*.

Particular attention *shall* be paid to the separation of independent earthing systems and the proximity of earthed infrastructure such as metallic fences, *premises* and buried external services so as to avoid the possibility of hazardous step and touch potentials. External services (e.g. water pipes, communication circuits) *must* be suitably electrically isolated to avoid hazardous transfer potentials. Refer to [clause 12.6.6](#) for additional information on clearances.

### **13.9.7.1 Communication equipment**

Where a telecommunication pit or connection is identified as being within a 15m radial distance of an existing HV earth, an evaluation of the asset is to be undertaken in accordance with the *network operator's technical requirements* and AS 4853 to determine if a hazard does or may exist and actions to be implemented resulting from the investigation outcomes.

### **13.9.7.2 HV power lines, cables and earths in proximity of metallic pipes**

Earth Potential Rise (EPR) and Low Frequency Induction (LFI) between the HV earth and metallic pipeline may be induced into or occur as a result of an earth-fault.

Where HV power lines, cables and earthing systems are to be installed in proximity to metallic pipeline(s), the installer is required to assess EPR and LFI impact on the pipeline in accordance with the *network operator's technical requirements*, AS 4853 and any design standard specified by the pipeline owner (e.g. Alinta, Water Corporation etc).

Where an assessment identifies a particular hazard, a report *shall* be prepared and forwarded to the pipeline owner for further consideration prior to the initiation of any related construction or installation activity. Both the assessment report and pipeline owner's response *shall* be provided to the *network operator*.

### **13.9.7.3 Metallic fences**

Metallic *substation* fencing, doors or enclosures *shall* be connected to the earthing system and grading ring as prescribed by the *network operator's substation technical requirements*. Where prescribed by the *network operator* steel reinforcing in the *substation* floor and walls *shall* be connected to the common earth terminal bar.

### **13.9.8 High voltage metering**

*High voltage metering equipment* arrangements are to be discussed with the *network operator* during the project design stage. Where *high voltage network metering* is required, the *network operator* will provide a quotation, inclusive of the costs to provide, install and commission the *metering equipment*.

For general information on *HV metering installation requirements* refer to [clause 11.15](#) of these *requirements* or for specific project assistance regarding metering, or installation contact should be made via the relevant *network designer*.

### **13.10 Consumer's electrical installations on public land**

The *network operator* *must* be contacted prior to consolidating any proposal to install a *consumer's electrical installation* on public/crown land or extending wiring and equipment from an *electrical installation* into or across public/crown land. Refer to [clause 6.12](#).

### **13.11 Inspection, testing and commissioning**

On the completion of a new, *altered*, upgraded or modified installation, the *consumer* *shall* meet the cost of *high voltage* installation and equipment testing *onsite* as prescribed by the [WAER](#), [Safety guideline](#), manufacturer, applicable Australian Standards including AS 2067 and the *network operator's technical requirements*.

The *network operator* may choose not to connect the whole or any part of a *high voltage* installation which in the *network operator's* opinion does not comply or is unsatisfactory for connection to the *distribution network*.

### 13.11.1 Horizon Power

For installations connected to Horizon Power's *distribution system*, all testing and commissioning of the HV *metering installations shall* be, prior to connection, completed by the Horizon Power's technical Metering team.

### 13.11.2 Western Power

For installations connected to the Western Power *distribution system* their technical Metering team *must* either be *onsite* to conduct the required testing and commission or witness the prescribed tests in accordance with the Metering Code.

Where testing is undertaken by a third party, the tests *shall* be performed by a competent organisation acceptable to the *network operator*. Test results of all *high voltage electrical equipment* up to and including the main switch *shall* be recorded and submitted to the *network operator* prior to final network connection being made available.

## 13.12 Safety

The *consumer* is responsible for the operation and ongoing maintenance of their "*high voltage installation*" (HVI), including any switching of the *consumer's* equipment.

A *consumer* is not permitted to operate *network operator* owned equipment unless expressly mentioned in the "*consumer operating (switching) protocol/agreement*" or as directed by the *network operator*.

The *consumer shall* nominate a *responsible person* to operate and maintain their *high voltage* installation and establish effective operating procedures/maintenance together with the provision of appropriately trained and authorised operators/personnel. *Consumer* personnel *shall* be supplied or have access to appropriate safety equipment to ensure the safe operation and performance of the *high voltage* installation. Unless specifically contracted, the *network operator* will not provide personnel or equipment for such purposes.

### 13.12.1 HV operation manuals and safety management plan

Each *consumer high voltage* installation *shall* have a set of operational procedures incorporated into their "*high voltage installation safety management plan*". The "*safety management plan*" *shall* coordinate with the *consumers'* maintenance plan.

The procedures and plan *shall* address, as a minimum, the *requirements* of the [WAER](#), [Safety guideline](#), relevant legislation, codes and Australian standards.

The following summarises the above:

- Isolation procedures including work permits, locking, testing and tagging.
- Personnel competencies, electrical access and operation (switching) authorisations.
- Barriers for electrical, mechanical and personal protection.
- Access to *large scale* installations, rotating machines and discharging of deactivated apparatus.
- Earthing and short circuit *requirements*.
- Provision and use of personal protective clothing and safety equipment.
- Training, education and worksite safety briefings.
- Internal and external communication *requirements* including emergency personnel and the *network operator* contact points.
- Emergency and evacuation procedures.

The *consumer* through their *responsible person shall* update and maintain the procedures, plans and related programs and if requested provide copies to the *network operator* and state government agencies including Building and Energy and WorkSafe.

The *responsible person shall* provide copies of the procedures and plan to each employee, switching operator or contractor engaged in activities within the *consumer's* HV installation. Each person in receipt of the procedures and plan *shall* make themselves fully aware of the *requirements* and *shall* acknowledge an assurance to comply with the *requirements*.

### **13.12.2 Access**

The *responsible person shall* ensure 24 hour 7 day access to suitably trained, competent and authorised *high voltage* personnel to undertake switching operations for the purposes of inspection, *load* shedding, routine maintenance or emergency *repair* of the incoming *high voltage* cable(s) or *network* equipment.

The *responsible person must* provide "access permits" to facilitate the movement and monitoring of all personnel accessing the *electrical installation*, to perform work and to ensure all such persons are clear prior to re-energisation of the installation.

*Consumers* and *network* personnel are required to have the appropriate training, qualifications, access authorities and consent prior to entering a *consumer's* or *network operator's* switchroom.

The *responsible person must* provide, in accordance with their safety management plan, appropriate barriers that clearly identify isolated, proven de-energised and earthed sections of the *high voltage* installation on which work can safely be performed.

### **13.12.3 Operating equipment**

Appropriate rated and tested *high voltage* safety apparatus including but not limited to the following:

- testing equipment to prove the HV mains and apparatus have been deactivated;
- operating sticks;
- portable earthing equipment;
- personal protective equipment and HV gloves;
- insulating mats, barriers and signs; and
- tags and locks;

*shall* be made readily available *onsite* by the *responsible person* for use by their operator(s) and where required the *network operator* personnel in accordance with the *consumer's high voltage* operating procedures and applicable legislation.

All operating equipment *shall* be maintained by the *responsible person* in a safe, fit-for-purpose condition for use at any time. The equipment *shall* be housed in labelled storage facilities, provided by the *responsible person* located as close as practicable to the point of use.

### **13.12.4 Operational diagram**

A single line schematic of the complete installation showing all aspects of the *high voltage* connection and supply arrangement (including normally open points) *shall* be provided in a suitable prominent and permanently displayed enclosure adjacent to all control and isolating switches within the *consumer's electrical installation*.

Where items of switchgear or equipment are remote from the main installation, the operating diagram *shall* also be permanently displayed at these locations.

### 13.12.5 Consumer operation (switching) protocol/agreement

The *consumer/responsible person* is required to establish a “*consumer operating (switching) protocol/agreement*” (“operating protocol”) with the relevant *network operator*. It is preferable that the “operating protocol” is finalised at the same time as the *connection agreement*. Refer [clause 13.12.6](#) for contact details.

The “operating protocol” may specify the *consumer/responsible person’s* obligations and responsibilities when undertaking switching activities within the specified HV installation/*network*. Switching *shall* be in accordance with the agreed procedures and where required *network operator* directives.

The “operating protocol” *shall* include provisions to ensure that the *responsible person* only performs switching operations on *consumer* owned equipment as listed in the “operating protocol”. The *responsible person* is not permitted to operate *network operator* owned equipment unless expressly mentioned in the “operating protocol” or as directed by the *network operator*.

The “operating protocol” *shall* also contain, where applicable, provisions that enable the *network operator* to operate *consumer* owned equipment as nominated by the *responsible person*.

The *responsible person shall* ensure that the “operating protocol” is kept up to date. Where a change is sought, the *responsible person shall* formally notify the *network operator* at the earliest possible opportunity via the contact point listed at [clause 13.12.6](#).

### 13.12.6 High voltage switching

The *responsible person shall* ensure that *high voltage* switches, other than control switches designated for the use of plant operators, *shall* be operated by persons selected, trained and authorised by the *responsible person*.

The *responsible person shall* ensure that their switching operator(s) are fully conversant with the HV installation operational procedures, “safety management plan” and the *network operator requirements* for HV switching.

The *responsible person shall* ensure that their switching operators are regularly assessed as competent, by registered training organisation (RTO), to perform the roles for which they are responsible including but not limited to the use of:

- Equipment operation.
- Personal protective equipment.
- *High voltage* testing equipment.
- *High voltage* earthing apparatus designed to facilitate the earthing of all types of *high voltage* equipment within the installation.
- Insulating mats, screens and other similar equipment necessary for the safe operation of the *high voltage* installation.

The switching operator *shall* coordinate their activities with the *network operator* and, where required, be responsible for the issuing of access permits authorising persons to work on isolated and earthed sections of the installation.

The *responsible person shall* establish (before commissioning) and maintain a register of all authorised persons with details of switching competencies and any restrictions.

The *responsible person shall* provide their contact details inclusive of name, position, contact number and email address to the relevant *network operator*. If the contact details of the *responsible person* change, the *network operator must* be formally notified, as soon as is practical, but no later than one month from the date of the change.

Notifications *shall* be sent to the following address:

### 13.12.6.1 Horizon Power

Horizon Power, Head Office, Stovehill Road, Karratha WA 6714  
(Head Office) [karratha@horizonpower.com.au](mailto:karratha@horizonpower.com.au)

### 13.12.6.2 Western Power

Western Power, Network operations, GPO Box L921, Perth WA 6842:  
[contact us - Western Power](#)

### 13.12.7 Safety signs

Appropriate warning and safety signage *shall* be installed in accordance with these *requirements*, [WAER](#), the [Safety guideline](#), AS 2067, AS/NZS 3000, AS 1319 and the *network operator's technical requirements*.

In each HV equipment location, within the *consumer's* installation, durable safety signage outlining resuscitation methods and instruction in the release of persons from contact with live conductors, *shall* be displayed in a prominent and permanent position .

### 13.13 Final connection requirements

The *consumer*, through their agent *shall* ensure that they have submitted the following details to the *network operator* prior to seeking final connection of their HV installation:

1. final single line diagram;
2. agreed maximum demand;
3. main switch arrangements and specification; and
4. protection settings.

Prior to connection the *consumer's* agent *shall confirm*:

5. the *consumer* has safety operating procedures and a maintenance plan in place;
6. the following has been submitted for the equipment between the *point of supply (connection)* and main switch including but not limited to:
  - a. commissioning and test certificates/reports for the incoming circuit breaker(s) trip tests;
  - b. *HV metering installation* VT and CT test certificates/reports;
  - c. commissioned installation final certification; and
7. a duly completed and signed 'notice of completion' for the installation;
8. contact details of the *consumer's responsible person* are in place; and
9. clearances and authorisations from the *consumer* and the *network operator* to energise the installation have been issued.

**Note:** The identified tests *shall* be performed by a competent testing organisation acceptable to the *network operator*. In the case of *network* connections, satisfactory test results of all HV *electrical equipment* between the *point of supply (connection)* and the main switch *shall* be recorded and submitted to the *network operator* prior to permanent supply being made available.

Final certification is required by a *professionally qualified electrical engineer* that the 'as commissioned' installation complies with the design and relevant *technical requirements*. A copy of the final certification *shall* be given to the *network operator* (where connected to a *network*). Refer to [WAER](#) section 7.

### 13.14 Maintenance

A consumer who seeks *high voltage* a connection *shall* ensure through their *responsible person* that their *high voltage* installation:

- Safely performs the functions for which it is designed and intended.
- Operates in accordance with the manufacturer requirements.
- Is maintained in good order.
- In the event of a fault or malfunction *shall* not create a hazard or cause interference to the *network operator's distribution network*.

The *responsible person shall* implement the *consumer's* maintenance plan for the HV installation including the main incoming circuit breaker(s) and protection system.

The *responsible person shall* inform the *network operator* of any changes to the connection especially where there is an absence of *network* monitoring and control within the *consumer* HV installation by the *network operator's* control centre.

The protection and control systems associated with the installation *shall* be tested for correct operation in accordance with the manufacturer's specifications and *consumer's* maintenance plan. The *responsible person shall* keep records of maintenance tests and make them available to Building and Energy and the *network operator* upon request.

The *consumer's* agent *shall* provide to the *consumer* a written maintenance plan for the HV installation including the main incoming circuit breaker and protection system as a part of the commission process and before supply is made available to the installation.

Maintenance programs, frequencies and operations for particular item(s) of plant should be planned in accordance with the [Safety guideline](#) and in consultation with the manufacturer and *network operator*.

When conducting inspections of HV equipment the following should be considered:

- External insulation.
- Internal insulation including oil where appropriate.
- Contacts, interrupting devices and connections.
- Earthing systems and connections.
- Operating mechanisms and their lubrication.
- Weather seals and gaskets.
- Protective finishes and signs of corrosion.
- Moving parts and conductor joints, internal cleanliness, recommended clearances, and setting/effectiveness of the close/open operations.
- Legibility of labels and signage.

Due consideration *shall* be given to *site* conditions, with particular regard to airborne contaminants and dust. Periodic inspections of switchrooms and switchgear enclosures are required to ensure:

- Lighting is adequate and if artificial operational.
- Equipment labelling and operational diagrams are correct and legible.
- Where installed any ventilation or fire suppression system are fully operational.
- Emergency exits are not obstructed and panic release mechanisms are operational.
- No ingress of moisture or water or intrusion by rodents, birds or insects.
- Presence and legibility of safety signs.

Periodic inspections/examinations may give guidance on the intervals to be allowed to elapse between future inspections, examination and overhaul operations with reference to operating conditions.

The following publications *shall* be considered during the development of an ongoing maintenance regime:

- AS 2067 'Substations and high voltage installations exceeding 1000 V a.c'
- AS 1940 'The storage and handling of flammable and combustible liquids'
- AS 2467 'Maintenance of electrical switchgear'
- AS 1851 'Routine service of fire protection systems and equipment'
- AS 1883 'Guide to maintenance and supervision of insulating oils in service'
- AS 1767 'Insulating oil for transformers and switchgear'
- Guidelines for the Safe management of high voltage electrical installations
- IEC 61230 Live Working – Portable equipment for earthing or earthing and short-circuiting
- Network operator's technical requirements
- WA Electrical Requirements. [Safety guideline](#)

Before any installation maintenance work is carried out, the affected portion of the installation *must* be deactivated, tested to confirm its status then earthed. The *responsible person shall* provide suitable direct earthing equipment or use equipment with in-built earthing facilities.

Where the *consumer/operator* requires access to a *network* installation or part thereof for the purposes of maintenance and inspection, appropriate access arrangements *shall* be made with the relevant *network operator*.

### **13.15 Consumer HV installation audits**

As recommended by the [Safety guideline](#) the *responsible person* as part of their effective safety management plan *shall* conduct periodic audits of the HV installation to ensure the:

- Operational procedures and *site* safety management plan are relevant, up-to-date and applied in practice.
- Switching operator registers are valid and current.
- HV installation maintenance plans are being followed and maintenance records are being maintained.
- Any HV installation *augmentation* has been appropriately integrated.
- Compliance with the "operating protocol".
- Audits are to be conducted in accordance with the [WAER](#) and the *network operator's technical requirements*.

# **Service and Installation Requirements**

## **Section fourteen**

### **Substation installation requirements**

## 14 Substation installation requirements

### 14.1 General connection requirements

This [section](#) describes the *requirements* and *consumer* responsibilities where a new *substation* is to be installed or an existing *substation* is to be modified, *altered* or upgraded.

Typically, within *metropolitan* and *major regional centres* any connection over 250A (200A for a shared feeder) will *require* the installation of or access to a *network substation*.

A *substation* will always include a transformer and, associated switchgear. In country and regional areas outside town centres a *substation* will be required in most situations.

This [section](#) shall be applied in conjunction with the *network operator's technical requirements* for *consumer* connections and *substations including but not limited to* .

- **Horizon Power** - [Distribution construction standard](#) (section "G" drawings)
- **Western Power** - [Distribution substation plant manual](#) .

#### Notes:

1. In addition to the *requirements* specified in this section a *network operator* may also require *network* and or *consumer* equipment to be appropriately rated in accordance with environmental / climatic conditions applicable to the specific operational region or regions. For example, cyclonic conditions experienced in the north west of Western Australia.
2. It is the *customers/developers* responsibility to ensure that all of the *network operators requirements* and installation conditions are met, which may be audited by the *network operator* as a part of the commissioning processes. Refer to the relevant *network* website or designer for supplementary information / check lists.

### 14.2 Substation types

The decision to install a *district* or *sole use substation* remains with the *network operator* and not the *consumer*. The type of *substation* installed will depend on a number of factors including but not limited to:

1. requested capacity of the *consumer's load* or *generation* connection;
2. future expansion of *substation* capacity;
3. proposed location of the *consumer's* connection on the property, and distance from the *distribution network*;
4. type and nature of the *consumer's* connection (disturbing or passive);
5. nature and capacity of the existing *distribution* or *transmission network*;
6. the need for LV street feeds to or from the *substation* for the purposes of providing:
  - a. a backup supply to the *consumer's installation*;
  - b. future capacity and growth in the immediate area;
  - c. additional capacity to accommodate any growth in the *consumer's* connection; and
  - d. *consumer's* requirements for connection reliability and security.

