



Engineering Recommendation G81 Part 3

Issue 2 2016

Framework for new low voltage housing
development installations

Part 3 Installation and records

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Revised 2016

Amendments since publication

Issue	Date	Amendment
1	2004	First issue
1 + A1	2008	Amendment 1: 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.
2	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. Added definition of “ADMD” and “IDNO”. Added requirement for fault level contribution from distributed generation to be considered. 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. Clause 6.1: Added requirement for meter cabinets to conform to BS 8567. Clause 6.2:

	<p>Added the requirement to comply with Volume 4 NJUG guidelines for installation of cables in proximity to trees.</p> <p>Added requirement to ensure the safety of trenches comply with HSE publication HSG 150.</p> <p>Added the requirement to comply with ENA ER G12 for PME installations.</p> <p>Changed phase colour references from Red, Yellow, Blue to Brown, Black, Grey.</p> <p>Clause 6.3 Plant:</p> <p>Added requirement for installations to incorporate adequate distances around plant for carrying out subsequent operation, inspection, maintenance and testing activities.</p> <p>Added “to moisture ingress” after “exposure”.</p> <p>Added requirement for plant generally to be installed in accordance with the manufacturer’s instructions including those for lifting, bolting down and venting/pressure relief.</p> <p>Added requirement for substation signage to be fitted prior to energisation.</p> <p>Clause 6.4:</p> <p>Reference to ‘Black duct...’ for service cables changed to ‘Black or red duct, as specified by the Host DLH,...’.</p> <p>Clause 6.5:</p> <p>Installation requirements for multi-occupancy premises have been aligned with ENA publication for ER G87.</p> <p>Clause 6.5.3: Clarified “fire proof enclosure” as “...meeting the relevant requirements defined in the Building Regulations and Fire Safety Regulations...”.</p> <p>Clause 6.5.5: Clarified “fire resistance” as “...meeting the relevant requirements defined in the Building Regulations and Fire Safety Regulations...”.</p> <p>Minimum height above floor level for meters changed from “450 mm” to “500 mm” as defined in MOCOPA Schedule 5, 5(B).</p> <p>Clause 7:</p> <p>Added requirements to record link box locations, where applicable and date of manufacture for installed plant.</p> <p>Updated reference to record cables and joints in accordance with HAUC publication, <i>Code of Practice for Recording of Underground Apparatus in Streets</i>.</p> <p>Appendix A:</p> <p>Added sheath test.</p> <p>General:</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 3”.

This EREC replaces and supersedes ER G81 Part 3 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 1-3 are associated with low voltage (LV) housing development installations and associated new HV/LV distribution substations, where the requirements are documented as follows:

- Part 1 – Design and planning.
- Part 2 – Materials specification.
- Part 3 – Installation and records (this document).

Since ER 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 “should” is used to express a recommendation. 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 installation and recording of new low voltage underground electricity networks and associated distribution substations for housing developments undertaken under the Ofgem Competition in Connections regime. This document is one of the following suite of documents governing this work.

- Adoption Agreement².
- Design and planning framework (EREC G81 Part 1).
- Materials specifications framework (EREC G81 Part 2).
- Installation and records framework (EREC G81 Part 3).
- Underground unmetered connections framework.

This document must be read in conjunction with these documents as some issues, for example equipment ratings, are dependent both 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 installation and recording requirements which have to be met for a Host DLH to adopt contested LV networks and associated new HV/LV distribution substations for housing developments. This includes housing developments 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 only applies to connections to single-occupied premises and street lighting installations although some relevant design aspects associated with multi-occupied premises, e.g. blocks of flats, 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 connections. These are subject to separate consideration (see ER G83).

