WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

Company Directive

STANDARD TECHNIQUE: SD5A/5

Design of Low Voltage Domestic Connections

Policy Summary

This Standard Technique specifies the requirements for the design of LV domestic connections to WPD's distribution networks.

Author: **Seth Treasure / Matthew Pope**

Implementation Date: **November 2020**

Approved by:

Paul Jewell
DSO Development Manager

Date: **17th November 2020**

Target Staff Group	**Staff involved in the design, installation, maintenance and operation of the LV system.**
Impact of Changes	**Amber - Changes affect staff involved in the design, installation, maintenance and operation of the LV system.**
Planned Assurance Checks	**Managers shall ensure that all staff involved in the design, installation, maintenance and operation of the LV system are familiar with, and follow, the requirements of this document.** **At the end of 2021, the usage levels of three-phase service cables and meter boxes shall be compared to those at the end of 2020, to ensure design practices have changed as intended.**

IMPLEMENTATION PLAN

Introduction

This document specifies the requirements for the design of low voltage domestic connections to Western Power Distribution's network.

Main Changes

This document has been updated as follows:

- Housekeeping, to bring this Standard Technique in line with POL: GE1;
- Section 3.5 has been included, to introduce a requirement to assume that all new and substantially modified domestic connections will include a 32A Electric Vehicle Charge Point;
- A note to request installers use either manual or suitably staggered automatic restarts, where heating is proposed to predominantly comprise heat pump systems, has been added to Clause 7.1;
- Section 8.2 sub-clauses have been amended to highlight WPD's preference for 'multi-phase' connections, over single-phase, for new or substantially modified connections;
- Clause 8.2.6 has been added to inform designers of the preferred service cable route across privately owned land (e.g. gardens);
- Clauses 8.2.8 and 8.2.9 have been included to dictate that every customer must be able to have their supply isolated without affecting the supply of another customer;
- Clause 8.2.11 has been amended, to remove the prohibition of charging a developer / customer for the installation of link boxes, as their use *is* considered to constitute the minimum scheme.

Impact of Changes

Staff involved in the design, installation, maintenance and operation of the LV system must be made aware of the latest amendments to this document, as they considerably change how domestic connections to WPD's distribution networks are designed.

Target Staff Group	**Staff involved in the design, installation, maintenance and operation of the LV system.**
Impact of Changes	**Amber - Changes affect staff involved in the design, installation, maintenance and operation of the LV system.**

Implementation Requirements

Managers shall ensure that all staff involved in the design, installation, maintenance and operation of the LV system are familiar with, and follow, the requirements of this document.

Implementation Timetable

This Standard Technique shall be implemented with immediate effect for any new or substantially modified connections. Quotations already issued will be completed as designed upon acceptance, there is no retrospective actions for these connections. Connections designed to SD5A/4 by ICPs will remain acceptable for connection until the end of May 2021.

REVISION HISTORY

Document Revision and Review Table		
Date	**Comments**	**Author**
November 2020	• General housekeeping, to bring this Standard Technique in line with POL: GE1 • Section 3.5 has been included, to introduce a requirement to assume all connections will include an EV Charge Point • A note to request installers use either manual or suitably staggered automatic restarts, where heating is proposed to predominantly comprise heat pump systems, has been added to Clause 7.1 • Section 8.2 sub-clauses have been amended to highlight WPD's preference for 'multi-phase' connections, over single-phase • Clause 8.2.6 has been added to inform designers of the preferred service cable route across privately owned land • Clauses 8.2.8 and 8.2.9 have been included to dictate that every customer must be able to have their supply isolated without affecting the supply of another • Clause 8.2.11 has been amended, to remove the prohibition of charging a developer / customer for the installation of link boxes, as their use *is* considered to constitute the minimum scheme	Matt Pope
June 2019	• Clause 7.1 - Maximum impedance of main route conductors amended to facilitate the connection of Low Carbon Technology's.	Seth Treasure
December 2017	• Clause 7.1 - WinDebut phase to neutral impedances changed to align with ST:SD5R • Clause 8.1.4 - New buildings constructed in the proximity of a WPD substation shall, as far as possible, satisfy the requirements of 8.1.1.	Andy Hood
November 2016	• Table 1 and Table 2 have been modified to take account of electric vehicle charging points.	Andy Hood
September 2015	• Table 2 corrected	Andy Hood
February 2014	• References to G12/3 have been replaced with ST:SD6E	Andy Hood

CONTENTS

1.0 INTRODUCTION

1.1 This document provides guidance on design of low voltage domestic connections.

1.2 Western Power Distribution staff and contractors use WinDebut software to carry out load flow and protection studies for domestic connections. Independent Connection Providers (ICPs) may either use WinDebut or other alternative systems as long as the criteria specified in this document are satisfied.

1.3 Where there is any difficulty in implementing this ST the DSO Development Team shall be notified who will determine whether or not a variation is appropriate.

2.0 CUSTOMER INFORMATION

2.1 The first stage is to obtain relevant information on the connection requirements from the customer / developer. Further guidance for WPD staff / contractors on the minimum information requirements is included in Standard Technique: NC1Y.

3.0 LOAD ESTIMATES

3.1 The estimated annual kWh consumption and the after diversity maximum demand (ADMD) of each property can be estimated using Table 1 and Table 2, respectively. The ADMD of a property is the maximum demand that is assumed at the time at which peak demand occurs on the substation or LV circuit.

3.2 Substation and LV Circuit Ratings

3.2.1 The preferred method of determining the maximum demand on a substation or on an LV circuit is to enter the estimated annual consumption information and the expected profile type for each connection into WinDebut, the software used by WPD for LV network design. WinDebut uses this information to calculate load requirements. Further guidance on the use of WinDebut is provided in ST: SD5K.

3.2.2 An alternative method of determining the maximum demand requirements for a substation or a substantial LV circuit is to sum the ADMD values estimated for each connection. This method is likely to under estimate the load if applied to a low number of connections (less than 20). Where a small number of connections are made to the substation or cable then it is more appropriate to sum the Maximum Demand (and not the ADMD) for each individual connection.

