



Department of **Consumer
and Employment Protection**
Government of **Western Australia**

Energy Safety Directorate

WA Electrical Requirements

**Published by the
Director of Energy Safety
of
Energy Safety WA
under the provisions of Regulation 49
of the
*Electricity (Licensing) Regulations 1991***

This is a reprinted version of the 1 August 2000 edition, incorporating the amendments issued on 22 December 2000, 31 July 2002, and 19 March 2003.

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Preface

This document is issued under the authority of Regulation 49 of the Western Australian *Electricity (Licensing) Regulations 1991*. It should be read in conjunction with the *Electricity Regulations 1947*, Part VIII, and the *Electricity (Licensing) Regulations 1991*, which take precedence over this document. Except where stated otherwise, the requirements of this document are mandatory.

The document has been developed and prepared by Energy Safety WA¹ in liaison with the Network Operators and electrical contracting industry groups in Western Australia. The publication is based on information in the January 1993 issue of the “WA Electrical Requirements”, extensively updated and also revised to reflect the changes resulting from the restructure of the Western Australian energy industry on 1 January 1995.

The principal purpose of this document is to provide an authoritative reference to technical requirements for the safe and efficient connection of consumers’ installations to electricity networks, in Western Australia. The technical requirements of all Network Operators are consolidated in Sections 1 to 12. Section 13 contains the specific requirements of particular Network Operators.

The requirements of Sections 1 to 12 are mandatory and apply in all electricity networks in Western Australia. The contents of Section 12 are additional to, or override, the requirements detailed in Australian Standards.

Section 13 is not mandatory, but specifies those requirements which are necessary for an installation to be connected to a particular network. Although non-compliance does not constitute a breach of the *Electricity (Licensing) Regulations 1991*, it may result in connection to a network being refused by the Network Operator.

Regulation 49 of the *Electricity (Licensing) Regulations 1991* mandates several Australian Standards, and, as a general rule, nothing contained in those Standards is replicated in this document and it is assumed that the reader is conversant with the requirements of the Standards.

The requirements of Sections 1-12 in this document are to be complied with unless a prior written exemption is obtained from the Director of Energy Safety (refer to Section 1 “Introduction”). Failure to comply with a requirement may cause delays in the installation being connected to electricity supply. It may also result in proceedings being taken under the *Electricity (Licensing) Regulations 1991*.

The Director of Energy Safety is also able to hear appeals against Inspectors’ orders, should a person feel aggrieved by such an order (eg. to rectify certain work).

¹ Prior to 1 July 2002, Energy Safety WA was the Technical & Safety Division of the Office of Energy.

On 1 August 2000, this document replaced the former "WA Electrical Requirements" (which became effective 1 January 1995) together with the subsequent amendments to it which were published in Energy Bulletins. It does not apply retrospectively.

The WA Electrical Requirements document is reviewed regularly by a Review Committee comprising representatives from Energy Safety WA, Network Operators and the Electrical Contractors Association, to ensure that it remains up to date and relevant.

Energy Bulletins will continue to be published by Energy Safety WA to provide advice on amendments to the "WA Electrical Requirements". Formal amendments will be issued as necessary. The latest version of the "WA Electrical Requirements" and Energy Bulletins may be accessed on Energy Safety WA's website located at <http://www.energysafety.wa.gov.au>.



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July 2002

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Table of Contents

1	INTRODUCTION	1
2	DEFINITIONS.....	3
3	GENERAL REQUIREMENTS.....	5
3.1	SUPPLY ARRANGEMENTS.....	5
3.2	EARTHING SYSTEM	5
3.3	POWER FACTOR	5
3.4	PERMANENTLY INSTALLED STAND-ALONE GENERATING SETS	5
3.5	LOADS WHICH AFFECT THE SUPPLY TO OTHER CUSTOMERS	6
3.5.1	<i>General</i>	6
3.5.2	<i>Electrical Equipment Inrush Current</i>	6
3.5.3	<i>Maximum Size of Single Phase Appliances.....</i>	6
3.6	NUMBER OF CONNECTIONS (SERVICES) TO A SINGLE LOT	7
3.7	LOCATION OF MASTER METER(S)	7
3.7.1	<i>Residential Installations.....</i>	7
3.7.2	<i>Rural Installations.....</i>	7
3.7.3	<i>Commercial and Industrial Installations</i>	7
3.7.4	<i>Multiple Installations.....</i>	7
4	OVERHEAD SUPPLY.....	9
4.1	PRINCIPLES	9
4.2	INTRODUCTION	9
4.2.1	<i>Overhead Service.....</i>	9
4.3	SERVICE ROUTE AND POINT OF ATTACHMENT	9
4.3.1	<i>Special Overhead Considerations</i>	9
4.3.2	<i>Crossing of Adjoining Property.....</i>	10
4.4	AERIAL CONSUMERS MAINS	10
4.5	SPANS AND CLEARANCES	10
4.5.1	<i>Maximum Span</i>	10
4.5.2	<i>Clearances from Structures, Vegetation and Ground</i>	10
4.6.	ACCESS TO SERVICE MAIN AND POINT OF ATTACHMENT	10
4.7.	POINT OF ATTACHMENT	10
4.7.1	<i>Location of Point of Attachment.....</i>	10
4.7.2	<i>Consumers Poles.....</i>	11
4.7.3	<i>Attachments to Buildings or Structures.....</i>	11
5	UNDERGROUND SUPPLY	15
5.1	PRINCIPLES	15
5.2	INTRODUCTION	15
5.3	TYPES OF CABLES AND ENCLOSURES	15
5.4	INSTALLATION REQUIREMENTS	15
5.4.1	<i>Location of Mains</i>	15
5.4.2	<i>Location of Service Pillar</i>	15
5.4.3	<i>Building Entry.....</i>	16
5.4.4	<i>Depth of Laying.....</i>	18

5.4.5	<i>Termination In Service Pillar</i>	18
5.5	NETWORK OPERATORS' ON SITE SUBSTATIONS	18
5.5.1	<i>Network Operators' "District" Type Sub-Stations</i>	18
5.5.2	<i>Network Operators' "Sole Use" Type Substations</i>	18
5.6	TERMINATION OF CONSUMERS MAINS	19
6	SERVICE AND METERING EQUIPMENT	21
6.1	PRINCIPLES	21
6.2	GENERAL	21
6.3	LOCATION AND ACCESSIBILITY OF SERVICE AND METERING EQUIPMENT	21
6.3.1	<i>Single Domestic Premises</i>	22
6.3.2	<i>Single Business Premises</i>	24
6.3.3	<i>Multiple Occupancy Premises</i>	24
6.4	UNSUITABLE LOCATIONS	24
6.5	FACILITIES FOR THE INSTALLATION OF SERVICE AND METERING EQUIPMENT	25
6.5.1	<i>Service and Metering Equipment Enclosure</i>	25
6.5.2	<i>Physical Protection of Service And Metering Equipment</i>	25
6.5.2.1	<i>Isolated and Unattended Locations</i>	25
6.6	LOCKING OF AND ACCESS TO SERVICE AND METERING ENCLOSURES	26
6.7	SERVICE PROTECTION	26
6.7.1	<i>Location</i>	26
6.7.2	<i>Service Protective Device</i>	26
6.7.3	<i>Energisation of Installation</i>	27
6.8	SERVICE ACTIVE AND NEUTRAL LINKS	27
6.9	REVENUE METERS - WHOLE CURRENT	27
6.10	REVENUE METERS - LOW VOLTAGE - CURRENT TRANSFORMER CONNECTED	28
6.10.1	<i>Introduction</i>	28
6.10.2	<i>Voltage Circuit Protection</i>	28
6.10.3	<i>Current Transformers</i>	28
6.11	METERS LOCATED REMOTE FROM MAIN SWITCHBOARD	29
6.11.1	<i>General Requirements</i>	29
6.11.2	<i>Limited Application</i>	29
6.11.3	<i>Bonding of Remote Metering Enclosure</i>	29
7	HIGH VOLTAGE INSTALLATIONS	31
7.1	PRINCIPLES	31
7.2	INTRODUCTION	31
7.3	SUBMISSION OF PROPOSAL	31
7.4	PROVISION OF FACILITIES FOR METERING EQUIPMENT	32
7.5	CONSUMERS HIGH VOLTAGE ELECTRICAL INSTALLATION	33
7.5.1	<i>Point of Supply</i>	33
7.5.2	<i>Supply Voltage</i>	33
7.5.3	<i>Fault Levels</i>	33
7.5.4	<i>Main Switches</i>	33
8	SPECIAL LV SUPPLY ARRANGEMENTS	35
8.1	PRINCIPLES	35
8.1.1	<i>Unmetered Supply</i>	35
8.1.2	<i>Standby Supply</i>	35
8.1.3	<i>Supply to a Common Load</i>	35

8.2	UNMETERED SUPPLY	35
8.3	STANDBY SUPPLY	36
8.3.1	<i>Introduction</i>	36
8.3.2	<i>Changeover Switch</i>	36
8.3.3	<i>Single Phase Stand Alone Generating Sets</i>	36
8.3.3.1	Winding To Frame Connection	36
8.3.4	<i>Single Phase Generator Connected to Consumers Installations</i>	37
8.3.5	<i>Three Phase Generating Set Connected to Consumers Installation</i> ..	38
8.3.5.1	Connection to a Switchboard without a MEN connection.....	38
8.3.5.2	Connection to a Switchboard with a MEN Connection.....	38
8.4	SUPPLY TO A COMMON LOAD	38
8.4.1	<i>Single Source of Supply</i>	38
8.4.1.2	Dual Sources of Supply	38
8.5	SUPPLY TO SHORT TERM EVENTS	38
9	PRIVATE GENERATORS CONNECTED TO NETWORKS.....	39
9.1	PRINCIPLES	39
9.2	INTRODUCTION	39
9.3	CATEGORIES OF PRIVATE PARALLEL GENERATION SCHEMES	39
9.3.1	<i>Power Flow</i>	39
9.3.2	<i>Small Packaged Arrangements</i>	40
9.4	SAFETY.....	40
9.4.1	<i>General</i>	40
9.4.2	<i>Fault Protection</i>	40
9.4.3	<i>Interlocks</i>	40
9.5	PROTECTION, MONITORING & CONTROL.....	40
9.5.1	<i>Protection Equipment</i>	40
9.5.2	<i>Islanding Protection</i>	41
9.5.3	<i>Monitoring & Control</i>	41
9.5.4	<i>Quality of Supply</i>	41
10	SUPPLY TO CONSTRUCTION SITES	43
10.1	PRINCIPLES	43
10.2	SUPPLY TO CONSTRUCTION SITES.....	43
10.2.1	<i>Underground Supply</i>	43
10.2.1.1	Arrangements for a Portable Supply	43
10.2.1.2	Arrangements for Supply in the Permanent Meter Position	43
10.2.2	<i>Overhead Supply</i>	44
11	SUPPLY UNDER EMERGENCY CONDITIONS	45
11.1	PRINCIPLES	45
11.2	DEFECTIVE MAIN SWITCH.....	45
11.3	DEFECTIVE BOUNDARY FUSE.....	45
11.4	CONSUMERS MAINS FAILURE	45
11.5	MAINS CONNECTION BOX FAILURE	46
11.6	WARNING NOTICES	46
12	SPECIAL REQUIREMENTS FOR INSTALLATIONS IN WA.....	47
12.1	PRINCIPLES	47
12.2	CONSUMERS MAINS.....	47

12.3	PROTECTION AGAINST EARTH LEAKAGE CURRENT	47
12.4	CURRENT CARRYING CAPACITY OF CABLES	48
12.5	SEGREGATION OF ELECTRICAL INSTALLATIONS	48
12.6	MINIMUM CROSS SECTIONAL AREA OF CONDUCTORS	48
12.7	CLASSIFICATION OF ZONE 2 AND 3 AREAS IN LOCATIONS CONTAINING BATHS AND SHOWERS AS DEFINED IN SECTION 7 OF THE WIRING RULES	48
13	ADDITIONAL SPECIFIC REQUIREMENTS OF NETWORK OPERATORS	49
13.1	INTRODUCTION	49
13.2	DEFINITIONS	49
13.3	BHP IRON ORE.....	51
13.3.1	<i>Introduction</i>	51
13.3.2	<i>Definitions</i>	51
13.3.3	<i>General Requirements</i>	51
13.3.3.1	Connection process	51
13.3.3.2	Supply Arrangements	51
13.3.4	<i>Overhead Supply</i>	52
13.3.4.1	Overhead Service Mains	52
13.3.4.2	Point of Attachment	52
13.3.5	<i>Underground Supply</i>	52
13.3.5.1	Supply Mains	52
13.3.5.2	Terminations.....	52
13.3.5.3	Cable.....	52
13.3.5.4	Digging Requirements	52
13.3.6	<i>Service and Metering Equipment</i>	52
13.3.6.1	General	52
13.3.6.2	Remote Metering	52
13.3.6.3	Types of Metering	53
13.3.7	<i>High Voltage Installations</i>	53
13.3.8	<i>Special LV Supply Arrangements</i>	53
13.3.9	<i>Private Generators Connected to Networks</i>	53
13.3.10	<i>Supply to Construction Sites</i>	53
13.3.11	<i>Supply Under Emergency Conditions</i>	53
13.3.12	<i>Special Requirements for Installations in WA</i>	53
13.3.13	<i>Additional Specific Requirements of Network Operators</i>	53
13.3.14	<i>General Information</i>	53
13.3.14.1	Books/Manuals/Handbooks.....	53
13.3.14.2	Contact Details	53
13.4	HAMERSLEY IRON PTY LTD	55
13.4.1	<i>Introduction</i>	55
13.4.2	<i>Definitions</i>	55
13.4.3	<i>General Requirements</i>	55
13.4.3.1	Supply Arrangements	55
13.4.3.2	Earthing System	55
13.4.4	<i>Overhead Supply</i>	55
13.4.5	<i>Underground Supply</i>	55
13.4.6	<i>Service and Metering Equipment</i>	56
13.4.7	<i>High Voltage Installations</i>	58
13.4.8	<i>Special LV Supply Arrangements</i>	58
13.4.9	<i>Private Generators Connected to Networks</i>	58

13.4.10	<i>Supply to Construction Sites</i>	58
13.4.11	<i>Supply Under Emergency Conditions</i>	58
13.4.12	<i>Special Requirements for Installations in WA</i>	58
13.4.13	<i>Additional Specific Requirements of Network Operators</i>	58
13.4.14	<i>General Information</i>	58
13.5	ROBE RIVER IRON ASSOCIATES.....	59
13.5.1	<i>Introduction</i>	59
13.5.2	<i>Definitions</i>	59
13.5.3	<i>General Requirements</i>	59
13.5.4	<i>Overhead Supply</i>	59
13.5.5	<i>Underground Supply</i>	59
13.5.6	<i>Service and Metering Equipment</i>	59
13.5.7	<i>High Voltage Installations</i>	59
13.5.8	<i>Special LV Supply Arrangements</i>	60
13.5.9	<i>Private Generators Connected to Networks</i>	60
13.5.10	<i>Supply to Construction Sites</i>	60
13.5.11	<i>Supply Under Emergency Conditions</i>	60
13.5.12	<i>Special Requirements for Installations in WA</i>	60
13.5.13	<i>Additional Specific Requirements of Network Operators</i>	60
13.5.14	<i>General Information</i>	60
13.6	ROTTNEST ISLAND AUTHORITY.....	61
13.6.1	<i>Introduction</i>	61
13.6.2	<i>Definitions</i>	61
13.6.3	<i>General Requirements</i>	61
13.6.3.1	Connection Process	61
13.6.3.2	Supply Arrangements	61
13.6.3.3	Boundary Fuses.....	61
13.6.4	<i>Overhead Supply</i>	61
13.6.5	<i>Underground Supply</i>	61
13.6.6	<i>Service and Metering Equipment</i>	61
13.6.7	<i>High Voltage Installations</i>	61
13.6.8	<i>Special LV Supply Arrangements</i>	61
13.6.9	<i>Private Generators Connected to Networks</i>	61
13.6.10	<i>Supply to Construction Sites</i>	61
13.6.11	<i>Supply Under Emergency Conditions</i>	62
13.6.12	<i>Special Requirements for Installations in WA</i>	62
13.6.13	<i>Additional Specific Requirements of Network Operators</i>	62
13.6.14	<i>General Information</i>	62
13.7	WMC RESOURCES PTY LTD	63
13.7.1	<i>Introduction</i>	63
13.7.2	<i>Definitions</i>	63
13.7.3	<i>General Requirements</i>	63
13.7.3.1	Connection Process	63
13.7.3.2	Supply Arrangements	63
13.7.3.3	Boundary Fuses.....	63
13.7.4	<i>Overhead Supply</i>	63
13.7.5	<i>Underground Supply</i>	63
13.7.6	<i>Service and Metering Equipment</i>	63
13.7.7	<i>High Voltage Installations</i>	63
13.7.8	<i>Special LV Supply Arrangements</i>	63

13.7.9	<i>Private Generators Connected to Networks</i>	63
13.7.10	<i>Supply to Construction Sites</i>	64
13.7.11	<i>Supply Under Emergency Conditions</i>	64
13.7.12	<i>Special Requirements for Installations in WA</i>	64
13.7.13	<i>Additional Specific Requirements of Network Operators</i>	64
13.7.14	<i>General Information</i>	64
13.8	WESTERN POWER CORPORATION	65
13.8.1	<i>Introduction</i>	65
13.8.2	<i>Definitions</i>	65
13.8.3	<i>General Requirements</i>	65
13.8.3.1	Connection Process	65
13.8.3.2	Supply Arrangements	65
13.8.3.3	Earthing System for High Voltage Installations.....	65
13.8.3.4	Non-interconnected Towns	65
13.8.3.5	Interconnected South West System.....	67
13.8.3.6	Pilbara Interconnected System.....	67
13.8.3.7	Number of Dwellings per Service Pillar	67
13.8.3.8	Boundary Fuses.....	67
13.8.4	<i>Overhead Supply</i>	69
13.8.5	<i>Underground Supply</i>	69
13.8.6	<i>Service and Metering Equipment</i>	69
13.8.6.1	General	69
13.8.6.2	Types of Metering Systems Available	70
13.8.6.3	Conditions for Multiple and Distributed Master Metering with Remote Reading Facilities.....	72
13.8.6.4	Conditions for Multiple and Distributed Master Metering without Remote Reading Facilities.....	72
13.8.6.5	Smartpower Meters (Single and Three Phase)	72
13.8.6.6	Remote Master Meter Reading Facility	75
13.8.6.7	Customer Master Meter Reading Facility.....	75
13.8.6.8	Low Voltage Switchboards with CT Metering.....	75
13.8.6.9	General Metering Arrangements - Direct Connected	75
13.8.6.10	Conversion of Subsidiary Meters to Master Meters	80
13.8.6.11	Conversion of Direct Connected Meters to CT Connected Meters	80
13.8.6.12	Relocation of Existing Metering Point	80
13.8.7	<i>High Voltage Installations</i>	80
13.8.7.1	Fault Levels.....	80
13.8.8	<i>Special LV Supply Arrangements</i>	80
13.8.9	<i>Private Generators Connected to Networks</i>	80
13.8.10	<i>Supply to Construction Sites</i>	80
13.8.11	<i>Supply Under Emergency Conditions</i>	80
13.8.12	<i>Special Requirements for Installations in WA</i>	80
13.8.13	<i>Additional Specific Requirements of Network Operators</i>	81
13.8.14	<i>General Information</i>	81
13.8.14.1	Books/Manuals/ Handbooks	81
13.8.14.2	Software	81
13.8.14.3	Enquiries.....	81
13.8.14.4	Network Connections	82

Table of Figures

Fig. 2.1	Diagram explaining some common terms	3
Fig. 2.2	Diagram explaining some common terms	4
Fig. 4.1	Acceptable Service and Raiser Brackets.....	12
Fig. 4.2	ABC Universal Bracket Detail.....	13
Fig. 4.3	Standard Consumer Pole	14
Fig. 5.1	Typical location of service pillar	16
Fig. 5.2	House Termination (Typical)	17
Fig. 5.3	Mechanical Protection of Consumers Mains Conduit (Typical).....	17
Fig. 6.1	Suitable Metering Locations for Single Domestic Installations.....	23
Fig. 6.2	Arrangements for neutral bonding of remote meter enclosure	30
Fig. 8.3.1	Single Phase stand-alone generating set.....	37
Fig. 8.3.2	Single Phase generator connected to consumers installation	37
Fig. 13.4.6	Typical wiring details for multiple master installation	57
Fig. 13.8.1	Arrangement for directly connected switched load (circuit protective devices not shown).....	73
Fig. 13.8.2	Arrangement for indirectly connected switched load (sub-circuit protective devices not shown).....	73
Fig. 13.8.3	Arrangement for directly connected switched load (circuit protective devices not shown).....	74
Fig. 13.8.4	Arrangement for directly connected switched load (circuit protective devices not shown).....	74
Fig. 13.8.5	Panel arrangement for loads up to 60A maximum demand	77
Fig. 13.8.6	Panel arrangement for loads up to 100A maximum demand	77
Fig. 13.8.7	Typical wiring details for multiple master installation	78
Fig. 13.8.8	Typical mounting details for multiple meter panels.....	79

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1 Introduction

In this publication, unless stated otherwise, reference to the following terms shall be read as shown:

- a) **the Act** shall mean the Western Australian *Electricity Act 1945*;
- b) **the Regulations** shall mean regulations under the Western Australian *Electricity Act 1945*;
- c) **the 'Wiring Rules'** shall mean the current edition of the AS/NZS 3000 Wiring Rules;
- d) **Network Operator** shall mean the relevant electricity supply authority, as defined in the Act, currently being the following:
 - BHP Iron Ore
 - Hamersley Iron P/L
 - Robe River Iron Associates
 - Rottnest Island Authority
 - WMC Resources Pty Ltd
 - Western Power Corporation

and 'relevant' shall be taken to mean relevant to their area of supply.

