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# NPS/002/016 – Technical Specification for 33kV Cable Joints and Terminations

## 1. Purpose

The purpose of this document is to detail the technical requirements for 33kV cable joints and terminations for use on the Northern Powergrid (the Company) distribution network.

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

Reference	Version	Date	Title
NPS/002/016	4.0	Sep 2022	Technical Specification for 33kV Cable Joints and

## 2. Scope

This specification details the requirements for 33kV joints and terminations for use on the Company's distribution network.

Suppliers shall consider and include any project specific requirements as detailed in Appendix 5, and provide details of any periodic inspection and maintenance information requirements in Appendix 7.

Any technical documents referenced within this specification refer to the latest versions of the relevant International Standards, British Standards (BS), Energy Networks Association (ENA) Standards current at the time of supply.

The following appendices form part of this technical specification;

- Appendix 1 – Cables Types and Sizes,
- Appendix 2 – Current Range of Joints and Terminations,
- Appendix 3 – Logistical Requirements,
- Appendix 4 – Self Certification Conformance Declaration,
- Appendix 5 – Addendum to Supplier Requirements,
- Appendix 6 – Management systems of occupational health and safety (OHS),
- Appendix 7 – Routine Inspection and Maintenance Requirements,
- Appendix 8 – Quality Management Systems(QMS),
- Appendix 9 – Technical Information Check List.

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### 3. Technical Requirements

#### 3.1. Conditions of Operation

The following are the general conditions under which joints and terminations purchased in accordance with this specification are required to operate.

- Nominal system voltage 33kV.
- The working voltage of any part of the system does not normally exceed the normal system voltage by more than 10%.
- Nominal system frequency 50Hz.
- The system operates with the neutral point earthed either directly or through a resistance or reactance.
- 3 phase symmetrical short circuit currents of 20kA for 2seconds and phase to earth faults of 3kA for 2 seconds (at 33kV phase to earth currents are less than 3 phase currents) where the system has been designed with earth fault factor of 1.73.
- The withstand level for indoor terminations shall be 170kV.

Joints and terminations specified in this document are required for installation on cables which are pulled or laid into open trenches, into ducts or installed in the open air. After installation, joints and terminations can be expected to be subjected to the full range of climatic conditions encountered in the UK, and joints may be surrounded by ground water for most of their operating lives. Outdoor terminations will be exposed to direct sunlight and weathering during normal service conditions.

#### 3.2. Cable Types

All new installations will be XPLE cables to BS7870-4, however when jointing onto the existing network older Paper insulated cables will found.

Cable joints will be required to join:

- XLPE to XLPE
- XLPE to Paper insulated cables, and,
- Paper insulated cables to Paper insulated cables (this will be an occasional requirement).

Cables may be of the following type:

- Single or three-core,
- Paper (PILC) or XLPE insulated,
- Have aluminium (solid and stranded) or stranded copper conductors,
- Belted or core screened,
- May contain water sellable tapes or powders,
- Have lead or aluminium sheaths with or without armour serving, or copper screen wires, and,
- Cables can be hessian (PILC), PVC or PE over sheathed.

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### 3.3. Joints

Cable joints are required to make a physical and electrical connection between cables of various sizes and types.

#### **Joint Type 1 – Single Core XLPE (XLPE to XLPE) to Single Core Joints**

Single core joints shall have a cold applied central system that includes stress control and insulation over the central core and connector. This should be a conductive Faraday cage and shall be designed to be compatible with and overlap the mechanical connector. The joint body shall preferably incorporate geometric stress cones and be designed to make contact with the semi-conductive screen on the cables at both sides. Other methods of stress control may be considered with further technical approval. The joint body shall preferably be on a spiral holdout with a minimum 2-year shelf life from delivery. Further technical preference may be given to products offered with further extended shelf life than the minimum requirement. Alternative means of collapsible joint bodies (e.g. self-eject carriers) may be considered with further technical approval.

For any alternative collapsible joint bodies, which may require special tooling, the tooling shall be included in the kits.

A secondary mechanical protection layer maybe cold or heat applied.

There may be a requirement for size transition joints outside the scope within Appendix 2 – Current Range of Joints and Terminations. The supplier shall set out their capabilities to offer size transitions other than stated in Appendix 2.

#### **Joint Type 2 – Single Core XLPE (XLPE to XLPE) to Single Core Joints, with an External Earth**

As well as the requirements for single core to single core jointing, there is a requirements to make a XLPE to XLPE joints where all three earths are connected together and a suitable earth electrode installed. This joint as well as having a cold applied system (as stated in Joint type 1), will be required to encapsulate all three single core joints together into one shell, using a filling medium such as resin or an equivalent. There is a requirement to install a suitable earth connection, from the metallic sheath or screen wires, within the joint to an external earth electrode.

