



Electricity Specification 400 C11

Low Voltage Mains Cables

Issue 10

May 2026

Amendment summary

Issue No/Date	Description
Issue 7 July 2021	An additional requirement for the maximum insulation thickness has been added in Section 10.3.3 to ensure insulating piercing connectors work satisfactory with the waveform cables. Other minor changes as marked. Prepared by: David M Talbot Approved by: Policy Approval Panel and signed on its behalf by Steve Cox, Engineering and Technical Director
Issue 8 August 2024	Updated to new ES template. No technical content changed. Prepared by: P Howell Approved by: Policy Approval Panel and signed on its behalf by Paul Turner, PAP Chairperson
Issue 9 January 2025	Shrinkage test of LSOH oversheath material added. Removal of requirement for dry curing of XLPE. Reference to Drum specification ES400 DS1 added. date of specification for solid aluminium Class 1 conductor profile. Prepared by: P Howell Approved by: Policy Approval Panel and signed on its behalf by Paul Turner, PAP Chairperson
Issue 10 May 2026	Updated to new template. Prepared by: Elizabeth Pattison Approved by: Technical Policy Panel and signed on its behalf by Paul Turner, PAP Chair

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1. Scope

This Specification covers the technical requirements for Low Voltage (LV) mains cables for use on the Electricity North West Limited (hereinafter referred to as SP Electricity North West) Distribution System.

2. Definitions

Approval	Sanction by the SP Electricity North West Underground Circuits Manager that specified criteria have been satisfied
Contract	The agreement between SP Electricity North West and the Contractor for the execution of the Works including therein all documents to which reference may properly be made in order to ascertain the rights and obligations of the parties under the said agreement.
Contractor	The person or person's firm or company, including personal representatives, successors and permitted assigns, who's Tender has been accepted by SP Electricity North West.
LSOH	Low Smoke, Zero Halogen
PVC	Poly Vinyl Chloride
Specification	The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.
Sub-Contractor	Any person (other than the Contractor) named in the Contract for any part of the Works or any person to whom any part of the Contract has been sub-let with the consent in writing of the SP Electricity North West Underground Circuits Manager, and the legal representatives, successors and assigns of such person.
Supplier	Any person or person's firm or company who supplies goods to SP Electricity North West or to its Contractor.
Tender	An offer in writing to execute work or supply goods at a fixed price.
Tenderer	The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by SP Electricity North West to submit a Tender.
XLPE	Cross linked Polyethylene

3. General Requirements for Approvals and Testing

3.1. Product not to be Changed

Compliance with this clause shall be in accordance with ES001.

3.2. SP Electricity North West Limited Technical Approval

Compliance with this clause shall be in accordance with ES001.

3.3. Quality Assurance

Compliance with this clause shall be in accordance with ES001.

3.4. Formulation

Compliance with this clause shall be in accordance with ES001.

3.5. Identification Markings

Compliance with this clause shall be in accordance with ES001.

3.6. Minimum Life Expectancy

The minimum life expectancy of all products covered by this Specification is 60 years.

3.7. Product Conformity

Compliance with this clause shall be in accordance with ES001.

3.8. Confirmation of Conformance

The Tenderer shall complete the conformance declaration sheets in [Appendix B](#).

Failure to complete these declaration sheets may result in an unacceptable bid.

4. Requirements for Type and Routine Testing

Compliance with this clause shall be in accordance with ES001.

4.1. Requirement for Type Tests at Suppliers Premises

Compliance with this clause shall be in accordance with ES001.

4.2. Requirement for Routine Tests at the Supplier's Premises

Compliance with this clause shall be in accordance with ES001.

5. Conditions of Installation

Cables specified in this Specification will be pulled or laid into open trenches, pulled into ducts or installed in air. Cables may also be installed directly by trenchless installation techniques.

During storage and after installation cables can be expected to be subjected to the full range of climatic conditions encountered in the UK.

Cables may be surrounded by ground water for most of their operating life. Where cables are installed in ducts, flooding of ducts can occur resulting in permanently wet sections along the cable route.

Cables installed above ground will be supported by means of cleats either vertically or horizontally and these cables may be exposed to direct sunlight for significant periods.

Cables may be installed on wood poles in contact with the pole and, therefore, in contact with a pole preservation medium such as creosote.

Accessories may be cold applied or require application of heat.