In areas where there is no distribution network, Energy Safety WA is to be taken as the relevant Network Operator, such as for submission of notices.

- e) **the Director** shall mean the Director of Energy Safety, Energy Safety WA, as defined in the *Energy Coordination Act 1994*.

Whilst this document refers to responsibilities of consumers, in many instances the relevant responsibilities are carried out by a licensed electrical contractor or other person, on behalf of the consumer.

The Director of Energy Safety may upon application in writing, exempt in writing any Network Operator or other person from a requirement set out in Sections 1 to 12 of this publication, or vary the application of any requirements on any Network Operator, or other person, subject to any conditions as stated in the Director's response.

As a general rule, the Director will not consider an exemption from the normal requirements set out in this document unless the applicant clearly demonstrates in writing the special circumstances that may justify such an action.

Nothing in Sections 1 to 11 and 13 may be used or interpreted to vary any of the requirements for a consumer's installation specified in any of the Australian Standards prescribed in Reg. 49 of the *Electricity (Licensing) Regulations 1991*, unless:

- (a) the detail of such variation(s) is set out in this document; or
- (b) the relevant Standard has a specific provision for varying the prescribed requirements (for the matter in question), at the discretion of the Network Operator.

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2 Definitions

The terms used in this document are defined in the Wiring Rules or below: (for convenience, some of those terms are also shown at “Figures 2-1 and 2-2 - Diagram Explaining Some Common Terms”).

Consumers Pole: A support pole provided by the consumer to provide ground clearance for overhead service mains which are connected to the point of supply (either on a building or another pole).

Network Operator:

(Referred to as “electricity distributor” in the Wiring Rules).

- Western Power Corporation and all “supply authorities” as defined in the Act (ie. persons who supply electricity to the public), and
- independent power producers, that is persons who have an authorisation under the Act, any other Act, or an Agreement Act to supply electricity to certain persons or consumers, other than those who are tenants on the same site.

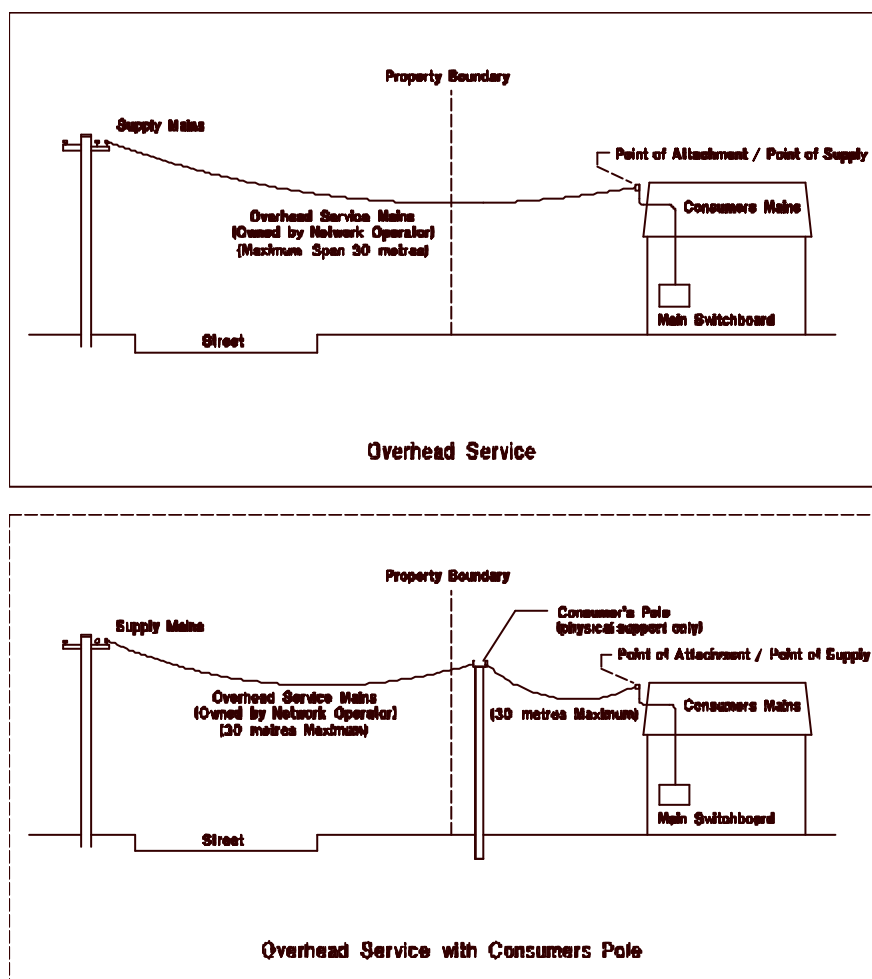


Fig. 2.1 Diagram explaining some common terms

The above diagrams provide an explanation of definitions. Refer to Sections 1 to 13 for requirements in each Network Operator's area

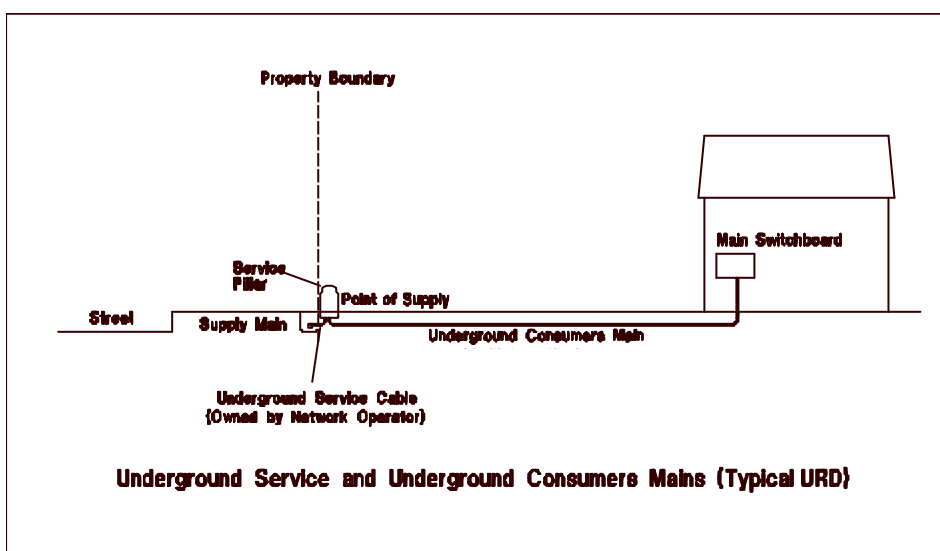
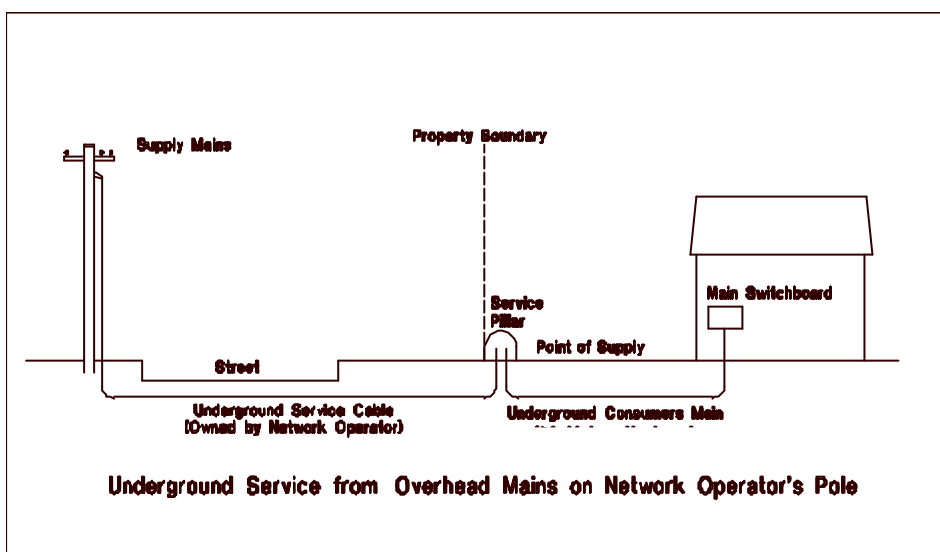
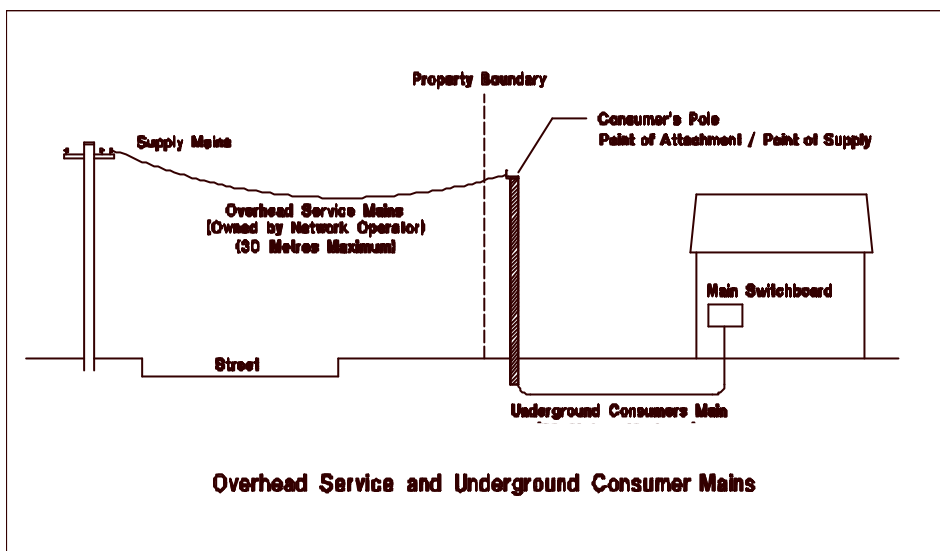


Fig. 2.2 Diagram explaining some common terms

The above diagrams provide an explanation of definitions. Refer to Sections 1 to 13 for requirements in each Network Operator's area.

3 General Requirements

3.1 Supply Arrangements

On application from a consumer (or representative) the Network Operator will advise details of the method of supply for a new or upgraded installation, and they will include:

- voltage;
- point of supply (location);
- supply capacity;
- fault level;
- characteristics of network protection grading;
- system of earthing; and
- any other requirements,

and the consumer's installation shall be designed and constructed accordingly.

3.2 Earthing System

Unless otherwise approved by the Network Operator the earthing system which is to be used in all low voltage installations will be the Multiple Earthed Neutral (MEN) system.

The MEN connection is to be located at the installation main switchboard unless otherwise approved or directed by the Network Operator. Other MEN connections for sub-installations may be installed in accordance with the Wiring Rules.

The earthing system for high voltage installations shall comply with Section 7 of the Wiring Rules.

3.3 Power Factor

The power factor of all installations connected to a distribution network, measured at the point of supply, shall not be less than 0.8 lagging at the time of the consumers daily peak demand.

At no time shall the power factor of an installation be permitted to become leading unless prior written approval of the Network Operator has been obtained.

3.4 Permanently Installed Stand-Alone Generating Sets

Where generating sets are permanently installed to provide an electricity supply which is independent from a Network Operator, the installation shall comply with:

AS 3010.1	when the generator is driven by an internal combustion set
AS 4509	for renewable energy power supply systems
AS 2743	for stabilized power supplies

3.5 Loads Which Affect the Supply to Other Customers

3.5.1 General

Any equipment which causes or may cause rapid changes in electricity demand shall not be connected to electricity supply without the prior approval of the Network Operator.

Equipment connected to electricity supply shall comply with AS2279 and AS61000 as applicable unless exempted by the Network Operator. If a consumer operates any equipment which, in the opinion of the Network Operator, may interfere with the electricity supply to other consumers, the Network Operator may require the consumer to make appropriate adjustments or alterations to the equipment so that the supply to other consumers will not be interfered with.

The above requirement is to apply both on initial connection of an installation to a distribution network, and at all times thereafter.

3.5.2 Electrical Equipment Inrush Current

Unless authorised otherwise by the Network Operator, equipment shall be of a type provided with suitable current limiting so that the maximum inrush current complies with the table below.

For the purposes of this rule, inrush current means the total current drawn by the equipment on initial energisation or start-up.

Location	Electrical Rating	Maximum Inrush Current
Cities and major towns	Single phase	45 A
Rural and other areas (outside Cities and major towns)	Single phase	18 A
All areas	Three phase - Up to 1.5 kW Three phase - Between 1.5 and 6.0 kW Three phase - Exceeding 6.0 kW	13 A 6.5 A per 0.75 kW 33 A plus 2.4 A per 0.75 kW

Table 3.1 – Electrical Equipment Inrush Currents

These limits may be exceeded if written approval of the Network Operator has been obtained.

Refer to Section 13 for the maximum inrush current limits for particular locations in Network Operators' areas.

Consumers shall negotiate with the Network Operator regarding the conditions for connection of any installation where the rating of any item of plant exceeds 75 kW.

3.5.3 Maximum Size of Single Phase Appliances

Single phase 240 volt appliances with a rating which exceeds 5kW (20A) (or 13.5kW for ranges, ovens, hot plates) shall not be connected to supply unless:

- switching arrangements are incorporated which prevent the loading of any one switching operation exceeding 20A and impose a minimum 20mS delay between successive switching operations (on or off); or
- approved by the Network Operator.

3.6 Number of Connections (Services) to a Single Lot

Generally the Network Operator will only provide one connection to an individual allotment of land. This will be the case for lots up to 2500m² in size.

If an installation extends over more than one lot, then only one connection will be provided unless the installation is divided into sections by fire rated walls or separate buildings. No part of the electrical installation of one section shall enter the physical area of another section.

In the case of large rural lots, multiple connections may be provided to separate installations if each installation is more than 200 metres from an adjacent installation and the electrical services of each installation will always retain electrical separation.

3.7 Location of Master Meter(s)

3.7.1 Residential Installations

For single lots with a gazetted road frontage and an area of up to 2500m², the meter shall be located such that it is no more than 30 metres from the street property boundary. For those "battle-axe" lots which have no street frontage, other than the driveway or part thereof, the meters may be located on the individual dwelling.

For situations which do not meet the above requirements, suitable arrangements must be made with the Network Operator.

For lots with an area exceeding 2500m², refer to the requirements of Sections 6 and 13.

3.7.2 Rural Installations

The above conditions shall apply, however, the meter should be positioned so that the meter reader does not have to enter an area containing animals, open gates or climb stiles to access the meter.

3.7.3 Commercial and Industrial Installations

The above conditions shall apply, however, the meter should be positioned so that it is not rendered inaccessible in situations where the building is locked, unless suitable arrangements have been made to enable the Network Operator to obtain meter readings.

3.7.4 Multiple Installations

Refer to Section 6 and Section 13 for conditions applying to multiple installations.

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4 Overhead Supply

4.1 Principles

Where possible service mains should be installed underground, however some circumstances require an overhead service to be installed. The service mains from the Network Operator's distribution system to the point of attachment/supply forms part of the distribution network and is the responsibility of the Network Operator.

The point of attachment of the service main should be selected so that the service does not pass over an adjoining property. If necessary, the consumer shall install a pole at a suitable location on the property to achieve this result.

If a span of the service mains would exceed 30 metres, a pole(s) shall be installed at a suitable location(s) to restrict any span to not more than 30 metres. If the 30 metre point measured from the Network Operator's supply mains falls within the road reserve, the Network Operator will supply and install the pole. If it falls within the consumer's property, the consumer shall supply and install the pole. If the specified ground clearance cannot be achieved, the consumer shall supply and install a pole within the property to achieve the required clearance.

The Network Operator will arrange for the installation of the overhead service main. The details that follow are provided to allow the point of attachment to be determined so that all specified ground clearances and other requirements can be achieved.

4.2 Introduction

This Section outlines the requirements for the installation of overhead service mains where the maximum demand of the installation does not exceed 200 A.

4.2.1 Overhead Service

The Network Operator will determine whether a premises will be supplied by an overhead service. The Network Operator must approve the:

- point of supply
- type of construction
- point of attachment
- route of the service.

An underground service may be provided by negotiation with the Network Operator (refer to Section 5).

4.3 Service Route and Point of Attachment

4.3.1 Special Overhead Considerations

The following factors should be taken into consideration:

- the location of the Network Operator's poles in the street supplying adjacent properties
- the position, including its height above ground, of the point of attachment
- the existence of trees and large shrubs
- required clearances
- the location of any additional consumers pole
- the selection of the point of attachment to ensure that the route of the service is clear of swimming

- o pools, vegetation and other relevant building features such as doors, windows, balconies and entrances
- o the location of other utility services.

4.3.2 Crossing of Adjoining Property

A route crossing an adjoining property is only acceptable provided a suitable easement is obtained by the customer over the property.

4.4 Aerial Consumers Mains

Aerial consumers mains are not permitted.

4.5 Spans and Clearances

4.5.1 Maximum Span

The maximum span for overhead service mains is 30m.

4.5.2 Clearances from Structures, Vegetation and Ground

When determining the height of the supports required for service mains, minimum clearances shall be maintained: Refer to HB C(b)1 "Guidelines for design and maintenance of overhead distribution and transmission lines" (published jointly by the Electricity Supply Association of Australia Ltd and Standards Australia) for minimum clearance requirements.

4.6. Access to Service Main and Point of Attachment

The overhead service main and point of attachment must be erected within readily available access. The area below the point of attachment should

provide a firm, level base with sufficient space to safely erect a standard extension ladder.

The point of attachment must not be accessible without the use of a ladder or other device to assist climbing.

4.7. Point of Attachment

4.7.1 Location of Point of Attachment

The point of attachment must be located on the aspect of the building facing the supply mains, or on a consumers pole or other structure accessible from the distribution system.

A minimum clearance of 2.5 metres is to be maintained between the finished ground or floor level and the mains connection box or the service leads, whichever is the less.

The maximum height permitted for a point of attachment is 7 metres from the finished ground level.

Where a pole mounted point of attachment is used a minimum clearance of 3.0 metres applies.

4.7.2 Consumers Poles

Consumers poles shall be capable of withstanding a horizontal force of 2250N applied 5.2 metres above ground without the deflection at the point of application of the force exceeding 230mm. There shall be no permanent deformation.

The pole shall be a minimum of 114mm OD galvanised steel pipe with a minimum wall thickness of 4.5mm. Any hole provided in the pole for the entry or exit of cables is to be prepared with a welded fitting to prevent the ingress of moisture into the pole.

The pole shall be capped at the top to prevent the ingress of moisture and be securely embedded in a concrete base.

A typical consumer's pole is shown at Fig. 4.3.

4.7.3 Attachments to Buildings or Structures

The overhead service main support structure must be capable of withstanding the load imposed by the service main.

Publication ESAA / SA HB C(b)1 – 1999, *Guidelines for design and maintenance of overhead distribution and transmission lines*, gives guidelines for the design of structures to support of overhead service mains.

Suitable standard service brackets are shown at Fig. 4.1 and Fig.4.2.

