1. SCOPE

This document details the Scottish Hydro-Electric Power Distribution Ltd (SHEPD Ltd) and Southern Electric Power Distribution plc (SEPD plc) requirements for the design of low voltage underground cable electricity networks including their new associated HV / LV distribution substations. The document only relates to greenfield housing estates constructed under Ofgem's Competition in Connections regime. This document does not detail arrangements for multi-occupied premises or industrial / commercial supplies.

The document forms the Scottish and Southern Energy appendix to, and must be read in conjunction with, G81 – the Electricity Association publication titled: Framework for design and planning, materials specification and installation and record for Greenfield low voltage housing estate installations and associated, new, HV / LV distribution substations.

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. It also details arrangements for normal domestic and related small commercial premises, but does not cover situations where loads include large motors, welder's etc.

2. CONTENTS

3. DEFINITIONS AND ABBREVIATIONS

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 SHEPD Ltd / SEPD plc.
CDM	The Construction (Design and Management) Regulations 1994.
CNE	Combined neutral and earth (of cable construction).
Customer	The recipients of the power supply being a tenant or owner of a domestic dwelling or small commercial premise.
Distributor	A main electricity cable laid externally in the ground and supplying more than one customer.
External Meter Cupboard	An approved cupboard, supplied and installed by the applicant, and 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 previous development.
Housing Site	A development consisting of domestic dwellings.
Interconnector	Cables that have more than one supply source available.
Link Box	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 Pillar	An outdoor cupboard arrangement that enables cables to be isolated by the removal of links / fuses.
NRSWA	New Roads and Street Works Act 198.
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 SHEPD Ltd / SEPD plc to the customer.
Service	A cable providing supply to an individual premise.
Service Position	The location in the customer's property at which the SHEPD Ltd / SEPD plc cable termination (cut-out) is located.
Service Strips	A clear route through a housing site containing utility infrastructure.
SHEPD Ltd	Scottish Hydro-Electric Power Distribution Ltd - The Distribution Licence Holder for the Distribution service area formerly known as Scottish Hydro-Electric.
SEPD plc	Southern Electric Power Distribution plc - The Distribution Licence Holder for the Distribution service area formerly known as Southern Electric.
Company	A term used throughout this document to refer to either SHEPD Ltd / SEPD plc including all associated design and planning practices.

4. RELATED DOCUMENTS

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

(a) **Electricity Association Documents:**
Engineering Recommendation G81 - Framework for design and planning, materials specification and installation and record for greenfield low voltage housing estate installations and associated, new, HV / LV distribution substations.

- Part 1: Design and Planning
- Part 2: Materials Specification
- Part 3: Installation and Records

(b) **The Company Internal Documents:**

Information and specifications provided to assist the installer of New Connections. Copies of these are available on the Company's website at www. scottish-southern.co.uk/contractmanagement.asp

All authorised designs must comply with both the requirements described within this document and those detailed in (a) and (b) above.

5. GENERAL

Unless otherwise stated, the term "the Company" is used throughout this document to refer to both Scottish Hydro-Electric Power Distribution Limited and Southern Electric Power Distribution plc including all associated design and planning practices.

The data and guidance contained within this document remains the property of the Company 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 the Company.

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

The Company reserves the right to change the data contained within this document without notification. Although specific network extensions will be designed by third parties, the Company maintains the responsibility for the design of the distribution system and since the guidance cannot cover every eventuality, reserve the right to apply other criteria where necessary. The Company 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. Applicants should be able to demonstrate this if required. When available, applicants will be required to achieve accreditation in accordance with the Lloyds Design Module for New Electrical Connections.

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.

6. NETWORK DESIGN PRINCIPLES

Within the design process, the principles of sound health and safety management should be taken fully into account, to ensure the electrical system can be constructed, maintained and operated safely and effectively. Reference should be made to relevant Regulations, including the Construction (Design and Management) Regulations 1994 and the Electricity Safety, Quality and Continuity Regulations 2002.

6.1 Security of Supply

The minimum design requirement will satisfy Engineering Recommendation P2/5, comply with the Company's policy as detailed in this document and will ensure the technical and performance characteristics of the existing network infrastructure are not compromised below the Company acceptable minimum standards. However it should be noted that P2/5 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 customer or additional load must not adversely effect the performance of the existing network or the security of supply provided to existing customers to levels below the Company's 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. Teed connections will cause longer restoration times for faults on the associated high voltage network section. If a teed connection is being proposed, customers should be made aware of how this may affect their electricity supply restoration times.