For both *district* and *sole use substations*, the *network operator* owns, operates and maintains the *network* equipment.

Where HV switchgear is required for a *district* or *sole use substation*, the setback limits for the switchgear are shown in the relevant *network operator substation* technical drawings. Refer to [clause 14.1](#).

### 14.2.1 District substation

A *district substation* is defined as one with LV connections to the street mains.

*Substation* size is limited to 2MVA and a capacity below this limit may be offered to a *consumer* where it is available. The use of a *district substation* for a *consumer* connection is subject to *network operator* approval.

*Substations* are to be located within the *property on the street boundary*. A maximum setback of 30 metres (to limit LV volt drop on street feeds) is permitted.

### 14.2.2 Sole use substation

A *sole use substation* is defined as one with no LV connections to the street mains and limited to a maximum installed capacity of 4MVA where a fire-rated *substation* is constructed (otherwise 2MVA).

**Note:** In determining the size of a *consumer* connection, *network metering equipment* (CT) operational limitations shall be considered. Refer to [section 11](#).

A *sole use substation* is available to *consumers* who satisfy one or more of the following criteria:

7. point of common coupling (PCC) will be the HV network;
8. *consumer's* electrical connection may be classified as a disturbing load;
9. the *site* is large with the connection located more than 30 metres from the *property boundary*, refer to the Note 1;
10. the *substation* site location is such that a LV feed to the street will never be required; and
11. the required connection either now or in the future will require all of the respective transformer capacity.

Should the eligibility criteria change a *network operator* may consider converting a *sole use substation* into a *district substation* to service a new connection subject to the following conditions where:

12. the *substation* that was once servicing a disturbing connection is no longer doing so; and
13. the existing *consumer* is utilising all of the transformer's capacity but there is sufficient room in the enclosure to house an additional transformer or upgraded unit of greater capacity; and
14. fire clearance requirements can still be met without any required increase in the *substation* footprint.

**Note: 1:** *Network* HV feeder cables located on a *consumer's* property require additional mechanical protection. Therefore, feeder cables shall be kept as short as possible, with the HV equipment located:

15. on the *property boundary* for all Horizon Power connections; and
16. within 5 metres of the *property boundary* for all Western Power connections.

There is no limitation on the length of transformer cables extending from HV switchgear into the *consumer's* property.

### 14.2.3 Consumer owned substation

A *consumer owned substation* is defined as one where the *consumer* is subject to a HV tariff. The *consumer* owns and is responsible for all equipment (e.g. transformers, fuses, circuit breakers etc.) other than the *network operator's* metering equipment and HV *substation* switchgear required to facilitate the *network* connection.

Where an HV metering unit is installed, the output terminals are the *point of supply (connection)*. Under some circumstances, a *consumer owned substation* may be provided with *low voltage* metering even though an HV tariff is applicable. The placement of HV switchgear and transformers shall be as prescribed in [clause 14.4.2](#) with *point of supply (connection)* for these connections determined by the *network operator*.

### 14.3 Substation arrangements

The *consumer* is responsible for the construction and maintenance of *consumer owned substations* and *substations* that are to be fire rated. In specific situations as described in [clause 14.3.3](#) the *network operator* will install a *package substation* arrangement.

#### 14.3.1 Modular package substation (MPS)

A modular package *substation* ([figure 55](#)) comes complete with a single transformer and LV switchgear. It is housed in a self-contained metal enclosure and is installed on an inverted, direct buried culvert. If HV switchgear is required, this is also housed in a self-contained metal enclosure which is installed adjacent to the transformer on a direct buried mounting frame.

Modular package *substations* are specifically designed to be used as *district substations*. They are not fire rated, configured or suitable for use as a *sole use substation*. The largest size transformer that can be used in the MPS configuration is 630kVA.



**Figure 55:** Modular package substation

#### 14.3.2 Non modular package substation (non-MPS)

A non-MPS arrangement ([figure 56](#)) comprises a combination of one or more transformers plus LV and HV switchgear as required. Each of these items is a separate component housed in a self-contained metal enclosure. The transformer is installed on an inverted, direct buried culvert.

The LV and HV switchgear enclosures are installed on direct buried mounting frames. Non-MPS components are not installed as a single package. They may be installed either as a “cluster” *substation* or in a fire rated enclosure. In the case of fire rated enclosures, the culvert and switchgear mounting frames may not be required.

Non-MPS arrangements can be used as both *district* and *sole use substations* comprising multiple transformers, up to and including individual units 1000kVA in size.



**Figure 56:** Non modular package (cluster) substation arrangement

### 14.3.3 Selecting MPS or non-MPS arrangements

The MPS arrangement is the preferred arrangement for a *district substation* where a single transformer is required up to 630kVA. An MPS *substation* generally does not need to be fire rated unless located in close proximity to *premises*, hazardous areas or *property boundary* lines.

Where a *sole use substation* is deemed necessary, multiple transformers are required, the *substation* is to be fire rated, or there is a possibility that a future upgrade of the 630kVA transformer will be needed, a non-MPS arrangement *must* be used.

**Note:** MPS and non-MPS arrangements do not generally require the construction of an enclosure for the *substation*.

### 14.3.4 Consumer-owned substation arrangements

Where a *consumer owned substation* is to be installed, neither a MPS nor non-MPS arrangement is appropriate. The *network operator* will provide extendable or non-extendable HV switchgear necessary for connection to the *network*. This equipment *shall* be installed in a switchroom constructed by the *consumer*, along with the *consumer's* own LV/HV switchgear.

*Consumer* constructed *substations* *shall* be designed to withstand, without damage, the maximum currents which may flow through the installation under fault conditions. There are three types of *consumer owned substations* suitable for HV switchgear installations. These are:

- Indoor ground mounted switchgear where a switchroom *must* be constructed
- Outdoor ground mounted switchgear.
- Outdoor aerial switchgear.

#### 14.3.4.1 HV indoor ground mounted switchgear

Where a *consumer's* installed capacity exceeds 4 MVA, a HV indoor ground mounted switchgear arrangement *shall* be used.

The *consumer* *shall* supply and install an adequately rated *high voltage* main switch (circuit breaker) and a connection arrangement suitable for coupling to the *network operator's* HV metering unit.

Although the use of switchgear identical to the *network operator's* standard range of equipment is preferred, *consumers* may purchase and install switchgear of a different make, provided that it is capable of accommodating a cable connection to the *network operator's* metering equipment or switchgear. Details of the *network operator's* standard range and types of switchgear are available on application.

**Note:** A number of existing indoor ground mounted *substation* arrangements retain a bus-section switch disconnecter connection between the *network* and *consumer*. This type of interconnection is permitted to remain in place where the existing *substation* equipment remains in service. Where either *network* or *consumer* equipment is to be *altered* or upgraded a cable interconnector *shall* be installed which may require modification of the *premises* by the owner to comply with AS 2067. Refer to the relevant *network operator* to determine the required connection option.

The *consumer* is responsible for supplying and installing all support structures fixed to the enclosure (including cable tray/ladder) for the *network operator's* HV switchgear, metering unit and *consumer* HV switchgear in the switchroom. Support structure fabrication details are specified within the respective *network operator's substation technical requirements*.

*Consumer* future capacity expectations *shall* be considered when determining the switchboard design and supply arrangement. Where the *consumer's* installed capacity is or expected to exceed 4 MVA, the *consumer's installation shall* be supplied from two fire segregated switchboards. The connection *shall* be distributed evenly across both switchboards.

For *consumer* owned *substations* with a cable (or existing bus) section switch/es between two switchboards and operates with the section open (i.e. two feeders/feeder legs operating radially), mechanical interlocking is required to prevent closed ring operation via the *consumer's* switchboards while the *network* section switch is open. Paralleling of the *consumer's* switchboards is not permitted unless directed and approved by the *network operator*.

#### **14.3.4.2 HV outdoor ground mounted switchgear**

Where the *consumer's* installed capacity is 4 MVA or less, HV outdoor ground mounted switchgear may be considered. A *consumer* owned HV outdoor ground mounted *substation* cannot be upgraded for connections above 4 MVA.

In the event that the *consumer's* capacity increases above 4 MVA, the *substation must* be converted to a HV indoor ground mounted *substation*, contained within a switchroom, built by the *consumer*. The converted installation *shall* be noise and fire rated in accordance with the *network operator's technical requirements*.

All HV switchgear equipment *shall* be installed in free-standing cabinets in a cluster configuration.

The *consumer's* HV switchgear cabinet/s *shall* be fitted with the *network operator's* locking system to facilitate 24 hour 7 day access for *network operator* personnel.



**Figure 57:** HV outdoor ground mounted switchgear & transformer

### 14.3.4.3 HV outdoor aerial mounted switchgear

In situations where the *consumer's substation* is required in a rural area, this type of arrangement may be considered if supported by an extensive overhead *distribution network*. This option may be considered for use within the *metropolitan areas* or *major regional centres* but is subject to *network operator approval*.

Re-closers or pole-top switches with fuses may be used in the following situations covering smaller HV installations, subject to fault level limitations:

- a. re-closers (fitted with three-phase overcurrent and earth-fault protection but no auto reclose provision) may be used to control the HV aerial supply to a *consumer's* small HV installation; or
- b. pole top switches with integral drop-out (expulsion) fuses may be used to control a HV aerial supply to individual, pole mounted transformers with a rating not exceeding 315kVA.

The *consumer shall* ensure the fuses or protection settings in the main switch coordinate with the *network operator's* up-stream protection. Changes to settings *shall* not be made without the *network operator's* prior approval.

*Consumers shall* supply and install an adequately rated HV main switch for connection to the *network operator* HV metering unit. Where a recloser is used by the *consumer* as the main switch, then the auto recloser *must* be disabled.



**Figure 58:** HV outdoor aerial mounted equipment

## 14.4 Common installation conditions for substations

### 14.4.1 Application

The following clauses describe the conditions common to all *substation* installations, regardless of whether or not the *consumer* is required to construct the enclosure or switchroom for the *substation*.

### 14.4.2 General conditions

The *network operator* publishes *technical requirements* and drawings showing the required size and general arrangement of *substation* sites and enclosures. The *consumer* is responsible for preparing detailed structural and equipment *substation* designs in accordance with the *network operator's requirements* and for the submission of those design drawings to the *network operator's* designer for review prior to commencement of construction.

*Network operators* takes no responsibility for any structural design as a *network* review covers only placement, clearance and access *requirements*. In general enclosures *shall*:

1. be designed to the *network operator's* design and *technical requirements* for the installation of electrical plant and safe operation;
2. ensure compliance with statutory obligations, industry standards, building codes and local government requirements. (The *consumer* is responsible for applying for and obtaining all necessary approvals);
3. contain no *consumer* or other services apart from those shown on *network* documentation;
4. sited in accordance with *network operator technical requirements*; and
5. be configured and constructed so as to ensure the installation is retained in good condition by the owner/operator of the installation in accordance with *industry best practice*, applicable regulations and *network requirements* for the life of the installation.

This *shall* include advising future/potential owners of their obligations should there be a change in ownership.

#### **14.4.3 Substation enclosures**

The *consumer shall* construct a minimum two hour fire rated enclosure in the following situations where:

- required clearances cannot be achieved;
- required by the *network operator's technical requirements*;
- a *consumer owned substation/switchroom* is required;
- a *network operator substation* is to be constructed within a *premises*; and
- the *substation* is located within a restricted area as defined by National Construction Code (NCC).

In all other situations, the *substation shall* be designed and constructed to protect and safeguard adjacent *premises* or structures from the effects of noise and or fire originating from within the *substation*.

The *network operator's technical requirements* provides specific location and application details on *substation* noise and fire risk zones for a variety of situations inclusive of those illustrated through the NCC and AS 2067.

No essential public fire escapes or access/exits *shall* pass through or open into a fire risk zone created by the establishment of a *substation* enclosure.

In all cases where another *premise/structure* conflicts with a *substation* noise and or fire risk zones, the choice exists for the *consumer* to either construct a rated enclosure for the *substation* or to rate the *premises/structures* within the risk zone subject to the consent of all affected parties. Agreement *shall* be reached with the *network operator* before the design is submitted as this will determine whether or not the *consumer* is required to provide a rated *substation* enclosure.

In commercial or industrial situations where the *consumer* requires the *substation* to be installed within the noise and or fire risk zone of a *property side boundary*, a rated enclosure maybe required to protect against the event of a *premises* being constructed on the adjoining property within the *substation* risk zone.

Local government, NCC and AS 2067 *requirements shall* be considered by the *consumer* when determining whether a rated enclosure is *required* in relation to minimum setbacks and distance to the *property side/rear boundaries*.

#### 14.4.4 Hazardous areas

Adequate separation and clearances *shall* be maintained not only to avoid the transfer of fire from a *substation* but to protect the *substation* from fire originating from within or from an adjacent hazardous area. Hazardous areas or materials may include but are not limited to:

- Combustible *premises*.
- Facilities that exchange, store, dispense or refill:
  - Petrol and diesel fuels.
  - Liquefied petroleum gas (LPG).
  - Compressed natural gas (CNG).
- Fencing surfaces.
- Flammable building products.
- Motor vehicle battery charging.
- Stored materials.
- Vegetation.

Additional detailed information is contained within the following publications:

- AS 1940: The storage and handling of flammable and combustible liquids.
- AS 2067: Substations and high voltage installations exceeding 1kV a.c.
- AS 2419.1: Fire hydrant installations Part 1.
- AS/NZS 3000: Electrical installations.
- AS/NZS 60079.10.1: Classification of areas – Explosive gas atmospheres.
- NCC. National Construction Code.

##### 14.4.4.1 Storage of flammable material

Collection and storage of flammable material adjacent to *electrical equipment* and *substation* enclosures including flammable liquids/items, gas cylinders and rubbish, is actively discouraged particularly in areas designated for personnel/vehicle access or evacuation.

Under no circumstances *shall* hazardous or flammable material be stored within the confines of a *network operator's* or *consumer's substation* including areas designated as a fire risk zone.

##### 14.4.4.2 Fire hydrant installations

Australian standard 2419.1-“Fire hydrant installations”, requires that fire hydrants and brigade booster assemblies, be located in a position at least 10 metres from any *high voltage* main electrical distribution equipment including transformers and switchboards.

##### 14.4.4.3 Separation from petroleum and gas installations

Minimum clearances of 8 metres *shall* be provided from any *network operator distribution system* equipment to a *consumer's* commercial installation containing petroleum/gas storage or dispensing facilities. Clearances will vary dependent on the related environment, activity, nature of the hazard and location of the ignition source. For example:

- A petrol station requires a 4m minimum horizontal clearance from petrol bowsers in an outdoor facility and an 8m clearance in an indoor facility.
- An additional 1m clearance is required beyond the full extension of a vehicle filling hose.
- A 4m lateral clearance *must* be provided to fill, dipping points and vapour vent pipes for underground petrol tanks.
- LPG dispensing units, the horizontal clearance for an outdoor facility *must* be 6m beyond the full extension of the vehicle filler hose which in practice generally means 8m from the LPG bower.

Where the 8 metre clearance cannot be achieved or other safety concerns prevail, appropriate specialist technical advice *must* be obtained prior to commencing any development of the *substation* site. For specific detailed direction relating to separation *requirements* refer to the references listed in [clause 14.4.4](#). For the purposes of these *requirements* hazards associated with diesel fuel and CNG have been classified as being the same as for petrol and LPG.

#### **14.4.5 Alarm systems**

The installation of fire alarm and fixed fire suppression systems may be a condition of building approval as determined by the relevant government authority, an operational condition required by the *network operator* or fitted at the discretion of the *consumer / premises owner*.

Alarm systems for non-fire rated *distribution substations* may be required by the *consumer*, or the *network operator*. Where installed the system *shall* comply with the NCC and any additional *technical requirements* of the *network operator*. For fire rated *substation* alarm and extinguishing system installation *requirements* refer to [clause 14.6.4](#).

#### **14.4.6 Substation site requirements and preparation**

A range of variables may impact the finished ground levels of a *network substation* site including but not limited to the following geographical, environmental and climatic factors:

- soil types, content, compaction and stabilisation qualities;
- existence of environmentally sensitive or public drinking water protected areas;
- elevation above flood levels and drainage;
- located in relation to coastal or inland environments;
- climatic conditions including ambient temperatures and levels of precipitation;
- existing or introduced vegetation/natural ground cover; and
- site shape, height and slope (need for retaining walls).

The following conditions *shall* apply where a *substation* site is required:

1. a suitable site shall be provided by the *consumer* at no cost to the *network operator*;
2. the area depicted by the *network operator's technical requirements* shall be retained for their *sole use*, for the life of the *substation* installation;
3. the *consumer* shall provide engineering/architectural drawings of the proposed site, including areas adjacent to it, for review prior to commencing *substation*;
4. the site height shall be as prescribed by the *network operator* for predicted 100-year flood levels and where not specified no lower than:
  - a. the finished level of the surrounding *lots* and the adjacent road carriageways. In rural regions the finished level of carriageways may be higher than that of the surrounding areas to allow for natural drainage of the carriageway; and
5. *substations* sites shall not be:
  - a. located in water courses or drains;
  - b. public drinking water or environmental sensitivity areas unless approved and equipped with appropriate containment measures; and
6. the site shall be:
  - a. free from non-related services either on, under or in close proximity to the site;
  - b. suitably prepared, stabilised and pegged;
  - c. compacted and level in accordance with the *network operator's technical requirements*. (A compaction certificate may be required);
  - d. clear of any vegetation and materials other than sand (e.g. rock, clay or building materials);and

7. for sites higher than the neighbouring finished levels, civil engineer (NER) certified batters, kerbs, retaining walls, screens, access steps, safety barriers and drainage *shall* be provided by the *consumer* at no cost to the *network operator*:
  - a. these features *shall*, in addition to providing the required safety measures prevent site erosion. Where retaining walls, access steps, screens and/or batters are installed, the land requirements *shall* be increased to accommodate these features and associated footings; and
  - b. footings for such structures and or adjacent properties *shall* not encroach into the *substation* site. A signed certificate of verification is required from a registered NER civil engineer verifying that the substation retaining walls are structurally sound and/or battered slopes are suitable for their purpose;
8. *substation* sites *shall* be protected where there is a potential impact hazard in accordance with *network operator's technical requirements* for ground mounted equipment:
  - a. for sites located in a car park or near general traffic flow, protective structures *shall* be installed around the site boundary as prescribed by the *network operator*; and
9. following the installation of all *substation* equipment, exposed surface areas at the site *shall* be stabilised to mitigate against the effects of erosion in accordance with the *network operator's technical requirements*. Treatments *shall* be completed to the satisfaction of the *network operator*.