#### **Joint Type 3 – Transition Joints (PILC to XLPE)**

Joints suitable for three or single core paper cables (PILC) to single core XLPE cables. Joints shall have a cold or heat applied central system that includes stress control and insulation over the central core and connector. They should also have cold or heat applied stress control for the semi-conductive screens of XLPE cables and PILC screened cables. The joints shall be encapsulated in in a filling medium such as resin or an equivalent alternative. There is a requirement to install a suitable earth connection from the metallic sheath or screen wires within the joint to an external earth electrode.

#### **Joint Type 4 – Paper Insulated (PILC) to Paper Insulated (PILC) Joints**

Joints for jointing PILC to PILC cables shall have a cold or heat applied central system that includes stress control and insulation over the central core and connector and shall be encapsulated in in a filling medium such as resin or an equivalent alternative.

#### **Joint Type 5 – Stop End Joints**

Joints suitable for single core paper cables (PILC) or single core XLPE cables. Single core XLPE Joints shall have a cold applied central system that includes stress control and insulation over the central core and connector. This should be a conductive Faraday cage and shall be designed to be compatible with and overlap the mechanical connector. The joint body shall preferably incorporate geometric stress cones and be designed to make contact with the semi-conductive screen on the cables at both sides. Other methods of stress control may be considered with further technical approval. The joint body shall preferably be on a spiral holdout with a minimum 2-year shelf life from delivery. Further technical preference may be given to products offered with further extended shelf life

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than the minimum requirement. Alternative means of collapsible joint bodies (e.g. self-eject carriers) may be considered with further technical approval.

For any alternative collapsible joint bodies, which may require special tooling, the tooling shall be included in the kits.

A secondary mechanical protection layer maybe cold or heat applied.

Single core paper cables (PILC) Joints shall have a cold or heat applied central system that includes stress control and insulation over the central core and connector. They should also have cold or heat applied stress control for the semi-conductive screens of XLPE cables and PILC screened cables. The joints shall be encapsulated in in a filling medium such as resin or an equivalent alternative. There is a requirement to install a suitable earth connection, from the metallic sheath or screen wires.

All 33kV joints and insulated stop ends shall be tested for conformance to the requirements of BS 7888-4.1 (extruded cables), BS 7888-4.2 (paper cables and transition joints) using the test methods in BS EN 61442.

### 3.4. Connectors, Lugs and Earthing Connections

Cable lugs and connectors shall be tested to BS EN 61238-1. Lugs and connectors that have passed ENA ER C79, BS 4579 Parts 1 to 3 or equivalent shall be acceptable, providing field service history and performance can be cited.

Lugs and Connectors should be:

- Blocked when used on stranded cable conductors. Suitable for connection of both copper and aluminium cored conductors including combinations of both
- Suitable for connection of both copper and aluminium cored conductors including combinations of both
- Lugs for outdoor use shall have two palm holes (hole and slot) and be suitable for an outdoor environment. Preference will be given to brass or tinned copper lugs for outdoor use. If tinned aluminium or other type of lugs are offered for outdoor use, evidence of performance in outdoor environments would be required for consideration. There shall be sufficient length on mechanical connectors (lugs) to enable an adequate moisture seal on the lug barrel above the uppermost conductor clamping shear bolt.
- Shear-bolt mechanical lugs shall have sufficient barrel length above the uppermost conductor clamping bolt in order to ensure an adequate moisture seal.
- Earthing/Screen lugs and connectors shall be brass, tested and designed to meet BS EN 61238-1, BS 4579 or ENA ER C93 or equivalent. They should have a minimum of two bolt connections onto each conductor.
- Constant force springs (roll springs) will not be accepted as primary earth connections. They may only be used for secondary connections e.g. circumferential earth screens across joints.
- Worm drive clips (hose clamps) utilised within PILC/PICAS cables earthing kits/components shall preferably comply to the latest BS 5315. Worm drive clips provided should have a minimum torque break of not less than 10Nm. Type test certificates and type test reports shall be provided at the time of tender. Alternatives offered to worm drive clips may be considered.

### 3.5. Terminations

Indoor and outdoor terminations shall be supplied in kit form and shall be suitable for polymeric cables as specified in the Company’s specification NPS/002/021 – ‘Technical Specification for 33kV Power Cables’. The range of sizes is detailed in Appendix 1.

Indoor terminations shall be suitable for unfilled type cable boxes, fully or partially insulated.

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The termination body shall preferably be on a spiral holdout with a minimum 2 year shelf life from delivery. Further technical preference may be given to products offered with a shelf life beyond the minimum requirement

There will be a requirement on occasion to terminate a new XLPE cable into an older design cable box where the required electrical clearances cannot be achieved by air alone. In this instance a re-enterable resin will be required. A termination compatible with a suitable re-enterable resin shall be required in these circumstances.

