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NPS/001/007 – Technical Specification for Overhead Line Conductors

1. Purpose

The purpose of this document is to detail the range and technical performance of conductors utilised on the overhead line distribution networks of Northern Powergrid (the Company).

This document supersedes the following documents, all copies of which should be destroyed;

Document Reference	Document Title	Version	Published Date
NPS/001/007	Technical Specification for Overhead Line Conductors	9.0	Nov 2019

2. Scope

This document applies to all Aluminium and Copper based overhead line conductors both insulated and bare. The technical requirements are detailed in national, international and industry standards that are quoted within this document.

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3. Technical Requirements

3.1. Condition of Operation

In accordance with this specification, conductors are required to withstand exposure to the relevant range of climatic conditions.

The ambient design temperature range shall be -20° C and 40° C with a maximum conductor operating temperature of 75° C.

3.2. Material Requirements

3.2.1. Stranded all Aluminium Alloy Conductors (AAAC)

AAAC conductors shall be manufactured in accordance with BS EN 50182 and BS EN 50183. The conductors shall be greased in accordance with the requirements of the Energy Networks Association Engineering Recommendation L38. All sizes of AAAC conductor as specified in Appendix 1 shall be supplied with AL5 alloy instead of AL3 alloy. Aluminium Alloy conductors shall be supplied with the conductors in an inert condition as detailed in BS EN 50182 clause 5.5.7.

Manufacturers shall carry out additional tests to confirm the inertness of the completed conductor. This shall involve running out a 20m test length of conductor on a flat surface and visually confirming that the conductor lies flat. Conductors that exhibit a pigtail or helix effect are not acceptable. This test shall be applied to one sample of conductor from every production run. This frequency may be increased where a history of this problem exists.

This is the standard conductor type for all new or refurbished HV and EHV overhead lines.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.2. Stranded Aluminium (Steel Reinforced) ACSR Conductors

The conductors shall be manufactured in accordance with BS 215 Part 2 and BS EN 50182 with the grade and class of zinc coated steel wire manufactured in accordance with BS EN 50189.

Conductors shall be greased in accordance with the requirements of the Energy Networks Association Engineering Recommendation L38.

This conductor is primarily used for repairs or diversions of existing EHV overhead line Routes.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.3. Stranded Aluminium Alloy (Steel Reinforced) AACSR Conductor

The conductors shall be manufactured in accordance with BS EN 50182 and BS 215, Pt 2 with the grade and class of zinc coated steel wire manufactured in accordance with BS EN 50189. The conductors shall be greased in accordance with the requirements of the Energy Networks Association Engineering Recommendation L38.

This conductor is primarily used for earth wires on L3 construction tower lines.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.4. Plain Hard Drawn Stranded Aluminium Conductor

The conductors shall be manufactured in accordance with BS 215 Part 1, BS EN 50182, and BS EN 60889. The conductors shall be greased in accordance with the requirements of the Energy Networks Association Engineering Recommendation L38.

This conductor is primarily used for the repair of existing bare LV network conductors

The range of conductors and stranding configurations are detailed in Appendix 1.

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3.2.5. Aerial Bundled Conductors

LV Aerial Bundled Conductors (ABC) shall be manufactured and tested in accordance with BS 7870-5 and any additional variations detailed in ENA TS 43-13.

Two core bundles shall consist of one phase core and one neutral core.

Four core bundles shall consist of three phase cores and one neutral core.

Five core bundles that include protective conductors shall be as described for 4 core bundles with the addition of a 50mm smooth (no rib markings) insulated core as detailed in BS 7870-5 clause 6.3.

Cores shall be of un-greased, compacted, circular, stranded aluminium manufactured in accordance with BS 7870-5. They shall be insulated with extruded cross-linked polyethylene and coloured black, with insulation thickness and core diameter in accordance with BS 7870-5 Table 1. The Insulation material shall be tested as detailed in BS7870-5 table 5 with a maximum shrinkage of 2%.

The phase and neutral cores of aerial bundled conductor shall be identified in accordance with BS 7870-5 Figure 1 and clause 6.1 & 6.2 respectively with laying up of the cores as detailed in BS 7870-5 clause 7.

This conductor is the default conductor for use on new and refurbished LV networks.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.6. Compact Covered Conductors

The Compact Covered Conductors (CC) shall be manufactured in accordance with ENA TS 43-122.

The conductor cores shall be circular, stranded and compacted with a longitudinal water barrier. They shall utilise AlMgSi wires according to BS EN 50183 type Al 3 as detailed in ENA TS 43-122 Table 1B.

The conductors shall be designed for operation at up to and including 33kV with a nominal covering of 2.3mm.

This conductor is primarily used for new routes or diversions of HV routes passing through high risk or high tree density areas.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.7. Plain Stranded Hard Drawn Bare Copper Conductors

Bare stranded hard drawn copper conductors shall be manufactured in accordance with the requirements of BS 7884 and shall not be greased.