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 8567, *Specification for outdoor electricity meter cupboards*

Energy Network Association publications³

ENA TS 12-23, *Polythene warning tape and polythene protection tape for buried electricity supply cable*

ENA TS 12-24, *Plastic ducts for buried electric cable*

ENA TS 37-2, *Public electricity network distribution assemblies*

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

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

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

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)*

ERep 2, *Guidance on security of substations, cable bridges & cable tunnels*

National Joint Utilities Group (NJUG) publications

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

Volume 2, *NJUG Guidelines on the Positioning of Underground Utilities Apparatus for New Development Sites*

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 SMRS

Ofgem agreed publications

The Distribution Code

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

Standard Conditions of the Electricity Distribution Licence

Other publications

Highways Authorities and Utilities Committee (HAUC) Publication, *Code of Practice for Recording of Underground Apparatus in Streets*

3 Terms and definitions

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

3.1

Applicant

company wishing to undertake the contestable work

3.2

BS

British Standard

3.3

BS EN

European Standard adopted as a British Standard

3.4

BSI

British Standards Institution

3.5

CDM

Construction (Design and Management) Regulations 2015

3.6

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.

3.7

Distribution Service Area (DSA)

service area of a DLH

3.8

ENA

Energy Networks Association

3.9

ENA TS

Energy Networks Association Technical Specification

NOTE: Engineering Recommendations issued by the ENA after 2010 may also be abbreviated as "EREC".

3.10

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.

3.11

ESQCRs⁴

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

3.12

Host DLH

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

3.13

housing development

development consisting of domestic dwellings

3.14

HSE

Health and Safety Executive

3.15

HV

high voltage exceeding 1 000 V a.c.

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

3.16

IDNO

Independent Distribution Network Operator

NOTE: An IDNO is a DLH.

3.17

IEC

International Electrotechnical Commission

3.18

LV

low voltage not exceeding 1 000 V a.c.

3.19

NRSWA

New Roads and Street Works Act

3.20

Ofgem

Office of Gas and Electricity Markets

3.21

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.

4 Legislation

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

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

- a) Ancient Monuments and Archaeological Areas Act 1979.
- b) Asbestos at Work Regulations 2002.
- c) Building Regulations (applicable to the location)^{5,6}.
- d) Confined Spaces Regulations 1997.
- e) Conservation of Habitats and Species Regulations 2010.
- f) Construction (Design and Management) Regulations 2015 (as amended).
- g) Contaminated Land (England) Regulations 2006⁷.
- h) Control of Noise at Work Regulations 2005.
- i) Control of Substances Hazardous to Health Regulations 2002.
- j) 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.
- k) Electricity at Work Regulations 1989.
- l) Electricity Safety, Quality and Continuity Regulations 2002 (as amended)⁸.
- m) Electricity Works (Environmental Impact Assessment) (England & Wales) Regulations 2000 (as amended).
- n) Environment Act 1995.
- o) Environmental Protection Act 1990. Health & Safety at Work etc Act 1974.
- p) Land Drainage Act 1991.
- q) Lifting Operations and Lifting Equipment Regulations 1998.
- r) Management of Health & Safety at Work Regulations 1999.
- s) Manual Handling Operations Regulations 1992 (as amended).
- t) New Roads and Street Works Act 1991 (NRSWA)⁹.
- u) Provision and Use of Work Equipment Regulations 1998. Regulatory Reform (Fire Safety) Order 2005¹⁰.
- v) Town and Country Planning Act 1990
- w) Town and Country Planning (General Development Procedure) Order 1995.
- x) Utilities Contract Regulations 2006 (as amended).
- y) Water Resources Act 1991.
- z) Wildlife and Countryside Act 1981.
- aa) Workplace Health, Safety and Welfare Regulations 1992.

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.

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 And all related Codes of Practice and Specifications.

¹⁰ Referred to as Fire Safety Regulations.

5 General

Networks must be such that they are installed and tested consistent with provision of a reliable and safe system of electricity supply.

This framework is subject to some local variation between DLHs because, for example, of differences in:

- substation specification;
- environment and impact on ratings, insulation, corrosion etc.;
- compatibility with existing equipment;
- installation practices;
- record systems.