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.

The Company will, as a standard, require that all new LV fuseboards have facilities to allow safe live connection of standby LV generation. Details are included in the specifications on the Company's website.

6.2 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 cover such matters as the specifications for approved materials, their installation requirements, the arrangement of equipment at the service termination and the depths / lateral position of cables and ducts.

Only new plant, equipment and materials shall be installed unless prior written agreement is obtained from the Company. For further information reference should be made to the specification documents available on the Company's website.

6.3 Establishing the Point Of Connection

The Company will specify the point of connection onto their network based on the load information provided by the Applicant (refer to Appendix A and B). The Company will carry out the necessary system design to specify the lowest cost practical point(s) of connection to the existing distribution system.

The Company will determine if any reinforcement works are required upstream from the point of connection, 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 to be undertaken beyond the point(s) of connection 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.

6.4 LV Design Considerations

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

Each property and streetlight is afforded a standard connection arrangement that meets the technical requirements of voltage, current rating and earth loop impedance.

The electrical installation beyond the point of connection for dwellings and street lighting shall comply with 16th Edition Wiring regulations, BS7671 and BS4730.

The distributors must be designed to experience a balanced load that is within their rating. The design must be such that the substation fuses will operate to clear faults on the distributors and services. Only Company approved fuse sizes and types shall be used.

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).

6.5 HV Network and Substation Design Considerations

6.5.1 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) HV cables for network extensions shall be selected to ensure that there is no derating of the existing overall circuit and shall be of an approved design.

(b) Details of approved ground mounted transformers are set out in our Specification for 11kV Distribution Substations which is available on the Company's website. Suitable transformer size must be selected to reflect maximum loading, but should also minimise losses.

(c) In areas where 6.6 kV networks exist, dual ratio (11/ 6.6 kV) transformers shall be installed.

(d) For smaller sites **in rural areas** having a total ADMD load less than 200 kVA; 200kVA, 100 kVA, 50 kVA 3-phase transformer sizes and 100kVA, 50 kVA, 25 kVA or 16kVA single phase transformers are acceptable. In all cases, 3-phase units will be used where 3-phase high voltage mains are available, unless advised by the Company.

(e) Transformers shall never be directly teed onto the HV Main and shall always be connected via suitable HV switchgear that provides transformer protection (fuses or circuit breaker).

6.5.2 For the purpose of housing developments only, the transformer nameplate ratings as detailed in (b) and (d) 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.

6.5.3 To reflect current levels of customer expectation, in order to allow restoration of supply to customers due to 11kV network faults, and to maintain supplies during maintenance, the normal arrangement will be for new substations to be looped into the existing high voltage network.

Teed substations will only be allowed where:-

(1) the long term costs of a teed connection are less than the short term costs of installing a looped connection. In this respect, loop connections shall be installed where the length of the proposed new high voltage connection, from the proposed substation to the existing high voltage main is less than shown in Table 1.

Table 1:

No of customers	Substation to be looped if less than given distance from existing HV circuit
50	61
100	75
150	97
200	111
250	129
300	142
350	156
400	172
450	186
500	200

AND

(2) there are no other existing tees on this section of the network (i.e. only one teed connection will be allowed between switching points) unless otherwise agreed with the Company.

6.5.4 3-core 70 mm^2 11kV cables will only be allowed in locations where existing fault level is less than 100MVA. Written approval is required from the Company for cases where this is proposed.

6.5.5 The preferred substation configuration is an approved unit type arrangement with an approved substation weatherproof housing placed on a concrete plinth. In situations where such housing is considered undesirable, an approved brick built equivalent is acceptable. Specifications of approved designs are available on the Company's website.

6.5.6 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:

(a) Shall have permanent street–level 24-hour vehicular access suitable for heavy plant delivery wagons.

(b) 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.

(c) The substation shall normally be located as near as physically possible to the centre of the load it supplies. However, where the low voltage mains are to be operated interconnected, the substation should be approximately equidistant between the existing secondary substations.

(d) Environmental factors such as noise pollution, risk of flooding, vandalism, etc.

6.6 Interconnection Approach

In order to meet current required levels of continuity of supply, to facilitate maintenance of substation plant and to speed fault restoration, interconnection by LV cables should normally be provided to the extent of one third of the substation's ultimate load providing an adjacent 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.