This conductor is primarily used for repairs or diversions of existing bare HV & LV lines.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.8. Plain Stranded Annealed Bare Copper Conductors

Bare stranded annealed copper conductors shall be manufactured in accordance with BS EN 60228 class 2, table 2 to provide a high conductivity circular plain conductor.

This conductor is primarily used for jumpers to pole mounted HV plant where it is required to be supported by pilot pin insulators. Where pilot pin insulators are not required, its use shall be substituted by materials specified to clause 3.2.10 of this document.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.9. Hard Drawn, Black PVC Covered Copper Conductors

The conductor shall be un-greased hard drawn copper manufactured in accordance with BS 7884 with a black PVC covering manufactured in accordance with BS 6485: Table 1, Type 8.

This conductor is primarily used for LV insulated open wire network conductors.

The range of conductors and stranding configurations are detailed in Appendix 1.

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3.2.10. Single Core Flexible Copper Braid, PVC Insulated (Black)

The conductor shall be single core copper flexible braid manufactured generally in accordance with BS EN 60228 class 6 and shall be provided with black PVC covering of type TI 1 to BS EN 50363-3 applied around the conductor in accordance with BS EN 50525-2-31 Clause 4.2 and table B.2 type H07V-K

The conductor shall be UV resistant with an operating range -40/+105 capable of operating at 750 volts.

This conductor is primarily used for unsupported jumpers on HV Pole mounted equipment.

The range of conductors and stranding configurations are detailed in appendix 1.

3.2.11. Single Core Annealed Plain Copper Wire, PVC Insulated and Sheathed

This conductor shall be single core, circular plain annealed copper wire manufactured in accordance with BS EN 60228, class 2, Table 2. It shall be covered with a layer of brown PVC type TI 1 Insulation to BSEN 50363-3 and provided with a black PVC over-sheath in accordance with BSEN 50525-2-31 clause 4.1 and table B.1, type H07V-U/R. The conductor shall be designed for operation at 450/700V.

This conductor is primarily used for pole mounted transformer tails to LV fuses.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.12. Single Core stranded copper conductor, PVC Insulated and Sheathed

This conductor shall be single core stranded copper conductor to BS EN 60228 class 2 with blue or brown PVC type TI 1 Insulation to BSEN 50363-3, covered with a Grey PVC type 6 sheath manufactured in accordance with BS BSEN 50525-2-31 clause 4.3 and table B.3, Type H05V-k. The insulation shall be designed for operation at 300/500 V.

This conductor is primarily used for meter tails.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.13. Single Core Annealed Copper Wire, PVC Insulated - Green

This conductor shall be single core, plain stranded annealed copper wire (H07V-R) manufactured in accordance with BS EN 60228 class 2, table 2. It shall be covered with a layer of Green PVC type TI 1 Insulation to BSEN 50363-3 and BS EN 50525-2-31 clause 4.1 and table B.1, type H07V-U/R. The insulation thickness shall be enhanced to a 2.0mm thickness with a rated voltage 450/750V.

This conductor is primarily used for overhead line HV earth leads and bonds.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.14. Single Core Annealed Copper Wire, PVC Insulated - Black

This conductor shall be single core, plain stranded annealed copper wire (H07V-R) manufactured in accordance with BS EN 60228 class 2, table 2. It shall be covered with a layer of Black PVC type TI 1 Insulation to BSEN 50363-3 and BS EN 50525-2-31 clause 4.1 and table B.1, type H07V-U/R. The insulation thickness shall be enhanced to a 2.0mm thickness with a rated voltage 450/750V.

This conductor is primarily used for transformer neutral earth leads.

The range of conductors and stranding configurations are detailed in Appendix 1.

3.2.15. Single Core Stranded Copper Wire, PVC Insulated

Single core, plain stranded annealed copper wire (H07V-R) manufactured in accordance with BS EN 60228 class 2, table 2. It shall be covered with a layer of Green/Yellow PVC type TI 1 Insulation to BSEN 50363-3 and BS EN 50525-2-31 clause 4.1 and table B.1, type H07V-U/R

The range of conductors and stranding configurations are detailed in Appendix 1.

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3.3. Greasing Requirements

3.3.1. General

Overhead line conductor greasing shall comply with the requirements of the ENA Engineering Recommendation L38.

PVC sheathed copper conductors and LV aerial bundled conductors shall not be greased.

Where required, conductors shall be greased using one of the following materials:

- (a) Ensis 358 or CC manufactured by Shell
- (b) Rustilo 431 manufactured by Burmah-Castrol
- (c) Rustilo 450 manufactured by Burmah-Castrol (cold application)
- (d) Metalube OCG1000 or OCG4500 (Cold Application)
- (e) Metalube OCG3000

The Company has a requirement for cold applied grease. Where alternatives are offered, this must be noted as a deviation from the specification.

Appendix 1 details each conductor type and the category of grease that shall be applied.