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

6 Installation

6.1 General

The installation of all plant and equipment to be adopted by the Host DLH shall meet the requirements of the listed references, all applicable legislation and the details in Clause 6. It must be noted that ratings will be influenced by the installation arrangement and reference shall be made to the Design and Planning framework (EREC G81 Part 1) and Appendices regarding equipment ratings.

All plant and equipment installed shall comply with the requirements of the Materials Specifications framework (EREC G81 Part 2) and Appendices.

The installation shall be such as to permit future live low voltage working on the asset by the Host DLH.

6.2 Underground cables

There shall be no material change to routes, installation depths, ducting, proximity to other cables, ducting etc. (to the extent that it affects design criteria) detailed in previously submitted plans unless otherwise agreed in writing with the Host DLH and other interested parties.

Cable shall be laid at minimum depths as Volume 1 NJUG Guidelines, unless otherwise agreed, and shall be recorded. The maximum depth of cables shall be in accordance with Host DNO requirements as specified in Appendix B.

In addition, the requirements of Regulation 14 of the ESQCRs to protect and/or mark cables to avoid damage or danger associated with future excavation shall be complied with. Installation of cables in proximity to trees shall be as Volume 4, NJUG Guidelines, unless otherwise agreed.

Trenches shall be prepared so that the bottom of the trench is free of rubble, sharp stones, flint etc., and an adequate layer of sand or other suitable bedding has been laid. Where a change of level is necessary, the bottom of the trench shall rise or fall gradually. Precautions to ensure the safety of trenches shall comply with HSG 150.

Ducts shall be laid at least 300 mm below the carriageway construction and shall extend to the outer extremities of the kerb haunchings. Checks shall be made that all installed ducts are undamaged and are not obstructed (including any ducts laid as spare for future use). Duct mouths shall be sealed to prevent ingress of water, noxious or explosive liquids or gases. Ducts shall be suitably spaced to avoid congestion at either end to facilitate future jointing. Spare ducts shall be installed by the Applicant at positions agreed with the Host DLH.

Wherever a winch is employed to pull the cable, rollers and skid plates shall be used in the trench to ensure that the cable does not touch the ground during pulling. A cable stocking, fitted with a swivel, must be used to connect the bond to the cable and a dynamometer used to check that the maximum pulling tension for the cable is not exceeded.

Cable laying shall only take place when the ambient temperature is above 0 °C and has been above this temperature for the previous 24 hours. Alternatively, special precautions agreed with the Host DLH shall be taken to maintain cables above this temperature to avoid risk of damage during handling.

Cables shall not be bent further than their minimum bending radius.

The cable shall be correctly spaced from other cables and other utility services, in accordance with NJUG specifications.

Earth conductors and rods shall be laid in accordance with the previously submitted plans. The requirements of ESQCR 9 (2) (a) apply in relation to the need for earths to be installed at the remote end of the main, during each stage of the energisation programme. Where applicable, the requirements of ER G12 shall be followed for PME installations.

Before backfilling, a visual inspection shall be carried out to ensure the cable is free from damage. After laying, the cable shall be backfilled with suitable graded fine fill material to tape level and the correct marker tape laid, in compliance with the ESQCRs and Host DLH policy.

Cable, jointing and ducting materials shall comply with the Host DLH specification or an agreed equivalent.

Jointing practice shall be in accordance with a specification agreed with the Host DLH.

Unless agreed otherwise with the Host DLH, joints shall be made 'Colour True'.

- a) For new installations this shall be Brown - 1, Black - 2, Grey - 3, Blue – Neutral.
- b) For jointing of existing cables this shall be Red – 1, Yellow – 2, Blue – 3, Black – Neutral.

Cable terminations shall be made with correct phase connections.

Service connections shall be made to the correct phase as shown on network drawings.

Phase and neutral conductors shall be separately identified and marked close to the supply terminals as Regulation 24(3) of the ESQCR.

The number of service cables and service connections taken from a single joint shall not exceed the number agreed with the Host DLH; that number being the maximum the Host DLH would accept for work undertaken directly on its own behalf.

