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Engineering Recommendation

G81 - Part 4: Design and Planning

Issue 2

Amendment 1 – January 2008

energynetworks association

Framework for materials specifications for industrial and commercial underground connected loads up to and including 11kV.

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Amendment 1: January 2008

Summary of Amendments:

Reference to ENA Engineering recommendation G5/4 updated to G5/4-1

Reference to ENA Engineering recommendation P2/5 updated to P2/6

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.

CONTENTS

1 BACKGROUND

a. This document was agreed by the Ofgem Electricity Connections Steering Group in May 2006. This revision has been extended to include appendix C; Point of Connection (POC) Quotations.

b. If there are queries about this document please discuss them with the 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.

2 SCOPE

a. The document sets out the minimum requirements for design of low voltage, 6.6kV and 11kV underground industrial and commercial connections, including their new associated HV and HV/LV distribution substations. It is one of the following suite of documents governing this work:

- Adoption Agreement
- Design and Planning framework (ER G81 Part 4)
- Materials Specifications framework (ER G81 Part 5)
- Installation and Records framework (ER G81 Part 6)
- Underground unmetered connections framework

b. This document must be read in conjunction with these documents as some issues, for example equipment ratings, are dependent both on specification and the manner in which their use is designed or installed.

c. For requirements relating to underground connected housing developments, see Engineering Recommendation G81 parts 1, 2 and 3.

NB This suite of documents applies only to NEW installations and is not to be applied retrospectively

d. It is intended to set out or make reference to design and planning requirements which have to be met for a Host DLH to adopt contested HV and LV networks and their associated new HV and HV/LV distribution substations supplying industrial and commercial loads connected up to and including 11kV.

e. This document is intended to supplement but not amend, abridge or override any Statutory legislation referred to within this document.

f. This suite of documents only applies to connections to single-occupied premises and street lighting installations. For design issues associated with multi-occupied premises (e.g. blocks of offices or shops) please see Host DLH Appendix.

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

3 REFERENCES

This document makes reference to the documents listed below, which must be complied with unless otherwise agreed in writing with the DLH. The latest editions of these documents including all addenda and revisions shall apply unless otherwise agreed with the host DLH.

3.1 Energy Networks Association publications

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

Engineering Recommendations (ER)

G5/4-1	Planning levels for harmonic voltage distortion and connection of non-linear equipment to transmission and distribution networks in the UK
G12/3	Requirements for the application of protective multiple earthing to low voltage networks
G14	Protective multiple earthing recommended principles of testing to ensure correct polarity
G17/3	Leakage of flammable gases: recommendations
G39/1	Model code of practice covering electrical safety in the planning installation commissioning and maintenance of public lighting and other street furniture
G74	Procedure to meet the requirements of IEC 909 for the calculation of short-circuit currents in three-phase AC power systems
G78/2	Recommendations for low voltage connections to mobile phone base stations with antennae on high voltage structures
P2/6	Security of Supply
P17	Current rating guide for Distribution Cables
P25/1	The short circuit characteristics of PES low voltage distribution networks and the co-ordination of over-current protective devices on 230v single phase supplies up to 100A
P26	The estimation of maximum prospective short-circuit current for three phase 415V supplies
P28	Planning limits for voltage fluctuations caused by Industrial, Commercial and Domestic equipment in the United Kingdom
P29	Planning limits for voltage unbalance in the United Kingdom for 132 kV and below
S3/1	Metering current transformers for use in switchgear
S15	Standard schematic diagrams (it is likely that Host DLHs will have their own standards)

Energy Networks Association Technical Specifications (ENATS)

ENATS 12-08	The application of fuselinks to 11kV/415v and 6.6kV/415V Underground Distribution Networks
ENATS 41-24	Guidelines for the design, installation, testing and maintenance of main earthing systems in substations
ENATS 41-36	Distribution switchgear for service up to 36kV (cable and overhead conductor connected)

3.2 National Joint Utilities Group (NJUG) publications

NJUG 7	Recommended positioning of Utilities apparatus for new work on new developments and in existing streets
NJUG 10	Guidelines for the planning, installation and maintenance of utility services in proximity to trees

3.3 Health & Safety Executive (HSE) publications

HS (G) 47	Avoiding danger from underground services
GS 6	Avoidance of danger from overhead electric power lines