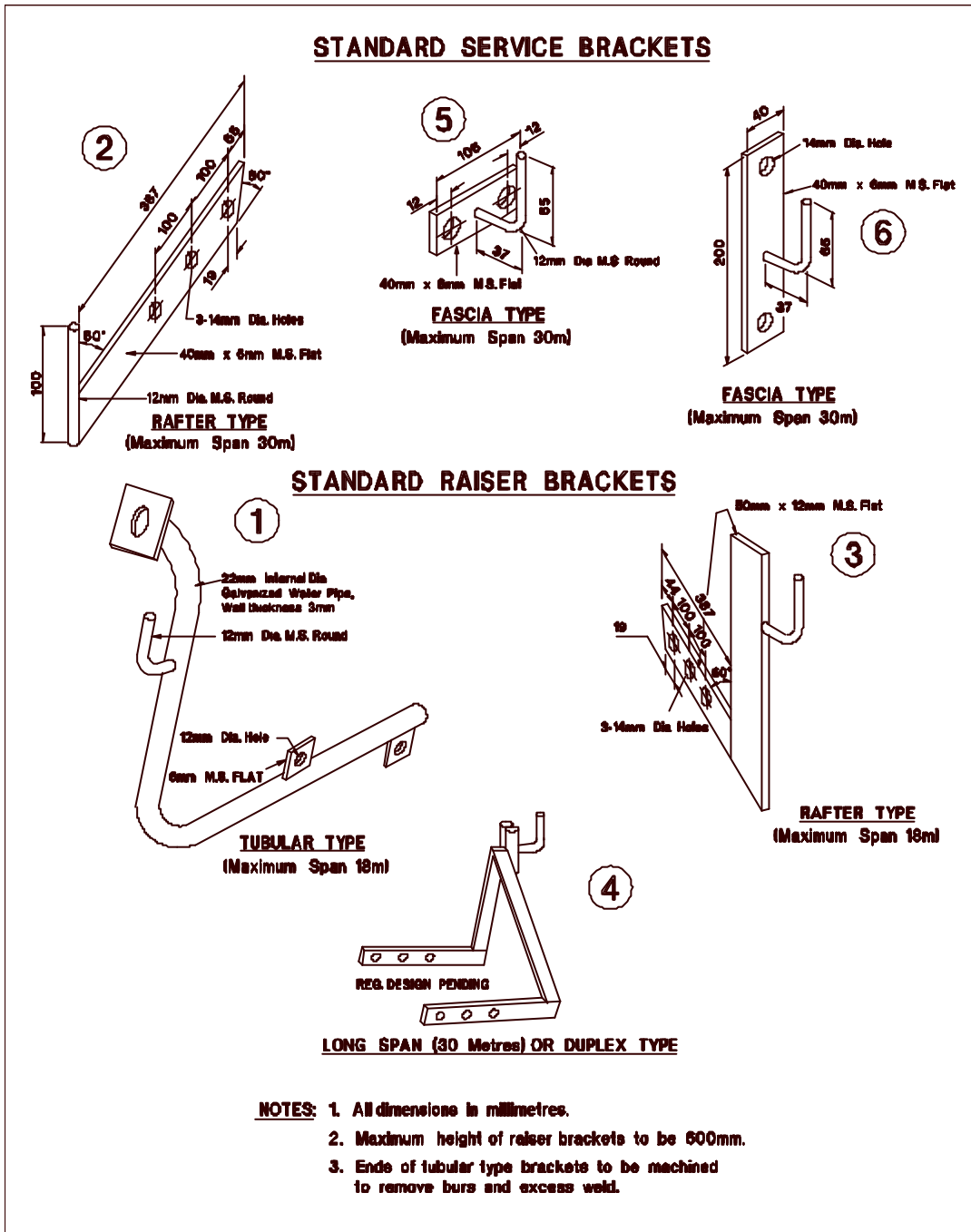


Fig. 4.1 Acceptable Service and Raiser Brackets

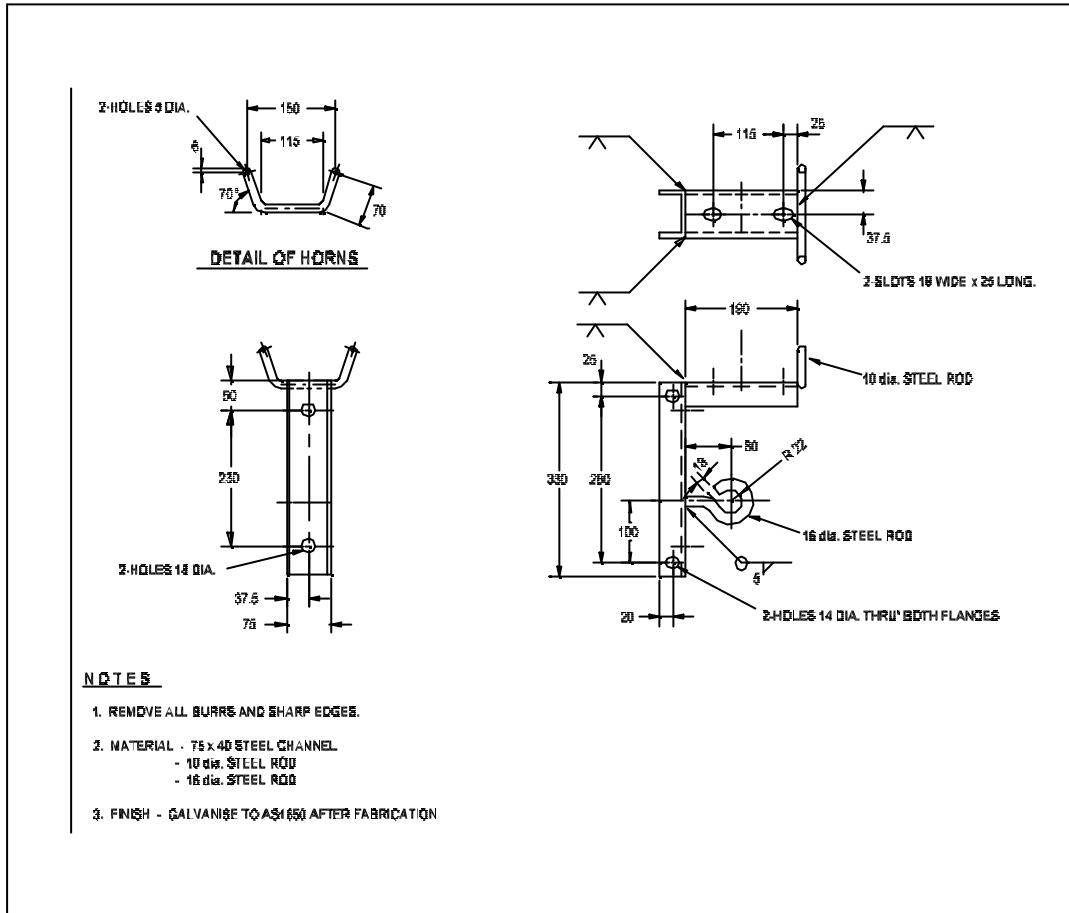


Fig. 4.2ABC Universal Bracket Detail

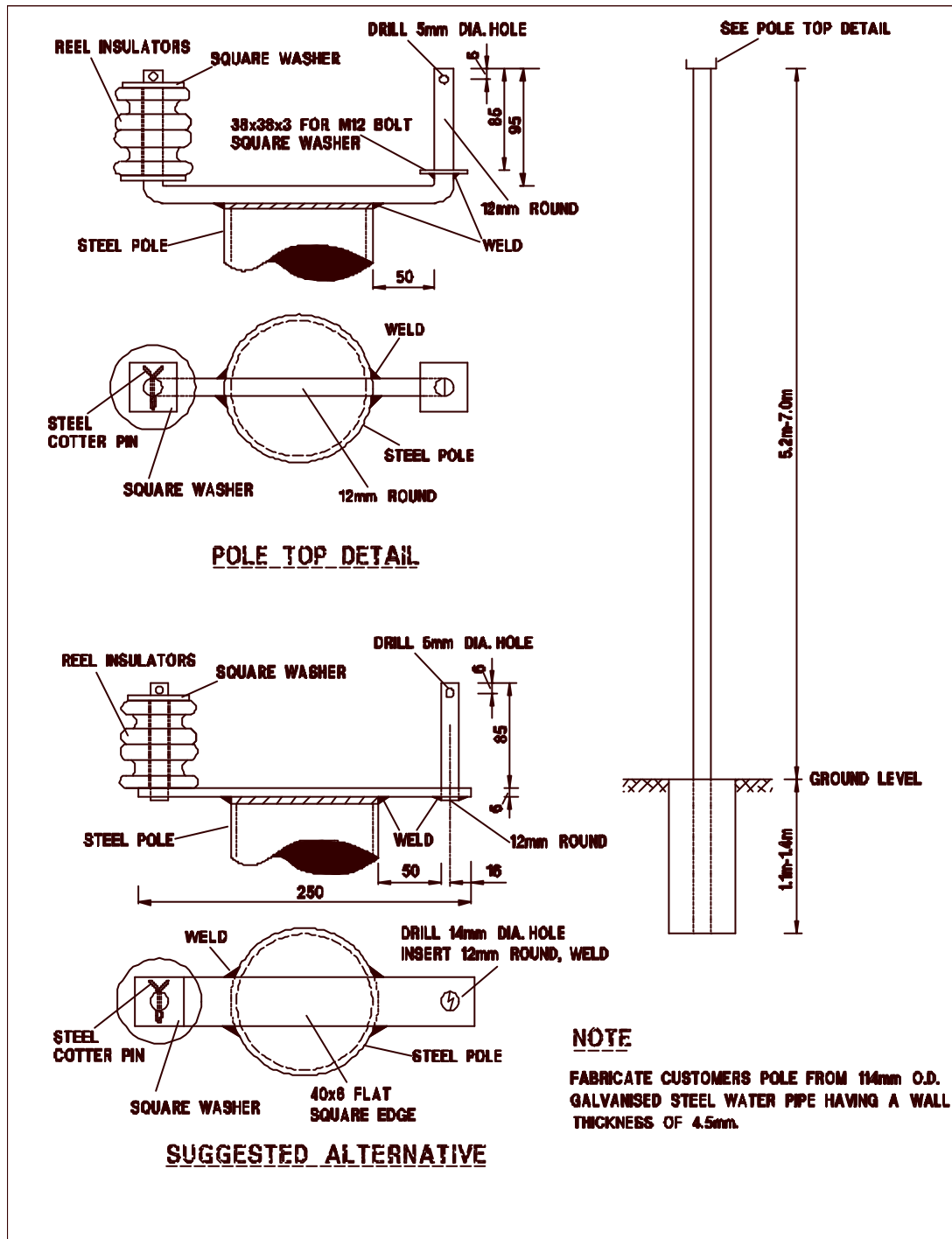


Fig. 4.3 Standard Consumer Pole

5 Underground Supply

5.1 Principles

The preferred method of supply for loads up to 200A is by underground mains cables which terminate in a supply pillar or low voltage frame unit installed just inside the customer's front property boundary or the dividing property boundary. For loads exceeding 200A a supply will be generally made from the substation low voltage frame unit in a kiosk, compound or building.

Special supply arrangements apply to installations supplied at high voltage or from multiple transformers. These installations must be negotiated with the Network Operator.

5.2 Introduction

This Section outlines the requirements for the installation and termination of the consumers mains installed within the customers property.

5.3 Types of Cables and Enclosures

Cables shall be insulated and sheathed and installed in a heavy duty non-metallic enclosure. Enclosures shall comply with AS 2053 and be installed a minimum 500 mm below finished ground level.

Conduits for above ground outdoor use shall be of heavy duty types to AS 2053 and specially treated for direct sunlight or painted with a light coloured water-based acrylic paint.

5.4 Installation Requirements

5.4.1 Location of Mains

For multiple installations, underground consumers mains are to be installed in common ground or easements parallel to or perpendicular to the property boundary. The cable shall be within 1.0m of the boundary.

5.4.2 Location of Service Pillar

The Network Operator will usually provide the service pillar in its Underground Residential Distribution scheme as depicted in Fig. 5.1.

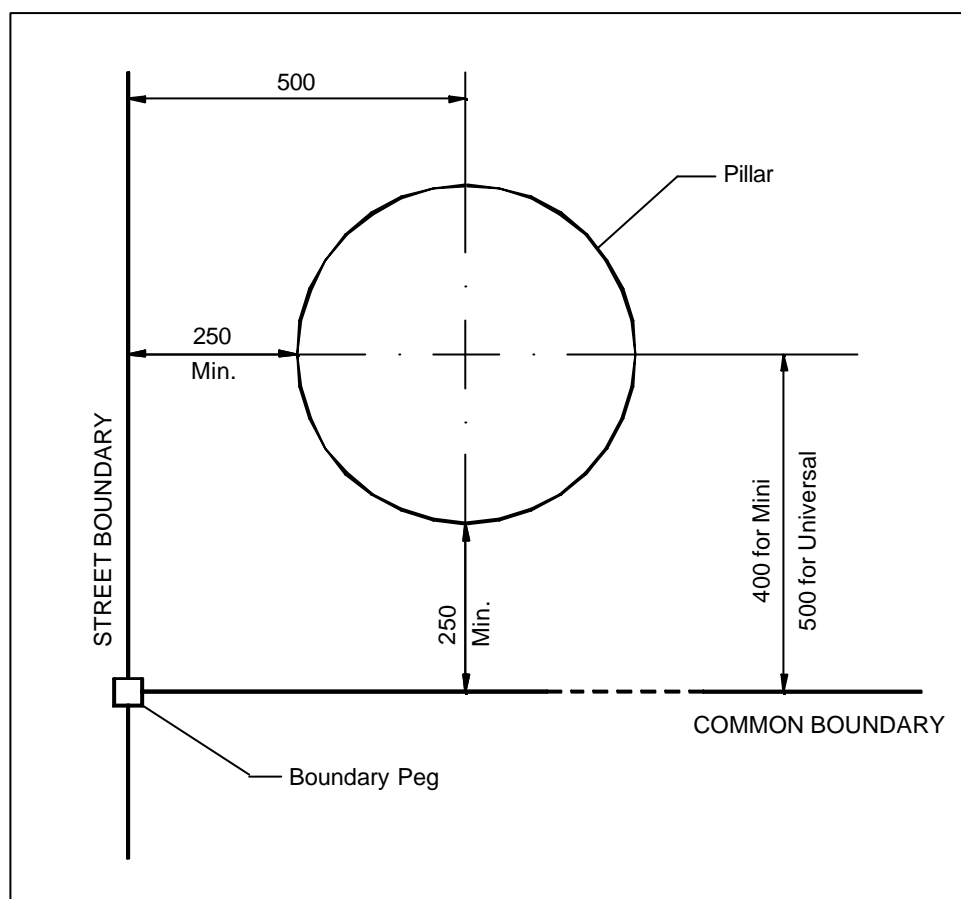


Fig. 5.1 Typical location of service pillar

5.4.3 Building Entry

Provision should be made in the building at the construction stage for the consumer's mains conduit to pass through the building foundations and into the wall cavity. See Figure 5.2.

If provision has not been allowed at the initial building stage, the conduit shall be enclosed in galvanised pipe to provide additional mechanical protection. Figure 5.3 shows an acceptable method of installation.

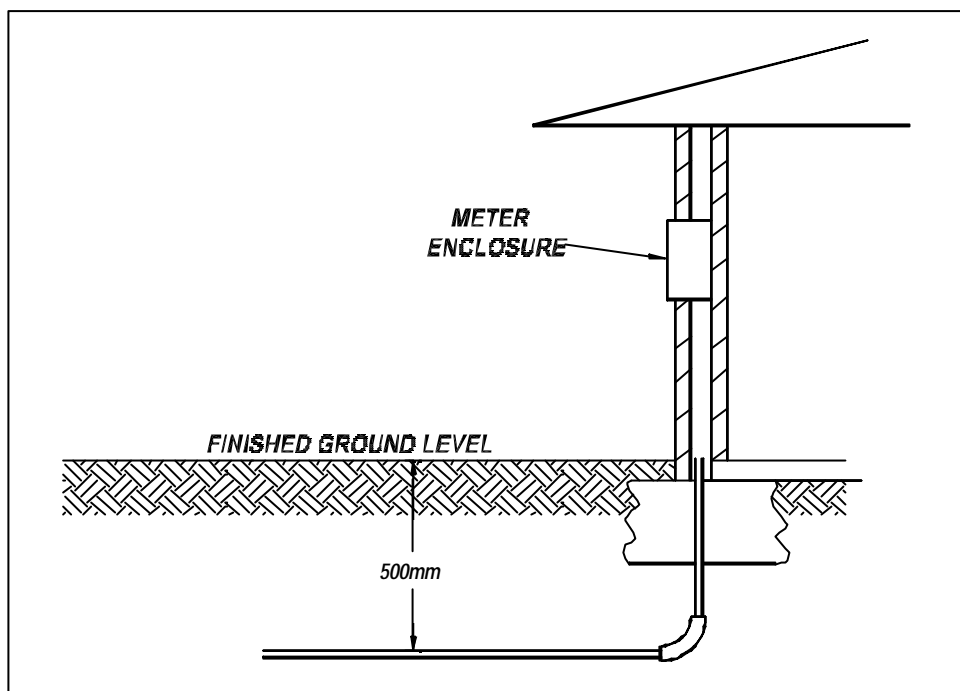


Fig. 5.2 House Termination (Typical)

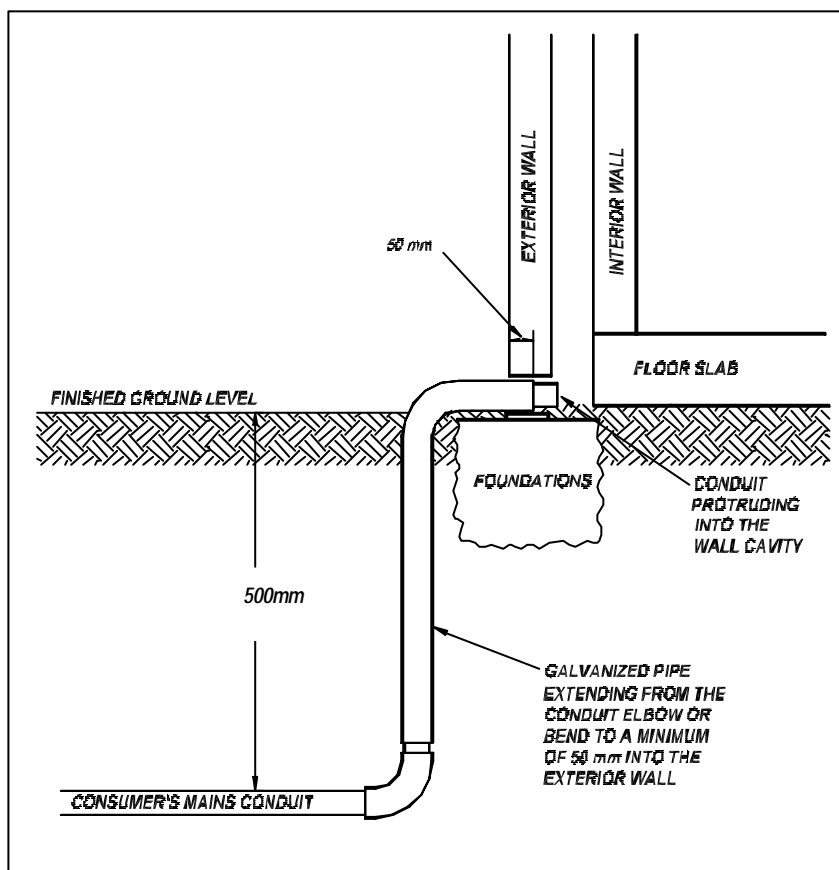


Fig. 5.3 Mechanical Protection of Consumers Mains Conduit (Typical)

5.4.4 Depth of Laying

If the consumers mains are installed with other services (ie. gas, water or telephone) the consumers mains must be located greater than 100mm below these services.

If a depth of 500mm cannot be maintained, due to the presence of rock, the consumers mains may be installed as a Category "C" system, with a concrete cover, in accordance with the Wiring Rules. The concrete should be poured after the final termination at the pillar, thereby providing mechanical protection over the entire length of cable up to the edge of the pillar.

5.4.5 Termination In Service Pillar

For details of termination of consumers mains in the service pillar refer to Network Operators.

5.5 Network Operators' on Site Substations

Where a Network Operators' substation is to be located on the consumers property the electrical consultant or contractor shall refer to the Network Operator for supply details.

5.5.1 Network Operators' "District" Type Sub-Stations

"District" type substations are those which incorporate a low voltage interconnection with the supply mains.

In all cases, the main switch for the consumer's installation shall comprise either a moulded case or withdrawable air circuit breaker (complete with overcurrent protection).

Where the installation main switchboard is contiguous with the

network operator's substation enclosure, then the consumers mains do not require overcurrent protection.

If the installation main switchboard is not contiguous with the substation enclosure, then consumers mains overcurrent protection must be provided in the substation.

5.5.2 Network Operators' "Sole Use" Type Substations

"Sole use" type substations are those which do not incorporate a low voltage interconnection with the supply mains.

The main switchboard shall be contiguous with the substation enclosure and the main switch shall comprise either a moulded case or withdrawable air circuit breaker. If more than one main switch is provided, or the main switch/es is a moulded case air circuit breaker, then manually operated isolating links shall be installed on the line side of the main switch/es.

The links shall be installed in such a manner that they may be operated by customers for isolating purposes, and shall be labelled "mains isolation only, do not operate in event of fire".