Where a DLH employs such a system, a unique permanent labelling system shall be applied to the joint giving the jointer's name and the name of the organisation the work was carried out by.

The Applicant must provide a Completion Certificate, signed by the jointer, for each joint made. These shall be kept in the health and safety file, together with copies of the inspection forms.

NOTE: The preparation or revision of a health and safety file is a requirement of the CDM Regulations. The health and safety file contains information necessary for future construction, maintenance, refurbishment or disposal of network assets to be carried out safely, and will be retained by the Host DLH.

6.3 Plant

Installations of HV/LV distribution substations shall follow Host DLH standards detailed in Appendix B. This may include such issues as plant layout, enclosure type (incorporating correct installation of internal arc pressure relief), compliance with the ESQCRs and associated Guidance, security requirements, substation labels etc. Any enclosures or materials shall conform with requirements stated in EREC G81 Part 2. Installations shall incorporate adequate distances around plant for carrying out subsequent operation, inspection, maintenance and testing activities.

Plant delivered from manufacturers shall be unloaded and stored in a way that avoids damage or exposure to moisture ingress.

Plant shall be installed in accordance with the manufacturer's instructions including those for lifting, bolting down and venting/pressure relief.

The Host DLH shall supply plant and substation numbering signage, property ownership and "Danger of Death" signs, which shall be fitted prior to energisation.

6.4 Service entries

Service entry policy may vary between Host DLHs – see information in Appendix B of Design and Planning framework (EREC G81 Part 1) document for details.

Volume 2 NJUG Guidelines shall be implemented unless otherwise stated by the Host DLH.

Cavity service entry shall not normally be permitted as this de-rates the service cable.

If site specific arrangements do not allow service entries to be installed in the normal manner then, as a minimum, the following shall be taken into account.

- a) The air temperature surrounding the cut-out must not exceed a value, typically 30 °C, that would exceed the environmental condition requirements of the cut-out, meter and associated connections.
- b) All meter cabinets must be installed in a way that maintains the manufactured fire resistance values.

Service ducting shall be installed from the service position to the point where the service cable will be jointed onto the main. The service cable shall be drawn by hand into this duct. Black or red duct, as specified by the Host DLH, shall be used for electrical service cables, to prevent confusion with other utility services (see EREC G81 Part 4 for approved ducts).

The Applicant shall provide phase marking on cut-out terminals.

6.5 Multi-occupancy dwellings

6.5.1 General

The following additional clauses apply to installations for multi-occupancy dwellings. There are a number of different approaches which are employed in various DLH service areas on the design of connections to multi-occupancy dwellings such as flats and maisonettes. The following paragraphs describe the most common practices, not all will necessarily be accepted by Host DLH; refer to Appendix B for any Host DLH variations.

6.5.2 LV cable entry to building

The LV cable entry to a building shall comply with Clause 4.1.2 of ER G87, unless specified otherwise by the Host DLH in Appendix B.

6.5.3 LV intake position accommodation

A suitable secure and fire proof enclosure meeting the relevant requirements defined in the Building Regulations and Fire Safety Regulations shall be provided for accommodating the cut-out and distribution board (when required) in a suitable common access location that meets the requirements of ER G87, in particular, Clause 4.1.1 [of ER G87].

Communal meter/service enclosures shall not be used for other purposes posing increased risk to equipment, risk of fire or risks to operatives.

The size of the enclosure is dictated by the equipment installed and the need for adequate working space. The minimum separation from electrical service equipment to any gas meter or gas pipe joints and the average ambient temperature inside the enclosure shall comply with the requirements in ER G87, in particular, Clause 6.6.2.

Where the building entrance is normally locked for security reasons or there is no alternative means of escape, the LV enclosure should be sited in an external wall, where access to the LV enclosure is unrestricted. If outside doors are used these shall be lockable, weatherproof and vandal resistant. See Appendix B for Host DLH requirements on locks.

6.5.4 Lateral connections

Developers are responsible for the design, construction and installation of the service cable routes within the building. The design route/cable length used to calculate voltage drop shall not be exceeded.

The routing and method of installation of mains and service cables shall comply with ER G87, in particular, Clause 4.2.

Mains and service cables must not be installed in the same duct as non-electrical services. Where not ducted, cables must be clipped to cable tray(s). Where a multi-service shaft is provided, the electrical installation [to be adopted] must be compartmented to provide a fire barrier from the other services. Every vertical duct, shaft or trunk must have internal barriers to prevent excessive heat rise at the top. The maximum separation between barriers is 1 floor or 5 metres, whichever is less. After installation of cabling fire stopping shall be carried out using suitable materials, for example, cement mortar, gypsum based plaster, cement or gypsum based vermiculite/perlite mixes, intumescent mastics, proprietary sealing systems, rockwool or as specified differently by the Host DLH in Appendix B. The method of ducting should be agreed with the Host DLH taking account of the derating factor of the current carrying capacity of the cables.

If service or mains cables pass through a part of the building required to have a minimum fire resistance period, the installation must maintain the integrity of the fire resistance.

Minimum fire resistance periods are listed in the Building Regulations, to which reference must be made.

6.5.5 LV meter positions

Meter cabinets shall be fire resistant meeting the relevant requirements defined in the Building Regulations and Fire Safety Regulations, and of a type approved by the Host DLH conforming to BS 8567. Meter positions shall be accessible from communal areas. Meters should be positioned so that they are installed not less than 500 mm and not more than 1 800 mm from the floor.

Meter positions shall either be separated by 2 metres, or effectively screened or effectively bonded against the risk of electric shock by simultaneous touch under earth fault conditions.

LV group meters and switchgear must be clearly and permanently identified to the appropriate dwelling by a secure label supplied and installed by the developer.

All other requirements for installation of metering in multi-occupancy dwellings shall comply with Clause 6 of ER G87.

6.5.6 Bonding

The bonding of the electrical installations must be in accordance with BS 7671. The developer shall ensure that PME bonding shall include bonding to metal services as close as possible to their point of entry into the building and to accessible steelwork.

Each dwelling shall be regarded as separate and treated in the same way as individual houses, irrespective of any bonding carried out elsewhere, e.g. where communal services enter the building.

All other requirements for installation of earthing/bonding in multi-occupancy dwellings shall comply with Clause 5 of ER G87.

6.6 Work in contaminated land

Where work is to take place in contaminated land, special precautions will need to be established to cover in particular, the following.

- a) Prevention of the creation of pathways, for example by trenching, allowing the movement of contamination.
- b) Prevention of damage or reduction in normal life of assets as a result of contamination, e.g. by the removal of contamination, creation of barriers or use of specific resistant materials.
- c) The CDM file shall include:
 - i. details of the contamination survey; and
 - ii. worker risk mitigation both during installation and during subsequent service life to asset removal.

7 Records

It shall be the responsibility of the Applicant to provide the Host DLH with accurate records of the installation. These records shall include the following.

- a) For all installed cables and joints, plans showing:
 - i. route;
 - ii. depth;

- iii. cable types and sizes;
 - iv. duct lengths and sizes;
 - v. joint locations;
 - vi. joint and service phasing;
 - vii. earth rod location(s);
 - viii. link box locations (where applicable).
- b) For all installed plant:
- i. location;
 - ii. manufacturer;
 - iii. date of manufacture;
 - iv. type;
 - v. rating(s);
 - vi. serial number(s).

The accuracy requirements and means by which plans are provided to the Host DLH shall be the same as would apply if the work was undertaken directly for the Host DLH. The Host DLH shall provide the Applicant with information in Appendix B to facilitate this.

Relevant requirements of Highway Authorities and Utilities Committee (HAUC) publication *Code of Practice for Recording of Underground Apparatus in Streets* shall be met including requirements for accuracy and recording distances from fixed reference points to facilitate accurate cable location in future.

