ESP UTILITIES GROUP LTD/ES PIPELINES LTD/ESPE

ESPE Electricity Ltd

G81 – Design and Planning

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Contents

1.0 Introduction

This document is intended to provide guidance in the Design and Planning of any works that interface with ESP Electricity Networks, for High Voltage and Low Voltage Distribution Networks up to and including 33kV.

This document covers the design parameters for ESPE networks. In particular, the document sets forward requirements for design of networks considering the impacts of Low Carbon Technologies (LCT).

If an Independent Connection Provider (ICP) wishes to undertake the design of a connection and the installation of a Network, then the following requirements must be complied with:

- The principles of any design are to be agreed with ESP Electricity at the outset of the design process and should comply with this document and the G81 documentation of the DNO where applicable.
- The details of the proposed design are to be submitted to ESP Electricity for review and approval and should contain all of the information detailed in this document.

Where ESP Electricity requirements are not specified in this document, the designer shall plan to undertake any design work in accordance with best industry practice, complying with all appropriate legislation. If an ICP chooses to use a design specification that is not included within this document, the ICP should liaise with ESP Electricity for confirmation that the proposals are in keeping with the ESP Electricity design methodology. ICP's are also required to obtain design approval from ESP Electricity prior to implementation.

If further clarifications on the design process are required please contact ESP Electricity at: espedesign@espug.com

2.0 Security of Supply

Networks must be designed to meet the requirements of Engineering Recommendation P2 – Security of Supply. For large developments where the network is to be extended in phases over a prolonged period, the network must be designed to ensure that these requirements are met at the completion of each phase. At the design stage the designer must consult with ESP Electricity to agree timescales and security of supply risks associated with each phase of the development.

3.0 Network Configuration

Each individual HV network is designed to be operated as an open ring in a 'Ring Main Tee Ring Main' configuration. Additional connections should continue this philosophy. Any proposal to install additional 'Tees', or proposals that result in extended spurs being created during an extended development period will need to be approved by ESP Electricity at design stage. The first section of HV cable from the DNO primary Substation is normally connected to a ring main unit without any intervening tee connection, within a Boundary Substation or Switch-Room.

The choice of connection method, made by ESP Electricity, in any particular circumstance, will depend on the application of requirements of the installation. The design must take into account the requirements of ER P2 "Security of Supply". Consideration must also be given to:

- Where a Network design includes multiple Substations, LV Back-Feeds must be included to meet the requirements of the ESQCR's and ER P2
- In most cases the interconnection of Substations to the LV network of adjacent Substations will be via normally open LV link boxes
- Facility on the LV panel for generator connection, together with adequate parking for generation equipment when required

3.1 Secondary Supplies

Where secondary supplies are required for essential services or firefighting supplies, these can only be provided from separate feeders from the same source.

It should be noted that this arrangement will not comply with the requirements of BS: 9999 (Code of practice for fire safety in the design, management and use of buildings), and supplementary arrangements should be made to address this if necessary.

4.0 LV Network Design

All LV POCs for more than one customer will need to be connected to the DNO or other IDNO Network via a Link-Box, this will be funded by the ICP.

The software package proposed by the designer must be approved by ESP Electricity prior to commencement and presented in an agreed format to ESP Electricity for approval. ESP Electricity currently uses Win Debut.

A maximum of 75 customers shall be connected to a radial LV feeder; this will assist in the restoration of supply when LV cable faults are experienced. Any LV feeders with more than 75 customers connected must be agreed with ESP Electricity.

4.1 Voltage Regulation

- Low Voltage limits shall be in compliance with the ESQCR's. The maximum permissible voltage range shall be 230 volts +10% and -6%.
- Maximum Voltage at the distribution system Exit Point shall NOT exceed 253V.
- Minimum Voltage at the distribution system Exit Point shall NOT be less than 216V
- Maximum Voltage regulation from LV bus-bars of HV / LV Substations to the end of each main shall not exceed 5%
- Maximum Voltage regulation in any service cable shall not exceed 2%.

4.2 Voltage Flicker

The use of high load instantaneous shower units (unity power factor loads) can cause voltage flicker problems to the LV system particularly where ADMD's are low.

To avoid these problems, the network should be designed such that the cable circuit resistance (Phase / Neutral Loop) from the Substation to any consumer terminals, and the substation transformer resistance combined do not exceed 250 milliohms.

This will ensure that a start-up load of 20A (4.8kW) will cause no more than 2% voltage dips, or 30A (7.2kW) no more than 3% dips, which will generally be acceptable at the sort of frequencies associated with instantaneous shower units.