#### **14.4.7 Access**

##### **14.4.7.1 Site**

Access to *substation* sites *shall* be suitable for heavy vehicles to enable construction, maintenance and operation of the *substation*. It is essential that the immediate area around the *substation* is level to facilitate the installation, removal or replacement of the transformers, switchgear and related *substation* equipment. Where the required access conditions cannot be achieved due to specific site restrictions or space limitations the *consumer* or their agent *must* liaise with the *network operator* to facilitate an alternative acceptable access arrangement.

For additional information and guidance refer to the *network operator's technical requirements*.

##### **14.4.7.2 Pits and cover access**

Pits and associated cover(s) *shall* be approved for use. Access to pits and covers *shall* be maintained at all times both within and outside the *substation* installation and site.

Within the structure, ceiling heights and wall clearances shall be such that pits and covers can be easily accessed to allow for the installation of *network operator* cables and plant.

Outside the *premises* or structure, there *shall* be suitable access provided for a crane from the street or right of way with no obstructions above the pits and covers.

##### **14.4.7.3 Equipment**

Access to a *substation* *shall* be suitable for heavy plant with allowances provided for the installation of large *network distribution system* infrastructure (i.e. size and weight). Refer to the *network operator's technical requirements* for dimensions, size and weight details.

##### **14.4.7.4 Personnel**

Direct access to all *substations* *shall* be provided for *network operator* personnel, 24 hours per day, 7 days per week even where the *substation* is located within a *premises* or structure or more than 30 metres from a *property boundary*.

#### 14.4.8 Sizing of transformers

The maximum discrete capacity that can be connected to or from a *district substation* is the nameplate rating of the transformer. Transformer *overload/cyclic* rating capability is not to be taken into account when selecting the minimum transformer size.

The maximum discrete capacity that can be connected to or from a *sole use substation* is nominally the nameplate rating of the transformer, which may be less than the nameplate rating due to protection grading obligations. However, in selecting the minimum transformer size, the *overload/cyclic* rating capability of the transformer may be taken into account based on the specific connection profile of the *consumer*.

#### 14.4.9 Point of supply (connection) and consumer mains cable

The *consumer shall* provide and install the *consumer mains cable* from the *consumer's main switchboard* (MSB) to the *network operator's* designated *point of supply (connection)* (PoS). These cables *shall*:

- Preferably copper due to smaller lug sizes
- Installed in PVC ducts
- Take the shortest possible route from the PoS to the MSB, not crossing underneath any *network operator* equipment.

**Note:** *Substation network* access permits may be required where existing *network* equipment is installed and or energised.

*Consumer mains cable* including neutral conductors, switchboards, main switch and SPD *shall* comply with these *requirements* and the *network operator's technical requirements*. The maximum size of *consumer mains cable* that can be terminated to a *district* or *sole use substation* is prescribed by the relevant *network operator's technical requirements*.

The *network operator* may approve the use of double insulated single core cables, installed on cable tray where access to terminations permits, the MSB is contiguous, the connection originates from the *substation* and no further mechanical protection is *required*.

The use of bus duct or busways may also be used subject to *network operator* consideration and approval.

##### 14.4.9.1 District substations

Where the *consumer's main switchboard* is remote from the *substation*, the *consumer mains cable shall* have overcurrent and short circuit protection. To ensure grading with upstream protection, the *consumer's* maximum connection *shall* be in accordance with the *network operator's technical requirements*.

Where higher *loads* are required, the MSB *shall* be contiguous with the *substation* so that links may be used for connection to the *network operator's* LV switchboard.

##### 14.4.9.2 Sole use substations

In all cases, the *consumer's main switchboard shall* be contiguous with the *substation*, with the *consumer mains cable* connected to the MSB from the LV terminals on the *network* transformer.

The *consumer's service protection device shall* be with-drawable unless approved otherwise by the relevant *network operator*.

### 14.4.10 General earthing requirements

*Substation* earthing systems *shall* be installed in accordance with the applicable industry standards, [WAER](#), and *substation* earthing arrangements as illustrated by the *network operator's technical requirements*.

An effective earthing system *shall* be installed within the *substation* to maintain a low potential difference between the exposed metallic parts of the *substation* installation and earth. The system *shall* be suitably rated to withstand the magnitude of any prospective fault current.

#### 14.4.10.1 General conditions

In addition to the *network operator's technical requirements*, the following *requirements shall* apply to all *district* and *sole use substation* installations:

1. earthing conductors *shall* be in accordance with AS 2067;
2. earth electrodes and flexible connections *shall* be as prescribed by *network operator's technical requirements* ;
3. earth connections are to be crimped and provided from *network* equipment and metallic parts to the main earth conductor;
4. connections *shall* be tagged and labelled at the main earth bar to clearly indicate purpose and origin; and
5. the *substation* earthing grid *shall* be buried in accordance with the *technical requirements* below the *substation* finished ground level. (Minimum 500mm for Horizon Power *substation* installations).

Refer to [clauses 14.5](#) and [14.6](#) for additional specific earthing *requirements* for both fire and non-fire rated *substation* installations.

#### 14.4.10.2 System testing and commissioning

The earthing installation *shall* be tested and commissioned in accordance with the *requirements* of, AS 2067, AS/NZS 3000 and as specified by the *network operator*. Test results *shall* be made available to *network* construction project Manager.

#### 14.4.10.3 Metallic screens and fencing

Metallic screening or boundary fencing adjacent to *substations* is not recommended and is to be avoided wherever possible. Where a *consumer/developer* installs metallic screening, boundary fencing or other conductive fittings, they *shall* make future land-owners aware of the potential hazards and implement the following minimum *requirements*.

##### 14.4.10.3.1 Horizon Power

The use of metallic screen fencing is not recommended. When a *consumer* requires a conductive fence to be installed in close proximity to a *substation*, a 2 metre separation from the *substation* earth-grid and the conductive fence is required.

The *requirements* of AS 2067 and AS/NZS 3000 *shall* apply and approval of the proposed earthing arrangement *shall* be obtained from the *network operator's* project Manager prior to installation.

##### 14.4.10.3.2 Western Power

Dependent on the *network connection point* for each project, Western Power will advise if metallic fences will pose a step-touch *voltage* risk or not. Unless exempted by Western Power step-touch *voltages* on metallic fences on the *substation* site boundary *shall* be considered in an EPR (Earth Potential Rise) study for every *substation*.

**Note:** EPR studies may still be required for other metallic structures/services around the *substation* site such as metallic pipelines or telecommunication services.

The step-touch *voltages shall* be assessed assuming that a metallic fence will be erected on the *substation* site boundary unless the site is located inside a *premises* or structure. If an exemption is granted, the *consumer* or *developer shall* record this exemption in the project records as the outcome of the metallic fence step-touch *voltage* assessment by Western Power. If no exemption is granted, an EPR study *shall* be carried out to assess step-touch *voltages* on the metallic fence for the *substation(s)* in that *subdivision* stage/project. It *shall* be assumed that a metallic fence is installed on the Western Power *substation* site boundary but not connected to the *substation* earth.

For such fences the *subdivision/substation(s)* earthing *shall* be designed to meet tolerable step-touch *voltage* limits of AS 2067. The EPR study *shall* be undertaken using the fault levels and protection settings provided by Western Power.

An EPR report detailing any mitigation needed to meet tolerable *voltage* limits on the fence is to be submitted to Western Power for consideration. The EPR study will have one of two outcomes:

1. the *substation* earthing has been designed such that step-touch *voltages* on the fence are within tolerable *voltage* limits and metallic fences will not pose a step-touch *voltage* risk; or
2. the step-touch *voltages* limits on the metallic fence cannot be met, then one of the following options can be used:
  - a. the *substation* site boundary can be increased such that the step-touch limits on the metallic fence are met at the new *substation* site boundary; or
  - b. the *developer shall* install a masonry *property boundary* fence at the same time as the installation of the *substation*. This masonry fence is *required* on all sides of the *substation* adjoining private property and extending along the private *property boundaries* to the point where step-touch *voltages* on the *property boundary* fence are within limits.

**Note:** These options *shall* not be used to mitigate step-touch *voltages* for the power system earthing design of the Western Power *substation* site. Western Power may consider a *consumer/developer* alternative solution.

#### **14.4.11 Vegetation screens**

Where the *consumer* seeks to use vegetation as a form of natural screening for either aesthetic or operational reasons the *consumer shall* comply with fire zone *requirements*. An appropriate vegetation management plan shall be developed and implemented to ensure the safe operation of the installation and the safety of *network* staff and the community.

The selection of vegetation *shall* be such that any introduced flora is not hazardous to persons, livestock, the installation or the environment. Screens manufactured from combustible materials or products *shall* not be installed or located within the fire risk zone and *shall* not compromise the safety of the installation or firefighting personnel in event of a fire.

#### **14.4.12 Metering**

##### **14.4.12.1 Low voltage metering**

The maximum single electrical connection (*network* exit point) that can be LV metered is 2695A. Refer to [section 11](#) for full details of LV metering arrangements.

##### **14.4.12.2 High voltage metering**

Where *high voltage metering equipment* is required, the *network operator* will provide a quotation, inclusive of the costs to provide, install and commission the *metering equipment*. Refer to [section 11](#) for further information including details of indoor and outdoor metering units.

Enquires about *metering equipment*, including details of installation facilities, should be referred to the *network designer* or construction project Manager.

### 14.4.13 Requirement for a contiguous switchboard

Where a *consumer* is fed from a fused LV supply out of a *network operator district substation*, the magnitude of the connection *shall* be limited so that the *consumer's* main switch will grade with the *network operator's* LV fuse.

The maximum size *network operator* LV fuses which can be used is in turn dependent on the transformer rating/voltage (and whether the transformer is protected by HV dropout fuses or a RMU fuse switch). Should the cable to the *consumer's point of supply (connection)* be protected by a fuse, the *consumer's* switchboard can be remote from the *substation*.

Where a *consumer* is fed from a *district substation* and the magnitude of the connection is such that the *consumer's* main switch cannot grade with the maximum sized *network* LV fuse which can be used with the transformer, the *consumer* will be supplied either from links or a disconnect unit (depending on the magnitude of the connection). In this configuration the *main switchboard shall* be contiguous with the *substation*.

Where a *consumer* is fed from a *sole use substation*, the *consumer* is connected directly to the LV bushings of the transformer. In this case the cable to the *consumer's point of supply (connection)* is not protected therefore the *main switchboard shall* be contiguous with the *substation*, to limit the amount of unprotected cable exposed to damage.

For the *consumer's switchboard* to be considered as contiguous and where:

- The *substation* is screened, the switchboard *shall* be against the exterior of the screening.
- A *substation* enclosure is constructed, the switchboard *shall* be against the exterior wall of the enclosure.
- There is no screening or enclosure the switchboard *must* be immediately adjacent to the edge of the *substation* site boundary but not more than 1 metre from the *point of supply (connection)*.

**Note:** For *sole use substation consumer* connections, a *network operator* may elect to designate a *network* circuit breaker located within their *substation* equipment as the *consumers point of supply (connection)*. For addition specific information on *consumer* switchboard locations refer to the *network operator's technical requirements*.

## 14.5 Conditions non fire rated substation enclosures

### 14.5.1 Application

This [section](#) describes the additional conditions to those specified in [clause 14.4](#) which *shall* apply to situations where the *network operator* does not require the *consumer* to construct a fire rated *substation* enclosure.

### 14.5.2 Substation site requirements and preparation

Refer to [clause 14.4](#) for details of site *requirements* preparation.

### 14.5.3 Earthing requirements for non-fire rated substations

The *network operator* will undertake the earthing installation for *district* and *sole use substations* except where the *substation* is installed as a part of a *subdivision development*. Refer to the *network operator's UDS manual* for further details.

### 14.5.4 Screening

Where a MPS or non-MPS cluster arrangement is installed, the *network operator* has no specific requirement for screening around the *substation* site. The *consumer* may elect to install screening (preferably not metallic) for aesthetic or other reasons in which case the screening remains the *consumer's* responsibility.

If the *consumer* chooses to install screening, approval *shall* be obtained from the *network operator* prior to its erection.

Where approved, screens *shall* be constructed, installed and maintained as prescribed by the *network operator* inclusive of the following:

1. non-metallic screening is permissible (e.g. non-conductive fencing, masonry walls, etc). The *network operator* will provide technical indicative permissible screening arrangements for *substation* sites;
2. where full screening is proposed, two access openings are required. If the *consumer* elects to install doors they *shall* be hinged to open outwards, with no self-locking. The doors *shall* be unobstructed with no physical barriers within a 2 metre radius of an opened door. If locking is required, *network operator* padlocks are to be used;
3. where a roof is required, the *consumer shall* liaise with the *network operator* to address clearance, ventilation, access and future equipment maintenance *requirements*;
4. screening *shall* be installed after the *network operator* has completed all site works;
5. no part of the screening or associated foundations/supports *shall* encroach into the *substation* site;
6. unless specifically negotiated otherwise with the *network operator*, screening and any associated foundations or supports *shall* be in accordance with the *network operator's Distribution substation plant manual*; and
7. the *consumer shall* be responsible for ongoing maintenance of the screening.

## **14.6 Conditions for fire rated substation enclosures**

### **14.6.1 Application**

This [section](#) describes the additional conditions to those specified in [clause 14.4](#) which *shall* apply to situations where the *network operator* requires the *consumer* to construct a fire rated *substation* enclosure. It is the *consumer's* responsibility to ensure that these *requirements* and *network operator's technical requirements* are met which may be audited by the *network operator*.

Where a *consumer's premises* or structure encroaches a fire or noise risk zone around a *substation*, the choice exists as to whether to construct a fire rated barrier/enclosure around the *substation* or to fire rate the *consumers premises* or structure within the fire risk zone.

### **14.6.2 General construction requirements**

In addition to this [section](#) general *requirements*, enclosures *shall*:

1. be designed by a chartered *structural engineer* to:
  - a. the *network operator's technical requirements*; and
  - b. to resist loads and forces as outlined in AS/NZS 1170;
2. with:
  - a. minimum ceiling heights, dust tight roof, ventilation and external storm water guttering;
  - b. trench surfaces, covers and floors sealed for the purposes of waterproofing the treated surfaces and sealing concrete to control dust;
  - c. no more than two transformers in the same enclosure, with transformer pairs fire segregated; and
  - d. no essential public access/exit/escape pass through or open into the fire risk zone.

No other *premises* or structure is permitted within the *substation* fire risk zone unless it has a two hour fire rating.

### **14.6.3 Earthing requirements for fire rated substations**

#### **14.6.3.1 District and sole use substations**

The *network operator* will undertake the installation of the earthing system for *district* and *sole use substations*.

The *consumer shall* arrange with the *network operator* to have the earth electrodes installed in the enclosure floor before pouring the concrete. This also enables drilling access where deep earthing is required.

Where earth electrodes cannot be installed within the enclosure, the *consumer shall* supply and install earth pits, conduits and earth conductors, outside the enclosure in accordance with the *network operator's technical requirements*.

#### **14.6.3.2 Consumer owned substations**

For indoor ground mounted switchgear *substations*, the earthing system *shall* be installed by the *consumer* in the switchroom.

Where outdoor ground mounted switchgear is used, the *network operator* will install the earth grid around the *network* switchgear and the *consumer* will be responsible for the installation of the earth grid around their switchgear. The *consumer* is to provide suitable termination facilities for the connection of the distribution earth grid and *shall* liaise with the *network operator* to ensure both earthing grids are interconnected.

The *consumer shall* install earth electrodes in trenches, as directed during construction of the switchroom. Where there are separate trenches, a minimum of one electrode is required in each trench, with access provided between trenches to allow electrode interconnection. For further detail on earthing *requirements* refer to [clause 14.1](#).

Where the *consumer* purchases from the *network operator* a *substation* to convert to a HV tariff, it is the *consumer's* responsibility to ensure the *substation* earthing complies with the *network operator's technical requirements*.

Maintenance of the earthing systems *shall* be in accordance with the *network operators requirements*.

### **14.6.4 Fire alarms and extinguishing systems**

As prescribed by AS 2067, manually operated fire extinguishers suitable for suppressing an electrical fire *shall* be installed in an easily accessible location external to (or immediately internal to) the entry to each switchroom compartment.

Where required by the National Construction Code (NCC) and or the *network operator*, two hour fire rated *substations shall* be fitted with fire alarms supplied and installed by the *consumer*. The system *shall*:

1. alarm to the *consumer*;
2. comply with the *requirements* of the NCC and any additional *requirements* specified by the local government authority and *network operator*; and
3. *shall* not include any water sprinkler system or mechanism.

Where fire extinguishing or suppression system equipment is installed to ensure NCC compliance, the *consumer shall* provide details of the system to the *network operator*. Refer to [clause 13.14](#) for details relating to maintenance of systems and equipment.

### **14.6.5 Oil containment**

Fire rated enclosures housing *distribution system* equipment containing oil *shall* have oil containment systems and or bunding installed in accordance with the *network operator's technical requirements*.

### 14.6.6 Doors and locks

Doors for a fire rated *substation* enclosures *shall* comply with *network operator's technical requirements*, AS 2067 and the following:

1. doors and all associated hardware *shall* be fire rated in accordance with the NCC and AS/NZS 1905;
2. where self-closing/locking doors are installed, the doors shall be fitted with panic release bars supplied and installed by the *consumer*. For double door arrangements, a panic bar is required only on the active leaf;
3. two unrestricted exits from the enclosure are required which *shall* not open directly into trafficable areas. (Exits *shall* not be on the same wall or adjacent to each other);
4. all doors *shall* be fitted with external door handles, key operated external latches, fitted with standard *network operator* barrels,
5. meter enclosures *shall* be fitted with standard *network operator* padlocks. *Consumer* access requests *shall* be directed to the *network operator*, and
6. the *consumer shall* fit labels complying with AS 2067, AS 1319 and the *network operator's technical requirements*.