8 Tests

The Applicant shall perform tests on the complete installation to verify that it has been correctly installed, it is functional, it is safe to energise and customers may be safely connected. Appendix A provides a list of typical test requirements.

The extent of tests required, the test acceptance criteria and the format for recording test results will be specified by the Host DLH in Appendix B.

Appendix A (normative)

Test requirements

Each service

- a) Polarity/phase rotation (3 phase).
- b) Insulation resistance 500/1 000V.
- c) Earth loop impedence.

Each new section of main

- a) Insulation resistance ph-ph and ph-n/earth 500/1 000 V.
- b) Continuity.

Each PME electrode

- a) Earth resistance.

Earthing resistance

- a) Overall value measured at substation.
- b) At HV/LV substation:
 - i. combined HV/LV earth resistance;
 - ii. separate HV and LV earth resistance;
 - iii. overlap (depends on achieving < 1 ohm).

LV fuse cabinet

- a) Insulation resistance 500/1 000 V.

HV/LV transformer

- a) Insulation resistances HV to LV winding/earth.
- b) Pressure test.
- c) Voltage and phasing checks.
- d) Tap setting check.
- e) Oil moisture content.
- f) Oil electric breakdown strength.
- g) Statement on polychlorinated biphenyl (PCB) content < 2 ppm new oil.

HV Switchgear

- a) Insulation resistance 5 kV.

- b) Pressure test.
- c) Protection test, secondary injection or dummy HV fuse tester (e.g. B&S device¹¹).
- d) Functional test of interlocks and operation.
- e) Insulation test any loose test devices.
- f) Busbar resistance if work includes connection of busbars (i.e. new to new or new to existing).
- g) Gas pressure (if gas filled).

HV Cables

- a) Insulation resistance 5 kV.
- b) Pressure test:
 - i. Brown, Black and Grey combined to earth;
 - ii. Brown and Black combined to Grey;
 - iii. Grey and Brown combined to Black.
- c) Continuity.
- d) Sheath test.

Fault Passage Indicators

- a) Functional test of operation, indication(s), alarm(s) and communications, as applicable.

Automation Equipment

- a) Functional test of remote control operation, position indication(s), alarm(s).
- b) Check mechanical disconnection/reconnection of actuator from switch
- c) Commissioning test of RTU functions and communications

¹¹ B&S device is a proprietary device used to replicate the operation of a HV fuse of the striker pin type.

Appendix B (normative)

Host DLH requirements – Typical example only

The following is only provided as an indication of the type of information which would be included by the Host DLH in this Appendix.

Service entries (Clause 6.4)

Volume 2 NJUG Guidelines shall be implemented with the exception that cavity service entry shall not normally be permitted as this de-rates the service cable.

The meter cabinet and installation arrangement shall be one of the types agreed with the Host DLH (ongoing need to hold spare doors etc.). These arrangements shall be agreed in advance and documented, with appropriate drawings.

If alternative arrangements are considered the following shall be taken into account.

- a) The air temperature surrounding the cut-out must not exceed 30 °C.
- b) All meter cabinets must be installed in a way that maintains the manufactured fire resistance values.

Specific requirements for multi-occupancy dwellings (Clause 6.5)

Substations (Clause 6.9)

- a) Installation standards for new substation buildings.
- b) Installation standards for substation enclosures.
- c) Land requirements for buildings, plinth and enclosures.
- d) Substation labels
- e) Approved glass reinforced plastic (GRP) enclosures

Asset recording (Clause 7)

- a) Principles of recording cables.
- b) Taking measurements using triangulation.
- c) Extended sight lines and right angles.
- d) Chain lines.
- e) Same feature recording.
- f) Other data to be recorded on site.
- g) Recording of cable sections.
- h) Process of cable recording.
- i) Example of cable sketch.

Testing (Clause 8)

- a) Extent of tests required.
 - b) Test acceptance criteria.
- Format for recording test results.

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).