4.3 Maximum Earth Loop Impedance

To end of the domestic services shall be 250 milli-ohms. Where this is unachievable the maximum Earth Loop Resistance permissible at the service cut out position is 300 milli-ohms, with individual service calculations undertaken as needed. This shall only be considered where the upstream LV POC offered exceeds 200 milli-ohms and other steps to reduce the Earth Loop.

Resistance, such as shorter routes and increased cable sizes, have already been exhausted.
For other services, refer to the requirements of P23.

4.4 Prospective Short Circuit Current

Prior to design work being carried out exact design values of PSCC at the point of connection need to be established, from the upstream NOs network to which that they are going to connect the network to. The maximum design value of the PSCC for single phase 230V supplies should be taken as 19.6kA at the connection of the service to the LV distribution main. In practice a service length of 2m or more will reduce this value to 16kA. As a result, the latest issue of ER P25 and BS7671 requires as a minimum standard all equipment must be capable of withstanding 16kA for single-phase connections up to 100A. The Maximum design value of PSCC for three phase 400V supplies in situations where the service is connected directly to the LV busbar of the substation, should be taken as 25.9kA. Where the service is connected to the LV distribution main the maximum PSCC will be lower than 25.9kA, dependent upon the length and size of the LV main and service.

4.5 ADMD

The following ADMD should be used when carrying out the initial design of an ESP Electricity Network. Further diversity may not be applied unless agreed with ESP Electricity:

Property Type	Gas Heating	All Electric Heating
Studio Flat	1.2kVA	2.5kVA
1 Bed Flat / House	1.2kVA	3kVA
2 Bed Flat / House	1.5kVA	3kVA
3 Bed Flat / House	1.5kVA	3kVA
4 Bed House	1.8kVA	4kVA
5 Bed House	2kVA	4kVA
Air Source Heat Pumps	50% Load of pump + Appropriate ADMD Above	N/A

4.6 Car Charging Points

For all Networks that are constructed with the knowledge of Electric Car Smart Charging Points being installed, if the load is less than 7.2kW, no additional allowance is needed per property.

For car chargers exceeding 7.2kW per plot, they will be reviewed in a case by case basis. Where four or more sockets are installed on a Network, then a diversity of 0.5 can be applied.

5.0 Fault Level – HV System

The fault levels on the ESP Electricity networks are contained to the rating of the High Voltage Switchgear connected to the system. 11kV Switchgear is rated at 16kA.

6.0 Transformers

Only ESP Electricity approved transformers may be connected onto an ESP Electricity network. Details of all approved transformers are contained within the ESP Electricity Materials Specification Document.

ESP Electricity does not accept, and will not adopt, pole-mounted transformers.

6.1 Transformer sizes

The following transformer sizes are acceptable to ESP Electricity:

- 315kVA
- 500kVA
- 800kVA
- 1000kVA
- 1250kVA – These can only be used for single bulk supplies due to the requirements of P2.
- 1500kVA – These can only be used for single bulk supplies due to the requirements of P2.
- 2000kVA – These can only be used for single bulk supplies due to the requirements of P2.

7.0 Services and Service Entries

On new housing developments, the preferred location of the service termination is in an external meter cabinet. Service entry should be in accordance with NJUG. The service cable should be installed at a depth of 450mm below the finished ground level, and ducted into the Meter Cabinet with the use of a 32mm 'Hockey Stick'. These hockey sticks may be installed externally or within the cavity, to suit the type of Meter Cabinet being used.

The maximum length of a service cable to a domestic property shall be no greater than 30m

Ducts and/or service cable routes from the service termination to the mains cable should be via the shortest practical route and should not cross third party land or property.

Each customer to be connected to the service must have their own fuse-way. Where this cannot be provided by a suitable Approved Cut-Out then a Distribution Board will also be required.

The termination of the service cable into the Cut-Out is the furthest point of the ESP Electricity installation. On energisation the fuse carrier will be fitted with the correct design load fuse and sealed in position using a temporary plastic seal. Cable blanks should be fitted to prevent anything being inserted into the live terminals.

7.1 Meter Locations

ESP Electricity's preferred position for domestic service terminations should be encased in external meter boxes. External meter boxes must be mounted into or onto an external wall, located at the front or side elevation of the property. Boxes must not be positioned behind a fence or gate as this could restrict access in the event of an emergency or for data collectors.

External meter boxes should be installed at a:

- Maximum height of 1,800mm from ground level to the top of the box – to enable access without ladders or steps.
- Minimum height of 500mm from ground level to the bottom of the box – to reduce the risk of water entering the box in the event of flooding or fire-fighting activities.

