



# Engineering Recommendation G81 Part 2

Issue 2 2016

Framework for new low voltage housing  
development installations

Part 2 Materials specification

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Revised, 2016

### Amendments since publication

Issue	Date	Amendment
1	2004	First issue
1 + A1	2008	Amendment 1: Reference to ENA Technical Specification 41-26 removed. 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. Clause 3: Added definitions of IDNO. Amended term “ER” to include “EREC”. 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: Reworded such that protection of buried assets is a mandatory requirement. Aligned this clause with ENA ER G87/1 including inserting appropriate cross-references in place of requirements. Changed requirement for cables to be low smoke zero halogen. Deleted sentence relating to harmonisation of phase colours.

		<p>Added new paragraph and requirements for conformity assessment to ENA TS and various Assessment Panels.</p> <p>Clarified “fire resistance” as “...meeting the relevant requirements defined in the Building Regulations and Fire Safety Regulations...”.</p> <p>Added requirement for meter cabinets to conform to BS 8567.</p> <p>Clause 6.2:</p> <p>Added new requirement that options that exist within relevant Standards publications, which are not specified in this document or DLH Appendices, are agreed with the Host DLH.</p> <p>Added requirement for Applicants to be responsible for ensuring that materials are checked prior to installation and for test results to be obtained and reviewed.</p> <p>Added requirement for plant to be unloaded and stored in a way that avoids safety risks and risk of theft.</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 2”.

This EREC replaces and supersedes EREC G81 Part 2 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 (this document).
- Part 3 – 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 high voltage cables<sup>1</sup>. 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 (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.

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<sup>1</sup> See Ofgem decision letter dated 8 May 2012 [1].

## 1 Scope

This document sets out the materials specification requirements for 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 governing this work.

- Adoption Agreement<sup>2</sup>.
- 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 materials specification requirements which have to be met for a Host DLH to adopt contested LV networks and associated new HV/LV distribution substations on 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 principally 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 and Host DLH Appendix.

This suite of documents does not include any requirements in respect of generator connections 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 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 31, *Specification steel conduit and fittings for electrical wiring*

NOTE: This Standard is current, obsolescent (see BS 4568-1, BS EN 60423 and BS EN 61386-1).

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<sup>2</sup> Also known as "Agreement to Adopt".

BS 4568-1, *Specification for steel conduit and fittings with metric threads of ISO form for electrical installations. Steel conduit, bends and couplers*

BS 6946, *Specification for metal channel cable support systems for electrical installations*

BS 7654, *Specification for single-phase street lighting cut-out assemblies for low-voltage public electricity distribution systems. 25 A rating for highway power supplies and street furniture*

NOTE: To be read with BS EN 60947-1 (as amended).

BS 7657, *Specification for cut-out assemblies up to 100 A rating, for power supply to buildings*

NOTE: To be read with BS EN 60947-1 (as amended).

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

BS 7870-3.40, *LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for distribution cables of rated voltage 0,6/1 kV. XLPE insulated, copper wire waveform concentric cables with solid aluminium conductors*

BS 7870-4.10, *LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for distribution cables with extruded insulation of rated voltages of 11 kV to 33 kV. Single-core 11 kV to 33 kV cables\*\**

BS 7870-4.20, *LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for distribution cables with extruded insulation for rated voltages of 11 kV to 33 kV. Three-core 11 kV cables\*\**

BS 7888-4.1, HD 629.1 S2, *Test requirements on accessories for use on power cables of rated voltage from 3,6/6(7,2) kV up to 20,8/36(42) kV. Cables with extruded insulation*

BS 7888-4.2, HD 629.2 S2, *Test requirements on accessories for use on power cables of rated voltage from 3,6/6(7,2) kV up to 20,8/36(42) kV. Cables with impregnated paper insulation*

BS 7933-1, HD 631.1 S2, *Electric cables. Accessories. Material characterisation. Fingerprinting and type tests for resinous compounds*

BS 8567, *Specification for outdoor electricity meter cupboards*

BS EN 50085, *Cable trunking systems and cable ducting systems for electrical installations.*

BS EN 50393, *Test methods and requirements for accessories for use on distribution cables of rated voltage 0,6/1,0 (1,2) kV*

NOTE: This Standard relates to complete LV cable joints and has replaced BS 7888-1, BS 7888-2 and BS 7888-3.

BS EN 60269-1, BS 88-1, *Low-voltage fuses. General requirements.*

BS EN 60423, *Conduit systems for cable management. Outside diameters of conduits for electrical installations and threads for conduits and fittings*

BS EN 60598-1, *Luminaires. General requirements and tests*

BS EN 60947-1, *Low-voltage switchgear and controlgear. General rules*

NOTE: See also ER C81, ER C79 and BS HD 60269-2, BS 88-2 for link boxes.

*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*

NOTE: BS 88-5 fuses are now referred to as BS HD 60269-2, BS 88-2 fuse system I gU fuse-links with wedge tightening contacts.

