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# Electricity Specification 400C13

Issue 7 August 2024

## Multipair & Multicore Auxiliary Cables

## Amendment Summary

| ISSUE NO. DATE | DESCRIPTION |
|---|---|
| **Issue 6**<br><br>**September 2021** | New template applied throughout.<br><br>Prepared by: D M Talbot<br><br>Approved by: Policy Approval Panel and signed on its behalf by Steve Cox, Engineering and Technical Director |
| **Issue 7**<br><br>**August 2024** | New template for ES documents applied.<br>Combined power and data cable added<br>Removal of requirement for waterproof compound over galvanised armour wires in multicore and multipair control cables.<br>Addition of requirement for multicore cables to be BASEC approved.<br>Commodity Codes for all current approved cable types added in Appendix A<br><br>Prepared by: P Howell<br><br>Approved by: Policy Approval Panel and signed on its behalf by Paul Turner, PAP Chairperson |

# Contents

# 1 Scope

This Specification covers the technical requirements for multicore and multipair auxiliary cables for use on the Electricity North West Limited (hereinafter referred to as Electricity North West) Distribution System.

The cables are used for providing control, signalling and data functions on the Electricity Noth West Network. They are not used to transmit electrical power as part of the Public Electricity Supply network.

It should be noted that not all the cable types in this specification are purchased under framework agreements. Appendix A lists cable types and their corresponding Electricity North West Commodity Code which currently have approved suppliers and may be purchased and stocked following a Tender. However, other cable types may be purchased on an occasional basis for specific projects under separate Purchase Orders, and therefore in these cases, the conditions set out in Section 3 shall not always apply. Aug 24

In all cases, all cables supplied must fully comply to the Technical Requirements in Section 8 of this specification.

# 2 Definitions

| | |
|---|---|
| **Approval** | Sanction by the Electricity North West Circuits Policy Manager that specified criteria have been satisfied |
| **Contract** | The agreement between 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 Electricity North West. |
| **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 Electricity North West Circuits Policy Manager, and the legal representatives, successors and assigns of such person. |
| **Supplier** | Any person or person's firm or company who supplies goods to 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 Electricity North West to submit a Tender. |

# 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 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 or cable ties 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.

Cables may be installed near transformers where there may be transformer oil.

Accessories may be cold applied or require application of heat.

# 6 Power System Conditions of Operation

The following are the general conditions under which multicore and multipair cables purchased in accordance with this specification are required to operate adjacent to:

- Nominal power system voltage (V): 11 000/6 360; 33 000/19 000 and 132 000/76 000.
- The working voltage of any part of the power system does not normally exceed the normal system voltage by more than 6%.
- Nominal power system frequency: 50Hz.
- The power system operates with the neutral point earthed either directly or through a resistance or reactance at one or more points.

# 7 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. The cross-linking process will be completely “Dry Cured,” and no water will be used during this process.

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

# 8 Technical Requirements

## 8.1 General

Cable technical characteristics shall be in accordance with ENA TS 09-6 unless stated otherwise.

The installation of Low Smoke Zero Halogen (LSZH) sheathed cables is not permitted due to its potential reduced chemical resistance to electrical insulating oils. The only exception to this shall be installations in complex or public buildings where the risk of smoke needs to be specifically addressed and managed. Where this issue is present the requirement should be documented as part of the risk assessment process detailed in CP357.

## 8.2 Multicore Protection and Control Cables

These cables are for internal substation use only for light current control, indication, alarm connections and protection CT and VT connections.

All cores shall be coloured white with black text numbered markings.

### 8.2.1 2.5mm$^2$ CSA Multicore Protection and Control Cables

Only 4, 7, 12 and 19 core cables shall be installed.

These cables shall comply with BS 7870 Part 8 Section 8.1

These cables shall be seven stranded 0.67mm diameter (i.e. 2.5mm$^2$ CSA = 7/0.67mm strands), circular copper conductors complying with BS EN 60228 (class 2); PVC insulation, PVC bedding, one layer of galvanized steel wire armour, and black PVC oversheath.