External meter boxes must not be installed:

- Inside a property
- At the rear of a property
- At the side of the property behind a fence or gate
- Inside a dustbin, coal or refuse store
- Inside a garage or porch
- Underneath a window unless the minimum installation height of 450mm is achievable.

The customer's consumer unit must be located so that the conductors from the electricity Meter comply with the BS7671 regulations. If the unit exceeds this requirement then suitable switch fused protection must be installed. This protective device must still be installed within the limits of BS7671.

Single-phase service cables must run vertically into the meter box, and must be installed within a service duct or Hockey Stick. This duct may be surface mounted or installed within the wall cavity, to suit the type of meter box, provided that it is secured in position and protrudes into the meter box.

Installation of a meter inside a property will only be permitted if the proposed site is a listed building or within conservation areas or the Developer can demonstrate that the Local Planning Authority will not allow an outdoor installation. These installations will be reviewed and agreed on a site-specific basis at the design stage of the Network.

ESP Electricity's acceptance of any such proposal will be subject to the following conditions:

- The design of the indoor position does not put tradesmen or occupiers at risk of coming into contact with live equipment during installation and subsequent building work and occupiers at risk thereafter.
- The service cable must be ducted and routed inside the building by the shortest and most direct route possible. The cable route must not pass through the rear garden of the property. The internal end of the duct must be sealed immediately after the cable has been installed.
- The service equipment must be installed on a brick or block-work wall. This should always be an external wall, or immediately adjacent to an external wall.
- In timber-framed buildings a suitable brick or block-work wall may not be available. In these circumstances, a steel sheet, at least 1mm thick and earthed, should be fixed behind the service cable, cut-out and meter. This is to protect persons drilling through the wall from electric shock.
- The cable, cut-out and meter must be housed in a suitable meter cabinet extending from ground level. The service cable must not be hidden by panelling of any type or routed behind cupboards or fittings. The service duct must rise through the floor and into the approved meter cabinet.
- Standard fibre glass outdoor meter boxes are not suitable for use indoors as they do not comply with the appropriate British Standards for Fire Resistance and Fume Emissions. You must ensure meter boxes comply fully with fire regulations and any local bylaws.

If an internal meter position has been agreed with ESP Electricity then the following space is required inside the dwelling:

- 1,250mm high x 550mm wide x 300mm deep.
- The position must be a maximum height of 1800mm from ground floor level to the top of this meter board, and a minimum height of 450mm to the bottom.

Internal meters cannot be installed:

- Inside a dustbin, coal or refuse store
- Basement or cellar
- WC, kitchen or bathroom
- Above doorways
- On partition walls made of plasterboard, drywall or similar material
- Under stairs where headroom is less than 2m
- In any location which is in breach of the current edition of BS7671 'Requirements for Electrical Installations'.

Consideration should be given to the type of meter being installed, and the possible requirements of the property occupier. Many Suppliers / Meter Operators will refuse to install Pre-Payment Meters internal to the property. As previously noted, these discussions should be had with the Supplier prior to agreeing the meter locations.

7.2 Multiple Service Joints

Multiple service joints may be used where the correct service joint has been selected. The maximum number of services per joint shall be limited to one service per phase.

Each property should be separately serviced from the distribution main, and any proposed looped service arrangements will not be accepted by ESP Electricity.

9.0 Underground Cables

9.1 Cable Ratings

Where cables are being installed and will be adopted by the DNO, then the relevant sections within their G81 documents must be adhered to.

All cables that form part of the ESP Electricity Network will comply with the ESP Electricity materials specification, and supporting cable calculations must be submitted to justify the cable selection. ESP Electricity reserves the right to increase the cable size where necessary. During the design stage, all cables must be de-rated to take into account the installation in ducts, and no diversity factors should be applied to cables supplying off-peak loads.

9.2 Cable Positioning and Duct Requirements

All cables should be located and installed in accordance with the National Joint Utility Group Publication NJUG7 and the ESP Electricity Installation and Record Appendix.

Mains cables should not pass under buildings and should be laid in ground to be adopted by the local authority. Where this is not practical, an 'Easement' will be required for any such cable routes.

ESP Electricity will not accept cable routes that run through the rear gardens of properties.

All road crossings shall be ducted with at least one spare duct per crossing, per voltage level.

Any required cable joints should be located beneath the footpath and not in the carriageway.

