

# **Electricity Specification 400C3**

Issue 9 September 2021

Wood Pole Overhead Line Conductors (up to and including 132kV)





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## **Amendment Summary**

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07/09/21	Prepared by: D M Talbot
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## 1 Introduction

This Specification comprises general requirements for the Approval and testing of wood pole overhead line conductors used on the distribution network owned by Electricity North West Limited (Electricity North West), as Distribution Licensee and Service Provider.

## 2 Scope

This Specification covers conductors used on Electricity North West's wood pole overhead line system up to and including 132kV.

## 3 Definitions

AAAC	All Aluminium Alloy Conductor.
ABC	Aerial Bundled Conductor.
ACSR	Aluminium Conductor Steel Reinforced.
Approval	Sanction by the Electricity North West Overhead Line 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.
ENA ER	Energy Networks Association Engineering Recommendation.
ENA TS	Energy Networks Association Technical Specification.
HDAI	Hard-Drawn Aluminium.
HDCu	Hard-Drawn Copper.
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-



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	let with the consent in writing of the Electricity North West Overhead Line 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.

## 4 General Requirements for Approvals and Testing

## 4.1 Product not to be Changed

No change in the product, packaging or labelling shall be made after Approval has been granted without prior notice to the Electricity North West Overhead Line Circuits Policy Manager, and receipt of a written agreement to the proposed change from the Electricity North West Overhead Line Circuits Policy Manager.

## 4.2 Electricity North West Technical Approval

The Tenderer shall submit, with this Tender, proposals for testing which will demonstrate, to the satisfaction of the Electricity North West Overhead Line Circuits Manager, compliance with this Specification. Such tests shall be carried out without expense to Electricity North West.

Alternatively, technical reports and other data may be submitted that the Tenderer considers will demonstrate, to the satisfaction of the Electricity North West Overhead Line Circuits Policy Manager, compliance with this Specification. Acceptance of this evidence shall be at the discretion of the Electricity North West Overhead Line Circuits Manager but will not be unreasonably withheld.

Approval shall be 'factory specific' and is not transferable to another factory without the written Approval of the Electricity North West Overhead Line Circuits Policy Manager.

The Supplier and product shall comply with all the relevant requirements of Electricity North West documents EPD311 and CP311.

## 4.3 Quality Assurance

The Tenderer shall confirm whether or not Approval is held in accordance with a quality assurance scheme accredited under ISO 9000. If not, the Tenderer shall submit a statement of the quality assurance procedures employed to control the quality of the product, including the performance of Suppliers and Sub-Contractors.

The right is reserved for the repeat of such tests, from time to time, that the Electricity North West Overhead Line Circuits Policy Manager may deem to be reasonably necessary to demonstrate continued compliance with the Specification.



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The Tenderer shall submit, with the Tender, a list of tests and inspections which are carried out on the product prior to despatch which shall demonstrate, to the satisfaction of the Electricity North West Overhead Line Circuits Policy Manager, fitness for installation and service.

The Tenderer shall provide free of charge to Electricity North West such samples as may, in the opinion of the Electricity North West Overhead Line Circuits Policy Manager, be reasonably required for inspection and/or retention as quality control samples. The Electricity North West Overhead Line Circuits Policy Manager will confirm the requirement for samples at the time of Tendering.

The right is reserved for inspections to be made of Tenderer's facilities, from time to time, as deemed reasonably necessary by the Electricity North West Overhead Line Circuits Policy Manager to ensure compliance with this Specification and any Contract of which it forms a part.

The Tenderer shall submit, with the Tender, such details of product packaging disposal, as will enable Electricity North West to comply with the requirements of BS EN ISO 14001 - Environmental Management Systems.

#### 4.4 Formulation

The Tenderer shall submit, with the Tender, such details of the formulation and use of the product and associated substances as will enable Electricity North West to comply with the obligations of the Health and Safety at Work Act 1974 and the Control of Substances Hazardous to Health Regulations 2002, in the use, storage and disposal of the product. The Tenderer may stipulate, prior to submission of such information, that it is to remain confidential, and the Electricity North West Overhead Line Circuits Policy Manager will, if requested, confirm agreement to this prior to receipt of the information.