6. Conditions of Operation for Power Cables

The following are the general conditions under which power cables purchased in accordance with this Specification are required to operate:

- Nominal system voltage 400/230 volts
- The working voltage of any part of the system does not normally exceed the normal system voltage by more than 10%.
- Nominal system frequency: 50Hz.
- The system operates with the neutral point earthed either directly or through a resistance or reactance at one or more points.

7. Cable Longevity

Reliability is paramount. When any Tender for LV mains cables is evaluated, preference will be given to proven established designs.

The Supplier shall demonstrate reliability for the offered design of the cable by providing evidence of satisfactory service life.

Cables offered shall be designed and manufactured to operate satisfactorily under the installation and operating conditions detailed in Section 5 and 6.

8. Technical Particulars

8.1. Technical Requirements

Where a requirement of this Specification differs from that of another quoted Specification or Standard, the requirements of this Specification shall apply.

If a Tenderer is unsure regarding any requirement of this Specification, clarification shall be sought in writing from SP Electricity North West.

8.2. Cable Design

This Specification covers the supply of the following types of Low Voltage Mains cables:

- a. Single phase; 400mm² Copper, XLPE insulated, unarmoured with PVC sheathed cable to BS7889
- b. Single phase; 400mm² Copper, XLPE insulated, aluminium wire armoured with PVC sheathed cable to BS5467
- c. Three and four core; 95, 185 and 300mm² Aluminium, XLPE insulated, copper wire waveform cable with PVC sheath to BS7870-3.40
- d. Three and four core; 95, 185 and 300mm² Aluminium, XLPE insulated, copper wire waveform cable with LSOH sheath to BS7870-3.50

8.3. Conductors

Phase conductors for single core cables shall be round stranded copper and shall comply to the requirements for stranded conductors (class 2) as specified in BS EN 60228.

Phase conductors for 3 and four core waveform cables shall be sectoral shaped solid aluminium and shall comply to the requirements for solid conductors (class 1) as specified in BS EN 60228. The conductors shall also conform to Class 1 requirements as specified in BS 7870-3.40 Clause 5.1. The conductors shall also conform to the dimensional requirements specified in BS 7870-3.40 Annex C Table C.1.

8.4. Insulation

The maximum permissible shrinkage of insulation on all Low Voltage Mains cables shall be 2%. The test shall be carried out at both 65°C for 24 hours and 130°C for 1 hour.

Single phase Low Voltage Mains cables insulation shall be XLPE type GP 8 conforming to BS 7655-1.3, or type GP 6 conforming to BS 7655-1.2.

Single phase cables shall have black insulation.

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Three or four core cables Phase core insulation shall be XLPE type DIX 3 complying with the requirements of BS 7870-1 Annex B.

Three phase Waveform Mains Cables shall have the cores laid up with a right-hand direction of lay in the sequence brown, black, grey for three core cables, and brown, black, grey, blue for four core cables.

Phase core insulation for three and four waveform cable types shall have a minimum average insulation thickness as defined in BS 7870-3.40 or 3.50 and in addition, the maximum insulation thickness at any point around the conductor shall be no more than the following values:

Cable Conductor Cross Section	Maximum Insulation Thickness at Any Point
95 mm ² Solid Sectoral Aluminium	1.5mm
185 mm ² Solid Sectoral Aluminium	2.0mm
300 mm ² Solid Sectoral Aluminium	2.2mm

8.5. Waveform Copper Wires

Three and four core waveform cables shall have plain annealed copper wires applied in waveform embedded on synthetic rubber. The wire diameter and formation shall comply with the requirements in BS7870-3.40 or BS7870-3.50.

The copper wires shall not stick to the synthetic bedding layer.

8.6. Oversheath

For single core cables, the oversheath shall be an extruded layer of black PVC material conforming to the requirements of Type 9 specified in BS 7655-4.2.

For three and four core waveform cables, depending on the specific cable, the oversheath shall be either:

- a. an extruded layer of black PVC DMV 23 complying to the requirements of BS 7870-1 Annex B and applied so that there is no internal protrusion of the oversheath material around the copper waveform wires.
- or
- b. an extruded layer of orange Low Smoke, zero halogen (LSOH) compound to type DMZ 4 to BS 7870-1, Annex B and applied so that there is no internal protrusion of the oversheath material around the copper waveform wires.

Maximum permissible shrinkage of any oversheath shall be 3% when subjected to a retraction test as defined in BS EN 60811

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In addition to the requirements for oversheath markings detailed in the relevant specification for each cable supplied, a unique reference number shall be embossed, indented or ink jet marked on the cable oversheath.