3.3.2. Category of Grease

Category 4 - Fully greased and wiped

Conductors shall not be greased overall and excessive external grease is unacceptable. Conductors must be clean to handle with surplus grease wiped off to produce a clean conductor surface.

Category 3 - Internally fully greased

Conductors shall be greased in accordance with Category 3 of Engineering Recommendation L38.

Conductors shall have their inner wires coated with grease and no grease shall be visible on the outer surface of the conductor.

3.4. Testing

Conductors shall be tested in accordance with this specification and the subsequent standards relevant to each particular conductor type. The Self Certification Conformance Declaration (in Appendix 3) shall be completed for each conductor.

3.5. Drum and Packaging Requirements

Drum types are detailed for each conductor in Appendix 1 with specific types and maximum dimensions and weights detailed in Appendix 3.

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4. References

The products described within this specification shall comply with all current versions of the relevant International Standards, British Standard Specifications and all relevant Energy Networks Association Technical Specifications (ENATS) current at the time of supply.

4.1. External Documentation

Reference	Title
BS 215 Part 2: 1970	Aluminium stranded conductors for overhead power transmission
BS 6004: 2012	Electric cables - PVC insulated, non-armoured cable for voltages up to 450/750 Volt for electrical power, lighting and internal wiring
BS 6485: 1999	Specification for PVC - covered conductors for overhead power lines
BS 7870 – 5: 2014	LV and MV polymeric insulated cables for use by distribution and generation utilities – Insulated aerial bundled conductors (ABC) of rated voltage 0.6/1 kV for overhead distribution
BS 7884: 1997	Copper and copper cadmium stranded conductors for overhead electric traction and power transmission systems
BS EN 50182: 2001	Conductors for overhead lines - Round wire concentric lay stranded conductors.
BS EN 50183: 2000	Conductors for overhead lines – Aluminium-magnesium-silicon alloy wires.
BS EN 50189: 2000	Conductors for overhead lines. Zinc coated steel wires
BS EN 50525-2-31	Electric cables — Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U): Part 2 -3 Cables for general applications - Single core non-sheathed cables with thermoplastic PVC insulation
BS EN 60228: 2005	Conductors of insulated cables
BS EN 60889: 2022	Conductors for overhead lines. Aluminium and aluminium alloy wires for concentric lay stranded conductors
ENA ER L38 (Issue 3): 2016	Overhead Line Conductors – Protection Against Corrosion By The Application Of Anti-Corrosion Grease During Manufacture
ENA TS 43 – 13 (issue 3): 2013	Aerial Bundled Conductors Insulated with Cross-Linked Polyethylene for Low Voltage Overhead Distribution
ENA TS 43-122 (Issue1):2002	XLPE Cover-conductors for overhead lines (greater than 1kV, up to and including 33kV Overhead Lines)

4.2. Internal Documentation

Reference	Title
NPS/002/024	Technical Specification for Fibre Optic Cables, Wrap, OPGW and ADSS

4.3. Amendments from Previous Version

Reference	Description
3.2.5 Material Requirements for ABC	The size of the fifth core on 5- core bundles that include protective conductors shall be amended from 25mm to 50mm
4.1 External Documentation	Updated with current revisions
Appendix 1- Technical Schedule	The addition of two new types of ABC i.e. 4 x 185mm and 4 x 185mm with a 50mm protective conductor and an amendment from the current size of protective conductor on 4 x 120mm ABC to show this now being 50mm

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5. Definitions

Term	Definition
EHV	Extra High Voltage – 22,000V and above
HV	High Voltage – in excess of 1,000V and less than 22,000V
LV	Low Voltage – up to 1,000V
OAR	Ordered as required
PVC	Polyvinyl Chloride
RD	Returnable Drum
The Company	Northern Powergrid

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6. Authority for Issue

6.1. CDS Assurance

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		Date
Liz Beat	Governance Administrator	15/03/2023

6.2. Author

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

Review Period - This document should be reviewed within the following time period;

Standard CDS review of 3 years?	Non Standard Review Period & Reason	
No	Period: 5 years	Reason: Alignment with 5 year proposed contract period
Should this document be displayed on the Northern Powergrid external website?		Yes
		Date
Steven Salkeld	Policy and Standards Engineer	15/03/2023

6.3. Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

		Date
Ged Hammel	Senior Policy and Standard Engineer	15/03/2023
Joseph Helm	Policy and Standards Manager	21/03/2023

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	Head of System Engineering	24/04/2023

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Appendix 1 – Technical Schedule