## 4.5 Identification Markings

The Tenderer shall submit, with the Tender, details of markings which it is proposed to apply to the product or packaging to identify manufacturing batches or items. The forms and content of such markings shall be subject to the Approval of the Electricity North West Overhead Line Circuits Policy Manager and shall in all cases include the Electricity North West approved description and commodity code number.

The Tenderer shall submit, with the Tender, such details of marking gross weight on components, assemblies and packages, as will enable Electricity North West to comply with the Health and Safety Manual Handling Operation Regulations 1992, for components, assemblies and packages supplied with a gross weight over 1kg. The forms and content of such markings shall be subject to the Approval of the Electricity North West Overhead Line Circuits Policy Manager.

## 4.6 Minimum Life Expectancy

The minimum life expectancies of all products covered by this Specification are:

- 40 years for aluminium based conductors.
- 75 years for copper based conductors.

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## 4.7 Product Conformity

Preference will be given to those Suppliers who can provide suitable product conformity certification to a recognised or specified standard, or an equivalent certification.

## 4.8 Confirmation of Conformance

The Tenderer shall complete the conformance declaration sheets in <u>Appendix D</u>. Failure to complete these declaration sheets may result in an unacceptable bid.

## 5 Requirements for Type and Routine Testing

The Electricity North West Overhead Line Circuits Policy Manager shall set out the requirement of the following tests to be carried out by the Supplier at the Supplier's cost.

## 5.1 Requirement for Type Tests at Suppliers Premises

These are a series of one-off type tests, which are carried out to ensure the satisfactory performance of the product design, under extremes of operating stresses, and of endurance, as may be appropriate, to be determined by the Electricity North West Overhead Line Circuits Policy Manager.

These may or may not be destructive tests.

## 5.2 Requirement for Routine Tests at the Supplier's Premises

These tests may be required to be carried out on every individual unit or component, as specified, or at some regular frequency to be determined by the Electricity North West Overhead Line Circuits Policy Manager.

The results of these tests may be required to be supplied to Electricity North West with each unit purchased or retained for inspection, at a period to be determined by the Electricity North West Overhead Line Circuits Policy Manager.

## **5.3** Requirement for On-Site Tests

These will normally be included within the scope of on-site commissioning but may be included if appropriate.

## 6 Technical Particulars

#### 6.1 General

Only the conductors listed in the appendices of this Specification shall be used on the wood pole overhead line system. Additionally:

- New or refurbished lines shall use only the conductors (as identified in the appropriate overhead line specification) listed in Appendix A of this Specification.
- Conductors identified as "for repair only" (Appendix B) shall be used only for this purpose, ie to match
  existing requirements. They shall not be used in the construction of new or refurbished lines, nor
  shall they be used to repair new lines built in accordance with this Specification. (Refer to the Note
  in Appendix B.)

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# **6.2** Specifications for Individual Wires used to Manufacture Conductors to BS EN 50182

Wires used to manufacture conductors to BS EN 50182 shall comply with:

- BS EN 50183 for aluminium-magnesium-silicon alloy wires.
- BS EN 50189 for zinc coated steel wires.
- BS EN 60889 for hard-drawn aluminium wires.
- BS EN 61232 for aluminium-clad steel wires.

## 6.3 Conductor Greasing

Specific greasing requirements for each conductor type are given in the appendices. Where conductor greasing is applicable, it shall also comply fully with ENA ER L38.

#### 6.4 Drums

All conductors shall be supplied on drums manufactured from timber and complete with battens sufficient in quantity to protect conductors during transport, storage and handling.

The drums shall be of such a design that they will withstand transport to site and usage appropriate to the erection of conductors by standard methods.

The drums shall conform to ES400C1.

## 6.5 Requirements for Approvals, Testing and Quality Control

Type Approval, Quality Assurance, Formulation and Labelling shall be in accordance with the requirements of the appropriate conductor specification (refer to <u>Appendix A</u> or <u>B</u> for the conductor/specification reference).

The quality control scheme applicable to Aluminium Alloy Conductors shall include the following test which shall be applied to each drum of completed conductor:

- A 50m length shall be pulled off the drum.
- During this operation the conductor shall not have any undue tendency to form into a helix.
- When released the conductor shall not have a tendency to recoil back towards the drum.