3.4 Pooling & Settlement Agreement

Agreed Procedure – Unmetered Supplies Registered in PRS Vol. 5 AP 520 Issue 3 – now BSCP 520

3.5 Ofgem agreed publications

Distribution Code

Distribution Licence Conditions

3.6 International and National Standards

IEC 909	Short circuit current calculations in 3 phase ac systems
BS EN 50160	Voltage characteristics of electricity supplied by public distribution systems
BS EN 61508	Functional safety of electrical / electronic / programmable electronic safety related systems
BS 88 Pt 5	Cartridge fuses for voltages up to and including 1000 V and 1500 V DC – Supplementary requirements for fuse links for use in ac electricity supply networks.
BS 7671	Requirements for Electrical Installations (IEE Wiring Regulations. 16th edition)

4 LEGISLATION

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

a. Asbestos at Work Regulations 2002
b. The Building Regulations (and its related current Approved Documents)
c. Construction (Design Management) Regulations 1994
d. Contaminated Land (England) Regulations 2000
e. Electricity Act 1989 as amended by the Utilities Act 2000; and the Distribution Code which is given legal authority by the provisions of the Public Electricity Supply Licence issued under it
f. Electricity at Work etc Regulations 1989
g. Electricity Safety Quality and Continuity Regulations 2002, as amended 2006 (and their associated Guidance documents issued by DTI)
h. The Electricity Works (Environmental Impact Assessment) (England & Wales) Regulations 2000 (as amended 2007)
i. Environmental Protection Act 1990 & 1995
j. Fire Precautions Act 1971
k. Fire Precautions (Workplace Regulations 1997 as amended 1999)
l. Health & Safety at Work etc Act 1974
m. The Management of Health & Safety at Work Regulations 1999
n. The New Roads and Street Works Act (and all related Codes of Practice and Specifications)
o. Town & Country Planning Act – General Development Order 1990
p. Wildlife and Countryside Act 1981

5 DEFINITIONS AND ABBREVIATIONS

ADMD	After Diversity Maximum Demand
Applicant	The Company wishing to undertake the contestable work
BS	British Standard
BS EN	A European Standard adopted as a British Standard
BSI	British Standards Institution
CNE	Combined neutral and earth (of cable construction)
DLH	Distribution Licence Holder – defined in Standard Licence Conditions for Electricity Distributors, issued under the Utilities Act and effective from 1st Sept. 2001
DSA	Distribution Service Area – the service area of a DLH
EA	Electricity Association (replaced by ENA for Networks issues post Oct 2003)
ENA	Energy Networks Association
ENATS	Energy Networks Association Technical Specification
ESQCRs	The Electricity Safety, Quality and Continuity Regulations 2002
HD	Harmonised Document (IEC standard adopted as a European reference document)
Host DLH	The DLH in whose licensed area (DSA) the works are to take place
Housing development	A development consisting of domestic dwellings
HSE	Health & Safety Executive
IEC	International Electrotechnical Commission
NRSWA	New Roads and Street Works Act
OFGEM	Office of Gas and Electricity Markets
PSCC	Prospective Short Circuit Current

6 INTRODUCTION

a. This framework document describes requirements for design and planning of low voltage, 6.6kV and 11kV underground industrial and commercial connections, including their new associated HV and HV/LV distribution substations. 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.

b. This framework is subject to some local variation between DLH's because, for example, of differences in:

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

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

7 DESIGN

7.1 General

a. The Applicant shall develop a network design which complies with the engineering standards specified in section 3.0 above and all applicable statutory legislation, examples of which are included in 4.0 above. 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.

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

c. Network electrical design shall comply with the requirements of this framework document, employing the data listed in the Appendices. It is important to note that these data may vary between DLH's, for reasons such as described above.

7.2 Preliminary considerations

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

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

b. 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 P2/5 “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 a 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.

c. 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 Regulations This may affect siting, routing and access.

d. If “joint use” of a substation is to be required after it has been put into service; for example by use of a common switch room housing both Host DLH and Customers own equipment, those future arrangements need to be discussed 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 Customers staff to hold appropriate formal Operational Authorisations from the Host DLH.

Issues primarily directly affecting Applicant and Host DLH

e. If the 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 / change over schemes, protection and future outage co-ordination (e.g. work or faults which would adversely impact on the selected “enhanced security” option).

f. 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.

g. An accurate assessment of the proposed demand, load profile and any loads falling under ERs G5/4 or P28 is required. Loads of more than 1 MW may have an impact on the network at a voltage above that at the point of connection. HV network connections may require upstream reinforcement. Additional load that requires 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.

h. 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. The 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.

i. The loading of networks 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.

j. Section 7.20 includes further requirements affecting previously developed sites.

