1. SCOPE

This document details the SP Distribution plc and SP Manweb plc requirements for the design of low voltage underground cable electricity networks including their new associated HV / LV distribution substations. The document specifically relates to housing estates constructed under Ofgem Competition in Connections regime. This document does not detail arrangements for multi-occupied premises or industrial / commercial supplies.

The document forms the Appendix to, and shall be read in conjunction with, the Energy Networks Association Engineering Recommendations EREC G81 – Parts 1, 2 and 3 (Framework for new low voltage housing development installations; design and planning, materials specification and installation and records).

This document only applies to new developments comprising of single-occupied premises and their associated street lighting installations and is not to be applied retrospectively.

2. ISSUE RECORD

This is a Controlled document. The current version is held on the EN Document Library.

It is your responsibility to ensure you work to the current version.

Issue Date	Issue No.	Author	Amendment Details
20th October 2016	Issue 6	Jonathan Mitchell	Amendment to Section 10.5 (p) only to remove ambiguity of requirement to terminate additional cables to spare fuse ways on take-off chamber and LV Boards.
March 2019	Issue 7	Matthew Jones	ADMD demand estimator amended for inclusion of EVSEs. Minimum LV cable specifications increased. Other updates throughout.
July 2024	Issue 8	ShengJi Tee	Minor amendments to guidance on estimation of domestic demand (ADMD). Updates to guidance on multiple / temporary supplies, HV network design considerations, and single occupied domestic premises. Other updates throughout. The review period of this issue has been reduced from five years to 12-months due to ongoing review and benchmarking of ADMD.

3. ISSUE AUTHORITY

Author	Owner	Issue Authority
ShengJi Tee Lead Engineer	Russell Bryans System Design & Development Manager	Malcolm Bebbington Head of Distribution Network Planning p.p. Iain Divers, Head of Distribution Networks..... Date:...08/08/2024.....

4. REVIEW

This is a Controlled document and shall be reviewed as dictated by business / legislative change but at a period of no greater than 5 years from the last issue date.

5. DISTRIBUTION

This document is part of the SP Distribution and SP Manweb System Design Virtual Manual(s) maintained by Document Control but does not have a maintained distribution list. It is also published on the SP Energy Networks website.

SP Distribution DOC-00-206
SP Manweb DOC-00-310

6. CONTENTS

7. DEFINITIONS AND ABBREVIATIONS

ADMD	After Diversity Maximum Demand.
Applicant	The organisation (or their representative) responsible for the overall design and development of the Housing Site. Typically referred to as the Client or Principal contractor under the CDM regulations.
Approved	Policy and design parameters contained within this document and its appendices or the written approval of SP Distribution plc / SP Manweb plc.
CDM	The Construction (Design and Management) Regulations 1994.
CNE	Combined neutral and earth (of cable construction).
Common Access	Parts of the development to which all residents / SP Distribution plc / SP Manweb plc representatives have unrestricted access.
Customer	The recipients of the power supply being a tenant or owner of a domestic dwelling.
Distributors	A main electricity cable laid externally in the ground and supplying more than one Customer.
EV	An Electric Vehicle (EV) is a vehicle that uses battery technology to power an electric-drive train for propulsion. In this context it refers to vehicles which connect to EVSE equipment for battery charging.
EVSE	Electric Vehicle Supply Equipment, also known as EV Charge Points, provide an electrical supply for the charging of an EV from the Customers side of a connection.
External Meter Cupboard	A cupboard, positioned external to the property and containing the customer's Point of Supply.
Greenfield	A plot of land that has not been subject to any form of development.
Housing Site	A development consisting of domestic dwellings.
Incoming Supply Cable	An electricity cable connecting the building to the SP Distribution plc / SP Manweb plc network.
Interconnection	Cables that have more than one supply source available. Full interconnection refers to cables that run normally with more than one supply source in use as found in unit protected networks.
Link Boxes	A device buried in the ground but accessible from street level that enables cables to be isolated by the removal of links.
Mains	See distributor definition.
Network Pillars	An outdoor cupboard arrangement that enables cables to be isolated by the removal of links / fuses.

New Connection Contractor	Independent contractor wishing to undertake Contestable Work within the Company's licensed area, as detailed in Energy Networks document ASSET-01-015.
NRSWA	New Roads and Street Works Act.
PME	Protective multiple earthing.
Point of Connection	The position at which a developer's network would connect to the existing distribution system.
PSCC	Prospective Short Circuit Current.
Point of Supply	The point at which the ownership of the electrical cable network passes from SP Distribution plc / SP Manweb plc to the Customer.
Energy Networks	SP Energy Networks, operator of network assets on behalf of the Company.
Service	A cable providing supply to an individual house.
Service Position	The location in the Customer's property at which the SP Distribution plc / SP Manweb plc cable termination (cut-out) is located.
Service Strips	A clear route through a Housing Site containing utility infrastructure.
SP Distribution plc	The Distribution Licence Holder for the Distribution Service area formerly known as Scottish Power.
SP Manweb plc	The Distribution Licence Holder for the Distribution Service area formerly known as Manweb.
The Company	A term used throughout this document to refer to both SP Distribution plc and SP Manweb plc including all associated design and planning practices.

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8. RELATED DOCUMENTS

This document is one of a suite of specifications relating to this subject area and should be read in conjunction with:

(a) Statutory Legislation

- The Electricity Safety, Quality and Continuity Regulations 2002
- New Roads and Street Works Act 1991
- Construction (Design and Management) Regulations 2015

(b) British Standards

- BS 7671 Requirements for electrical installations – IET wiring regulations
- BS 7430 Code of practice for protective earthing of electrical installations

(c) National Joint Utilities Group (NJUG) Publications

- Guidelines on the positioning and colour coding of Utilities' apparatus

(d) Energy Network Association Documents:

- Engineering Recommendation G81 (2016) – Framework for new low voltage housing development installations
  - Part 1: Design and Planning
  - Part 2: Materials Specification
  - Part 3: Installation and Records
- Engineering Recommendation G12/4 Amendment 3 (2021): Requirements for the application of protective multiple earthing to low voltage networks
- Engineering Recommendation P2/8 (2023): Security of supply
- Engineering Recommendation P28 (2019): Planning limits for voltage fluctuations caused by industrial, commercial and domestic equipment in the United Kingdom
- Engineering Recommendation P29 (1990): Planning limits for voltage unbalance in the UK for 132kV and below
- Engineering Recommendation G5/4-1 (2005): Planning levels for harmonic voltage distortion and the connection of non-linear equipment to transmission systems and distribution networks in the United Kingdom
- Engineering Recommendation G100 Issue 2 Amendment 2 (2022): Technical Requirements for Customers' Export and Import Limitation Schemes

(d) Energy Networks Internal Documents:

- ESDD-01-001: Design Philosophy & Principles
- EPS-02-005: Installation and Record framework for Low Voltage Housing Developments, Underground Networks and Associated New HV/LV Distribution Substations
- SUB-02-013: Policy and Specification for the Interface with Independent Distribution Network Operators Installations
- SUB-02-006: Secondary Substation Installation and Commissioning Specification
- ASSET-01-015: New Connections Independent Connection Provider (ICP) Approval Policy
- ESDD-01-005: Distributed Generation Connection Requirements
- EART-01-002: Low Voltage Earthing Policy and Application Guide

(e) Energy Networks Approved Equipment Register:

- https://www.spenergynetworks.co.uk/userfiles/file/Approved_Equipment_Register.xlsx

All authorised designs must comply with both the requirements described within this document and those detailed above.

