



Engineering Recommendation G81 Part 4
Issue 3 2016

Framework for new industrial and commercial
underground connections
Part 4 Design and planning

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Revised, 2016

Amendments since publication

Issue	Date	Amendment
1	2006	First issue
2 + A1	2008	Revision and Amendment 1: Reference to ENA Engineering recommendation G5/4 updated to G5. Reference to ENA Engineering recommendation P2/5 updated to P2. Reference to Electricity and Pipe Line Works (assessment of environmental effects) Regulations removed. Reference to Electricity Works (Environmental Impact Assessment)(England and Wales) Regulations changed to refer to the document amended in 2007. Reference to Electricity Safety, Quality and Continuity Regulations 2002 changed to refer to document amended in 2006.
3	2016	Minor revision to reflect changes in the Ofgem Competition in Connections regime and updating of reference publications and legislation. This issue includes the following principal technical changes. Clause 1: Scope amended to generally cover HV underground connections up to and including 20 kV to account for changes in ER G88. Added definition for "End Customer" Earth loop resistance changed to earth loop impedance. Added definition of "ADMD" and "IDNO". Added requirement for fault level contribution from distributed generation to be considered.

		<p>Clause 4: Changed 'Building Regulations 2010' to 'Building Regulations (applicable to the location)' to reflect different Building Regulations apply for different locations of the UK. Added explanatory footnote.</p> <p>Clause 6.2.2: Added requirement for any relevant requirements in the Meter Operation Code of Practice Agreement (MOCOPA®) to be adhered to.</p> <p>Clause 6.10 Added requirement for substations not be located on land that is exposed to the risk of flooding, wherever possible.</p> <p>Annex C.1.1:</p> <p>Replaced reference to Ofgem Final Proposals document with Host DLH Connection Charging Methodology/Statement.</p> <p>Reference to CDM Regulations changed from "2007" to "2015".</p> <p>Details of all other technical, general and editorial amendments are included in the associated Document Amendment Summary for this Issue (available on request from the Operations Directorate of ENA).</p>
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Foreword

This Engineering Recommendation (EREC) is published by the Energy Networks Association (ENA) and comes into effect from date of publication. It has been prepared under the authority of the ENA Engineering Policy and Standards Manager and has been approved for publication by the ENA Electricity Networks and Futures Group (ENFG). The approved abbreviated title of this engineering document is “EREC G81 Part 4”.

This EREC replaces and supersedes ER G81 Part 4 2008 (as amended).

This document is a “qualifying standard”, being listed in Appendix 2 of The Distribution Code, and has been revised under the governance of the Distribution Code Review Panel and in association with the Ofgem Electricity Connections Steering Group.

EREC G81 is a suite of engineering documents that sets out a national framework to facilitate competition in new connections. EREC G81 Parts 4-6 are associated with commercial and industrial connections and associated new HV and HV/LV distribution substations, where the requirements are documented as follows:

- Part 4 – Design and planning (this document).
- Part 5 – Materials specification.
- Part 6 – Installation and records.

Since EREC G81 was last amended in 2008 the contestability of connection work has been extended to include jointing of metered and unmetered supplies to existing low voltage mains cables and to jointing of high voltage cables¹. In addition, a significant number of references in the documents have been superseded and new references relevant to EREC G81 have been published. These changes and resultant changes to requirements are captured in this revision. The opportunity has been taken to align the document with the current ENA engineering document template and ER G0 governing the rules for structure, drafting and presentation of ENA engineering documents.

This document is intended to be used by Independent Connection Providers (ICPs) and Independent Distribution Network Operators (IDNOs) that undertake new connections under the Ofgem Competition in Connections regime.

Where the term “shall” or “must” is used in this document it means the requirement is mandatory. The term “may” is used to express permission.

NOTE: Commentary, explanation and general informative material is presented in smaller type, and does not constitute a requirement.

If there are queries about this document, please discuss them with the Host Distribution Licence Holder (Host DLH) in whose area it is proposed that work is to be undertaken. In the event that it is not possible to resolve the question with the Host DLH, please seek advice from the Connections Policy Team, Ofgem, 9 Millbank, London SW1P 3GE.

¹ See Ofgem decision letter dated 8 May 2012 [1].