Table 1 Estimated Annual Consumption for Domestic Properties

Description of Heating	WinDebut Profile	1 Bedroom		2 Bedroom		3 Bedroom		4 Bedroom		5 Bedroom	
		Day kWh	Night kWh	Day kWh	Night kWh	Day kWh	Night kWh	Day kWh	Night kWh	Day kWh	Night kWh
Gas Central Heating	OFFER 1	1900+A+E		2650+A+E		3600+A+E		4200+A+E		4800+A+E	
Electric E7 Heating	OFFER 2	1900 +A+E	1300 +B+C+F	2700 +A+E	1560 +B+C+F	3500 +A+E	1950 +B+C+F	4100 +A+E	2200 +B+C+F	4650 +A+E	2200 +B+C+F
Electric E10 Heating	ECO10	1900+D+E		2650+D+E		3600+D+E		4200+D+E		4800+D+E	
Heat Pumps	See Table 2	Use ADMD method (See Table 2)		Use ADMD method (See Table 2)		Use ADMD method (See Table 2)		Use ADMD method (See Table 2)		Use ADMD method (See Table 2)	
Other Non-electric Central Heating	OFFER 1	2150+A+E		2900+A+E		3900+A+E		4600+A+E		5300+A+E	

Where:

A = 640 x total kW rating of any direct heating.
B = 160 x total kW rating of any direct heating.
C = 800 x total kW rating of any ‘off peak’ heating (e.g. storage heaters).
D = 800 x total kW rating of the electric heating and electric water heating load. For existing connections add together the unrestricted and restricted units together.
E = 1000 x total kW rating of any electric vehicle charging points.
F = 300 x total kW rating of any electric vehicle charging points.

Table 2 Estimated ADMD Values (kW) for Domestic Properties

Description of Heating	WinDebut Profile	1 Bedroom		2 Bedroom		3 Bedroom		4 Bedroom		5 Bedroom	
		Day kW	Night kW	Day kW	Night kW	Day kW	Night kW	Day kW	Night kW	Day kW	Night kW
Gas Central Heating	OFFER 1	0.9+A+E		1.3+A+E		1.7+A+E		2.0+A+E		2.3+A+E	
Electric E7 Heating	OFFER 2	1.3 +A+E	1.3 +B+C+E	1.8 +A+E	2.0 +B+C+E	2.3 +A+E	2.5 +B+C+E	2.7 +A+E	2.8 +B+C+E	3.1 +A+E	2.9 +B+C+E
Electric E10 Heating	ECO10	1.3+D+E		1.8+D+E		2.3+D+E		2.7+D+E		2.9+D+E	
Heat Pumps	OFFER 1	0.9+D+E		1.3+D+E		1.7+D+E		2.0+D+E		2.3+D+E	
Other Non-electric Central Heating	OFFER 1	0.9+A+E		1.3+A+E		1.7+A+E		2.0+A+E		2.3+A+E	

Where:

A = 0.2 x total kW rating of any direct heating.
B = 1.0 x total kW rating of any direct heating.
C = 1.0 x total kW rating of any ‘off peak’ heating (e.g. storage heaters).
D = 1.0 x total kW rating of the electric heating and electric water heating load. For existing connections add together the unrestricted and restricted units together.
E = 0.5 x total kW rating of any electric vehicle charging points.

3.3 Service and Cut-out Ratings

3.3.1 The MD (maximum demand) for a single domestic connection can normally be determined using the following formulae, however, where the customer is known to have additional electrical equipment that is likely to increase the demand then these values may need to be increased. Examples of such additional equipment include electric vehicles, multiple high power electric showers, kilns etc.

Properties with Gas Central Heating or other Non-Electric Heating:

- MD = 2 x ADMD + 8kW

Properties with Economy 7 Electric Heating:

- MD (day) = 2 x ADMD (day) + 8kW
- MD (night) = ADMD (night) + 4kW

Properties with Economy 10 Electric Heating or a Heat Pump:

- MD = ADMD (day) + 4kW

3.3.2 If, for example, a two bedroom property has 2.5kW of direct heating and 8kW of electric storage heaters fitted and uses an Economy 7 off peak tariff (or equivalent) then the following values would apply:

- ADMD (Day) = 1.8 + 0.2 x 2.5 = 2.3kW
- ADMD (Night) = 2.0 + 1.0 x 2.5 + 1.0 x 8.0 = 12.5kW
- MD (Day) = ADMD (day) x 2 + 8kW = 2.3 x 2 + 8 = 12.6kW
- MD (Night) = ADMD (night) + 4kW = 12.5 + 4 = 16.5kW

The service, cut-out and cut-out fuse will all have to be suitable for at least 16.5kW (i.e. 71.7A at 230V). In this case WPD's standard 80A cut-out fuse would be applicable.

3.4 Generation

Where domestic customers utilise generation it is often necessary to carry out studies to represent periods of maximum generation and minimum demand. Under these circumstances the following 'rules of thumb' may be applied:

- For circuit / substation design purposes the Minimum Demand associated with domestic load is assumed to be as detailed in ST: SD5K, Table 6.

- Diversity may be assumed between wind turbines and PV systems, due to the unlikelihood of the maximum outputs of these two technology types occurring simultaneously. It is advised to use either 100% of the rating of the PV + 50% of the rating of the wind turbines or 50% of the rating of the PV systems + 100% of the rating of the wind turbines, whichever is the greater.

- No diversity is to be applied between the same type of generator or between other types of generation (other than wind and PV).

- The output of PV systems is assumed to be zero between 6pm and 6a.m.

- Hybrid systems, which consist of both PV and Electrical Energy Storage Systems (EESS) – most commonly batteries – connected to the DC side of a single converter (inverter), should be considered as a non-intermittent technology type, due to the EESS element being able to export active power at any time of day or night.

3.5 Electric Vehicle Charge Points

3.5.1 This document should be read in conjunction with Standard Technique: SD5G Parts 1 and 2, when considering the installation of Electric Vehicle (EV) Charge Points.

