

# Engineering Recommendation **G81 - Part 5**

Issue 1

Amendment 1 – January 2008



energy**networks**  
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 Technical Specification 41-26 Removed.

Reference to Electricity Safety Quality and Continuity Regulations 2002 changed to refer to document amended in 2006.

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## 1 BACKGROUND

- a. This document was agreed by the Ofgem Electricity Connections Steering Group on October 12<sup>th</sup> 2004. This revision extends the scope to include previously developed (“brownfield”) sites as well as the “Greenfield” sites previously covered.
- 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. This document sets the materials specification requirements for 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 materials specification 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 legislation referred to within this document.

### 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 / ESI publications

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

Engineering Recommendations (ER)

C79	Type approval tests for connectors and terminations for aluminium conductors of insulated power cables.
C81/4	Type approval tests for accessories for 600/1000 volt cable systems
C89	Performance specification for terminations on polymeric insulated cables rated at 12kV and 36kV maximum voltage
C90/1	Type approval tests for straight joints for 6350/11000 volt three core MIND paper insulated solid type cables
C92 part 1	Performance specifications for pole top terminations on 6350/11000 volt paper insulated cables
C93	Type approval for mechanical connectors to metallic sheaths of cables
G12/3	Requirements for the application of protective multiple earthing to low voltage networks
G39/1	Model code of practice covering electrical safety in the planning installation commissioning and maintenance of public lighting and other street furniture
P17	Current rating guide for Distribution Cables

### **3.2 Energy Networks Association Technical Specifications (ENATS)**

ENATS 09-07	PVC and XLPE insulated concentric service cables with stranded copper or solid aluminium phase conductors and copper concentric neutral conductors
ENATS 09-12	Impregnated paper insulated corrugated aluminium sheathed 6350/11000 volt cable **
ENATS 09-17	Single core cables for use in substations having extruded insulation and rated voltages of 6350/11000 and 19000/33000 volts ( note used outside substations too ) **
ENATS 12-03	Outdoor meter cupboards
ENATS 12-23	Polythene protection tape for buried electricity supply cable
ENATS 12-24	Plastic ducts for buried electric cable
ENATS 35-1	Distribution transformers (from 16 kVA to 100 kVA)
ENATS 37-2	LV distribution fuseboards
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)*
ENATS 43-94	Earth rods and their connectors

\* Note 2 – HV Cables (complying with appropriate selection of options from the documents) may be selected from the listed EATS, HD or IEC documents

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

NJUG 10	Guidelines for the planning, installation and maintenance of utility services in proximity to trees.
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### **3.4 Health & Safety Executive (HSE) publications**

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

### **3.5 Pooling & Settlement Agreement**

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

### **3.6 Ofgem agreed publications**

Distribution Code

Distribution Licence Conditions

### **3.7 British Standards**

BS 31	Specification steel conduit and fittings for electrical wiring.
BS 88 Pts 1 & 5	Cartridge fuses for voltages up to and including 1000.V ac & 1500 V dc - Specification of supplementary requirements for fuse links for use in ac electricity supply networks.
BS 731	Flexible Steel Conduit
BS 1361	Specification for cartridge fuses for ac circuits in domestic and similar premises
BS 1858 Pt 2	Specification for bitumen based filling compounds for electrical purposes
BS4533	Luminaries
BS 4648	Cable Trunking Part 1: Steel Surface Trunking Part 2: Steel Underfloor Trunking
BS 6099:	Conduits for electrical installations Part 1: Specification of General Requirements Part 2: Specification for rigid non-flame propagating conduits of Insulating materials
BS 6910 Pt 1	Cold pour resin compound and heat shrink cable joints in the voltage range up to 1000V ac and 1500V dc
BS 6946:	Specification for metal channel cable support systems for electrical installation

BS 7671	Requirements for Electrical Installations (IEE Wiring Regulations. 16 <sup>th</sup> edition)
BS 7654	Specification for single phase street lighting fuses (cut outs) for low voltage public electricity distribution systems. 25A rating for highway supplies and street furniture. (read with BS EN 60947 pt 1)
BS 7657	Specification for fuses (cut outs), ancillary terminal blocks and interconnecting units up to 100A rating, for power supplies to buildings. (read with BS EN 60947 Pt 1)
BS 7870 Pt 3.4	Polymeric insulated, combined neutral/earth (CNE) cables with solid aluminium phase conductors and concentric copper or aluminium wire waveform neutral/earth conductor
BS 7888	LV and MV accessories for power cables with rated voltage from 0.6/1kV up to and including 20.8/36kV
BS EN 60255	Specification for electrical protection relays
BS EN 60688	Electrical measuring transducers for converting A.C. electrical quantities to analogue or digital signals.
BS EN 60898	Circuit breakers for overcurrent protection for household and similar installations
BS EN 60947 Pt 1	Specification for low voltage switchgear and controlgear.
BS EN 61508	Functional safety of electrical / electronic / programmable electronic safety related systems

### 3.8 International and European Standards

HD 620	Distribution cables with extruded insulation for rated voltages from 3.6kV to 36kV**
IEC 60502	Power cables with extruded insulation and their accessories for rated voltages from 1kV up to 30kV **
IEC 60947	Link boxes (see also, at present, ERs C81, C79 and BS 88)

\*\* Note – HV Cables (complying with appropriate selection of options from the documents) may be selected from the listed ENATS, HD or IEC documents.