**NOTE:** 1.5mm$^2$ conductors are NOT permitted for these functions and SHALL not be used

### 8.2.2 4.0mm$^2$ CSA Multicore Protection and Control Cables

Only 7, 12 and 19 cores cables shall be installed.

These cables shall comply with BS 5467 and BS EN 60332.

These cables shall be seven strand 0.85mm diameter (i.e. 4.0mm$^2$ CSA = 7/0.85mm strands), circular copper conductors complying with BS EN 60228 (class 2); XLPE insulation, PVC bedding, one layer of galvanized steel wire armour, and black PVC oversheath.

### 8.2.3 6.0mm$^2$ CSA Multicore Protection and Control Cables

Only 7 cores cables shall be installed.

These cables shall comply with BS 5467 and BS EN 60332.

These cables shall be seven strand 1.04mm diameter (i.e. 6.0mm$^2$ CSA = 7/1.04mm strands), circular copper conductors complying with BS EN 60228 (class 2); XLPE insulation, PVC bedding, one layer of galvanized steel wire armour, and black PVC oversheath.

## 8.3 Multipair Control Cables

### 8.3.1 1/0.8mm Multipair Light Current Control Cables for Tele-control Signalling

These cables are for internal substation use only for connections from switchgear and protection panels to Remote Terminal Units.

Only 5, 10 and 20 pair cables shall be installed.

These cables shall be in accordance with ENA TS 09-6 Issue 8 Table E3b.

These cables shall have circular solid copper conductors of 0.8mm diameter (i.e. 0.5mm$^2$ CSA = 1/0.8mm strand) complying with BS EN 60228 as far as applicable, PVC insulation, PVC bedding, one layer of galvanized steel wire armour, and black PVC oversheath.

These cables shall be of the unfilled type.

The pairs shall be clearly identified by colours in accordance with the sequence detailed in ENA TS 09-6, and as Table 1 as follows:

**Table 1 – Details of pair layup and colour ID for 1/0.8mm Multipair Control Cables**

| No. of Cable Pairs | 5 | 10 | 20 |
|---|---|---|---|
| No. of pairs in centre | Filler | 2 | 1 |
| No. of pair in 1st layer | 5 | 8 | 6 |
| No. of pairs in 2nd layer | - | - | 13 |
| Pair No. 1 | Orange - White | Orange - White | Orange – White |
| Pair No. 2 | Red – Grey | Green - Black | Orange - White |
| Pair No. 3 | Blue – Brown | Orange - White | Red – Grey |
| Pair No. 4 | Red – Grey | Red – Grey | Blue – Brown |
| Pair No. 5 | Green - Black | Blue – Brown | Red – Grey |
| Pair No. 6 | - | Red – Grey | Blue – Brown |
| Pair No. 7 | - | Blue – Brown | Green - Black |
| Pair No. 8 | - | Red – Grey | Orange - White |
| Pair No. 9 | - | Blue – Brown | Red – Grey |
| Pair No. 10 | - | Green - Black | Blue – Brown |
| Pair No. 11 | - | | Red – Grey |
| Pair No. 12 | - | | Blue – Brown |
| Pair No. 13 | - | | Red – Grey |
| Pair No. 14 | - | | Blue – Brown |
| Pair No. 15 | - | | Red – Grey |
| Pair No. 16 | - | | Blue – Brown |
| Pair No. 17 | - | | Red – Grey |
| Pair No. 18 | - | | Blue – Brown |
| Pair No. 19 | - | | Red – Grey |
| Pair No. 20 | - | | Green - Black |

### 8.3.2 1/0.8mm Multipair 5kV Pilot Cables

These cables are for general communications and protection signalling connections between substations.

Only 7, 19, 37 and 61 pair cables shall be installed. Only unfilled types are permitted.

The cable shall be capable of withstanding a minimum 5kV DC test voltage for 1 minute between both conductor to conductor and conductor to armouring.

Unless otherwise specified, pilot cables installed between substations for the purpose of communications and protection signalling shall have an insulation rated to 5kV between cores and cores and armouring. Where studies determine a higher insulation level is required, cables with an insulation rated to 15kV between cores and cores and armouring shall then be installed (see Section 8.3.3).