3.5.2 With the increase in up-take of EV, and planning ahead for the Future Homes Standard, it will become fairly typical for developers to install:

- For new domestic housing: A 32A (7.36kVA) EV Charge Point for each new property that includes a driveway or dedicated parking; and

- For new flats with dedicated parking: A 32A (7.36kVA) EV Charge Point for 20% of those parking spaces and the *provision* for the future installation of an Electric Vehicle Charge Point (e.g. the installation of the required ducting and wiring) for the remainder.

The installation of a *provision* for an EV Charge Point will now only meet what is recommended for 80% of flats with dedicated parking, and not for standard domestic housing.

3.5.3 As Battery Electric Vehicles (BEV) become ever more popular, there is an increasing likelihood that existing properties will also include an EV Charge Point, which could considerably increase the property's electricity demand.

3.5.4 For the above reasons, all[1] new or substantially modified connections to domestic properties shall be modelled with a 32A EV Charge Point included within the customer installation. Diversity shall be allowed, between multiple EV Charge Points connected to a single feeder (except for on assets that will see the full load current, such as service cables and cut-outs), by either calculating a customer's consumption (using either Table 1 or 2) or by utilising a suitable EV Charge Point profile within LV network modelling software (e.g. 'BEV_REX' within WinDebut).

3.5.5 New domestic connections to the distribution network are highly likely to include an EV Charge Point, making their inclusion within the modelling and costing of the new connection(s) part of the minimum scheme. Any costs associated with remedial works, required to accommodate the new connection(s) shall, therefore, be apportioned between the customer and WPD according to ST: NC1P. Where the proposed EV Charge Point is rated ≤32A per phase, and does not include a DC output (Mode 4 charging), it shall be assumed that the EV Charge Point meets the technical requirements of BS EN 61000-3-2 and BS EN 61000-3-3.

3.5.6 Modified connections (e.g. augmentations) shall be designed and costed to include a 32A EV Charge Point within the customer installation, as a part of the minimum scheme. Where it is determined that remedial works are required to accommodate the modified connection, designers should refer to ST: NC1P and ST: SD5G Part 1 or 2 (as applicable) for charging methodology.

Notes:

[1] Exceptions may be made, where it has been deemed that the installation of an EV Charge Point is highly unlikely. Examples of such circumstances include:

- Multi-Occupancy Buildings (particularly those in which customer supplies originate from a Multi-Service Distribution Board (MSDB)) where EV Charge Points are planned to be connected to the building's landlord supply – In such cases, it may be pertinent to discuss an increased capacity for said landlord supply, to accommodate the EV Charge Points;

- A property that does not have a driveway (dedicated or shared), or one or more dedicated parking spaces;

- A property with a dedicated car port (or other location intended for parking vehicles) which derives an electricity supply via another connection to the distribution network.

4.0 THERMAL REQUIREMENTS

4.1 Substations, cables, overhead lines, services and cut-out shall be rated for the expected demand and, where applicable generation. The Meter Operator and the customer shall ensure that their equipment is also adequately rated.

4.2 When designing new or augmented networks where the load is predominantly domestic, the maximum demand normally occurs during the autumn or winter periods and loads can normally be assumed to be cyclic (i.e. with a load factor of 0.68 or lower). In such cases autumn cyclic ratings should be used for cables, spring/autumn ratings used for overhead lines and then name plate rating used for new transformers. Where load is to be added to an existing transformer the enhanced rating of the transformer may be used (as defined in ST: SD8D).

4.3 If the demand or generation is expected to be high during other times of year (e.g. during the summer) then equipment ratings shall be reduced appropriately. Further guidance is provided in ST: SD8A (overhead lines), ST: SD8B (cables) and ST: SD8D (distribution transformers).

5.0 VOLTAGE REQUIREMENTS

5.1 The voltage on the LV network shall remain within statutory limits (i.e. 253V to 216.2V). In order to achieve this requirement:

- The voltage drop across the LV network (including services) and local distribution transformer shall not exceed 8%[2].

- Voltage drop along single-phase services shall be limited to 1%[2]. This requirement helps to control potential differences between PME earth terminals and the general mass of earth.

- Voltage rise (due to generation) across the LV network and local distribution transformer shall not exceed 1.5%[2].

5.2 WinDebut checks that the maximum voltage drop across mains and service cables / lines is less than 6%[2]. (based on unity power factor). The maximum voltage drop across the transformer is assumed to be 2%[2]or less.

Notes:
[2] Percentage values of voltage drop and voltage rise are based on 230V.

5.3 Where WinDebut is used to check voltage rise, a separate study must be carried out to determine the voltage rise across the transformer (as voltage rise / drop across the transformer is not checked by WinDebut as standard).

6.0 POWER QUALITY REQUIREMENTS

6.1 Equipment rated up to 16A per phase must comply with the following standards:

- BS EN 61000-3-2: Limits for harmonic currents produced by equipment connected to public low-voltage systems with inputs current ≤16A per phase.

- BS EN 61000-3-3: Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage systems, for equipment with rated current ≤16A per phase and not subject to conditional connection.

- BS EN 61000-3-11: Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage systems – equipment rated current ≤75A per phase and subject to conditional connection.

- BS EN 61000-3-12: Limits for harmonic currents produced by equipment connected to public low-voltage systems with inputs current >16A and ≤75A per phase.

It should be noted that BS EN 61000-3-11 and BS EN 61000-3-12 define requirements for the maximum system impedance and minimum fault level at the exit point which the equipment is connected to. These requirements shall be met when designing networks and when assessing whether reinforcement is needed (before such equipment may be connected).

6.2 The LV network shall be designed in accordance with:

- ENA Engineering Recommendation G5: Planning levels for voltage distortion and connection of non-linear equipment to transmission systems and distribution systems in the UK.

- ENA Engineering Recommendation P28: Planning limits for voltage fluctuations caused by industrial, commercial and domestic equipment in the UK.

- ENA Engineering Recommendation P29: Planning limits for voltage unbalance in the UK.