#### **4 LEGISLATION**

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

Building Regulations (and its related current Approved Documents)

Confined spaces regulations 1997

Construction (Design Management) Regulations 1994

Construction Health, Safety & Welfare Regulations

Control of Substances Hazardous to Health Regulations 1999

EC Utilities Directive 93/38/EEC and UK SI 1996 No 2911

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.

Electricity Safety Quality and Continuity Regulations 2002, as amended 2006 ( and their associated Guidance documents issued by DTI)

Electricity at Work etc Regulations 1989

Health & Safety at Work Act 1974

Lifting Operations and Lifting Equipment Regulations 1998

Management of Health & Safety at Work Regulations 1999

Manual Handling Operations Regulations 1992

New Roads and Street Works Act and all related Codes of Practice and Specifications

Noise at Work Regulations 1989

Provision and Use of Work Equipment Regulations 1998

Town & Country Planning Act – General Development Order 1990

Workplace Health, Safety and Welfare Regulations

## 5 DEFINITIONS AND ABBREVIATIONS

OFGEM	Office of Gas and Electricity Markets
ADMD	After Diversity Maximum Demand
Applicant	The Company wishing to undertake the contestable work
BSI	British Standards Institution
BS	British Standard
BS EN	A European Standard adopted as a British Standard
CDM	Construction (Design Management) Regulations 1994
CNE	Combined neutral and earth (of cable construction)
Applicant	The Company wishing to undertake the contestable work
DLH	Distribution Licence Holder – defined in Standard Licence Conditions for Electricity Distributors, issued under the Utilities Act and effective from 1 <sup>st</sup> Sept. 2001
DSA	Distribution Service Area – the service area of a DLH
EA	Electricity Association ( replaced by ENA for Networks issues post Oct 2003)
ENATS	Energy Networks Association Technical Specification
ENA	Energy Networks Association
ER	National Engineering Recommendation issued by ENA or EA
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
PSCC	Prospective Short Circuit Current

## **6 INTRODUCTION**

- a. This framework describes the materials specification requirements for low voltage, 6.6kV and 11kV underground industrial and commercial connections, including their new associated HV and HV/LV distribution substations.
- b. This document 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
- c. Where a deviation from this framework is identified, it will be stated in the Appendices to this Technical Framework document.

## **7 MATERIALS**

### **7.1 General**

- a. Materials shall be new, meet the requirements of the listed references, all applicable legislation, and the duty and rating requirements imposed by the design. See also notes in ER G81 Part 4 on equipment ratings, and the need to protect buried assets in contaminated land. Such protection may be by agreed means, such as removal of contaminant or creation of barriers, and / or the selection of specific resistant materials.
- b. 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 variations.
- c. Multi-occupancy premises - There are a number of different approaches which are employed in various DLH service areas on requirements for connections to multi-occupancy premises such as offices and shops. LV meter cabinets shall be fire resistant and of a type approved by the Host DLH. Where employed by the Host DLH, cables shall be low smoke fume type.
- d. DLHs are currently seeking to establish programmes with their cable suppliers for the managed introduction of the new European harmonised cable colours (Black, Brown, Grey phases with Blue Neutral). This should be discussed with the Host DLH.
- e. Particular care is required in the specification, testing and certification of CTs and VTs for metering application, to meet the requirements of BSCP 520, which in some instances impose extended range accuracy requirements. Another important feature of BSCP 520 is that it's requirements are based on the rating of the connection not the size of the load.

- f. Host DLHs will require evidence that proposed HV switchgear to be supplied has demonstrated compliance with the relevant specification, such as ENATS 41-26 or 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 these ENATSs. Assessment will be simpler if the equipment proposed has a current certificate of conformity issued by the ENA Switchgear Assessment Panel against the relevant ENATS, though this does not preclude other designs being offered. Should such other design 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, for example on HV test access, cable or VT isolation, are detailed in Appendix A.
- g. "Systems" (in their broadest sense) which include electrical / electronic / programmable electronic features having a safety related function, may require assessment against BS EN 61508, to meet HSE requirements. In the context of this Framework Document, such systems might include:
- protection relays
  - switchgear interlocking, including test access points
  - automation systems
- h. The determination of applicability of BS EN 61508 is dependent upon both the equipment under consideration and the situation in which it is employed. Consequently there will be a need for discussion with the Host DLH to determine what requirements of BS EN 61508, if any, are applicable.
- i. Details of applicable SCADA controls, analogues, indications, RTUs and Meter Operator data collections systems etc shall be discussed with the Host DLH if not fully detailed in Appendix A.

## 7.2 Provision of materials

- a. The Applicant shall arrange for procurement of materials which meet Host DLH requirements (in accordance with an agreed list of manufacturers and equipment). For materials proposed to be provided of a currently non agreed source, information shall be provided to the host DLH that allows compliance and quality assessments to be made. The level of information required will be pertinent to the complexity of the equipment and/or materials being considered, and will follow European Public Procurement type criteria.
- b. 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 Technical Specification, this can be obtained from the ENA web site: [www.energynetworks.org](http://www.energynetworks.org)
- c. Plant delivered from manufacturers shall be unloaded and stored in a way that avoids damage or exposure to moisture.

**APPENDIX A: DLH SPECIFIC DATA – Typical Example Only**

*Below is an example only of some data that might be included here, for example a list of suppliers already agreed. This appendix to be populated and updated as necessary by each DLH*

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

Etc.

**FOR EXAMPLE ONLY**