### 14.6.7 Ventilation

The preferred approach *shall*, wherever possible, be by natural ventilation for *substation* chamber and equipment rooms. This methodology minimises the risk of transformer or equipment failure due to an installed ventilation system malfunction.

*Substation* ventilation *shall* be as prescribed by the *network operator's technical requirements*.

Mechanical ventilation systems (permanent or temporary) *shall* be designed to take into consideration smoke removal from the *premises* and be so arranged that inspection and maintenance can be carried out while the *electrical equipment* is energised.

Basement chamber *substations shall* be provided with dedicated inlet and outlet ducts venting outside the *premises*.

Adequate vents *shall* be provided for pressure relief for roofed enclosures to prevent structural damage in the event of an explosion. In *substations* where transformers are installed, normal transformer ventilation meets this *requirement*. For *substations* where only switchgear is installed, pressure relief vent/s *shall* be installed and all vents *shall* be fitted with external security louvres.

Where natural cross flow ventilation for transformers cannot be achieved, and forced draught ventilation is required, the *consumer shall* supply and install the electrical system including distribution board, fans, ducting and weather-proof outlet grilles as required by the *network operator*. Fans *shall* be located inside the 2hr fire rated enclosure.

The electrical supply for the ventilation system, *shall* be sourced from the *consumer's electrical installation* or *network* LV frame where no other supply is available.

Fire dampened vents *shall* be installed as prescribed by the *network operator*. They *shall* be fitted with rotating type blades held in the open position by two thermal links in parallel and *shall* conform to AS 1682 and AS/NZS 1668.

Individual ducts *shall* be provided for each transformer. Grilles *shall* be of a robust construction with low air resistance. Refer to the *network operator technical requirements* for *substation* ventilation fan details and associated distribution board schematics. Air flow values are the minimum acceptable *requirement*.

If ducting passes over the top of the transformer, the ceiling height of the enclosure *shall* be increased in accordance with the *network operator's technical requirements* for *substation* enclosure construction.

### 14.6.8 Ducts, trenches and other penetrations

The *consumer* is responsible for the supply and installation of all ducts, trenches including covers and penetrations associated with the installation and operation of both *network* and *consumer* equipment.

Ducts, trenches and penetrations for electrical, communication, automation and *substation* supplementary systems *shall* comply with the *network operator's technical requirements*.

Covers *shall* be;

1. supplied and installed in removable sections;
2. fire resistant so as to not increase the fuel loading within the *substation*;
3. resistant to the effects of fauna and environmental conditions;
4. structural supported by brackets and fixtures throughout, that do not hinder cable installation; entry into equipment or access; and
5. are fixed in place to prevent movement under foot but allow for removal and replacement when required for maintenance and cable installation.

Retro fitting of covers may require modification of both the trench rebate and supports to ensure that covers sit flush with the floor and the switchgear/ring main unit mounting structures.

Where ducts or other penetrations enter the trench or enclosure, the *consumer shall* fit removable watertight seals to both ends of the installed ducts or penetrations prior to hand over. The seals *shall* be water and oil tight before and after cable and earth rod installation. *Network operator* personnel will reseal all ducts or penetrations after installation of *network* cables.

Where ducts are installed between fire segregated switchrooms, the *consumer shall* seal the ducts after the installation of all cables to maintain the required fire rating.

The *network operator* may require the installation of cable pulling eyes in trenches where a direct cable pull is not available or the enclosure is more than 20 metres from the street boundary. The eye *shall* be suitable for a working load of 30kN, to a safety (multiplying) factor of 2.

Cable turning pits may be required where a direct cable pull into the *substation* is not available. Pits *shall* be in accordance with the *network operator's technical requirements*.

### 14.6.9 Light and power

For *substations* housed in an enclosure, the *consumer shall be responsible for the* supply and installation of all general and emergency lighting fixtures, ventilation, general purpose outlets (GPOs) and associated wiring necessary for the equipment operation.

The electrical supply for the enclosure electrical system *shall* be sourced from the *consumer's electrical installation* or *network* LV frame where no other supply is available.

Lighting *requirements shall* be as prescribed by AS 2067, which in summary requires accessible indoor and outdoor installations to be provided with suitable lighting for routine operations.

Lighting levels *shall* be as agreed with the *network operator*. Emergency/auxiliary lighting *shall* be provided where deemed necessary by the *network operator*, which can be either a fixed installation or portable equipment. Refer to AS/NZS 1680 for guidance on lighting levels.

### 14.6.10 Wiring

Electrical wiring associated with ventilation, lighting and general power *shall* be installed in accordance with the Electricity (licensing) regulations and the AS/NZS 3000.

Where requested a copy of both the "completion notice" and "electrical safety certificate" *shall* be provided to the *network operator* on completion of this work.

#### **14.6.11 Fire rated certification**

A *network operator* may request from the *consumer/owner* certification that the completed installation complies with the relevant sections of the [WAER](#), *network operator's technical requirements* for *distribution substations*, National Construction Code and applicable industry standards to ensure *substation fire rated requirements* are achieved.

#### **14.6.12 Network section references**

##### **14.6.12.1 Horizon Power summary**

This section is to be read in conjunction with Horizon Power's [Distribution design rules and Distribution construction standard - Section "G" drawings](#).

##### **14.6.12.2 Western Power summary**

This section is to read in conjunction with Western [Power's Distribution substation plant manual](#) (DSPM).

# **Service and Installation Requirements**

## **Section fifteen**

### **Alternative & supplementary systems (generation)**

## 15 Alternative & supplementary systems (Generation)

### 15.1 Introduction

Generating installations including *Distributed Energy Resources* (DER) and *Alternative Energy* (AE) installations *must* be designed and installed by competent persons who have the required skills, knowledge and understanding of the effects of these energy sources on the operation of a *network operator's distribution network* and *consumer installations*.

The safety of users; *network/industry* personnel; and the general public is paramount when considering the installation, connection and operation of such systems.

Attention *shall* be given to the installation of compliant *generation systems* and effective operation, management of *voltage*, energy import and export limits, *islanding*, synchronisation and data collection (metering) over the life of the connected system.

A *network operator* may refuse to connect or choose to disconnect a *consumer's generating system* from the *distribution network* if the *generation system* or *unit* is:

- not approved for use or connection;
- non-compliant with regulatory and *network operator technical requirements*;
- is deemed operationally unsafe (to persons and users); and or
- considered by a *network operator*;
  - to be hazardous to the integrity of their *distribution network*; or
  - would adversely affect other *consumers* connected to that *network*.

### 15.2 Language

Within this [section](#) of the *requirements* the following references have the meaning as prescribed within the respective sub-clauses.

#### 15.2.1 Network power supply (normal)

A *consumer* that is connected directly to the *network operator's distribution system* is classified as having a normal *network* supply and connection. The *network* connection may incorporate or accommodate elements of an alternative, supplementary and or an uninterruptible supply through the use and connection of a *distributed energy resource* or *generation system(s)*.

The source of supply may be via a connection to a *network operator's distribution system* or *network stand-alone power supply*.

#### 15.2.2 Stand-alone power supply (SPS) (normal)

A *network* or private *stand-alone power supply* system is defined as being a self-contained *generation system* or *unit* providing the only source of energy, independent of any *network operator* mainstream (primary) *distribution network*.

The system may consist of one or a combination of *generating units* incorporating engine driven, renewable, *inverter*, or storage energy systems installed and maintained by the system owner.

*Stand-alone power supplies* are generally situated in remote areas to supply a *consumer's* installation which is not serviced by a *network operator's distribution network* or where there is no cost effective *network* access.

### 15.2.3 Alternative energy generation system(AE)

A *generation system* comprised of one or more *generating units* incorporating a changeover switching mechanism to maintain the functionality of a *consumer's electrical installation* or a part or parts thereof, in the event of an interruption of the normal *network* supply inclusive of:

1. emergency supply, to maintain operation of the *electrical installation*, or part thereof, for safety reasons;
2. standby supply to maintain normal operation of the *electrical installation*, or part thereof; and or
3. supplementary electricity supply

The system may consist of one or a combination of *generating units* incorporating engine driven, renewable, *inverter* or *energy storage systems* installed and maintained by the *consumer*.

### 15.2.4 Supplementary supply

A supply system intended to operate in conjunction with the *network* normal supply.

### 15.2.5 Uninterruptible power supply (UPS)

A combination of convertors, switches and energy storage devices (for example batteries) constituting a power system for maintaining continuity of supply in the event of an interruption of the normal network supply.

### 15.2.6 Parallel generation system or private parallel generator (PPG)

A *generation system* directly connected to a *network operator's distribution network*. The system may consist of one or a combination of engine driven, renewable, *inverter* or *energy storage systems (BESS)* installed and maintained by the system operator being either the *network operator* or *consumer* for the purposes of providing:

1. an *alternative energy* source;
2. *load* reduction or support; and or
3. parallel operation with a *network* supply.

**Note:** A PPG site may have the ability to export energy back into a *network distribution network*.

### 15.2.7 Distributed energy resource (DER)

*Distributed energy resources (DER)* is the collective term given to generation and renewable energy systems. Systems may include distributed energy devices such as dispersed power generation (including solar PV), energy storage, demand management and smart *inverters* located behind *network metering equipment* at the *consumer premises* or connected directly to a *distribution network*.

### 15.2.8 Embedded generation system (EG)

A *generation system* that can or is connected to or synchronise with the *distribution network* is defined as embedded.

## 15.3 Generation categories

Defining *generation system* categories assists both *network operators* and installation *applicants* develop assessment criteria and processes, thereby ensuring that the requirements for different systems are consistently managed and communicated to *consumers*, users, industry, *network* personnel and related government agencies.

### 15.3.1 Horizon Power categories

Connection Type	Connection Voltage	Technology Type	Capacity	Relevant Standards
Basic micro EG connection	Up to 1kV	Micro EG Inverter based	≤10kVA single phase ≤30kVA three phase	Published Basic micro EG connection technical requirements.
Low voltage EG connection	Up to 1kV	Inverter based	>30kVA to ≤1MVA three phase	Published LV EG connection technical requirements.
		Non- inverter based	≤10kVA single phase >30kVA to ≤1MVA three phase	
Medium voltage connection	1kV to 35kV	Any	Any size up to 10MW	Published Technical rules.
High voltage connection	>35kV	Any	Any size up to 10MW	
Registered generator connection	>35kV	Any	>10MW	

**Table 17:** Horizon Power categories

**Note:** The above is a summarised extract from Horizon Power's published EG connection *technical requirements*. For specific detail refer to [clause 1.6.1](#) or [Manuals and standards](#) website.

### 15.3.2 Western Power categories

Connection Type	Connection Voltage	Technology Type	Capacity	Relevant document
Basic EG connection	Up to 1 kV	Inverter energy systems without BESS	≤ 15 kVA 3Ø ≤ 5kVA 1Ø	Basic embedded generator (EG) connection technical requirements
		Inverter energy systems DC coupled with BESS	≤ 15 kVA 3Ø ≤ 5kVA 1Ø	
		Inverter energy systems AC coupled with BESS	≤ 30 kVA 3 Ø (15 kVA IES and 15 kVA BESS) ≤ 10 kVA 1Ø (5 kVA IES and 5 kVA BESS)	
LV EG connection	Up to 1 kV	All LV EG not covered by the Basic EG document	≤ 1 MVA	LV EG connection technical requirements
HV EG connection	> 1 kV	All HV EG systems	≤ 5 MVA	HV EG connection technical requirements

**Table 18:** Western Power categories

**Note:** The above is a summarised extract from Western Power's published *technical requirements*. For specific detail refer to [clause 1.6.2](#) or [Manuals and standards](#) website.

### 15.3.3 Notes to tables

**Note:** EG generation categories are based on the manufacturer's published AC power rating/output values for:

- Apparent power (kVA); or
- Maximum power, or
- Maximum and nominal power where the values are the same, or
- Nominal power where the maximum value is not published.

**Note:** Categories are based on the total combined AC power rating/output for the combined generation installation.

**Note:** Non-inverter connected *generation systems* less than 30 kVA, installed within Horizon Power's Pilbara Grid, NIS *network* or Western Power's SWIS *shall* comply with the relevant *network operator's Technical rules*.

## 15.4 Consumer/agent responsibilities

*Generation system* installations, connected to a *network operators distribution network shall* comply with but not limited to following:

- The Electricity Act, Metering Code and subsidiary legislation;
- Relevant statutory and regulatory *requirements* including the [WAER](#);
- These *requirements* and the *network operator's technical requirements clauses 1.6.1 and 1.6.2*;
- Industry standards as prescribed at [clause 15.4.1](#);
- The relevant electricity *retailer requirements*;
- *Consumer connection agreement*; and
- *Industry best practice* and the *manufacturers requirements*.

The *consumer* is responsible for the installation and maintenance of the *generation system* and for all costs incurred by the *network operator* resulting from the installation of that *generation system*.

This may include the provision of equipment to record the operation of the plant and or the control/protection of the *distribution network* where required by the *network operator*. The *consumer* and their agent(s) *shall* ensure that they are fully aware of their obligations and any conditions pertinent to the installation of this *generation system* and associated equipment.

### 15.4.1 Installation

The *generation system* installation and operation *shall* comply with but not limited to:

- regulatory *requirements* including but not limited to the [WAER](#);
- These *requirements*, the *network operator's Technical rules* and *technical requirements* as listed at [clauses 1.6.1](#) and [1.6.2](#);
- Applicable system Codes and Standards including but not limited to:
  - AS/NZS 3000, AS 2067, AS 3008, AS/NZS 3100;
  - AS/NZS 4777 all parts ,AS/NZS 5033, AS/NZS 5139, AS 62040, IEC 62109;
  - AS/NZS 3010, AS 2709, AS 1359, AS, 1940, AS/NZS4509, AS 60947.6.2;
  - AS/IEC 62619, AS 4086; and
  - AS/NZS 3100, AS/NZS 3017 and IEC 62116.

Where the system is to be a private *stand-alone power supply* with no existing or future intended *network* interconnection the installation *shall* comply with Building and Energy's *requirements*.

A *consumer*, system operator or their agent *shall* not connect any form of *generation system* to a *network* unless the *network operator* has first granted approval to do so. The *consumer*, system operator is also responsible for arranging (via their nominated *retailer*) for the installation of new or upgraded *metering equipment*, ([clause 15.12](#)) including commissioning and for all ongoing system inspections.

Where appropriate *network metering equipment* has not been commissioned and or connection approvals granted, the *network operator* may disconnect the *generation system*, which *shall* remain isolated until such time as the system has been confirmed as being compliant in accordance with the *network operator requirements*.

#### 15.4.2 Compliance and monitoring

The *consumer*, system operator *shall*:

1. maintain the *generation system* in a safe and functional condition;
2. ensure that the *generation system* complies at all times with these *requirements*;
3. not *alter* or interfere with the *network operator's* equipment located at the nominated system address;
4. seek approval from the *network operator* prior to *altering* the capacity of the *generation system* including those parts that may *alter* the system's operation or functionality;
5. not connect un-metered *loads* upstream of the *network metering equipment*;
6. ensure that their personnel, servants or agents who carry out any work or maintenance on the installation or any other part of the *generation system* or *electrical equipment* are appropriately qualified, skilled and where required *licensed* to do so; and
7. *shall* retain all certification(s) issued in respect of that work.

#### 15.4.3 Connection applications

Where a *generation system* is proposed, an application is required by the relevant *network operator* at the earliest possible opportunity and in all cases prior to connection. Where the *consumer* wishes to enter into an energy buy back scheme similar early advice *shall* be provided to the relevant electricity *retailer*. Refer to [clause 7.8](#).

Where there is no *generation system network* connection, the *consumer's* agent *shall* notify Building and Energy via the submission of a "preliminary notice" and "notice of completion".

A *network operator* may undertake an analysis or investigation of a *generation system* proposal before connection to confirm that the requested connection will not adversely impact the integrity, safety and security of the *network* or other *network* users.

##### 15.4.3.1 Installation restrictions

A *network operator's* approval to connect a *generation system* does not negate the need for the *consumer* or agent to seek and obtain approvals from other relevant federal, state, local authorities and electricity *retailers*.

It is essential to identify any installation restrictions or *requirements* with the applicable agency(ies) prior to applying for, purchasing, installing or commissioning a *generation system*.

#### 15.4.4 System changes or alterations

Any connection, *alteration* or *modification* of a *generation system* including increased output capacity, configuration, component upgrade or operational modification *shall* first be approved by the relevant *network operator* before the proposed change(s) is implemented.

Where a *generation system* is *altered* or installed and connected to an existing *network* supply arrangement and *electrical installation*, the modified/*augmented* element of the *altered network* connection, *electrical installation* or system *shall* comply with current *network* and industry protection and *technical requirements*.

**Note:** The *alteration* of an existing *network* connection and or *metering equipment* arrangement is classified as a new connection. Refer to [WAER](#) section 6.

*Generation system* relocations undertaken by the *consumer* *shall* be treated as a new installation. For more information refer to [clause 7.8](#)

Should the *consumer*, system operator intend to voluntarily disconnect their *generation system* from the *network*, formal notice *shall* be given to both the *network operator* and *retailer*.

## 15.5 Consumer equipment and appliances

Any technical analysis or investigation carried out by a *network operator* to determine the suitability of a *consumer's generation system* connection to their *distribution network* does not include an evaluation or consideration of the effect of that system on the *consumers electrical installation*, equipment or appliances.

It is the *consumer's* responsibility to seek advice from an appropriately trained, qualified and competent service provider to determine the effects, adverse or otherwise, of the *generation system* on the *consumer's electrical installation* and on the equipment or appliances connected to that *electrical installation*.

## 15.6 System designers and installers

Given the technical nature of the equipment, connection *requirements* and application process it is recommended, that the services of a qualified, competent and experienced system designer and installer is sought. For *large scale, stand-alone, commercial, industrial, high voltage* and *transmission generation systems*, designs and applications are to be prepared and submitted by an experienced, *professionally qualified electrical engineer*. System installations *shall* be completed by suitably qualified and experienced *electrical contractor*.

Where the nominal pressure (*voltage*) of the system exceeds 50V AC or 120V ripple free DC, the installation and connection of the *generation system shall* be completed by a competent *licensed electrical contractor*.

