

Engineering Recommendation **G81 - Part 7**

Issue 1

Amendment 1 – January 2008



energy**networks**
association

Framework for contestable diversionary and reinforcement underground and overhead works not exceeding 33kV and HV/LV distribution substations



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Summary of Amendments:

Reference to ENA Engineering Recommendation G70 replaced with ENA Technical Report 136

Reference to ENA Engineering Recommendation L38 replaced with L38/1

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.

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2 BACKGROUND

2.1 This document was agreed by the Ofgem Electricity Connections Steering Group on 23rd January 2007

2.2 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.

3 SCOPE

This document sets out design and planning, materials specification, inspection and records requirements for contestable diversionary and reinforcement works on underground cables and overhead lines not exceeding 33kV and on HV/LV distribution s/s

The following suite of documents already set out requirements for elements of such diversionary and reinforcement work, and their content also applies here –

- Adoption Agreement
- Design and Planning framework (ER G81 Parts 1 & 4)
- Materials Specifications framework (ER G81 Parts 2 & 5)
- Installation and Records framework (ER G81 Parts 3 & 6)
- Underground unmetered connections framework

This part of G81 serves to amplify and extend the requirement of these documents to relate to the above contestable diversionary and reinforcement works, and must be read in conjunction with them, as their content is not duplicated here

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

3.3 It is intended to set out or make reference to requirements which have to be met for a Host DLH to adopt HV or LV diversionary or reinforcement works installed on a contestable basis.

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

4 REFERENCES

- 4.1 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.
- 4.2 NB The following references supplement those already set out in ER G81 parts 1-6

Energy Networks Association / ESI publications

Engineering Recommendations (ER)

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
G55/1	Safe Tree Working in Proximity to Overhead Lines
L38/1	Protective greasing of PVC covered copper and bare and PVC covered Aluminium based overhead line conductors.
P17	Current rating guide for Distribution Cables

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 09-20	Single core cables having cross linked polyethylene insulation and lead sheath for rated voltage 19 000 / 33 000 volts (Um = 36 000 volts)
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
ENATS 43-8	Overhead Line Clearances
ENATS 43-12	Insulated aerial bundled conductors erection requirements for LV overhead distribution systems,
ENATS 43-13	Aerial bundled conductors (ABC) insulated with cross-linked polyethylene for low voltage overhead distribution,
ENATS 43-14	Conductor fittings and associated apparatus for use with LV aerial bundled conductors,
ENATS 43-15	Insulator binds and equivalent helical fittings for overhead lines
ENATS 43-30	Low voltage overhead lines on wood poles,
ENATS 43-40	Specification for single circuit overhead lines on wood poles for use at high voltage up to and including 33 kV
ENATS 43-88 Part 1	Selection and treatment of wood poles and associated timber for overhead lines. (Part 1: Technical Requirements)

ENATS 43-88 Part 2	Selection and treatment of wood poles and associated timber for overhead lines (Part 2: Essential quality requirements.)
ENATS 43-90	Anti-climbing devices and safety signs for HV lines up to and including 400kV,
ENATS 43-91	Stay strands and stay fittings for overhead lines
ENATS 43-92	Overhead Line Fittings
ENATS 43-93	Line Insulators
ENATS 43-94	Earth rods and their connectors
ENATS 43-95	Steelwork for overhead lines
ENATS 43-100	Conductor tensions and sags,
ENATS 43-101	Line and earth conductors,
ENATS 43-103	Low voltage overhead line temporary shrouding materials,
ENATS 43-105	Bi-metal connectors for line conductors,
ENATS 43-108	Suspension clamps for conductors,
ENATS 43-109	Bonds for earth conductors,
ENATS 43-110	Tension joints (mid span joints) for conductors,
ENATS 43-111	Non-tension joints and tee connectors for conductors,
ENATS 43-113	Vibration dampers for conductors,
ENATS 43-114	Anchor clamps for conductors,
ENATS 43-117	Installation of aluminium current carrying overhead line conductor fittings,
ENATS 43-119	Design and use of temporary scaffold guards,
ENATS 43-120	Fitting for XLPE covered-conductors for overhead lines (having rated voltages U_0/U greater than 0.6/1 kV
ENATS 43-121	Specification for single circuit overhead lines of compact covered construction on wood poles for use at high voltage up to and including 33 kV
ENATS 43-123	Performance criteria for fall prevention / fall arrest devices for use on poles whilst ascending and descending,

ENATS 43-124 Performance criteria for work positioning devices for prevention of falls on poles,

* Note 1 – Some designs of switchgear made to comply with ENATS 41-26 are still in manufacture and would not be assessed for compliance with ENATS 41-36. Unless otherwise specified, designs of equipment made to ENATS 41-26 shall also be acceptable.