1 Scope

This document sets out the minimum requirements for design and planning of new low voltage and high voltage (generally up to and including 20 kV) underground electricity networks and associated distribution substations for industrial and commercial connections undertaken under the Ofgem Competition in Connections regime. It is one of the following suite of documents governing this work.

- Adoption Agreement².
- Design and planning framework (EREC G81 Part 4).
- Materials specifications framework (EREC G81 Part 5).
- Installation and records framework (EREC G81 Part 6).
- Underground unmetered connections framework.

This document must be read in conjunction with these documents as some issues, for example equipment ratings, are dependent on the way equipment is specified, designed or installed.

NOTE: This suite of documents applies only to new installations and is not to be applied retrospectively.

This document sets out and makes reference to design and planning requirements which have to be met for a Host DLH to adopt contested HV and LV networks and associated new HV and HV/LV distribution substations supplying industrial and commercial connections generally up to and including 20 kV. This includes industrial and commercial connections on both 'greenfield' and 'brownfield' sites.

This document supplements but does not amend, abridge or override any statutory legislation referred to within this document.

This suite of documents principally applies to connections of industrial and commercial developments although some relevant design aspects associated with multi-occupied premises, e.g. blocks of offices or shops, have been summarised from ER G87. Detailed arrangements associated with planning, connection and operation of new installations involving an interface between the Host DLH and IDNOs are specifically addressed in ER G88.

This suite of documents does not include any requirements in respect of generator or traction supply connections. These are subject to separate consideration.

2 Normative references

The following referenced documents, in whole or part, are indispensable for the application of this document and must be complied with unless otherwise agreed in writing with the Host DLH. The latest editions of these documents including all addenda and revisions shall apply unless otherwise agreed with the Host DLH.

NOTE: It is not appropriate to cross-reference all relevant requirements from the following publications in this document. Where a publication is not specifically cross-referenced in the main clauses of this document then all relevant requirements are deemed to apply.

Standards publications

BS 7671, *Requirements for electrical installations (IET Wiring Regulations, Seventeenth Edition)*

² Also known as "Agreement to Adopt".

BS EN 50160, *Voltage characteristics of electricity supplied by public electricity networks*

BS EN 61508, *Functional safety of electrical/electronic/programmable electronic safety related systems*

BS EN 60909 (all Parts), *Short-circuit currents in three-phase a.c. systems*

BS HD 60269-2, BS 88-2, *Low-voltage fuses. Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application). Examples of standardized systems of fuses A to J*

Energy Network Association publications³

ENA TS 12-8, *The application of fuselinks to 11 kV/425 V and 6.6 kV/415 V underground distribution networks*

ENA TS 41-24, *Guidelines for the design, installation, testing and maintenance of main earthing systems in substations*

ENA TS 41-36, *Switchgear for service up to 36 kV (cable and overhead conductor connected)*

ER G5, *Planning levels for harmonic voltage distortion and connection of non-linear equipment to transmission and distribution networks in the UK*

ER G12, *Requirements for the application of protective multiple earthing to low voltage networks*

ER G14, *Protective multiple earthing: recommended principles of testing to ensure correct polarity*

ER G39, *Model code of practice covering electrical safety in the planning, installation, commissioning and maintenance of public lighting and other street furniture*

ER G74, *Procedure to meet the requirements of IEC 909 for the calculation of short-circuit currents in three phase AC power systems*

ER G78, *Recommendations for low voltage supplies to mobile phone base stations with antennae on high voltage structures*

ER G87, *Guidelines for the provision of low voltage connections to multiple occupancy buildings*

ER G88, *Principles for the planning, connection and operation of electricity distribution networks at the interface between Distribution Network Operators (DNOs) and Independent Distribution Network Operators (IDNOs)*

ER P2, *Security of supply*

ER P17 (all Parts), *Current rating guide for distribution cables*

ER P25, *The short-circuit characteristics of Public Electricity Suppliers low voltage distribution networks and the co-ordination of overcurrent protective devices on 230 V single phase supplies up to 100 A*

³ ENA documents can be obtained via the ENA web site: www.energynetworks.org.