**Note:** To be eligible for government or state agency grants and rebates the *generation system* installer is required to be the holder of specific *generation system* qualifications and or additional endorsements.

## 15.7 Generation licence requirement

*Generation systems* operating at higher *distribution* and *transmission voltages* are required to be *licensed* in accordance with the Electricity Industry Act. Systems that do not require a "generation licence" *shall* be listed with the relevant *network operator* and *retailer*. For more information pertaining to "generation licences" refer to the [Economic Regulation Authority](#)

## 15.8 Connection arrangements

### 15.8.1 Connection

The aggregate output capacity of all *generation systems* installed downstream of the *point of supply (connection)* *shall* not exceed the operational capacity of the *network service apparatus* or *consumer's electrical equipment* connected to that *apparatus*.

It is preferable that the *generation system* is connected to the *electrical installation main switchboard*. Where this is not possible due to distance or cost considerations, the nearest distribution board may be used as a point of connection as long as compliance is achieved.

The *generation system* connection *shall* be via a dedicated circuit complying with the *network operator's technical requirements*, AS/NZS 3000, AS/NZS 4777 and AS 3008.

Cabling connecting the *generation system* to the *electrical installation* switchboard including all cables between that switchboard and associated distribution board(s) *shall* be sized to address *voltage rise/drop requirements* and be capable of carrying the full rated output capacity of the *generation system*.

Segregation of wiring systems conveying different *voltage* levels *shall* be suitably maintained in accordance with AS/NZS 3000 utilising installation methods described in the *network operator's technical requirements* with particular attention given to circuits conveying DC *voltages*.

### 15.8.2 Isolation and main switch

Both the *consumer's* installation main switch(es) and the *inverter* main switch *shall* ensure the *consumer's electrical installation* and connected *generation system* can be isolated from the *network operator's distribution system*. Refer to AS/NZS 3000 clauses 2.3 and 7.3.

The *consumer's installation* main switch(es) *shall* be rated and comply with the *requirements* of [section 11](#) and [clause 11.6.4.3](#). The *inverter* main switch *shall* be rated in accordance with AS/NZS 4777 and AS/NZS 3000.

**Note:** For connections to Western Power's *distribution network* the *electrical installation* main switch(es) *shall* be a circuit breaker. Should the *consumer's electrical installation* not have a circuit breaker as the installation main switch(es), the *electrical installation* *shall* be upgraded to incorporate a circuit breaker before connection and energisation of the *generation system* is undertaken. For additional information refer to AS/NZS 3000 clause 7.3.8.2.3.

### 15.8.3 Switching and fuse devices

All devices *shall* be suitably rated for the required duty and *voltage* type. Switching devices *shall* be lockable in the OFF position.

Where the source is direct current (DC), switches *shall* be DC rated and double pole, operating simultaneously in both the positive and negative conductors of the DC source.

AC rated devices *shall* not be used to control DC circuits. Where a DC fuse switch is used the fuse contacts *shall* be touch safe from both energy sources when in the open position.

### 15.8.4 Residual current devices (RCDs)

*Generation systems* *shall* be connected to the *electrical installation* on the *distribution network* side of any *consumer* or installation residual current device(s).

### 15.8.5 Security of operational settings

Where operational settings are applied via a keypad or switches, adequate security *shall* be employed to prevent tampering or inadvertent/unauthorised setting changes. A suitable lock or password system *shall* be used. The *network operator* *shall* approve setting changes prior to implementation.

## 15.9 Fault Protection

All equipment within the installation *shall* be adequately protected from electrical faults originating from either the *consumer's electrical installation* or the *network operator's distribution system*.

Fault contributions from the installation at each *point of supply (connection)* *shall* not exceed the values agreed between the *consumer*, system operator and the *network operator* as stated in the *connection agreement*.

When operating a *generation system* in a *stand-alone* configuration additional system *augmentation* may be required to achieve the required fault levels and appropriate level of protection.

### 15.10 Interlocks and change over

Where a *generation system* is installed for the purposes of providing an *alternative energy* supply to the *consumer's premises*, the standby/emergency systems *shall* not be used or operated in parallel with the *network operator's distribution network*.

The connection arrangement *shall* ensure that it is not possible for the *alternative energy generation system* to be connected to the *network* or permit the *network service* and *metering equipment* to be energised in the event of an intentional or unintentional loss or partial loss of the *network* connection.

All systems within the *electrical installation* capable of interconnecting the *alternative energy generation system* to the *network operator's distribution network* shall be adequately interlocked.

Switching shall be via a suitable interlocking device that prevents the simultaneous connection of the *alternative energy supply* to the *distribution network*. *Alternative energy generation systems* shall not rely on an external communication signal to initiate, operate or maintain a *consumer's alternative energy generation system*. The opening or closing of any associated switchgear door or cover shall not affect or control the interlocking system.

Where the *alternative energy generation system* automatically comes into operation on the loss of the *network* connection, a means of isolating the *generation system* shall also be provided.

Switchgear to facilitate the manual or automatic changeover shall be located on or adjacent to the switchboard controlling that part of the *electrical installation* to be supplied from the *alternative energy supply*.

A changeover switch shall provide isolation between the *generating unit* and the *network operator's distribution system*. It shall be permanently wired and may incorporate an intermediate "off" position. The changeover switch shall not be used in place of the site main switch for the *consumer's installation*.

The neutral shall not be switched or broken on the *network distribution* (upstream) side of the M.E.N. connection. Refer AS/NZS 3000 Section 7.

Changeover switches shall comply with AS 60947.6.1. Contactors and circuit breakers for automatic changeover shall meet the requirements of AS/NZS 3010.

### **15.11 Islanding prevention and protection schemes**

All protection settings and schemes to the extent that they may affect the associated *distribution network* shall coordinate and grade with the *network operator's* protection apparatus.

Prevention and protection schemes shall be installed in accordance with the *network operator's technical requirements* together with applicable codes and standards as referenced in [clause 15.4](#)

The *generation system* shall disconnect automatically from the *network* for any of the following events:

1. loss of *network* stability;
2. loss of *network* connection, supply;
3. detection of *network/consumer* fault conditions
4. power export exceeding agreed limits; and
5. generation equipment pole slip.

Where the *generation system* has the required *network* protection infrastructure and protocols, the system may continue to supply the *consumer's electrical installation* during loss of *network* supply. Reconnection to the *distribution network* shall be in accordance with the *network operator's [Technical rules](#)*.

It should not be assumed that standard *electrical installation* practices and *islanding* protection will be adequate for larger *generation systems* or for those systems located on the fringe or outside a major part of a *distribution network*.

The *network operator* may require the *consumer* to install within their *electrical installation*, additional protection measures to ensure the effective protection of personnel, infrastructure and the operation of the *distribution network* and *consumer's* system.

Mitigation options may include but be not limited to:

1. *augmentation* of the *network* or the *consumer's* infrastructure;
2. neutral *voltage* displacement (NVD) relays;
3. inter-trips (IT);
4. negative phase sequence (NPS) protection; and
5. other anti-*islanding* relay options.

The *consumer* shall install all (secondary) wiring associated with the above mitigation options and liaise with the *network operator* regarding termination/connection *requirements*.

### **15.12 Metering, monitoring, control and data-acquisition**

The *consumer*, system operator is responsible for arranging for the installation of or changes to their *metering equipment* via a separate application to the relevant electricity *retailer*

No *generation system* shall be connected to a *network operator's* *distribution system* prior to the installation of new or upgraded code compliant import/export *metering equipment* as approved by the *network operator*. Refer to [sections 7](#) and [11](#).

The *consumer*, system operator shall where required enable monitoring of the installation and appropriate control of switches by the *network operator* to safeguard its personnel, the public and the *network*.

Costs associated with the supply and installation of new import/export *metering equipment*, modification or reprogramming of existing *metering equipment* inclusive of appropriate enclosures to house that equipment shall be borne by the *consumer*.

The enclosure(s) shall be in an appropriate non-hazardous area, established and maintained by the *consumer* for the life of the *metering installation*. Refer to [section 11](#).

In all cases the *metering equipment* shall be as specified and remain the property of the *network operator*. The availability of buy back tariffs should be negotiated with the relevant electricity *retailer*.

### **15.13 Power quality**

*Network operators* are charged with the responsibility of ensuring the quality of supply to all *consumers* as prescribed in [section 10](#).

Modification to a *consumer's* *electrical installation* may be required to ensure *voltage* levels or imbalances are avoided both in the installation and in the *network*.

Where unacceptable operational parameters are identified or discovered, the *network operator* may require or perform a power quality investigation to determine the cause and specify an appropriate course(s) of action including the upgrade or disconnection of the offending installation or equipment.

#### **15.13.1 Network connection limits**

The maximum amount of generation that can be connected to the *network operator's* *distribution system* is determined by the characteristics and the ability of that *network* to meet the performance *requirements* of the applicable *network operator*.

A detailed evaluation may be required to ensure that the *voltage* performance *requirements* of the *network operator* are not compromised when the system is either generating, off-line or not available. If an application for additional generation results in the *network* limits being exceeded, the *network operator* may:

1. reject the application as presented, therefore disallowing the *network* connection; or
2. consider a downsized *generation system* that satisfies *network* performance limits; or
3. require an upgrade of the affected portion of the *network distribution system* and associated connection to accommodate the proposed *generation system*.

For specific information on maximum limits refer to:

- **Horizon Power's** *technical requirements* nominated at [clause 1.6.1](#); or
- **Western Power.** *technical requirements* nominated at [clause 1.6.2](#).

### 15.13.2 Voltage-drop

To determine *voltage* drop along *network* feeders and infrastructure, the energy provided by the *generation system* is not deducted from the *consumer's* maximum demand.

The *network* is designed assuming that a *consumer generation system* is not available, power quality can be maintained and requested capacity limits *loads* can be achieved. This ensures the *network* capacity is not exceeded should the system be removed from service.

### 15.13.3 Voltage rise

It is a *network requirement* that *voltage* rise across the *network* and *consumer's electrical installation* shall not exceed the *network operators* specified limits for the rated *voltage*. Modification to the *consumer's electrical installation* inclusive of *consumer mains cable and sub-main cables* may be required to ensure *voltage* levels or imbalances are avoided both in the *consumer's installation* and in the *network*. Refer also to clause [15.17.6.2](#).

### 15.13.4 Power factor

The *network operator's* [Technical rules](#) details power factor *requirements* for both connected *loads* and generation. Refer to [section 10](#).

## 15.14 Labelling

The *consumer's electrical installation* and *generation system* shall be labelled in accordance with these *requirements*.

System installers when applying signage and labelling shall consider the fundamental safety and operational purpose for each and where required vary the terminology to ensure a clear understanding is delivered. In summary labels and signage shall be:

1. in English, legible with lettering sized appropriately for the location;
2. constructed in accordance with AS 1319 of durable materials suitable for the location and purpose;
3. fixed in a manner that ensures the sign/label remains in place;
4. indelible, clearly visible; and
5. effectively maintained for the life of the equipment.

Signs and labels shall not be obscured by placement or location so that the meaning or warning is lost or incorrectly conveyed. As a guide lettering height should be 5mm for upper case and 4mm for lower case, per metre of viewing distance.

All isolation and control devices shall be labelled to confirm their functionality and relationship with the *generation system* and the *network operator's distribution network*. If the system is connected to a sub board, all up-stream (i.e. towards the *main switchboard*) switches and switchboards shall also be labelled.

Multiple sources of generation, incorporating automatic or manual switching shall have prominent labels and signage placed both at the source and *point of supply* and or connection informing operational staff of:

1. the existence and location of each generation source;
2. type(s) of generation;
3. point(s) of isolation;
4. type of and location of the switching operation; and
5. shut down, priority sequences and isolation procedures for each generation source.

## 15.15 Commissioning and maintenance

The *consumer*, system operator is responsible for system commissioning, maintenance and all ongoing inspections.

### 15.15.1 Commissioning

The *generation system shall* be tested and commissioned by a competent *electrical engineer/contractor* following the installation of code compliant *metering equipment*. The commissioning process *shall* as a minimum confirm and verify that the completed *electrical installation and generation system*:

1. complies with the required *network operator technical requirements* and is fit for the purpose;
2. functions correctly within the specified operational parameters and ranges;
3. isolation and protection devices are installed and functional;
4. *islanding* protection operates in accordance with *network generation system requirements*;
5. has compliant signage and labelling is in accordance with these *requirements*
6. operational manuals, shut down procedures and diagrams have been validated and accurately reflect the installed system;
7. shutdown procedures are prominently displayed or readily accessible; and
8. has been commissioned and where required certified by a *professionally qualified electrical engineer*.

Where the *consumer*, system operator has entered into an agreement to export energy, the electricity *retailer* may require confirmation that the *generation system* has been installed, tested and commissioned in accordance with their technical *requirements*.

### 15.15.2 Operational manual

As a part of the commissioning process the system installer *shall* provide system operation and technical manuals together with sufficient *onsite* instruction/training to the *consumer*, system operator to ensure there is a clear understanding of the:

1. obligations and responsibilities associated with operating the *generation system*;
2. operating principles, component identification and functionality;
3. safety features and modes of operation;
4. energisation and isolation procedures;
5. operational relationship with the associated *distribution network*; and
6. care and maintenance requirements.

It is the *consumer*, system operator's responsibility to ensure that they are informed and understand the operation and functionality of their *generation system* and that the system is maintained in accordance with the manufacturer's, *network operators* and where applicable the *retailer's requirements*. The *consumer*, system operator *shall* not subsequently modify the *generation system* without first notifying and gaining approval from the *network operator* and electricity *retailer*.

### 15.15.3 Shut down procedure

Each *generation system shall* have a shutdown procedure, describing the shutdown and emergency processes to be implemented by the *consumer*, system operator, *network* staff and emergency services personnel. As a minimum, the procedure *shall* be prominently displayed in or be accessible at the following locations:

1. *main switchboard*; and
2. the switchboard to which the system is directly connected to; and
3. fire panel where such systems are installed.

The procedure may also include information relating to the start-up procedures.

**Note:** Portable *generation systems* may have similar instructions/procedures affixed to the equipment.

#### **15.15.4 Maintenance**

The *network operator* and the electricity *retailer* may elect to inspect the *generation system* from time to time to ensure continued compliance. In the event that the *network operator* considers that a *generation system* and or DER installation poses a threat to safety, quality of supply or to the integrity of the *distribution system* the *network operator* may restrict the use of or disconnect the system.

Protection systems *shall* be tested for correct functionality at regular intervals in accordance with the manufacturer's *requirements*. The *consumer*, system operator *shall* engage the services of a suitably competent service provider to conduct these tests. Results of tests *shall* be certified by the service provider and retained by the *consumer*, system operator for provision to the regulator, *network operator* or *retailer* when requested.

#### **15.16 Additional requirements - Parallel connected generation**

A direct connected *generation system* is defined as all *generation systems* not covered by the *requirements* of AS/NZS 4777 series of industry standards.

This definition may include but is not limited to *generation systems* and *large scale consumer installations* consisting of:

1. *embedded generation*;
2. *synchronous generating units* driven by gas engines, gas turbines or petrol/diesel engines;
3. *energy storage systems*;
4. large fuel-cell installations;
5. wind turbine *generating units*; and
6. *synchronous and asynchronous generating units*.

Direct connected *generation systems* including both export and non-export systems connected in parallel with a *network operator's distribution network*, *shall* comply with the *network operator's [Technical rules](#)* and these *requirements*.

##### **15.16.1 Application and connection**

Both small to *large scale system* connection applications *shall* be prepared utilising the services of a *professionally qualified electrical engineer* with generation industry experience to aid the *consumer* with the technical details and completion of the application.

An application *shall* be submitted to and approved by the *network operator* prior to the commencement of any installation work. For more information refer to [clause 7.8](#).

Each application will be individually assessed by the relevant the *network operator* for connection suitability and compliance with regulatory and *network operator technical requirements*.

##### **15.16.1.1 Horizon Power**

For further information and guidance on Horizon Power's connection *requirements* within the Pilbara Grid and NIS *networks*, reference *shall* be made to the Horizon Power's [Technical rules](#) and the *network* documents listed at [clause 1.6.1](#). For assistance contact [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

##### **15.16.1.2 Western Power**

The user guide [Generators up to 10 MVA](#), *network* documents listed at [clause 1.6.2](#) and Western Power's [Technical rules](#) provide information on the pertinent *requirements* for connection to the SWIS *distribution network*. Enquiries should be made via the online contact [portal](#).

### 15.16.2 Design and installation

Direct connected *generation systems* shall be mechanically and electrically isolated from the *distribution network* supply where it is not a *parallel generation system*. The system shall be protected against weather, dampness, fire and over-current.

Conductors shall be suitably segregated and spaced from all the other conductors of the *electrical installation*, to limit any damage to the *consumer's electrical installation* if an internal *generation system* fault occurs. The correct sizing of both the earth and neutral conductors is essential for permanently connected generation equipment as these conductors may carry substantial fault currents. Refer to AS/NZS 3000 and AS 2067 for specific information.

### 15.16.3 Multiple generation units

*Consumers* must discuss the method of connection with the relevant *network operator* where multiple generation units are to be connected in parallel.

Methods will vary dependent on the size of the *site* and whether or not all the units are to be connected at the same switchboard. *Large scale consumer installations* may have generation units at multiple locations, whereas smaller *sites* may have generation units located in one position. Refer to [clause 15.10](#) for additional changeover requirements.

It should be noted that harmonic currents may be produced by these generation arrangements through the neutral conductor. Where dissimilar generation units are operated in parallel, steps shall be taken to limit the circulating current in the neutral connection between the units.

## 15.17 Additional requirements - Inverter connected systems

The term '*inverter energy system*' (IES) as described in these requirements has the same meaning as in AS/NZS 4777.

The definition includes systems connected to a *distribution network* via an approved (dc/ac sine wave) *inverter*. Complete systems may include but not limited to *stand-alone power*, supplementary, standby or parallel arrangements consisting of one or more of the following components:

- *inverters*;
- *photovoltaic PV array* (solar panels);
- engine, wind or hydro *generating unit*, and or
- *energy storage system* (*battery*)

### 15.17.1 Technical requirements

Each *network operator* has detailed *technical requirements* for their respective *distribution networks* that prescribe the IES parameters, *consumer*, system operator obligations, connection and operational requirements pertinent to the connection of such systems to their *networks*.