8.7. Cable Identification

Each delivery length of cable shall be allocated a unique reference number. This unique reference number shall be marked on the cable. This unique reference number will be used to identify all materials used within the manufacturing process. This number shall appear on the factory test sheet covering the cable length and shall be clearly marked on the drum on which the length is delivered and shall be referred to on all invoices and advice notes.

9. Manufacturing

At the time of Tender, the Tenderer shall provide details of manufacturing location(s) for each cable offered. For cables with extruded insulation, the Tenderer shall also provide details of extrusion and curing technology for each cable offered.

Any Approval granted will be site specific and will not be transferable to any other site without the prior written agreement of the SP Electricity North West Underground Circuits Manager.

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10. Type Tests

All cables offered shall be fully Type Tested and Qualified according to the requirements of the Technical Specification and Standards detailed for each cable type. The Tenderer shall provide Type Test certificates and Type Test reports, including details of independent witnesses, at the time of Tender.

Where a Tenderer wishes to offer a cable which has been Type Tested to an alternative Standard(s), full details of the alternative Standard(s) and how it differs from the Specified Standard(s) shall be provided at the time of Tender along with Type Test certificates.

11. Logistical Requirements

11.1. Cable Drums

The cable on the drum shall not be susceptible to damage during transit, storage and handling on site.

Drums used for 11kV cables shall have a maximum width of 1200mm and a maximum weight of 2500kg. Cable drums shall meet the requirements of ES400DS1.

All cable drums shall be returnable, and the Tenderer shall arrange to collect empty drums from the company's normal delivery locations. Tenderers shall state at the time of Tender their proposed cable drum sizes and weights for each cable type offered.

The ends of all cables shall be effectively sealed against the ingress of moisture by a method appropriate to the cable type. Tenderers shall detail at the time of Tender their proposed sealing arrangement for each cable type offered.

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The cable end projecting from the drum shall be protected from damage during transit, storage and handling on site.

Tenderers shall state at the time of Tender their proposed method of protection for each cable.

11.2. Drum labels

All cable drums shall be marked in accordance with the relevant cable specification or standard. The drum label shall also contain:

- SP Electricity North West commodity code
- Name of manufacturer
- Supplied length
- Rated voltage
- Number of cores
- Size of conductor
- Type of conductor material ("Cu" or "Al")
- Abbreviated description of cable construction
- Gross and nett weights
- Direction of rolling drum
- The metre marking start and end values
- The unique reference number

Cable drums may be stored for long periods outdoors. All drum labels shall remain legible and durable under these conditions

12. Technical Support

The required minimum level of support is as follows:

- Contractual or technical advice is to be available, in English, by telephone during normal working hours.
- Attendance at site by the manufacturer, or the manufacturer's representative within 5 working days of any request made by SP Electricity North West following identification of a defect or other major issue relating to the cable.

Tenderers shall provide details of the support available including contact details of Technical Support operatives.

13. Samples

During the Tender period the Tenderer shall submit samples for Approval as required by the SP Electricity North West Underground Circuits Manager. The samples will be of reasonable lengths to allow for any testing on suitability for the SP Electricity North West cable jointing system to be made.

Such samples shall remain the property of SP Electricity North West.

14. Cable Data Sheets

The Tenderer shall supply full Technical Data sheet for each cable type, detailing the following information:

- Cable Construction including cross sectional drawing
- Maximum dc resistance of phase conductor at 20°C in ohm/km.
- Maximum ac resistance of phase conductor at maximum conductor temperature in ohm/km.
- Equivalent star reactance at 50 Hz in ohm/km.
- Equivalent star capacitance in pF/km.
- Charge current per phase at normal voltage and frequency in mA/m.
- Zero sequence impedance $R_0 + jX_0$ in ohms/km.
- Minimum dynamic bending radius in mm.
- Minimum static bending radius in mm.
- Recommended pulling method and maximum pulling tension in kgF.
- The maximum continuous current carrying capacity per phase conductor for the following conditions:
 - In Air (shaded with no solar gain)
 - Laid direct in ground with Ground thermal resistivity (g) = 1.2 °C/W (see Note)
 - Laid direct in ground with Ground thermal resistivity (g) = 0.9 °C/W (see Note)
 - Drawn into a 150mm ID smooth wall plastic duct (one cable per duct) where g = 1.2 °C/W (see Note)
 - Drawn into a 150mm ID smooth wall plastic duct (one cable per duct) where g = 0.9 °C/W (see Note)

The following assumptions shall be made when quoting ratings:

- Single core cables are laid in touching trefoil.