ER P26, *The estimation of maximum prospective short-circuit current for three phase 415 V supplies*

ER P28, *Planning limits for voltage fluctuations caused by industrial, commercial and domestic equipment in the United Kingdom*

ER P29, *Planning limits for voltage unbalance in the UK for 132 kV and below*

ER S15 (all Parts), *Standard schematic diagrams*

NOTE: It is likely that Host DLHs will have their own standards.

ETR 138, *Resilience to flooding of grid and primary substations*

National Joint Utilities Group (NJUG) publications

Volume 1, *NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus*

Volume 4, *NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees*

Health & Safety Executive (HSE) publications

GS6, *Avoiding danger from overhead power lines*

HSG47, *Avoiding danger from underground services*

HSG150, *Health and safety in construction*

Balancing & Settlement Code

Balancing & Settlement Code (BSC) Procedure BSCP 520 Unmetered Supplies Registered in Settlement Meter Registration Service (SMRS)

MOCOPA[®] Meter Operation Code of Practice Agreement

Ofgem agreed publications

The Distribution Code

Standard Conditions of the Electricity Distribution Licence

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

After Diversity Maximum Demand (ADMD)

maximum demand of an individual consumer property that includes diversity of load usage for the purpose of calculating site/substation maximum demand

3.2

Applicant

company wishing to undertake the contestable work

3.3

BS

British Standard

3.4

BS EN

European Standard adopted as a British Standard

3.5

BSI

British Standards Institution

3.6

CDM

Construction (Design and Management) Regulations 2015

3.7

CNE

combined neutral and earth (of cable construction)

3.8

Distribution Licence Holder (DLH)

Holder of an Electricity Distribution Licence as defined in the Electricity Act 1989 Standard conditions of the Electricity Distribution Licence

NOTE: Host DLH refers to the Distribution Licence Holder for the public electricity network concerned.

3.9

Distribution Service Area (DSA)

service area of a DLH

3.10

ENA

Energy Networks Association

3.11

ENA TS

Energy Networks Association Technical Specification

3.12

End Customer

Customer who ultimately takes supply from the connection under the connection agreement

3.13

Engineering Recommendation (ER or EREC)

engineering document published by the ENA, whose title may be abbreviated to ER or EREC

NOTE: Engineering Recommendations published from 2012 onwards are generally referred to as ERECs.

3.14

ESQCRs

Electricity Safety, Quality and Continuity Regulations 2002 (as amended)⁴

3.15

Harmonised Document (HD)

IEC Standard adopted as a European reference document

⁴ And associated Guidance documents issued by DTI (now BIS) including URN 06/1294 [2].

3.16

Host DLH

DLH in whose licensed area (DSA) the works are to take place

3.17

HSE

Health and Safety Executive

3.18

HV

high voltage exceeding 1 000 V a.c.

NOTE: See Clause 1 for HV limit that applies to this document.

3.19

IEC

International Electrotechnical Commission

3.20

LV

low voltage not exceeding 1 000 V a.c.

3.21

NRSA

New Roads and Street Works Act

3.22

Ofgem

Office of Gas and Electricity Markets

3.23

Point of Connection (POC)

point on the existing Host DLH network to which new assets will be connected

3.24

Protective Multiple Earthing (PME)

neutral and protective functions combined in a single conductor in part of the electricity distribution system

NOTE: Referred to as a TN-C-S (PME) system in BS 7671.

3.25

PSCC

Prospective Short-Circuit Current

4 Legislation

All requirements of all relevant legislation must be met. The following is a list of some of the relevant legislation.

- a) Building Regulations (applicable to the location)^{5,6}.
- b) Conservation of Habitats and Species Regulations 2007.
- c) Contaminated Land (England) Regulations 2006⁷.

⁵ The Buildings Regulations 2010 (as amended) only apply in England. Equivalent Building Regulations apply in Northern Ireland, Scotland and Wales.

⁶ Requirements of related current approved documents also apply.

- d) Control of Asbestos Regulations 2012.
- e) Control of Noise at Work Regulations 2005.
- f) Construction (Design and Management) Regulations 2015 (as amended).
- g) Electricity Act 1989 as amended by the Utilities Act 2000; and The Distribution Code which is given legal authority by the provisions of the Electricity Distribution Licence issued under it.
- h) Electricity at Work Regulations 1989.
- i) Electricity Safety, Quality and Continuity Regulations (as amended)⁸.
- j) Electricity Works (Environmental Impact Assessment) (England & Wales) Regulations 2000 (as amended)⁹.
- k) Environment Act 1995.
- l) Environmental Protection Act 1990.
- m) Health & Safety at Work etc Act 1974.
- n) Management of Health & Safety at Work Regulations 1999.
- o) New Roads and Street Works Act 1991 (NRSWA)¹⁰.
- p) Regulatory Reform (Fire Safety) Order 2005¹¹.
- q) Town and Country Planning Act 1990.
- r) Town and Country Planning (General Development Procedure) Order 1995.
- s) Wildlife and Countryside Act 1981.

5 General

Networks must be such that they are developed and maintained to provide an efficient, secure and co-ordinated system of electricity supply that is both economical and safe.

The framework described in the suite of EREC G81 documents is subject to some local variation between DLHs because, for example, of differences in:

- substation specification, network design and fault levels;
- environment and impact on ratings, insulation, corrosion etc.;
- compatibility with existing equipment.

Where a deviation from this document is identified, it will be stated in the DLH Appendices to this document.

⁷ For equivalent Regulations in Scotland and Wales refer to The Contaminated Land (Scotland) Regulations 2005 and The Contaminated Land (Wales) Regulations 2006 respectively.

⁸ And associated Guidance documents issued by DTI (now BIS) including URN 06/1294 [2].

⁹ For equivalent Regulations in Scotland refer to The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended).

¹⁰ And all related Codes of Practice and Specifications.

¹¹ Referred to as Fire Safety Regulations.

6 Design and planning

6.1 General

The Applicant shall develop a network design which complies with requirements in those publications stated in Clause 2 and all applicable statutory legislation, examples of which are included in Clause 4.

In particular, the principles of sound health and safety management shall be taken fully into account to ensure that the system can be constructed, maintained and operated safely and effectively.

The Applicant shall ensure that the operating duty of equipment is within its design rating and shall state the assumptions that have been made in deriving ratings and operating duty.

Network electrical design shall comply with the requirements of this document, employing data listed in the Appendices. It is important to note that data may vary between DLHs, for reasons such as those described in Clause 5.

6.2 Preliminary considerations

There are, depending on the nature of the scheme, a significant number of preliminary issues that need to be considered and discussed with the relevant parties at the initial stages of developing a proposed design. Many of these issues are interdependent.

6.2.1 Issues directly affecting the Host DLH, Applicant, End Customer and Principal Contractor

To best serve the interests of the End Customer, they must be advised that it may be possible to increase the level of security of supply above that provided under the ER P2 “minimum scheme”, at greater cost, if this is technically feasible. This might take the form of duplicate off load transferable supplies at low voltage. At high voltage this might mean use of ring main equipment or a circuit breaker switchboard loop in/out arrangement, or some form of auto changeover scheme. As the availability of many of these options interact with and are dependent on the Host DLH network, it is important that the Applicant, discusses these with the Host DLH at an early stage.

A risk assessment on a proposed substation is required under the ESQCRs, but risk assessment of the installation also forms part of duties imposed on the overall development and Principal Contractor under CDM, Building and Fire Safety Regulations. This may affect siting, routing and access.

If “joint use” of a substation is to be required after it has been put into service, for example by use of a common switchroom housing both Host DLH and End Customer owned equipment, those future arrangements need to be discussed and agreed at the planning stage. They may entail the provision of physical barriers between parts of switchrooms, and the establishment of “responsibility schedules” under The Management of Health & Safety at Work Regulations. It may also impact on the need for End Customer staff to hold appropriate formal Operational Authorisations from the Host DLH.

6.2.2 Issues primarily directly affecting Applicant and Host DLH

If the End Customer has expressed a desire to seek optional enhanced security of supply above the “minimum scheme”, it will be necessary to discuss the available options taking account of the constraints imposed by, for example, network open points, automation/changeover schemes, protection and future outage co-ordination, e.g. work or faults which would adversely impact on the selected “enhanced security” option.

Policy on the maximum load supplied and termination arrangements at LV, standard ratings of HV/LV transformer and metering will vary between DLHs and Meter Operators, and need to be discussed. Any relevant requirements in the Meter Operation Code of Practice Agreement¹² (MOCOPA) will need to be adhered to.