Aluminium Alloy (AAAC) to BS EN 50183 See Clause 3.2.1

Conductor (mm²)	Stranding Details	BS EN 50182 Description	Conductor Greasing ER L 38	Commodity Code	Standard Drum type & Conductor Length (m)
50mm	7/3.35mm Hazel	(60-AL5)	Cat 4	226233	RD 1500 or OAR
100mm	7/4.65mm Oak	(119-AL5)	Cat 4	226248	
175mm	19/3.76mm Elm	(211-AL5)	Cat 3	226252	RD 1000 or OAR
200mm	37/2.87mm Poplar	(239-AL5)	Cat 3	020866	RD - OAR
300mm	37/3.53mm Upas	(362-AL5)	Cat 3	223911	
500mm	16/3.5mm Rubus	(587-AL5)	Cat 3	226254	

Stranded Aluminium Steel Reinforced (ACSR) to BS 215 – Part 2. See clause 3.2.2

Conductor (mm²)	Stranding Details	BS EN 50182 Description	Conductor Greasing ER L 38	Commodity Code	Standard Drum type & Conductor Length (m)
70mm	12+7 /2.79mm Horse	73-AL1/43-ST1A	Cat 3	226515	RD 1000 or OAR
100mm	6/ 4.72+ 7 /1.57mm Dog	105-AL1/14-ST1A	Cat 3	226534	RD 1000 or OAR
150mm	18+1 /3.35mm Dingo	159-AL1/9-ST1A	Cat 3	226581	RD 1000 or OAR
150mm	30+7/2.59mm Wolf	158-AL1/37-ST1A	Cat 3	226549	RD 1000 or OAR
175mm	30+7 /2.79mm Lynx	183-AL1/43-ST1A	Cat 3	226568	RD 1000 or OAR
175mm	18+1/3.61mm Caracal	184-AL1/10-ST1A	Cat 3	220627	RD 1000 or OAR

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Aluminium Alloy Conductor Steel Reinforced (AACSR) to BS 215, Pt 2. See clause 3.2.3

Conductor (Mm ²)	Stranding Details	BS EN 50182 Description	Conductor Greasing ER L 38	Commodity Code	Standard Drum type & Conductor Length (m)
160mm	30+7/2.79mm Keziah	183-AL5/43-ST1A	Cat 3	221031	RD OAR

Hard Drawn Aluminium Stranded Conductor to BS 215 – Part 1 See clause 3.2.4

Conductor (mm ²)	Stranding Details	BS EN 50182 Description	Conductor Greasing	Commodity Code	Standard Drum type & Conductor Length (m)
50mm	7/ 3.10mm Ant	53-AL1	Cat 4	226337	RD 1000 or OAR
100mm	7/4.39mm Wasp	106-AL1	Cat 4	226582	RD 1000 or OAR

LV Aerial Bundled Conductors (ABC) to BS 7870-5 See clause 3.2.5

Conductor (mm ²)	Stranding Details	BS EN 50182 Description	Conductor Greasing	Commodity Code	Standard Drum type & Conductor Length (m)
4 core 35mm	N/A	N/A	N/A	022855	RD 500
4 core 70mm	N/A	N/A	N/A	226031	RD 500
4 core 120mm	N/A	N/A	N/A	226021	RD 500
4 core 185mm	N/A	N/A	N/A	226025	RD 500
4 Core 120mm + 50mm Protective conductor	N/A	N/A	N/A	226030	RD 500
4 core 185mm + 50mm Protective conductor	N/A	N/A	N/A	226028	RD 500

Compacted Covered Conductor (CCC) Aluminium Alloy EATS 43-122. See clause 3.2.6

Conductor (mm ²)	Stranding Details	BS EN 50182 Description	Conductor Greasing	Commodity Code	Standard Drum type & Conductor Length (m)
50mm	7 strand compacted	N/A	N/A	221033	RD 1000 or OAR
120mm	19 strand compacted	N/A	N/A	221070	

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Conductor (mm ²)	Stranding Details	BS EN 50182 Description	Conductor Greasing	Commodity Code	Standard Drum type & Conductor Length (m)
185mm	34 (min) strand compacted	N/A	N/A	221072	

Plain Stranded Hard Drawn Bare Copper Conductors to BS 7884 - Copper conductor shall be high conductivity bare stranded. See clause 3.2.7

Conductor (mm ²)	Stranding Details	BS EN 50182 Description	Conductor Greasing	Commodity Code	Standard Drum type & Conductor Length (m)
16	3/2.65mm	N/A	N/A	026534	RD - 500
32	3/3.75mm	N/A	N/A	225264	RD - 500
70	7/3.55mm	N/A	N/A	225298	RD - 500
100	7/4.30mm	N/A	N/A	225300	RD - 500
125	19/2.90mm	N/A	N/A	225315	RD - 500

Plain Stranded Annealed Bare Copper Conductors to BS EN 60228 class 2, table 2 high conductivity circular plain. See clause 3.2.8

Conductor (mm ²)	Stranding Details	BS EN 50182 Description	Conductor Grease	Commodity Code	Standard Drum type & Conductor Length (m)
32	7/2.46mm	N/A	N/A	222177	C - 500
70	19/2.14mm	N/A	N/A	225584	C - 500