Preference for fully insulated screened separable connectors suitable for inner and outer cone bushing arrangements (BS EN 50180/50181). Typical arrangements shall be interface C (outer cone) and size 3 (inner cone including voltage detector).

Dual cable termination arrangements shall be accommodated using an outer cone screened separable connector arrangement which has been designed to accommodate the second cable circuit and to mate with the rear end of the base screened connector system.

Terminations shall be cold applied and contain all the necessary items including shear-head mechanical lugs.

Terminations shall be tested to the requirements of BS 7888-4.1 or HD 629.1 using the test methods in BS EN 61442.

### 3.6. Stop Ends

Stop ends are required for existing paper cables and for polymeric cables. Stop ends for polymeric cables shall be cold applied. Stop ends for Paper cables may be cold or heat applied.

### 3.7. Insulation Shrouding Boots

Where required, shrouding boots shall be cold applied and such that they will fit both straight and angled switchgear bushings. Shrouding boots shall be tested to meet the requirements of BS 7888-4.1.

### 3.8. Earth Connections

Earth connections shall be suitable for a fault level of 3kA for 2s and shall conform to ENA ER C93 or equivalent.

### 3.9. Oil and Gas Filled Accessories

The additional requirements for oil and gas filled systems shall be specified in accordance with the relevant sections within NPS/002/017 – ‘Technical Specification for 66kV and 132kV Cable Accessories’.

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## 4. References

The products described within this specification shall comply with the latest versions of the relevant International Standards, British Standard Specifications and all relevant Energy Network Association Technical Specifications (ENA TS) current at the time of supply. The following documents are particularly relevant.

### 4.1. External Documentation

Reference	Version/Date	Title
<b>Energy Networks Association Standards</b>		
ENA ER C79	2014	Type tests for connectors for copper and aluminium conductors of insulated power cables (References BS EN 61238-1)
ENA ER C93	1992	Type approval tests for mechanical connections to metallic sheaths of cables
<b>British Standards</b>		
BS 7870 – 4.10	2011	LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for distribution cables with extruded insulation of rated voltages 11kV to 33kV. Single-core 11kV to 33kV cables
BS 7888 – 4.1	2006	Test requirements on accessories for use on power cables of rated voltage from 3.6/6 (7.2)kV up to and including 20.8/36 (42)kV. Cables with extruded insulation (Implementation of CENELEC HD 629.1)
BS 7888 – 4.2	2006	Test requirements on accessories for use on power cables of rated voltage from 3.6/6 (7.2)kV up to and including 20.8/36 (42)kV. Cables with impregnated paper insulation (Implementation of CENELEC HD 629.2)
BS EN 50180	2015	Bushings above 1kV up to 52kV and from 250A to 3.15kA for liquid filled transformers
BS EN 50181	2010	Plug-in type bushings above 1kV up to 36kV and from 250A to 2.50kA for equipment other than liquid filled transformers
BS-2562	1979	Specification for cable boxes for transformers and reactors
BS EN 61238 – 1	2003	Compression and mechanical connectors for power cables for rated voltages up to 36kV ( $U_m = 42kV$ ). Test methods and requirements
BS EN 61442	2005	Test methods for accessories for power cables with rated voltages from 3.6/6kV ( $U_m = 7.2 kV$ ) up to and including 20.8/36 ( $U_m = 42kV$ )
<b>IEC/CENELEC Technical Specification</b>		
CENELEC HD 629	2019	Test requirements on accessories for use on power cables with rated voltages from 3.6/6kV ( $U_m = 7.2 kV$ ) up to and including 20.8/36 ( $U_m = 42kV$ .)
IEC 60502-4	2005	Power Cables with Extruded Insulation and Their Accessories for Rated Voltages from 1kV ( $U_m = 1,2kV$ ) up to 30kV ( $U_m = 36kV$ ) - Part 4: Test Requirements on Accessories for Cables with Rated Voltages from 6kV ( $U_m = 7,2 kV$ ) up to 30kV ( $U_m = 36kV$ )

### 4.2. Internal Documentation

Reference	Title
NPS/002/017	Technical Specification for 66kV and 132kV cable accessories
NPS/002/021	Technical Specification for 33kV Power Cables

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### 4.3. Amendments from Previous Version

Reference	Update
Appendix 2	<ul style="list-style-type: none"> <li>- Remove rationalised 185-630mm joint application</li> <li>- Amended joint cable size applications</li> <li>- Include Aluminium conductors in all accessories</li> </ul>
3.3 Joints	Additional size transition capabilities information required
3.3 Joints & 3.5 Terminations	Clarification of 2 year shelf life from delivery

## 5. Definitions

Term	Definition
'H' Type	Hochstadter – screened 33kV paper insulated cable
'HSL' Type	Hochstadter – screened separately lead sheathed 33kV paper insulated cable
PE	Polyethylene
PILC	Paper Insulated Lead Covered
PVC	Polyvinyl Chloride
Separable connector	Fully insulated termination permitting the connection and disconnection of the cable to and from the mating plug-in type bushing
The Company	Northern Powergrid
XLPE	Cross Linked Polyethylene

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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.