These cables shall comply with BS 7870 Part 8 Section 8.2.

These cables shall have circular solid copper conductors of 0.8mm diameter (i.e. 0.5mm$^2$ CSA = 1/0.8mm strand) complying with BS EN 60228 as far as applicable, polyethylene insulation, polyethylene bedding, one layer of galvanized steel wire armour, and black PVC oversheath.

The cable sheath shall, in addition to the requirements of BS 7870 Part 8, be embossed with the conductor diameter and number of pairs, e.g. 0.8mm/37pr and indicate the cable is unfilled.

The pairs shall be clearly identified by colours in accordance with the sequence detailed in ENA TS 09-6, section 3.6 as shown in Table 2.

### 8.3.3 1/0.8mm Multipair 15kV Pilot Cables

These cables shall be capable of withstanding a minimum 15kV DC test voltage for 1 minute between both conductor to conductor and conductor to armouring.
They are for general communications and protection signalling connections between substations where a higher insulation level is required. Generally, this will only be a requirement for substations with very high Earth Potential Rise (EPR) values or where the pilot cables are routed in close proximity to 275kV and 400kV power circuits. The higher insulation rating of the pilot circuit shall be continued within the substation installation between the pilot termination point and the connected device (i.e. relaying equipment) at each end.

Only 7, 19, 37 and 61 pair cables shall be installed. Only unfilled types are permitted.

These cables shall comply with BS 7870 Part 8 Section 8.2.

These cables shall have circular solid copper conductors of 0.8mm diameter (i.e. 0.5mm$^2$ CSA = 1/0.8mm strand) complying with BS EN 60228 as far as applicable, polyethylene insulation, polyethylene bedding, one layer of galvanized steel wire armour, and black PVC oversheath.

The cable sheath shall, in addition to the requirements of BS 7870 Part 8, be embossed with the conductor diameter and number of pairs, e.g. 0.8mm/37pr and indicate the cable is unfilled.

The pairs shall be clearly identified by colours in accordance with the sequence detailed in ENA TS 09-6, section 3.6 as shown in Table 2.

**Table 2 - Details of pair layup and colour ID for 1/0.8mm Pilot Cables**

| No. of Cable Pairs | 7 | 19 | 37 |
|---|---|---|---|
| No. of pairs in centre | 1 | 1 | 1 |
| No. of pair in 1st layer | 6 | 6 | 6 |
| No. of pairs in 2nd layer | - | 12 | 12 |
| No. of pairs in 3rd Layer | - | - | 18 |
| Pair No. 1 | Red - Yellow | Red - Yellow | Red - Yellow |
| Pair No. 2 | Black - Violet | Black - Violet | Black - Violet |
| Pair No. 3 | Orange - Grey | Orange - Grey | Orange - Grey |
| Pair No. 4 | Green – Brown | Green – Brown | Green – Brown |
| Pair No. 5 | Orange - Blue | Orange - Blue | Orange - Blue |
| Pair No. 6 | Green - Brown | Green - Brown | Green - Brown |
| Pair No. 7 | Orange - White | Orange - White | Orange - White |
| Pair No. 8 | - | Black - Violet | Black - Violet |
| Pair No. 9 | - | Red - Yellow | Red - Yellow |
| Pair No. 10 | - | Green - Brown | Green - Brown |
| Pair No. 11 | - | Red - Yellow | Red - Yellow |
| Pair No. 12 | - | Green - Brown | Green - Brown |
| Pair No. 13 | - | Red - Yellow | Red - Yellow |
| Pair No. 14 | - | Green - Brown | Green - Brown |
| Pair No. 15 | - | Red - Yellow | Red - Yellow |
| Pair No. 16 | - | Green - Brown | Green - Brown |
| Pair No. 17 | - | Red - Yellow | Red - Yellow |
| Pair No. 18 | - | Green - Brown | Green - Brown |
| Pair No. 19 | - | Blue - White | Blue - White |
| Pair No. 20 | - | - | Black - Violet |
| Pair No. 21 | - | - | Red - Yellow |
| Pair No. 22 | - | - | Green - Brown |
| Pair No. 23 | - | - | Red - Yellow |
| Pair No. 24 | - | - | Green - Brown |
| Pair No. 25 | - | - | Red - Yellow |
| Pair No. 26 | - | - | Green - Brown |
| Pair No. 27 | - | - | Red - Yellow |
| Pair No. 28 | - | - | Green - Brown |
| Pair No. 29 | - | - | Red - Yellow |
| Pair No. 30 | - | - | Green - Brown |
| Pair No. 31 | - | - | Red - Yellow |
| Pair No. 32 | - | - | Green - Brown |
| Pair No. 33 | - | - | Red - Yellow |
| Pair No. 34 | - | - | Green - Brown |
| Pair No. 35 | - | - | Red - Yellow |
| Pair No. 36 | - | - | Green - Brown |
| Pair No. 37 | - | - | Blue - White |