Where ducts are to be installed in concrete, prior agreement must be obtained by ESP Electricity. In these cases, the ducts will be steel pipes, to be medium quality, screwed, complying with BS1387:1985.

9.3 Cable Bending Radii

The minimum cable bending radii will not be less than 12 times the overall diameter of the cable.

9.4 Bulk LV Supplies

To allow greater flexibility of connecting bulk LV supplies into properties, either a traditional single core Solid cable can be used or a method utilising a suitably sized 3c waveform, generally 185 or 300mm.

A 3c waveform cable can be bunched at both ends to form a "single conductor", however they need to be clearly labelled for clarification of its respective phase conductor at each termination point.

In addition to this, 1 to 3 bare 70/120mm earth conductors must be used for create a 'SNE' connection dependant on the calculated fault currents.

Both ends of the waveform when bunched all of the earth sheaths should be terminated into the Earth Bar at both the Transformer LV cabinet and the customers MCCB.

10.0 Substations

Substations must be sited as closely as possible to the major load centres, and they must allow 24-hour unimpeded access.

ESP Electricity will require the Freehold or a 99 year lease for every Substation.

The minimum requirement for an ESP Electricity Substation is a GRP enclosure.

Standard Substation layout drawings can be made available on request. These drawings detail the minimum requirements and are not construction drawings.

GRP Substations should not be located any closer than 7m from any property, this distance may be reduced to a minimum of 3m if constructed in brick.

10.1 Substation Enclosures

10.1.1 New Substation Buildings

ESP Electricity will approve the details for the Civil Works required for each Substation submitted by the ICP, and will inspect each Substation for compliance during the construction process.

Due to the complex nature of some Substations within Towns and Cities, it is likely that the Substation buildings may be one-off designs, taking into account the available footprint of the proposed Substation, and any architectural constraints.

Substations that are to be located integral to the new development, shall take into account the necessary ventilation and access requirements.

The contact details for any information regarding proposed sub-stations are normally provided during the quotation process for a new connection.

All new substations shall require DNO approved vibration padding.

The Substation locking arrangement must be compliant with the Host DNO, who will have dual access into the Substation.

10.2 Ventilation

Special attention is required to Substation ventilation in order to dissipate heat losses from electrical equipment. Adequate ventilation must be provided to dissipate the heat generated by the transformer and other heat emitting plant or equipment.

Substations shall be designed to achieve this by using natural ventilation as far as possible, generating a cross flow of air over the transformer(s) and other plant. Wherever possible, natural air flow to the outside of the building will be used. Forced ventilation should only be used where natural ventilation is not practicable or does not provide sufficient cooling.

The ventilation must be sufficient to ensure the maximum room temperature does not exceed 40 ^{O}C when all transformers/plant are operating at nameplate rating. Air inlets and outlets must be arranged to achieve an even distribution of air flow over the transformers, plant and equipment.

Substantial vertical separation is required between inlet and outlet openings. Inlet and outlet openings should preferably be clear of pedestrian areas and must be located to prevent entry of noxious gases such as vehicle exhausts, pollutants such as smoke, soot, dust, ash etc. Air being removed from an internal substation must be directly and independently ducted to outside air.

Mechanical ventilation systems require ongoing maintenance and have a history of being temperamental if not maintained correctly. Due to the ongoing maintenance issues, mechanical ventilation will only be considered as a last resort.

10.2.1 Natural Ventilation

The position of the vents must be directly to outside air. The most common ventilation arrangement is via low level 'inlet' louvres within the doors with high level 'outlet' louvre's behind or adjacent to the transformer, plant or equipment position on the opposing side of the substation. The design calls for the designer to provide vermin proof, weather proof louvered vents of a specified design in the walls and/or doors in order to achieve natural ventilation. Position of vents shall be such as to provide cross ventilation across the transformer, plant or equipment. Allow 1m² of inlet area and 1m² of outlet area per 1000 kVA. 2sqm will generally provide 1.5m² of free area.

The areas outside the louvres must not be subjected to fire risk. In some cases, where the roof of the substation is external and exposed to open air, weatherproof roof vents may also be specified. It is important where roof vents are installed that these are fixed securely. It is important that the 'outlet' louvres are located as high as possible and are not sited immediately above any wall mounted LV fuse boards. Louvres should not vent into bin stores, car parks or loading bay areas. All ventilation proposals are subject to approval by ESP Electricity.

10.2.2 Louvre's

Louvre blades are to be of a profile so as to prevent the ingress of driving rain and also prevent foreign objects etc. being inserted through the louvres. The steel blades are to be individually welded into the frame for security and to also prevent the blades becoming dislodged in the event of an overpressure within the substation. Louvres shall be powder coated. Louvre's must always be installed horizontally and not raked or installed vertically.

10.2.3 GRP Substations

The GRP enclosure should have manufactured ventilation louvres within the rear panel and to both side panels. The standard design also permits additional outlet ventilation via the eaves detail. Consideration is to be given at the design stage if adjacent soft landscaping is proposed; planting schemes must allow adequate provision for future plant growth without compromising air flow through the louvres. Louvre's fitted within the walls of the standard GRP Substation housing will comprise of galvanised or stainless steel encapsulated within GRP and fitted with an expanded metal mesh to the rear acting as vermin mesh.

10.2.4 Freestanding Brick Built Substations

The most common ventilation arrangement for this location is via low level 'inlet' louvres within the doors with high level 'outlet' louvre's behind or adjacent to the transformer, plant or equipment position on the opposing side of the substation. Louvres must not be located in areas where heat or smoke dissipation could compromise adjoining escape routes. Louvres fitted to brick-built structures are to be of steel construction within a steel frame and secured internally by suitable anchor fixings into the brickwork with no external fixings.

10.2.5 Integral Substations

For an integral location, ventilation is best achieved by siting the substation on the corner of the building and venting on both external faces to generate good cross flow ventilation. For a substation containing a single transformer up to 1000kVA rating a ventilation requirement of 3m² total Louvre area is required, this is split approximately in half (50%/50%) between 'inlet' and 'outlet' louvres. Louvres are assumed as being approximately 50% efficient. It should be noted that Integral substation ventilation requirements differ to that of freestanding substations, the freestanding type are subjected to greater thermal losses on all sides and through the roof slab. All new substations shall require approved Anti-Vibration padding.

10.2.6 Basement Substations

Basement substations are to be ventilated by using passive 'stack' ventilation principles, the system is driven by the difference in air pressure between the cold air 'inlet' and the hot air 'outlet'. For this to work efficiently a dedicated inlet and outlet ventilation duct is required ideally on opposite sides of the transformer. The cold air inlet is trunked to low level, 500mm above substation finish floor level (FFL) and the hot air 'outlet' is via a slot at high level. This is the preferred method of venting because it requires virtually no subsequent maintenance. For a substation containing a single transformer up to 1000kVA rating, a minimum cross sectional area of 0.75m² is required for both the 'inlet' and 'outlet' duct. This equates to a ventilation requirement of 3m² total louvre area at ground level, assuming that louvres are approximately 50% efficient. Ventilation ductwork, if required, should not exceed a total length of 10m and must contain no more than two changes in direction. Ductwork in excess of 10m may be considered but only if the duct arrangement is predominantly vertical and has an increased cross-sectional area of 1.0m². Louvres must not vent into an area where heat or smoke dissipation from the substation below would compromise adjoining escape routes.

Ventilation shafts are considered to be an extension of the substation and as such are to be constructed to the same structural criteria. Ventilation shafts shall be constructed from steel/cement composite fire board, standard 215mm fully bonded brickwork or cast in-situ reinforced concrete to the clients Structural Engineering Design requirements with sufficient cover to steelwork as required in order to achieve the four hour fire rating.

10.3 External Distribution Substation Enclosures

For Substation enclosures, the following items shall be incorporated into the design:

- It is essential that the external area around the louvers is kept clear. A minimum space of 500mm is required around all Substations.
- Substation doors are to be compliant with the ESP Electricity Materials Specification. Wooden doors will not be accepted on ESP Electricity Substations.
- 24hour Vehicle access is required to the Substation doors.
- If the Development is secured by means of access gates, and the Substation is located within these gates, then the access will be available by use of an over-ride key, which will be located within a secure box on an adjacent wall. Access via a security guard will not be acceptable under any circumstances.
- 500mm clear paved access around the Substation enclosure. Where this access strip forms a corridor at the sides and rear between the site and other boundaries, then unauthorised access around the Substation will be prevented by means of a barrier such as palisade fence on either side at the front of the enclosure.
- 750mm clearance around all HV Equipment.
- Building services – to include as a minimum Distribution Board, lighting, Socket Outlet, and auxiliary feed for protection equipment. Switch-rooms will also require thermostatically control tubular heating.
- GRP Enclosures are to be compliant with the ESP Electricity Materials Specification.
- To comply with Regulation 3(4) of The Electricity Safety, Quality and Continuity Regulations 2002, all cable entries into the Substation must be sealed. The installer of the ducts must seal the gap between the outside of the ducts and the building structure. The installer of the cables must seal the annular gaps between the cables and the insides of the ducts where the cables at all duct entry points. The type of seal selected must provide a liquid and gas tight seal; this may take the form of Mastic, Expanding foam, or a Mechanical Seal. The manufacturer's details are to be provided for approval prior to fitting.