		<b>Date</b>
Liz Beat	Governance Administrator	21/06/2023

### 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 and Reason	
No	Period: 5 years	Reason: Update will be dictated by contract renewal date or any significant changes in the specification or documents referenced.
<b>Should this document be displayed on the Northern Powergrid external website?</b>		Yes
		<b>Date</b>
Paul Hanrahan	Engineer - Asset Management	21/06/2023

### 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.

		<b>Date</b>
Steve Salkeld	Policy & Standards Engineer	21/06/2023
Joe Helm	Policy & Standards Manager	03/07/2023

### 6.4. Authorisation

Authorisation is granted for publication of this document.		
		<b>Date</b>
Paul Black	Head of System Engineering	24/07/2023

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## Appendix 1 – Typical Cable Types and Sizes

Typical 33 kV cable types on the Company’s distribution network are as follows.

<b>A1.1 - Single-core or 3-core paper cables</b>
0.25 in <sup>2</sup> to 1.0 in <sup>2</sup> (or metric equivalent): copper or aluminium conductor, lead or aluminium sheath with a PVC or Hessian oversheath. 3-core lead sheathed cables are likely to have steel wire armours
<b>A1.2 - Single-core XLPE (extruded) cables</b>
240mm <sup>2</sup> circular stranded copper conductor
300mm <sup>2</sup> circular stranded copper conductor
400mm <sup>2</sup> circular stranded copper conductor
500mm <sup>2</sup> circular stranded copper conductor
630mm <sup>2</sup> circular stranded copper conductor
800mm <sup>2</sup> circular stranded copper conductor
500mm <sup>2</sup> circular stranded aluminium conductor
630mm <sup>2</sup> circular stranded aluminium conductor
800mm <sup>2</sup> circular stranded aluminium conductor
<b>A1.3 - Single-core XLPE (extruded) cables in triplex formation</b>
240mm <sup>2</sup> circular stranded copper conductor
300mm <sup>2</sup> circular stranded copper conductor

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## Appendix 2 – Current Range of Joints and Terminations

Northern Powergrid Commodity Code	Requirements
<b>33kV Cold applied straight joints for single-core XLPE cables (supplied in kit of one) Complete with Phase and screen/earth mechanical connectors unless stated</b>	
162083	Straight Joint: 240mm <sup>2</sup> -/300mm <sup>2</sup> - 240mm <sup>2</sup> -/300mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162085	Straight Joint: 240mm <sup>2</sup> /300mm <sup>2</sup> 400mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162086	Straight Joint: 400mm <sup>2</sup> – 500mm <sup>2</sup> /630mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162105	Straight Joint: 500mm <sup>2</sup> /630mm <sup>2</sup> - 800mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162106	Straight Joint: 800mm <sup>2</sup> - 800mm <sup>2</sup> Stranded Copper or Aluminium Conductor

<b>33kV Cold applied stop ends for single-core XLPE cables (supplied in kit of one)</b>	
162107	Stop end: 240mm <sup>2</sup> -300mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162108	Stop end: 400mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162110	Stop end: 500mm <sup>2</sup> /630mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162111	Stop end: 800mm <sup>2</sup> Stranded Copper or Aluminium Conductor

<b>33kV Indoor Cold applied terminations for single-core XLPE cables (supplied in kit of one) Complete with phase and screen/earth mechanical lugs</b>	
159880	Termination Indoor: 240mm <sup>2</sup> Stranded Copper or Aluminium Conductor
159881	Termination Indoor: 300mm <sup>2</sup> - 400mm <sup>2</sup> Stranded Copper Conductor
159882	Termination Indoor: 500mm <sup>2</sup> - 630mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162112	Termination Indoor: 800mm <sup>2</sup> Stranded Copper or Aluminium Conductor

<b>33kV Termination Kits: Compatible with hV re-enterable resin for cable end boxes to BS 2562. To include centre palm phase lugs, screen/earth lugs, gland sealing sleeves and associated mastic sealants &amp; greases.</b>	
162113	Termination Indoor: 240mm <sup>2</sup> - 300mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162114	Termination Indoor: 400mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162115	Termination Indoor: 500/630mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162116	Termination Indoor: 800mm <sup>2</sup> Stranded Copper or Aluminium Conductor

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<b>33kV Outdoor Cold applied terminations for single-core XLPE cables (supplied in kit of one) Complete with phase and screen/earth mechanical lugs</b>	
159883	Termination Outdoor: 240mm <sup>2</sup> Stranded Copper or Aluminium Conductor
159884	Termination Outdoor: 300mm <sup>2</sup> - 400mm <sup>2</sup> Stranded Copper or Aluminium Conductor
159885	Termination Outdoor: 500mm <sup>2</sup> - 630mm <sup>2</sup> Stranded Copper or Aluminium Conductor
162117	Termination Outdoor: 800mm <sup>2</sup> Stranded Copper or Aluminium Conductor

<b>33kV Screened Separable Connectors (Outer Cone)</b>	
162118	Termination Outer Cone: 800A Bolted Connection 300mm <sup>2</sup> Stranded Copper or Aluminium Conductor (Bushing Profile 'C')
162119	Termination Outer Cone: 1250A Bolted Connection 500mm <sup>2</sup> Stranded Copper or Aluminium Conductor (Bushing Profile 'C')
162120	Termination Outer Cone: 1250A Bolted Connection 630mm <sup>2</sup> Stranded Copper or Aluminium Conductor (Bushing Profile 'C')
162121	Termination Outer Cone: 1250A Bolted Connection 800mm <sup>2</sup> Stranded Copper or Aluminium Conductor (Bushing Profile 'C')

<b>33kV Plug-in type Separable Connectors (Inner Cone)</b>	
162122	Termination Inner Cone: 800A Plug-In 300mm <sup>2</sup> Stranded Copper or Aluminium Conductor, Size 3 with voltage detector
162123	Termination Inner Cone: 1250A Plug-In 500mm <sup>2</sup> Stranded Copper or Aluminium Conductor, Size 3 with voltage detector
162124	Termination Inner Cone: 1250A Plug-In 630mm <sup>2</sup> Stranded Copper or Aluminium Conductor, Size 3 with voltage detector
162125	Termination Inner Cone: 1250A Plug-In 800mm <sup>2</sup> Stranded Copper or Aluminium Conductor, Size 3 with voltage detector

<b>33kV Resin filled transition joints for single-core and 3-core 'H' &amp; 'HSL' type PILC cables to XLPE (supplied in kit of one) Complete with mechanical connectors</b>	
084145	185mm <sup>2</sup> - 400mm <sup>2</sup> single-core transition joint PILC to XLPE cable
084707	185mm <sup>2</sup> - 400mm <sup>2</sup> single-core straight joint PILC to PILC
084764	185mm <sup>2</sup> - 400mm <sup>2</sup> transition/trifurcating Joint: 3-core 'H' type paper to 3 x single-core XLPE cables
084708	33kV Resin filled transition joint accessory. 185mm <sup>2</sup> - 400mm <sup>2</sup> 'HSL' type paper splitter module kit used in conjunction with 084764

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## Appendix 3 – Logistical Requirements

### A3.1 Storage

To enable the Company to store the product(s) in accordance with the manufacturer’s recommendations the tenderer should provide details of the recommended storage environment and maximum stacking height for each tendered product.

Details should be provided, where relevant, of the maximum exposure levels, frequency of exposure and duration of exposure of the packaged item with respect to:

- Ambient temperature
- Atmospheric corrosion
- Humidity
- Impact
- Water
- Vibration
- Dust
- Solar radiation

### A3.2 Packaging and Labelling

The tenderer shall ensure that each item is suitably packaged and protected to maintain the product and packaging as “fit for service” prior to installation, taking account of the potential for an outdoor storage environment. All packaging shall be sufficiently durable giving regard to the function, reasonable use and contents of the packaging. Where product packages tendered are made up of sub-packages, all the sub-packages shall unless varied by this specification, be supplied securely packaged together. Where items are provided in bagged form the material from which the bags are manufactured shall be capable of sustaining the package weight and resisting puncture by the materials within. The tenderer shall submit at the time of tendering the details of the proposed packaging (i.e. materials, composition and structure) to be used for each product. Where the tenderer is unable to provide packaging suitable for outdoor storage, this should be stated at the time of tender.

In order to maximise storage space all palletised goods shall be supplied in standard returnable box pallets with the following specification. Where applicable, suppliers shall also indicate the maximum number of units of each product that are storable per box pallet.

- Size – 1200mm (w) x 1000mm (d) x 750mm (h)
- Weight (empty) – Up to 33kg
- Load capacity – Up to 450kg
- Maximum stacking capacity – 10 high

Suppliers shall also include details of the type of material used to manufacture the box pallets.

The Company will give consideration to innovative alternatives to this packaging specification.

Clearly legible, easily identifiable, durable and unambiguous labelling shall be applied to each individual package and, where relevant, multiple packing of like products. Where product packages tendered are made up of sub-packages each sub-packages shall be marked.

As a minimum requirement the following information shall be included on packaging:

- Manufacturer’s trademark or name
- Supplier’s trademark or name
- Description of item
- Date of packaging and/or batch number
- Northern Powergrid product code
- Weight
- Shelf life
- Pack quantity

The tenderer shall submit at the time of tendering a sample of the proposed labelling for each product package.

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## Appendix 4 – Self Certification Conformance Declaration

33 kV cable joints and terminations required to be supplied against this specification shall comply with the latest issues of the relevant ENA, British and International Standards specified. The following tables are intended to amplify and/or clarify the requirements of elements of these Standards but do not preclude meeting all requirements.

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

### 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 to confirm 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' 'IEC' 'HD' or 'ENATS' as appropriate.
- Provide technical data sheets and associated drawings for each product.

**Manufacturer / Supplier:**

**Manufacturer / Supplier Product Reference:**

**Northern Powergrid Product Reference (Commodity Code):**

**Details of the Product Type: ( e.g. Voltage, Conductor Type and Size)**

**Name:**

**Signature:**

**Date:**

**NOTE:** One sheet shall be completed for each type of cable offered.

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## Appendix 4 – Self Certification Conformance Declaration (continued)

Technical Specification for 33 kV Joints and Terminations (Cables with Extruded Insulation)					
	Test	Requirements HD 629.1/BS 7888-4.1	Conformance Code	Evidence Reference	Remarks/Comments
1.	DC Voltage Withstand Dry	15 min / 6 U <sub>0</sub>			
2.	AC Voltage Withstand Dry	5 min / 4.5 U <sub>0</sub>			
3.	AC Voltage Withstand Wet	5 min / 4.5U <sub>0</sub>			Only outdoor terminations
4.	Partial Discharge at Ambient	Max 10 pC @ 1.73 U <sub>0</sub>			
5.	Impact	IR: min 10 <sup>3</sup> MΩ – conductor / screen min 50 MΩ – screen / water			Only joints
6.	Impulse Voltage at Elevated Temperature	10 impulses of each polarity			
7.	Heating Cycle Voltage in Air	126 cycles @ 2.5 U <sub>0</sub>			63 cycles for joints and separable connectors Not applicable to stop ends
8.	Heating Cycle Voltage in Water	63 cycles @ 2.5 U <sub>0</sub>			Only Joints and Separable Connectors
9.	Immersion	10 cycles			Only outdoor terminations
10.	AC Voltage Withstand Dry	500 h / 2.5 U <sub>0</sub>			Only stop ends
11.	AC Voltage Withstand in Water	500 h / 2.5 U <sub>0</sub>			Only stop ends
12.	Partial Discharge at Elevated and Ambient Temperatures	Max 10 pC @ 1.73 U <sub>0</sub>			After short circuit and disconnection / connection tests for separable connectors
13.	Thermal Short Circuit (screen)	2 x short circuits @ I <sub>sc</sub>			Not applicable to stop ends

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## Appendix 4 – Self Certification Conformance Declaration (continued)

Technical Specification for 33kV Joints and Terminations (Cables with Extruded Insulation)					
	Test	Requirements HD 629.1/BS 7888-4.1	Conformance Code	Evidence Reference	Remarks/Comments
14.	Thermal Short Circuit (conductor)	2 x short circuits to raise conductor to $\theta_{sc}$			Not applicable to stop ends
15.	Dynamic Short Circuit	1 x short circuits @ $I_d$			Not applicable to stop ends
16.	Disconnection/connection	5 complete operations			Only separable connectors
17.	Impulse Voltage at Ambient Temperature	10 impulses of each polarity			
18.	AC Voltage Withstand Dry	15 min / 2.5 $U_0$			
19.	Humidity / Salt Fog	300 h @ 1.25 $U_0$ / 1000 h @ 1.25 $U_0$			Humidity only indoor terminations Salt fog only outdoor terminations
20.	Operating Eye	Axial force:1 300 N / 1min torque 14 Nm			Only separable connectors
21.	Partial Discharge at Ambient	Max 10 pC @ 1.73 $U_0$			Only separable connectors
22.	Examination	Visual			
Additional requirements for plug-in and screened separable connectors					
23.	Screen Resistance	Max 5 000 $\Omega$			
24.	Leakage Current	Max 0.5 mA @ $U_M$			
25.	Screen Fault Current Initiation	Fault current to flow continuously			
26.	Operating Force	<900 N			
27.	Capacitive Test Point	Capacitance ( $C_{tc}$ ) of test point to cable conductor >1.0 pF			
		Ratio of capacitance test point to earth ( $C_{te}$ ) / ( $C_{tc}$ ) $\leq 12$			

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## Appendix 4 – Self Certification Conformance Declaration (continued)

Technical Specification for 33kV Joints and Terminations (Cables with Extruded Insulation)					
	Test	Requirements HD 629.1/BS 7888-4.1	Conformance Code	Evidence Reference	Remarks / Comments
<b>Additional requirements for smallest and largest conductor size compliance</b>					
28.	DC Voltage Withstand Dry	15 min / 6U <sub>0</sub>			
29.	AC Voltage Withstand Dry	5 min / 4.5 U <sub>0</sub>			
30.	Partial Discharge at Ambient	Max 10 pC @ 1.73 U <sub>0</sub>			
31.	Impulse Voltage at Ambient Temperature	10 impulses of each polarity			
32.	Heating Cycle Voltage in Air	10 cycles @ 2.5 U <sub>0</sub>			
33.	Partial Discharge at Elevated and Ambient Temperatures	Max 10 pC @ 1.73 U <sub>0</sub>			
34.	AC Voltage Withstand Dry	15 min / 4.5 U <sub>0</sub>			
35.	Examination				
<b>Additional requirements for insulation screen compliance</b>					
36.	DC Voltage Withstand Dry	15 min / 6 U <sub>0</sub>			
37.	AC Voltage Withstand Dry	5 min / 4.5 U <sub>0</sub>			
38.	Partial Discharge at Elevated and Ambient Temperatures	Max 10 pC @ 1.73 U <sub>0</sub>			
39.	Heating Cycle Voltage in Air	126 cycles @ 2.5 U <sub>0</sub>			
40.	Impulse Voltage at Ambient Temperature	10 impulses of each polarity			
41.	AC Voltage Withstand Dry	15 min / 2.5 U <sub>0</sub>			
42.	Examination				

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## Appendix 4 – Self Certification Conformance Declaration (continued)

Technical Specification for 33kV Joints and Terminations (Cables with Paper Insulation – Joints and Stop Ends)					
	Test	Requirements HD 629.1/BS 7888-4.2	Conformance Code	Evidence Reference	Remarks/Comments
1.	DC Voltage Withstand Dry	15 min / 6 U <sub>0</sub>			
2.	AC Voltage Withstand Dry	5 min / 4.5 U <sub>0</sub>			
3.	Impact	IR: Min 10 <sup>3</sup> MΩ – conductor / screen Min 50 MΩ – screen / water			Only joints
4.	Impulse Voltage at Elevated Temperature	10 impulses of each polarity			
5.	AC Voltage Withstand Dry	500 h / 1.5 U <sub>0</sub>			Only stop ends
6.	AC Voltage Withstand in Water	500 h / 1.5 U <sub>0</sub>			Only stop ends
7.	Heating Cycle Voltage in Air	63 cycles @ 1.5 U <sub>0</sub>			Only joints
8.	Heating Cycle Voltage in Water	63 cycles @ 1.5 U <sub>0</sub>			Only joints
9.	Thermal Short Circuit (screen)	2 x short circuits @ I <sub>sc</sub>			Not applicable to stop ends
10.	Thermal Short Circuit (conductor)	2 x short circuits to raise conductor to θ <sub>sc</sub>			Not applicable to stop ends
11.	Dynamic Short Circuit	1 x short circuits @ I <sub>d</sub>			Not applicable to stop ends
12.	Impulse Voltage at Ambient Temperature	10 impulses of each polarity			
13.	AC Voltage Withstand Dry	15 min / 2.5 U <sub>0</sub> Joints 4 h / 3 U <sub>0</sub> stop ends			
14.	Examination	Visual			

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#### Appendix 4 – Self Certification Conformance Declaration (continued)

Technical Specification for 33kV Joints and Terminations (Cables with Paper Insulation – Joints and Stop Ends)					
	Test	Requirements HD 629.1/BS 7888-4.2	Conformance Code	Evidence Reference	Remarks/Comments
<b>Additional requirements for smallest and largest conductor size compliance</b>					
15.	DC Voltage Withstand Dry	15 min / 6 U <sub>0</sub>			
16.	AC Voltage Withstand Dry	5 min / 4.5 U <sub>0</sub>			
17.	Impulse Voltage at Ambient Temperature	10 impulses of each polarity			
18.	Heating Cycle Voltage in Air	10 cycles @ 1.5 U <sub>0</sub>			
19.	AC Voltage Withstand Dry	4 h / 3 U <sub>0</sub>			
20.	Examination				
<b>Additional requirements non-circular conductor compliance and insulation screen compliance</b>					
21.	DC Voltage Withstand Dry	15 min / 6 U <sub>0</sub>			
22.	AC Voltage Withstand Dry	5 min / 4.5 U <sub>0</sub>			
23.	Heating Cycle Voltage in Air	126 cycles @ 1.5 U <sub>0</sub>			
24.	Impulse Voltage at Ambient Temperature	10 impulses of each polarity			
25.	AC Voltage Withstand Dry	4 h / 3 U <sub>0</sub>			
26.	Examination				

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## Appendix 5 – Addendum to Supplier Requirements

All Joints, Terminations and Module kits shall be provided with clear and concise Installation Instructions. The Installation Instructions shall be provided for approval, in an agreed format, at the time of tender and cover the assembly of all the components.

The Installation Instructions shall include all cable Types and sizes, the Company’s commodity codes and suppliers kit references.

### Technical Support

Joints and Terminations supplied and purchased by the Company within this specification are required to receive full technical support throughout the contract period (including extensions).

The Company may call on successful Tenderer(s) to support uncommon, non-standard applications that may arise during the contract period. The successful Tenderer(s) shall be expected to provide Technical support and solutions when required.

The Tenderer(s) shall provide contact details of dedicated Company technical support at the time of tender. The Tenderer(s) shall also state reasonable expected response and support timescales if/when the Company request of them.

### Joints and Termination Failures

The Company are committed to continuous improvement of network reliability. Any supplied joints or termination failures which occur throughout the life of the contract, and within the accessories expected minimum life expectancy, shall be fully investigated and supported by the successful Tenderer(s). A full report, by the supplier, shall be issued in a reasonable timescale of approx. two weeks after the completion of the failure investigation, detailing the failure findings.

In the event of unresolved and undetermined failure investigations carried out and provided by the supplier, the Company shall reserve the right to engage an independent investigation.

### Kitting

All joint and terminations will be supplied in kit form with the components required including connectors, lugs and work instructions included in the kit.

To keep the amount of kits down to a minimum, a base kit and module kits to suit different sizes will be considered.

### Tooling

The tooling costs associated with the handling, installation, inspection, maintenance, repair and decommissioning of the product(s) is crucial to the Company’s assessment of product viability.

To enable the Company to understand and assess the cost of required tooling the tenderer should provide full details of the tooling recommended for use by the manufacturer for the purpose of handling, installation, commissioning, inspection, maintenance, repair and decommissioning of each tendered product. The tenderer should provide, where available, indicative prices applicable to the recommended tooling.

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## Appendix 6 - Management Systems of Occupational Health and Safety (OHS)

The Tenderer shall at the time of tender submit all Material Safety Data Sheets (MSDS) for all products offered that require them as part of COSHH regulations(including greases, adhesives, mastics, solvents, compounds etc).

## Appendix 7- Routine Inspection and Maintenance Requirements

Suppliers shall provide details of the recommended pre-commission testing and inspection required.

They shall also provide information regarding periodic inspection and maintenance requirements to be undertaken during the lifetime of their product.

Detailed inspection and maintenance instructions shall also be provided.

## Appendix 8 - Quality Management Systems (QMS)

The Tenderer(s) shall operate a fully documented quality assurance system and shall provide details of this system at the time of tender, e.g. certified by approved quality assurance system BS EN ISO 9001.

The Tenderer(s) shall retain all production and traceability records applicable to the manufacturing and service provision of products supplied to the Company. These records shall be retained by the supplier and copies provided on request by the Company.

Where the Tenderer(s) is not the manufacturer of a product that they intend to bid for, the factories where key components of each product are manufactured shall also be certified to a fully documented quality assurance system. Full details shall be provided at the time of tender.

All products bid for and their components shall be traceable back to the point of manufacture. Evidence of this level of traceability shall be submitted during the tender process.

The Company shall perform factory audits to assure the service or product conforms to BS EN ISO 9001. The audits will generally take place prior to the award of a new contract, or when the level of consistency or conformance falls below acceptable levels. Appropriate notification, along with the audit scope, will be communicated and agreed prior to audit implementation.

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## Appendix 9 – Technical Information Check List

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

Requirement	Provided (Y/N)
Appendix 3 - Packaging/delivery information	
Appendix 4 - Full product descriptions and part number/reference	
Appendix 4 – Completed self-certification conformance declaration	
Appendix 4 - Complete set of drawings (e.g. Product Datasheets, Brochures etc) for each variant	
Appendix 4 - Type test/Test evidence	
Appendix 5 - Routine test plan (example)	
Appendix 5 – Provision of Technical Support	
Appendix 5 – Complete set of all Installation Instructions	
Appendix 6 – MSDS (COSSH)	
Appendix 7 - Detailed inspection and maintenance instructions	
Appendix 8 - BS EN ISO 9001	