5.6 Termination of Consumers Mains

A Network Operator may authorize the electrical contractor to terminate the consumers mains at the supply pillar and at the meter. This will generally be the case where whole current metering is installed. A multi-point terminal block will be provided in the pillar. Only one wire shall be terminated in each tunnel of the terminal block. If insufficient terminals are available, contact the Network Operator.

Access to the pillar or removal of the pillar lid shall not be restricted by fences, structures or vegetation.

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6 Service and Metering Equipment

6.1 Principles

Meters shall be located so that the Network Operator has unimpeded access for reading and maintenance unless a remote reading facility has been provided. Meters with a remote reading facility may be located in a secure area with time restricted access should maintenance be required.

Enclosures shall restrict the entry of water and shall be designed to ensure that under normal operation contact cannot be made with live exposed metal parts. Direct connected and CT connected meters may be installed on hinged panels.

Service protective devices (previously known as “meter fuses”) are provided to protect the metering equipment from fault incidents within the installation, to allow the safe replacement of the equipment and to provide an electrical isolation point. The device will usually be located adjacent to the meter.

In installations where there are multiple meters it shall be possible to remove any meter without interrupting the continuity of the neutral connection of the installation or supply to other parts of the installation.

All service links, fuses and circuit breakers on the supply side of the meter shall be provided with a robust facility for the application of seals by the Network Operator. Such seals shall only be removed by the Network Operator's personnel or persons authorised by the Network Operator.

6.2. General

The consumer shall provide and install:

- service fuses/circuit breakers (service protective devices);
- service neutral/active links;
- the meter enclosure and panel;
- the switchgear enclosure;
- associated wiring and connections.

The Network Operator shall maintain the revenue meters but not the panels, wiring or enclosures.

The Electrical contractor will assess the maximum demand for service and metering equipment. Where it exceeds 100A per phase for separately metered parts of an installation, Current Transformer (CT) metering must be installed. In all other cases direct connected metering will be installed.

6.3 Location and Accessibility of Service and Metering Equipment

Service and metering equipment must be located so that it is accessible from the street level of the building or one floor above or below street level for multi-storey buildings.

Service and metering equipment must be located on common property for multiple installations.

Access to any enclosure for meters or service and metering equipment must never be restricted or made unsafe. The location must always be kept clear.

The metering equipment is to be easily accessible to Network Operator officers within normal Network Operator working hours.

As an alternative and subject to agreement between the consumer and the Network Operator, an alternative metering system utilising a remote reading facility may be installed. Any gas meter, fittings, enclosures or other obstructions installed below the service metering panel must not project further than 300mm from the face of the wall on or in which the service metering panel is mounted.

Adequate space shall be provided and maintained in front of the service and metering equipment panel or cabinet, to enable the equipment to be operated or adjusted.

The space must:

- enable the door or panel to be opened or removed; and
- provide a vertical clearance of not less than 2 metres from the ground, floor or platform and a minimum horizontal clearance of not less than 0.6 metre from either the equipment if mounted on the hinged panel or the external front edge of the switchboard enclosure, whichever is the most onerous.

When a hinged meter panel is extended on its hinge to the 90° open position, a clearance of 200mm is to be maintained between the front face of the panel in its open position and any fixed object.

If the panel is enclosed in other than a standard meter enclosure, a clearance of 175mm from the front of the panel to the door is to be provided.

6.3.1 Single Domestic Premises

The service and metering equipment must be located on the face of the residence towards a street, or other principle access or along the adjacent side wall within 1.0 metre of that face or an associated corner window of the residence to which ready pedestrian access exists and will be maintained. Suitable locations are shown in Figure 6.1.

The service and meter position must not be located behind fences or locked gates unless a remote reading facility is provided.

Where a perimeter or security fence is erected between the building and the access street it is recommended that a suitable vandal resistant meter box be installed in the fence. Alternatively a remote reading facility should be provided.

If the meter is installed inside the dwelling then the consumer must arrange for the service protective device to be accessible from outside the dwelling.

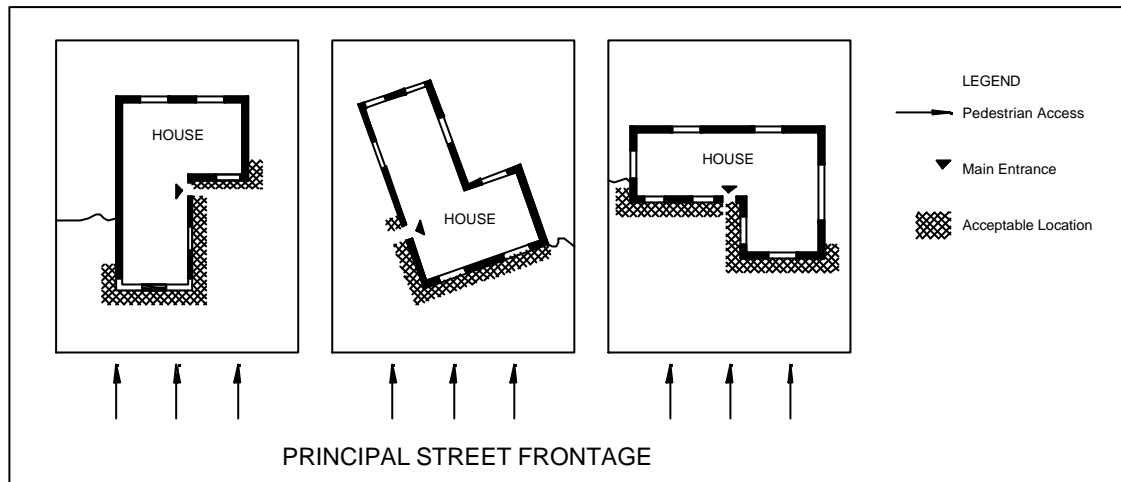


Fig. 6.1 Suitable Metering Locations for Single Domestic Installations

6.3.2 Single Business Premises

Service and metering equipment must be fixed in a position as close as practicable to the entrance to the premises and which is readily accessible without having to enter rooms or areas not normally open to visitors or the public unless otherwise agreed by the Network Operator.

In addition, metering equipment must not be located in areas intended for product display such as shop windows or where access is restricted during normal operations for security, health or other reasons.

Access must be available during the Network Operator's normal business hours.

Service and metering equipment may be located in less accessible areas if a remote reading facility is provided.

If the meter is installed inside the premises then the consumer must arrange for the service protective device to be accessible from outside the building.

6.3.3 Multiple Occupancy Premises

Metering for each multiple occupancy premises will be grouped at the one metering position. Provision should be made to cater for any future metering requirements.

The grouped metering must be in a location accessible to all associated tenants. It must not be located within any one occupancy.

Alternatively, Distributed Master Metering may be installed. Refer to the relevant Network Operator's requirements for this type of metering arrangement.

6.4 Unsuitable Locations

Service and metering equipment must not be installed behind locked gates or doors unless they are fitted with a remote reading facility.

Service and metering equipment shall not be installed:

- over stairways or ramps, in narrow passageways, or in confined spaces;
- in vehicle docks, driveways, factory passageways where the equipment or a person working on it would not be effectively protected;
- in close proximity to, or over, machinery or open type switchgear;
- in locations which are liable to be affected by floods, fumes, vibration, dampness, or dust, which may cause deterioration of equipment or unsatisfactory working conditions;
- in hazardous or prohibited switchboard locations as defined in the Wiring Rules;
- where the normal ambient temperature exceeds 50°C;
- where there is insufficient light;
- where exposed to direct sunlight;
- where the use of a ladder would be necessary;
- where projections at head height are a hazard;
- in pool or spa areas;
- in carports;

- on enclosed verandahs;
- in areas enclosing animals;
- 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);
- behind a fence without a gate;
- near gas cylinders - AS/NZ 2430.3.4;
- in fire isolated stairways, passageways or corridors;
- where access is restricted by vegetation.

6.5 Facilities for the Installation of Service and Metering Equipment

6.5.1 Service and Metering Equipment Enclosure

Generally service and metering equipment should be mounted on a panel installed in an enclosure approved by the Network Operator.

The panel material shall comply with AS 1795, Part 1 and Part 2 - 1983. It shall be constructed using a type x or z non-hygroscopic material as defined in AS 1795 and shall be a minimum of 6mm thick.

Panel sizes will generally be either:

- 450mm high by 225mm wide;
or
- 450mm high by 450mm wide

unless the Network Operator has agreed to the use of panels of other dimensions.

Meter enclosure manufacturers shall obtain approval for each variation of their enclosures from the Network Operator. The Network Operator will provide a manufacturer with an enclosure specification upon request.

6.5.2 Physical Protection of Service And Metering Equipment

Service and metering equipment must be protected from:

- the weather;
- mechanical damage;
- salt or dust laden air or corrosive atmospheres; and
- vandalism.

Where an enclosure is used to protect the equipment, it must be fitted with a hinged door and catch.

6.5.2.1 Isolated and Unattended Locations

Where service or metering equipment is installed in an enclosure externally on a building or a pole in an isolated and unattended location, the enclosure must be constructed of material of sufficient strength to achieve protection against vandalism, weather or other external factors and be fitted with a lock using the Network Operator's standard locking system. A remote reading facility is not necessary for this situation.

6.6. Locking of and Access to Service and Metering Enclosures

Enclosures for service and metering equipment may be fitted with a locking system provided that the locking system is compatible with the Network Operator's standard locking system. If fitted with a lock, either a meter viewing window shall be provided or alternatively a remote reading facility shall be provided.

The Network Operator will not accept a key for a non-approved lock.

6.7. Service Protection

6.7.1 Location

An approved service protective device shall be provided by the customer in accordance with the following:

- The service protective device shall be located no more than 2.0m to the top of the device and no less than 0.5m to the bottom of the device above the ground floor or platform, unless located in a pillar or pit.
- The service protective device shall be located at the meter position for installations with a maximum demand of up to 100A per phase or less, unless otherwise approved by the Network Operator.
- If the meter is installed in a normally inaccessible location with a remote reading facility provided, the service protective device must be located in an accessible location.
- For installations with a maximum demand exceeding 100A per phase, the service protective device must be located adjacent

to or incorporated in the main switchboard and shall be installed on the line side of the current transformers.

6.7.2 Service Protective Device

This device has traditionally been referred to as the meter fuse.

The service protective device may be either a fuse(s) or a fault current limiting circuit breaker.

An individual service protective device(s) shall be provided for each meter installed. The non-replaceable components of the service protective device shall have a continuous current rating of 100A.

If a fuse is installed it shall:

- have a continuous rating of 100A (base and holder);
- be back wired (not studs);
- be able to be sealed when the fuse carrier is inserted using facilities cast into the base and carrier;
- have all live parts shrouded;
- be suitable to accept a Type IIb current limiting (HRC) fusible link manufactured to the requirements of AS 2005.30 (30mm barrel).

Where a circuit breaker is used as the service protective device it shall:

- be of the fault current limiting type, without considering the effects of cascading (if used);
- have a rated short circuit current capacity equal to or greater than the

prospective short circuit current at the point of its installation;

- grade (discriminate) with the Network Operator's protection;
- have the facility for locking and sealing in the 'off' position
Note: Where the circuit breaker is required to be locked in the ON position by the Wiring Rules it must be fitted with the Network Operator's lock;
- have any adjustable settings sealable such that only authorised persons have access;
- have unmetered active/live connections enclosed and have facilities for sealing to prevent unauthorised access;
- be maintained by the consumer in accordance with the manufacturers specifications.

6.7.3 Energisation of Installation

The Electrical contractor may operate the service protective device to check the operation of the meter(s) where direct connected meter(s) are installed.

On completion of this work the service protective device shall be placed in the OFF position, if a circuit breaker is installed, or the fusible element(s) removed, if a fuse(s) is installed.

A caution tag shall be attached to the service protective device to indicate that only the Network Operator's personnel may remove the tag and energise the installation. This will be done after receipt of the Notice of Completion from the Electrical contractor.

6.8 Service Active and Neutral Links

The link must:

- be insulated from earth;
- be fitted with a cover suitable for sealing where direct contact is possible;
- have a separate terminal for each conductor;
- have a current rating not less than the current carrying capacity of the incoming conductor;
- be located so that it is easily accessible and safe to work on;
- be labelled.

If the link is mounted on the rear of the panel, the panel shall be hinged.

6.9 Revenue Meters - Whole Current

Whole current revenue meters shall be installed as follows:

- the top edge of the meter shall be no more than 2.0 metres above the ground, floor or platform beneath the meter;
- the bottom of the lowest meter shall be at least 0.6 metres above the ground, floor or platform.

For multiple installations meters must be clearly and permanently labelled to identify occupancy.

The label shall be affixed to the panel.

6.10 Revenue Meters - Low Voltage - Current Transformer Connected

6.10.1 Introduction

Where the assessed load of an installation, or portion of an installation which is to be separately metered exceeds 100A per phase the Network Operator will require that the meter be of a type operated by a current transformer (CTs).

The consumer must provide the facilities for the mounting and connection of the current transformers, meters and associated equipment. Refer to the Network Operator for specific requirements.

The Network Operator will specify the type of CTs and the meter test block required. The Network Operator will supply and install the meter(s) in the switchboard following its installation on site.

6.10.2 Voltage Circuit Protection

Two levels of protection shall be provided. The first level of protection shall be via a set of Fault Current Limiters mounted on the 415 volt busbars on the line side of the current transformers. A 32A HRC fuse link shall be installed in each limiter by the switchboard manufacturer.

The second level of protection shall be via a set of Potential Fuses mounted on a suitable bracket in an accessible and safe position.

A 6A HRC fuse link shall be installed in each potential fuse by the switchboard manufacturer.

The customer shall provide and install the potential and limiters which shall be either:

- a current limiting (HRC) type NS to AS 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
- Class gG current limiting (HRC) fuse links in a modular fuse holder complying with IEC 269 - Part 2.

Fuses must be suitable for sealing the fuse-link holder to the base. Alternatively, a sealable cover over all the fuse assemblies may be provided. The fuses should be installed so that they are extracted away from the face of the panel and towards the operator.

A clearance of between 100mm (minimum) to 300mm (maximum) between the panel and the enclosure door shall be provided.

Alternative forms of potential fuse mounting include:

- "DIN" rail;
- securely fixed on a steel bracket provided the mounting screw hole is covered with a suitable insulating material.

6.10.3 Current Transformers

The consumer shall provide and install the CT's. The CT's must comply with the Network Operator's requirements. The secondary terminals of the CTs are to be short-circuited to prevent inadvertent damage and shock. The short circuit bridges will be removed by the Network Operator's Officer

when commissioning the metering installation.

The CTs shall be mounted with the polarity marks P1, L or a distinctively coloured dot adjacent to the terminals facing the incoming supply.

Current transformer operated meters may be installed in an enclosure separate from the switchboard that contains the current transformers as long as the length of the CT secondary wiring does not exceed 10 metres from the CT terminals to the meter terminals.

6.11 Meters Located Remote From Main Switchboard

6.11.1 General Requirements

A meter and associated service protective devices may be located in a position remote from the consumers main switchboard under the following circumstances:

- A single tariff applies to the installation.
- The meter is of the whole current direct connected type.
- The meter is located not more than 30 metres inside the property boundary (street).

6.11.2 Limited Application

The application of remote metering is limited to domestic, commercial and industrial installations which are self contained, separate buildings.

Remote metering may not be used for an installation that is arranged for multiple master metering.

6.11.3 Bonding of Remote Metering Enclosure

Where a MEN system is used, the remote metering enclosure shall be earthed by bonding to the load neutral with a conductor of cross sectional area not less than the consumers mains conductors.

In this case, consumers mains shall not exceed 30 metres in length. Refer to Figure 6.2.

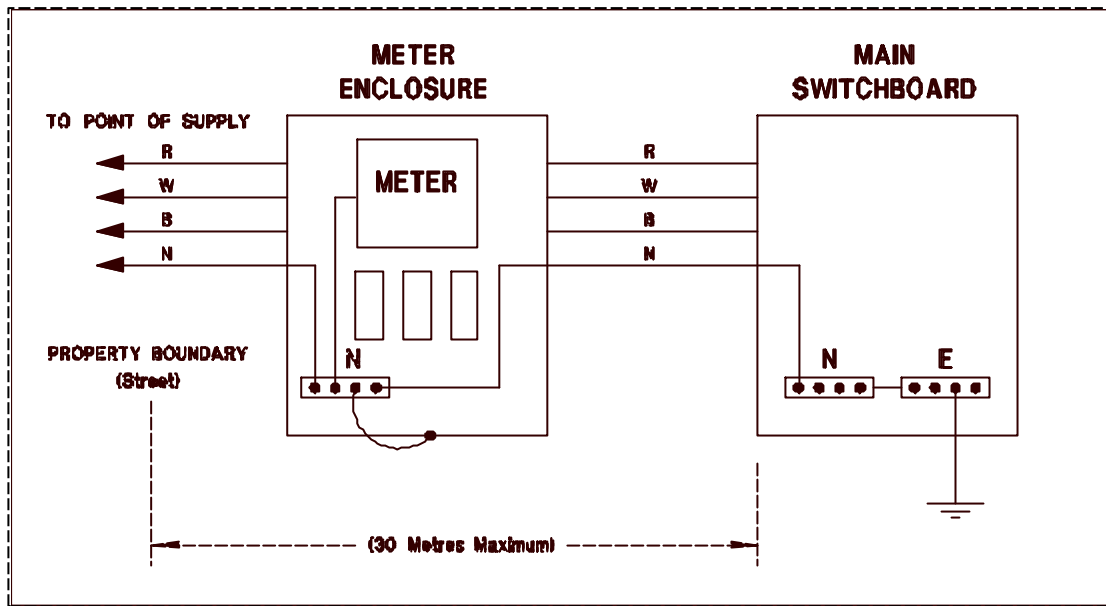


Fig. 6.2 Arrangements for neutral bonding of remote meter enclosure

7 High Voltage Installations

7.1 Principles

Consumers High Voltage installations must be designed by persons with engineering competence and an understanding of the effects of voltages exceeding 1kV and associated high load and fault currents. The High Voltage installation must be designed, constructed, maintained and operated to ensure the safety of personnel. To achieve this, systems for access, egress, movement of people vehicles and machinery, earthing and signage must be implemented.

7.2 Introduction

This Section outlines the procedures and requirements for the supply of electricity at voltages higher than the 415/240V standard low voltage supply (or 480/240 V in special cases). This section covers supply in the range 1kV to 33kV.

Inquiries relating to high voltage supply and installations should be directed to the Network Operator's offices. For supply at voltages greater than 33kV inquiries should be directed to the Transmission System Operator.

7.3 Submission of Proposal

A consumer's High Voltage installation proposal is to be certified by a Chartered Professional Engineer. The proposal is to be submitted to the Network Operator before equipment is purchased and construction commences. The following details are to be included in the submission:

1. Single line diagram of the high voltage installation, including main transformer voltage levels and winding configurations, eg. 33kV Delta - 11kV Star and fault level gradients.
2. Loading details, eg. maximum expected load, load characteristics, duty cycles, large motor starting details, other disturbing load details, etc.
3. Where the incoming protection device is a switch fuse unit:
 - Rated current of fuse
 - Rated breaking current of fuse
 - Make and type of fuse
 - Current-time characteristic curves.
4. Where the incoming protection device is a circuit breaker:
 - (a) A control and protection schematic diagram of the incoming circuit breaker(s).
 - (b) Make, type, rated load current and rated fault MVA or rated breaking current of incoming circuit breaker(s).
 - (c) Details of protection relays used, including:
 - Make and type
 - Setting range
 - Characteristic curves drawn for the selected settings
 - Thermal ratings of input circuit
 - Tripping and control supply details.

(d) Protection current transformer details including:

- Make and type
- Primary current rating
- Secondary current rating
- CT class
- Short time rating
- Length and size of secondary circuit wiring
- Proposed location.

Note: CT's which utilise primary tapplings for ratio changes are not acceptable.

5. Protection details of the next line of protection within the installation which demonstrates that a realistic grading has been achieved.
6. Voltage transformer details including:
 - Make and type
 - Primary voltage rating
 - Secondary voltage rating(s)
 - Category of performance
 - Rated burden
 - Accuracy class
 - Rated voltage factor and rated duration.
7. Estimated date when protection is to be commissioned
8. Estimated date when supply is required. Indicate if this is a temporary or permanent supply. If temporary, indicate when the permanent supply is required.
9. A locality plan.
10. Details of earthing system including schematic arrangements.
11. A description of the specific technical standards to which the installation and equipment is to conform.
12. Operational procedures (refer to AS 2467) and the name of the person who will be responsible for the operation of the installation.

7.4 Provision of Facilities for Metering Equipment

Generally the metering equipment (current and voltage transformers) is supplied and installed by the Network Operator.