9. GENERAL

The data and guidance contained within this document remains the property of Energy Networks and may not be used for purposes other than that for which it has been supplied and may not be reproduced either wholly or in part, in any way whatsoever, nor may it be used by, or its contents divulged to, any other person whosoever, without the prior written permission of Energy Networks.

This document applies to new installations and is not to be applied retrospectively.

Energy Networks reserves the right to change the data contained within this document without notification. Although specific network extensions will be designed by third parties, Energy Networks retains the overall responsibility for the design of the distribution system and since the guidance cannot cover every eventuality, reserves the right to apply other criteria where necessary. Energy Networks accepts no responsibility for any inaccuracies in, or omissions from the document. The Applicant is responsible for ensuring they have all relevant information to undertake the design. Only Applicants possessing the appropriate skills, training and experience shall use the data and guidance contained within this document.

The requirements detailed within this document should be considered as minimum requirements. Commercial apportionment rules are applicable where indicated although the costs associated with the establishment of the infrastructure will generally be borne by the developer. At the discretion of the developer and where considered economic, incremental works may be undertaken again, in general, with the costs being borne by the developer.

Energy Networks may nominate a contractor to undertake some or all of its non-contestable obligations.

In addition to the requirements of this document, prior to design approval and subsequent adoption of networks, **New Connection Contractors** shall adhere to the requirements detailed in ASSET-01-015 New Connections Independent Connection Provider (ICP) Approval Policy.

The data and guidance contained within this document details the electrical design only and does not embrace the physical construction of the distribution system or the associated safety, environmental and legal requirements.

10. NETWORK PRINCIPLES

10.1 Security of Supply

The minimum design requirement will satisfy EREC P2, comply with Energy Networks' policy as detailed in this document and will ensure the technical and performance characteristics of the existing network infrastructure are not compromised below Energy Networks' acceptable minimum standards. However, it should be noted that EREC P2 is not applicable to individual end customers (applies to Demand Groups), so specific solutions may be offered to meet an individual customer's requirements.

The connection of a new or additional load must not adversely affect the performance of the existing network or the security of supply provided to existing customers to levels below Energy Networks' minimum acceptable standards.

Applicants must ensure that customers are made aware of (and understand) all possible connection arrangements which can vary the level of supply security for specific connections. Energy Networks will recommend a minimum level of security believed appropriate to the customer's needs – known in this document as Energy Networks recommended design solution.

Security of supply issues include the ability to restore the network following a fault, the continuity of supply as construction proceeds and continuity of supply during maintenance of the local network. This may be particularly relevant to larger developments, where the alternative means of supply may not be available until completion of the final phase of the development, some years ahead. Networks shall be designed to limit the number of customers affected by any fault and to facilitate the shortest restoration and repair times. Likewise, networks shall be designed to minimise system losses.

10.2 Plant, Equipment and Materials

All plant, equipment and materials and their associated installation shall comply with the appropriate specifications for work in the Company's network areas. These are available upon request and cover such matters as the installation requirements, the arrangement of equipment at the Service termination and the depths / lateral position of cables and ducts.

Only Energy Networks Approved plant, equipment and materials shall be used. Only new plant, equipment and materials shall be installed unless prior agreement is obtained from Energy Networks. Further information is available in the Approved Equipment Register detailed within the Related Documents section.

Under no circumstances shall plant rated with non-standard Company system voltages be connected to the distribution network.

10.3 Establishing the Point of Connection

Energy Networks will provide an indicative Point of Connection onto the Company network based on the load information provided by the Applicant (refer to Appendix A and B). Energy Networks will carry out the necessary system design to specify the lowest cost practical point(s) of connection to the existing distribution system. For housing developments, the Point of Connection will normally be either an existing low voltage Main(s), the outgoing fuse-way(s) of an existing low voltage substation or an existing high voltage Main(s) (requiring a secondary substation) and/or existing extra high voltage Main(s) (requiring a primary substation).

Upstream from the Point of Connection, Energy Networks will design high voltage or high voltage / low voltage systems as appropriate and will advise:

(a) The characteristics of the high / low voltage system at the point(s) of connection.

(b) Any additional requirements for low voltage and high voltage Mains cables through the site and any diversionary works required to accommodate the site.

(c) Where appropriate and if provided with sufficient information, the type and approximate preferred location of substation(s).

The objective is to provide sufficient information to enable the high / low voltage distribution system design and layout beyond the point(s) of connection to be undertaken by the applicant.

Where appropriate, an estimate will be provided for reinforcement of the existing upstream distribution system to accommodate the additional load at the point(s) of connection.

There shall be only one permanent point of connection. This is in order to avoid significant safety and technical issues associated with segregation of installations, risk of interconnection and multiple points of isolation. It is acceptable during the installation of a new connection or upgrade of an existing connection for there to be a temporary second supply to a premises to allow the transfer of supply from an existing point of connection to a new point of connection. This second supply shall only be in place for the minimum time required to allow the transfer of supply, it shall be continuously worked, and in place for no longer than 48 hours. Requests for permanent additional low voltage standby supplies shall be refused on the above grounds coupled with the fact that the standby supply would have no greater reliability.

10.4 LV Design Considerations

As a minimum, designs shall ensure that the following requirements are met (these are discussed in more detail later within this document).

Each domestic property and streetlight are afforded a standard connection arrangement that meets the technical requirements of voltage, frequency and loop impedance. Suitable Approved customer isolator switches shall be installed at the Service position.

The electrical installation beyond the Point of Connection for dwellings and street lighting shall comply with the latest edition of BS7671 for electrical installations and BS7430 for protective earthing.

LV Distributors must be designed to experience a balanced load within their rating. Service breaches should ensure that load is balanced across phases as equally as reasonably practicable, this will ensure LV network losses are minimised and balance HV transformer loading. The design must be such that substation fuses will operate to clear faults on the Distributors and Services. Only Company Approved fuse sizes and types shall be used.

To assist in customer restoration during LV cable faults a maximum of 75 Customers shall be connected to a radial LV feeder. LV feeders with a Customer count in excess of this shall be provided with a

suitable backfeed. However, in certain circumstances and where reasonably practicable Energy Networks can insist on a suitable backfeed for LV feeders with less than 75 Customers. This backfeed can be controlled from the same substation.

Cables used as backfeeds shall have a minimum conductor cross sectional area of 300 mm^2 Waveform.

10.5 HV Network and Substation Design Considerations

As a minimum, the design shall ensure that the following requirements are met. Where relevant, these are discussed in more detail within this document.

(a) All HV overhead lines shall be designed to the relevant Energy Networks specification.

(b) HV cables for network extensions shall be selected to ensure that there is no de-rating of the existing overall circuit and shall be of an Approved design.

(c) Only Energy Networks Approved, 500 kVA and 1000 kVA 3-phase transformers are acceptable depending on the overall load. In LV networks operating interconnected (e.g. SP Manweb plc's X – type network) only 500 kVA transformers shall be used.

(d) In areas where 6.6 kV networks exist, dual ratio (11/ 6.6 kV) transformers shall be installed. Similarly dual ratio transformers will be required for networks operating at 6kV or 6.3kV.

(e) For sites in rural areas having a total ADMD load less than 200 kVA, an approved pole-mounted transformer arrangement may be used. In such cases, 200 kVA, 100 kVA, 50 kVA 3-phase transformer sizes and 50 kVA or 25 kVA single-phase transformers are acceptable, where possible lower loss amorphous steel core transformers should be used. Details provided in TRAN-06-001 – Approved Equipment Register – Transformers.

(f) Consideration should be given to falling distances with regards to adjacent properties when siting the pole location. A pole must not be constructed within falling distance (i.e. height of the pole above ground) plus 5 m from a property building/structure, garden or perimeter boundary.