In summary those *technical requirements* include but are not limited to the following:

#### 15.17.1.1 Horizon Power

- Basic micro EG connection technical requirements.
- Low voltage embedded generation connection technical requirements.
- Transfer of customer load between embedded generators and the distribution network.
- [Technical rules](#).

For direct access to these and other related documents refer to [clause 1.6.1](#) or go to the [Manuals and standards](#) page.

### 15.17.1.2 Western Power

- Battery inverter energy system (IES) requirements.
- Basic embedded generation (EG) connection technical requirements
- Distributed energy resource management - Validation principles
- LV EG connection technical requirements
- HV EG connection technical requirements
- [Technical rules](#).

For direct access to these and other related documents refer to [clause 1.6.2](#) or go to the [Manuals and standards](#) page.

A *consumer*, system operator *shall* advise and apply to the relevant *retailer* and *network operator* when contemplating the connection of an IES to a *distribution network*.

The services of an experienced, qualified system designer and installer is recommended to determine the appropriate type, size, system control (Energy Solar Management ESM) and installation *requirements* for the proposed DER system and location.

The *consumer* should complete their negotiations with the *retailer* and *network operator* before proceeding with any detailed design, placement of orders for equipment or letting of *contracts*. This action will avoid costs to the *consumer* arising from designs or equipment identified as being unsuitable for connection to the respective *distribution network*.

### 15.17.2 Energy exporting

With the exception of Horizon Power, *network operators* are not able to enter into direct energy buyback agreements.

*Consumers* wishing to offset part or all of their electricity needs by exporting (selling) to an electricity *retailer*, any excess energy produced by their system, need to enter into a separate agreement with their *retailer* prior to having the system connected to the relevant *network*.

### 15.17.3 Approved inverters

The *inverter* and protection equipment *shall* be certified by a recognised testing laboratory and approved for use prior to being connected to a *distribution network*.

It is the manufacturer's and installing agent's responsibility to ensure that the *inverter's* certification is and remains current. *Inverters* that do not have the required certification and approval *shall* not be or remain connected to the *network operator's distribution network*.

Where there is doubt on the level of equipment compliance, the manufacturer or installing agent *shall* validate the equipment certification with the [Clean Energy Council](#) or relevant *network operator*.

### 15.17.4 Compliance

In addition to the general *requirements* contained within this [section](#) an *inverter energy system* *shall* comply with the *requirements* listed at [clause 15.4](#).

### 15.17.5 Inverter energy system capacity

A *network operator* may carry out a connection assessment of an *inverter energy system* to confirm *network* performance standards will and are being met when the system is operational.

### 15.17.6 Connection and wiring

IES wiring *shall* be installed in accordance with the *requirements* of [clause 15.4](#). Adequate protection from UV and mechanical damage *shall* be provided in accordance with AS/NZS 3000 including clauses 3.3.2.11 and 3.9 with additional protection provided for array wiring as prescribed by AS/NZS 5033.

### 15.17.6.1 Connection

Wiring connecting the IES to the installation *shall* be rated to accommodate the full rated output of the *inverter*. It is preferable for the system to be connected to the *premises main switchboard*. Refer to [clause 15.8](#).

### 15.17.6.2 Consumer mains cable

Modification to the *consumer's electrical installation* and connection arrangement may be required to ensure *low voltage* levels and imbalances are maintained within the installation and on the *network*. *Low voltage* rise:

1. within the *consumer's electrical installation* from the EG system to the *point of supply (connection)* *shall* not exceed 2%; and
2. *shall* not exceed 1% of the rated *voltage* across the *network*:
  - a. *overhead service cable from the point of supply (connection) to the street mains; or*
  - b. *underground service mains from the point of common coupling to the junction with the street mains cable.*

**Note:** Costs associated with both *consumer* and *network* infrastructure upgrades *shall* be borne by the *consumer*.

### 15.17.6.3 Array and sub array

PV string, array and sub-array wiring *shall* be selected and sized in accordance with the *requirements* prescribed by AS/NZS 3000 and AS/NZS 5033.

### 15.17.6.4 Earthing arrangements

Where a PV array has the capability of delivering *voltages* greater than ELV all exposed metal module frames *shall* be earthed. Earthing of the array mounting frames *shall* also be undertaken where the array wiring is not mechanically protected.

Exposed conductive parts including structural metalwork (e.g. module frames, structures) *shall* be bonded to earth via an earthing conductor complying with AS/NZS 3000 with a minimum cross sectional area of 4mm<sup>2</sup> connected directly to the installation's earthing system.

If the exposed conductive parts of a PV array are exposed to lightning, the bonding conductor *shall* have a minimum cross-sectional area of 16mm<sup>2</sup> copper or equivalent. Refer to AS/NZS 5033.

### 15.17.6.5 Wiring segregation and identification

PV array and sub array cabling installed on or within a *premises* *shall* be either distinctively manufactured and permanently embossed to identify their function or distinctively marked with coloured labels bearing the words 'SOLAR' attached at intervals not exceeding 2 metres. Where enclosure in conduit or duct, it *shall* be labelled 'SOLAR' at each end and at each change in direction.

### 15.17.7 Schematic diagram

On completion and commissioning of the installation, an accurate single sided wiring diagram of the installation showing all equipment and isolation components *shall* be affixed adjacent the *inverter energy system* or incorporated into the user's technical manual.

### 15.17.8 Isolation and protection

There *shall* be a visible and accessible method of ensuring that the *inverter energy system* can be disconnected from the *distribution network* and disconnected from the *consumer's* installation.

### **15.17.8.1 Over-current protection**

Over-current protection *shall* be provided at the *inverter energy system* in accordance with AS/NZS 4777 unless otherwise agreed to by the *network operator*.

### **15.17.8.2 Isolation**

Isolation and protection *shall* be installed in accordance with the *requirements* of AS/NZS 3000, AS/NZS 4777 and AS/NZS 5033, irrespective of where the *inverter energy system* circuit emanates from.

### **15.17.8.3 PV array switching and fuse devices**

PV array and sub array devices *shall* be supplied and installed in accordance with the *requirements* of AS/NZS 5033.

## **15.17.9 Safety**

### **15.17.9.1 Restricted access to PV arrays**

The installation of PV arrays, including associated equipment, wiring and protection, *shall* be constructed in accordance with AS/NZS 5033 and AS/NZS 4777, so that where required, access is restricted to authorised persons only.

### **15.17.9.2 Fire safety**

*Consumers*, system operators of IES *shall* consider the implications of electrical or mechanical damage to the PV array's sub-mains cable and wiring systems in the event of a fire or other significant adverse event. A potential exists for emergency services personnel and industry operatives to receive an electric shock through direct or indirect contact via water spray with a full or partially operational PV array and wiring. Refer to the *requirements* of AS/NZS 3000 and AS 5033.

### **15.17.10 Commissioning**

In addition to the general *requirements* for system commissioning the service provider *shall* confirm that the:

- completed installation complies with AS/NZS 4777 and AS/NZS 5033;
- *islanding* protection operates correctly;
  - disconnecting the *inverter energy system* from the *network* within 2 seconds;
  - reconnecting following restoration of normal supply is greater than 1 minute;
- operational manual, shut down procedure and diagrams accurately reflect the installed system; and
- owner/operator understands their obligations and responsibilities.

### **15.17.11 Labelling and signage guide**

The system installation *shall* in addition to the general *requirements* be labelled in accordance with AS/NZS 4777, AS/NZS 5033 and IEC 62109.

### **15.17.12 Shut down procedure**

A shutdown procedure as prescribed by AS/NZS 5033 and AS/NZS 4509 *shall* be provided at the switchboard to which the system is directly connected to.

### **15.18 Additional requirements - Portable generation systems**

Portable *generation systems* may be temporarily connected to a *consumer's installation* provided that the system cannot be directly or indirectly connected to the *distribution network*. The method of connection *shall* be in accordance with the *requirements* specified at [clause 15.4](#) including AS/NZS 3000 and AS 2709. Compliance with these *requirements* is essential as there is no adequate protective mechanism for the control of *islanding* or automatic disconnect/reconnection of the portable *generation systems*.

### **15.19 Additional requirements - Transmission generation systems**

Generation and *large scale installation* operators *shall* seek the advice and services of a *professionally qualified electrical engineer* with specialist power system experience to provide the required data and meet the *network operator's technical requirements* for connection to and operation on a *transmission system*.

#### **15.19.1 Horizon Power**

For further information and guidance on Horizon Power's connection *requirements* within the Pilbara Grid and NIR *networks*, reference *shall* be made to the Horizon Power's [Technical rules](#) and the *network* documents listed at [clause 1.6.1](#). For assistance contact [enquiries@horizonpower-reply.com.au](mailto:enquiries@horizonpower-reply.com.au)

#### **15.19.2 Western Power**

The user guide [Generators up to 10 MVA](#), *network* documents listed at [clause 1.6.2](#) and Western Power's [Technical rules](#) provide information on the pertinent *requirements* for connection to the SWIS *distribution network*. Enquiries should be made via the online contact [portal](#).

#### **15.19.3 Applications and connections**

*Large scale consumer installation* connections *shall* be prepared utilising the services of a *professionally qualified electrical engineer* with generation industry experience to aid the *consumer*, system operator with the technical details and completion of the application and "submission".

It is important that an application is submitted to and approved by the *network operator* prior to the commencement of any installation work. For more information refer to [section 13](#).

# **Service and Installation Requirements**

## **Appendices**

**Appendix A. Document amendments**

<b>Initial Publication</b>		
<b>Date of Publication</b>	<b>Date of Application</b>	<b>Sections Amended</b>
May 2010	1 June 2010	New edition

<b>Version 02</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
December 2010	February 2011 (refer Clause 2.4)	All Sections except for of 4 and 5

<b>Version 03</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
February 2012	March 2012 (refer Clause 2.4)	All Sections

<b>Version 04</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
April 2013	1 <sup>st</sup> June 2013 (refer Clause 2.4)	All Sections

<b>Version 05</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
December 2014	30 <sup>th</sup> January 2015 (refer Clause 2.4)	All Sections

<b>Version 06 (Incorporates the following revisions)</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
Addendum #1	18 <sup>th</sup> March 2015	Clauses 11.9.2 & 12.3
Addendum #2	16 <sup>th</sup> December 2015	Clauses 11.5, 11.11 & 11.12 Figure 62 update

<b>Version 07</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
Addendum #3	1 <sup>st</sup> October 2016	Clauses 8.1.5, 8.4, 11.8.1, 11.8.2 ,11.12, Figures 46,47,52 and 12.4.8

<b>Version 08</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
Addendum # 4	1 <sup>st</sup> May 2019	All Sections

<b>Version 09</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
Addendum # 5	1 <sup>st</sup> February 2020	WP only alignment with Switchboard Guideline

Version 10		
Date of Amendment	Date of Application	Sections Amended
1 <sup>st</sup> August 2021	1 <sup>st</sup> August 2021 (refer Clause 2.4)	All Sections WASIR new edition
Version 10 incorporating First amendment		
Date of Amendment	Date of Application	Sections Amended
5th November 2021	8th November 2021	As listed
Clause #	Amendment detail (Text changes shown in blue or red strikethrough)	
Definition	⑥ Enterprise definition reworded An owner, operator, business, company or corporation <del>or company</del> governed by a single administrative body or entity <del>for commercial purposes</del> .	
Definition	⑥ Omitted definition for consumer reinstated A person or enterprise with an existing connection or seeks a connection to a network operator's distribution network for the purposes of consuming (importing) and or generation (exporting) electricity from and or to that network.	
Definition	⑥ Definition for Western Power's standard connection service (supply) amended to include 32A three-phase (415 volts) reference	
7.10.1 figure 10	⑥ Redundant equipment pictures shown under heading 100A/200A cut out box updated.	
11.6.3	⑥ Heading and clause restructured <del>Active and neutral</del> Links Service and reference links for both neutral and active and neutral conductors shall comply with these requirements and AS/NZS 3000	
11.6.3.1	⑥ Heading and clause restructured and reworded Active and neutral service link(s) Where required <del>links are required the links</del> shall be: <ol style="list-style-type: none"> <li>consumer panel mounted, <del>all</del> insulated from earth type, fitted with a sealable active colour coded <del>or labelled</del> covers;</li> <li>easily accessible to facilitate connection/disconnection, testing and commissioning;</li> <li>current rated at not less than the capacity of the incoming conductor with separate terminals for all incoming and outgoing conductors;</li> <li>where active the links are mounted on the rear of a panel, the panel shall be hinged in accordance with AS/NZS 3000; and</li> <li>labelled as <del>"Service Active Links"</del> to identify the links function in a legible and durable manner.</li> </ol>	
11.6.3.2	⑥ Heading and clause restructured and reworded <del>Service and</del> Reference link(s) shall be: <ol style="list-style-type: none"> <li>meter panel mounted, insulated from earth type, fitted with a sealable neutral colour coded and labelled covers;</li> <li>current rated <del>at not less than the capacity of the incoming conductor</del> with separate terminals for each conductor, clamped by no less than two screws;</li> <li>located in an accessible position to facilitate <del>that conductors can be conveniently</del> connection/disconnection for testing and commissioning compliance purposes;</li> <li>identified labelled as "Neutral Reference Neutral Link", in a legible and durable manner; and</li> <li>able to accommodate the:               <ol style="list-style-type: none"> <li><del>incoming main neutral conductor</del>;</li> <li>neutral connection to the consumer's neutral service link and associated neutral reference links; and</li> <li>individual neutral conductors to each meter.</li> </ol> </li> </ol>	

Figures 33 and 35	® Notes to the figure have been amended to align with changes to clauses 11.6.3.1 and 11.6.3.2	
12.4.12	® The following note has been added to the clause. Note: One (1) span is deemed to be a standard service cable length.	
<b>Version 10 incorporating Second amendment</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
3 <sup>rd</sup> June 2022	10 <sup>th</sup> June 2022	As listed
<b>Clause #</b>	<b>Amendment detail</b> (Text changes shown in blue or red strikethrough)	
1.1 (5)	® Replace the reference to " <del>Occupational Safety and Health Act 1984</del> " with the following reference to "Work Health and Safety Act 2020"	
1.2	® Amend the definition of responsible person by replacing the reference to " <del>Occupational Safety and Health Act 1984</del> " with the reference to "Work Health and Safety Act 2020"	
1.2	® Amend the last dot point in the definition for "standard connection service (supply) Western Power" to read 46 20 amps per phase, multi-phase, (480 volts); and	
1.4.1	® Amend the clause by removing the references to: <ul style="list-style-type: none"> <li>• <del>Mines Safety and Inspection Act 1994</del></li> <li>• <del>Mines Safety and Inspection Regulations 1995</del></li> <li>• <del>Occupational Safety and Health Act 1984</del></li> <li>• <del>Occupational Safety and Health Regulations 1996</del></li> </ul> ® And inserting the following references: <ul style="list-style-type: none"> <li>• Work Health and Safety Act 2020 (previously Occupational Safety and Health Act 1984)</li> <li>• Work Health and Safety (General) Regulations 2022</li> <li>• Work Health and Safety (Mines) Regulations 2022</li> <li>• Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022</li> </ul>	
1.6.2	® Amend the document reference list to read: <ul style="list-style-type: none"> <li>• Distributed energy resource management - Validation principles</li> <li><del>Network integration guideline.(NIG)</del></li> </ul>	
3.6.6	® Replace the existing heading and clause with: <b>Work Health and Safety Act 2020</b> The objectives of the WHS Act are to: <ol style="list-style-type: none"> <li>1. protect the health and safety of workers and other people by eliminating or minimising risks arising from work or workplaces</li> <li>2. ensure fair and effective representation, consultation and cooperation to address and resolve health and safety issues in the workplace</li> <li>3. encourage unions and employer organisations to take a constructive role in improving work health and safety practices</li> <li>4. assist businesses and workers to achieve a healthier and safer working environment</li> <li>5. promote information, education and training on work health and safety</li> <li>6. provide effective compliance and enforcement measures</li> <li>7. deliver continuous improvement and progressively higher standards of work health and safety.</li> </ol>	

	<p>® And remove the following references:</p> <p><b>Occupational Safety and Health Act 1984</b></p> <p><del>8.—promote and secure the safety and health of persons at work;</del>  <del>9.—protect persons at work from hazards;</del>  <del>10.—assist in securing safe and hygienic work environments;</del>  <del>11.—to reduce, eliminate and control hazards to which persons are exposed at work;</del>  <del>12.—to foster co-operation and consultation; and</del>  <del>to promote education and community awareness on matters relating to OS&amp;H.</del></p> <p>® And insert the following references:</p> <p>The WHS 2020 Act replaces in part or in full the following legislation:</p> <p>13. Occupational Safety and Health Act 1984  14. the work health and safety elements of the following Acts, covering mining and petroleum:</p> <p>a. Mines Safety and Inspection Act 1994  b. Petroleum and Geothermal Energy Resources Act 1967  c. Petroleum (Submerged Lands) Act 1982  d. Petroleum Pipelines Act 1969.</p>
3.6.6.1	<p>® Replace the existing heading and clause with:</p> <p><b>Work Health and Safety Regulations 2022</b></p> <p>1. Work Health and Safety (General) Regulations 2022  2. Work Health and Safety (Mines) Regulations 2022  3. Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022</p> <p>In general, the WHS Regulations, replace the Occupational and Safety Regulations 1996.</p> <p>® And remove the following references:</p> <p><b>Occupational Safety and Health Regulations 1996</b></p> <p><del>These Regulations make provision for:</del></p> <p><del>1. the general and administrative provisions of the Act;</del>  <del>2. workplace safety including general duties, environmental, workplace activities, electricity, earthworks, and demolition as they apply to the workplace;</del>  <del>3. plant, equipment and hazardous substances; and</del>  <del>4. certificates of competency.</del></p>
3.6.7	<p>® Deleted the existing heading and clause:</p> <p><b>Mines Safety and Inspection Act 1994</b></p> <p><del>The objectives of this Act are to:</del></p> <p><del>1.promote, and secure the safety and health of persons engaged in mining operations;</del>  <del>2.assist in identifying and reduce hazards relating to mines, mining operations, work systems and plant at mines;</del>  <del>3.protect against and eliminate risks associated with mines, mining operations, mining systems, and plant and hazardous substances;</del>  <del>4.foster and facilitate cooperation and consultation; and</del>  <del>5.provide for procedures to contribute to the development and formulation of safety legislation.</del></p>
3.6.7.1	<p>® Deleted the existing heading and clause:</p> <p><b>Mines Safety and Inspection Regulations 1995</b></p> <p><del>These Regulations make provision for the:</del></p> <p><del>1.general and administrative provisions of the Act;</del>  <del>2.management of mines;</del></p>