*BS HD 60269-3, BS 88-3, Low-voltage fuses. Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications). Examples of standardized systems of fuses A to F*

NOTE: BS 1361 fuses are now referred to as BS 88-3 fuse system C.

*CENELEC HD 620 S2, Distribution cables with extruded insulation for rated voltages from 3,6 (7,2) kV up to and including 20,8/36 (42) kV\*\**

NOTE: BS 7870-4.10 is the UK implementation of HD 620 Parts 100 and 110.

\*\*NOTE: HV cables (complying with appropriate selection of options from the documents) may be selected from the listed ENA TS, CENELEC HD or IEC documents.

### **Energy Networks Association publications<sup>3</sup>**

*ENA TS 09-07, PVC and XLPE insulated concentric service cables with stranded copper or solid aluminium phase conductors and copper concentric neutral conductors*

*ENA TS 09-9, Low voltage 3-phase polymeric insulated copper wire concentric cables with solid aluminium phase conductors*

*ENA TS 09-12, Impregnated paper insulated corrugated aluminium sheathed 6 350/11 000 volts cable\*\**

*ENA TS 09-17, Single core cables for use in substations having extruded insulation and rated voltages of 6 350/11 000 and 19 000/33 000 volts\*\**

NOTE: Single core cables to ENA TS 09-17 may also be used outside substations, where agreed with the Host DLH.

*ENA TS 09-22, Protection of cable installations against the effects of fire*

*ENA TS 12-11, Dry cable terminations in HV switchgear for service at rated voltages 12, 24 and 36 kV*

*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 35-1 Part 1, Distribution transformers, Common clauses<sup>4</sup>*

*ENA TS 35-1 Part 2, Distribution transformers, Ground mounted transformers — not close-coupled<sup>4</sup>*

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<sup>3</sup> ENA documents can be obtained via the ENA web site: [www.energynetworks.org](http://www.energynetworks.org)

<sup>4</sup> Schedules that accompany each Part of ENA TS 35-1 may be applicable

ENA TS 35-1 Part 3, *Distribution transformers, Ground mounted transformers — close-coupled<sup>4</sup>*

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*

ENA TS 41-36, *Switchgear for service up to 36 kV (Cable and Overhead Conductor Connected)*

ENA TS 43-94, *Earth rods and their connectors*

\*\*NOTE: HV cables (complying with appropriate selection of options from the documents) may be selected from the listed ENA TS, CENELEC HD or IEC documents.

ER C79, *Type tests for connectors and terminations for copper and aluminium conductors of insulated power cables*

ER C81/4, *Type approval tests for accessories for 600/1 000 volt cable systems*

ER C89, *Performance specification for terminations on polymeric insulated cables rated at 12 kV and 36 kV maximum system voltage*

ER C90/1, *Type approval tests for accessories for power cables with rated voltage from 3.6/6 kV up to and including 19/33 kV*

ER C92, *Performance specifications for pole top terminations on 6 350/11 000 volt paper insulated cables*

ER C93, *Type approval tests for mechanical connections to metallic sheaths of cables*

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

### **National Joint Utilities Group (NJUG) publications**

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

### **Balancing & Settlement Code**

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

### **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**

**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**

**Distribution Licence Holder (DLH)**

Holder of an Electricity Distribution Licence as defined in 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.

**3.6**

**Distribution Service Area (DSA)**

service area of a DLH

**3.7**

**ENA**

Energy Networks Association

**3.8**

**ENA TS**

Energy Networks Association Technical Specification

**3.9**

**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.

**3.10**

**Harmonised Document (HD)**

IEC Standard adopted as a European reference document

**3.11**

**Host DLH**

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

**3.12**

**housing development**

development consisting of domestic dwellings

**3.13**

**HSE**

Health & Safety Executive

### **3.14**

#### **HV**

high voltage exceeding 1 000 V a.c.

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

### **3.15**

#### **IDNO**

Independent Distribution Network Operator

NOTE: An IDNO is a DLH.

### **3.16**

#### **IEC**

International Electrotechnical Commission

### **3.17**

#### **LV**

low voltage not exceeding 1 000 V a.c.

### **3.18**

#### **Ofgem**

Office of Gas and Electricity Markets

## **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)<sup>5,6</sup>.
- b) Confined Spaces Regulations 1997.
- c) Construction (Design and Management) Regulations 2015 (CDM).
- d) Control of Noise at Work Regulations 2005.
- e) Control of Substances Hazardous to Health Regulations 2002.
- f) 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.
- g) Electricity at Work Regulations 1989.
- h) Electricity Safety, Quality and Continuity Regulations 2002 (as amended)<sup>7</sup>.
- i) Health & Safety at Work etc Act 1974.
- j) Lifting Operations and Lifting Equipment Regulations 1998.
- k) Management of Health & Safety at Work Regulations 1999.
- l) Manual Handling Operations Regulations 1992 (as amended).
- m) Provision and Use of Work Equipment Regulations 1998.

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

<sup>6</sup> Requirements of related current approved documents also apply.

<sup>7</sup> And associated Guidance documents issued by DTI (now BIS) including URN 06/1294 [1].