Hard Drawn Copper Conductors (based on BS 7884) PVC Covered to BS 6485: Table 1, Type 8 Black (Section 3.2.9)

Conductor (mm ²)	Stranding Details	BS EN 50182 Description	Conductor Greasing	Commodity Code	Standard Drum type & Conductor Length (m)
16	7/1.7mm	N/A	N/A	224740	R - 500
32	7/2.46mm	N/A	N/A	224755	R - 500
70	7/3.55mm	N/A	N/A	224774	R - 250

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Single Core Copper flexible braid PVC Covered (Black). See clause 3.2.10

Conductor (mm ²)	Stranding Details	BS EN 50182 Description	Insulation Colour	Commodity Code	Standard Drum type & Conductor Length (m)
35mm	12 bunches of 165/0.15mm	N/A	Black	224807	R - 500
70mm	13 bunches of 307/0.15mm	N/A	Black	224808	
120mm	12 bunches of 566/0.15mm	N/A	Black	224809	
240mm	13 bunches of 1046/0.15mm	N/A	Black	224810	R - 50

Single core, annealed copper conductor covered with a layer of brown PVC Insulation and provided with a black PVC over-sheath. See Clause 3.2.11

Conductor (mm ²)	Stranding Details	Conductor Greasing ER L 38	Insulation Colour	Commodity Code	Standard Drum type & Conductor Length (m)
35mm	19/1.53mm	N/A	Brown Ins, Black Sheath	028563	C - 100
95mm	37/1.78mm	N/A	Brown Ins, Black Sheath	028621	C - 100
120mm	37/2.03mm	N/A	Brown Ins, Black Sheath	028647	C - 100
150mm	37/2.25mm	N/A	Brown Ins, Black Sheath	028648	C - 100

Single core stranded copper conductor covered with a layer of blue or brown PVC Insulation and a Grey PVC over sheath. See clause 3.2.12

Conductor (mm ²)	Stranding Details	Conductor Greasing ER L 38	Insulation colour	Commodity Code	Standard Drum type & Conductor Length (m)
16mm	7/1.70mm	N/A	Brown/Grey	220186	C - 100
16mm	7/1.70mm	N/A	Blue/Grey	220190	C - 100
25mm	7/2.14mm	N/A	Brown/Grey	220203	C - 100
25mm	7/2.14mm	N/A	Blue/Grey	220218	C - 100

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Annealed high conductivity copper circular conductors covered with a layer of Green PVC Insulation. The insulation thickness shall be enhanced to a 2.0mm thickness with a rated voltage 450/750V. See clause 3.2.13

Conductor (mm ²)	Stranding Details	Conductor Greasing ER L 38	Insulation colour	Commodity Code	Standard Drum type & Conductor Length (m)
32mm (Green)	7/2.46mm	N/A	Green	220147	R - 250
70mm (Green)	7/3.55mm	N/A	Green	220146	R - 250

Single core, plain stranded annealed copper wire covered with a layer of Black PVC Insulation with enhanced nominal radial thickness of PVC covering to 2.0mm. See Clause 3.2.14.

Conductor (mm ²)	Stranding Details	Conductor Greasing ER L 38	Insulation colour	Commodity Code	Standard Drum type & Conductor Length (m)
32mm (Black)	7/2.46mm	N/A	Black	224806	R - 250

Single core, plain stranded annealed copper wire covered with a layer of Green/Yellow PVC Insulation. See Clause 3.2.15.

Conductor (mm ²)	Stranding Details	Conductor Greasing ER L 38	Insulation Colour	Commodity Code	Standard Drum type & Conductor Length (m)
6.0mm	7/1.04mm	N/A	Green/Yellow	220148	C – 100
10.0mm	7/1.35mm	N/A	Green/Yellow	220150	C – 100
16.0mm	7/1.70mm	N/A	Green/Yellow	027672	C – 100
25.0mm	7/2.14mm	N/A	Green/Yellow	027730	C - 50
35.0mm	19/1.53mm	N/A	Green/Yellow	027771	C – 50
70.0mm	19/2.14mm	N/A	Green/Yellow	027854	C – 50
120.0mm	37/2.03mm	N/A	Green/Yellow	027904	C – 50

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Appendix 2 – Logistical Requirements

Drum and Packaging Requirements

All overhead line conductors shall be supplied on returnable drums (RD), on reels (R) or in coils (C) as specified in Appendix 1. Standard drum lengths are detailed in Appendix 1 together with a requirement for section lengths to be ordered as required (OAR).

Returnable Drums (RD)

Standard Drum Dimensions – Maximum flange diameter 1200mm, maximum drum width of 1000mm (this dimension shall include any bolt heads or studs located on the side of the drum) and a minimum barrel diameter of 600mm except when the drum is used to carry 100mm² AAAC. Then the minimum diameter shall be 800mm. The spindle hole shall have a diameter between 80 – 100mm. The gross weight shall not exceed 670kg.