	<p><del>3-general safety requirements;</del></p> <p><del>4-electricity infrastructure in mines; and</del></p> <p><del>5-general mining types and specific methods of operations.</del></p>
4.3.7.3	<p>Ⓡ Amend the clause to read:</p> <p>A Division of the Department of Mines Industry Regulation and Safety, responsible for the administration of the occupational <b>work, health and safety</b> <del>and health</del> legislation throughout the state.</p> <p>The principal objective of the <i>Western Australia's Work Health and Safety Act 2020</i> <del>Occupational Safety and Health Act 1984</del> is health and safety <del>and health</del> within the workplace. For more information about <a href="#">WorkSafe</a> refer to their website.</p>
6.2	<p>Ⓡ Amend the 2<sup>nd</sup> paragraph to read:</p> <p>The provision, connection and use of electricity requires the highest standards of <b>health and safety</b> <del>and health</del>. Horizon Power and Western Power are committed to the prevention of injury and harm and therefore strive to continuously improve <b>health and safety</b> <del>and health</del> across their respective <i>networks</i>.</p>
6.3	<p>Ⓡ Amend the 1<sup>st</sup> paragraph to read:</p> <p>Any entity or individual working on or near a <i>distribution network</i> or a <i>consumer's electrical installation</i>, must manage their <b>health and safety</b> <del>and health</del> obligations in accordance with <i>industry best practice</i>, applicable legislation, codes, industry standards and the <i>network operator's safety, operational and technical requirements</i>.</p>
6.3.1	<p>Ⓡ Amend the 1<sup>st</sup> dot point:</p> <ul style="list-style-type: none"> <li>• <b>Work</b> <del>Occupational Safety and Health and Safety</del> Regulations 2022 <del>1996—Part 3</del> inclusive of <b>but not limited to Part 4.7 Divisions 6—Electricity and 12 Construction industry</b>; and</li> </ul>
6.3.2	<p>Ⓡ Amend the start of the 1<sup>st</sup> sentence to read:</p> <p>Under the <b>Work</b> <del>Occupational Safety and Health and Safety</del> Act 2020 <del>1984</del> DMIRS (WorkSafe) ..... control.</p>
7.7.4	<p>Ⓡ Amend the 1<sup>st</sup> paragraph to read:</p> <p>The <b>Work</b> <del>Occupational Safety and Health and Safety</del> Regulations 2022 <del>1996</del> (Regulation 163 <del>6.35</del>) requires a person conducting a business or undertaking that includes construction work, to comply with the <i>requirements</i> of AS/NZS 3012. That work may require the provision of <del>a site main contractor, where it is practicable to do so, to have</del> temporary power supply available before <del>the time</del> construction, on the <i>site</i>, has reached plate height or the equivalent.</p> <p><b>Where required</b> the electricity supply <i>shall</i> be via a <i>network connection</i> service by way of either a temporary or permanent connection.</p> <p><del>This DMIRS WorkSafe requirement focuses on noise and environmental issues, created by using portable generation systems and to ensure the safety of tradespeople when working on construction sites.</del></p>
8.1.3	<p>Ⓡ Insert the following sentence after the last paragraph:</p> <p><b>Note:</b> It is essential that the installation, checking and testing results associated with work described within the submitted "notice of completion" are recorded and retained as required by Regulation 52 of the Electricity (Licensing) Regulations 1991.</p>
10.11.6	<p>Ⓡ Delete the existing clause and sub-clauses.</p> <p>Ⓡ Insert the following restructured and amended content.</p> <p><b>Electric vehicle supply equipment (EVSE) and associated EV plugs/connectors shall comply with relevant industry standards and the <i>network operators technical requirements</i>.</b></p> <p>The installation of EVSE may <i>alter</i> the <i>consumers site</i> maximum demand and potentially the associated <i>network</i> supply and connection arrangement requiring additional or upgraded infrastructure <b>and installation</b> protection.</p>

	<p>(For additional information refer to the relevant <i>network operator</i> and clause 11.6.4)                  The rated current of EVSE shall not <del>exceed</del> <b>cause</b> the <b>total load</b> limits specified:</p> <ol style="list-style-type: none"> <li>1. in clause 7.6.2, <b>table 3</b> for equipment to be connected to Horizon Power's <i>distribution network</i>; or</li> <li>2. for a <i>standard connection service</i> connected to Western Power's <i>distribution network</i>;</li> </ol> <p>to be exceeded.</p>
11.1.2.1	<p>Ⓜ Amend the sentence to read:                  Where a <i>consumer's</i> supply arrangement and or switchboard is <del>altered or</del> upgraded, any existing rewirable fuse protection assemblies <b>on that switchboard</b>, shall be replaced with protection devices complying with AS/NZS 3000 and these <i>requirements</i>.</p>
11.6.4	<p>Ⓜ Amend the 2<sup>nd</sup> sentence to read:                  Installation main switch(es) shall, <b>in</b> addition to the <i>requirements</i> of the <b>WAER</b>, AS/NZS 3000, AS 2067 and AS/NZS 4777, comply with these <i>requirements and the network operator's embedded generation (EG) technical requirements</i>.</p>
11.6.4.3	<p>Ⓜ Clause amended to read:                  A <i>consumer's electrical installation</i> shall have an installation main switch or switches installed as prescribed by AS/NZS 3000, the <b>WAER</b>, these <i>requirements</i> and the <i>network operators</i>:</p> <ul style="list-style-type: none"> <li>• <b>Technical rules</b>; and</li> <li>• <b>Embedded generation (EG) and Electric vehicle (EV) technical requirements</b>.</li> </ul> <p>Where required by the <i>network operator</i>, the <i>consumer's</i> main switch(es) shall be a circuit breaker with visible and lockable isolation facilities, <b>and where</b>:</p> <ol style="list-style-type: none"> <li>1. a single main switch is installed, it shall be rated to the lesser value of the <i>network connection service</i> or the <i>consumer's</i> requested and agreed allocated capacity for the <i>consumer's electrical installation</i>; or</li> <li>2. multiple main switches are installed and the <i>service protection device</i> (SPD) is a fuse(s), the sum of the current ratings of the individual main switches, shall not exceed the lesser value of <i>network connection service</i> or the <i>consumer's</i> requested and agreed allocated capacity for that <i>consumer's electrical installation</i>; or</li> <li>3. multiple main switches are installed and the <i>service protection device</i> (SPD) is a circuit breaker, the agreed allocated <i>network</i> capacity across the individual main switches, shall not exceed the lesser value of <i>network connection service</i> or <i>service protection device</i> SPD rating.</li> </ol> <p><del>1. the lesser value of network connection service capacity or the consumer's requested and agreed calculated maximum demand for the consumer's electrical installation; or</del>  <del>2. where multiple main switches are installed, the sum of the current ratings of the individual protection devices shall not exceed the lesser value of network connection service capacity or service protection device (SPD) rating.</del></p> <p>Notes:</p> <ol style="list-style-type: none"> <li>a. This is a mandatory <i>requirement</i> for all connections to Western Power's <i>distribution network</i>. For additional guidance refer to AS/NZS 3000 clause 2.5.1.</li> <li>b. <b>Horizon Power</b> may also require, specify the application of this <i>requirement</i> as a condition of connection to their <i>distribution network</i>.</li> </ol>
11.11.5	<p>Ⓜ Clause amended through either removal of the reference to <del>tee-off box(s)</del> or clarification of the term via the insertion of the word <b>riser</b> before the word tee-off.</p>
11.11.6	<p>Ⓜ Clause clarified via the insertion of the word <b>riser</b> before the word tee-off.</p>
11.12.4	<p>Ⓜ Clause amended by the removal of the reference to <del>tee-off box(s)</del></p>
11.12.5	<p>Ⓜ Clause amended by the removal of the reference to <del>tee-off box(s)</del></p>
Figure 38	<p>Ⓜ Add the following note to the diagram:  <b>7. Earthing realigned with AS/NZS 3000</b></p>

Figure 39	<p>® Add the following note to the diagram: 7. Earthing realigned with AS/NZS 3000</p>
12.4.4	<p>® Amend the last paragraph to read: Access <i>shall</i> not be restricted by any portion of the <i>consumer's premises</i> or require <i>network/electrical</i> personnel to climb over or onto a roof or other structure to gain access to the PoA/PoS. Access <i>shall</i> be in accordance with the WAER, the <del>Work Occupational Health and Safety</del> <i>legislation Regulations</i> and these <i>requirements</i>.</p>
12.6.8	<p>® Clause amended to read: Joints in <i>consumer mains cable</i> are not permitted unless approved by the <i>network operator</i>, subsequent to the <del>following</del> <i>submission</i> of a "preliminary notice". If jointing is unavoidable and approval has been granted, an <del>the</del> <i>electrical contractor</i> may join a <i>consumer mains cable</i> by means of a full enclosed cast resin or a gel design <del>epoxy</del> <i>jointing kit</i> that ensures the same level of protection as that prescribed by WAER Section 5 and AS/NZS 3000. The joint <i>shall</i> be located <del>with</del> <i>in</i> a position that ensures unrestricted access, for the life of the <i>electrical installation</i>, within a <i>pit</i> or similar appropriate enclosure. Where the depth of the joint would exceed the confines of the enclosure (e.g. &gt; 600mm over the entire cable route length) it may be direct buried. The joint location <i>shall</i> be clearly identified and recorded on the <i>site</i> "as installed" drawings, in accordance with the <i>requirements</i> of AS/NZS 3000 and any addition specified <i>network operator</i> conditions. A "notice of completion" <i>shall</i> be submitted to the relevant <i>network operator</i> as required by the Electricity (Licensing) Regulations 1991.</p>
12.11.5	<p>® Amend the 1<sup>st</sup> paragraph to read: <del>It is a requirement of The Work Occupational Safety and Health and Safety Regulations 2022 1996 (Regulation 163), 65) specify that requirements for where it is practical to do so, that by the time the work carried out on construction on the site has reached plate height or the equivalent, electricity has been supplied to the sites. from a network operator's network by way of a temporary or permanent connection.</del></p>
15.17.1.2	<p>® List of document references amended:</p> <ul style="list-style-type: none"> <li>• <del>Network integration guideline.(NIG)</del> Distributed energy resource management - Validation principles</li> </ul>
15.17.1.2	<p>® 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> paragraphs amended to read: A <i>consumer</i>, system operator <i>shall</i> advise and apply to the relevant <i>retailer and network operator</i> when contemplating the connection of an IES to a <i>distribution network</i>. <del>It is recommended that</del> The services of an experienced, <del>and</del> <i>qualified</i> system designer and installer <del>is recommended sought by the consumer</del> to determine the appropriate type, size, <i>system control (Energy Solar Management ESM)</i> and installation <i>requirements</i> for the <i>proposed DER system and given</i> location. <del>Dependent on the system size, generation capacity, location and network operator technical requirements</del> The <i>consumer should</i> <del>may need to enter into complete their</del> negotiations with the <i>retailer and network operator</i> before proceeding with any detailed design, placement of orders for equipment or letting of <i>contracts</i>. This action will avoid costs to the <i>consumer</i> arising from designs or equipment identified as being unsuitable for connection to the respective <i>distribution network</i>.</p>
15.17.6.2.	<p>® 1<sup>st</sup> sentence amended to read: Modification to the <i>consumer's electrical installation</i> and the <del>network</del> <i>connection arrangement service</i> may be required to ensure low <i>voltage</i> levels and imbalances are maintained within the installation and on the <i>network</i>.</p>

15.17.9.1.	<p>Ⓢ Clause amended to read:</p> <p><del>PV arrays for installation on domestic premises shall not have Voc array maximum voltages greater than 600 Vdc. For non-domestic</del> The installations of where the PV arrays <del>maximum voltage exceeds 600 Vdc the entire PV array</del> including associated equipment, wiring and protection, shall be constructed in accordance with AS/NZS 5033 and AS/NZS 4777, so that where required, access is restricted to authorised persons only.</p>	
<b>Version 10 incorporating Third amendment</b>		
<b>Date of Amendment</b>	<b>Date of Application</b>	<b>Sections Amended</b>
3 <sup>rd</sup> April 2023	11 <sup>th</sup> April 2023	As listed
<b>Clause #</b>	<b>Amendment detail (Text changes shown in blue or red strikethrough)</b>	
All	Ⓢ Document indexes updated and aligned	
All	Ⓢ Document formatting and content tables updated: Minor editorial updates	
All	Ⓢ References to “customer services centres” standardised	
All	Ⓢ References to multi-phase clarified as either split or three phase	
All	<p>Ⓢ Definitions for and references to Horizon Power’s Tech Rules and associated network descriptions amended:</p> <p><b>distribution system (network)</b> - Electricity infrastructure used, or to be used, for, or in connection with, or to control, the transportation of electricity at nominal voltages of less than 66 kV, forming part of <del>the Horizon Power’s Pilbara Grid, NIS or Western Power’s NWIS, NIS or</del> SWIS.</p> <p><b>network</b> - The electricity distribution and transmission system within either <del>the Horizon Power’s Pilbara Grid, a NIS network or Western Power’s NWIS, NIS or</del> SWIS</p> <p><b>network operator</b> - Means either Horizon Power or Western Power as the entity defined by Electricity Industry Act 2004 and the Energy Operators (Powers) Act 1979 that lawfully operates the distribution and transmission systems within <del>the Horizon Power’s Pilbara Grid, a NIS network or Western Power’s the NWIS, NIS or</del> SWIS.</p> <p><b>Pilbara Grid</b> – The interconnected network located in the Pilbara region of the state of Western Australia. (Formerly known as the Horizon Power’s North West Interconnected System, NWIS)</p> <p><b>Technical rules</b> – The “Technical Rules for the Pilbara Grid (formerly known as the North West Interconnected Network) and Non- Interconnected Systems”, as published by Horizon Power.</p> <p>The “Technical Rules for the South West Interconnected Network”, as published by Western Power and approved by the Economic Regulation Authority.</p> <p><b>transmission system (network)</b> – Any apparatus, equipment, plant or structures used, or to be used for, or in connection with, the transportation of electricity at nominal voltages of 66 kV or higher that forms part of <del>Horizon Power’s Pilbara Grid, a NIS network or Western Power’s the NMIS, NIS or</del> SWIS.</p>	
1.2	<p>Ⓢ Definition for connection service (network) added:</p> <p>The installed electricity infrastructure rated in accordance with the connection agreement to facilitate the transfer of electricity to or from the network operators electricity network.</p> <p>Existing references to “services”, standardised throughout the document.</p>	
1.2	<p>Ⓢ Definition for metropolitan area added:</p> <p><b>metropolitan area</b> As definition in section 12 of this document</p>	

1.2	<p>Ⓔ Existing definition for standard connection service (supply) Horizon Power replaced with the following revised definition:</p> <p>Standard supply is defined as 240 volt single-phase (+/- 6%) or 415 volt three-phase (+/- 6%) for:</p> <p>a new or altered network connection service from and within Horizon Power's service area:</p> <ul style="list-style-type: none"> <li>Supply capacity requirements and limits are dependent on regional specific criteria. For Horizon Power serviced areas and regional specific criteria refer to Section 7 Table 3 – Horizon Power Towns and Networks Maximum Allowable supply per installation.</li> </ul> <p>Notes:</p> <ol style="list-style-type: none"> <li>Subject to service availability</li> <li>Is not applicable for network stand - alone power supply systems.</li> <li>For network connection generation capacity limits, refer to Section 15 and Horizon Power's embedded generation requirements.</li> </ol>
1.2	<p>Ⓔ Existing definition for standard connection service (supply) Western Power replaced with the following revised definition:</p> <p>Standard supply is defined as 240 volt single-phase (+/- 6%) or 415 volt three-phase (+/- 6%) for:</p> <p>a new or altered network connection service from and <del>Perth metropolitan and major regional centres</del> within the SWIS:</p> <ul style="list-style-type: none"> <li>63 amps single-phase (240 volts); or</li> <li>32 amps per phase, three-phase (415 volts) (Note1); or</li> </ul> <p><del>Rural centres and connections within the SWIS (Note 1):</del></p> <ul style="list-style-type: none"> <li><del>20</del> 32 amps per phase, multi-phase, (480 volts) (Note1); and</li> </ul> <p>to maximum size of consumer mains/submain cable shall not exceeding 35 mm<sup>2</sup>.</p> <p>Notes:</p> <ol style="list-style-type: none"> <li>Subject to service availability.</li> <li>Is not applicable for network stand - alone power supply systems.</li> <li>For network connection generation capacity limits, refer to Section 15 and Western Power's embedded generation EG technical requirements.</li> </ol>
1.3	<p>Ⓔ Abbreviations for and references to Horizon Power's networks amended:</p> <p><b>NIS</b> - Non- Interconnected System</p> <p>The transmission and distribution electricity networks owned and operated by Horizon Power in towns and communities outside those areas covered by the Pilbara Grid <del>NWIS</del> and the SWIS.</p> <p><b>NWIS</b> - North West Interconnected System. (Now known as Pilbara Grid).</p> <p>The transmission and distribution electricity network owned and operated by Horizon Power in the Pilbara Region extending from Karratha to Port Hedland in the North West of Western Australia.</p>
1.4.2	<p>Ⓔ Reference and link amended: to "Guidelines for safe management of private power poles and lines (commerce.wa.gov.au)</p>
1.6.1	<p>Ⓔ Reference to Horizon Power's Technical rules amended to read:</p> <ul style="list-style-type: none"> <li><u>Technical rules</u> <ul style="list-style-type: none"> <li>Pilbara Grid (formerly known as the Horizon Power North West Interconnected System, NWIS);</li> </ul> </li> </ul> <p>and</p> <ul style="list-style-type: none"> <li>Non Interconnected Systems</li> <li>Pilbara Harmonised Technical Rules <del>Derogation for Dampier 33kV</del></li> </ul>