## 6.6 Confirmation of Compliance Schedule

Tenderers shall complete the Confirmation of Compliance Schedules (refer to Appendix D).

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## 7 Documents Referenced

	DOCUMENTS REFERENCED
Health and Safety at Work Act 1974.	
Control of Substances Hazardous to Health Regulations 2002.	
Manual Handling Operations Regulation 1992 (as amended).	
BS EN ISO 9000:	Quality management systems.
BS EN ISO 14001: 2000:	Environmental management systems. Requirements with guidance for use.
BS EN 50182:	Conductors for overhead lines. Round wire concentric lay stranded conductors.
BS EN 50183:	Conductors for overhead lines. Aluminium-magnesium-silicon alloy wires.
BS EN 50189:	Conductors for overhead lines. Zinc coated steel wires.
BS 6004:	Electric cables. PVC insulated, non-armoured cables for voltages up to and including 450/750 V, for electric power, lighting and internal wiring.
BS EN 60889:	Hard drawn aluminium wire for overhead line conductors.
BS EN 61232:	Aluminium-clad steel wires for electrical purposes.
BS 6485:	PVC-covered conductors for overhead power lines.
BS 7884:	Specification for copper and copper-cadmium stranded conductors for overhead electric traction and power transmission systems.



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ENA TS 43-13:	ABC Insulated with Cross-Linked Polyethylene for LV Overhead Distribution.
ENA ER L38:	Overhead Line Conductors – Protection Against Corrosion by the Application of Anti-Corrosion Grease During Manufacture.
SS 4241463 Edition 4:	Covered stranded conductors for overhead lines with rated voltage up to and including 24 kV - Design and testing.
EPD311:	Approval of Equipment.
CP311:	Equipment Approval Process.
ES400C1:	Specification for drumming and supply of Overhead Line conductors.
ES400O2:	Overhead-Lines of Compact-Covered-Construction for 11/6.6 kV: Design and Construction.
ES400O3:	Bare-Wire Overhead-Lines on Wood Poles for 11/6.6 and 33 kV: Design and Construction.
ES400O4:	LV ABC Overhead Lines and Services.

## 8 Keywords

Overhead; Conductor;



# Appendix A – Conductors for New or Refurbished Line Construction: Specific Requirements

## **A1 – Plain Stranded Hard Drawn Copper Conductors**

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATIO N	CONDUCTO R GREASING	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, HDCu, 38mm <sup>2</sup> (7/2.65)	BS 7884	N/A		013198	
Conductor, HDCu, 70mm <sup>2</sup> (7/3.55)	BS 7884	N/A		013196	
Conductor, HDCu, 100mm <sup>2</sup> (7/4.3)	BS 7884	N/A		013199	

## **A2 – Plain Stranded Aluminium Alloy Conductors**

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION *	CONDUCTOR GREASING ENA ER L38	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, AAAC, 25mm <sup>2</sup> (Almond) (7/2.34)	BS EN 50182	Cat 4		013668	
Conductor, AAAC, 50mm <sup>2</sup> (Hazel) (7/3.3)	BS EN 50182	Cat 4		013684	
Conductor, AAAC, 100mm <sup>2</sup> (Oak) (7/4.65)	BS EN 50182	Cat 4		013676	
Conductor, AAAC, 150mm <sup>2</sup> (Ash) (19/3.48)	BS EN 50182	Cat 4		013688	
Conductor, AAAC, 175mm² (Elm) (19/3.76)	BS EN 50182	Cat 4		013677	
Conductor, AAAC, 200mm <sup>2</sup> (Poplar) (37/2.87)	BS EN 50182	Cat 3		013690	
Conductor, AAAC, 300mm² (Upas) (37/3.53)	BS EN 50182	Cat 3		013920	

<sup>\*</sup> Individual wires shall comply with the appropriate specification as listed under Technical Particulars.