7.0 PROTECTION REQUIREMENTS

7.1 The following protection criteria shall be satisfied for new and substantially modified LV designs:

- LV circuits shall be protected by HRC (high rupturing capacity) fuses that comply with BS88 Part 5, located at the substation. Circuits shall not normally be designed to be sub-fused.

- LV fuses shall be designed to grade with HV transformer protection. Further information on distribution transformer protection is included in ST: TP4B.

- Mains cables and main overhead lines shall be protected against short circuit current.

- The clearance time for faults on mains cables and main overhead lines shall be 60s or below.

- The phase to earth loop impedance and the phase to neutral loop impedance shall be in accordance with ST: SD5R.

- The maximum main route cable impedance (ph-n) of conductors connected to a transformer rated ≤ 315kVA shall be ≤ 0.245Ω and for transformers rated > 315kVA the ph-n impedance shall be ≤ 0.144Ω.

- WinDebut is set with a maximum earth fault loop resistance of 0.14Ω (to the end of the main route conductor) and 0.22Ω (to the end of the main and service conductors).

- The impedance requirements will help facilitate the installation of Low Carbon Technologies with a rating ≤ 32A per phase (up to the thermal capacity of the circuit).

- Cut-out fuses or metering circuit breakers shall operate within 5s for faults on the terminals of the cut-out or circuit breaker.

- The standard cut-out fuse rating is 80A although alternative sizes may be used. Further guidance on standard cut-out arrangements are included in ST: SD5D.

- Where a development is proposed to include a high proportion of heat pump systems, designers are to request that either manual restarts or suitably staggered automatic restarts are included, to mitigate against the potential for feeder fuses blowing due to high currents being caused by multiple systems starting concurrently

7.2 All the criteria in Clause 7.1 assume that that there is zero resistance at the point of fault.

7.3 The customer (or customer's electrical installer) is responsible for ensuring the customers installation is adequately protected in accordance with BS7671 (IET Wiring Regulations).

8.0 PHYSICAL DESIGN REQUIREMENTS

8.1 Substation Requirements

8.1.1 Where a substation is required this shall be located:

- As close to the centre of load as is reasonably practicable, with consideration being given to likely earthing arrangements (e.g. declaration of a 'hot' or 'cold' substation), site specific layout and conditions (e.g. ground type, flood risk areas, ecological impact, noise, EMF concerns, etc.).
- At least 5m from the living areas of domestic properties (e.g. living rooms, kitchen, bedrooms, etc.), to minimise the risk of receiving noise complaints.
- At least 9m from earthed LV metalwork (e.g. steel framed buildings) where the HV and LV earths of the substation need to be segregated. Further guidance on earthing requirements is provided in ST: TP21D.

8.1.2 All new ground mounted substations shall be installed on anti-vibration pads (to minimise vibration and noise) and either within a GRP enclosure or within a dedicated building. Requirements for substation foundations and enclosures are specified in ST: NC1V.

8.1.3 All new LV fuse cabinets associated with HV/LV transformers shall include a means of connecting temporary LV generation. Further information is included in EE SPEC: 16.

8.1.4 Where new buildings are proposed to be constructed in the proximity to an existing substation, WPD shall, as far as possible, ensure that the minimum distances stated in 8.1.1 are maintained.

8.2 Requirements for LV Mains and Services

8.2.1 Supplies to new groups of customers shall normally be provided by underground cables. Exceptionally, overhead lines may be used where the use of underground cable is not reasonably practicable.

8.2.2 Mains cables shall normally be laid direct in the ground along one side of the road (in the footpath or service strip). Road crossings shall be provided to service properties on the opposite side. Mains cables may be installed on both sides of the road to accommodate large concentrations of load or as a means of reinforcing existing developments. Detailed cable installation requirements are specified in ST: CA6A.

8.2.3 LV circuits shall normally be arranged as multi-branched radial feeders. Unused ways in the substation LV feeder pillar shall be cabled out, to beyond the HV segregation zone, and pot ended to enable future circuits to be added without making the feeder pillar dead. The end boxes shall not have PME earth electrodes installed where this may compromise the separation of the HV and LV earth electrode systems.

8.2.4 Mains cables shall normally be laid direct in the ground unless there are other good reasons to install the cables in ducts (e.g. to deal with traffic management issues). Where mains cables are laid in or across roads they shall be installed in 150mm diameter rigiducts.

8.2.5 Where multiple phases are available at the mains cable to which a connection is being made (i.e. three-phase, split-phase or two-phase), providing that it is reasonably practicable to do so, new and substantially modified connections shall be installed as 'multi-phase', rather than single-phase, with an order of preference:

- Three-phase;
- Split-phase;
- Two-phase (i.e. two phases of a three-phase network); and
- Single phase (where the provision of multiple phases has been deemed to be impracticable).

For single-phase customers being connected to a network with multiple phases available, a three-phase service cable (connected, colour true, to all of the available phases) and cut-out shall be installed. An appropriately sized fuse shall be fitted in only one of the fuse carriers, whilst the remaining fuse carriers are to be fitted with dummy fuses, to allow for possible future conversion to 'multi-phase' or to alter the phase to which the customer is connected (e.g. for phase balancing). A suitable label shall be included on or immediately adjacent to the cut-out, dictating which phase the fuse is to be inserted, to make the Meter Operator aware of which phase to connect the metering.

Meter Operators shall not be permitted to alter the on-site phasing arrangement or fuse size without prior agreement from WPD.

8.2.6 To aid future identification of the service cable routes, wherever it is reasonably practicable to do so, WPD service cables shall be installed on as direct a route as possible, from the public footway to the termination / metering position, taking the shortest route across privately owned land[3].

This requirement will often result in the service cable being installed in a straight line, perpendicular (at 90°) to the meter cabinet, with the service trench not deviating beyond the width of said meter cabinet. Once the service route meets the public footway, it can be diverted towards the service joint (See Figure 1, below).

Services should only be laid on less direct routes to the mains cable (e.g. diagonally, across gardens or driveways) where a direct route is not reasonably practicable.

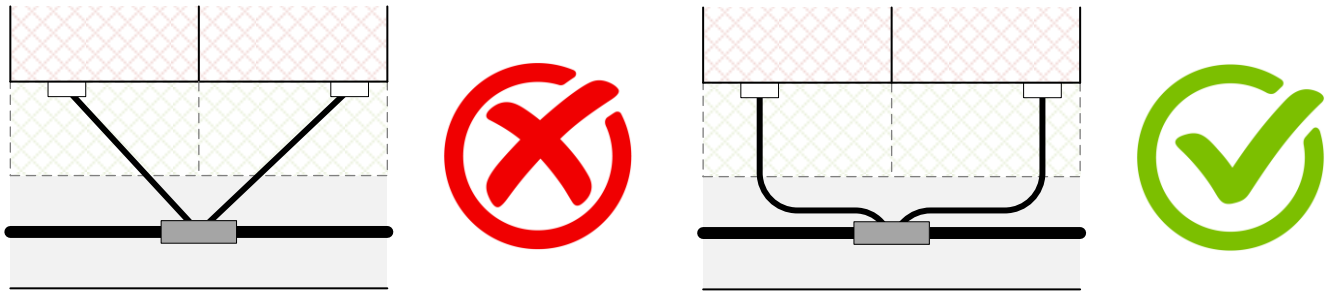


Figure 1 – Preferred Service Cable Routes from the Main

Notes:

[3] Customers will often assume that their service cable runs in a straight line, from the mains cable location (often in public footway) to their termination position (e.g. an outdoor meter cabinet). By designing service routes to be installed in such a way, it is thought that this will aid future service cable route identification and help to reduce inadvertent service cable damage.

8.2.7 Underground service cables shall normally be installed in 38mm (internal diameter) black alkathene ducting.

8.2.8 Each connection shall be provided with a dedicated form of isolation (e.g. fuse or circuit breaker) that allows said connection to be isolated by the DNO or Meter Operator without interfering with the supply of another customer. This will normally dictate that each connection shall be provided with its own, dedicated cut-out, fuseway or circuit breaker (as applicable).

8.2.9 With the exception of connecting a compact 7 way Multi-Service Distribution Board (MSDB) above such a cut-out, where a standard 100A cut-out is used, no single fuse is to be shared between multiple customers.

8.2.10 Services shall not be looped.

8.2.11 Link boxes (or equivalent cabinets) should be installed to provide back-feeding facilities between WPD owned substations and LV feeders, where it is reasonably practicable to do so. Where a link box or cabinet is installed, the circuit feeding the link box should not be tapered. Where the network is to be installed by an ICP and adopted by WPD, WPD should specify the requirement for any additional link boxes or cabinets that have not been included in the ICP design, where it is reasonably practicable for them to be included. This requirement excludes link boxes or cabinets that are proposed to be installed at the boundary between WPD's LV network and the LV network of an IDNO. Where a link box is specifically required or requested at this ownership boundary, the associated costs shall be borne by the party requiring the link box, in accordance with ST: NC6A.

8.2.12 Networks shall be designed for PME earthing as standard unless there are good safety reasons for not providing PME. Further guidance on LV system earthing is included in ST: TP21D.

Information on the provision of earth terminals to customers LV installations is given in ST: TP21E.

8.3 Service Entry Requirements

8.3.1 On new housing developments the preferred method of service entry is via an external meter cabinet located in an accessible position on the front or side of the building. With WPD's preference for a 'multi-phase' connection in mind, all new or substantially modified domestic properties that are to include an external meter box shall be designed to include a three-phase meter box, rather than a single-phase version, in accordance to ST: SD5D. When installed, the bottom of the meter box shall be no lower than 500mm and no higher than 1000mm above ground level.

8.3.2 Meter cabinets shall be installed in a manner that preserves the manufactured fire resistance values.

8.3.3 Customer equipment, with the exception of the tails that connect between the meter installation and customer's installation shall not be installed within the meter cabinet. Where Western Power Distribution or the Meter Operator provide an isolation switch this may also be located inside the meter cabinet.

8.3.4 Meter cabinets shall be supplied by Western Power Distribution or by an Independent Connection Provider to Western Power Distribution specification EE SPEC: 37. Meter cabinets are considered to be part of the fabric of the building and, therefore, ownership and the responsibility for their maintenance passes to the building owner once they have been installed. Western Power Distribution hold stocks of various types of meter cabinet door and reserve the right to charge building owners / customers for replacing damaged doors.

8.3.5 Cut-out / meter positions may be located inside domestic properties so long as the following criteria are satisfied:

- The air temperature surrounding the cut-out does not exceed 30^{o}C.
- The cut-out / metering equipment is easily accessible and placed in a well-lit and ventilated area.
- Sufficient space shall be provided for and dedicated to the cut-out and metering equipment (e.g. 600mm x 400mm) and sufficient space shall be provided in front of the meter position to enable the equipment to be maintained and replaced (e.g. a minimum depth of 1000mm should be provided).
- The entire cut-out / meter position shall be positioned between 500mm and 1800mm above the finished floor level.
- The cut-out / meter position shall not be located in a bathroom, toilet, shower-room or close to a source of water that could potentially damage the equipment or cause an electrocution risk.
- The cut-out / meter position shall not be located in an airing cupboard, boiler room, sauna, steam room or in any other type of room or enclosure that includes a heat source that is likely to increase the ambient temperature above 30^{o}C.

- The cut-out / meter position shall be located such that the electrical installation (service cable, cut-out, metering and meter tails) is separated by a minimum distance of 300mm from any gas meter and a minimum distance of 25mm from any gas pipes.
- The service cable can be easily accessed and replaced.

8.3.6 The standard method of service entry into the meter cabinet shall be by means of a white, ultra violet proof PVC preformed tube ('hockey stick') with an external diameter of 38mm and a wall thickness of 2mm. The tube shall be fixed to the outside wall using appropriate cleats.

8.3.7 Service cables shall normally be installed within black alkathene service ducting (as specified in 8.2.7). The alkathene service ducting should be laid from the service joint to directly beneath the cut-out termination position. Where the use of a 'hockey stick' is applicable, the alkathene ducting should be directly connected to the 'hockey stick'.

8.4 Street Lighting

8.4.1 The design of street lighting connections shall be in accordance with ST: SD5P.

STANDARD DRAWINGS FOR METER CUPBOARDS/CABINETS

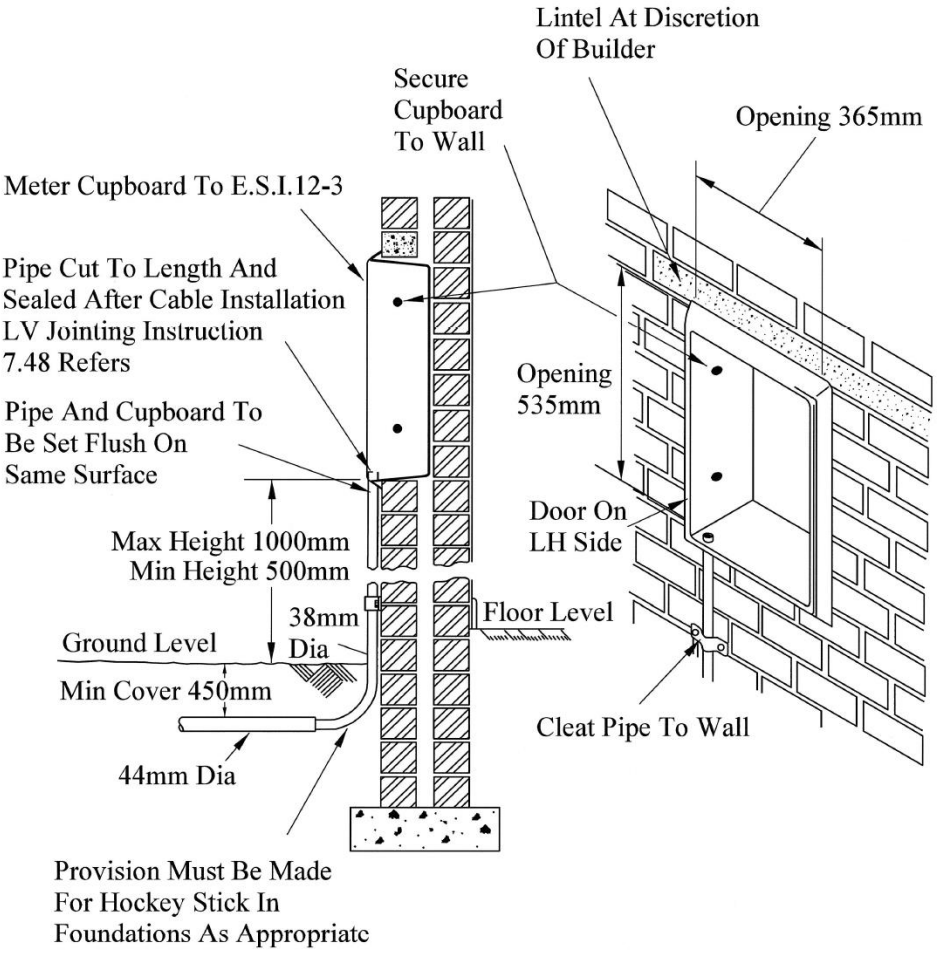
Drawing Number OG/65/4418 Flush mounted meter cabinet – single phase

Drawing Number OG/65/4418/3 Flush mounted meter cabinet – 3 phase

Drawing Number OG/65/4421 Surface mounted meter cabinet – single phase

Drawing Number OG/65/4421/3 Surface mounted meter cabinet – 3 phase

All dimensions in mm



Rev No	Drawn	Chk'd	App'd	Date	Revision
4	RJB			11/11	TITLE CHANGED

ORIGINAL ISSUE		DATE
Drawn	JR	2.87
Checked		
Approved		
SCALE	N.T.S.	

WESTERN POWER DISTRIBUTION
Design Department.
Avonbank,Feeder Road,Bristol BS2 0TB
Tel: 0117 933 2000 Fax: 0117 933 2001.

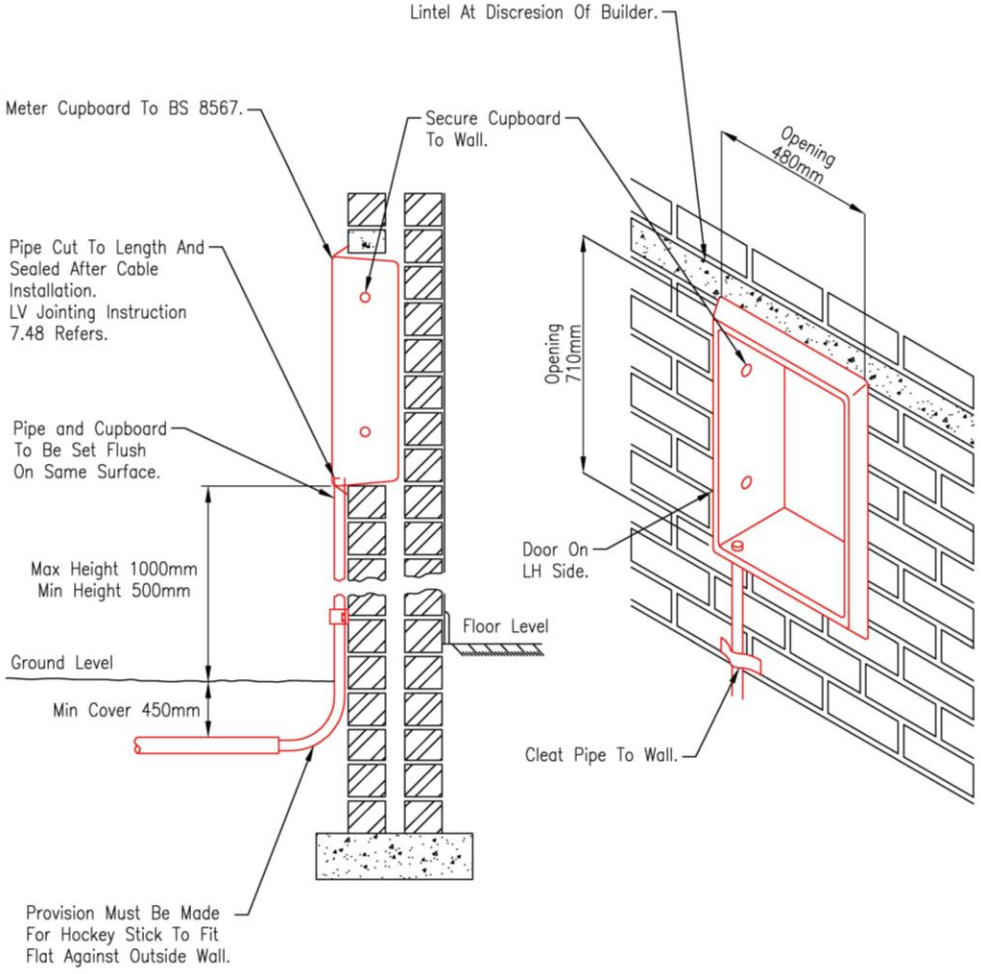
WESTERN POWER DISTRIBUTION

Title
GENERAL ARRANGEMENT FOR FLUSH MOUNTED METER CABINET - SINGLE PHASE

Drg. No. OG/65/4418

Rev No 4

All Dimensions in mm.



Rev No.	Drawn	Checked	Approved	Date	Revision
6	JJH			12/21	AMENDED OPENING DIMENSIONS

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Approved			
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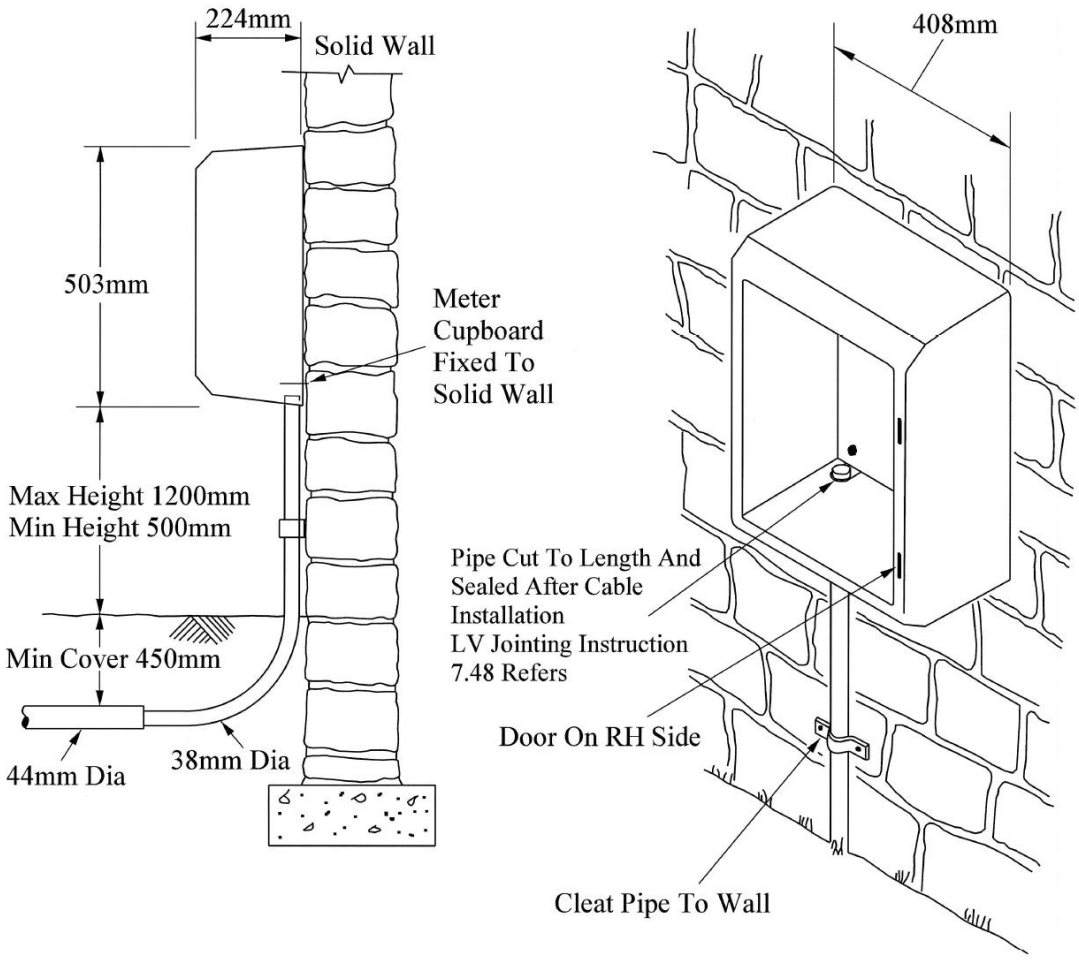
Drg. No. OG/65/4418/3

Rev No. 6

All dimensions in mm



Rev No	Drawn	Chk'd	App'd	Date	Revision
4	RJB			11/11	TITLE CHANGED

ORIGINAL ISSUE		DATE	WESTERN POWER DISTRIBUTION Design Department. Avonbank,Feeder Road,Bristol BS2 0TB Tel: 0117 933 2000 Fax: 0117 933 2001.
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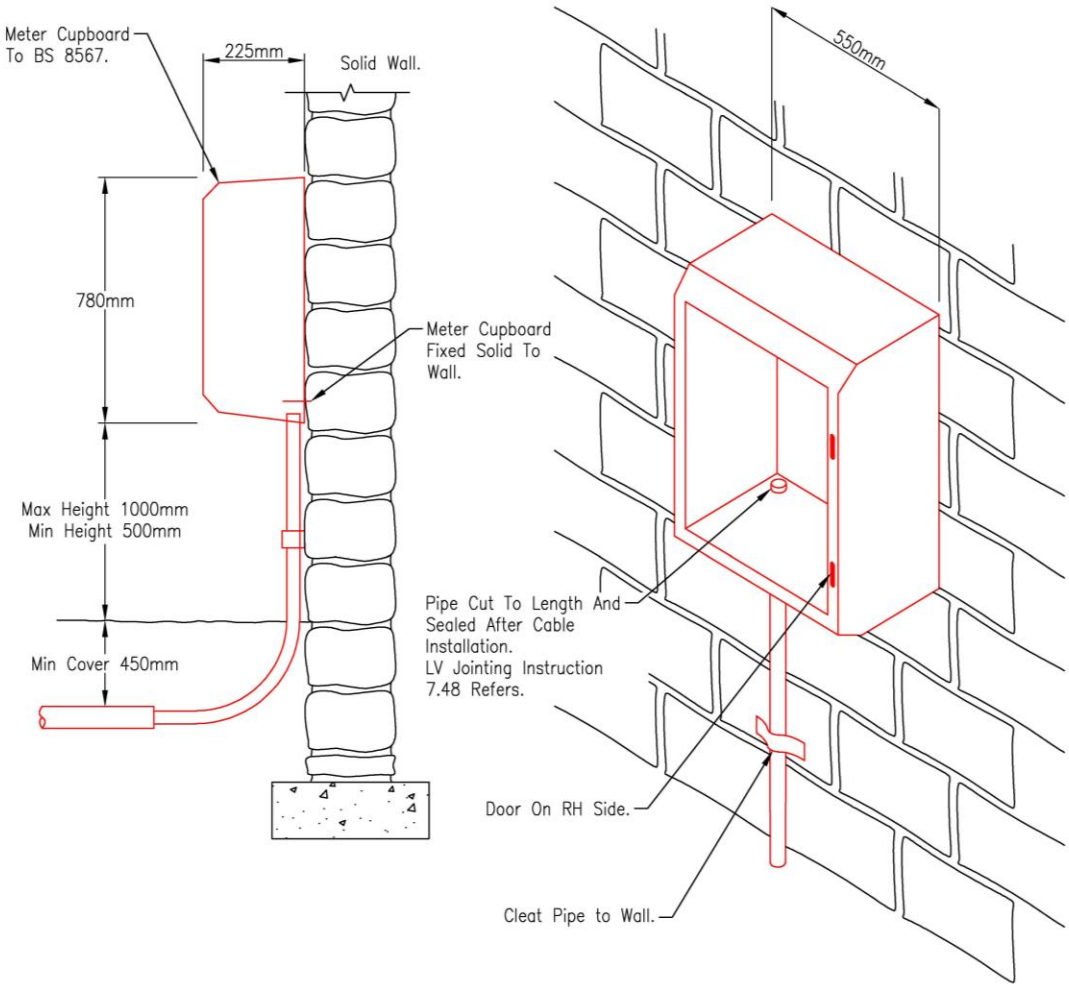
Approved			
SCALE	N.T.S.		Title GENERAL ARRANGEMENT FOR SURFACE MOUNTED METER CABINET - SINGLE PHASE

WESTERN POWER DISTRIBUTION

Drg. No.	Rev No
OG/65/4421	4

All Dimensions in mm.



Rev No.	Drawn	Checked	Approved	Date	Revision
4	JJH			10/21	AMENDED DIMENSIONS

Original Issue		Date
Drawn	JR	02/87
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Approved		
Scale	NTS	

Western Power Distribution
Engineering Design Department
Avonbank, Feeder Road, Bristol, BS2 0TB
Tel : 0117 9332000

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Serving the Midlands, South West and Wales

Title

GENERAL ARRANGEMENT FOR SURFACE MOUNTED METER CABINET – 3 PHASE

Drg. No. OG/65/4421/3

Rev No. 4

APPENDIX B

SUPERSEDED DOCUMENTATION

This document supersedes ST: SD5A/4 dated June 2019 which has now been withdrawn.

APPENDIX C

RECORDING OF COMMENT DURING CONSULTATION

ST: SD5A/5 Comments

APPENDIX D

ASSOCIATED DOCUMENTATION

BS7671	IET wiring regulations
ENA ER G5/4	Planning levels for voltage distortion and connection of non-linear equipment to transmission systems and distribution systems in the UK
ENA ER P28	Planning limits for voltage fluctuations caused by industrial, commercial and domestic equipment in the UK
ENA ER P29	Planning limits for voltage unbalance in the UK
EE SPEC: 16	LV Distribution Fuse Boards
EE SPEC: 37	Outdoor meter cabinets
ST: CA6A	The installation of underground cables
ST: NC1P	The Basis of Charges for Connection for Reinforcement
ST: NC1V	Standard foundation and enclosure details and specifications for 11kV Substation plant
ST: NC1Y	Minimum information requirements
ST: SD5D	Arrangements for LV cut-outs and multi-service distribution boards.
ST: SD5G Part 1	The Connection of Low Carbon Technology with a Capacity ≤ 32A per phase
ST: SD5G Part 2	The Connection of Low Carbon Technology with a Capacity > 32A per phase
ST: SD5K	Use of WinDebut software
ST: SD5P	Design of un-metered connections
ST: SD5R	Earth fault loop impedances and phase to neutral loop impedances at LV installations
ST: SD8A	Overhead line ratings
ST: SD8B Part 1	LV underground cable ratings
ST: SD8B Part 2	11kV underground cable ratings
ST: SD8D	Distribution transformer ratings
ST: TP4B	11kV and 6.6kV transformer protection
ST: TP21D	HV and LV system earthing
ST: TP21E	Provision of WPD earth terminals to customer LV installations

APPENDIX E

KEY WORDS

Earth Fault, Loop Impedance, Cut-out, IET Wiring Regulations, BS7671, PME, SNE, TT, EV, Electric Vehicle, Electric Vehicle Charge Point.