4.3.8	<p>Ⓢ First sentence of the first paragraph amended to read: A Western Australia independent economic regulator, responsible for issuing <b>and regulating performance of</b> electricity...</p>
6.7	<p>Ⓢ The following sentence inserted after the first sentence: The Energy Operators (Powers) Act 1979, inclusive of but not limited to s28, makes provision for the acquisition and or use of private land, by a <i>network operator</i> for the purposes of installing and operating a <i>transmission</i> and or <i>distribution network</i>. Refer also to <a href="#">clause 3.6.5</a>.</p>
6.14	<p>Ⓢ New paragraph inserted after the first paragraph: In addition to the need to be operationally compatible a <i>network operator</i> may also require <i>network</i> and or <i>consumer</i> equipment to be appropriately rated in accordance with environmental / climatic conditions applicable to the specific operational region or regions. For example, cyclonic conditions experienced in the north west of Western Australia.</p>
6.19.1	<p>Ⓢ Clause amended to read: Industry self-connection programs do not apply to <del>For full details of</del> Horizon Power's service areas. For full details of their connection <i>requirements</i>, refer to Horizon Power's main website or the relevant regional office</p>
7.2	<p>Ⓢ First sentence of the last paragraph amended to read: Conditions of connection may include responsibilities, type, capacity, <b>appropriately rated environmental / climatic equipment</b>, connection point location, standards, timeframes or costs to be met.</p>
7.3	<p>Ⓢ Last sentence amended to read: Refer to the <a href="#">Appendices</a> for details of <i>network operator's</i> operational areas <b>and definition for a standard connection service</b> provided by the applicable <i>network operator</i>. Refer to <a href="#">clause 1.2</a> for definitions and <a href="#">clause 7.6</a> for addition information :</p> <ul style="list-style-type: none"> <li>• <a href="#">standard connection service (supply) Horizon Power</a></li> <li>• <a href="#">standard connection service (supply) Western Power</a></li> </ul>
7.6	<p>Ⓢ First sentence of the last paragraph amended to read Note: Where the <i>load</i> or generation capacity exceeds the <i>consumer's electrical installation standard connection service</i>, that <i>network</i> connection <i>shall</i> be upgraded or protected by an appropriately <del>whole-of-site</del> rated <i>consumer</i> fault and <i>load</i> limiting protection device(s) in addition to the SPD.</p>

7.6.2

® Table 3 title and supply allocations amended as prescribed by the following values

Location	Maximum single phase supply	Maximum three phase supply (per phase)	Maximum motor size (3 phase DOL)
Ardyaloon	63A 32	32A 15	3kW
Beagle Bay	63A 32	32A 15	3kW
Bidyadanga	63A 32	32A 15	3kW
Broome	63A	32A	
Camballin / Looma	63A 32	32A 15	3kW
Point Samson <sup>1</sup>	63A	32A	
Carnarvon	63A	32A	
Coral Bay	63A 32	32A 15	3kW
Cue	63A 32	32A 15	3kW
Dampier <sup>1</sup>	63A	32A	
Denham	63A 32	32A 15	3kW
Derby	63A 32	32A 15	3kW
Esperance Town	63A	32A	
Esperance Rural	Refer to the Esperance district office <sup>2</sup>		
Exmouth	63A	32A	
Fitzroy Crossing	63A 32	32A 15	3kW
Gascoyne Junction	63A 32	32A 15	3kW
Halls Creek	63A 32	32A 15	3kW
Hopetoun	63A 32	32A 15	3kW
Hopetown Rural	Refer to the Esperance district office <sup>2</sup>		
Kalumburu	63A 32	32A 15	3kW
Karratha <sup>1</sup>	63A	32A	
Kununurra	63A	32A	
Lake Argyle	63A 32	32A 15	3kW
Laverton	63A 32	32A 15	3kW
Leonora	63A 32	32A 15	3kW
Lombadina/Djarindjin	63A 32	32A 15	3kW
Marble Bar	63A 32	32A 15	3kW
Meekatharra	63A 32	32A 15	3kW
Menzies	63A 32	32A 15	3kW
Mount Magnet	63A 32	32A 15	3kW
Norseman	63A 32	32A 15	3kW
Nullagine	63A 32	32A 15	3kW
Onslow	63A 32	32A 15	3kW
Port and South Hedland <sup>1</sup>	63A	32A	
Roebourne <sup>1</sup>	63A	32A	
Sandstone	63A 32	32A 15	3kW
Warmun	63A 32	32A 15	3kW
Wiluna	63A 32	32A 15	3kW
Wyndham	63A 32	32A 15	3kW
Yalgoo	63A 32	32A 15	3kW
Yungngora	63A 32	32A 15	3kW
<b>Note 1</b> Indicates Pilbara Grid connections to NWIS	<b>Note 2</b> For supplies to be connected to areas immediately outside the town boundaries or the 33kv network		

Table 3: Horizon Power Towns and networks maximum allowable supply regional towns

8.1.4	<p>® The following note insert:</p> <p>Note: Where a <i>premises/property</i> has been disconnected for a period longer than 6 months, Horizon Power requires an electrical <i>site</i> inspection of the <i>premises/property</i> and provision of a “electrical safety certificate” prior to the <i>site</i> being reconnected to the associated <i>network</i>.</p>
10.1.1	<p>® Clause amended and restructure to read as follows:</p> <p>Horizon Power owns and operates both <i>distribution and transmission system networks</i> inclusive of the Pilbara Grid and a number of non-interconnected (NIS) <i>systems (or microgrids)</i>, <del><i>networks</i></del> servicing <i>isolated</i> towns and communities not connected to the South West Interconnected System (SWIS).</p> <p>The Pilbara Grid extends from Karratha to Port Hedland.</p> <p><del>NIS networks include</del> The non-interconnected systems (microgrids) are located in the <i>regions</i> of Esperance and Hopetoun in the south, through the eastern Goldfields (excluding Kalgoorlie), to the Midwest, Gascoyne and Kimberley <i>with some microgrids also in the Pilbara region</i>.</p> <p><del>The Pilbara Grid extends from Karratha to Port Hedland.</del></p> <p>Energy supplied to the isolated towns and communities in these areas is obtained from private <i>generators</i> (IPPs) and <i>network</i> owned <i>generation systems</i> with Horizon Power being the primary and only <i>retailer</i> of electricity associated with these <i>distribution and transmission systems</i>.</p> <p>The extent of the areas covered by Horizon Power’s <i>networks</i> can be viewed in the appendices.</p>
10.11.6.	<p>® Clause amended to read:</p> <p>Electric vehicle supply equipment (EVSE) and associated EV plugs/connectors <i>shall</i> comply with relevant industry standards and the <i>network operators technical requirements</i>.</p> <p>The installation of EVSE <i>equipment or system, will likely may</i> alter the <i>consumers site</i> maximum demand and potentially the associated <i>network</i> supply/connection arrangement, requiring additional or upgraded infrastructure and installation protection.</p> <p>The rated current of EVSE <i>shall</i> not cause the total <i>load</i> limits specified:</p> <ol style="list-style-type: none"> <li>1. in clause 7.6.2, <b>table 3</b> for equipment to be connected to a Horizon’s Power <i>distribution network</i>; or</li> <li>2. for a <i>standard connection service</i> connected to Western Power’s <i>distribution network</i>;</li> </ol> <p>to be exceeded.</p> <p><b>Note:</b> <b>Note</b> clause 11.1.2, classifies the installation and connection of <i>consumer DER</i> and EVSE equipment to an existing <i>network</i> connection or <i>metering equipment</i> as an <i>alteration</i>.</p> <p>In determining the <i>requirements</i> for the connection of EVSE equipment, evaluation of the <i>consumer’s electrical installation</i> calculated maximum demand in accordance with AS/NZS 3000 clause 2.2.2 and these <i>requirements</i> is essential, together with formal <i>network operator</i> notification prior to equipment connection / activation.</p> <p>For additional information refer to the relevant <i>network operator</i> and <a href="#">clause 11.6.4</a></p>
10.14	<p>® 3<sup>rd</sup> sub dot amended by the word “<i>consumer’s</i>” inserted in front of the words “installation/equipment”</p>
11.1.8.2	<p>® Note 3 amended to read:</p> <ol style="list-style-type: none"> <li>3. where the maximum demand <i>consistently</i> exceeds 80A actual <i>load</i> or <i>exceeds</i> 100A calculated <i>load</i> per phase ...</li> </ol>

11.6.4.3	<p>Ⓜ Clause dot points amended to read:</p> <ul style="list-style-type: none"> <li>• <i>Technical rules at clauses 1.6.1 and 1.6.2;</i> and</li> <li>• <i>Embedded generation (EG) and electric vehicle (EV) technical requirements, at clauses 1.6.1 and 1.6.2</i></li> </ul> <p>Ⓜ Clause notes amended to read:</p> <ol style="list-style-type: none"> <li>a. This is a mandatory <i>requirement</i> for all connections to <i>Horizon Power and Western Power distribution networks.</i></li> <li>b. <i>The combined rating of the consumer's protection shall not exceed the installed capacity of the consumer's electrical installation to the point of supply (connection).</i></li> </ol> <p><del>Horizon Power may also require, specify the application of this requirement as a condition of connection to their distribution network.</del></p> <p>For additional guidance refer to AS/NZS 3000 clause 2.5.1.</p>
11.6.4.3	<p>Ⓜ Reference to AS/NZS 3000 clause 2.5.1.in the notes modified to read:</p> <p><i>The combined rating of the consumer's protection shall not exceed the installed capacity of the consumer's electrical installation to the point of supply (connection).</i></p> <p>For additional guidance refer to AS/NZS 3000 clause 2.5.1.</p>
11.9.1	Reference added to <a href="#">clause 11.1.8.2</a>
11.11.4	<p>Ⓜ Last paragraph amended to read:</p> <p>The common (house) services meter <i>shall</i> be <i>located in either the first or last position on in the upper left hand corner of</i> the meter panel, <del>with</del> <i>and</i> the common (house) services main switch <i>located in a the</i> corresponding position on the <i>site main switchboard.</i></p>
Figure 34	Ⓜ Diagram updated
Figure 35	Ⓜ Diagram updated
Figure 36	Ⓜ Diagram updated
Figure 37	Ⓜ Diagram updated
11.13	<p>Ⓜ First paragraph amended to read:</p> <p><i>...electrical installation, consistently exceeds actual loads greater than 80A per phase or exceeds 100A calculated load...</i></p>
11.13.4	<p>Ⓜ Note added after the second dot point:</p> <p><i>Refer the relevant Metering technical services (Section 5) for specific detail or requirements.</i></p>
11.13.6	<p>Ⓜ Second paragraph amended to read:</p> <p>Where there are two or more transformers in parallel, the <i>consumer's SPD</i> overload protection <i>must</i> be set to prevent damage to the <i>network operator's</i> upstream <i>metering equipment</i> in the event of one <del>device SPD</del>-tripping or being switched off in error.</p>
Figure 43	Ⓜ Diagram updated
12.6.9.4	Ⓜ The words, <i>where able</i> , inserted before the word 'twisted'
13.1	<p>Ⓜ Third paragraph amended to read:</p> <p>The <i>consumer shall</i> appoint appropriately qualified and skilled person(s) who <i>shall</i> be responsible for the design, <i>HV submission lodgement</i>, construction, commissioning, operation and maintenance of the HV installation. <i>The provision of an appropriate HV submission to the network operator is required prior to any works commencing. Refer to <a href="#">clause 13.7</a></i></p>

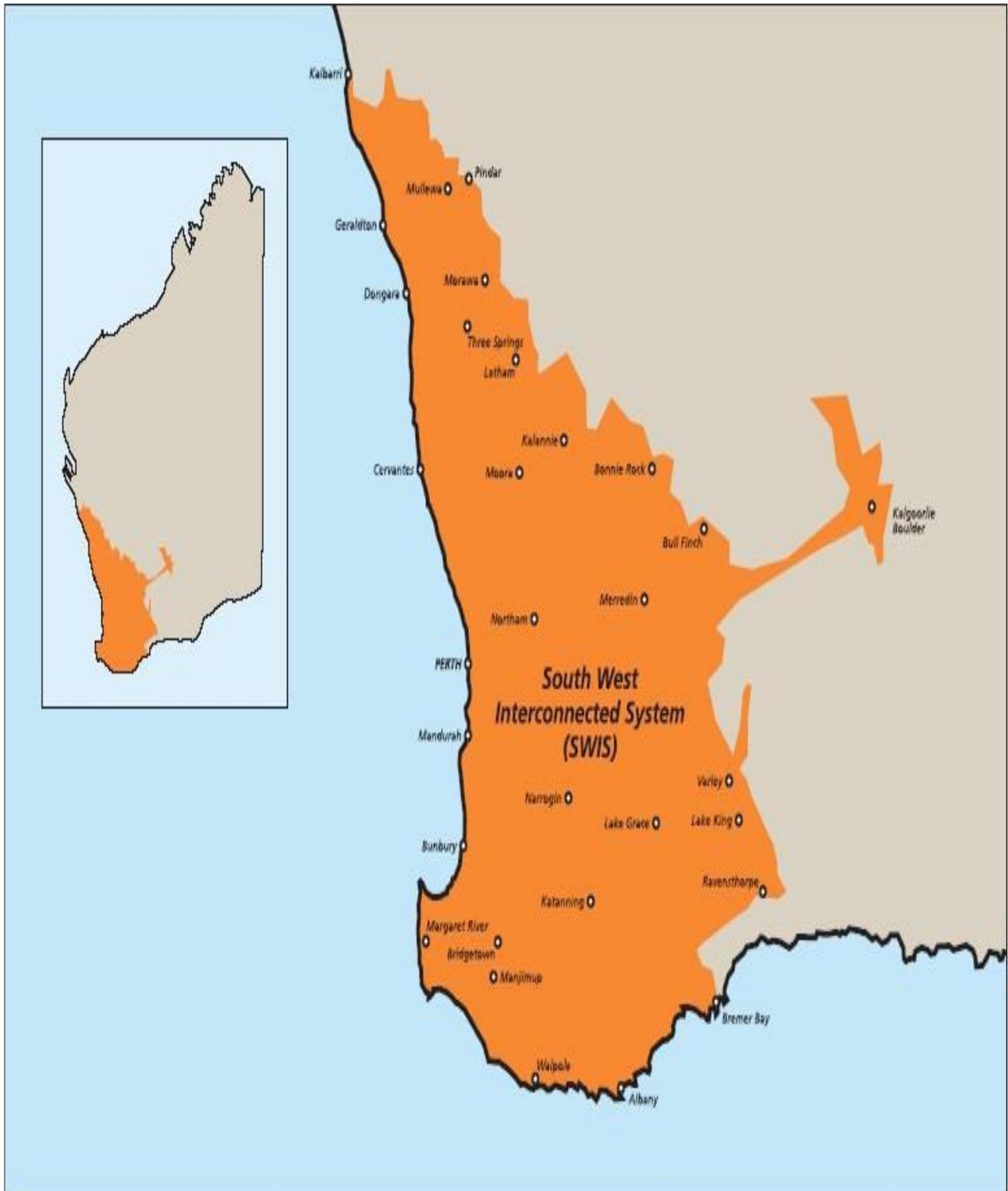
14.1.	<p>® New notes inserted after the last paragraph:</p> <p>Note:</p> <ol style="list-style-type: none"> <li>In addition to the <i>requirements</i> specified in this section a <i>network operator</i> may also require <i>network</i> and or <i>consumer</i> equipment to be appropriately rated in accordance with environmental / climatic conditions applicable to the specific operational region or regions. For example, cyclonic conditions experienced in the north west of Western Australia.</li> <li>It is the <i>customers/developers</i> responsibility to ensure that all of the <i>network operators requirements</i> and installation conditions are met, which may be audited by the <i>network operator</i> as a part of the commissioning processes. Refer to the relevant <i>network website</i> or designer for supplementary information / check lists</li> </ol>
14.4.4	<p>® Dot points applicable to the clause have been subjected to an editorial review and restructure.</p>
14.5.4	<p>® Item 6 amended to read:</p> <p>...unless specifically negotiated otherwise with the <i>network operator</i>, screening and any associated foundations or supports <i>shall be in accordance with the network operator's Distribution substation plant manual</i> <del>extend more than 550 mm below finished ground level to ensure protection of cables entering and exiting the substation site. Note: Deep footings shall not exceed the depth of the inverted culvert</del> ; and</p>
14.6.3.2	<p>® Last sentence amended to read:</p> <p>Maintenance of the earthing systems <i>shall be in accordance with the network operators requirements.</i> <del>ain the responsibility of the respective installing party.</del></p>
14.6.6	<p>® The reference to '<del>night</del>' removed from item 4</p>
15.8.2	<p>® Clause has been restructured to read as follows</p> <p>Both the <i>consumer's installation</i> main switch(es) and <del>on</del> the <i>inverter consumer's</i> main switch <del>board shall ensure isolate</del> the <i>consumer's electrical installation</i> and connected <i>generation system can be isolated</i> from the <i>network operator's distribution system</i>. Refer to AS/NZS 3000 clauses 2.3 and 7.3.</p> <p><del>For embedded generation systems, t</del> The <i>consumer's installation</i> main switch(es) <i>shall</i> be rated and comply with the <i>requirements</i> of section 11 and clause 11.6.4.3. The <i>inverter</i> main switch <i>shall be rated in accordance with AS/NZS 4777 and AS/NZS 3000.</i></p> <p><b>Note:</b> For connections to Western Power's <i>distribution network</i> the <i>electrical installation</i> main switch(es) <i>shall</i> be a circuit breaker. Should the <i>consumer's electrical installation</i> not have a circuit breaker as the installation main switch(es), the <i>electrical installation</i> <i>shall</i> be upgraded to <i>incorporate</i> a circuit breaker before connection and energisation of the <i>generation system is undertaken</i>. For additional information refer to AS/NZS 3000 clause 7.3.8.2.3.</p>

**Appendix B. Horizon Power’s Pilbara Grid and NIS regional networks**

# Service area



### Appendix C. Western Power’s SWIS distribution network



**Document end**