The consumer must provide accommodation and facilities for the installation of metering equipment in accordance with the Network Operator's requirements. The meter enclosure shall be located at a position which is approved by the Network Operator and shall be within the main switchboard building, on an external wall in a position shielded from direct sunlight, or adjacent to a pole mounted metering transformer.

As the Network Operator's portion of the installation does not include low voltage distribution facilities, the consumer must provide adequate lighting and general purpose outlets within the high voltage switchroom.

Facilities for the remote reading of the meters may be installed. The consumer may be required to install a telephone service or contribute to the provision of mobile phone or radio equipment.

7.5 Consumers High Voltage Electrical Installation

7.5.1 Point of Supply

The point of supply will be designated by the Network Operator. Generally the consumer's high voltage installation will commence at the load terminals of the Network Operator's metering equipment.

7.5.2 Supply Voltage

The Network Operator will nominate the supply voltage.

7.5.3 Fault Levels

The Network Operator will advise in writing the maximum prospective fault level on the distribution system at the point of supply, under normal operating conditions.

7.5.4 Main Switches

The main switch for an installation supplied at high voltage shall generally be a circuit breaker rated for the prospective fault level and fitted with three-phase overcurrent and earth fault protection. Alternatively, single or multiple switch fuses, reclosers or pole top switches may be used in the following situations, subject to fault level limitations:

- Single or multiple switch fuses (fitted with three phase tripping and operating in all phases simultaneously) may be used to isolate individual transformers with a rating not exceeding 1500kVA and 22kV.
- Reclosers (fitted with three-phase overcurrent and earth

fault protection but no auto reclose provision) may be used to disconnect the aerial supply to a consumer's distribution system.

- Pole top switches with drop out fuses may be used to isolate an aerial supply to single, pole mounted transformers with a rating not exceeding 315kVA.

The consumer shall nominate the protection settings in the main switch to coordinate with the up-stream protection of the Network Operator.

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8 Special LV Supply Arrangements

8.1 Principles

8.1.1 Unmetered Supply

An unmetered supply may be provided to a load for which the energy consumption can be determined by means other than kWh meters.

8.1.2 Standby Supply

A consumer may install a standby power supply arranged to operate on failure of the Network Operator's supply. Wiring must be arranged so that it is not possible for the standby supply to be connected to the Network Operator's distribution system.

8.1.3 Supply to a Common Load

Two consumers may provide separate supply 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.

8.2 Unmetered Supply

Special arrangements apply for supply to certain small installations usually located in public places. If the consumer and the Network Operator mutually agree then the Network Operator will provide an unmetered supply. In all cases the service will be underground.

The Network Operator will provide guidance on the selection of the point of supply. Generally supply to these installations is continuous and is limited to 240V single phase and 20A.

The consumer shall submit a location sketch of each site to the Network Operator's nominated office. It should detail the position of the consumers structure with distances from the Network Operator's equipment and property lines.

If a suitable Network Operator pillar is available then the consumers mains are connected to a fuse in the pillar. If a suitable supply pillar is not available then the Network Operator will arrange the installation of an underground pit or other suitable means of connection.

Only a Network Operator's authorized service provider may install the fuse and make the connection of the consumers mains to the fuse.

If the consumers equipment is to be more than 25 metres from the pillar then the consumer must obtain a written agreement from the Network Operator.

These arrangements do not include supplies to building sites or fetes etc. in public places.

8.3 Standby Supply

8.3.1 Introduction

The basic requirements when installing a generating set for emergency use or as a standby to the Network Operator's distribution system, is that these generating sets are:

- Installed in accordance with this publication, AS/NZ 3000, AS 3010.1 and where relevant AS 3009.
- In compliance with the relevant requirements of AS 2790.
- Mechanically and electrically isolated from the Network Operator's supply.
- Protected against weather, dampness, fire and over-current.

The following information is provided to assist in the application of the above requirements.

Note: All diagrams have the circuit protection element (fuses, etc) omitted for simplicity.

8.3.2 Changeover Switch

This switch provides isolation between the generating set and the Network Operator's distribution system. It is permanently wired and may or may not incorporate an intermediate "off" position.

If the changeover switch has an intermediate "off" position, it may be used in place of the main switch of the installation. Otherwise, a separate main switch (or switches) must be provided.

8.3.3 Single Phase Stand Alone Generating Sets

8.3.3.1 Winding To Frame Connection

AS 2790-1989 specifies that single phase generators may have one end of their winding connected to the generator frame provided that the generator output is protected by a Residual Current Device (RCD). It is important to ensure that the winding to frame/enclosure connection is removed if the RCD is removed or the generating set is connected to an installation with a MEN connection.

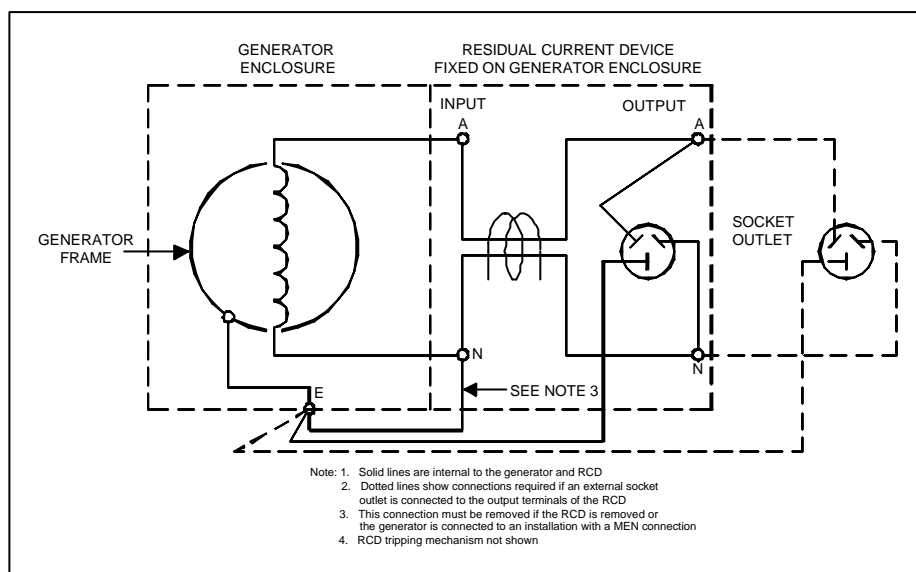


Fig. 8.3.1 Single Phase stand-alone generating set

8.3.4 Single Phase Generator Connected to Consumers Installations

A generator may be connected to a consumers installation provided that it cannot be connected to the Network Operator's distribution system.

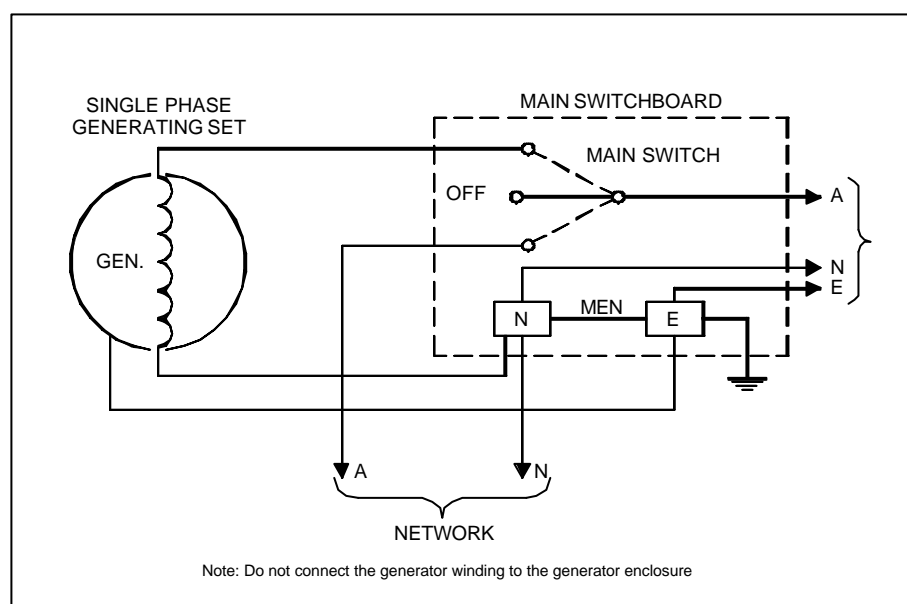


Fig. 8.3.2 Single Phase generator connected to consumers installation

8.3.5 Three Phase Generating Set Connected to Consumers Installation

(A changeover switch arrangement is not acceptable).

8.3.5.1 Connection to a Switchboard without a MEN connection

When a three phase generating set is connected temporarily or permanently to a switchboard which does not have a MEN connection, ie. to a distribution board which is located in the same building as the main switchboard, the neutral conductor must be switched and a neutral earth connection must be made at the generating set or alternatively at the distribution board.

- Connection: to the load (starter or contactor) may be effected by a flexible cord and plug arrangement to either socket outlet.
- An isolating switch with facility to be locked in the open position shall be located adjacent to the load. A permanent legible notice shall be located adjacent to the isolating switch indicating supply may be made available from two sources.

8.3.5.2 Connection to a Switchboard with a MEN Connection

When a generating set is connected to and utilises the MEN connection at the switchboard to solidly earth the neutral, no neutral earthing connection is to be made at the generating set and the neutral conductor need not be switched.

8.5 Supply to Short Term Events

Short Term Events are such activities as fetes, circuses, exhibitions and similar events of a non-permanent nature.

The organisers shall arrange for an electrical contractor to assess the maximum demand and submit a Preliminary Notice in the usual manner. If the demand is such that supply cannot be obtained from a permanent supply point on the property, the Preliminary Notice should request a short term supply and should indicate the estimated maximum demand and the period that the supply is required.

8.4 Supply to a Common Load

8.4.1 Single Source of Supply

Where a load, eg. bore pump, is located in one property the supply to it must originate from the electrical installation in that property. Various metering arrangements can be utilised to permit sharing of the running costs.

The electrical installation shall comply with the requirements of the Wiring Rules and other relevant Australian Standards.

8.4.1.2 Dual Sources of Supply

Where the load is located straddling a property boundary, the following may apply:

- Electricity Supply: may be arranged by installing individual final sub circuits to a position at which suitable socket outlets may be installed. Each socket outlet must be located within its respective property boundary.

9 Private Generators Connected to Networks

9.1 Principles

Power generation installations intended for connection to the Network Operator's distribution network should be designed by persons with engineering competence and an understanding of the effects of embedded generation sources on the operation of a distribution network.

Consideration must be given to the personal safety of employees working in the installation and on the distribution network. Consideration must be given to voltage control, power import and export limits, synchronising and islanding, metering, reclosing and fault levels.

9.2 Introduction

All privately owned generating installations connected to the Network Operator's distribution system must comply with all statutory and regulatory requirements, including:

- the Wiring Rules;
- AS 3010.1 'Electrical installations - supply by generating set Part 1: Internal combustion engine driven set';
- this publication;
- the Network Operator's customer connection contract.

The Network Operator may disconnect generating equipment from their distribution system if:

- the equipment is dangerous to the Network Operator's staff or representatives;
- the continued operation of the equipment is dangerous to the integrity of the Network Operator's distribution system.

The generator operator must seek approval from the Coordinator of Energy, Office of Energy, for parallel operation with the Network Operator's distribution network (in accordance with Section 7 of the Act).

All enquires regarding private parallel generation schemes must be directed to the Network Operator.

9.3 Categories of Private Parallel Generation Schemes

9.3.1 Power Flow

The power flow categories of private parallel generation schemes are described below:

- **Export and Import**
The installation would normally operate its generators in parallel with the distribution network on a continuous basis during agreed time intervals whilst exporting or importing real and reactive power to or from the network.
- **Import Only**
The installation would normally operate its generators in parallel with the distribution network on a continuous basis during agreed time intervals whilst only importing real and reactive power from the distribution network.

- **Bumpless transfer**

The installation would normally operate its generators in parallel with the distribution network for short time intervals whilst only importing real and reactive power from the distribution network. The major application for this category is to transfer load from one power supply to another without a break in supply.

9.3.2 Small Packaged Arrangements

Single phase photovoltaic systems up to 10kVA and three phase wind or hydro driven systems up to 30kVA may be connected to the Network Operator's distribution network in accordance with the requirements of the relevant Australian Standard or industry guideline.

9.4 Safety

9.4.1 General

The generator operator shall ensure that the reliability, integrity and safe operation of the network is not compromised.

The installation shall comply with all Australian Standards and other statutory requirements.

Suitable areas shall be established and maintained within the installation that are not deemed to be hazardous as defined in the Wiring Rules and AS 2430, where the Network Operator's apparatus such as metering and SCADA equipment, may be located and operated satisfactorily. All connections to the Network Operator's apparatus shall be protected with electrical barriers or other means if these connections originate from or pass through hazardous areas.

9.4.2 Fault Protection

All equipment within the installation shall be adequately protected from any electrical faults in either the installation or the Network Operator's distribution system.

The fault contributions from the installation at each point of connection shall not exceed the values agreed between the customer and the Network Operator.

9.4.3 Interlocks

All switches within the installation capable of interconnecting the generation equipment to the Network Operator's distribution network shall be adequately interlocked to reduce the risk of an out-of-synchronism fault and to prevent paralleling of the Network Operator's distribution network feeders.

9.5 Protection, Monitoring & Control

9.5.1 Protection Equipment

All protection apparatus shall comply with IEC Standard 253. All protection settings and schemes shall be to the approval of the Network Operator and shall be such that satisfactory coordination is achieved with the Network Operator's protection apparatus.

9.5.2 Islanding Protection

The generator operator must prevent intentional or unintentional islanding. This may occur when the generator continues to energise the network when normal network supply is lost.

The generators shall be automatically and immediately disconnected from the Network Operator's network for any of the following events:

- Loss of supply from the distribution network.
- Agreed real or reactive power export limits are exceeded.
- Generator pole slip.

The generators may continue to supply the consumer's internal distribution network.

9.5.3 Monitoring & Control

The generator operator shall enable monitoring of the installation and limited control of switches by the Network Operator as reasonably required to adequately safeguard the Network Operator's personnel and the public and to protect the network. The revenue meter and the remote terminal unit will be supplied, installed, owned, operated and maintained by the Network Operator.

9.5.4 Quality of Supply

The generator operator shall comply with the requirements specified in the Network Operator's Quality of Supply publications.

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10 Supply to Construction Sites

10.1 Principles

Supply to a construction site shall be effected in accordance with the requirements of the Wiring Rules. The appropriate Notices shall be sent by the Electrical contractor to the Network Operator.

10.2 Supply to Construction Sites

10.2.1 Underground Supply

The electricity supply will be made available at a supply pillar installed near the street front property boundary. The Network Operator's street mains may be underground or overhead. The meter may be installed in an enclosure mounted on a steel post installed near the supply pillar and which can be moved from site to site. Alternatively, the meter may be installed in an enclosure built into the building in its permanent location.

10.2.1.1 Arrangements for a Portable Supply

The installation of the portable supply and its connection to the supply pillar is the consumer's responsibility. The appropriate Notices are to be submitted to the Network Operator. On completion of the works the consumer is to arrange for the removal of the portable supply and the disconnection from the supply pillar by an Electrical contractor.

10.2.1.2 Arrangements for Supply in the Permanent Meter Position

A separate temporary portable power supply which is completely independent of the permanent installation is recommended for construction sites.

However, for domestic installations, the permanent main switchboard may be utilized as a construction power supply subject to the following conditions being met:

- The switchboard and power outlets are safe and do not present a safety hazard to workers.
- The switchboard is protected from the adverse environmental influences which are likely to occur during construction (such as ingress of moisture).
- The consumers mains and circuit cabling is provided with appropriate protection against the increased risk of mechanical damage during construction (including warning signs).
- The live temporary power supply wiring is physically and electrically isolated from the permanent installation wiring.
- The permanent installation is not energized until the building is essentially completed (and can be secured) and the necessary checking and testing conducted.

Construction power supplies which are installed to meet the requirements of Energy Bulletin No. 14 are deemed to comply with the above requirements.

10.2.2 Overhead Supply

The Network Operator, at its discretion, may provide an overhead supply to a construction site. In this case the aerial service main installation will be arranged by the Network Operator. The service main will terminate on a consumer's pole. This pole may also have the meter box and power outlets attached or they may be located elsewhere.

11 Supply Under Emergency Conditions

11.1 Principles

Where an installation has been damaged, a Network Operator or an electrical contractor may make repairs to reconnect supply to enable occupants to use all or designated parts of the installation for a short period of time whilst permanent repairs are being arranged.

The installation must be made electrically safe before the installation can be energised.

Cables, wiring and apparatus may be installed in a non-permanent manner so as to provide rapid restoration of supply. All these installations must be notified to the Network Operator as soon as practical after energisation of the installation. A Notice of Completion shall be forwarded to the Network Operator on completion of the permanent repairs.

11.2 Defective Main Switch

In the event of a main switch becoming defective the Network Operator may disconnect, and later reconnect, the electrical supply to enable replacement of the switch by an electrical contractor.

11.3 Defective Boundary Fuse

The same procedure is to be followed as directed in "11.2 Defective Main Switch" above.

11.4 Consumers Mains Failure

The electrical contractor may provide an emergency consumers mains to an installation to maintain electricity supply when failure or damage has occurred to consumers mains. In these instances an emergency consumers mains will only be maintained for a maximum period of 14 days (21 days for isolated country districts). The owner or occupier of the installation is required to obtain the services of an electrical contractor to effect the necessary repairs.

Subsequent to the installation of emergency consumers mains, the following work shall be undertaken:

Meter panel (Size and Fixing): Where the existing meter panel space is not sufficient to fix a 450 x 225mm meter panel, a new panel shall be supplied by the electrical contractor to fit the existing space (only if there is sufficient space to fix a standard meter and fuses), or suitable fixing or enclosure is to be provided to accommodate a new meter panel.

MEN location: The MEN connection is to be re-made at the consumers neutral link (not at the Network Operator's meter or neutral link).

Rear clearance: A 50mm rear clearance will be acceptable for existing meter enclosures, provided that a consumer's mains cable size of 16mm² is not exceeded.

11.5 Mains Connection Box Failure

The Network Operator or electrical contractor may provide mains connection box when failure or damage has occurred. This work must be coordinated with the Network Operator.

11.6 Warning Notices

Where an emergency supply has been installed the electrical contractor shall leave a warning notice in the main switchboard before leaving the site.

The warning notice shall indicate the nature of the emergency work installed and contact details should it be necessary for anyone to discuss the nature of the repairs with the contractor.

The warning notice should indicate when permanent repairs to the installation will be carried out. The warning notice shall only be removed on completion of the permanent repairs.

12 Special Requirements for Installations in WA

12.1 Principles

This section details those requirements which are in addition to, or at variance with, the Wiring Rules and other Standards.

In accordance with Regulation 49 of the *Electricity (Licensing) Regulations 1991*, these requirements take precedence over those detailed in the prescribed standards and must be complied with at all times.

12.2 Consumers Mains

Single phase and multiphase consumers mains shall have a minimum current-carrying capacity of 32A per phase except for:

- (a) **Single domestic installations** where the minimum current carrying capacity shall be:

- (i) Single-phase: 63A
- (ii) Multiphase: 32A per phase

and;

- (b) **Multiple installations which incorporate a domestic installation** where the minimum current carrying capacity shall be:

- (i) Single-phase: 63A
- (ii) Multiphase: 63A per phase.

When calculating the voltage drop in an installation, that component of voltage drop on the consumers mains shall be assessed using the maximum demand of the installation.

12.3 Protection Against Earth Leakage Current

Where RCD protection is required in domestic and residential type electrical installations, two or more RCD's shall be provided to ensure that not all final sub-circuits for lighting and socket outlets in the installation are de-energised should one RCD operate.

For *existing* domestic and residential type installations, the following will apply:

- (a) **Part or full rewiring jobs:**
At least two RCDs are mandatory if the electrical work includes replacement of the main switchboard's control and protective devices.
- (b) **Addition of one new circuit:**
Only the new circuit will require RCD protection (if not already provided).
- (c) **Addition of more than one new circuit:**
A minimum of two RCDs is required.
- (d) **Where the owner of an existing installation has commissioned the fitting of RCD protection and no other alterations or additions are to be carried out:**
One RCD may be installed, although two (or more) are **recommended**.

NOTE: RCD protection is not required for fixed electrical cooking appliances.

12.4 Current Carrying Capacity of Cables

Where cables are installed in the roof space of domestic installations, they shall be deemed to be either partially or completely surrounded in thermal insulation for the purpose of calculating current carrying capacity, if they are installed within 100mm above the ceiling.

If a length of cable not exceeding 150mm passes through bulk thermal insulation eg. for connection to a lighting point, it shall not be considered as being surrounded by thermal insulation.

Where cables are installed in such a manner that permits the free circulation of air around the cables, eg. in a wiring enclosure of adequate dimensions, and in any case not less than 50mm x 100mm, the cables are not considered as being surrounded by thermal insulation

12.5 Segregation of Electrical Installations

No part of the consumers mains or installation wiring of consumer premises on one lot shall be located in another lot except where consumers mains are in the immediate vicinity of a service pillar.