An accurate assessment of the proposed demand, load profile and any loads falling under ER G5 or ER P28 is required. Loads of more than 1 MW may have an impact on the network at a voltage above that at the POC. HV network connections may require upstream reinforcement.

Additional load that requires upstream reinforcement may result in increased fault levels with subsequent impact upon existing and proposed equipment. A proposed load may impact on the load transfer capability of the network, thus reducing network security for existing and new customers.

Larger developments may be part of a long term strategy or infrastructure agreement which encompass the needs of an area not just a particular site. Some principles will have been discussed with the Local Authority and so liaison between the Developer, the Host DLH and the Local Authority may be required at the outset.

The loading on the network and need for diversionary/reinforcement work, together with the lead times for ordering and installing non-stock equipment may impact on the timescale of the proposed works and need to be considered at the outset.

Clause 6.20 includes further requirements affecting previously developed sites.

6.3 Design approval

It is necessary for the Host DLH to approve the network design prior to construction. Each DLH will define the information requirements necessary to support the approval process. Use of the same design tool as the Host DLH will simplify the design approval process and it is recommended that the Applicant discusses with the Host DLH the manner in which information is provided.

Submission of designs by the Applicant to the DLH for approval shall include:

- copies of inputs and outputs from the design package used by the appropriate DLH;
- a statement of the design parameters used – see Appendix A for list;
- a drawing showing the network layout to a suitable scale showing, routes, joint positions, cable sizes, link box positions and LV phase connections;
- confirmation that the design meets the requirements of this document as supplemented in the Appendices.

¹² See <http://www.mocopa.org.uk/>

The Host DLH may elect to opt for a design which exceeds the requirements of this document, for example to provide additional LV linking facilities or to increase conductor sizing to permit later network extension not covered by the Applicant's programme. If there are generic requirements such as provision of mobile generator connection facilities, these should be set out in the DLH specific details in Appendix B. Requirements which are relevant to individual designs would be discussed with the Applicant during the design process, as provided for under the terms of the Adoption Agreement.

6.4 Voltage regulation

The voltage regulation between the LV busbars of the HV/LV substation and the end of any service, including the maximum proportion of regulation in the service, shall not exceed the limits stated by the Host DLH in the Appendices.

6.5 Voltage unbalance, disturbing and fluctuating loads

Single phase connections shall be balanced such that the resultant network voltages fall within the voltage unbalance limits of ER P29, taking existing network connections into account. Limits for voltage fluctuations caused by industrial, commercial and domestic equipment, e.g. for motors or sewage pumps, are set out in ER P28. Planning requirements for harmonic voltage distortion and the connection of non-linear equipment are set out in ER G5.

6.6 Losses

Networks must be developed to be efficient, co-ordinated and economical. The design shall minimise lifetime costs, including: initial capital costs, installation, operation and maintenance. An evaluation of network losses using loss £/kWh as used and stated by the Host DLH in Appendix B shall be carried out.

6.7 Earth loop impedance

The maximum earth loop impedance (LV main plus service cable loop) shall be as stated by the Host DLH in the Appendices.

6.8 Low voltage underground cable network

The low voltage underground cable network shall be of CNE cable construction utilising the standard sizes of cable employed by the Host DLH as specified in Appendix B.

The network shall be earthed using the PME system in accordance with ER G12.

The voltage drop on the low voltage underground cable network between the substation LV busbars and all extremities of the network shall not exceed the limits specified in Appendix B. This voltage drop shall be calculated assuming that all customers are taking their design ADMD with allowance for unbalance and diversity. Host DLH-specific design ADMDs for different classes of customer are listed in Appendix B.

6.9 High voltage network

The high voltage network shall utilise the standard design of overhead line or type of underground cable and conductor sizes employed by the Host DLH as specified in Appendix B. Where work falling within the scope of this document entails modification of an existing DLH circuit, the design, for example in selection of conductor materials and sizes, shall be such that existing ratings are maintained.

6.10 Substations

The HV/LV distribution substation(s) shall utilise the standard sizes of transformer employed by the Host DLH as specified in Appendix B [of this document] and Appendices to the materials specifications framework (EREC G81 Part 2).