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

Energy Networks Association Engineering Technical Reports – ENA ETR

ETR 132 Improving network performance under abnormal weather conditions by use of a risk based approach to vegetation management near electric overhead lines

ETR 136 Vegetation Management near Electricity Equipment – Principles of Good Practice

National Joint Utilities Group (NJUG) publications

NJUG 10 Guidelines for the planning, installation and maintenance of utility services in proximity to trees.

Health & Safety Executive (HSE) publications

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

Pooling & Settlement Agreement

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

Ofgem agreed publications

Distribution Code

Distribution Licence Conditions

British Standards

BS 31: Specification steel conduit and fittings for electrical wiring.

BS 88 Cartridge fuses for voltages up to and including 1000.V ac & 1500 V DC
Pts 1 & 5 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	Specification for bitumen based filling compounds for Pt 2 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 1c	Cold pour resin compound and heat shrink cable joints in the voltage range up to 1000V ac and 1500V d
BS 6946:	Specification for metal channel cable support systems for electrical installation
BS 7671	Requirements for Electrical Installations (IEE Wiring Regulations. 16 th 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	Polymeric insulated, combined neutral/earth (CNE) cables with solid aluminium phase conductors and concentric copper or aluminium wire waveform neutral/earth conductor (includes ABC)
BS 7884	Specification for Copper and copper-cadmium stranded conductors for overhead electric traction and power transmission systems.
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 50182	Conductors for overhead lines - Round wire concentric lay conductors.
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

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.

5.0 LEGISLATION

5.1 All requirements of all relevant legislation must be met.

The following is a list of **some** of the relevant legislation –

Ancient Monuments and Archaeological Areas Act 1979

Building Regulations (and its related current Approved Documents)

Confined spaces regulations 1997

Construction (Design Management) Regulations 1994

Construction Health, Safety & Welfare Regulations

Contaminated Land (England) Regulations 2000

The Control of Pollution (Oil Storage) (England) Regulations 2001

Control of Substances Hazardous to Health Regulations 1999

Countryside and Rights of Way Act 2000

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

Electricity Works (Environmental Impact Assessment) (England & Wales) Regulations 2000, as amended 2007

Environmental Protection Act 1990 & 1995

EU Habitats Directive 92/43/EEC – Special Areas of Conservation

Electricity Act 1989 as amended

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

Electricity at Work etc Regulations 1989

Fire Precautions Act 1971

Fire Precautions (Workplace Regulations 1997 as amended 1999)

Health & Safety at Work etc Act 1974

Land Drainage Act 1991

Lifting Operations and Lifting Equipment Regulations 1998

Management of Health & Safety at Work Regulations 1999

Manual Handling Operations Regulations 1992

Manual Handling Operations Regulations 1992

National Parks and Access to the Countryside Act 1949

National Parks are designated under the National Parks (Scotland) Act 2000

Nature Conservation (Scotland) Act 2004

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

Town and Country Planning (Scotland) Act 1997

Water Resources Act 1991

Wildlife and Countryside Act 1981

Workplace Health, Safety and Welfare Regulations

[Traffic Management Act – expected to come into force shortly]

6.0 DEFINITIONS and ABBREVIATIONS

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
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)
ENATS – Electricity 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
HSE – Health & Safety Executive
IEC – International Electrotechnical Commission
NRSWA – New Roads and Street Works Act
OFGEM – Office of Gas and Electricity Markets
TMA – Traffic Management Act

7.0 INTRODUCTION

- 7.1 This document sets out design and planning, materials specification, inspection and records requirements for contestable diversionary and reinforcement works on underground cables and overhead lines not exceeding 33kV and on HV/LV distribution s/s
- 7.2 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
- 7.3 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. Where a deviation from this framework is identified, it will be stated in the Appendices to this Technical Framework document.
- 7.4 Within the scope of this document, the dismantlement of existing Host DLH assets and the design of reinforcement works are non-contestable.

8.0 PROGRAMMING

8.1 It is important that the Applicant and Host DLH discuss and agree at an early stage the programme of work relating to-

- approval of the Applicant's detailed design proposal (electrical, layout, civil, physical as applicable)
- materials approval,
- inspections
- provision of records
- outage programming, including requirements for other diversionary works and final connection into the existing system
- DLH dismantlement of redundant assets.
- Wayleaves / easements and construction access

8.2 The Adoption Agreement shall include provision to refresh and update the programme. Where the diversionary work entails work in the Highway, it is important to establish responsibilities at the outset for submission of streetworks notices including any need for long term advance notice in certain classifications of highway. The Adoption Agreement will need to cover NRSWA [and TMA] costs including notices, penalties and long term liabilities, such as for reinstatement works