ABC Drum Dimensions - Maximum flange diameter of 1800mm, maximum drum width of 1100mm (this dimension shall include any bolt heads or studs located on the side of the drum) and a minimum barrel diameter of 30 x the diameter of the conductor or a minimum of 800mm. The spindle hole shall have a diameter between 85 – 100mm. The gross weight shall not exceed 1300kg.

For all drum types the two outer flanges shall be drilled with two 25mm diameter holes opposite to each other and 275mm from the central spindle hole.

All drums shall be designed to take a round spindle and be lagged to protect the conductor, whilst on the drums, from the risk of damage during transportation and handling on site.

The inner end of the conductor projecting from the drum shall be secured and protected to avoid damage with the direction of rolling being indicated on the outer flange of drum.

All returnable drums, reels and coils shall be labelled on one flange and the label must state:

- (a) The Company order number and date
- (b) The Company commodity code
- (c) Manufacturer's name
- (d) Conductor type
- (e) Conductor cross section and stranding
- (f) Conductor length in metres (either standard or OAR)
- (g) Drum net weight excluding lagging
- (h) Drum gross weight
- (i) Labels shall have a provision for the future use of bar codes

Labelling shall be by any method that fulfils all of the following criteria:

- (a) Is not affected by rain or other adverse weather
- (b) Is not affected by ultra violet light
- (c) Remains, legible

The use of cards or papers whether or not enclosed is **NOT ACCEPTABLE**.

Drums shall be lagged using weatherproof wood fibreboard such as Nolco-flex providing suitable protection to the conductor and secured with a circumferential banding system.

Drums with battens nailed to the flanges **ARE NOT ACCEPTABLE**.

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Drums shall not be protected with any secondary protection such as water resistant paper.

Drum delivery requirements

Drums shall be delivered to the Northern Powergrid Central Distribution Warehouse on curtain sided delivery vehicles or equivalent such that the drums can be offloaded from either side of the vehicles using fork lift trucks.

All drums must be loaded onto the vehicle in an upright manner allowing the forks of the forklift trucks to be placed beneath the protected conductor and between the sides of the drum, Under no circumstances must the drums be delivered on their sides.

Drums shall not be manufactured from plywood or other non-waterproof material as they will be stored outside

Reels (R)

Reels shall have a maximum height of 750mm, maximum width of 400mm and a minimum diameter of 250mm. The spindle hole shall have a diameter between 80 – 100mm. All other requirements shall be in accordance with those specified for returnable drums.

Coils (C)

Where conductors are supplied in coils the coil length shall be 50 or 100m secured by suitable cable ties. The coil diameter shall ensure the cable is not damaged and suitable for transportation.

Covered Conductor

The ends of all insulated or covered conductor including ABC shall be suitably sealed to prevent the ingress of moisture. Additionally all types of insulated or covered conductor shall be supplied with metre marking on the outer sheaths.