Transformer sizing shall be based on the aggregated ADMDs for all customers fed from the substation and the permissible cyclic rating of the transformer as specified in Appendix B, and minimising lifetime cost criteria as set out in Clause 6.6.

The substation location shall take into account access and environmental factors such as: noise, pollution, flooding risk and vandalism (see also ESQCRs and associated DTI (now BIS) Guidance [2]). Substations should not be located on land that is exposed to the risk of flooding. Where this is unavoidable then the principles and applicable requirements of ETR 138 should be applied for managing flooding risk.

Substation earthing shall prevent danger from rise of potential during network earth faults, shall take account of touch potentials, step potentials and transferred potentials and shall conform with requirements in ENA TS 41-24.

6.11 Services

Service cables shall be of CNE construction using standard sizes of cable employed by the Host DLH as specified in Appendices to the materials specifications framework (EREC G81 Part 2).

Service entry policy may vary between DLHs – see information in Appendix B for details.

6.12 Design of unmetered supplies

Only supplies covered by BSCP 520 may be unmetered supplies, and the provision of unmetered supplies requires prior approval of the Host DLH.

Loads shall be calculated in accordance with BSCP 520, where this provides information on the class of load.

The network design shall otherwise follow LV network design practice described in this document.

6.13 Ratings

The network design shall be such that equipment design ratings including any appropriate cyclic or short term ratings as defined in the appropriate specification or ER P17 are not exceeded, and must take into account the load profile characteristics and DLH specific criteria, such as ambient temperatures, soil thermal resistivity etc. as listed in Appendix B.

It is important to note that these factors are likely to differ between DLHs and so application of rating information in ER P17 will not produce common ratings throughout the UK. See Appendices for Host DLH data.

Ratings employed shall be appropriate to the duty and environment in which the equipment is used. An example of this is the rating of LV cut-outs terminated in a group metering cabinet; the cut-out may have a manufacturer's rating, but this is de-rated when installed in a metering cabinet in close proximity to other cut-outs. Cables in ducts shall be de-rated in accordance with ER P17. The ambient temperatures of substations located inside buildings will be influenced by transformer losses and care is required that these temperatures do not infringe ratings of other equipment such as switchgear.

The short-circuit rating of equipment provided shall not be less than the design fault level of the DLH distribution network to which it is to be connected (as specified in Appendix B).

NOTE: See The Distribution Code - DPC6.5.

6.14 Fault levels

Fault levels shall be sufficient to ensure operation of protection but shall not exceed the limit stated in Appendix B for the design PSCC at the substation LV busbars.

6.15 Maximum design PSCC at LV busbars of HV/LV substation

Networks shall be designed not to exceed the following PSCCs. The design PSCC at the LV busbars of the HV/LV transformer shall be as stated by the Host DLH in Appendix B, unless otherwise agreed in writing.

Allowance for fault infeed from the LV network shall be included in accordance with BS EN 60909.

The Applicant shall also take into account any fault level contribution from distributed generation connected to the LV network. The parameters used shall be stated by the Applicant.

ER P25 and ER P26 give the following figures (see Table 1) as maximum design values of PSCCs at the POC of the service line to the DLH main LV distributor:

Table 1 — Maximum design values of PSCC at the POC of LV services

230 V 1ph	16 kA
230/400 V 3ph	25 kA
230/460 V 2ph	25 kA

Maximum PSCC shall be quoted in kilo Amperes (kA) to avoid confusion arising from assumptions about nominal voltages.

6.16 LV protection

The protection of LV feeder circuits shall meet the following requirements.

- a) Feeder circuits supplying more than one customer shall be protected by fuses to BS HD 60269-2, BS 88-2, Fuse system I gU fuse-links with wedge tightening contacts.
- b) Feeder circuits supplying a single customer shall be protected by fuses or circuit breakers, dependent on supply capacity and customer's protection.
- c) Fuses must provide short-circuit protection for the whole length of the circuit up to the service cut-out. Phase to neutral fault clearance time shall be as stated by the Host DLH in Appendix B.
- d) Fuse ratings must allow for the cyclic overload rating of the circuit.
- e) For discrimination, the minimum pre-arcing I^2t of a feeder circuit fuse must exceed maximum total I^2t of any individual fuse downstream.
- f) Overcurrent protection shall be provided at the point of supply.
- g) LV fuses shall be sized to ensure discrimination with the transformer HV protection in accordance with ENA TS 12-8.