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

6.7 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 recent reinstatement and features to improve customer's security of supply.

At all times the Company 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. For example, locating a substation in the centre of the overall development rather than in the centre of the first phase.

In cases where the successive phases of a development are carried out by a different developer, the Company may consider funding the installation of additional or larger cables to suit the future phases, and recover these costs at a later date from the developer.

7. DETAILED DESIGN GUIDANCE

The design electrical requirements for single-occupied domestic properties shall ensure the technical requirements described in table 2 are met.

Table 2:

Characteristic	Value
Voltage	230V (-6%, +10%)
Number of phases	Single phase
Service cable	25mm^2 or 35mm^2 Al CNE
Maximum service cable voltage drop	2% (of 230V)
Service Joint	Single, dual, triple or quad
Cut-out rating	100A
Cut-out fuse rating	100A
Maximum PSCC (single phase)	16kA
Maximum Earth Loop Impedance	0.35 Ohms
Earthing system provided to customer	PME
Point of supply to customer	Out-going terminals of the Company's cut-out

The standard Company service arrangement for single-occupied premises shall be used. Appropriate metering shall be provided.

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.

(b) The service cable shall be as short as practicable. The service position should be in an approved external meter cupboard or on the wall of the house as close as possible to the LV mains cable. For internal points of supply, the service position shall be situated on the inside face of an external wall.

(c) The customer shall retain ownership / maintenance responsibilities for the cabinet, if installed.

7.1 Service Cables and Service Ducts

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

(a) Individual service cables shall be installed from the mains to each property. Looped services shall not be used.

(b) Each service cable shall be run in a Company approved 38 mm diameter polythene duct following a direct route with a continuous run length not exceeding 25m unless previously agreed with the Company from the service position to the service joint position, avoiding land allocated to other plots / properties. Where outdoor meter cabinets are used then entry to the service position shall be via a Company approved 'hockeystick' lead-in tube.

(c) Where services cross roads, they shall be run in 100 mm ducts.

7.2 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 will specify either individual street light connections / connection from a street lighting pillar or from a cabinet. Subject to loading and voltage considerations, looped services may be installed between lighting columns.

In the SEPD plc network area, supplies are normally made available to specific street lighting columns. However, in the SHEPD Ltd network area single or 3 phase supplies are made available to street lighting cabinets. Another party then installs the street lighting from that point.

Table 3:

Characteristic	**Value**
Voltage	230V (-6%, +10%)
Number of Phases	Single phase
Maximum Continuous Load	2kVA
Service Cable	25 mm^2 or 35mm^2 CNE
Maximum Service Voltage Drop	2%
Service Joint	Single
Cut-out rating	25A
Cut-out fuse rating	16A
Maximum PSCC	16kA
Maximum Earth Loop Impedance	0.35 Ohms
Earthing	PME
Point of Connection	Outgoing terminals of Cut-out

7.3 High / Low Voltage Mains Cables

All network designs and cable laying practices shall comply with the New Roads and Street Works Act (NRSWA) and the National Joint Utilities Group (NJUG) guidance notes.

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

(a) Shall run in an area of the site which is to be adopted by the local highway authority, normally the footpath or service strip. Easements (England and Wales), Servitude's (Scotland) or wayleaves shall be obtained by the Company for equipment in land that is not to be adopted by the local highway authority.

(b) Ownership of substation sites will be transferred to the Company prior to Adoption of the assets.

(c) Shall consider future requirements (i.e. additional phases to the development).

(d) Road crossings ducts shall cross roads at 90 degrees to the road centre-line. Spare road crossing ducts shall be provided on the basis of one spare duct for each voltage.

(e) Ducted runs should not exceed 15m unless agreed in advance with the Company

(f) Service Strips / Footpaths should normally be approximately 1.8 – 2.0 m wide.