10.4 Integral Distribution Substation

For Substation Enclosure that form part of the building fabric of the Development, then the following items shall be incorporated into the design in addition to those identified in section 12.12 above:

- The building fabric must provide 3 hour fire protection.
- Where cables run through free space within a building, in areas such as basement car parks, the cables must be mechanically protected with the use of appropriately sized steel pipes. Alternative solutions may be proposed, and shall be agreed on a project specific basis prior to the installation commencing.
- All new substations shall require approved Anti-Vibration padding.

Basement Substations will require blast proof steel doors. These doors will require a specific opening forming from reinforced concrete, or solid engineering brick.

10.5 Selection of Substation Construction

The selection of enclosure will be influenced by an assessment of the likely risk to the structure and will take into account the following:

- Interference
- Noise Pollution
- Risk of Flooding
- Vandalism
- Unauthorised Access
- Surrounding area
- Selection of Doors / Locks

Regulations 3 & 11 of The Electricity Safety, Quality and Continuity Regulations 2002, makes reference to the areas that must be considered during the design of any Substation enclosure. A design Risk Assessment must be completed for all proposed Substations.

The minimum Substation design is a GRP enclosure, and this will be the standard ESP Electricity requirement. However Stand-Alone brick built Substations or Substations integral to the new development with external access may be preferred by the developer in certain circumstances

10.6 Substation Earthing

The guidelines set out in EATS 41-24 shall be followed for all new substation sites.

The HV and LV Earthing Systems shall not be combined unless:

- The combined resistance to Earth does not exceed 1Ω
- The normal HV supply to the site is via a continuous underground cable circuit back to the primary Substation
- For HDNO Primary Substations designated as 'Hot', then the proposed substation is outside of the 'Hot' zone.
- The risk of potential of the Earthing System as a result of an HV Earth fault is likely to exceed 430 Volts.

ESP Electricity will provide guidance on whether the HV and LV Earthing systems should be combined or remain separate. In the event that the HV and LV Earthing systems are separated, special safety signs are required to be installed.

11.0 Multi-Occupied Buildings

For ESP Electricity to adopt the Mains and Services to Multi-Occupied Dwellings, the installation shall be designed in the following manner:

All installations shall comply with the requirements of ER G87

11.1 Maisonette Type Domestic Buildings

A duct must be installed and terminated into meter cabinet located at ground level, external to the building. Cabinets to be sited so that the top of the cabinet is not more than 1800mm above finished ground level, and the bottom of the cabinet is not less than 450mm above finished ground level. Each cabinet needs to be large enough to accommodate both a meter and a time switch, the minimum space required for this will be 350mm wide by 350mm high. PME Earth terminal is to be provided with each service.

11.2 Multiple Storey Domestic Buildings

A buried 150mm Rigi-Duct shall be installed to a full height service cupboard, with full height doors, in a common access area on the ground floor of the building. A 3 phase service will be terminated into a Multi-Way service head or a three phase service head with an approved distribution board. PME Earth terminal is to be provided with each service.

For larger multiple storey developments, a central internal rising sub-main to distribution boards on each floor with lateral connections to each dwelling may be installed. This would only be acceptable to ESP Electricity if this system were to be installed by an ESP Electricity Approved ICP.

The distribution boards can service only the floor it's on, the floor above and the floor below only. Any further floors to be service from another distribution board closer to these floors as explained previously.

Where the internal rising and lateral cabling system is to be installed by others then this must be carried out in accordance with Engineering Recommendation G87. In these circumstances, the building owner will have to employ a BNO to operate and maintain the internal cabling system. The internal rising and lateral system must remain tamper proof at all times.

In order for rising and lateral connection installations to be accepted for connection to the distribution network, a safe and adequate system is required. Section 11.4 of this document will provide guidance.

Where the multiple storey development is a steel framed building, the internal distribution shall be an SNE installation.

11.3 General Design Requirements for Multi-Occupancy Buildings

These general requirements are applicable to all systems whether to be Owned or Operated by ESP Electricity.

- The main electrical in-take position within the building must be sited so that the incoming underground service cable is terminated as close as possible to its entry point to the building.
- The in-take position must be in a communal part of the building exclusively set aside for the purpose and not in a Store, or Bin area, or Shared area.
- The in-take position must be segregated from the Gas and Water services.
- The rising mains must be fully segregated from all other services.
- The rising and lateral connection system design and installation must be fully compliant with the requirements of ESP Electricity. Only a cabled system will be acceptable to ESP Electricity.
- Rising recesses, where used, should be constructed of non-combustible material. They will have a minimum depth of 200mm, they will have removable covers, and they will have a fire barrier installed between each storey of the building.
- Each customer must be fed from a separate fuse. These fuses are to be housed in the cut-out of the service termination or in an approved distribution board with fuse-ways complying with BS1361 (all fuses shall be of HRC Type to BS1361).
- The maximum height of any meter shall be 1800mm from Finished Floor / Ground level. The minimum height of any meter shall be 450mm from Finished Floor / Ground level.
- Meter tails shall be less than 1m in length unless they are enclosed in Galvanised Steel Trunking, High Impact PVC Trunking, or Hard Drawn Galvanised Steel Conduit.
- Connections between distribution boards and individual domestic dwellings should have a minimum installed rating of 60 amps.
- Cables may be installed in a Duct, Conduit, Trunking, Rising Recess, or be clipped to a cable tray / ladder rack. Mechanical protection and measures to prevent damage and interference from Third parties must be provided.
- The installation shall be designed to facilitate the repair, maintenance and future replacement. Cables shall not be cast directly into the building slab or plastered into wall screeds. Where cables are clipped directly to the surface, all of the clips shall be positioned to be accessible at a later date. If cables are installed above false ceilings, then they shall be accessible through removable panels.
- Steel Wire Armoured and MIMS cables cannot be terminated directly into the individual meter. The cables will have to be terminated into sealable connector blocks immediately adjacent to the meter position. 16mm² or 25mm² copper stranded, double thermoplastic insulated single core meter tails to be provided for the final connection into the meter.
- Multi-Way service heads shall have individual fuses labelled with each flat number and NOT the plot number.
- The Loading on Rising and Lateral Sub-Mains, and internal rising Sub-Mains shall be determined using calculations of demand determined by the software programme being used. All the assumed defaults will be shown on the software programme. The loading will be dependent upon the number of units and the Designers estimate of the unit consumption.

11.4 Building Network Operators (BNOs)

Where the installation within a Multi-Occupancy Building is not compliant with ESP Electricity requirements but has been designed and constructed in accordance with BS 7671, and ER G87, then the internal rising and lateral mains may be maintained and operated by a BNO.

Full contact details of the BNO, including out of hours contacts, shall be provided to ESPE prior to energisation.

ESP Electricity shall provide a point of supply into the Multi-Occupancy building to an agreed intake position, which shall be considered the first point of isolation for the building network. ESP Electricity will require unrestricted access to this point.

ESP Electricity shall provide the MPANs for all of the properties within the building.

The BNO Building design shall incorporate:

- Full compliance with ER G87.
- Full compliance with BS7671 and the requirements of the relevant Building Control notices.
- Ensuring that the building network is secured to prevent illegal abstraction of electricity.
- The use SNE cables throughout the building, which shall be owned and maintained by the BNO.
- The BNO shall provide and maintain any enclosure for an intake position that is separate from the building in a free-standing cabinet or switch room if such a structure is necessary.
- The design shall include the provision of the SNE tails from the BNO equipment for ESP Electricity to connect onto the load side terminals of the intake position.
- The building design shall provide and maintain cable routes that are in secure areas of the building to minimise the risk of damage, unauthorised access, illegal abstraction and vandalism.
- The prevention of interference to, and inadvertent contact with, the intake position or any part of the BNO Network in accordance with BS 7671. The precautions may involve barriers, a caged area or a designated area.
- Ensure that all cables and ancillary equipment between the intake position and individual premises are installed in accessible areas within the building and not routed through the property of a third party.
- The use of cables with low smoke and zero halogen sheathing is recommended for cables where fire might affect publicly accessible areas.

Prior to energisation of a Multi-Occupancy Building, the BNO shall be appointed by the building owner, and the company details along with the designated Engineers contact details shall be provided to ESP Electricity. ESP Electricity shall then formally write to the named party informing them of their responsibilities.

Within a Multi-Occupancy Building, the BNO with be responsible for:

- The quality of the customer supply at the customer supply terminals in accordance with the Electricity Safety, Quality and Continuity Regulations (ESQCR).
- The operation and maintenance of the internal distribution network.
- The restoration of supply to customers in the event of a fault on the BNO network.
- Any compensation payments that may be due to Customers in the event of loss of supply, where the fault is on the BNO Network.