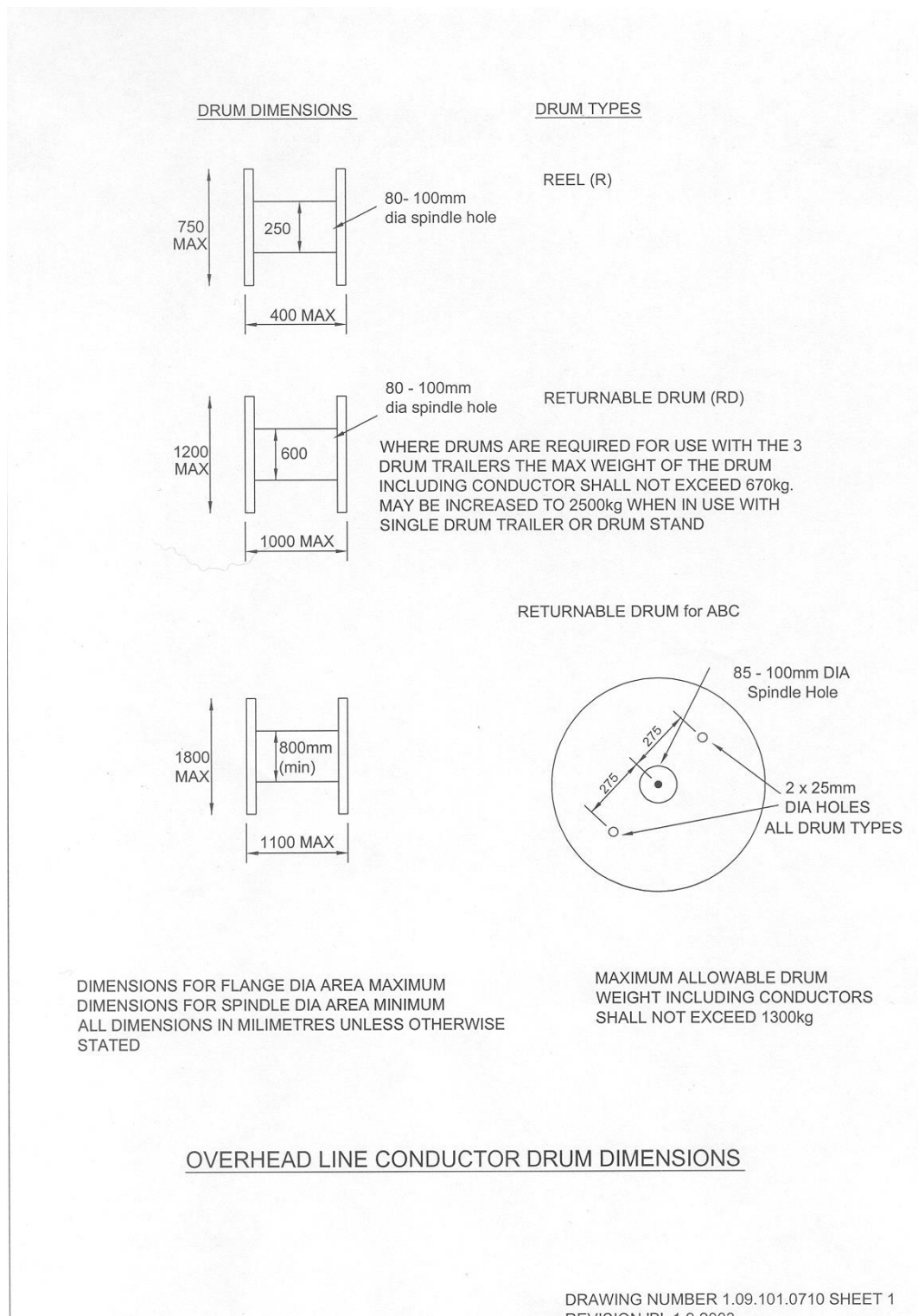
Drum delivery requirements

Drums shall be delivered to the Northern Powergrid Central Distribution Warehouse on curtain sided delivery vehicles or equivalent such that the drums can be offloaded from either side of the vehicles using fork lift trucks.

All drums must be loaded onto the vehicle in an upright manner allowing the forks of the forklift trucks to be placed beneath the protected conductor and between the sides of the drum, under no circumstances must the drums be delivered on their sides.

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Appendix 3 – Drum details



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Appendix 4 – Self Certification Conformance Declaration

Conductors for overhead lines shall comply with the latest issues of the relevant international and British Standards.

The relevant BS, BS EN and ENA Technical Specifications are quoted to amplify and/or clarify the requirements of those Standards.

This check sheet identifies the particular clauses of the aforementioned Standards relevant to overhead line conductors.

The manufacturer shall declare conformance or otherwise, clause by clause, using the following levels of conformance declaration codes for each conductor.

Conformance declaration codes

N/A = Clause is not applicable/ appropriate to the product

Cs1 = The product conforms fully with the requirements of this clause

Cs2 = The product conforms partially with the requirements of this clause

Cs3 = The product does not conform to the requirements of this clause

Cs4 = The product does not currently conform to the requirements of this clause, but the manufacturer proposes to modify and test the product in order to conform.

Instructions for completion

- When Cs1 code is entered the supplier shall provide evidence of conformance
- When any other code is entered the reason and supporting evidence for non-Conformance shall be entered
- Prefix each remark with the relevant 'BS EN' or 'ENATS' as appropriate

Manufacturer:

Product Reference:

Name:

Signature:

Date:

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All aluminium alloy conductors (AAAC) – Clause 3.2.1

Stranded aluminium steel reinforced (ACSR) – Clause 3.2.2

Stranded aluminium alloy steel reinforced (AACSR) – Clause 3.2.3

Plain hard drawn stranded aluminium – Clause 3.2.4

BS EN 50183			
Clause/Sub-clause	Requirements	Conformance Code	Remarks
4	Materials		
5 - Table 1	Properties of heat treated wires		
6	Diameter and tolerance on diameter		
7	Wire surface		
9	Joints		
10	Sampling		
11	Tests		
BS 215-1			
1.3	Standards for hard-drawn aluminium wire		
2	Materials		
3	Dimensions and construction		
4	Tests		
BS EN 50182			

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5	Requirements for stranded conductor, including the inertness of the conductor in clause 5.5.7		
6	Tests		
7	Packaging and marking		
Annex F – Tables 39-43	Conductor characteristics		
ER L38			
1	General		
2	Properties		
3	Quality Control		
4	Categories (where applicable)		
Table 1 and 2	Conductor Greased Weights		

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Aerial Bundled Conductor - Clause 3.2.5