7.4 Voltage Drop and Maximum Demand

Key Points

- The Company's LV network has a design maximum volt drop of no more than 5% in the main and no more than 2% in the service. The domestic and commercial volt drop charts attached give the maximum distances for a given number of houses or electrical demand to achieve this. New LV networks will be designed to these parameters.
- Applicants will use either the annual unit usage or the After Diversity Maximum Demand (A.D.M.D). for different sizes of houses in determining loading or voltage drop on the proposed network.
- Calculations can be made using either manual calculation methods or by using the EATL "Debut" software package.
- Table 4 and Graph 1 below may be used by Applicants to determine ADMDs and ensure suitable network designs.
- If the "Debut" software package is used, volt drop and cable capacity at each node on the network is calculated automatically and any issues highlighted.
- The Volt Drop calculations assume that the service connections to the low voltage cable are carried out in a specific way found to minimise total volt drop. They must be connected in the order RYB BYR RYB BYR etc.
- Where the load is likely to occur in summer, e.g. for air conditioning or refrigeration load, Applicants must use the summer sustained rating for the service cable.

7.4.1 Demand Estimation and Voltage Drop - ADMD Approach

The methodology for calculating the demand set-out here applies to the typical situation where there is no existing LV system. Further guidance should be sought where this is not the case. The site maximum demand shall be calculated using the formula:

$$\text{Site Maximum Demand} = (ADMD_w \times N) + 18\ \text{kW}$$

Where

- $ADMD_w$ is the weighted average After Diversity Maximum Demand (ADMD) per house.
- N is the ultimate number of houses

For example, the $ADMD_w$ figure shall represent the weighted average $ADMD_w$ for the number and type of house based on Table 4. Hence, if it is planned to connect 20 houses with say an ADMD of 2.3 kW and 60 with an ADMD of 1.9 kW, the weighted average $ADMD_w$ used would be 2 kW.

The demand on each LV cable shall be calculated taking account of the appropriate weighted average ADMD. Street lighting loads may be ignored.

The specific ADMD figures to be used will vary depending on the type of heating scheme installed. For example, electrically heated dwellings should use the total installed heating load (including water heating) as the basis of determining an appropriate ADMD. It is the responsibility of the Applicant to correctly assess the ADMD of the individual houses and overall site. These figures and calculations must be declared to the Company.

For houses with off-peak electric heating the After Diversity Maximum Demand (A.D.M.D.) can be obtained from graphs 1 below.

For houses with Non-Electric heating Applicants should assume a Daytime ADMD of 2.25kVA and a Night time A.D.M.D. of 0.5 kVA

7.4.2 Demand Estimation and Voltage Drop – "Windebut" Approach

Key Points

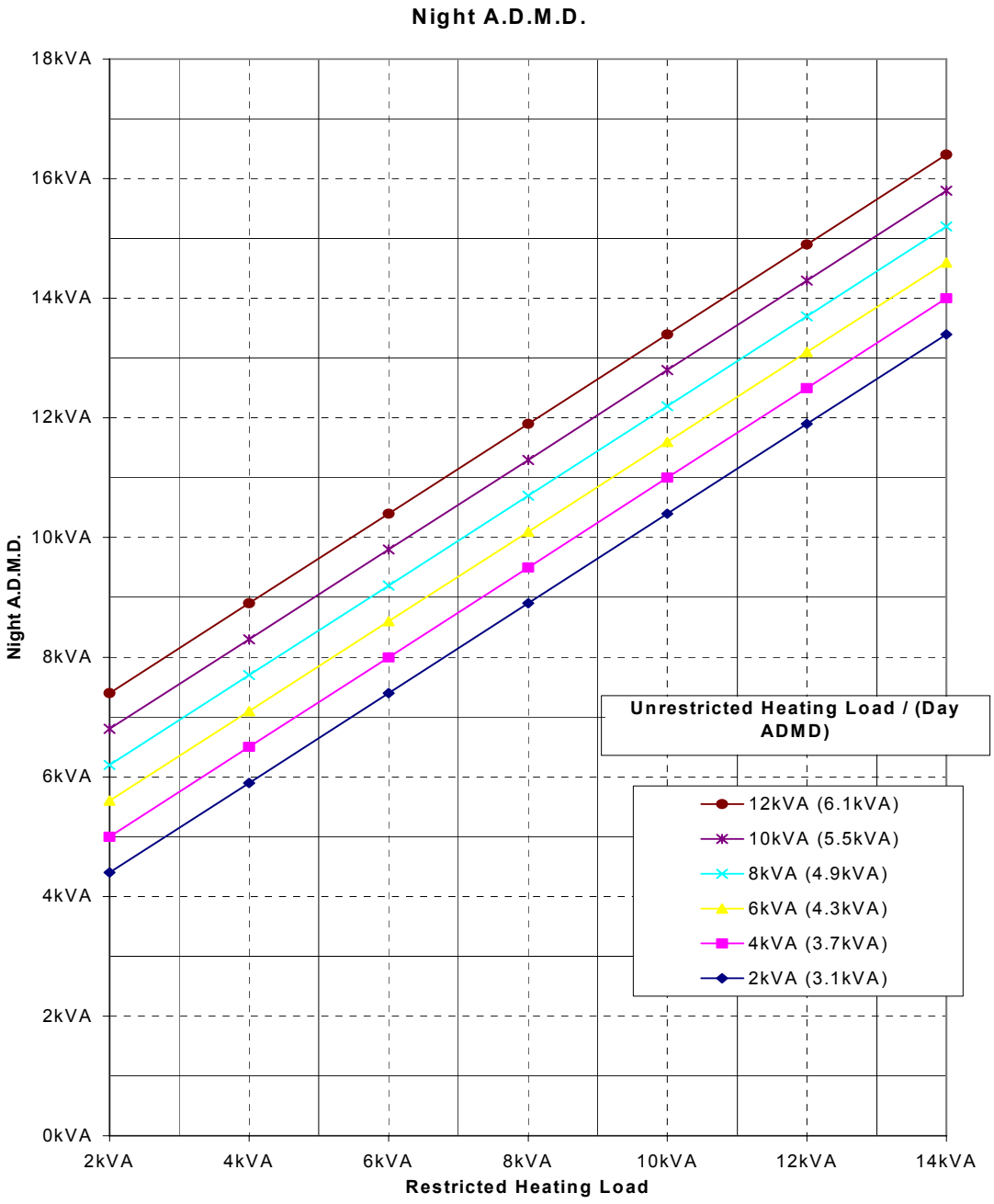
- The maximum demand and volt drop for new houses connected to a feeder can be modelled using EATL's "Debut" software modelling package (SSE's preferred solution)
- For houses with Non-Electric heating:

Table 4:

Non-Electric	Annual Units		A.D.M.D	
	Cons Type	Day Units	Day	Night
3-Bed	URMC	4,500	2.25kVA	0.5kVA
4-Bed	URMC	5,000	As Above	As Above
5-Bed	URMC	6,000	As Above	As Above

(URMC= Un-restricted Medium Consumption in EATLs "debut" software modeling package)

- For houses with off-peak electric heating the daytime annual units may be assumed to be the same as an equivalent non-electric house while the night-time units may be calculated by allowing 1000 units per kW of restricted heating load, 800 units per kW of unrestricted heating load. Unless another known tariff is to be used (such as total control), the consumer type may be assumed to be DRHIII in EATLs "debut" software modeling package.


Night A.D.M.D.
18kVA
16kVA
14kVA
12kVA
10kVA
8kVA
6kVA
4kVA
2kVA
0kVA
Night A.D.M.D.
2kVA
4kVA
6kVA
8kVA
10kVA
12kVA
14kVA
Restricted Heating Load
Unrestricted Heating Load / (Day ADMD)
12kVA (6.1kVA)
10kVA (5.5kVA)
8kVA (4.9kVA)
6kVA (4.3kVA)
4kVA (3.7kVA)
2kVA (3.1kVA)

Graph 1

7.5 Cable Rating & Maximum Lengths

7.5.1 Service Cable Ratings

The following are continuous ratings.

Table 5:

Service CSA	Normal		Duct		In Hockey Stick or Insulated Cavity	
25mm^2 single phase	115A	28kVA	94A	23kVA	76A	18kVA
35mm^2 single phase	140A	34kVA	115A	28kVA	91A	22kVA
35mm^2 3-phase	115A	83kvA	96A	69kVA		

7.5.2 Service Lengths

- Table 6 below gives the maximum lengths of individual service for various sizes of load to achieve a maximum volt drop of 2%.

Table 6:

Maximum Service Lengths		
Heating Load	**35mm^2 Cable**	**25mm^2 Cable**
Non Electric Heating	37m	27m
10kVA	35m	24m
15kVA	27m	19m
18kVA	24m	17m

7.5.3 Mains Cable Ratings

Applicants should:-

(1) Check if load is constant or cyclic for underground circuits
(2) Check if maximum load will occur in summer or winter
(3) Use derating factors if cable is in ducts, air etc

3 Phase Low Voltage Cable Ratings – Laid Direct in Ground

Table 7:

Conductor Cross Section	Winter Cyclic		Summer Sustained	
	Amps	**3 Phase kVA**	**Amps**	**3 Phase kVA**
300mm Al Wavecon	550	396	435	313
185 mm AL Wavecon	425	306	336	242
95 mm Al Wavecon	300	216	237	171

3 Phase Low Voltage Cable Ratings – Laid in ducts longer than 15m

Table 8:

Conductor Cross Section	Winter Cyclic		Summer Sustained	
	Amps	**3 Phase kVA**	**Amps**	**3 Phase kVA**
300mm Al Wavecon	440	317	348	250
185 mm AL Wavecon	340	245	269	193
95 mm Al Wavecon	240	173	190	137

The rating of a cable is determined by the maximum temperature that the insulation can withstand without damage. This is dependant on the current, the duration of the load and the ability of the ground, duct, air etc. to conduct the heat away.

Where the cable is to be used as a service, a cyclic rating should not be used and the summer sustained rating should be applied.

The winter cyclic rating is used for mains cables where the maximum demand occurs during the winter. This is the normal situation.

Where there is the likelihood that the summer demand will be significant, (i.e. where there is air-conditioning load) then the summer ratings will be used.

7.5.4 Derating effects on Circuit Capacities

Key Points

- Various conditions restrict the ground's ability to conduct heat away from the cable. This reduces the current carrying capacity.
- Derating factors are detailed below:

Table 9:

Winter Sustained Rating	**Winter Cyclic × 0.88**
Summer Sustained Rating	**Winter Cyclic × 0.79**
Summer Cyclic Rating	**Winter Cyclic × 0.90**
Rating in Air (>15m)	**Appropriate Rating × 0.87**
Rating in Ducts (>15m)	**Appropriate Rating × 0.80**
Close proximity of 2 partially loaded cables (>15m)	**Appropriate Rating × 0.95**
Close proximity of 2 fully loaded cables (>15m)	**Appropriate Rating × 0.80**

Partially Loaded means less than 90% of it's capacity e.g. there are three cables, two of which are loaded at less than 90% of their capacity and the third (additional) one can be rated at 95% of its rating.

The derating factors in **Air, Ducts** and due to **proximity** are applicable where the individual continuous lengths of cable affected are greater than 15m. Where there is more than one length in a duct, for example, it is not necessary to add the total length to determine whether to apply the derating factor. For road crossings etc. less than 15m in length the derating factor need not be applied.

Close is defined as less than 150mm between centres.

The **Air** rating assumes that the cable is shielded from the sun.

Where more than one derating factor is applicable to the same section of cable they should be multiplied together.

e.g. Where there is a ducted cable, with duct length greater than 15m, that is used as a service the derating factor will be 0.8 (derating for ducts) x 0.79 (derating for summer sustained rating), that is 0.632. This will be multiplied by the winter cyclic rating to obtain the cable rating in these circumstances.

Where the cable runs in a duct for 25m and further along runs in air, the derating factor to be applied will be the most significant, not the multiplication of the two factors. This is because the two derating factors are applied over two different sections of the same cable. In this case the duct derating factor of 0.8 would be used.

7.6 Voltage Calculations

The Company's design criteria are to allow a maximum of 5% voltage drop on the mains cables and a maximum of 2% voltage drop on the service cables. The Company will advise the minimum design voltage at the HV or LV point of connection. Applicants will require to design their networks to ensure that the overall voltage drop limits are met.

Small motors, lifts, water or sewerage pumps associated with proposed developments can be included in proposed designs. In such cases, Applicants will request information from the Company regarding the Fault Level at the Point of Connection and will use this information to determine suitable designs.

The acceptable maximum starting current will be determined by the frequency of starting which determines the maximum voltage change at the point of common coupling (POCC) on the network. Applicants should ensure that designs met the requirements of Figure 4 in Engineering

Recommendation P28. As part of Design Acceptance, Applicants must confirm the starting current, estimated frequency of starting and calculated voltage change at the POCC.

7.6.1 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 = $(Nb \times ADMD_w) + 18$ kW

Where:-

- Nb is the number of houses on the branch
- $ADMD_w$ is the weighted average ADMD per house

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.

7.7 Low Voltage Earthing and Bonding

New low voltage distribution systems associated with new single-occupied domestic premises shall be designed for protective multiple earthing (PME). A PME earth terminal shall be made available at the service termination where appropriate. This shall meet the requirements of the Electricity Safety, Quality and Continuity Regulations 2002 and in addition at CNE distributor potends (stop-ends), the combined neutral/earth shall be connected to an earth electrode in an approved manner.