7.3 Design approval

a. It is necessary for the Host DLH to approve the design against this document 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 Applicants discuss with the Host DLH the manner in which information is provided.

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

- Copies of input and output from the design package used by the appropriate DLH.
- A statement of the design parameters used and – see Appendix A for list.
- A drawing showing the network layout to a suitable scale showing, routes, joint positions, cable sizes, link boxes and LV phase connections.
- Confirmation that the design meets the requirements of this framework as supplemented in the Appendices.

c. 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 issues such as provision of mobile generator connection facilities, these will often be set out in the DLH specific details in Appendix B. Issues 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.

7.4 Voltage regulation

The allocation of voltage regulation limits 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.

7.5 Voltage unbalance, disturbing and fluctuating loads

Connections shall be balanced to 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 G5/4.

7.6 Losses

Systems must be developed to be efficient, co-ordinated and economical. The design shall minimise lifetime cost of installation and operation and shall include evaluation of system losses using loss £/kWh as used and stated by the Host DLH in the Appendices. (Detailed requirements may be subject to review when the Ofgem Environmental Action Plan is finalised).

7.7 Earth loop resistance

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

7.8 Low voltage underground cable network

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

b. The network shall be earthed using the PME system in accordance with ER G12/3.

c. 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.

7.9 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.

7.10 Substations

a. The HV/LV distribution substation(s) shall utilise the standard sizes of transformer employed by the Host DLH as specified in Appendix B.

b. 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 7.6. above.

c. 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 Guidance).

d. Substation earthing shall be such as to prevent danger from rise of potential during system earth faults and shall take account of touch potentials, step potentials and transferred potentials. See EATS 41-24 for further information.

7.11 Services

a. Service cables shall be of CNE construction using standard sizes of cable employed by the Host DLH as specified in Appendices to the Materials framework document.

b. Service entry policy may vary between DLH's – see information in Appendix B for details.

7.12 Design of unmetered supplies

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

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

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

7.13 Ratings

a. The 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 the Appendices.

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

c. Ratings employed shall be appropriate to the duty and environment in which the equipment is used. An example of this is the rating of an LV house service cut out in a meter cabinet; the cut out may have a maker's rating of 100A, but this is de-rated when used in the environment of a cabinet. 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.

d. 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).

7.14 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.

7.15 Maximum design Prospective Short Circuit Current (PSCC) at LV busbars of HV/LV substation

a. 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.

b. Allowance for fault infeed from the LV system shall be included in accordance with IEC 909. The parameters used shall be stated by the Applicant.

c. ERs P25/1 and P26 give the following figures as maximum design values of PSCCs at the point of connection of the service line to the DLH main LV distributor:

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

d. 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. (Distribution Code - DPC 6.5).

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

7.16 LV protection

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

- Feeder circuits supplying more than one customer shall be protected by fuses to BS88 part 5.
- LV supply cables to single customers shall be protected by fuses or circuit breakers, dependent on supply capacity and customer's protection.
- 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.
- Fuse ratings must allow for the cyclic overload rating of the circuit.
- For discrimination, the minimum pre-arcing I^2t of a feeder circuit fuse must exceed maximum total I^2t of any individual fuse downstream.
- Excess current protection shall be provided at the point of supply.
- LV fuses shall be sized to ensure discrimination with the transformer HV protection in accordance with EATS 12-08.

7.17 HV Protection

This will be interdependent with Host DLH protection of the feeder. See Appendix B for Host DLH generic policy and discuss the scheme specific requirements.

7.18 Provision of information required under ESQC Regulations

Regulation 28 of The ESQCRs require that:

The distributor shall provide in respect of the existing or proposed installation of a consumer a written statement of:

- the maximum prospective short circuit current at the supply terminals; and
- for low voltage installations, the maximum earth loop impedance of the earth fault path outside the consumer's installation;
- the type and rating of the supplier's fusible cut-out or switching device nearest to the supply terminals,
- 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. This information shall be provided to the Host DLH by the Applicant.