12.6 Minimum Cross Sectional Area of Conductors

In domestic installations, conductors for final sub-circuits which supply socket-outlets installed less than 2.3m above the ground, floor or platform shall have a cross-sectional area of not less than 2.5mm².

12.7 Classification of Zone 2 and 3 areas in locations containing baths and showers as defined in section 7 of the Wiring Rules

Zone 2 (refer to Wiring Rules Clause 7.1.2.1 (c) (ii)): The height of Zone 2 is the lower of either:

- 2.25 m above the floor: or
- the room ceiling.

Zone 3 (refer to Wiring Rules Clause 7.1.2.1 (d) (ii)): The height of Zone 3 is the lower of either:

- 2.25 m above the floor: or
- the room ceiling.

13 Additional Specific Requirements of Network Operators

13.1 Introduction

This Section is not mandatory, but specifies those requirements which are necessary for an installation to be connected to a particular network. Although non compliance does not constitute a breach of the *Electricity (Licensing) Regulations 1991*, it may result in connection to a network being refused by the Network Operator.

13.2 Definitions

The relevant Network Operators are:

- BHP Iron Ore
- Hamersely Iron Pty Ltd
- Robe River Iron Associates
- Rottnest Island Authority
- WMC Resources Pty Ltd
- Western Power Corporation.

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13.3 BHP Iron Ore

13.3.1 Introduction

The following requirements are particular to BHP Iron Ore's electricity network which supplies the town of Newman, BHP Iron Ore's Mt Whaleback mine, the surrounding satellite mines, borefields, airport, Capricorn Roadhouse and local Aboriginal community.

The supply voltages on the BHP supply grid are as follows:

- Low voltage AC: Three-Phase, 50 hertz, 440/254 volts nominal
- High voltage AC: Three Phase, 50 hertz 11kV and 66kV.

13.3.2 Definitions

BHP Iron Ore's Network Operator is herein abbreviated to BHPIOSA.

Authorised Person: Any person nominated by BHPIOSA whilst in its employ, or any person so nominated by BHPIOSA in writing but not necessarily in its employ to carry out a specific duty.

13.3.3 General Requirements

13.3.3.1 Connection process

Formal application for supply to a new installation, or to an addition, should be lodged with BHPIOSA as soon as it is known the installation is to proceed.

The details of the customer's requirements in the installation should include the size of the load or the location if remote, as considerable time may be required for negotiation and acceptance of final proposal. Matters which may effect the design of a building project, such as the position

of the service equipment, point of attachment for the service line or point of entry, size of underground service cable and the position of any substation on the premises should be settled at an early stage.

Any connection to BHPIOSA's mains shall only be undertaken by BHPIOSA unless authorised in writing by BHPIOSA. No unauthorised person may interfere with or make connection or disconnection to any meter, service fuse or link or other device which is the property of or under control of BHPIOSA or any conductor which is directly connected to BHPIOSA's supply system.

On completion of the installation, including testing, the electrical contractor will submit the completion notice to BHPIOSA. The installation will then be inspected by a BHPIOSA Inspector in accordance with the BHPIOSA inspection plan.

13.3.3.2 Supply Arrangements

The electrical contractor or consultant who is responsible for the design of every intended new connection or addition to an existing network, will initiate the procedure by submitting a preliminary notice with the Maximum Demand details to enable BHPIOSA to assess the load requirements, ensure the system is adequate and issue any relevant service rulings. This includes such items as point of attachment, type of bracket, the position of the consumer's pole if required, and meter position.

13.3.4 Overhead Supply

protection fuses. For larger lots, a service pillar is provided for each lot.

13.3.4.1 Overhead Service Mains

Overhead service mains shall be of the aerial bundled conductor type with a minimum cross sectional area of 10mm².

13.3.5.3 Cable

All cables installed underground in the network is termite proofed either with double brass tape or nylon screen.

13.3.4.2 Point of Attachment

The point of attachment for domestic installations shall comprise boundary fuses and mains connection box mounted on the fascia or, alternatively, at a consumer pole with a mains connection box fitted.

13.3.5.4 Digging Requirements

An Excavation and Penetration Permit is required prior to any digging or excavation deeper than 150mm being carried out.

In an industrial or commercial installation the point of attachment will be the same as above or as agreed by BHPIOSA.

13.3.6 Service and Metering Equipment

13.3.5 Underground Supply

13.3.6.1 General

The revenue meter and associated equipment remains the property of BHPIOSA and all seals are to remain intact. If for any reason these seals are breached, BHPIOSA is to be informed immediately. BHPIOSA will supply and install all metering equipment unless prior approval in writing is obtained.

13.3.5.1 Supply Mains

Three-phase underground supply mains and service cables are installed in gazetted domestic lots in most cases. When a lot is developed, BHPIOSA should be notified so that the service can be located.

13.3.6.2 Remote Metering

A remote meter or reading facility is to be installed if access is not available to the meter for reading or servicing purposes during normal business hours of BHPIOSA.

The service cables installed are 16mm² for the smaller domestic lots and 35mm² for the larger unit blocks.

13.3.5.2 Terminations

For smaller lots, underground service cables are terminated at a service pillar which is common to four lots. This pillar is fitted with fused protection and is installed in an easement on one of the boundaries between two lots. Consumers mains are to be installed to the meter panel via a set of service

13.3.6.3 Types of Metering

Standard types of metering are offered, but if a special type is required, a case is to be presented to BHPIOSA for consideration.

13.3.7 High Voltage Installations

No additional requirements.

13.3.8 Special LV Supply Arrangements

No additional requirements.

13.3.9 Private Generators Connected to Networks

No additional requirements.

13.3.10 Supply to Construction Sites

No additional requirements.

13.3.11 Supply Under Emergency Conditions

A contractor may remove BHPIOSA fuses to make safe the installation and re-connect when the emergency condition no longer exists. BHPIOSA must then be notified of the situation and kept informed of the progress of repairs.

13.3.12 Special Requirements for Installations in WA

No additional requirements.

13.3.13 Additional Specific Requirements of Network Operators

This Section refers.

13.3.14 General Information**13.3.14.1 Books/Manuals/Handbooks**

Additional special requirements for installations at Newman and the mine site are specified in the publication "BHP Service and Installation Rules and General Conditions of Supply".

The following information can also be supplied by BHPIOSA:

- Guidelines for Developers
- Hand book for Excavation and Penetration Permits.

13.3.14.2 Contact Details

The BHPIOSA Inspector can be contacted at:

Tel (Work): (08) 9175 3303
Tel (After hours): (08) 9175 1954
Mobile: 0418 372 407
Facsimile: (08) 91 75 1297
Email: middleton.barry.b@bhp.com.au

Emergency number for electrical fault reporting – 1800 677 639.

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13.4 Hamersley Iron Pty Ltd

13.4.1 Introduction

The following requirements are particular to Hamersley Iron's electricity network, which includes the towns of Dampier, Tom Price and Paraburdoo, and Hamersley Iron's mining and port operations, and interconnecting transmission and distribution system.

13.4.2 Definitions

No additional definitions.

13.4.3 General Requirements

13.4.3.1 Supply Arrangements

Application for supply or substantial increase in connected load must be made on the standard form obtained from the Network Operator.

Significant expense should not be incurred, as a result of a new connection or substantial load increase, prior to receipt of written response to an application from Hamersley Iron.

The system of supply is alternating current, 3 phase, 50 hertz and 415/240 volt.

Standard ratings of supply are as follows:

- Domestic – 63 Amp, 3 phase
- Commercial/Industrial – 32Amp, 3 phase minimum.

Other loads are to be negotiated with Hamersley Iron.

In an installation supplied through a service having more than one phase conductor, the total load shall be balanced as near as practicable over the phase conductors.

13.4.3.2 Earthing System

Two earthing systems are used:

- Direct earthing by laid up Network Operator's earth
- M.E.N. system.

Contact the Network Operator for the earthing system to be used at each installation.

13.4.4 Overhead Supply

Low voltage overhead supply is not available.

High voltage overhead supply will be considered.

13.4.5 Underground Supply

All low voltage consumer supplies and consumer mains are to be installed underground.

Where deemed practicable, by Hamersley Iron, new or upgraded supplies will be supplied from a distribution pillar or board located as per Fig. 5.1.

Connection to Hamersley Iron's distribution equipment will be made by Hamersley Iron officers or those authorised by Hamersley Iron.

Where Hamersley Iron deem it necessary to install a substation on the consumer's property, the consumer will provide an accessible space and enclosure to the satisfaction of Hamersley Iron for transformers, switchgear, metering equipment and associated apparatus.

13.4.6 Service and Metering Equipment

Hamersley Iron provides supply to consumers by a number of methods:

- In-ground tee-off from supply main laid in the road verge.
- In-ground tee-off from supply main laid at the rear of the consumer's property.
- Distribution pillar positioned at the rear of the consumer's property.
- Distribution pillar positioned within the road verge.
- Underground supply from aerial conductors positioned at the rear of the consumer's property.
- Direct from a distribution substation or distribution switchboard.
- Consumers mains created by positioning a distribution pillar adjacent to and within the consumer's boundary.

Where practicable for new or upgraded supplies the consumers mains option is preferred. This may require the additional Network Operator infrastructure to be installed.

For all new or upgraded mains installations contact Hamersley Iron for advice on the method to be used at

each installation and the proposed point of supply.

Service Protective Devices

All supply mains are protected by fuse or circuit breaker located:

- Within a distribution pillar or distribution switchboard.
- At and external to the rear of the consumer's residence or building.
- At and external to the front of the consumer's residence or building.
- Within a distribution substation.
- In the case of a consumers mains, within the distribution pillar positioned within the consumer's property.

Service protective devices are not required on the consumer's switchboard except in the following:

- Multiple consumer installations.
- CT metering.
- HV CT metering.

The consumer must contact Hamersley Iron for direction on the location of new or upgraded Service Protective Devices.

Service Protective Devices are locked or sealed by Hamersley Iron and are not to be accessed by other than Hamersley Iron officers or those authorised by Hamersley Iron.

Hamersley Iron personnel or those authorised by Hamersley Iron will energise all new installations and all installations where an upgraded service has been installed.

Metering Equipment

Unless otherwise directed by Hamersley Iron, Hamersley Iron will supply direct connected meters for installation by the consumer.

Metering CT's shall comply with ESAA publication S(b)9-1976 – Specification for Current Transformers – Customer Metering. Class of accuracy – Bulk Supplies 0.2% General Tariff 0.5%

All other service equipment, metering equipment and wiring will be supplied and installed by the consumer.

Where multiple meters are required they must be installed as per Fig. 13.4.6.

Revenue meters will be the direct read type.

Once installed and energised, metering equipment becomes the responsibility of Hamersley Iron.

Low voltage loads which exceed 100 Amps per phase must be CT metered.

Consumers mains and equipment housing and supporting metering equipment are the responsibility of the consumer.

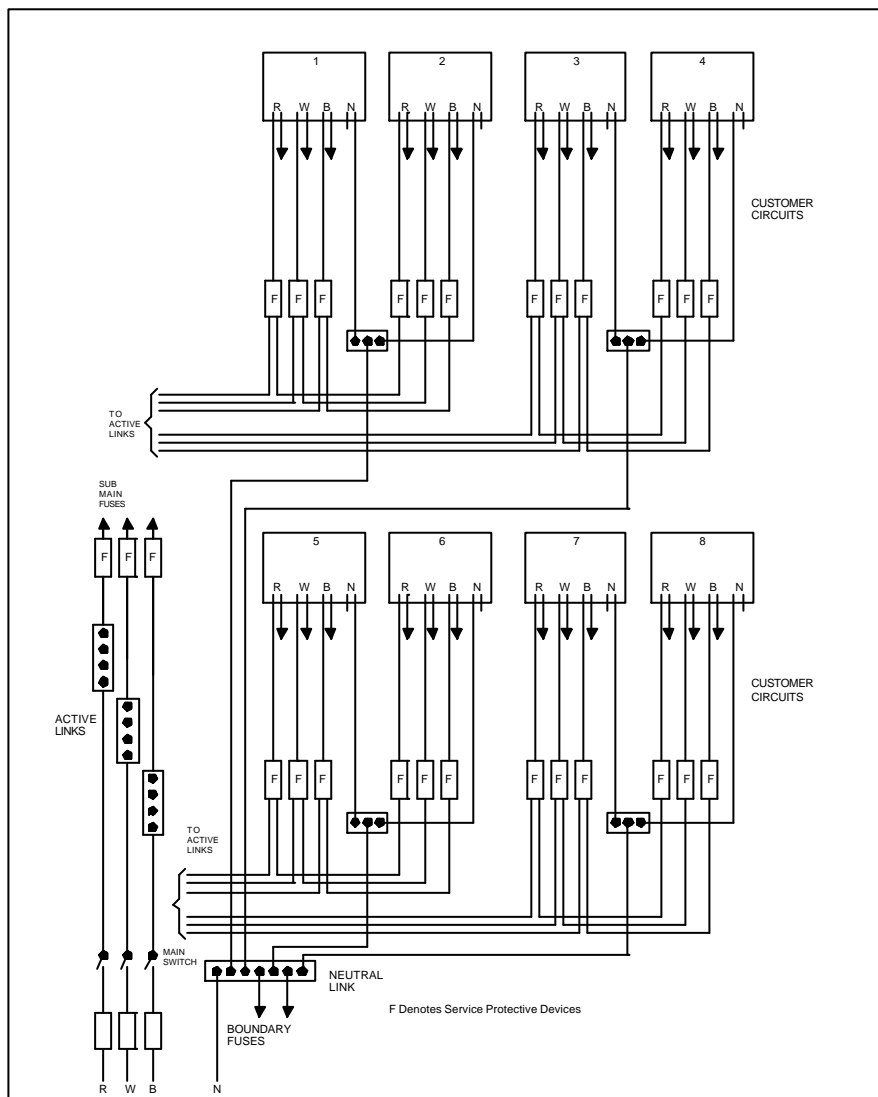


Fig. 13.4.6 Typical wiring details for multiple master installation

13.4.7 High Voltage Installations

Application for supply or substantial increase in connected load must be made on the standard form obtainable from Hamersley Iron.

Contact Hamersley Iron for advice on High Voltage installations.

13.4.8 Special LV Supply Arrangements

An application for supply or substantial increase in connected load must be made on the standard form obtainable from Hamersley Iron.

For some special low voltage supplies, Hamersley Iron may apply a standard service charge as an alternate to consumption metering. For determination of this alternative, Hamersley Iron may require additional load information.

13.4.9 Private Generators Connected to Networks

No additional requirements.

13.4.10 Supply to Construction Sites

Application for supply or substantial increase in connected load must be made on the standard form obtainable from Hamersley Iron.

On receipt of the application, Hamersley Iron will advise on the appropriate point of supply and additional Network Operator infrastructure.

Only Hamersley Iron personnel or those authorised by Hamersley Iron will access and make connection to the Network Operator's system.

13.4.11 Supply Under Emergency Conditions

Access to Hamersley Iron's equipment such as supply pillars and protection equipment shall be by Hamersley Iron officers or those authorised by Hamersley Iron.

13.4.12 Special Requirements for Installations in WA

No additional requirements.

13.4.13 Additional Specific Requirements of Network Operators

This section refers.

13.4.14 General Information

Hamersley Iron contacts:

**Office Hours – 0700 to 1530
Monday to Friday****Dampier**

Electricity Account Enquiries –
9143 5674
All other Enquiries – 9143 5650

Tom Price

Electricity Account Enquiries –
9143 5674
All other Enquiries – 9143 3211

Paraburdoo

Electricity Account Enquiries –
9143 5674
All other Enquiries – 9143 4501

After Hours for all Locations

Emergency or Supply Interruptions–
9143 5549.

13.5 Robe River Iron Associates

13.5.1 Introduction

The following requirements are particular to Robe River Iron's electricity networks.

13.5.2 Definitions

No additional requirements.

13.5.3 General Requirements

Materials and equipment shall generally be in accordance with Specification SS-EI-031 "Nominated Electrical and Instrumentation Equipment". Any proposed alternatives must be approved by Robe Electricity Supply Authority.

13.5.4 Overhead Supply

Shall be designed, installed, maintained and operated in accordance with:

- Energy Safety WA *Guidelines for Electricity Transmission and Distribution Work in Western Australia*; and
- Robe River Iron Associates Specification SS-EI-016 "Design, Supply and Erection of High Voltage Overhead Power Lines".

13.5.5 Underground Supply

Shall be designed and installed in accordance with Robe River Iron Associates Specifications:

- SS-EI-009 "Supply, Installation and Erection of Electrical Equipment and Materials in All Plant and Mine Areas".

- SS-EI-013 "Electrical Design Criteria".

13.5.6 Service and Metering Equipment

Shall be installed in accordance with current Western Power requirements. Refer to section 13.8.6.

13.5.7 High Voltage Installations

Shall be designed, installed, maintained and operated in accordance with Robe River Iron Associates specifications:

- SS-EI-004 "Power Transformers"
- SS-EI-007 "High Voltage Indoor Switchgear"
- SS-EI-009 "Supply, installation and Erection of Electrical Equipment and Materials in All Plant and Mine Areas"
- SS-EI-013 "Electrical Design Criteria".
- SS-EI-015 "Pre-Operational Inspection and Tests for Electrical Material and Equipment"
- SS-EI-016 "Design, Supply and Erection of High Voltage Overhead Power Lines", and
- Energy Safety WA *Guidelines for Electricity Transmission and Distribution Work in Western Australia*.

13.5.8 Special LV Supply Arrangements

No additional requirements.

13.5.9 Private Generators Connected to Networks

No additional requirements.

13.5.10 Supply to Construction Sites

No additional requirements.

13.5.11 Supply Under Emergency Conditions

Shall be determined in consultation with the Robe River Supply Authority Electrical Inspector.

13.5.12 Special Requirements for Installations in WA

No additional requirements.

13.5.13 Additional Specific Requirements of Network Operators

This section refers.

13.5.14 General Information

Contacts and business hours telephone numbers:

Manager, Maintenance and Operations

Tel: (08) 9159 2253

Superintendent Engineering

Tel: (08) 9159 2118

Electrical Inspectors:

Tel: (08) 9159 2205

Tel: (08) 9159 2294

13.6 Rottnest Island Authority

13.6.1 Introduction

The following requirements are particular to Rottnest Island Authority's electricity networks. Contact details for the Rottnest Island Authority (RIA) are listed at the end of this section.

13.6.2 Definitions

No additional definitions.

13.6.3 General Requirements

13.6.3.1 Connection Process

On completion of the installation, including testing, the electrical contractor shall submit written notification to the RIA.

13.6.3.2 Supply Arrangements

Prior to commencement of work, the electrical consultant or contractor responsible for the project design shall submit details to the RIA of any new connections or any additional load that will increase the maximum demand on an existing installation.

13.6.3.3 Boundary Fuses

Boundary fuses shall be provided as specified at Section 13.8.3.7. Submit details of proposals to the RIA prior to commencement of work.

13.6.4 Overhead Supply

No additional requirements.

13.6.5 Underground Supply

No additional requirements.

13.6.6 Service and Metering Equipment

Details of metering systems required will be provided on application. The requirements of Section 13.8.6 will generally apply.

13.6.7 High Voltage Installations

No additional requirements.

13.6.8 Special LV Supply Arrangements

No additional requirements.

13.6.9 Private Generators Connected to Networks

No additional requirements.

13.6.10 Supply to Construction Sites

No additional requirements.

13.6.11 Supply Under Emergency Conditions

Under emergency conditions, so as to make an installation safe, an electrical contractor may remove the service fuse(s) and subsequently replace the services fuse(s) when the emergency condition no longer applies. The RIA must be notified as soon as practical after removal of the service fuse(s) and will indicate at that time if replacement of the service fuse(s) can be performed by the contractor. The above applies if the service protective device is a circuit breaker.

13.6.12 Special Requirements for Installations in WA

No additional requirements.

13.6.13 Additional Specific Requirements of Network Operators

This section refers.

13.6.14 General Information

Contact details for the RIA for:

- Specific information
- Submission of Preliminary Notices
- Request for a supply or regulatory inspection ruling
- Submission of Notice of Completion

are as follows:

The Rottnest Island Authority
Contracts Office, Rottnest
PO Box 693
Fremantle WA 6959 Australia
Telephone: (08) 9372 9739
Facsimile: (08) 9372 9716

13.7 WMC Resources Pty Ltd

13.7.1 Introduction

The following requirements are particular to WMC Resources – Leinster Nickel Operation electricity networks, and are monitored by the Leinster Supply Authority.

13.7.2 Definitions

No additional definitions.

13.7.3 General Requirements

13.7.3.1 Connection Process

The electrical contractor must contact the Leinster Supply Authority.