6.17 HV Protection

This will be interdependent with Host DLH protection of the feeder (see Appendix B for Host DLH generic policy). In addition to meeting generic protection requirements the Applicant shall discuss any scheme specific requirements with the host DLH to ensure suitable co-ordination and grading of main protection and any back-up protection.

6.18 Provision of information required under ESQCRs

The Applicant shall provide the Host DLH with a written statement of the following information. This information is to allow the Host DLH to fulfil its obligations under Regulation 28 of The ESQCRs in respect of the proposed installation of a consumer.

- a) The maximum PSCC at the supply terminals; and
 - i. for low voltage installations, the maximum earth loop impedance of the earth fault path outside the consumer's installation.
- b) The type and rating of the supplier's fusible cut-out or switching device nearest to the supply terminals.
- c) The type of earthing system applicable to the connection and (in accordance with Regulation 27 (1)) the number of phases, the frequency and the voltage at which it is proposed to supply electricity which apply, or will apply, to that installation to any person who has reasonable cause for requiring that information.

6.19 Planning applications and consents

Attention is drawn to the requirements of various legislation for extended periods of statutory consultation with bodies such as English Heritage, Natural England, Environment Agency, Highways Authorities¹³ (NRSWA etc.) and equivalents in Scotland and Wales, which will impact upon finalisation of proposed installations and work, where such statutory consultation applies.

It is the Applicant's responsibility to obtain planning and other consents.

If the site, or the route by which connections are made to the site, are subject to Compulsory Purchase Order(s), the process of managing the terms and conditions to safeguard existing plant/cables shall be undertaken by the Host DLH.

6.20 Previously developed sites

There are a number of issues that are more likely to arise on previously developed ("brownfield") sites, and which will require discussion and resolution between the Applicant and the Host DLH at an early stage in the planning process. The following are the more common.

- a) Existing electricity infrastructure in place:
 - i. Whether the site is to be totally cleared of existing infrastructure to create a "blank sheet" starting point.
 - ii. If not, then how will existing Host DLH infrastructure, and supplies to existing connected customers inside/outside the development, be safeguarded at all stages of the development?

¹³ Also refers to other agencies requiring consents for work on or near major highways including the Highways Agency, Transport for Scotland and the Welsh Assembly.

- iii. Where will existing infrastructure “end up” in the new development having regard to ongoing access and consents?
 - iv. Where existing infrastructure, or part of it, is to remain in place, there will in consequence be a mix of cable types, ages and designs on site, which will have an impact on subsequent live working requirements.
- b) Access and obstructions:
- i. Preferred access for cables may not be via the site entrance.
 - ii. Cable routes outside the development area may also be on previously developed land.
 - iii. Cable routes need to take account of obstructions and an early survey by the Applicant may be needed, to determine such obstructions, other utility services, abandoned works etc.
- c) Contaminated land, including asbestos:
- i. The Applicant shall, unless otherwise agreed with Host DLH, provide a Contaminated Land survey.
 - ii. Works on site, and in particular trenching, may require special measures to be taken to protect the ongoing reliability of buried assets and to avoid the creation of “pathways”, which would otherwise allow contamination off site.
- d) Conversion of existing buildings:
- i. Suitability for rising and lateral mains.
 - ii. Impact of current Fire Safety Regulations on conversion.
 - iii. Suitability for location of internal substations.

Appendix B (normative)

Data specific to Host DLH – Typical example only

This is an example of the type of data that would be inserted into Appendix B by the Host DLH and is included only for indicative purposes

NOTE: The Host DLH may cross-reference other internal documents containing technical requirements, which will be made available to the Applicant.

Maximum voltage regulation from LV busbars of HV/LV substation: (Clause 6.4)

To end of service	+ %	- %	
To end of main, where no service exists	+ %	- %	

Maximum volt drop from LV busbars of HV/LV substation: (Clause 6.8)

To end of service	%	
To end of main, where no service exists	%	

Maximum earth loop impedance: (Clause 6.7)

To end of service	ohms	
To end of main, where no service exists	ohms	

Design PSCCs at LV busbars of HV/LV substation: (Clause 6.15)

1 000 kVA transformer	kA
800 kVA transformer	kA
500 kVA transformer	kA
etc.	