**NOTE:** 61 pair cable has 4 layers with remaining 24 pairs. Construction and colours for centre, 1st, 2nd and 3rd layers are as per 37 pair. 4th layer starts with pair colours Black – Violet, followed by 22 pairs in Red – Yellow and Green – Brown sequence and ends with pair colours Blue – White.

## 8.4 LV Multicore Supply Cables

These cables are for internal substation use, primarily for connections from the substation LV distribution to items requiring an LV AC supply.

Only 3 and 4 core cables shall be installed.

These cables shall comply with BS 5467 and BS EN 60332. Cables purchased for specific projects outside of a Tender Agreement shall be BASEC approved. As per comment in Section 8.1, the use of cables with low smoke, zero halogen sheaths is not allowed unless it has been explicitly stated in any project documentation. Aug 24

Cables with a CSA up to, and including 35mm$^2$, shall have circular copper conductors of seven strands (of the appropriate diameter) complying with BS EN 60228 (class 2); XLPE insulation, PVC bedding, one layer of galvanized steel wire armour, and black PVC oversheath.

Cables with a CSA greater than 35mm$^2$, shall have circular copper conductors of multiple layers of strands (of the appropriate diameter) complying with BS EN 60228 (class 2); XLPE insulation, PVC bedding, one layer of galvanized steel wire armour, and black PVC oversheath.

3 core cables shall have cores coloured Brown, Black and Grey.

4 core cables shall have cores coloured Brown, Black, Grey, and Blue.

## 8.5 Combined Power and Data Cables

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These cables are for internal substation use, primarily for items requiring both a power supply and data/signal connection where the combined cable construction means only one cable needs to be installed, e.g. where ethernet is required to connect remote devices such as transducers to an RTU but also require power.

The general construction of the cable shall be the same as LV Multicore cables in Section 8.4, except only 3 core cables with cross sections no more than 4mm$^2$ shall be used.

3 core cables shall have cores coloured Brown, Blue and Green/Yellow and be laid up together with a complete Category 5 Enhanced 4 pair screened data cable conforming to BS EN 50173-1. The cores of the data cable shall be rated at the same voltage level as the power cores.

## 8.6 Cable Identification

In addition to the requirements detailed in the relevant specification for each type of cable supplied, a unique reference number shall be embossed or printed in the cable oversheath at regular intervals to enable batch traceability. This unique identifier / batch number shall also be referenced on drum labels and test documentation.

The Tenderer shall provide details of additional costs for the option of providing the text “Electricity North West” printed or embossed/indented onto to the conductor sheath to enable positive identification of ownership in event of theft.

# 9 Logistics Requirement

## 9.1 General Logistical Requirements

Tenderers shall state at the time of Tender their proposed cable drum sizes and weights for each cable type offered.

Cable drums may be stored for long periods outdoors and shall be constructed to be adequately durable to withstand normal transit, storage, handling, and environmental conditions expected on sites.

The cable on the drum shall not be susceptible to damage during transit, storage, and handling on site. Tenderers shall state at the time of Tender of any proposed method of protection for each cable type.

The ends of all cables shall be effectively sealed against the ingress of moisture by a method appropriate to the cable type. The cable end projecting from the drum shall be protected from damage during transit, storage, and handling on site. Tenderers shall detail at the time of Tender their proposed sealing arrangement for each cable type offered.