- n) Regulatory Reform (Fire Safety) Order 2005<sup>8</sup>.
- o) Town and Country Planning (General Development Procedure) Order 1995.
- p) Utilities Contract Regulations 2006 (as amended)<sup>9</sup>.
- q) Workplace Health, Safety and Welfare Regulations 1992.

## 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.

## 6 Materials

### 6.1 General

Materials shall be new and meet:

- a) the requirements of the listed references (see 3);
- b) all applicable legislation (see 4); and
- c) the duty and rating requirements imposed by the design.

The requirements in EREC G81 Part 1 relating to equipment ratings and the need to protect buried assets in contaminated land (see EREC Part 3) shall be followed. Such protection shall be afforded by means agreed with the Host DLH. For example, removal of contaminant or creation of barriers, and/or the selection of specific resistant materials.

Due to differences in DLH networks, there will be variations on type and ratings of equipment employed. See Appendix A for further information on specifications and Host DLH requirements.

A number of different approaches are employed in various DSAs for connections to multi-occupancy dwellings such as flats and maisonettes. Material requirements associated with multi-occupied premises shall be in accordance with ER G87 and the Host DLH Appendices [EREC G81]. 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. Where required by the Host DLH, cable materials shall be low smoke zero halogen.

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<sup>8</sup> Referred to as Fire Safety Regulations.

<sup>9</sup> For equivalent Regulations in Scotland refer to the Utilities Contract (Scotland) Regulations 2006.

Cables shall be in accordance with European harmonised cable colours (Black, Brown, Grey phases with Blue Neutral).

Host DLHs will require evidence that certain proposed equipment (e.g. HV switchgear) to be supplied has demonstrated compliance with the relevant specification (e.g. ENA TS 41-36). It is important to note that manufacturers may make a range of equipment types of the same or similar designation and that not all versions will necessarily be compliant with the relevant ENA TS. Assessment will be simpler if the equipment proposed has a current certificate of conformity issued by the relevant ENA Assessment Panel (e.g. Switchgear Assessment Panel), though this does not preclude other designs being offered.

Should other designs be offered, it must be noted that additional time will be needed for the Host DLH to undertake a conformity assessment, and that this timescale will also be governed by the manufacturer's speed in providing information such as evidence of relevant type testing of the equipment actually being offered. Any Host DLH specific requirements (e.g. associated with HV test access, cables or VT isolation) are detailed in Appendix A.

## 6.2 Provision of materials

The Applicant shall arrange for procurement of materials which meet Host DLH requirements, in accordance with agreed lists of manufacturers and equipment specified in Host DLH Appendices to this document. Information shall be provided to the Host DLH that allows conformance and quality assessments to be made for materials of a non agreed source. The level of information required shall be pertinent to the complexity of the equipment and/or materials being considered and shall follow European Public Procurement type criteria<sup>10</sup>.

It should not normally be necessary to provide copies of material specifications to the Applicant or their proposed Supplier, as the Supplier will normally have copies of relevant specifications. If a DLH uses its own specification, a copy will be provided to the Supplier. If it is necessary to provide an ENA publication, this can be obtained from the ENA<sup>11</sup>.

NOTE: The Applicant is expected to obtain any Standards publications <sup>12</sup> that they require.

The Applicant shall ensure that any options that exist within relevant Standards publications, which are not specified in this document or DLH Appendices, are agreed with the Host DLH.

The Applicant shall be responsible for ensuring that materials, in particular cables and accessories, are checked prior to installation to ensure they have been supplied to the correct specification and quality requirements for the application. Where appropriate, test results to be provided by the Supplier shall be obtained and reviewed by the Applicant to ensure requirements have been met. This is particularly important for main plant items (e.g. switchgear, transformers, LV substation cable distribution boards etc).

Plant delivered from Suppliers shall be unloaded and stored in a way that avoids damage, exposure to moisture, safety risks and risk of theft.

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<sup>10</sup> See the Utilities Contract Regulations 2006 (as amended) and the Utilities Contract (Scotland) Regulations 2006 (as amended).

<sup>11</sup> ENA documents can be obtained via the ENA web site: [www.energynetworks.org](http://www.energynetworks.org).

<sup>12</sup> National Standards documents can be obtained via the BSI website: <http://shop.bsigroup.com/>.

## Appendix A (normative)

### Data specific to Host DLH – Typical example

This is an example of the type of data (for example a list of Suppliers already agreed) that would be inserted into Appendix A 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.

**Table A.1 — List of agreed Suppliers – Example**

Item	National specification	Agreed suppliers	Size/Ratings
Earth Rods	ENA TS 43-94	W Furse Nottingham; or CBS Products Oakham	
Fuses (LV)	BS88 Part 5	Cooper UK Ltd Bourton On Wold Leicestershire; or GEC Alsthom Liverpool; or MEM Tyseley Birmingham	82 mm & 92 mm slot sizes Ratings as agreed

Etc.

**FOR EXAMPLE ONLY**

## **Bibliography**

### **Other publications**

[1] *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)