7.19 Planning applications and consents

a. Attention is drawn to the requirements of various legislation for extended periods of statutory consultation with bodies such as English Heritage, English Nature, the Countryside Commission, Environment Agency, Highways Authorities (NRSWA etc), which will impact upon finalisation of proposed installations and work, where such statutory consultation applies.

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

c. 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.

7.20 Previously developed sites

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

a. Existing electricity infrastructure in place:

- Whether the site is to be totally cleared of existing infrastructure to create a “blank sheet” starting point.
- If not – how will existing DNO infrastructure, and supplies to existing connected Customers inside / outside the development, be safeguarded at all stages of the development.
- Where will existing infrastructure “end up” in new development having regard to ongoing access and consents.
- 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. This will have an impact on subsequent live working requirements.

b. Access and obstructions:

- Preferred access for cables may not be via site entrance
- Cable routes outside development area may also be on previously developed land
- Cable routes need to take account of obstructions – early survey by Applicant needed, to determine such obstructions, other utility services, abandoned works etc.

c. Contaminated land, including asbestos:

- The Applicant shall, unless otherwise agreed with Host DNO, provide a Contaminated Land survey
- 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” allowing contamination off site.

d. Conversion of existing buildings -

- Suitability for rising and lateral mains will need to be discussed
- Impact of current fire regulations on conversion
- Suitability for location of internal substations

APPENDIX A: DESIGN INFORMATION – DATA REQUIRED FROM APPLICANT

Typical example only - subject to Host DLH variation

For each feeder:

Number of Customers and connections on each phase

Maximum feeder load in Amps

Fuse selected and maximum clearance time – ph to earth fault at cut out

Maximum voltage regulation at a cut out position + and - %

Maximum earth loop resistance

Connected motor loads / disturbing loads

Maximum voltage unbalance (%)

ADMDs / Annual consumptions by customer class

A listing of demand profile classes + ADMDs / annual consumption used for each category of service, together with information (as required in Distribution Code - DPC 5.2.1), on individual maximum power requirements kVA or kW.

The type and electrical loading of equipment to be connected, e.g. number and size of motors, cookers, showers, space and water heating arrangements including details of equipment which is subject to switching by the Supplier.

Any fluctuating or disturbing loads falling under ER G5/4 or ER P28

Diversity (%)

Economic rating - fixed losses	£ / kW
- variable losses	£ / kW

[subject to requirements of Ofgem Environmental Action Plan]

Maximum design PSCCs at connection of service to main

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

Design PSCC at LV busbars of HV/LV transformer kA

Unmetered supplies

Classes and max demands per BSCP 520

Rating criteria – Undergorund

List of cable type by DLH, sizes and ratings employed. – see Appendix B for DLH specific rating criteria.

APPENDIX B: 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

Maximum voltage regulation from LV busbars of HV/LV s/s

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

Maximum earth loop resistance

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

Design PSCCs at LV busbars of HV/LV substation

1000kVA t/f	kA
800kVA t/f	kA
500kVA t/f	kA
etc	

Loss evaluation criteria employed

Economic rating - fixed losses	£ / kW
- variable losses	£ / kW

ADMD information

Maximum number of services per joint

Use of looped services

Service entries

Preferred method of service entry to a customers electrical installation

Termination arrangements

Standard intake arrangements

Maximum LV metered loads, protection arrangements
HV intake arrangements, including metering

Underground cable ratings - criteria

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.

APPENDIX C: POINT OF CONNECTION (POC) QUOTATIONS

Typical information to be provided by DNO

a. Commercial information

Information on charges for non-contestable work to be provided in format specified by Ofgem in August 2002 Final Proposals document :

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

b. Technical information
- Geographic plan showing POC location
- Mains records showing existing DNO equipment and POC location
- Single line diagram (i.e. system diagram) showing existing DNO equipment and POC location
- Confirmation of demand / demand characteristics provided by ICP
- DNO design assumptions applied to connected demand (e.g. ADMD, No. 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 500kVA TX with 1000kVA, upgrade 185mm LV cable in highway to 300mm)
- Description of recovery/diversionary works (e.g. remove HV overhead line, relocate terminal pole, divert HV cable)
- Geographic plan showing recovery/diversionary work

NB The above is a typical example of information to be provided for illustration only. The level of detail provided will clearly be dependant 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 DNO that may be necessary to clarify or justify the quotation. The DNO will charge for this supplementary information in circumstances where the original POC design proposal and quotation is subsequently confirmed to be appropriate.