## A3 - Aerial Bundled Conductors (ABC)

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION	CONDUCTOR GREASING	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, ABC, 2x35mm <sup>2</sup>	ENA TS 43-13	N/A		012092	
Conductor, ABC, 3x35mm <sup>2</sup>	ENA TS 43-13**	N/A		012105	
Conductor, ABC, 4x35mm <sup>2</sup>	ENA TS 43-13	N/A		012106	
Conductor, ABC, 4x35mm², double insulated	ENA TS 43-13*	N/A		012107	
Conductor, ABC, 5x35mm <sup>2</sup>	ENA TS 43-13**	N/A		012108	
Conductor, ABC, 2x95mm <sup>2</sup>	ENA TS 43-13	N/A		012122	
Conductor, ABC, 3x95mm <sup>2</sup>	ENA TS 43-13**	N/A		012075	
Conductor, ABC, 4x95mm <sup>2</sup>	ENA TS 43-13	N/A		012076	
Conductor, ABC, 5x95mm <sup>2</sup>	ENA TS 43-13**	N/A		012077	

<sup>\*</sup> This conductor shall generally be as specified in ENA TS 43-13, but with double insulation.

#### ABC shall be ribbed as follows:

- 2- and 3-core: Phase -1 rib; Neutral fully ribbed; Earth ( $3^{rd}$  core) smooth (no ribbing).
- 4- and 5-core: L1 1 rib; L2 2 ribs; L3 3 ribs; Neutral fully ribbed; Earth (5<sup>th</sup> core) smooth (no ribbing).

## A4 – Compacted Covered Conductors (AAAC)

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION	CONDUCTOR GREASING	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, Compacted Covered, 50mm <sup>2</sup>	SS4241463 edition 4	N/A		011570	
Conductor, Compacted Covered, 120mm <sup>2</sup>	SS4241463 edition 4	N/A		011572	
Conductor, Compacted Covered, 185mm <sup>2</sup>	SS4241463 edition 4	N/A		493191	

<sup>\*\*</sup> The third and fifth cores of 3- and 5-core ABC, respectively, are insulated earth wires which shall be the same as the other four cores.



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## A5 – Conductor, Flexible CU, Covered

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION	CONDUCTOR GREASING	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, flexible, 65mm², 307 Wires x 12 Spindles (3684/0.15)	N/A	N/A		012130	

## A6 – Conductor, PVC Insulated Earth Wire

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION	CONDUCTOR GREASING	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, HDCu, 70mm <sup>2</sup> (green/yellow covered)	BS 6004	N/A		357243	

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# Appendix B – Conductors for Refurbishment and Repair Only: Specific Requirements

The conductors listed below are for refurbishment and repair only, therefore, the quantities ordered need to reflect this.

## **B1 – Plain Stranded Hard Drawn Copper Conductors**

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION	CONDUCTOR GREASING	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, HDCu, 16mm <sup>2</sup> (3/2.65) Conductor, HDCu, 32mm <sup>2</sup> (3/3.75)	BS 7884 BS 7884	N/A N/A		013129 013145	

## **B2 – Plain Stranded Aluminium Alloy Conductors**

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION*	CONDUCTOR GREASING ENA ER L38	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Not applicable.					

<sup>\*</sup> Individual wires shall comply with the appropriate specification as listed under Technical Particulars.

## **B3 – Stranded Aluminium (Steel Reinforced)**

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION*	CONDUCTOR GREASING ENA ER L38	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, ACSR, 75mm <sup>2</sup> (Racoon) (6/4.10+1/4.10)	BS EN 50182	Cat 3		013678	
Conductor, ACSR, 100mm <sup>2</sup> (Dog) (6/4.72+7/1.57)	BS EN 50182	Cat 3		013862	
Conductor, ACSR, 150mm <sup>2</sup> (Wolf) (30/2.59+7/2.59)	BS EN 50182	Cat 3		013679	
Conductor, ACSR, 150mm <sup>2</sup> (Dingo) (18/3.35+1/3.35)	BS EN 50182	Cat 3		013890	
Conductor, ACSR, 175mm <sup>2</sup> (Caracal) (18/3.61+1/3.61)	BS EN 50182	Cat 3		013919	
Conductor, ACSR, 175mm <sup>2</sup> (Lynx) (30/2.79+7/2.79)	BS EN 50182	Cat 3		013927	

<sup>\*</sup> Individual wires shall comply with the appropriate specification as listed under Technical Particulars. Steel strands shall be clad with aluminium. Aluminium clad steel wires are not permitted on the outer layer of the conductor.