13.7.3.2 Supply Arrangements

The electrical contractor or consultant responsible for the project design shall submit details to the Leinster Supply Authority of any new connections that increase the maximum demand of an existing or new installation.

The method of connection and details of requirements will be location dependent.

13.7.3.3 Boundary Fuses

The Leinster Supply Authority must be consulted as to where and the type of boundary fuses that are required and these will generally be in accordance with the WPC requirements detailed in Section 13.8.3.7.

13.7.4 Overhead Supply

The Leinster Supply Authority must be consulted as to where overhead supplies may be used.

13.7.5 Underground Supply

No additional requirements.

13.7.6 Service and Metering Equipment

The Leinster Supply Authority must be consulted for the types of metering systems in Leinster.

13.7.7 High Voltage Installations

The Leinster Supply Authority must be consulted with regards to enquiries relating to supplies at high voltage which are normally 33 kV.

13.7.8 Special LV Supply Arrangements

The Leinster Supply Authority must be consulted with regards to any special LV supply arrangements as specified in Section 8.

13.7.9 Private Generators Connected to Networks

Connection of private generators to the network will generally not be permitted. Individual applications will be considered on their merit and only for specific reasons.

13.7.10 Supply to Construction Sites

The Leinster Supply Authority must be consulted with regards to any supply to construction sites as specified in Section 10.

13.7.11 Supply Under Emergency Conditions

Under emergency conditions, so as to make an installation safe, an electrical contractor may remove the service fuse(s) and subsequently replace the service fuse(s) when the emergency condition is cleared. The Leinster Supply Authority must be notified as soon as practical after removal of the service fuse(s) and will indicate at the time if replacement of the fuse(s) may be performed by the contractor.

13.7.12 Special Requirements for Installations in WA

No additional requirements.

13.7.13 Additional Specific Requirements of Network Operators

This section refers.

13.7.14 General Information

An electrical contractor or consultant who requires:

- specific information from the Leinster Supply Authority;
- specific information for submission of Preliminary Notices or Notices of Completion;
- a Supply Ruling;
- a Regulatory/Inspection Ruling,

is required to contact the Leinster Supply Authority at the Electrical Inspector's Office at Leinster.

The Leinster Supply Authority
Electrical Inspector's Office
PO Box 22
LEINSTER WA 6437
Tel: (08) 9037 9327
Fax: (08) 9037 9128

13.8 Western Power Corporation

13.8.1 Introduction

The following requirements are particular to Western Power's electricity networks installed in various locations across Western Australia.

13.8.2 Definitions

No additional definitions.

13.8.3 General Requirements

13.8.3.1 Connection Process

It is intended that eventually all consumers mains and all service mains will be underground. In areas presently serviced by low voltage overhead street mains, Western Power will arrange for a supply pillar to be installed on the street property boundary which will be the point of supply to the installation. In rural areas the point of supply will be the load side terminals of the circuit breaker mounted on the pole below the overhead transformer or in the ground mounted enclosure.

On completion of the installation, including testing, the electrical contractor will submit the Completion Notice to the Connections Office. If required, Western Power will inspect the installation before or after connection of supply.

13.8.3.2 Supply Arrangements

The electrical consultant or contractor responsible for the project design shall submit details of any new load exceeding 63A maximum demand or any additional load exceeding 63A maximum demand to the Network Asset Management Branch at the

contact details listed at 13.8.14.4 so that the capacity of the network to supply the load can be investigated. This may be achieved by requesting a supply capacity ruling when the Preliminary Notice is submitted and a Supply Application is submitted.

The electrical consultant or contractor shall take particular notice of the quality of supply requirements contained in Western Power's document *Quality of Electricity Supply Part 2 – Technical Requirements*.

In an area supplied by overhead mains, and underground consumers mains installed, the mains cable may be extended up the pole for termination on the protective device provided by Western Power. This pole must be located on the consumer's property.

13.8.3.3 Earthing System for High Voltage Installations

For high voltage installations the combined earthing system shall be adopted.

13.8.3.4 Non-interconnected Towns

There are a number of remote towns supplied by individual power stations. It is important that the load connected to these power stations is balanced. In some locations there are special restrictions on the size of an installation's total load and the size of individual meters that may be

connected to the local power supply.
These special restrictions are listed
below:

TOWN	Max size of a single phase installation	MAX MOTOR SIZE
		3 Phase DOL
Broome	32A	
Broome 12 mile	15A	3kW
Camballin	15A	3kW
Carnarvon	32A	
Cue	32A	
Denham	32A	
Derby	32A	
Esperance	32A	
Exmouth	32A	
Fitzroy Crossing	32A	
Gascoyne Junction	15A	3kW
Halls Creek	32A	
Hopetoun	32A	
Kununurra	32A	
Lake Argyle	32A	
Laverton	32A	
Leonora	32A	
Marble Bar	32A	
Meekatharra	32A	
Menzies	15A	3kW
Mount Magnet	32A	
Murchison	15A	3kW
Nullagine	15A	3kW
Onslow	32A	
Sandstone	15A	3kW
Wiluna	32A	
Wittenoom	15A	3kW
Wyndham	32A	
Yalgoo	15A	3kW

Note: It may be possible to connect single phase loads of up to 63A in towns listed as 32A above but only with written approval. Conditions relating to the installation of motors exceeding 20kW rating shall be determined by Regional Power. Prior written approval for connection must be obtained.

13.8.3.5 Interconnected South West System

Cities and Major Towns: Installations will be connected single phase for loading up to 63A maximum demand unless a three phase service is requested or is necessary for a particular appliance (eg. three phase water heater, three phase motor or a range in excess of 13.5 kW total rating).

Rural Areas and Small Towns: In rural areas and small towns, if the installation's single phase maximum demand exceeds 32A, electrical contractors should apply for a ruling by submitting a Preliminary Notice as detailed at 13.8.14.4.

Rural Single Phase (240/480 volt): Special restrictions apply to the size of motors and other devices that produce inrush current when energised or during operation connected to the single phase rural network. 240 volt single phase motors may be started DOL. Also, 480 volt single phase motors up to 7.5 kW may be started DOL where the installation is served by a transformer that supplies only one installation. This is provided that the inrush current does not exceed the values given below:

Voltage	Max Inrush Current
Single Phase 240 volt	40A
Single Phase 480 volt	85.25A

These maximum inrush current values also apply to other devices such as electric welding apparatus.

13.8.3.6 Pilbara Interconnected System

A transmission system interconnects the Dampier Power Station owned by Hamersley Iron, to the Power Station owned by Robe River Iron Associates at Cape Lambert. This system supplies the towns of Karratha, Roebourne, Point Sampson and Port Hedland.

13.8.3.7 Number of Dwellings per Service Pillar

A maximum of up to two dwellings per lot may be connected to a single service pillar (if the maximum demand permits).

13.8.3.8 Boundary Fuses

Boundary fuses shall be provided and installed by the consumer.

The table below and associated footnotes indicate where boundary fuses are required and what type is to be used.

Type of supply system	Type of boundary fuse	See note
Aerial	Outdoor	a, b
Aerial	Indoor	c
Underground	Indoor	c

Footnotes to Table:

- a. Outdoor boundary fuses are required for:
- i. single insulated consumer's mains in metallic enclosures; and
 - ii. installations which are CT metered or which have a maximum demand exceeding 140A.
- b. The enclosed fuse-link size for outdoor boundary fuses is to be approximately twice the current carrying capacity of the consumers mains.
- c. Boundary fuses are not required if the consumers mains emanate from:
- i. a service protective device within a substation and the main switch is a CFS unit or a moulded case ACB; or
 - ii. an isolator, removable link or LV transformer terminals within the substation. When this occurs the consumers mains is to be as short as practicable and the main switchboard must be contiguous within the substation. The type of main switch is to be discussed with Western Power.
Note: Removable links or an isolator may be required within the main switchboard preceding the main switch.

The indoor boundary fuse type and fuse link size shall comply with the following details:

Installation Maximum Demand (MD)	Fuse Type
MD not in excess of 80A	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 BS88.
MD between 80A and 140A	200A GEC back connected RS 200 fuse holder with a type "T" 200A fuse link or similar, to AS 2005 or BS88.

13.8.4 Overhead Supply

No additional requirements.

For CT connected meters, Western Power will install and terminate the meter. Where high voltage metering is used, Western Power shall supply and install the HV metering unit.

13.8.5 Underground Supply

No additional requirements.

Notwithstanding the requirements stated above, the consumer may, either directly or through an intermediary, seek approval from Western Power to provide the meter(s) to be installed at an installation.

13.8.6 Service and Metering Equipment**13.8.6.1 General**

The consumer is responsible for the supply and installation of all service and metering equipment except for the revenue meter, which will be supplied by Western Power.

For whole current direct connected metering, the consumer shall arrange for the installation and termination of the revenue meter supplied by Western Power.

Western Power will supply a specification containing its requirements for such meters. The meters will transfer to Western Power's ownership at the time the installation is connected to the distribution network. Western Power will recompense the consumer or intermediary as the case may be for the cost of the meter(s).

Persons considering this option must contact Western Power before proceeding to purchase meters as approval to use this option will be limited. The need for remote reading facilities must also be considered.

13.8.6.2 Types of Metering Systems Available

Type	Description and Applicability
Direct 240/415 V	All the load current passes through the meter. Applicable for loads up to 100A per phase.
Current Transformer 415V	Load current exceeds 100 A per phase. May be used for load current up to 3750A.
HV Metering (greater than 415 V)	Used where the LV current exceeds 3750A or the customer supplies the transformer(s) and associated HV switchgear.
HV Supply with LV Metering	Used where the HV current is small (less than 5 A). May also be used in place of HV metering. The LV meters will be software summated to provide a site total coincident load for billing purposes. The LV meters may be grouped or distributed over the site. Remote reading facilities must be provided. A non-billable check metering installation may be required.
Multiple Master	Usually applies to multiple direct connected loads each not exceeding 100A per phase but may include some CT connected meters. Meters suitable for remote reading and remote reading facilities shall be provided where required under Section 13.8.6.3.
Distributed Master	Applies to direct connected master meters with connected loads not exceeding 100A per phase and CT connected meters, distributed throughout an installation both horizontally and/or vertically. The meters need not be grouped. Meters suitable for remote reading and remote reading facilities shall be provided where required under Section 13.8.6.3.
Whole-of-site Metering	Western Power no longer permits the installation of Whole-of-site metering.
Summation Metering	Where there are two or more sources of supply to an installation (eg feeders from different zone substations) each source will be metered, usually at HV, and the contributions will be summated to produce a single bill for the energy consumed on the site. The individual feeder contributions will not be identified. Summation may be achieved by electrical means or by software. Remote reading facilities are required for this type of metering.
Sub-division Metering	Developers may request that dwellings constructed on their sub-division be equipped with metering equipment that eliminates the need for a meter reader to enter the sub-division. This type of metering will be provided on the basis that ALL metering points in the area of the sub-division are provided with this metering equipment and that the developer contributes the difference in cost between this metering equipment and the standard manually read metering equipment that would normally be installed.

Type	Description and Applicability
High Security Area Metering	Where a developer/owner desires to install security systems to access a building or area remote meter reading facilities shall be provided to all master meters so that it is not necessary for a meter reader to enter the site. The technology used for reading the meters will depend on each circumstance and must be discussed with Western Power, preferably at the building design stage. This type of metering may be applied to a single residential installation, to multi-unit villages and high rise apartment buildings with mixed residential and commercial use.
Supply Quality Monitoring	A customer may request that a meter with the functionality to monitor the quality of the electricity supply be installed at an installation. Such a meter will be installed however all additional costs above the standard arrangement for that type of installation will be charged to the requestor. Arrangements for the delivery of power quality output and/or reports must be negotiated with Western Power on a case-by-case basis for each site.

13.8.6.3 Conditions for Multiple and Distributed Master Metering with Remote Reading Facilities

Where multiple or distributed master metering is installed and any of the following criteria apply, then meters suitable for remote reading and the remote reading facilities shall be installed:

- where access to the meters is restricted by a security system or process; or
- where any of the distributed meters are located on more than 3 levels, including below, on or above ground level; or
- where the total number of distributed master meters exceeds 20 per installation; or
- where the total number of multiple master meters exceeds 20 per installation and they are located in **other than** a readily accessible single common area of the installation.

13.8.6.4 Conditions for Multiple and Distributed Master Metering without Remote Reading Facilities

Where the criteria set out in Section 13.8.6.3 above do not apply, master meters may be located on one level or on different levels of an installation as long as there are at least 4 meters on each level and the meters are grouped at one location on a level. Under these circumstances, remote reading facilities are not required.

13.8.6.5 Smartpower Meters (Single and Three Phase)

Smartpower meters allow residential customers to access the residential time-of-use tariff under which energy is charged at rates set for defined time periods within the 24 hours of each day. All energy consumed in the installation is charged at the rate applicable to the time block in which it is consumed. The meter uses its internal clock to energise a separate circuit during the off-peak period (switched circuit). This switched circuit is provided principally to control off-peak electric storage hot water systems but may be used to control any load that can be utilised in the off-peak period eg. under floor heating. The switched circuit rating is 31.5A single phase.

Larger loads may be controlled through a separate contactor where the contactor is controlled by this switched circuit. As the electricity on this switched circuit is supplied directly from the meter, a separate main switch is required for loads supplied by the switched circuit.

The switched circuit may be activated at any time by pressing the BOOST button on the meter however, electricity consumed will be charged at the rate applying at the time of consumption.

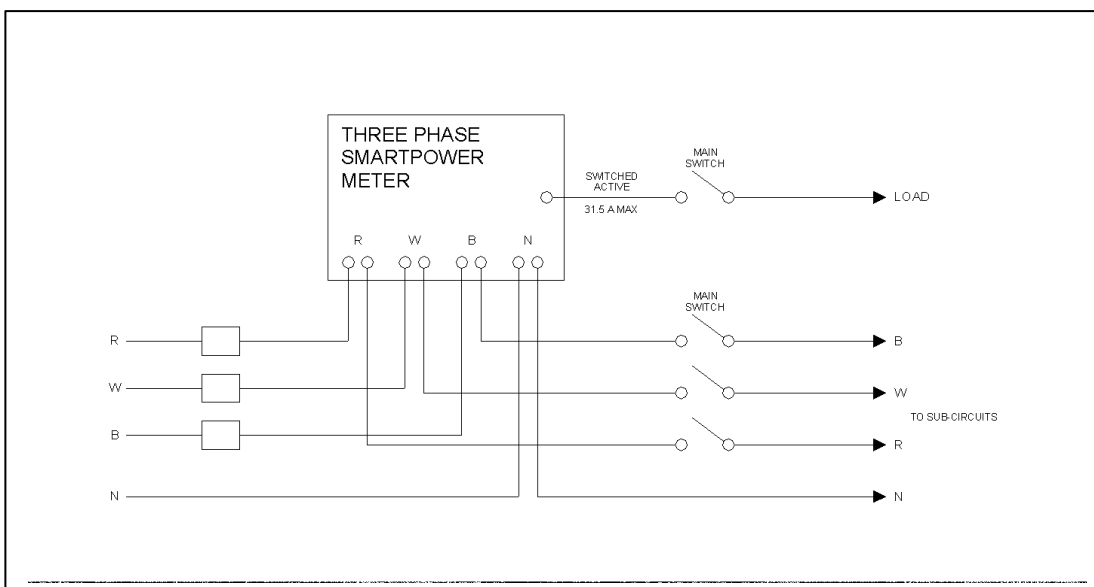


Fig. 13.8.1 Arrangement for directly connected switched load (circuit protective devices not shown)

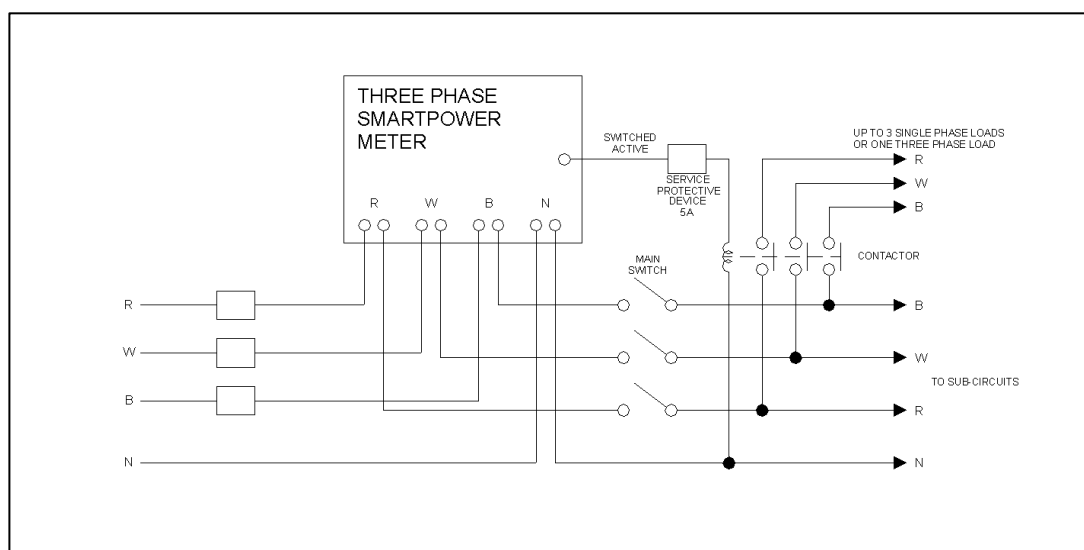


Fig. 13.8.2 Arrangement for indirectly connected switched load (sub-circuit protective devices not shown)

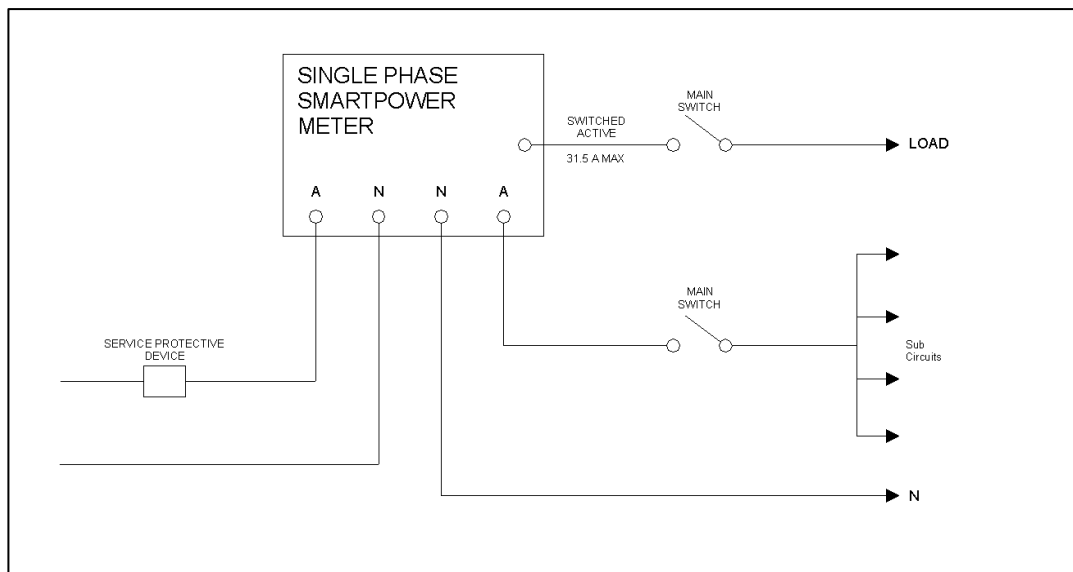


Fig. 13.8.3 Arrangement for directly connected switched load (circuit protective devices not shown)

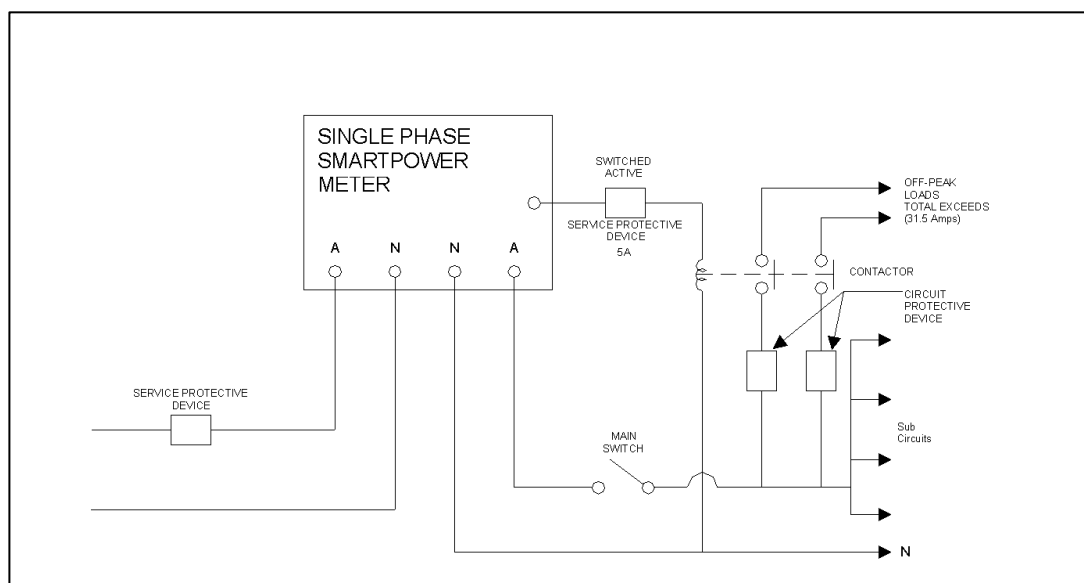


Fig. 13.8.4 Arrangement for directly connected switched load (circuit protective devices not shown)

13.8.6.6 Remote Master Meter Reading Facility

The type of remote master meter reading facility required will depend on the particular installation. The basic technologies are; telephone, power line carrier, pulse collecting, local area network, radio. Some technologies require data collection from the master meter on the site with a single communication link to a central reading location whilst others involve individual communications at each meter to the central reading location. Telephone, pulse counting and local area network systems require the developer to provide and install appropriate cabling to each meter from the data collecting device. Telephone systems will usually share the customer's telephone service.