BS 7870 – 5			
Clause/Sub-clause	Requirements	Conformance Code	Remarks
3	Voltage designation		
5	Insulation thickness and core diameter requirements – Table 1		
7	Lay Length – Table 2		
10	Routine tests		
11	Sample tests		
12	Type tests		
13	Sealing and drumming		
ENA TS 43-13			
3	Construction requirements		
4	Identification of Cores		
6	Type Test Requirements		
7	Sealing & Drumming		

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Compact Covered Conductor -Clause 3.2.6

ENA TS 43-122			
Clause/Sub-clause	Requirements	Conformance Code	Remarks
4.2	Conductor construction		
4.2.2	Voltage designation – Designed for operation up to and including 33kV.		
Table 1B	Conductor covering, thickness and technical parameters – Table 1		
Appendix A1	Current leakage Test		
Appendix A2	Longitudinal Water Tightness Test		
Appendix A3	Slippage test		
Appendix A4	Stripping Tests		
BS EN 60811-1-1, BS EN 60811-2-1, BS EN 60811-3-1and BS 2782 part 5			
Clause/Sub-clause	Requirements	Conformance Code	Remarks
Clause 9	Mechanical Properties without ageing (a)Tensile Strength (b) Elongation at break		
Clause 9.2	Water absorption of insulation 14 days at 85 °C		
Clause 11	Carbon Black Content		
Clause 10	Shrinkage test 1 hour at 130 °C		

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BS EN 60811-1-1, BS EN 60811-2-1, BS EN 60811-3-1 and BS 2782 part 5			
Clause/Sub-clause	Requirements	Conformance Code	Remarks
Clause 9 135 °C for 7 days	Compatibility Test Samples of complete covered conductor shall be aged in accordance with BS EN 60811-1-2 clause 8.1.4 (a) Tensile Strength (b) Elongation at break (c) Max variation a. Tensile Strength b. Elongation at break		
Clause 8 135 °C for 7 days	Mechanical Properties after ageing (a) Tensile Strength (b) Elongation at break		
BS EN 60811-3-1 Clause 8.1	Pressure test at high temperature Temperature test Max depth of indentation		
BS EN 60811-2-1	Hot Set tests (15mins at 0.2N/mm ²) Max elongation under load Maximum elongation after cooling		
BS 2782 part 5 Method 540F	Mechanical properties after UV exposure (UV stabilisers other than carbon black) Max variation from unexposed conductors (a) Tensile strength (b) Elongation at break		

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Plain Stranded Hard Drawn Copper Conductors - Clause 3.2.7

BS 7884			
Clause/Sub-clause	Requirements	Conformance Code	Remarks
4.1	Composition requirements		
Table 3	Physical, mechanical and electrical properties		
Table 5	Lay ratios of stranded conductors		
6	Selection of test samples		
8	Marking, labelling and packaging		

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Plain stranded annealed copper conductors – Clause 3.2.8

Single core flexible copper braid, PVC insulated, black – Clause 3.2.10

Single core annealed plain copper wire, Brown PVC insulated and Black PVC Over sheath – Clause 3.2.11

Single core stranded copper cable, Blue or Brown PVC insulated with Grey PVC Over sheath – Clause 3.2.12

Single core annealed copper wire, PVC insulated, Green. Clause 3.2.13

Single core annealed copper wire, PVC insulated, Black. Clause 3.2.14

Single core stranded copper wire, PVC insulated, Green/Yellow. Clause 3.2.15

BS 60228 - Conductor			
Clause/Sub-clause	Requirements	Conformance Code	Remarks
4	Material		
5.2 or 6	Stranded circular non-compacted conductor (class 2 or Flexible conductors Class 6)		
7	Check for compliance with Clause 5 & 6 – Table 2 or 4		
Tables 2, and 4	Stranding details		
Table C1	Additional data for annealed copper conductors		

BSEN 50525-2-31 - Insulation			
4.1, 4.2 or 4.3	General requirements		
Annex A	Tests		
Annex B	General Data		

BSEN 50363-3 - Insulation			
Table 1 & 2	Types of PVC Insulating Compound		

Hard drawn, Black PVC covered copper conductors – Section 3.2.9

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BS 7884			
Clause/Sub-clause	Requirements	Conformance Code	Remarks
4.1	Composition		
4.2.3	Stranded conductors		
4.3	Mechanical properties		
4.4	Electrical resistance		
4.5	Manufacture		
6	Selection of test samples		
BS 6485 Type 16 for Green Insulation			
BS 6485 Type 8 for Black Insulation			

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Appendix 5 - Technical Information Check List

The following information shall be provided by the supplier for review by Northern Powergrid. Additional information shall be provided if requested.

Requirement	Provided
Full product descriptions and part number/reference	
Appendix 3 – completed self-certification conformance declaration	
Type test evidence for each conductor being offered	
A Technical data sheet shall be supplied for each conductor or family of conductors being offered providing all of the mechanical and electrical properties of the conductor being offered.	
Manufacturing routine test or quality plan	
Packaging / drum / delivery information	
ISO:9001, ISO:14001 and ISO:18001 certificates	