9.0 OVERHEAD LINE WORKS

9.1 There are many interactions and interdependencies between the elements of line routing, design, consents, wayleaving and construction that are unique to overhead line work, which lead to significant contractual complexity and difficulty which is in the interest of no party. Consequently contestable work will, unless otherwise agreed, only be divided into pre-construction activity and construction activity, with all elements within the "bundle" being undertaken by the party. Where an environmental impact assessment is required, this might form part of wider study, e.g. a wind farm, and responsibility for undertaking it shall be agreed between the parties

Pre-construction activity

- Initial indicative route selection from exit point to Point of Connection
- Identification of Landowners and Tenants on initial route
- Liaison with Landowners and Tenants for permission to survey
- Detailed on site survey
- Liaison with Parish & Local Planning Authorities, Statutory Consultees, local interest groups
- Discussion with other Utilities
- Detailed design and profile of new overhead line to be agreed with Host DLH
- Compliance with ESQCR risk assessment requirements to be agreed with Host DLH (typically route, clearances, anti-climbing guards, additional notices, other physical protection and ongoing clearance to vegetation)
- Application for planning consent (Forms 10b or Transport and Works Act)

Construction activity

- Arranging permanent and temporary diversionary works of other assets / utilities to permit line construction
- Preparation of Safety Plan under Construction Design Management Regulations (CDM)
- Land access arrangements for construction materials storage, (and temporary site hut - if required
- Protection of road crossings and other obstacles
- Construction
- Handling of claims and compensation payments for access and land damage

9.2 Where the Applicant is undertaking the pre-construction activity, the Host DLH shall state the applicable loading criteria for the design (wind load, ice accretion), together with its policy on surge arresters in the Host DLH specific Appendix A to this document.

The Applicant shall submit; -

- their design,
- method statement for construction including maximum stringing tensions and means of controlling these
- ESQCR risk assessment
- proposed list of materials and suppliers

to the Host DLH and obtain agreement prior to the start of construction activity.

9.3 The design of the contested work shall be such that its construction does not encroach on safety and working access clearances to existing operational DLH assets. Whilst the closing energising connection is non-contestable, the design of the contested line will have an impact on the work necessary to complete that final connection. Consequently it is necessary to establish at the outset the final span configuration and that respective responsibilities in relation to provision and removal of temporary stays and for sagging (which might entail sagging of a section of the contested work) are established. Contested work shall not take place within the third party clearances stated in HS GS 6 unless otherwise agreed with the Host DLH.

9.4 Pre-commissioning inspection of the overhead line by the DLH shall include a walking inspection to confirm correct signage in place (Danger of Death plus any additional), support numbering, construction conformity with agreed design clearances, and anti-climbing guards

9.5 The following as erected documents for the contested works should be provided to the Host DLH by the Applicant in the formats agreed with the Host DLH–

- Route plan
- Line Profile [what CAD formats?]
- Wayleave agreements and easements

10 DESIGN AND PLANNING

Diversionsary works

- 10.1 The design of the diversion shall be such as to maintain the rating of the existing circuit or, where higher and applicable, match the rating of the newly installed contested circuit to which it is directly connected. (Further requirements are included in G81 Parts 1 and 4.)
- 10.2 The Host DLH may elect to opt for a design which exceeds these requirements, 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
- 10.3 The dismantlement of existing Host DLH assets is non contestable.

Reinforcement works

- 10.4 The design of reinforcement works is non-contestable. Where contestable reinforcement works are to be undertaken by the Applicant, the Host DLH will provide the design to enable them to work up a proposal covering materials, installation, records and programme etc for agreement with the DLH
- 10.5 The Host DLH may elect to opt for a design which exceeds the requirements for the minimum scheme reinforcement, 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. 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
- 10.6 The dismantlement of existing Host DLH assets is non contestable

11 PROVISION OF MATERIALS

- 11.1 This shall follow the arrangements set out in ER G81 Parts 2 and 4. 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.
- 11.2 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 it is necessary to provide an ENA Technical Specification, this can be purchased from Energy Networks Association, 18 Stanhope Place, London W2 2HH. If a DLH uses its own specification, a copy will be provided to the Supplier.
- 11.3 Plant delivered from manufacturers shall be unloaded and stored in a way that avoids damage or exposure to moisture, does not create a safety risk (e.g. conductor drums) or a risk of theft.

APPENDIX A

DATA SPECIFIC TO HOST DLH - Typical Only

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

Overhead line wind load	[units]
Overhead line ice load (or ENATS 43-40 classification)	[radial mm] [eg 4C]

Conductor types, sizes and maximum stringing tensions	[list]
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Policy on use of surge arresters