Maximum LV fault clearance time: (Clause 6.16)

Phase to neutral	s	
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Loss evaluation criteria employed: (Clause 6.6)

Economic rating – fixed losses.....	£/kW	
– variable losses.....	£/kW	

ADMD information. (Clause 6.8)

Maximum number of services per joint. (Clause 6.8)

Use of looped services. (Clause 6.8)

Service entries (Clause 6.11)

The preferred method of service entry to a customer’s electrical installation.

Termination arrangements.

Standard intake arrangements

Maximum LV metered loads, protection arrangements. (Clause 6.16)

HV intake arrangements, including metering. (Clause 6.17)

Underground cables (Clauses 6.7 & 6.8)

Standard conductor sizes.

Underground cable ratings criteria		(Clause 6.12)
Soil resistivities to be employed.		
Ground ambient temperatures – winter and summer.		
Maximum conductor temperatures.		
Definition of cyclic and distribution ratings.		
Ducts – maximum lengths without de-rating.		
Short-circuit rating requirements etc.		
HV network configuration		(Clause 6.8)
Maximum load on any teed section of HV network	MVA	
Security of supply requirements.		
Switchgear diversification requirements for adjacent substations.		
Fault restoration requirements.		
Fault passage indicator requirements.		
Remote operation/automation requirements.		
Substation		(Clause 6.9)
Standard transformer rated powers	kVA	
Transformer cyclic overload rating.	% of rated power hrs in 24 hr period	
Protection		
LV fuse protection		(Clause 6.16)
Standard LV fuse ratings	A	
Maximum permitted LV fuse rating for LV feeder	A	
HV feeder protection policy.		(Clause 6.17)

Appendix C (normative)

Point of Connection (POC) quotations

C.1 Typical information to be provided by Host DLH

C.1.1 Commercial information

Information on charges for non-contestable work (see below) will be provided in accordance with the Connection Charging Methodology and Connection Charging Statement of the Host DLH.

- Charge for information on POC.
- Charge for design approval.
- Charge for final connection of new assets to existing network (including work breakdown, e.g. make 300 mm to 185 mm waveform breach joint).
- Charge for inspection and monitoring of contestable work.
- Charge for acquisition of wayleaves and easements.
- Reinforcement costs.
- Diversion costs.
- Handover/adoption payment.
- Operation and Maintenance (O&M) charge.

C.1.2 Technical information

- Geographic plan showing POC location.
- Mains records showing existing Host DLH equipment and POC location.
- Single line diagram, i.e. system diagram, showing existing Host DLH equipment and POC location.
- Confirmation of demand/demand characteristics provided by ICP.
- Host DLH design assumptions applied to connected demand (e.g. ADMD, No. of plots, characteristics of disturbing loads etc.).
- POC specification (e.g. kVA capacity, voltage, frequency, source impedance, volt drop, fault level).
- Description of reinforcement work (e.g. replace 500 kVA TX with 1 000 kVA, upgrade 185 mm LV cable in highway to 300 mm).
- Description of recovery/diversionary works (e.g. remove HV overhead line, relocate terminal pole, divert HV cable).
- Geographic plan showing recovery/diversionary work.

NOTE: This is a typical example of information to be provided for illustration only. The level of detail provided will clearly be dependent on the nature and complexity of the connection/development. Following consideration of the POC quotation, the ICP may, in exceptional circumstances, request supplementary information (e.g. design options considered, interpretation of cost apportionment rules etc.) from the Host DLH that may be necessary to clarify or justify the quotation. The Host DLH will charge for this supplementary information in circumstances where the original POC design proposal and quotation is subsequently confirmed to be appropriate.

Bibliography

Other publications

[1] *Competition in connections – Decision on extending contestability to jointing to existing DNO mains and associated operational activities*, 8 May 2012: Ofgem.

[2] *Guidance on the Electricity Safety, Quality and Continuity (Amendment) Regulations 2006*, Publication reference URN 06/1294, Department for Trade and Industry (now Department for Business, Innovation & Skills).

