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NPS/001/026 - Technical Specification for Overhead Line Fibre Optic Wrap Fittings

1. Purpose

The purpose of this document is to detail the technical requirements for fittings associated with overhead line fibre optic wrap systems used to provide communication and protection links on the Northern Powergrid distribution system.

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

Document Reference	Document Title	Version	Published Date
NPS/001/026	Technical Specification for Overhead Line Fibre Optic Wrap Fittings	1.2	Feb 2019

2. Scope

This specification sets down the requirements for the fittings used in conjunction with wrapped fibre optic cable system for installation on overhead power lines from 11kV – 132kV. It includes down lead fittings and splice enclosures requirements where specific to wrapped cables.

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3. Code of Practice

3.1. Technical Specification

This specification sets down the requirements for the fittings used in the wrapped fibre installation guide NSP/004/123 for installation onto overhead power lines from 11kV up to 132kV. It includes down lead fittings and splice enclosures requirements where specific to wrapped cables.

Wrapped cable as detailed in NPS/002/024 is installed by helically wrapping around existing conductor, (earth-wire or phase-wire as detailed in NPS/001/007). Fittings are required to secure the cable to the conductor at the ends of spans, to transfer the cable around support structures and to route the cable down the support structure to a splice location. In the case of cable installed on phase wires an insulator system is also required to transfer the cable from phase potential to ground potential.

3.1.1. General Requirements

The design of fittings shall be such as to minimise the number of parts and the possibility of incorrect assembly and installation. As far as possible small components (e.g. fasteners) should be captive.

All threaded fasteners shall be locked to ensure that slackening does not occur due to vibration in service (see also requirements for bolts and fixings in clause 3.1.7.)

All fittings operate over the temperature range -40 to $+60^{\circ}\text{C}$ and those in direct contact with the conductor withstand short term temperatures of up to 300°C . All fittings in direct contact with the conductor shall resist 100 million vibration cycles of the conductor, and shall not cause damage the conductor. All plastic fittings exposed directly to U.V. radiation withstand U.V. ageing. All fittings subject to electrical stress shall be resistant to tracking and erosion.

Engineering drawings shall specify dimensional tolerances as required in BS 3288: Part 1 unless indicated otherwise. For dimensions where no special tolerances apply, the tolerance shall be up to and including $35\text{mm} \pm 0.7\text{mm}$, over $35\text{mm} \pm 2\%$.

3.1.2. Design Life

Fittings should be suitably designed for an operational life of at least 25 years. Additionally the design and manufacture of Wrap cable fittings shall ensure that the conductor (which may be more than 30 years old) is unaffected by installation of the fitting, either immediately, or in service. To this end the fitting shall not cause opening or damage to the conductor strands when first installed and shall not cause fretting, fatigue or corrosion of the strands in service.

3.1.3. Galvanising

All ferrous components shall be hot dip galvanised in accordance with BS EN ISO1461, or other means giving equivalent protection. Renovation of uncoated areas, or areas damaged in handling is permitted in accordance with BS EN ISO1461. Articles having any areas of rust will not be accepted.

3.1.4. Grease

All aluminium conductors installed in Northern Powergrid have been installed as greased conductors as such account must be taken of the fact that all fittings will be installed with grease filling the interfaces between the fitting and the conductor to exclude moisture. To prevent crevice corrosion any air gap between the fitting and the wrap cable shall be filled with a grease or mastic of some kind. For details on allowable grease types, reference shall be made to the grease installed on conductors as detailed in NPS/001/007.

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3.1.5. Markings

All fittings shall be permanently marked, according to BS EN 61284, with clearly legible lettering. In addition the following requirements shall be met. Any additional marking will be allowed provided it does not result in any ambiguity in interpretation of the required marking specified above. The manufacturers recommended installation torque(s) in Newton metres (e.g. "50 Nm") shall be marked, adjacent to screwed fasteners.

3.1.6. Elastomer and Plastic Compounds

Non-metallic materials shall have good resistance to ageing and be capable of withstanding in service temperatures without detrimental change in their properties. The materials used shall have adequate resistance to the effects of nitrogen oxides, ozone, ultra-violet radiation air pollution and electrochemical corrosion over the range of service temperatures from -30°C to +60°C. They shall not induce corrosion in materials in contact with them.

3.1.7. Bolts and Fixings

All bolts and fixings shall be hot dip galvanised high tensile steel (Grade 8.8 or equivalent). All fixings shall be ISO metric fittings to comply with BS 4190 prior to galvanizing and have thread profiles to BS 3643: part 2 after galvanising. With a Tolerance Class of 7h/8g or ISO Metric Precision Hexagon to BS 3692.

Nuts shall comply with BS 4190 prior to galvanising and have the thread cut to the profiles in BS 3643: part 2 after galvanising. The increase in diameter shall not be greater than 0.4 mm

Where a manufacturer deems a bolt or fixing must be rated to a higher specification class this must be clearly marked on the bolt head.

It is preferable that all clevis pins and split pins meet the dimension and profile as noted in BS 3288.