Full details of the Company's earthing requirements can be obtained in the Specification for Bonding and Earthing during the Installation of New Connections which is available on the Company's website. The requirements as set out in these documents shall be complied with.

Further guidance should be sought concerning the earthing arrangements in all other situations, including but not limited to, the provision of temporary site connections, agricultural premises, and connections to multi-occupied premises and where a new secondary substation is required. The design criteria for temporary supplies shall be the same as that applied to permanent supplies however, no earth shall be provided to such a supply.

7.8 Short Circuit Currents

The maximum earth loop impedance and maximum prospective short circuit current at each service termination shall meet the requirements set out in Tables 2 & 3.

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

- 25 kA for supplies taken directly from a substation's busbars on the low voltage (400 V) system
- 18 kA for 3 phase supplies taken at low voltage
- 16kA for single phase supplies taken at low voltage
- 13.1 kA (150 MVA) on the 6.6 kV system
- 13.1 kA (250 MVA) on the 11 kV system

N.B. 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.

HRC fuses will be installed at the substation to protect the low voltage mains cables. Applicants should ensure that:

(1) Fuse sizes are selected in accordance with Company Specification, and

(2) Sufficient phase to neutral short circuit current is available at all points on the proposed network design to ensure fuse operation within 30 seconds.

8. Design Approval

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

In most cases the development of a full detailed design will be a two-stage process:

1. The Applicant will submit an outline proposal (see Appendix A) providing sufficient detail to enable the Company to indicate the most suitable point of connection to the network given the information provided.

2. The Applicant to undertake a full detailed design (see Appendix B) which is submitted to the Company for approval.

There are three possible options when the Company responds to the proposed design These are set out in Table 10.

Table 10:

Technical Requirements	Additional Requirements	Response / Status
Proposed design does not comply with the requirements set out in this document	-	Not approved. Explanation given by Company
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 TEMPLATE FOR INDICATIVE CONNECTION COST.

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

(1) 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

(2) Number of houses

(3) Phasing of development and initial connection date of each phase

(4) Heating type e.g. gas/oil/storage heating/electric, etc

(5) Estimated individual demand

(6) Estimated total peak demand for the development

(7) Site layout plan if available

(8) Where known details of future new related development

(9) Applicants suggested / proposed connection point

APPENDIX B – MINIMUM INFORMATION TEMPLATE FOR DESIGN APPROVAL

Table 11:

Main Area	Component Details
Applicant(s)	• Name, address, contact details • Contractor(s) to be used
Location/environment	• Location plan at 1:2500 scale showing location of the site in relation to it's surrounding area • 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) • Heating type (space/water)
Phasing	• Phase(s) of development • Initial connection date of each phase • Estimated completion date of each phase
Connection	• Details of proposed meter positions for each premise • Details of Landlords connection(s) required • Details of any proposed temporary building supplies, motor/lift supplies or associated pumping station supplies
Demand	• Estimated individual dwelling maximum demand (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 layout drawing on 1:500 scale plan(s) showing the layout and details such as cable sizes, size and number of ducts etc of all proposed electrical apparatus shown against the new roads and housing background. Details of proposed substation

	locations, adopted areas and meter positions • The phase (red, yellow or blue) that each service is to be connected • 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 wayleaves / easements • Drawing indicating the location of the temporary builder supply (if applicable) • Separate drawing detailing street lighting proposals shown against the site layout (if applicable and Agreed with relevant Highway Authority). Unmetered supplies should be identified with details of classes and maximum demands as per BSCP520.
Design	• Maximum design PSCCs at points of supply • Voltage calculations for all proposed new mains and service cables • Calculated voltage fluctuation for any proposed small motors, pumps, etc associated with the proposed development • Details of calculated maximum demand and rating for all sections of LV cables • Maximum earth loop impedance at points of supply • For each feeder:- 1. Maximum demand calculated 2. Number of connections on each phase 3. Maximum volt drop on mains cables 4. Maximum volt drop on any service 5. Proposed mains cable fuse rating
Plant	• A full itinerary of equipment, plant and materials to be installed including types, sizes and ratings employed
Other	• Details of any land contamination issues / specific on-site Health and Safety issues requiring abnormal working requirements