All wooden cable drums shall be returnable. Any Plywood reels used shall be stated as either non-returnable or returnable by the Tenderer. The Tenderer shall arrange to collect empty drums from the company's normal delivery locations.

## 9.2 Cable Drum Labelling

The drum label shall contain the following information:

- Electricity North West commodity code (if provided)
- Name of manufacturer
- Supplied length on drum
- Rated voltage
- Cable type
- Number of cores/pairs and size of conductor
- Gross and nett weights
- The metre marking start and end values
- The unique reference number

All drum labels shall remain legible and durable when stored outside for long periods.

# 10 Technical Support

During the Contract period, there may be questions arising regarding unusual or non-standard applications where advice will be required on matters such as cable ratings etc. The successful Tenderer(s) will be expected to support Electricity North West with technical advice on these matters.

# 11 Samples

During any Tender period, the Tenderer may be asked to submit samples for Approval as required by the Electricity North West Circuits Policy Manager. Such samples shall remain the property of Electricity North West.

## 12 Documents Referenced

| All references to documents listed below are to the latest versions, unless stated otherwise. | |
|---|---|
| **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:** | Environmental management systems. Requirements with guidance for use. |
| **BS EN 50173-1:** | Information technology. Generic cabling systems. General requirements |
| **BS EN 60228:** | Conductors of insulated cables. |
| **BS EN 60332:** | Tests on electric and optical fibre cables under fire conditions. |
| **BS 5467:** | Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1 000 V and 1 900/3 300 V for fixed installations. |
| **BS 7870 Part 8 Section 8.1:** | Single wire armoured and PVC sheathed multicore cables with copper conductors. |
| **BS 7870 Part 8 Section 8.2:** | Single wire armoured and PVC sheathed multipair cables with copper conductors. |
| **ENA TS 09-06:** | Auxiliary Multicore & Multipair Cables. |
| **CP311:** | Equipment Approval Process. |
| **CP357:** | Fire Risk Assessments for Operational Sites. |
| **ES001:** | Main Specifications |

## 13 Keywords

Cable; multicore; multipair

# Appendix A – Schedule of Cables

The following cable types are those purchased on a Framework Agreement arising from Tender.
See Section 1 Scope for details of cables not covered in Framework Agreements.

| ITEM NO. | ORDERING SPECIFICATION | NO. OF CORES/PAIRS | ENW Commodity Code |
|---|---|---|---|
| 1 | **Multicore Cable,** PVC/SWA/PVC with 7/0.67mm conductors (2.5mm$^2$)<br>See Section 8.2 | 4 | 000370 |
| | | 7 | 000380 |
| | | 12 | 000390 |
| | | 19 | 000400 |
| 2 | **Multipair Cable**<br>(Induced Voltages not exceeding 5kV)<br>Unfilled polythene insulated multipair cable with PVC oversheath, with core diameter of 1/0.8mm<br>See Section 8.3.2 | 7 | 000381 |
| | | 19 | 000382 |
| | | 37 | 000383 |
| | | 61 | 000384 |
| 3 | **Multipair Cable**<br>(Induced Voltages may exceed 5kV but not exceed 15kV)<br>Unfilled polythene insulated multipair cable with PVC oversheath, with core diameter of 1/0.8mm<br>See Section 8.3.3 | 7 | 000385 |
| | | 19 | 000386 |
| | | 37 | 000387 |
| | | 61 | 000388 |

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# 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** | **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** | **Requirement for Type Tests at Suppliers Premises** | | |
| **4.2** | **Requirement for Routine Tests at Suppliers Premises** | | |
| **7** | **Manufacturing** | | |
| **8.1** | **Technical: General** | | |
| **8.2** | **Multicore control Cables** | | |
| **8.3** | **Multipair Cables** | | |
| **8.4** | **LV Multicore Supply Cables** | | |
| **8.5** | **Combined Power & Data Cables** | | |
| **8.6** | **Cable Identification** | | |
| **9** | **Logistics Requirements** | | |
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