(g) Consideration should be given to the nature of the land when choosing locations for HV poles. Where poles are located within the boundary, or falling distance plus 5 m, of recreational sites e.g. camp sites, fisheries etc. due consideration should be given to the nature of the land and the likely location of temporary structures e.g. caravans. Pole mounted transformers must not be installed within public open spaces, gardens or recreational areas.

(h) The HV network connection for both pole mounted transformers and HV overhead lines shall only be to a radial HV circuit with suitable protection complying with paragraph (g). Neither pole mounted transformers nor HV overhead lines shall be directly connected to interconnected HV circuits or HV circuits that have the capability of being interconnected in the SP Manweb plc area. To meet these requirements, it may be necessary to establish a new radial HV circuit through the installation of Approved HV switchgear.

(i) The source circuit breaker protecting HV pole mounted equipment (including pole mounted transformers, cable terminations, etc.) shall be equipped with earth fault protection. The circuit breaker protecting one or more spans of HV overhead line shall be equipped with sensitive earth fault protection.

Consideration needs to be given to the future operation of the HV network and as such pole mounted transformers must not be connected to HV circuits that consist solely of cable sections as this makes future isolation more complex.

(j) Transformers shall never be directly breeched onto the HV Main and shall always be connected via Approved HV switchgear providing transformer protection (fuses or circuit breaker).

(k) New substations will be looped into the HV network, as shown in Figure 1, unless the additional length of the existing circuit has been increased to such a degree that voltage issues could occur on the network. Each individual connection will be considered at the Point of Connection assessment stage.

For the purpose of housing developments only, the transformer nameplate ratings as detailed in (c) and (e) above may be exceeded by cyclic loads up to a maximum of 30 % for a 6-hour period in any 24 hours providing that the remainder of that time the transformer is loaded to no more than 80 % of its nameplate rating. The cyclic rating should not be relied upon for design duty.

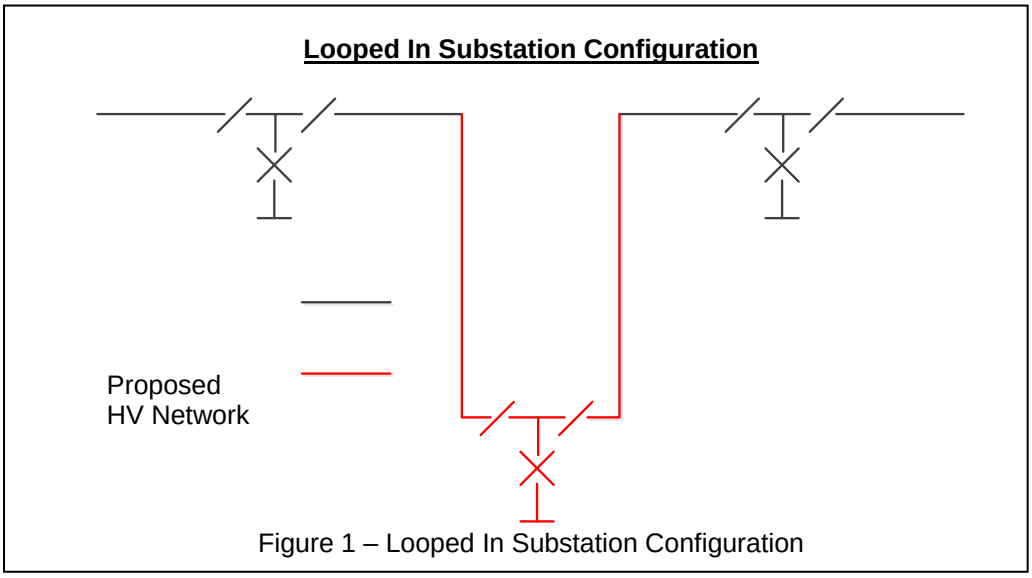

Figure 1 – Looped In Substation Configuration

(l) On HV cables, a maximum of one underground cable breach-connection feeding new switchgear is allowed between HV points of isolation unless otherwise agreed with Energy Networks. Where a Y-Type substation is installed in an X-Type HV circuit, the Solkor pilot cable, as a minimum, shall be laid with the associated HV cable and looped through the Y-Type substation.

(m) The recommended design solution may change for any engineering or technical constraints. For example, in a Solkor protection zone, the maximum in-zone load is 500 kVA at 11 kV and 300 kVA at 6.6 kV. Where a pre-existing Y-type substation is connected in-zone the minimum available solution should be based upon Figure 2. N.B. in this scenario, additional technical guidance should be sought from Energy Networks.

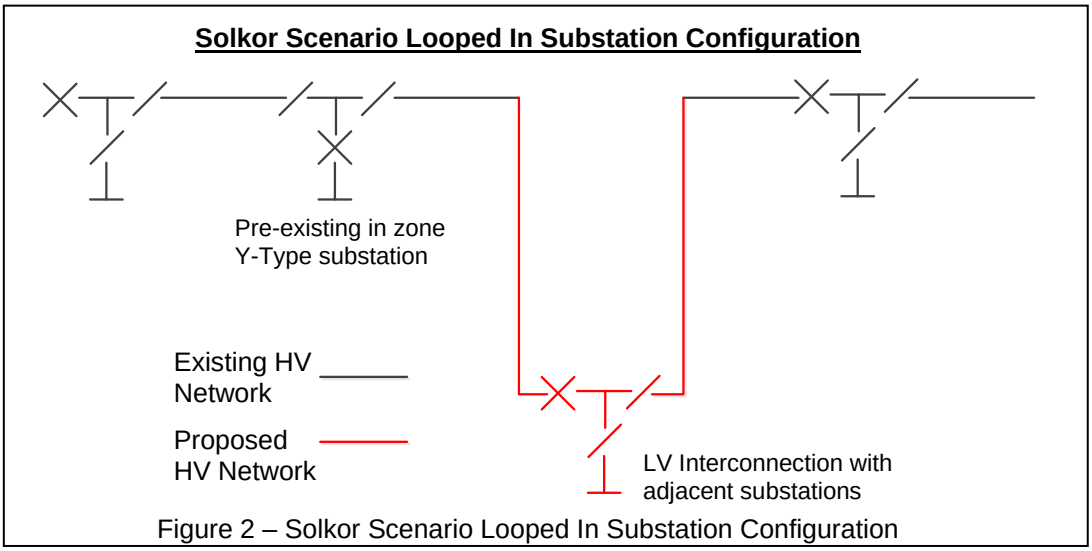

Figure 2 – Solkor Scenario Looped In Substation Configuration

(n) A unit substation will comprise of a unit type transformer, a direct coupled HV ring main unit and transformer mounted LV fuse cabinet usually housed in an Approved compact weatherproof housing placed on a concrete plinth. Unit substations will be used in all situations except in cases where a customer requests a construction which exceeds the civil integrity of a unit substation or in parts of Manweb plc's Network where Solkor protection and full Interconnection is specified by Energy Networks. In these cases, further guidance will be issued. Requirements for secondary substations are detailed in SUB-02-006 Secondary Substation Installation and Commissioning Specification.

(o) Construction of secondary substations may be included within the scope of the contestable work, with the point(s) of connection being on the Company's existing high voltage system. The following considerations apply when determining the location of the new substation:

1. The substation shall have suitable 24-hour access/egress for Energy Networks Authorised personnel.
2. The substation shall have suitable 24-hour street-level vehicular access/egress for Company Equipment.
3. Consideration needs to be taken if access is required across third party land to the substation or any Energy Networks equipment. It is essential that rights of access are gained for the land in question before the substation or equipment is energised.
4. Should be on the site being supplied, on land owned by the local highway authority (i.e. Public) or on land owned by the Company. Prior to energisation of the substation the land shall be transferred into the ownership of the Company and the building be classed as a network substation.
5. The substation shall normally be located as near as physically possible to the centre of the load it supplies. However, where low voltage mains are to be operated interconnected, the substation should be approximately equidistant between the existing secondary substations.
6. Consideration should be given to environmental factors such as noise pollution, risk of flooding, vandalism, etc.

(p) For compliance with the CDM regulations, where reasonably practicable and future development is foreseen in the area all ground mounted substations with Fuse Cabinets (Take-Off Chambers), freestanding pillars, and LV Boards, will have short lengths of LV Mains cables pot-ended no less than 2 m outside the substation building on each spare way. This also applies for the following activities:

1. Establishing new LV Fuse Cabinets (Take-Off Chambers), Free Standing Pillars and LV Boards.

2. Any works associated with terminating new LV cables on to legacy switchgear, where further spare LV ways remain available.
3. Modernisation/replacement of existing Fuse Cabinets (Take-Off Chambers), Free Standing Pillars and LV Boards.

These cables will be a minimum of 300 mm^2 conductor cross sectional area Waveform in SP Distribution plc and in SP Manweb plc.

10.6 Substation Interconnection

Substations should be interconnected on the LV network to facilitate maintenance of substation plant and to speed post fault restoration. Interconnection by LV cables should normally be provided to the extent of one third of the substation's ultimate load providing an accessible LV source is available.

It is to be assumed that the normal load on the interconnecting LV cables is reduced to one third of their maximum connected load when assessing the available Interconnection capacity. Link Boxes if used are only to be provided at points where it is necessary to provide Interconnection and the number of cableways should not normally exceed two. However, their use should not be encouraged and all other design options must be considered before they are installed. Network Pillars shall not be used.

In order to comply with the CDM regulations, consideration shall be given to performing additional LV work prior to energising Link Boxes. This would apply where it is known that this additional work will be required and a shutdown will be avoided. Hence while installing Link Boxes where not all the cableways will be utilised, LV mains cables pot-ended no less than 2 m from the Link Box shall be installed on each spare way. These cables will be a minimum of 300 mm^2 conductor cross sectional area Waveform in SP Distribution plc and in SP Manweb plc.

The system would normally run with links / fuses on interconnected circuits **removed**.

10.7 Specific Interconnection Issue in Parts of the SP Manweb Plc Network Area

In parts of the SP Manweb plc network area, full Interconnection is possible due to the historically applied network design philosophy of unit protected HV schemes. In such areas the SP Manweb plc system would normally run with links / fuses on interconnected circuit's **inserted** meaning load can be fully supported by LV Interconnection during HV outages. New network extensions do not always require full Interconnection, as per Sections 10.5 (j) & 10.5 (k) and LV interconnection is not permitted for IDNO connections as per SUB-02-013.

When designing Interconnection between secondary substations it is necessary to consider both the LV and HV networks since not all substations can be operated with low voltage Interconnection. Where practicable, 3 fuse-ways per substation should provide Interconnection with 3 other substations. On no account shall it be possible for a fault to be fed through more than three fuseways (nominal fuse rating 315 Amps). Equally it shall not be possible for more than one fuseway at the same secondary substation to feed into the same LV fault. This ensures fault infeed from one substation is not shared across fuseways.

An LV cable which is used to interconnect substations should connect a fuse-way in one substation to a fuse-way in up to two other substations. Where interconnectors are direct from a substation to one other substation a network study should be completed to ensure that the correct fuse size and feeder length combination are achieved for fuse failure given a short circuit fault.

On existing LV networks it may not be practicable to achieve adequate Interconnection without using three circuits, each from a different substation to feed into a common interconnector. Where three substations feed into a common interconnector, a network study should be completed to ensure the correct fuse rating and feeder length are achieved for fuse failure given a short circuit fault.

Link Boxes are only to be installed where it is necessary to provide Interconnection. In order to reduce the lifting, handling and infeed issues, 2-way Link Boxes should be used in preference to 4-way where possible. Network Pillars shall not be used. All other design options must be considered before they are installed and guidance sought form Energy Networks.

The correct operation and co-ordination of protection devices on interconnected networks is crucial for secure and reliable network operation. In all cases a network study should be completed to ensure correct fuse sizes and feeder lengths are chosen. A fault current not less than three times the fuse rating shall be available to operate each fuse, shown in Table 1.

Table 1: Minimum Design Phase to Neutral Fault Current

Substation Fuse Size (A)	Minimum Design Phase-Neutral Fault Current
200	600
315	945
400	1200

Designs shall ensure that the LV network short circuit fault level rating (25MVA) is not exceeded.

10.8 Phased Developments

The Applicant shall consider the future development of the HV and LV system. Where further phases of the housing development are planned this should be taken into account when determining the rating and location of apparatus. This approach avoids excavation and reinstatement of recently constructed road and pavements. The Applicant shall discuss with the housing developer the costs and benefits of additional features to reduce the need to re-excavate new reinstatements and features to improve customer's security of supply.

At all times Energy Networks shall:

- Take steps to minimise overall expenditure (although it is for customers / developers to consider (and make) investments in infrastructure which minimise their overall costs).
- Take all reasonable steps to make such opportunities visible to developers.
- Consider the implications of operational / performance constraints that will apply to the final overall development and take steps to minimise the total cost of complying with these constraints.

Where the same developer is involved in successive phases of a development, they can minimise their overall costs by making early provision for future phases e.g. locating a substation in the centre of the overall completed development rather than in the centre of the first phase.

11. DETAILED DESIGN GUIDANCE

The electrical design requirements for single-occupied domestic properties shall ensure the minimum technical requirements described in Table 2 and Table 3 are met, for some properties it may be necessary to exceed these requirements, in these cases further guidance from Energy Networks should be sought. Note that in line with the latest 2023 amendment of EREC G100, customer's limitation scheme can now be implemented to limit both export and/or import (previously only applicable to export).

Table 2: Single-Occupied Domestic Premises

Characteristic	Value
Voltage	230 V (-6%, +10%)
Number of Phases	Single
Maximum Continuous Load	20 kVA (PF=1.0)
Service Cable	35 mm^2 CNE
Maximum Service Cable Voltage Drop	3 % (of 230 V)
Service Joint	Single, dual, triple or quad
Cut out rating	100 A
Cut out fuse rating	80 A
Maximum Fault Level (single phase)	16 kA
Maximum Earth Loop Impedance	0.35 Ohms
Earthing System Provided to Customer	PME
Point of Connection	Outgoing terminals of the Company's cut out

As a minimum the standard Company Service arrangement for single-occupied premises shall be used. Appropriate metering shall be provided. Note that a three-phase Service should be considered where reasonably practicable.

The following considerations apply when agreeing the Service termination position for each property with the developer:

(a) The Service position shall be situated in the premises being supplied and a Service cable shall be installed from the Mains / Distributor to each property. "Looped Services" shall not be used.

(b) The Service cable shall be as short as practicable. The Service position should be on the wall of the house as close as possible to the LV mains cable.

(c) All Service position equipment including the metering equipment shall be fixed to a meter board of resin bonded compressed wood chipboard (or other Approved material). The cabling between the Customer's main switchgear (consumer unit) and where applicable the switch disconnector/neutral block, shall not exceed 2 m. There will only be one set of conductors between the switch disconnector and Customer's switchgear.

(d) Meter tails from the cut out to the meter shall have a minimum conductor cross sectional area of 35 mm^2. The cables must be double insulated, single core, stranded copper conductor, PVC insulated with a grey PVC outer sheathed. The colour of the core insulation for the phase conductors shall be brown and the neutral blue. Meter tails shall be as short as practicable and no more than 2 m in length.

(e) An external cabinet or suitably sized fire-proof backboard shall be attached to the wall at the agreed service position for Energy Networks equipment. The board shall be installed such that:
- For a single-phase Service – it is mounted at between 450 mm and 1200 mm above the finished floor level.
- For a three-phase Service – it is mounted at between 500 mm and 2000 mm above the finished floor level.
- A minimum of 750 mm access space is available in front of the board.
- It is directly above the Service entry tube.
- Spacer tubes are fitted to ensure the board is mounted clear of the wall to avoid problems arising from damp walls.

(f) The latest edition of the IEE Wiring Regulations states in Section 528 "Proximity of Wiring Systems to Other Services":
- 528.3.2 "Where a wiring system is routed below a Service liable to cause condensation (such as water, steam or gas Services) precautions shall be taken to protect the wiring system from deleterious effects."

- 528.3.3 “Where a wiring system is to be installed in proximity to non-electrical Services it shall be arranged that any foreseeable operation carried out on either Service will not cause damage to the other.”

Company termination equipment will be physically separate from water or gas equipment. Where reasonably practicable, they should be in separate cupboards but should always maintain a separation of at least 300 mm and never be located directly above or below water or gas equipment.

11.1 Service Cables and Service Ducts

The following considerations apply when designing the Service duct and Service cable route:

(a) Each Service cable shall be run in a Company Approved 32 mm diameter polythene duct following a direct route with a continuous run length not exceeding 25 m (unless previously agreed with the Company) from the Service position to the Service strip, avoiding land allocated to other plots / properties. Where outdoor meter cabinets are to be used, and explicitly approved by The Company, then entry to the Service position shall be via a Company Approved “hockey-stick” lead-in tube.

(b) The service duct shall be installed such that:

- Within the property, it is terminated level with the top of the flooring board.
- It is positioned to one side of the Service termination board.
- A minimum bending radius of 450 mm shall be used in the situation where the Service cable tube is bent upwards into the Service position.
- The Service termination tube shall be installed during the preparation of the ground on a route agreed with Energy Networks. It shall be laid in a straight and continuous length from the edge of the property to the Service termination position.
- Apart from the joint at the end of a hockey stick, Service cable tubes shall be free from joints and repairs.
- The wall around the Service cable tube shall be adequately sealed against the influx of gas at the point of entry to the external wall by the application of “Densyl” mastic putty or other suitable materials or methods.
- To protect against the influx of gas or water to the premise after completing the installation of the service cable, both ends of the Service cable tube must be sealed using “Densyl” mastic by pressing adequately malleable mastic into the service tube until further application is no longer possible. The external surfaces should be smoothed to eliminate porosity and cracks.

(c) Where Services cross roads, they shall be run in 100 mm ducts with a maximum of two Service cables per duct. The ends of 100 mm ducts shall avoid the driveways of properties.

11.2 Street Lighting Services

The electrical design requirements shall ensure the technical requirements shown in Table 3 are met.

The Approved unmetered Service arrangement for streetlights shall be used. Service cables and ducts shall be installed in accordance with the Company’s installation specification. The lighting authority specifies either individual street light connections / connection from a street lighting pillar or from a cabinet.

In the SP Manweb plc network area, supplies are normally made available to specific street lighting columns. However, in the SP Distribution plc network area 3 phase supplies are made available to street lighting cabinets. The developer then installs the street lighting from that point.

Table 3: Street Lighting Services Technical Requirements

Characteristic	Street Lighting Cabinet	Street Lighting Column
	Value	Value
Voltage	400 V (-6%, +10%)	230 V (-6%, +10%)
Number of Phases	Three-phase	Single-phase
Maximum Continuous Load	60 kVA (PF=1.0)	2 kVA (PF=1.0)
Service Cable	35 mm^2 CNE	4 mm^2 CNE
Maximum Service Cable Voltage Drop	3 % (of 230 V)	3 % (of 230 V)
Service Joint	Single	Single
Cut out rating	100 A	25 A
Cut out fuse rating	80 A	16 A
Maximum Fault Level	35 kA	16 kA
Maximum Earth Loop Impedance	0.35 Ohms	0.35 Ohms
Earthing System Provided to Customer	PME	PME
Point of Connection	Outgoing Terminals of Cut-Out	Outgoing Terminals of Cut-Out

11.3 High/Low Voltage Mains Cables

All new network designs and cable laying practices shall comply with the New Roads and Street Works Act (NRSWA) and the National Joint Utilities Group (NJUG) Guidelines on the positioning and colour coding of Utilities' apparatus.

The following criteria apply when designing the route of the Mains cables:

(a) Cable routes shall run in an area of the site which is to be adopted by the local highway authority, normally the footpath or if necessary the Service Strip. Easements (England and Wales), Servitudes (Scotland) or Wayleaves shall be obtained in the Company's name for equipment in land that is not to be adopted by the local highway authority.

(b) Cable routes shall consider future requirements (i.e. additional phases to the development).

(c) Road crossings shall be via 150 mm or 100 mm ducts; these shall cross roads at 90° to the road centre-line. Spare road crossing ducts shall be provided on the basis of one spare duct for each voltage level of the cables in the road crossing.

(d) Ducted runs should not exceed 30 m unless agreed in advance with the Company and shall avoid the driveways of properties.

(e) Service Strips / Footpaths should be 2 m wide.

(f) If cost-effective, the HV trench shall be used for both HV & LV cables. The cables shall be laid such that the minimum depth of cover (i.e. laying depth) is appropriate for all cables and voltage level. In addition, the minimum allowable spacing (again, as determined by the operating voltages) between adjacent cables must be maintained.

(g) All joint positions shall avoid the driveways of properties.

(h) Radial LV Mains shall have a minimum conductor cross sectional area of 185 mm^2 waveform.

(i) Interconnected LV Mains shall have a minimum conductor cross sectional area of 300 mm^2 conductor cross sectional area waveform cable. This shall include Mains that are interconnect-able via linking arrangements.

(j) HV cable with 95 mm^2 cross-sectional area conductor will only be used to feed switchgear controlling a transformer only. It shall not be used as part of the 11kV / 6.6kV ring unless otherwise specified by Energy Networks to meet specific design criteria.

11.4 Estimation of Domestic Demand

This section sets out the methodology for calculating site maximum demand, in the situation where there is no existing LV system, by utilising the After Diversity Maximum Demand ($ADMD$) approach. Further guidance should be sought where this is not the case.

The site maximum demand shall be calculated using the following formula:

$$Site\ Maximum\ Demand = (ADMD_{kW} \times N) + 8\ kW$$

Where:

- $ADMD_{kW}$ is the weighted average $ADMD$ per household within the site.
- N is the total number of houses.

To arrive at the weighted average $ADMD$, the following rule applies:

$$ADMD_{kW} = \frac{(N_1 \times ADMD_{kW,1}) + (N_2 \times ADMD_{kW,2}) + \cdots + (N_i \times ADMD_{kW,i}) + \cdots + (N_z \times ADMD_z)}{N_1 + N_2 + \cdots + N_i + \cdots + N_z}$$

Where:

- N_i is the number of houses that have the same $ADMD_{kW,i}$.

For example, if it is planned to connect 20 houses with an $ADMD$ of 5 kW and 60 houses with an $ADMD$ of 3 kW, the weighted average $ADMD_{kW}$ would be 3.5 kW, as below:

$$ADMD_{kW} = \frac{(20 \times 5\ kW) + (60 \times 3\ kW)}{20 + 60} = \frac{280}{80} = 3.5\ kW$$

Therefore:

$$Site\ Maximum\ Demand = (3.5\ kW \times 80) + 8\ kW = 288\ kW$$

The demand on each LV cable within the network shall be calculated using the above methodology where the number and type of houses considered are those connected to the specific cable.

The specific ADMD figures for each household will vary depending on the size of the house, the type of heating system installed and the presence of low carbon technologies. Given the ongoing and forecast uptake of low carbon technologies, ADMD values must reflect the electrification of heat and transport. This ensures adequate supply capacity is provided at the time of construction and avoids future network issues arising from thermal or voltage constraints.

It is the responsibility of the Applicant to correctly assess the ADMD of the individual houses and the overall site. These figures and their associated calculations must be declared to the Company at the time of application.

To calculate the ADMD for a new build property the following process shall be obeyed; a baseline ADMD shall be taken from Table 4, subsequent cumulative modifications shall be made to this baseline according to Table 5 and Table 6.

Depending on the type of property, the baseline ADMD set out in Table 4 should be used:

Table 4: Baseline ADMD Values

Type of Heating	Type of House	Estimated Annual Consumption (kWh)	ADMD (kW)
Gas Hot Water and Central Heating and/or 3 kW Immersion Heater	≥ 5 Bedroom property	5000	2.0
	4 Bedroom property, or 3 Bedroom detached property	4250	1.5
	1 or 2 Bedroom property, or 3 Bedroom non-detached property	3500	1.0

If the home is to be electrically heated, additional modifications set out in Table 5 should be made:

Table 5: ADMD Modifier for Electrically Heated Homes

Type of Heating Scheme	H (kW)	ADMD (kW)
Water and Space Heating (Property EPC* Rating A-C)	Total heating load including water heating, storage and panel heaters	+ 0.5H
Water and Space Heating (Property EPC* Rating D-G)	Total heating load including water heating, storage and panel heaters	+ 0.6H
Electric Central Heating Boilers	Total value of installed storage space heating only	+ H
Heat Pump (air/ground source)	Total installed Heat Pump capacity	+ H
*EPC – Energy Performance Certificate; typically A-C for a new build property. Where no data is provided assume D-G.		

With respect to Electric Vehicle Supply Equipment (EVSE) or EV charge point equipment, the ADMD modifications set out in Table 6 should be made, per each additional EVSE:

Table 6: ADMD Modifier for Presence of EVSE / EV Charging Equipment

Low Carbon Technology (LCT) Status	EVSE installation	EVSE Rating (kW)	ADMD (kW)
EVSE or EV charge point to be installed for domestic EV charging	Slow Charging	3.68 kW (16 A)	+ 1.5
	Fast Charging	7.36 kW (32 A)	+ 2.5
* EVSE not installed but off-street parking is available	Not installed at time of construction	-	+ 1.5
*Only applied if no other charge point equipment is specified.			

The resultant ADMD should be rounded-up to the nearest 0.5 kW.

Examples

A. A 3 bedroom detached property with off-street parking, 4.8 kW of installed panel heaters, an EPC rating of A and available will have a property specific ADMD of 5.5 kW:

$$1.5\ kW + 0.5(4.8\ kW) + 1.5\ kW = 5.4\ kW = 5.5\ kW\ (rounded - up)$$

B. A 5 bedroom property, 7.2 kW of installed panel heaters, an EPC rating of A, and an installed Fast Charging EVSE will have a property specific ADMD of 8.5 kW:

$$2.0\ kW + 0.5(7.2\ kW) + 2.5\ kW = 8.1\ kW = 8.5\ kW\ (rounded - up)$$

C. The weighted $ADMD_{kW}$ for the above two properties is found as follows:

$$\frac{(1 \times 5.5\ kW) + (1 \times 8.5\ kW)}{2} = 7\ kW$$

D. The $Site\ Maximum\ Demand$, for the above two properties is found as follows:

$$(7\ kW \times 2) + 8\ kW = 22\ kW$$

Where particular developments have dwellings with larger footprints or higher levels of amenities / accommodation, Energy Networks reserve the right to increase the applicable ADMD value from the value determined from Table 4, Table 5 and Table 6.

11.4.1 ADMD Calculator

Where reinforcement activities are planned for an existing network area with forecast penetration of LCTs, the SPEN ADMD Calculator may be sufficient to evaluate the site maximum demand: https://www.spenergynetworks.co.uk/pages/admd_calculator.aspx

This calculator is designed to assess the capacity that LV mains feeders and substations will need for both new and existing developments, through understanding the effects that LCTs have on ADMD and the subsequent strain on the network.

Based on the number of customers on feeder, the volume and type of EV chargers, heat pumps and battery storage, the calculator provides an assessment of the average household ADMD under standard and cold load pickup scenarios.

- Standard definition: Networks need to be designed for the realistic worse case ADMD – i.e. peak ADMD which occurs during a 1/20 winter in the UK.
- Cold load pickup definition: Peak ADMD which occurs during a 1/20 winter in the UK, coupled with a significant power cut at this time. When power supply is restored and the heat pump systems come back online, there is consequently no diversity as all households on the feeder will be attempting to warm their houses at an increased rate and at the same time. This results in an additional load above the standard design which needs to be catered for if no mitigating technologies are available. Although extremely unlikely, the knock-on effects of this scenario are severe if not considered.

Where particular developments have dwellings with larger footprints or higher levels of amenities / accommodation, Energy Networks reserve the right to increase the applicable ADMD value.

11.5 Estimation of Commercial Demand

For information regarding the calculation of commercial ADMD, please see ESDD-04-003 Section 11.2.2.

11.6 Cable Rating

The ratings of Approved HV and LV cables as detailed in Appendix D shall not be exceeded using the maximum design loading.

11.7 Quality of Supply

The supply industry endeavours to provide Customers with a pure sinusoidal voltage at a frequency of 50 Hz. Increasing numbers of electric and electronic appliances are sensitive to distortion of the supply waveform. This distortion is caused by these appliances and others taking current for only part of each cycle and the cumulative effect is to distort the waveform. Network designers must ensure proposed loads do not affect other Customers.

(a) Minimum voltage limit is a key design requirement. Energy Networks will advise the minimum design voltage at the HV or LV Point of Connection. Where the Point of Connection is the substation LV busbar, the minimum design phase voltage will normally be 246 V with respect to neutral. This assumes the transformer is operating at full load and has a nominal no-load LV phase voltage of 250 V. Assuming a balanced 3ph system, voltage limits will be met by a maximum Mains cable and Service cable voltage drop of 7 % from 246 V at the source substation. The LV Main design shall ensure that the 7 % voltage drop limit is not exceeded by an overall maximum demand in accordance with the approved voltage drop calculation method (Section 11.7) whilst, simultaneously, individual Services are subjected to maximum rating.

(b) Maximum voltage limit is of increasing significance in areas with high penetration of LV connected distributed generation. The upper voltage limit of 230 V+10% (253 V) shall not be exceeded at any Service joint under design loading. Refer to ESDD-01-005 for guidance.

(c) Unbalanced Voltages: Unbalance of the magnitude of three phase voltages can occur due to unequal loading of the three phases. For example, housing Services (and loads) should be connected evenly over the three phases utilising R, Y, B, B, Y, R. Refer to ESDD-04-003 for guidance. Engineering Recommendation P29 gives further guidance on voltage imbalance.

(d) Rapid Voltage Change and rapid Voltage Fluctuations: Load switching, lifts, water or sewerage pumps or motor starting currents can cause rapid voltage change, similarly industrial loads such as welding plant can cause rapid voltage fluctuations. Applicants must demonstrate that the principles in ER P28 have been applied to ensure customer disturbance is minimised.

(e) DC Component: DC currents can be induced by semi-conductor devices installed in both domestic and industrial premises. Although no limiting value is set, it is recommended that in all instances the dc component should be reduced to a minimum.

(f) Harmonic Distortion: The flow of harmonic currents in the system causes distortion of the voltage waveform that can result in overheating of motors or cause malfunctioning of electronic equipment. Applicants will have to demonstrate to Energy Networks that the requirements detailed in Engineering Recommendation G5/4 are fully adhered to.

Applicants must demonstrate to Energy Networks that the proposed design meets all quality of supply requirements detailed above.

11.8 Approved Voltage Drop Calculation Method

The total LV mains cable voltage drop shall be calculated by aggregating the voltage drops on each branch of an LV feeder, from the substation to the most remote point. The load assumed for each branch being given by the formula:

$$Design\ Load\ on\ Each\ Branch\ = (N_b\ \times\ ADMD_{kW}) + 8\ kW$$

Where:

- N_b is the number of houses on the branch
- $ADMD_{kW}$ is the ADMD in kW per house on the branch as evaluated from Section 11.4

A copy of the voltage drop calculation, with a branch and node diagram cross-referenced to the proposed layout shall be presented as part of the design for approval.

11.9 Low Voltage Earthing and Bonding

New low voltage distribution systems will meet the requirements of the Electricity Safety, Quality and Continuity Regulations 2002. Part VII, Supplies to installations and other networks, Section 24, Equipment on consumer's premises (4) states.

"Unless he can reasonably conclude that it is inappropriate for reasons of safety, a distributor shall, when providing a new connection at low voltage, make available his supply neutral conductor, or if appropriate, the protective conductor of his network for connection to the protective conductor to the consumers installation."

New single-occupied domestic premises shall be designed for protective multiple earthing. A PME earth terminal shall be made available at the Service termination where appropriate. It should be noted that there are situations where the Company will not provide an earth terminal.

Full details of the Company's earthing requirements can be obtained in guidance notes G12 and the EART-01-002 Low Voltage Earthing Policy and Application Guide.

11.10 Short Circuit Currents

The maximum earth loop impedance and maximum short circuit fault level at each Service termination shall meet the requirements set out in Table 2 and Table 3.

Unless otherwise advised, the maximum design three phase short circuit currents at the relevant voltage levels on the Company's network are:

- 35 kA (25 MVA) on the low voltage (400 V) system
- 13.1 kA (150 MVA) on the 6.6 kV system
- 13.1 kA (250 MVA) on the 11 kV system

There may be points within the system where high network density or close proximity to a grid supply point / generating stations leads to higher fault levels than those stated above. In such cases equipment of suitable short circuit duty must be installed.

High Rupturing Capacity (HRC) fuses at the substation protect low voltage mains cables. In order that the fuses shall operate to clear a fault at the most remote point on the LV main, the minimum phase to neutral short circuit current available shall be 3 times the substation fuse rating.

12. DESIGN APPROVAL

Where the Company is to adopt the new distribution system, the proposed design shall be Approved by Energy Networks (allowing sufficient time for any revisions) before commencing on-site construction.

Energy Networks make use of an internet based electronic registration and management system (RAdAR) to assist in the management of connection processes and documentation from application to completion. RAdAR enables electronic posting of all project documentation and full audit facilities to both Connectors and Energy Networks. Connectors wishing to use this system should contact Energy Networks Connections Business.

In most cases the development of a full detailed design will be a two-stage process. The Applicant will submit an outline proposal (see Appendix A) providing sufficient detail to enable Energy Networks to indicate the most suitable Point of Connection to the network given the information provided. This will then enable the Applicant to undertake a full detailed design, which can be submitted to Energy Networks for approval as the final proposal, see Appendix C. Having received this information Energy Networks will assess the design and prepare a formal quote for non-contestable works of the project.

Where an applicant requires a firm quotation for non-contestable works prior to full design approval Energy Networks require the information in Appendix B. This will enable Energy Networks to issue Point of Connection to the network details and issue a formal quote for non-contestable works. For full design approval the information in Appendix C is still required.

There are three possible options when the Company responds to the design; these are set out in the following Table 7.

Table 7: Design Approval

Technical Requirements	Additional Requirements	Response
Proposed design does not comply with the requirements set-out in this document	-	Not approved, with explanation
Proposed design complies with the requirements set-out in this document	The Company does not require additional work	Approved
	The Company requires additional work	Approved, subject to additional work being included

Only designs fully approved by the Company shall be constructed.

APPENDIX A – MINIMUM INFORMATION FOR INDICATIVE CONNECTION COST

In order to generate an **indicative Cost of Connection of New Housing Development** the following minimum information will be required:

Location Plan	Including OS map reference, of a suitable size and scale (normally 1:2500 or 1:1250) to allow the location of the proposed development against other surrounding features.
Number of houses	
Phasing of development and initial connection date of each phase	
Heating type	E.g. gas/oil/storage heating/electric, etc.
Installation of EV/EVSE equipment	E.g. Fast Charger (7 kW)
Estimated individual demand	
Estimated total peak demand for the development	
Site layout plan	If available.
Where known details of future new related developments	
Applicants suggested / proposed connection point	

APPENDIX B – MINIMUM INFORMATION FOR QUOTATION

Quotation request for connection of Low Voltage Housing Estates Installations & Associated HV / LV Distribution Substations

Please note the following:

- This template does not relate to multi-occupied premises, which are covered separately.
- Although Appendix A will allow an indicative cost for outline design purposes to be generated, the more detailed information specified in Appendix B will enable an accurate design to be undertaken by the Company. In some cases this may differ in cost from the original outline design quotation. To avoid / minimise such differences, it is strongly recommended that Appendix B information be provided in conjunction with the initial enquiry.

Main Area	Component details
Applicant(s)	• Name, address, contact details • Contractor(s) – indicating their NERS accreditation as detailed in Energy Networks New Connections Independent Connection Provider (ICP) Approval Policy ASSET-01-015 • Landowner • Solicitor of Landowner • Architect/Consultant
Location / environment	• Location/postal address/OS map reference. • Known details of future new related developments.
Overall size/type of development	• Total number of properties. • Number by type of housing/mix (no. of bedrooms, house/flat type etc.) and any issues relating to supply security e.g. sheltered housing, etc. • Heating type (space/water).
Phasing	• Phase(s) of development. • Initial connection date of each phase. • Estimated completion date of each phase.
Connection	• Suggested/proposed connection point. • Landlord's connection(s) required.
Demand	• Estimated individual dwelling demand including individual maximum power requirements kVA or kW per property, ADMD per property (with supporting evidence) and details relating to type and electrical loading of equipment to be connected. For example, the number and size of motors, cookers, showers, space and water heating arrangements including details of equipment which is subject to switching by the Supplier (e.g. Economy). • Estimated total site demand. • Estimated electric space heating load (off/on peak). • Associated street lighting (nos.) Un-metered supplies should be highlighted with classes and maximum demands.

APPENDIX C – MINIMUM INFORMATION FOR DESIGN APPROVAL AND QUOTATION

Quotation request for connection and design approval of Low Voltage Housing Estates Installations & Associated HV / LV Distribution Substations

Please note the following:

- This template does not relate to multi-occupied premises, which are covered separately.
- Although Appendix A will allow an indicative cost for outline design purposes to be generated, the more detailed information specified in Appendix C will enable an accurate design to be undertaken by the Company. In some cases this may differ in cost from the original outline design quotation. To avoid / minimise such differences, it is strongly recommended that Appendix B information be provided in conjunction with the initial enquiry.
- Energy Networks can respond to a request for design approval in three ways: Not Approved. Explanation given by Energy Networks; Approved, or: Approved subject to additional work being included.