- The provision of Periodic Test result for the installation to ESP Electricity.

11.4.1 Voltage Drop

For electrical design purposes, Internal Rising Sub-Mains will be treated as if they form part of the LV distribution network and the voltage drop from the Substation to any dwelling, as calculated by accepted methods, shall not exceed 6% or fall outside of the requirements of BS 7671.

12.0 Distribution Earthing

12.1 PME and Metal Conduit

Where a PME supply is provided to a building, any metal Conduit or Trunking forming rising or lateral accommodation shall be bonded to the building main Earth terminal.

The developer must provide bonding between the Earth terminal of the incoming service cable and the Water and Gas mains at the points of their entry into the building and into the individual premises. The position of the bond shall take into account insulated joints in the Water and Gas mains.

PME in Commercial / Industrial premises in a steel framed building will only be provided if there is only one supply into the building and the equipotential bonding complies with BS7671. For the purpose of this document, where two or more commercial / Industrial premises are within one building, then they shall be treated as separate units provided that there is no possibility of the individual supplies being cross connected at any point.

12.2 Earth Rods

An Earth Electrode system (single or multiple rods) shall be provided for all Rising and Lateral systems where the number of customers connected to the system exceed 4No using a minimum conductor size of 70mm bare earth from the first MSDB or HDCO.

12.3 Lightning Conductors

A Lightning Conductor system for a building will be electrically isolated from all other metalwork connected to the ESP Electricity Earthing Terminal unless the conductor is attached to a metallic structure on top of the building on which there is electrical equipment (e.g. lighting etc.), in which case an Earth bond will be permitted, providing that the lightning protection system has its own independent Earth electrode.

13.0 Unmetered Supplies

On ESP Electricity networks the preferred solution for street furniture is to provide a 3 phase supply to a street furniture cabinet. The developer will then install the street furniture installation from that point. This does not preclude the option for supplies to individual lighting columns.

The electrical design requirements for street furniture supplies:

	Street Furniture Cabinet	Individual Column / Bollard
Supply Voltage	400V (-6%, +10%)	230V (-6%, +10%)
Number of phases	Three phase	Single phase
Service Cable size	25mm² CNE or 35mm² CNE	4mm² CNE
Maximum Service Cable Voltage Drop	3% (of 230V)	3% (of 230V)
Maximum Continuous Load	60kVA	2kVA
Service Joint	Single	Single
Cut-Out Rating	100A	25A
Maximum Fault Level	35kA	16kA
Maximum Earth Fault Loop Impedance	0.25 Ohms	0.25 Ohms
Earthing system to Customer	PME	PME
Point of Connection	Outgoing Terminals of Cut-Out	Outgoing Terminals of Cut-Out

For each unmetered supply, the following information will be required:

- Road Reference (Street Name, unique road reference)
- Town, Parish, District
- Ordinance Survey Reference
- Total Connected Load
- Street Furniture Type (each type to be split into identified quantities)
- Switching Regime (No of different controls to be identified)
- Elexon approved Charge Code for the equipment installed.

Prior to connection of any Unmetered Supplies to an ESP Electricity Network, a completed application form and connection agreement must be in place (please refer to the National Terms of Connection). These are available on request form ESP Electricity. A completed UMS application will need to be provided with the design submission where streetlights are show on the drawing for design approval to be given.

13.1 Street Lighting Looping

Looped street lighting will not be adopted by ESP Electricity, unless it has been agreed by the Local Authority, and is carried out in the following way:-

- Connect a feeder pillar from an LV main, with each way powering a set of streetlights, which are looped.
- The service cable length to a street light is a maximum of 25 meters.

14.0 Documents required for design submissions

14.1 Link-box designs

The following documents are required for a design submission were a link-box is the point of connection onto the DNO network.

- Design report
- LV Site Layout drawing
- LV electrical design
- Windebut native file & PDF version

14.2 Substation designs

The following documents are required for a design submission were a substation is the point of connection onto the DNO network.

- Design report
- LV Site Layout drawing
- LV electrical design
- Windebut native file & PDF version
- Single Line Diagram drawing
- Substation construction details

For multiple substation designs:

- Single line diagram drawing showing the HV cables and RMUs

14.3 HV / EHV designs

The HV design shall include the following:

- Details of the Point of Connection to the DNO Network
- Details of the Isolation Points
- Details of the inter-connection between circuits
- Details of any load restrictions

Contact Details

ESP Electricity Ltd:

The Asset Management Team

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