Where a fixing specified by a manufacture meets the ISO DIN specifications and has a metric thread form not compatible with BS 3643 this must be pointed out and agreed by Northern Powergrid prior to the supply of the materials. The fixing supplier must notify the purchaser if any other thread specifications are to be used.

All split pins must be of Austenitic stainless steel as specified in BS 3288.

3.1.8. Fittings and Finish

All fittings shall have all burrs, sharp edges and corners removed.

3.2. Fitting Types and Requirements

3.2.1. Bypass Fittings

Bypass fittings often referred to as "Bale hangers" support the cable wherever it is not in contact with the conductor. These fittings shall be compatible with the line conductor on which they will be secured and withstand an axial pull load of 250N on a greased conductor, and a torsional load of 5Nm.

3.2.2. Span-End Clamps

Span end clamps grip the cable and conductor and shall be designed to withstand, without slipping, an axial load of 500N, on a greased conductor. The nylon inserts used to protect the conductor shall be designed to comply with the requirements of clause 3.1.6 of this specification. All fittings must be marked with the manufactures recommended torque values.

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3.2.3. Splice Box (Overhead)

The splice box or “donut splice” shall resist rain and humidity over the temperature range –30 to +60°C. The splice box shall resist 100 million vibration cycles when attached to the conductor, without measurable change in the splice losses of the fibres enclosed. The splice box shall also resist gunshot at a distance of 25m. Splice boxes shall be designed to accommodate the fibre count and fibre optic cable designs detailed in NPS/002/024.

3.2.4. Splice Box (Low level)

The splice box shall resist rain and humidity over the temperature range –30 to +60° C and shall meet an IP 65 rating. The outer case of the box shall resist gunshot at a distance of 25m. The splice box shall be fitted with an earthing point for electrical bonding which shall be an M10 bolt or stud or a clamping strap.

Splice boxes designed for mounting onto wood poles shall be designed to be fitted onto an M20 tie rods, to allow additional portable earths to be applied onto the rear of the fixing bolt in the event that the main earth connection has been interfered with.

3.2.5. Tower/Pole Down Pipe Clamps

The tower down pipe clamps shall grip and secure the 25mm conduit down pipe to the support structure.

3.2.6. Ground to Ground Termination

The Ground to Ground termination is used to transfer the wrap cable from the earth-wire to the support structure

3.2.7. Phase to Ground Termination

The phase to ground termination shall resist tracking and erosion, and water penetration, in accordance with the requirements set out in Appendix B of ENA TS 43-126 part 2. The tensile strength shall exceed 100kgf, and will be sufficiently flexible to allow bending as required on an overhead line structure, while still providing the required mechanical support and protection for the cable. The creepage length shall be at least 25kV/mm.

3.2.8. Type Testing

The optical cable and the fittings together form a system, the fittings therefore should be tested with the cable that they have been designed for.

All tests shall be performed on all fittings, except where Northern Powergrid waives tests on some fittings, which have common design elements.

All type tests shall be performed on three samples, which are identical, in all essential details, with fittings to be supplied. One of the type test samples shall be retained by the manufacturer for comparison with the production fittings.

Drawings for registration of the fittings shall be available at the time that type tests are undertaken.

Where assembly of the fittings onto the conductor or support structure is required the conductor or support used shall be of equivalent size and construction to the intended item. All testing shall meet the requirements of ENA TS 43-126 part 2 clause 6.0

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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 3288	Insulator and conductor fittings for overhead power lines. Specification for a range of insulator fittings
BS 3643	ISO metric screw threads. Principles and basic data
BS 3643: part 2	ISO metric screw threads. Specification for selected limits of size
BS 3692	ISO metric precision hexagon bolts, screws and nuts
BS 4190	ISO metric black hexagon bolts, screws and nuts
BS EN 61284	Overhead lines. Requirements and tests for fittings
BS EN ISO1461	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods
ENA TS 43-126 part 2	Fittings For Overhead Line Optical Cables - Wrapped Optical Cables

4.2. Internal Documentation

Reference	Title
NPS/001/007	Technical Specification for Conductors for Overhead Lines
NPS/002/024	Technical Specification for Fibre Optic Cables, Wrap, OPGW and ADSS
NSP/004/123	Guidance document on the installation of Fibre Optic Wrap onto Overhead Line Conductors

4.3. Amendments from Previous Version

Reference	Description
Whole Document	Document reviewed no changes required. Doc republished to grid - LB 26/04/2023 Doc approved by email Paul Black 11/01/2023

5. Definitions

Term	Definition
n/a	

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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	26/04/2023

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	
Yes	Period: n/a	Reason: n/a
Should this document be displayed on the Northern Powergrid external website?		Yes
		Date
Ged Hammel	Policy & Standards Engineer	29/12/2022

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
R McMahon	Policy & Standards Engineer	23/04/2013

6.4. Approval

Approval is given for the content of this document

		Date
Chris Holdsworth	Policy & Standards Manager	22/04/2013

6.5. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	System Engineering Manager	11/01/2023

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Appendix 1 - 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 (Y/N)
Full product descriptions and part number/reference	
Complete set of constructional drawings for each item	
Type test evidence	
Manufacturing routine test plan	
Packaging information	
Instructions/Manuals for transportation & handling, installation, maintenance and disposal	