Where it is intended to install this type of metering system, approach Western Power at the project design stage so that optimum use can be made of the technology in the design of the electrical system of the installation.

13.8.6.7 Customer Master Meter Reading Facility

It may be possible to provide a facility which would allow a customer to read the master meter at any time from a remote location. This will be dependant on the type of meter installed and the type of remote meter reading technology being used. The customer will be charged for any expenditure incurred in providing this facility.

13.8.6.8 Low Voltage Switchboards with CT Metering

These switchboards are to be provided complete with the appropriate current transformers, meter panels, wiring and ancillary equipment installed when erected on site. Full details are contained in Western Power's publication *415 Volt Switchboard Metering - Current Transformers, Meter Panels and Wiring*. The meters and any communication equipment will be installed by Western Power on-site. The building owner is responsible for the ongoing maintenance of the switchboard metering equipment except the meters and communications equipment installed by Western Power.

13.8.6.9 General Metering Arrangements - Direct Connected**Panel Sizes**

- 450mm high by 225mm wide
- 450mm high by 450mm wide

The panels shall be a minimum thickness of 6mm.

Wiring

The cables shall be of stranded copper conductors and be:

- Not less than 16mm² for meters with a maximum current which is limited by an HRC fuse with a rating of up to 80A; or
- Not less than 25mm² for meters with a maximum current which is limited by an HRC fuse with a rating of 100A.

The maximum outside diameter of cables shall be less than 11mm.

Panel Arrangements

Number of Meters x Ampere Rating	Number and Size of Meter Panels (mm)	Phase Link Requirement	Meter Neutral link
1 x 10-60	1 x (450 x 225 x 6)	Not required	Not required
2 x 10-60	1 x (450 x 450 x 6)	Not required	1 x 165A
3 x 10-60	1 x (450 x 450 x 6) 1 x (450 x 225 x 6)	3 x 165A	1 x 165A
4 x 10-60	2 x (450 x 450 x 6)	3 x 165A	2 x 165A
5 x 10-60	2 x (450 x 450 x 6) 1 x (450 x 225 x 6)	3 x 165A	2 x 165A
More than 5 x 10-60	Multiples of previous sizes		
1 x 30-100 (100A fuses) ^a	1 x (450 x 225 x 6)	Not required	Not required
2 x 30-100 (2 sets 100A fuses) ^b	1 x (450 x 450 x 6)	On link panel	1 x 165A

Metering Equipment Panel Arrangements**Footnotes to table**

- a. Maximum conductor size is 35mm²
- b. A link panel is required to terminate consumers mains. Maximum demand for each meter is 100A.

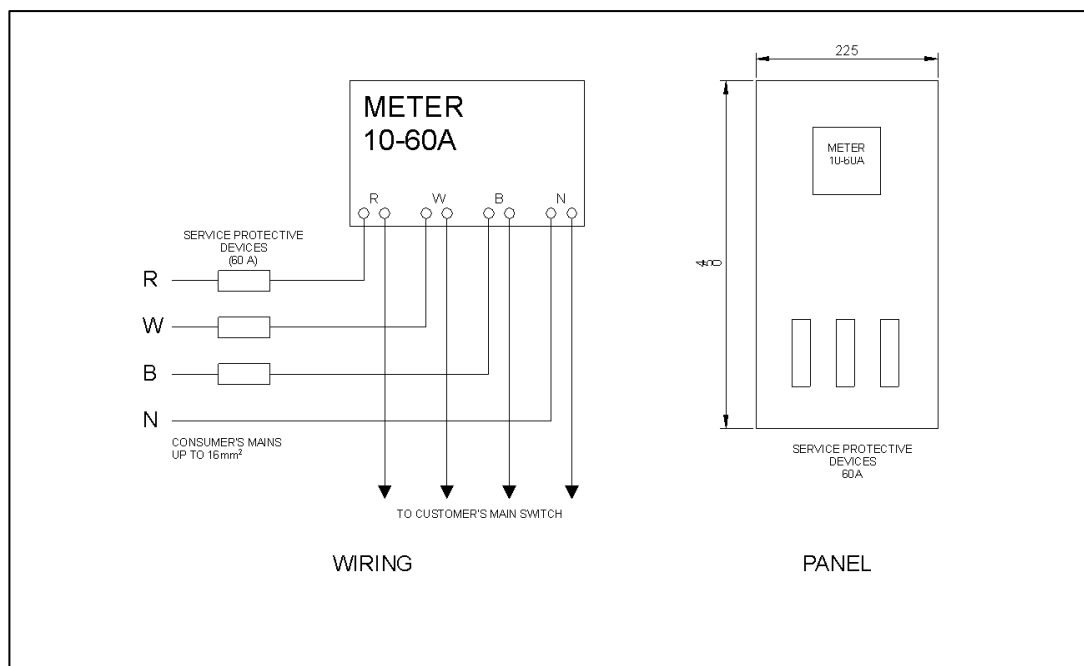


Fig. 13.8.5 Panel arrangement for loads up to 60A maximum demand

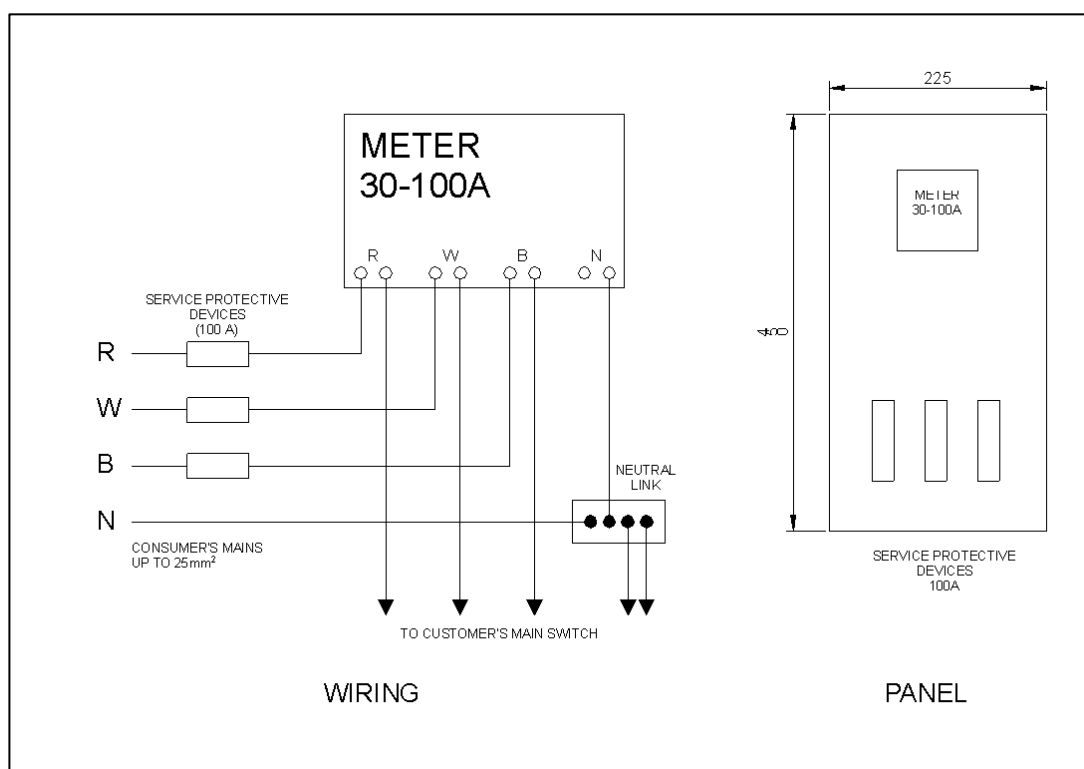


Fig. 13.8.6 Panel arrangement for loads up to 100A maximum demand

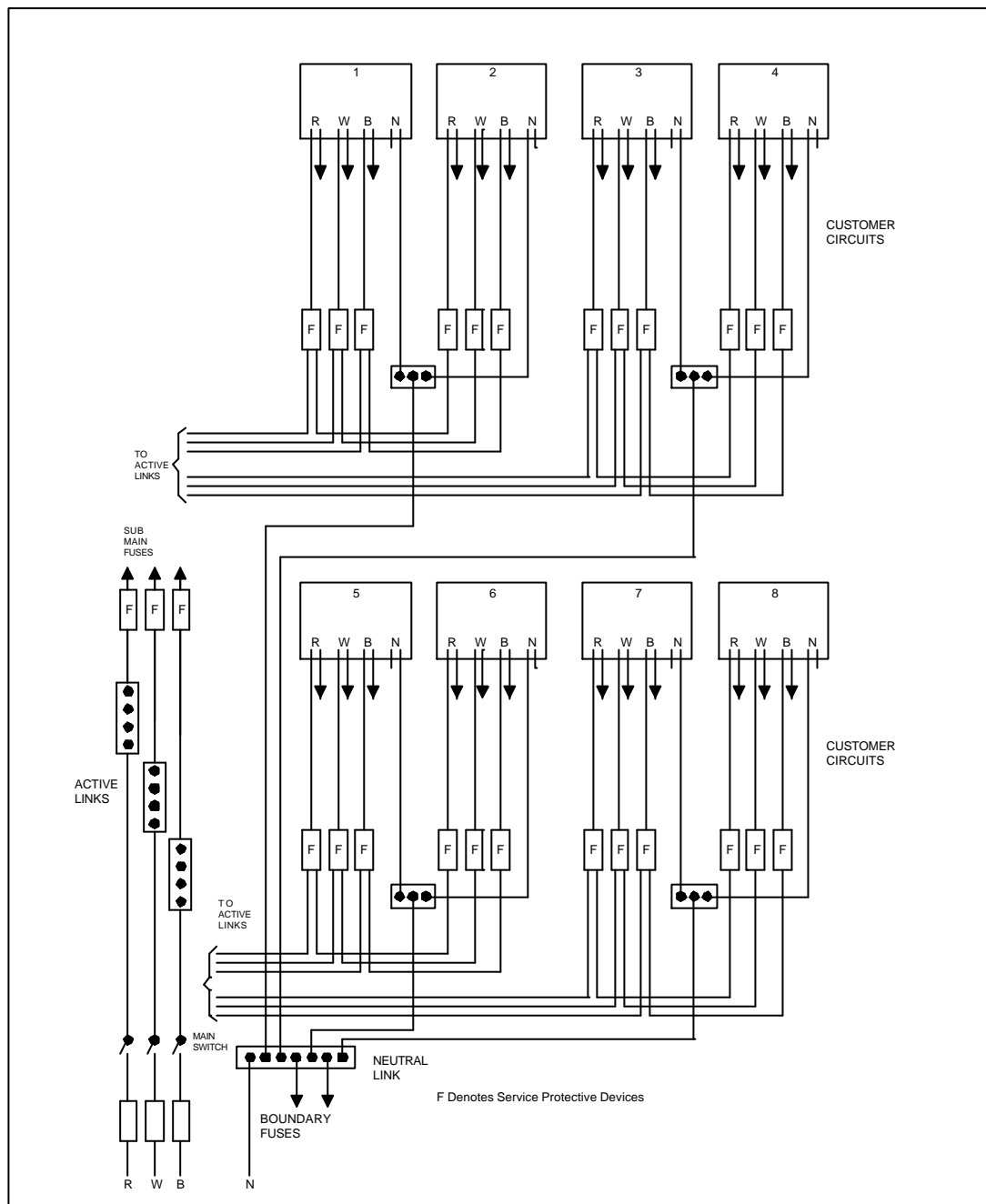


Fig. 13.8.7 Typical wiring details for multiple master installation

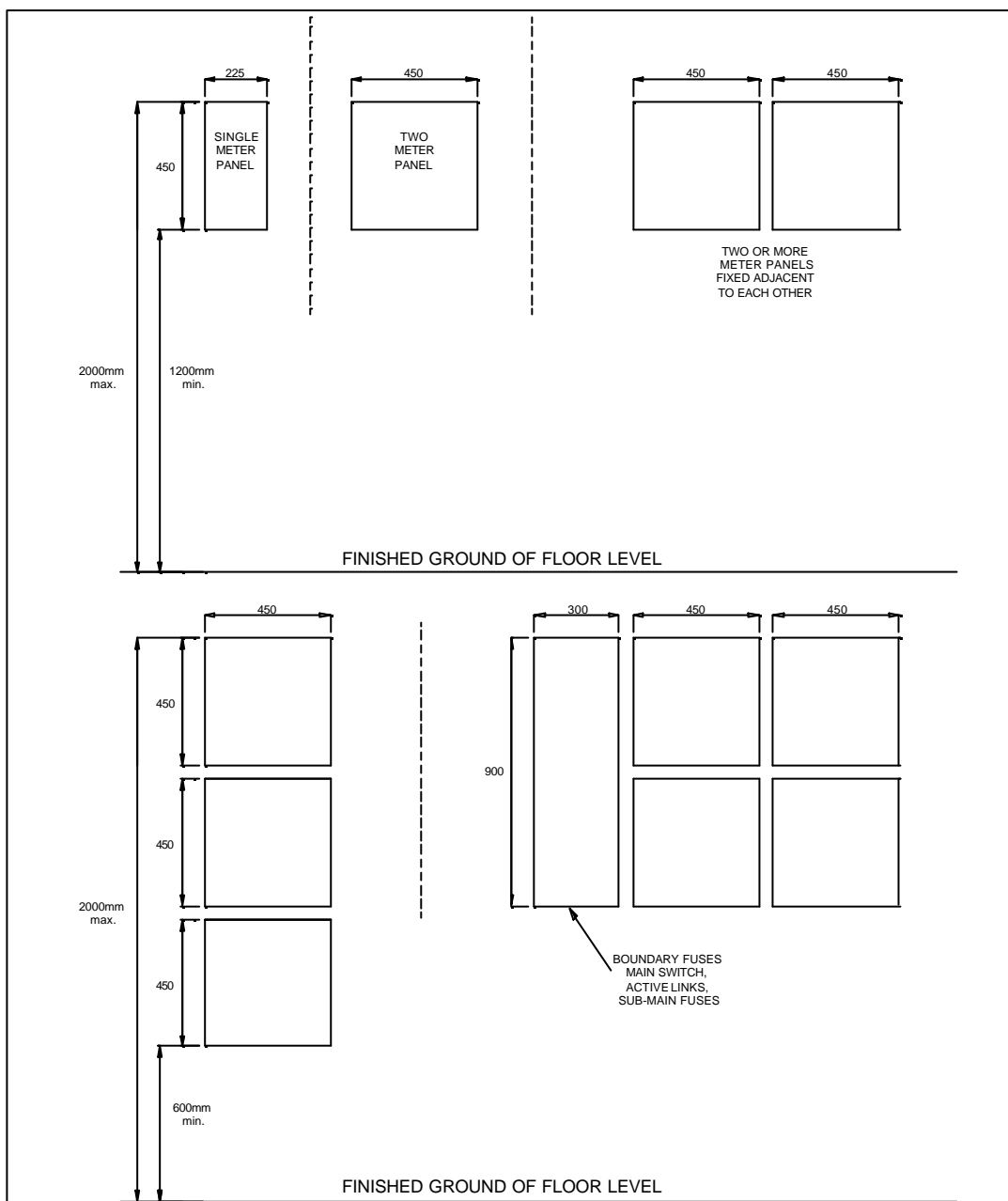


Fig. 13.8.8 Typical mounting details for multiple meter panels

13.8.6.10 Conversion of Subsidiary Meters to Master Meters

Contact Western Power for requirements.

13.8.6.11 Conversion of Direct Connected Meters to CT Connected Meters

When the load at an existing installation, or a separately metered part of that installation exceeds 100A, the metering must be converted from whole current direct connected to current transformer connected. The electrical contractor should submit a Preliminary Notice in the usual manner and indicate that the load is increasing, that a review of the capacity of the network is required and that CT metering is to be installed. The contractor will be informed about the capacity of the network and what, if any, upgrading has to be carried out. This may include the installation of a substation.

When the new switchboard is ready for connection, the contractor should contact Western Power's Project Construction Manager to arrange the necessary supply outage to allow the connection of the new switchboard. The Project Construction Manager will also arrange for the new meters to be installed, the metering to be commissioned and the redundant meters to be collected.

13.8.6.12 Relocation of Existing Metering Point

Contact Western Power for requirements.

13.8.7 High Voltage Installations**13.8.7.1 Fault Levels**

Consumers must install equipment that is rated for the following three phase levels for a 1 second duration.

- 6.6kV 18kA 200MVA
- 11kV 18kA 350MVA
- 22kV 13kA 500MVA
- 33kV 13kA 750MVA

13.8.8 Special LV Supply Arrangements

No additional requirements.

13.8.9 Private Generators Connected to Networks

No additional requirements.

13.8.10 Supply to Construction Sites

No additional requirements

13.8.11 Supply Under Emergency Conditions

Under emergency conditions, so as to make an installation safe, an electrical contractor may remove the service fuse(s) and subsequently replace the services fuse(s) when the emergency condition no longer applies. Western Power must be notified as soon as practical after removal of the service fuse(s) and will indicate at that time if replacement of the service fuse(s) can be performed by the contractor. The above applies if the service protective device is a circuit breaker.

13.8.12 Special Requirements for Installations in WA

No additional requirements.

13.8.13 Additional Specific Requirements of Network Operators

This section refers.

- Distribution Construction Manual, Distribution Design Manual, Residential Distribution Volume 4, Underground
- Western Power Accredited Person List

13.8.14 General Information

13.8.14.1 Books/Manuals/ Handbooks

The following books, manuals or handbooks are available on request and payment of a fee:

- Quality of Electricity Supply Part 1 “Statement to Customers” (UA1973)
- Quality of Electricity Supply Part 2 “Technical Requirements” (UA1974)
- Quality of Electricity Supply Part 3 “problems Explanations and Answers” (UA1975)
- Power Factor Correction (UA2076)
- Electricity Safety Instruction Manual (UA1496)
- Underground Distribution Schemes Policy and Installation Options including the Electrical Safety Handbook and comprising five parts:
 - Handbook for Developers (DSB95/1)
 - General Conditions for Developers (DSB95/2)
 - UDS Equipment Drawings (DSB95/3)
 - Cable Trenching/Laying/Joining Contractors, Materials, Equipment and Suppliers List (DSB95/4)
 - UDS Substation Installation Requirements (DSB95/6)

13.8.14.2 Software

The following software is available on request and payment of a fee:

- FLICK Plus
- FLICK Plus Support

Internet:

Flick@westernpower.com.au

- LVDESIGN
- LVDESIGN Support

Internet:

Lvdesign@westernpower.com.au

13.8.14.3 Enquiries

All enquiries to Western Power can be made by contacting:

Central Call Centre

Tel: 13 13 54

Fax: 9326 4595

Internet:

www.westernpower.com.au

Mail: Western Power Corporation
GPO Box L921
Perth WA 6842

13.8.14.4 Network Connections

Electrical contractors may obtain specific supply or regulatory inspections rulings by submitting a Preliminary Notice to a Western Power Connection Office.

- South West Interconnected System

Telephone 13 13 54 for the latest details of Connections Office location and mail, phone and fax details.

- Pilbara Power

Tel: 9159 9250
Fax: 9159 7288
Mail:
Connections
Western Power Corporation
Pilbara Power Division
PO Box 817
KARRATHA WA 6714

- Regional Power

Tel: 1800 055 005
Fax: 9441 3439
Mail:
Connections
Western Power Corporation
Regional Power
PO Box 79
CLOVERDALE WA 6985

This document is available on Energy Safety's website at:

www.energysafety.wa.gov.au

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