## **B4 – Plain Stranded Hard Drawn Aluminium Conductors**

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION *	CONDUCTOR GREASING ENA ER L38	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, HDAI, 50mm <sup>2</sup> (7/3.10) Conductor, HDAI, 100mm <sup>2</sup> (7/4.39)	BS EN 50182 BS EN 50182	Cat 3 Cat 3		013560 013587	

<sup>\*</sup> Individual wires shall comply with the appropriate specification as listed under Technical Particulars.

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## **B5 – Type 8 Stranded Hard Drawn Copper Black PVC Covered Conductors**

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION	CONDUCTOR GREASING ENA ER L38	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES	
Conductor, PVC, HDCu, 32mm <sup>2</sup> (7/2.46)	BS 6485	Cat 1		011568		

## **B6 – Type 8 Stranded Hard Drawn Aluminium Black PVC Covered Conductors**

APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	CONDUCTOR SPECIFICATION	CONDUCTOR GREASING ENA ER L38	ESTIMATED USAGE (METRES)	CC NUMBER	PRICE PER 1000 METRES
Conductor, PVC, HDAI, 50mm <sup>2</sup> (7/3.10)	BS 6485	Cat 1		012319	



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## **Appendix C – Confirmation of Compliance Schedules**

	TENDERER	TABLE 1
CONDUCTOR:		

ELECTRICAL AND MECHANICAL TESTS (SPECIFY BS):

SAMPLE NO AND LOCATION:

			Aluminium	/ Copper			Steel Wire				
	Stranded as Rec.	Dia Cleaned	Measured Resistance at 20 °C	Breaking Load	Wrapping Test	Torsion Test (Twists)	Strand Dia.	Tensile Strength	Stress at 1% Elongation	Elongation 200 mm Gauge Length %	Wrapping Test
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13 14											
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22											
23											
24											
25											
26 27											
28											
29											
30											

BS CRITERIA: BS CRITERIA:

Minimum specified diameter: Minimum specified diameter: Maximum specified resistance: Minimum tensile strength:

Outer strands (1-18) Minimum stress at 1% elongation:

Inner strands (19-30) Minimum elongation:

Minimum specified breaking loads:



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TENDERER	TABLE 2
I LIAD LIKLIKIIIIIIIIIIIII	IADEL 2

## **CONDUCTOR DETAILS** (To be completed by Tenderer for each conductor/size tendered for)

Item Number					
Conductor Size					
Conductor Stranding					
Conductor Material					
UTS	(N)				
Diameter	(mm)				
Bare Weight	(Kg/m)				
Greased Weight	(Kg/m)				
Cross Sectional Area	(Sq.mm)				
Modulus of Elasticity	(N/Sq.mm)				
Coefficient of Linear Exp.	(deg C)				

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## **Appendix D – 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.

C4 =	proposes to modify and test the product in order to conform.					
Manufacturer	<b>:</b>					
Product/Service Description:						
Product/Service Reference:						
Name:						
Company:						
Signature:						



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## **SECTION-BY-SECTION CONFORMANCE** Conformance Remarks \* **Section Section Topic Declaration** (must be completed if code is not C1) Code Product not to be 4.1 Changed **Electricity North West** 4.2 **Technical Approval** 4.3 **Quality Assurance** 4.4 **Formulation** 4.5 **Identification Markings Minimum Life** 4.6 **Expectancy** 4.7 **Product Conformity Confirmation of** 4.8 Conformance **Requirements for Type** 5.1 Tests at the Supplier's **Premises Requirement for Routine** 5.2 Tests at the Supplier's **Premises** 6.1 General **Specifications for Individual Wires used to** 6.2 **Manufacture Conductors** to BS EN 50182 6.3 **Conductor Greasing**

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**Drums** 

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6.5	Requirements for Approvals, Testing and Quality Control	
6.6	Confirmation of Compliance Schedule	

<sup>\*</sup> 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 Notes:**