Main Area	Component details
Applicant(s)	• Name, address, contact details • Contractor(s) – indicating their NERS accreditation as detailed in Energy Networks New Connections Independent Connection Provider (ICP) Approval Policy ASSET-01-015 • Landowner • Solicitor of Landowner • Architect/Consultant
Location/environment	• Location/postal address/OS map reference. • Known details of future new related developments.
Overall size/type of development	• Total number of properties. • Number by type of housing/mix (no. of bedrooms, house/flat type etc.) and any issues relating to supply security e.g. sheltered housing, etc. • Heating type (space/water).
Phasing	• Phase(s) of development. • Initial connection date of each phase. • Estimated completion date of each phase.
Connection	• Suggested/proposed connection point. • Landlord's connection(s) required.
Demand	• Estimated individual dwelling demand including individual maximum power requirements kVA or kW per property, ADMD per property (with supporting evidence) and details relating to type and electrical loading of equipment to be connected. For example, the number and size of motors, cookers, showers, space and water heating arrangements including details of equipment which is subject to switching by the Supplier (e.g. white meter, economy 7 or option heating schemes). • Estimated total site demand. • Estimated electric space heating load (off/on peak). • Associated street lighting (nos.) Un-metered supplies should be highlighted with classes and maximum demands.
Details/drawings	• 2 copies of a site location plan of suitable size and scale (1:2500 or 1:1250 as appropriate) to indicate location of development against other surrounding features. • 2 copies of a layout drawing on 1:500 scale plan(s) showing the layout and details such as cable sizes, etc. of all proposed electrical apparatus shown against the new roads and housing proposal. Details of proposed substation locations, adopted areas and meter positions shall also be marked. The phase (red, yellow or blue) that each Service is to be connected must be shown.

Main Area	Component details
	• 2 copies of a 1:500 plan showing Service and cable duct routes across the site. • 2 copies of a 1:500 plan showing detailed boundaries of any land/building to be transferred to Distribution Licence Holder (DLH) ownership and of any line/cable routes that will be subject to land-rights / easements. • 2 copies of overall development layout if phased. • Drawing indicating the location of the temporary builder supply (if applicable). • Drawing showing street lighting proposals (if applicable and agreed with relevant Highway Authority).
Design	• Maximum and actual design PSCCs at connection of Service to main and Design PSCC at LV busbars of HV/LV transformer (kA). • Voltage drop, loop impedance, site ADMD (After Diversity Maximum Demand) and for each feeder: - Number of customers and connections on each phase. - Maximum feeder load in Amps. - Fuse selected and maximum clearance time for a phase to earth fault at cut out. - Maximum voltage regulation at cut out position (+ and –). - Maximum earth loop resistance and maximum voltage unbalance.
Inventory of Plant, Equipment and Materials	• A full itinerary of equipment, plant and materials to be installed including types, sizes and ratings employed.
Other	• Name of Supplier if known. • Details of any land contamination issues / specific on-site Health and Safety issues requiring abnormal working requirements.

APPENDIX D – CABLE ELECTRICAL & RATING DATA

Cable Electrical & Rating Data for 11kV 3-Core XLPE cable

Conductor CSA (mm^2)	Cyclic Rating Factor	Cable Ratings (Amps)*				Cable Impedance Data (Ohms/km)			Capacitance (uF/km)
		Laid Direct		Ducted		Max DC resistance per phase @ 20 °C	Max AC resistance per phase @ 65 °C & 50Hz	Reactance @ 50Hz	
		Continuous	Cyclic	Continuous	Cyclic				
95	1.11	189	215	157	173	0.320	0.408	0.099	0.310
185	1.12	273	315	236	257	0.164	0.210	0.088	0.420
300	1.12	357	420	310	341	0.100	0.129	0.082	0.480

De-rating factors for groups of cables**	
No of Cables	De-rating factor
1	1.00
2	0.89
3	0.80
4	0.77

** Based on spacing between cables = 300mm

* Ratings are based on the following conditions (single core cables laid in trefoil and bonded at both ends)	
Depth of cover (m)	0.6
Ambient ground temperature (°C)	15
Soil thermal resistivity (Km/W)	1.2

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Cable Electrical & Rating Data for 11kV PICAS cable

Conductor CSA (mm^2)	Cyclic Rating Factor	Cable Ratings (Amps)*				Cable Impedance Data (Ohms/km)			Capacitance (uF/km)
		Laid Direct		Ducted		Max DC resistance per phase @ 20 °C	Max AC resistance per phase @ 65 °C & 50Hz	Reactance @ 50Hz	
		Continuous	Cyclic	Continuous	Cyclic				
95	1.11	185	205	160	177	0.320	0.379	0.087	0.450
185	1.12	270	302	230	258	0.164	0.195	0.080	0.580
300	1.12	355	408	305	351	0.100	0.120	0.077	0.710

De-rating factors for groups of cables**	
No of Cables	De-rating factor
1	1.00
2	0.89
3	0.80
4	0.77

** Based on spacing between cables = 300mm

* Ratings are based on the following conditions (single core cables laid in trefoil and bonded at both ends)	
Depth of cover (m)	0.6
Ambient ground temperature (°C)	15
Soil thermal resistivity (°Km/W)	1.2

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Internal Use

Cable Electrical & Rating Data for 3-Core Waveform cable

Conductor CSA (mm^2)	Cyclic Rating Factor	Cable Ratings (Amps)*				Cable Impedance Data (Ohms/km)			
		Laid Direct		Ducted		Max DC resistance per phase @ 20 °C	Max DC resistance of neutral/earth @ 20 °C	Max AC resistance per phase @ 80 °C / 50Hz	Reactance @ 50Hz
		Continuous	Cyclic	Continuous	Cyclic				
~~**95~~	~~1.15~~	~~192~~	~~240~~	~~154~~	~~209~~	~~0.320~~	~~0.320~~	~~0.398~~	~~0.0735~~
185	1.24	332	416	269	310	0.164	0.164	0.205	0.0740
300	1.28	436	546	356	410	0.100	0.164	0.126	0.0725

De-rating factors for groups of cables***	
No of Cables	De-rating factor
1	1.00
2	0.90
3	0.82
4	0.78

* Ratings are based on the following conditions (single core cables laid in trefoil and bonded at both ends)	
Depth of cover (m)	0.45
Ambient ground temperature (°C)	15
Soil thermal resistivity (°Km/W)	1.2

** 95mm no longer applicable for mains cable, values remain for design benefit.
*** Based on spacing between cables = 250mm

Cable Electrical & Rating Data for LV CNE Service cable

Phases	Conductor CSA (mm^2)	Conductor material	Cable Ratings (Amps)*			Cable Impedance Data (Ohms/km)			
			Laid Direct	Ducted	In Air	Max DC resistance per phase @ 20 °C	Max DC resistance of neutral/earth @ 20 °C	Max AC resistance per phase @ 80 °C / 50Hz	Reactance @ 50Hz
1	4	Cu	55	53	45	4.61	4.8	5.4	
1	25	Al	120	116	97	1.2	1.3	1.42	1.45
1	35	Al	146	140	120	0.868	0.91	1.02	1.05
3	25	Al	101	97	84	1.2	1.3	1.42	
3	35	Al	120	115	100	0.868	0.91	1.02	
3	95	Al	192	154	130	0.320	0.320	0.398	0.0735

* Ratings are based on the following conditions	
Depth of cover (m)	0.45
Ambient ground temperature (°C)	15
Soil thermal resistivity (Km/W)	1.2

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