- Depth of cover to top of LV cables is 500mm.
- Ground temperature = 15 °C.
- Air temperature = 25 °C.

Note – Data for conditions b), c), d) and e) are not required for single core 400mm² versions.

15. Documents Referenced

Health and Safety at Work Act 1974	
Control of Substances Hazardous to Health Regulations 2002	
Manual Handling Operations Regulations 1992	
BS EN ISO 9000:	Quality Management Systems.
BS EN ISO 14001: 2015	Environmental management systems. Requirements with guidance for use
BS 5467: 1997:	Specification for 600/1000 V and 1900/3300 V Armoured Electric Cables having Thermosetting Insulation.
BS EN 60228:	Conductors of insulated cables.
BS 7655:	Insulation and sheathing materials for cables.
BS 7870 -I	LV and MV polymeric insulated cables for use by distribution and generation utilities.
BS 7870 -3.40	Section 3.40: XLPE insulated, copper wire waveform concentric cables with solid aluminium conductors
BS7870- 3.50	Section 3.50: XLPE insulated, copper wire waveform or helical concentric cables with solid aluminium conductors, having low emission of smoke and corrosive gases when affected by fire.
BS 7889:	Specification for 600/1000 V Single-Core Unarmoured Electric Cables having Thermosetting Insulation.
CP311:	Equipment Approval Process.

ES400 DS1	Returnable Wooden Drums and Lifting Spindles used for Storage and Supply of Mains Conductors
ES001:	Main Specifications

Appendix A – Schedule of Cables

Item	Ordering Specification	Conductor Size (mm ²)	SP ENW Commodity Code
1	Cable, LV, single core, XLPE insulated, unarmoured to BS7889 (for use as transformer tails in <u>indoor</u> substations)	400	995246
2	Cable, LV, single core; XLPE insulated, armoured to BS5467 (for use as transformer tails in <u>outdoor</u> substations)	400	995247
3	Cable, LV, 3 core, waveform with PVC sheath to BS7870-3.40	95 185 300	003697 003700 003727
4	Cable, LV, 4 core, waveform with PVC sheath to BS7870.3.40	95 185 300	003735 000701 003759
5	Cable, LV, 3 core, waveform with LSOH sheath to BS7870-3.50 for enhanced fire performance	95 185 300	329253 995255 995256
6	Cable, LV, 4 core, waveform with LSOH sheath to BS7870-3.50 for enhanced fire performance	95 185 300	003760 003761 003762

Appendix B – Conformance Declaration

Section-By-Section Conformance With Specification

The Tenderer shall declare conformance or otherwise for each product/service or range of products/services, section-by-section, using the following Conformance Declaration Codes.

Conformance Declaration Codes:

N/A =	Clause is not applicable/appropriate to the product/service.
C1 =	The product/service conforms fully with the requirements of this clause.
C2 =	The product/service conforms partially with the requirements of this clause.
C3 =	The product/service does not conform to the requirements of this clause.
C4 =	The product/service does not currently conform to the requirements of this clause, but the manufacturer proposes to modify and test the product in order to conform.

Manufacturer:

Product/Service Description:

Product/Service Reference:

Name:

Company:

Signature:

Section-By-Section Conformance

Section	Section Topic	Conformance Declaration Code	Remarks * (must be completed if code is not C1)
3.1	Product not to be Changed		
3.2	SP Electricity North West Technical Approval		
3.3	Quality Assurance		
3.4	Formulation		
3.5	Identification Markings		
3.6	Minimum Life Expectancy		
3.7	Product Conformity		
3.8	Confirmation of Conformance		
4.1	Requirements for Type Tests at the Supplier's Premises		
4.2	Requirement for Routine Tests at the Supplier's Premises		
7	Longevity		
8.1	Technical Requirements		
8.3	Conductors		
8.4	Insulation		
8.5	Waveform Copper Wire Screen		

8.6	Oversheath		
8.7	Identification		
9	Manufacturing		
10	Type Tests		
11	Logistical Requirements		
12	Technical Support		
13	Samples		
14	Cable Data Sheets		
* Applicable specifications shall be stated in the Remarks column where alternatives are quoted within a section. The Remarks column shall also be used to indicate cases where the products or services exceed the quoted specifications.			

Additional comments: