NPS/002/015 – Technical Specification for 11kV and 20kV Cable Joints & Terminations

1. Purpose

The purpose of this document is to detail the technical requirements for 11kV & 20kV cable joints and terminations for use on the distribution networks of Northern Powergrid (the Company).

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

Reference	Version	Date	Title
NPS/002/015	4.0	Oct 2016	Technical Specification for 11kV and 20kV Cable Joints & Terminations

2. Scope

This specification details the technical requirements for 11kV and 20kV cable joints and terminations for use on the Company's distribution network. Accessories specified in this document shall be suitable for use on cables installed in accordance with the Company's policy, NSP/002 – Policy for the Installation of Distribution Power Cables.

The following appendices form part of this technical specification:

- Appendix 1: Typical cable types and sizes
- Appendix 2: Current range of Joints and Termination
- 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: Environmental Management Systems
- Appendix 10: Technical Information Check List

2.1. Table of Contents

3. Technical Requirements

3.1. Conditions of Operation for Cable Joint, and accessories

The following are the general conditions under which cable joints purchased in accordance with this specification are required to operate:

- Nominal system voltages: 11kV and 20kV.
- 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 at one or more points.
- The fault levels required will be 5kA for 2 seconds at 11kV and 2kA for 3 seconds at 20kV.
- The withstand level for indoor terminations shall be 95kV at 11kV and 125kV at 20kV

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.

They must be suitable to be installed in the full range of climatic conditions encountered within the UK, this applies to resins and cold applied products that must be ready for energising within 2 hours of completion.

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.

Suppliers shall provide details of any periodic inspection and maintenance information requirements as highlighted in Appendix 2.

3.2. Cable Types

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

Cable joints will be required to join:

- XLPE to XLPE
- XLPE to Paper insulated cables
- 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 swellable tapes or powders
- Have lead or aluminium sheaths with or without armour serving, or copper screen wires

- Cables can be hessian (PILC), PVC or PE over sheathed.

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) 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. 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, that may require special tooling, the tooling shall be included in the kits.

A secondary mechanical outer protection layer may be cold or heat applied. The outer protection shall be equivalent or greater than the mechanical protection of the cable outer sheath and must also withstand an insulation test of 5kV after backfilling to enable cable sheath testing.

Joint Type 2: Triplex - 3 x Single core XLPE (XLPE to XLPE) joints, including an external earth.

As well as the requirements for single core to single core jointing, there is a requirement to make 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/PICAS to XLPE)

Joints suitable for three core paper cables (PILC/PICAS) to three single core XLPE cables 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/PICAS 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. These joints can be either straight, branch or loop.

Joint type 4: Paper insulated (PILC/PICAS) to Paper insulated (PILC/PICAS) joints

Joints for jointing PILC/PICAS to PILC/PICAS cables shall have a cold, or heat applied central system that includes stress control and insulation over the central core and connector. They shall also have cold or heat applied stress control for the semi-conductive screens of XLPE cables and PILC/PICAS screened cables. The joints shall be encapsulated in in a filling medium such as resin or an equivalent alternative.

Joint Type 5: Single Core XLPE Stop end joints

Joints suitable for stop end applications 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. 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, that may require special tooling, the tooling shall be included in the kits.

A secondary mechanical outer protection layer may be cold or heat applied. The outer protection shall be equivalent or greater than the mechanical protection of the cable outer sheath and must also withstand an insulation test of 5kV after backfilling to enable cable sheath testing.

Joint Type 6: Single Core and 3 Core Paper(PILC /PICAS) Stop end joints

Joints suitable for three or single core paper cables (PILC/PICAS) shall have a cold or heat applied central system that includes stress control and insulation over the central core and connector when insulating rods and/or connectors are utilised. They should also have cold or heat applied stress control for PILC/PICAS screened cables.

The joints shall be encapsulated in in a filling medium such as resin or an equivalent alternative.

Note: <u>All</u> joint types (1 to 6) outer protection layers/encapsulation (heat/cold applied, resin encapsulated etc) must withstand a minimum 5kV insulation resistance cable sheath test after backfill and reinstatement.

3.4. Terminations and Insulation Boots

Terminations will be required for indoor and outdoor use.

Terminations shall be Cold applied.

Preference will be given to single piece pre-expanded termination bodies on a spiral holdout, with integrated stress control and integral sealing at the top end lug position. Other designs will be considered.

The termination body shall have a minimum 2 year shelf life. Further technical preference may be given to products offered with further extended shelf life than the minimum requirement.

The mastic sealing over mechanical lugs must cover all shear-off bolt positions with a minimum of 10mm above the top bolt.

Indoor terminations will normally be fitted into unfilled cable boxes and shall be fully or partially insulated type with insulated shrouding boots as appropriate where sufficient clearances cannot be obtained, or to reach the required impulse level. Terminations may also be screened separable type connectors.

Terminations shall be required to be compatible with the company's approved insulation bushing boots.

For applications that cannot utilise insulation bushing boots, an optional taped boot kit application would be required.

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.

3.5. 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.

Cable (earth) metallic sheath connections shall be tested to ENA ER C93

Lugs and connectors should be:

- Blocked when used on stranded cables
- Split for cables greater than 185mm^2
- Suitable for connection of both copper and aluminium cored conductors including combinations of both
- Lugs for outdoor use will have two holes (hole and slot) water blocked and suitable for all outdoor environments. 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.
- 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.

3.6. Joint Shells

Joint shells shall be made of a plastic-type material that is compatible with the company's approved resin. Vacuum formed shells shall be a minimum of 3mm thick and Injection moulded shells shall be a minimum 1.5mm thick, with ribbing for added strength and bleed holes to assist the release of any trapped air.

The joint shells shall be provided in two halves and preferably be horizontally split. Adequately sized resin port(s) openings/apertures shall be either pre-cut or incorporated within the shell manufacturing process by the manufacturer. The resin filling ports shall have suitable lids provided for installation after resin filling.

The joint shells are required to have stepped ports for cable entry and must be provided with any required fasteners. Plastic sliders shall be preferred to metal clip fasteners and should be suitable to ensure the joint shell halves remain intact without resin leakages after filling. Results of filling trials by the manufacturer to prove the system works adequately shall be provided.

Shells shall offer a minimum of 15mm clearance around the completed joint. Any additional sealing materials required to seal the joint shell shall be provided. The supplier shall advise the empty resin volumes for each joint shell.

3.7. Paper Cable Preparation

Technical preference will be given to innovative and / or proven designs which can be shown to enhance the performance of the cable crutch area on 3 core paper insulated cables to prevent any risk of premature failure.

3.8. Joints, Termination Kits and Modules

All joints, or terminations will be supplied either as a kit or kit plus module with suitable connectors and lugs contained within the kits or modules as required.

The Company has a variation of cable sizes and constructions that are outside the scope of the ranges set out in **Appendix 2 – Current Range of Joints and Terminations** on the network (0.0145sq", 0.04sq", 0.05sq",

0.1sq" etc). Preference will be given to module kits to cover size transitions and compatible with the relevant Base kit joint in Appendix 2.

3.9. 20kV Cable Joints and Terminations

All new installations utilise single core polymeric cables to BS 7870-4, the range of which is indicated in Appendix1.

3.9.1. Terminations

Indoor and outdoor terminations shall be cold applied, supplied as a kit of three and contain all the necessary items including mechanical lugs to complete the phase and screen/earth connections. The terminations shall be tested to BS 7888 - 4.1/4.2 and/or Cenelec HD629, or equivalent.

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

Preference will be given to M16 palm hole sizes for indoor single hole lugs including M12 reducers.

Outdoor lugs shall be two hole fixing M12 palm hole sizes with bottom hole slotted. They should be preferably brass or tinned copper. If tinned aluminium or other type of lugs are offered for outdoor use, providing evidence of performance in outdoor environments would be required for consideration.

3.9.2. Insulation Shrouding Boots

Shrouding boots shall be cold applied and such that they will fit both straight and angled switchgear bushings. Shrouding boots shall be tested to BS 7888 - 4.1/4.2 and/or Cenelec HD629, or equivalent.

An optional taped boot kit application will be required for cable end boxes that cannot achieve the appropriate/sufficient clearances or reach the required impulse level.

3.9.3. Insulated Pre-moulded Screened Separable Connectors

Separable connectors will be tested according to BS 7888 - 4.1 and HD 629. They shall be required to fit Cenelec EN 50180/EN 50181 interfaces.

Separable connectors shall be of push fit design, non-load break/make and 630, 800 or 1250 amp bolted type for Type 'C' bushings. The phase lugs shall be mechanical shear-off type with a minimum of two shear-off connections. They shall be a kit of three including phase, screen/earth mechanical lugs and all necessary components to complete the termination.

250 A Non-Load Break Elbow Connectors shall be mechanical phase lugs with a min two connections, for Type 'A' bushings. They shall be a kit of three including phase, screen/earth mechanical lugs and all necessary components to complete the termination.

200 A load break elbows shall be mechanical phase lugs with a min two connections and meets requirements of ANSI/IEEE Standard 386. They shall be a kit of three including phase, screen/earth mechanical lugs and all necessary components to complete the termination.

3.9.4. Screen/Earth Connections

Screen/Earth connections will be required to carry 2kA for 3 seconds and should comply with ENA ER C93 or equivalent.

3.9.5. Joints

Joints shall be tested to BS 7888 - 4.1/4.2 and/or Cenelec HD629, or equivalent and will be required to connect cable combinations as detailed in section 3.1.2. The joint, which shall be in kit form, shall

include all the necessary items including mechanical connectors to carry out the connection. Cold applied joints shall be provided for polymeric to polymeric cables.

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

3.9.6. Stop Ends

A stop end kit as detailed in BS 7888 - 4.1/4.2 is required for existing paper cable to BS 7894 and polymeric cables to BS 7870-4, cable range and size are as detailed in Appendix 1. Cold applied stop ends shall be provided for polymeric cables.

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

3.10. 11kV Cable Joints and Terminations

All new installations utilise single core polymeric cables to BS 7870-4, the range of which is indicated in Appendix 1. All 11kV joints and stop ends will be tested to BS 7888 - 4.1/4.2 and/or Cenelec HD 629 or equivalent.

3.10.1. Terminations

Indoor and outdoor terminations shall be cold applied supplied in kit form as a kit of three and contain all the necessary items including mechanical lugs to complete the phase and screen/earth connections. The terminations shall be tested to BS 7888 and/or Cenelec HD629, or equivalent.

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

3.10.2. Insulation Shrouding Boots

Shrouding boots shall be cold applied and such that they will fit both straight and angled switchgear bushings. Shrouding boots shall be tested to BS 7888 - 4.1/4.2 and HD 629, or equivalent.

3.10.3. Insulated Pre-moulded Screened Separable Connectors

Separable connectors will be tested according to BS 7888 - 4.1 and HD 629. They shall be required to fit Cenelec EN 50180/EN 50181 interfaces.

Separable connectors will push fit non-load break/make and 630, 800 or 1250amp bolted type for Type ‘C’ bushings. The phase lugs shall be mechanical shear-off type with a min two shear-off connections. They shall be a kit of three including phase, screen/earth mechanical lugs and all necessary components to complete the termination.

3.10.4. Screen/Earth Connections

Screen/Earth connections will be required to carry 5kA for 2 seconds and should comply with ENA ER C93 or equivalent.

3.10.5. Joints

Joints will be required to connect: -

- Single core polymeric to single core polymeric in straight and branch joint configurations.

- Single core polymeric onto three core paper insulated cables, which may have an aluminium or lead sheath.
- Three core paper cables to three core paper cables, which may have an Aluminium or lead sheath

3.10.6. Stop Ends

A stop end kit as detailed in BS 7888 - 4.1/4.2 is required for existing paper cable to BS 7894 and polymeric cables to BS 7870-4, cable range and size are as detailed in Appendix 1. Cold applied stop ends shall be provided for polymeric cables.

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

4. References

The joints and terminations within this specification shall comply with all current 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.

4.1. External Documentation

Reference	Version/Date	Title
Energy Network Association Engineering Recommendations (ENA ER) and Technical Specifications (ENA TS)		
ENA ER – C79	3.0 / 2014	Type tests for connectors for Copper and Aluminium conductors of insulated power cables.
ENA ER – C93	1.0 / 1992	Type approval tests for mechanical connections to metallic sheaths of cables.
ENA TS – 09-12	2.0 / 1990	Impregnated Paper Insulated Corrugated Aluminium Sheathed 6350 / 11000v Cable.
British Standards		
BS EN-50180-1	2015	Bushings above 1 kV up to 52 kV and from 250 A to 3,15 kA for liquid filled transformers.
BS EN-50181	2010	Plug-in type bushings above 1 kV up to 52 kV and from 250 A to 2,50 kA for equipment other than liquid filled transformers.
BS-2562	1979	Specification for cable boxes for transformers and reactors
BS-5315	1991	Hose clamps (worm drive type) for general purpose use (metric series)
BS-4579	1976	Specification for performance of mechanical and compression joints in electric cable and wire connectors. Mechanical and compression joints in Aluminium conductors
BS EN 61238-1	2003	Compression and mechanical connectors for power cables for rated voltages up to 36 kV (Um = 42 kV). Test methods and requirements
BS-6480	1988	Specification for impregnated paper-insulated lead or lead alloy sheathed electric cables of rated voltage up to and including 33000 V.
BS-7870-4	2011	LV and MV polymeric cables. Specification for distribution cables with extruded insulation for rated voltages of 11 and 33kV.
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 20,8/36(42) kV - Part 1: Cables with extruded insulation.
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 20,8/36(42) kV - Part 2: Cables with impregnated paper insulation.
BS-7894	2003	MV Impregnated Paper Insulated Cable 3.8/6.6kV to 19/33kV.
IEC Technical Specification		
Cenelec HD629		Test requirements on accessories for use on power cables with rated voltages from 3.6/6kV(Um = 7.2 kV) up to and including 20.8/36 (Um = 42kV.
Part 1		Cables with extruded insulation.
Part 2		Cables with impregnated paper insulation.

4.2. Internal Documentation

Reference	Title
NSP/002	Policy for the Installation of Distribution Power Cables

4.3. Amendments from Previous Version

Reference	Update
2.1. Table of Contents	# Additional Appendix added including page corrections
3. Technical Requirements	# 3.3 to 3.6, 3.9.1 to 3.9.3 and 3.10.3 – Additional technical requirement information added: i.e. - *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 comply to the latest BS 5315. Worm drive clips provided should have a minimum torque break of not less than 10Nm.* *- 5kV Withstand test requirement of mechanical outer protection layers and Resin encapsulation.* *- 200 A load break elbows shall be mechanical phase lugs with a min two connections and meets requirements of ANSI/IEEE Standard 386.* # Minor text changes throughout section 3
4.1 External Documentation	# BS 2562, BS 5135, BS 4579 & BS EN 61238-1 added to table # Additional resin joint encapsulation shell 'shell & sealing robustness' test requirement
Appendix 1	# Additions- 11kV 500mm², 11kV 800mm², 20kV 800mm² cables and 11kV/20kV cable type description changes
Appendix 2	# Various changes to text descriptions # Separated 11kV and 20kV Indoor & Outdoor terminations into specific items # Separated 11kV and 20kV joints into specific sections # Added new comm coded kit requirements # Added current module kits for use with base kits
Appendix 3	# Minor text changes
Appendix 4	# BS 5135, BS 4579 & BS EN 61238-1 added to relevant sections
Appendix 7 to 10	# Inclusion of new Appendices
Appendix 10	# Additional check list items
5. Definitions	# Cable abbreviations added

5. Definitions

Term	Definition
PICAS	Paper Insulated Corrugated Aluminium Sheath
PILC	Paper Insulated Lead Covered
The Company	Northern Powergrid
XLPE	Cross Linked Polyethylene

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	04/08/2022

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: Update will be dictated by contract renewal date or any significant changes in the specification or documents referenced.
Should this document be displayed on the Northern Powergrid external website?		Yes
		Date
Paul Hanrahan	Engineer - Asset Management	04/08/2022

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
Joe Helm	Policy & Standards Manager	08/08/2022
Steve Salkeld	Policy & Standards Engineer	04/08/2022

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	System Engineering Manager	25/08/2022

Appendix 1 – Typical Cable Types and Sizes

Or imperial equivalents which can be found on the Company's distribution network

20kV Cable Types and Sizes
95mm^2: Stranded Aluminium, or Copper Conductor Cable, Screened, PILC SWA, Served, 3-Core
185mm^2: Stranded Aluminium or Copper Conductor Cable, Screened, PILC SWA, Served, 3-Core
185mm^2: Single Core XLPE, Solid Aluminium Conductor and copper wire screens
300mm^2: Single Core XLPE, Stranded Copper and copper wire screens
400mm^2: Single Core XLPE, Stranded Copper and copper wire screens
800mm^2: Single Core XLPE, Stranded Copper and copper wire screens
11kV Cable Types and Sizes
95mm^2: Stranded Aluminium or Copper Conductor Cable, Screened or Belted PILC SWA, Served, 3-Core
150mm^2: Stranded Aluminium or Copper Conductor Cable, Screened or Belted, PILC SWA, Served, 3-Core
185mm^2: Stranded Aluminium or Copper Conductor Cable, Screened or Belted, PILC SWA, Served, 3-Core
300mm^2: Stranded Aluminium or Copper Conductor Cable, Screened or Belted, PILC SWA, Served, 3-Core
95mm^2: Aluminium Conductor, Belted, Paper Insulated Corrugated Aluminium Sheath(PICAS) and PVC over sheath
185mm^2: Aluminium Conductor, Belted, Paper Insulated Corrugated Aluminium Sheath(PICAS) and PVC over sheath
300mm^2: Aluminium Conductor, Belted, Paper Insulated Corrugated Aluminium Sheath(PICAS) and PVC over sheath
95mm^2: Single Core XPLE, Solid Aluminium Conductor and Copper Wire Screens
185mm^2: Single Core XLPE, Solid Aluminium Conductor and Copper Wire Screens
300mm^2: Single Core XLPE, Solid Aluminium Conductor and Copper Wire Screens
300mm^2: Single Core XLPE, Circular Stranded Copper Conductor and Copper Wire Screens
400mm^2: Single Core XLPE, Circular Stranded Copper Conductor and Copper Wire Screens
500mm^2: Single Core XLPE, Circular Stranded Copper Conductor and Copper Wire Screens
630mm^2: Single Core XLPE, Circular Stranded Copper Conductor and Copper Wire Screens
800mm^2: Single Core XLPE, Circular Stranded Copper Conductor and Copper Wire Screens

Appendix 2 – Current Range of Joints and Terminations

(Cold Applied and Resin Filled)

Northern Powergrid Commodity Code	Indoor and Outdoor Terminations COLD APPLIED For Single Core XLPE Cables (supplied in kit of 3)
11kV Indoor Terminations: To include M16 Mechanical Connectors and M12 reducers, and M12 lugs for screen wire connections	
163660	Termination Indoor: 95mm^2 Solid Aluminium Conductor
163661	Termination Indoor: 185/300mm^2 Solid Aluminium Conductor
163662	Termination Indoor: 300/400mm^2 Stranded Copper Conductor
163663	Termination Indoor: 500/630mm^2 Stranded Copper Conductor
165632	Termination Boot Kit (Cold Applied) BIL 95kV. Bushing diameters 46-70mm

11kV 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 & greases.	
160650	Termination Indoor: 95/300mm^2 Solid Aluminium Conductor
160670	Termination Indoor: up to 300/400mm^2 Stranded Copper Conductor
160671	Termination Indoor: 500/630mm^2 Stranded Copper Conductor
160672	Termination Indoor: 800mm^2 Stranded Copper Conductor

11kV Outdoor Terminations: To include M12 Two hole(bottom hole slotted) Mechanical Connectors and M12 Lugs for screen wire connections	
163664	Termination Outdoor: 95mm^2 Solid Aluminium Conductor
163665	Termination Outdoor: 185/300mm^2 Solid Aluminium Conductor
163670	Termination Outdoor: 300/400mm^2 Stranded Copper Conductor
160682	Termination Outdoor: 500/630mm^2 Stranded Copper Conductor

Screened Separable Connectors	
159948	11kV 250Amp Push on 95/185mm^2 Solid Aluminium Conductor - Non-load Break (Bushing Profile 'A')
159950	20kV 250Amp Push on 95/185mm^2 Solid Aluminium Conductor - Non-load Break (Bushing Profile 'A')
159946	11kV/20kV 630/800Amp Bolted Connection 185mm^2 Solid Aluminium Conductor (Bushing profile 'C')
160675	11kV/20kV 200Amp Load Break Push on 95/185mm^2 Solid Aluminium Conductor (ANSI/IEE Standard 386)
160683	11kV 630/800Amp Bolted Connection 300mm^2 Solid Aluminium Conductor (Bushing profile 'C')
160684	20kV 1250A Bolted Connection 800mm^2 Stranded Al/Cu (Bushing Profile ‘C’)

20kV Indoor Terminations: To include M16 Mechanical Connectors and M12 reducers, and M12 lugs for screen wire connections	
362069	Termination Indoor: 185mm^2 Solid Aluminium Conductor
362070	Termination Indoor: 300/400mm^2 Stranded Copper Conductor
164288	Termination: Taped Barrier Boot Kit (Cold Applied)

20kV 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 & greases.	
160650	Termination Indoor: 185mm^2 Solid Aluminium Conductor
160673	Termination Indoor: 300/400mm^2 Stranded Copper Conductor

160674	Termination Indoor: 800mm^2 Stranded Copper Conductor

20kV Outdoor Terminations: To include M12 Two hole(bottom hole slotted) Mechanical Connectors and M12 Lugs for screen wire connections	
163666	Termination Outdoor: 185mm^2 Solid Aluminium Conductor
163667	Termination Outdoor: 300/400mm^2 Stranded Copper Conductor
160676	Termination Outdoor: 800mm^2 Stranded Copper Conductor

Single Core XLPE - XLPE (COLD APPLIED Joint Body)	
11kV Straight Joints	
162072	Straight Joint: 95mm^2 - 95mm^2: Solid Aluminium Conductor
162073	Straight Joint: 185/300mm^2 - 185/300mm^2: Solid Aluminium Conductor
162094	Straight Joint: 300/400mm^2 - 300/400mm^2: Stranded Copper or Solid Aluminium Conductor
162007	Straight Joint: 500/630mm^2 - 500/630mm^2: Stranded Copper Conductor
160677	Straight Joint: 800mm^2 - 800mm^2: Stranded Copper Conductor
164545	Triplex Joint: up to 185/300mm^2 - 185/300mm^2 Solid Aluminium Conductor. Screen/Earth wires bunched, and external solid copper earth conductor fitted. Joint is 3 x single core joints encapsulated in single resin (or equivalent) shell, all screen earths bunched together, and an external earth fitted.

11kV Branch Joint	
162074	Branch Joint: Triplex Main 95mm^2/185mm^2 - Triplex Branch 95mm^2/185mm^2: Solid Aluminium Conductor
162075	Branch Joint: Triplex Main 300mm^2 - Triplex Branch 95mm^2 /300mm^2: Solid Aluminium Conductor

11kV Stop Ends	
162057	Stop End: 95/185mm^2: Solid Aluminium Conductor
162059	Stop End: 300mm^2: Solid Aluminium Conductor
160685	Stop End: 300/400mm^2: Stranded Copper Conductor
160686	Stop End: 500/630mm^2: Stranded Copper Conductor

11kV Loop Joints (Both cables entering same direction)	
162079	Loop Joint: 95/185mm^2 - 95/185mm^2: Solid Aluminium Conductor
162079	Loop Joint: 300mm^2 - 95/300mm^2: Solid Aluminium Conductor

20kV Straight Joints	
162053	Straight Joint: 95/185mm^2 - 95/185mm^2: Solid Aluminium Conductor
162054	Straight Joint: 300/400mm^2 - 300/400mm^2: Stranded Copper Conductor
160687	Straight Joint: 800mm^2 - 800mm^2: Stranded Copper Conductor
160688	Three Straight Joints: up to 185/300mm2 Stranded - 185/300mm2: Solid Aluminium Conductor. Joint is 3 x single core joints encapsulated in single resin (or equivalent) shell, all screen earths bunched together, and an external earth fitted.

20kV Branch Joint	
162075	Branch Joint: Triplex Main 95mm/185mm^2 - Triplex Branch 95/185mm^2: Solid Aluminium Conductor
160678	Branch Joint: 300/400mm^2 - 300/400mm^2: Stranded Copper Conductor

20kV Stop Ends	
162076	Stop End: 95/185mm^2: Solid Aluminium Conductor
160679	Stop End: 300/400mm^2: Stranded Copper Conductor
160680	Stop End: 800mm^2: Stranded Copper Conductor

20kV Loop Joint - (Both cables entering same direction)	
162079	Loop Joint: 95/185mm^2 - 95/185mm^2: Solid Aluminium Conductor

Resin (or equivalent) Filled Transition Joints (Paper to XLPE) and (Paper to Paper)	
11kV Trifurcating /Transition Straight Joint 3 x Single Core XLPE to 3-Core Paper	
084244	Trifurcating/Transition Joint: 95mm^2/185mm ^{2}PILC/PICAS to 95mm^2/185mm^2 Single Core Solid Aluminium Conductor, XLPE
084251	Trifurcating/Transition Joint: 185mm^2/300mm^2 PILC/PICAS –185mm^2/300mm^{2}Single Core Solid Aluminium Conductor, XLPE

11kV Branch Joints 3-core Paper to 3-core Paper	
084053	Branch Joint: 95mm^2/185mm^2 PILC/PICAS Main - 95mm^2/185mm^2 PILC/PICAS Branch
084061	Branch Joint: 185mm^2/300mm^2 PILC/PICAS Main - 185mm^2/300mm^2 PILC/ PICAS Branch

11kV Transition Branch Joints: 3 x Single Core XLPE to 3-Core Paper	
165576	Transition Branch Joint: 95mm²/185mm² PILC/PICAS Main - with 3 x 95mm²/185mm² Single Core Solid Aluminium Conductor, XLPE Branch Cables
165575	Transition Branch Joint: 185mm²/300mm² PILC/PICAS (main) - 3 x 185mm²/300mm² Single Core Solid Aluminium Conductor, XLPE Branch Cables

11kV Loop Joint: 3-Core Paper to 3-Core Paper and Transition 3 x Single Core XLPE to 3-Core Paper This requirement is for a branch type joint where both cables are jointed at the double end but no cable is required on the single end.	
084012	Loop Joint: up to 2 x 95mm²/185mm² PILC/PICAS
084020	Loop Joint: up to 2 x 185mm²/300mm² PILC/PICAS
160689	Transition Loop Joint: 95mm²/185mm² PILC/PICAS to 3 x 95mm²/185mm² Single Core Solid Aluminium Conductor, XLPE Cables
160690	Transition Loop Joint: 185mm²/300mm² PILC/PICAS to 3 x 185mm²/300mm² Single Core Solid Aluminium Conductor, XLPE Cables

11kV Straight Joint: 3-Core Paper to 3-Core Paper	
084376	Straight Joint: 95mm²/185mm² 3-Core PILC or PICAS
084384	Straight Joint:185mm²/300mm² 3Core PILC or PICAS

11kV Stop End for 3-Core Paper Cables.	
084400	Stop end: 95mm² to 300mm² 3Core PILC or PICAS

20kV Straight Joint: 3-Core Paper to 3-Core Paper	
164431	Straight Joint: 95mm²/185mm² 3-Core PILC paper - 95mm²/185mm² 3-Core PILC

20kV Transition/Trifurcating Joint 3 x Single Core XLPE to 3-Core Paper	
164732	Straight Joint: 95mm²/185mm² 3-Core Paper - 185mm² Single Core Solid Aluminium Conductor, XLPE
160691	185mm2 to 300mm2 3-Core Paper - Triplex Branch up to 300mm2: Stranded Copper Core

20kV Stop Ends 3-Core Paper	
164427	Stop-end: 95mm²/185mm² 3-Core Paper

11kV & 20kV Joint Module Kits	
11kV/20kV Modules for use with base kits: Including build up kits for smaller cross section cables (i.e. 0.0145sq", 0.0225sq", 0.04sq", 0.05sq", 0.1sq" PILC)	
084434	11kV Joint Build Up Kit: Kit 1: Cable Core Range 16-70mm²: Used in Conjunction with 95/185mm² Joint Kits
084459	11kV Joint Build Up Kit: Kit 2: Cable Core Range 95-150mm²: Used in Conjunction with 300mm² Joint Kits
084442	11kV Joint Build Up Kit: Kit 3: Cable Core Range 16 - 70mm²: Used in Conjunction with 300mm² Joint Kits
164709	20kV Build Up Kit: for 0.0225sq" Cable Core to equivalent 95mm² Cable Core

11kV Triplex/Single Core XLPE Modules for use with 11kV Branch/Loop Joint base kits – to be used when one or more triplex cable(s) enters the joint(i.e. Triplex into PILC Loop base joint kit, 2 x Triplex into Branch base joint kit)	
165573	11kV Triplex/Single Core 70-185mm² Polymeric Cable Preparation Kit including Support Ring
165574	11kV Triplex/Single Core 150-300mm² Polymeric Cable Preparation Kit including Support Ring

Appendix 3 – Logistical Requirements

To enable the Company to store the product(s) in accordance with the manufacturer's recommendations the Tenderer shall provide details of the recommended storage environment with respect to each tendered product.

Details shall be provided where relevant, in respect of the minimum and 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

The Tenderer shall ensure that each item is suitably packaged and protected to enable storage in an outdoor environment whilst maintaining the product and packaging as "fit for service" prior to installation.

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/boxed form the material from which the bags are manufactured shall be capable of sustaining the package weight and resisting puncture by the materials within.

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 then 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 specification.

Clearly legible, easily identifiable, durable and unambiguous labelling shall be applied to each individual and where relevant, multiple packages of like products. Where products packages tendered are made up of sub packages each sub packages shall be marked. As a minimum requirement for all products supplied, the following shall be included.

- Manufacturer's trademark or name
- Supplier's trademark or name
- Description of item
- Date of packaging and batch number(for quality assurance traceability)
- Northern Powergrid product code
- Weight
- Shelf life/Expiry date

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

Appendix 4 – Self Certification Conformance Declaration

Specification for 11kV and 20kV cable joints and terminations are required to be supplied against this specification shall comply with the latest issues of the relevant ENATS, 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 of the standards.

The manufacturer shall declare conformance or otherwise, clause by clause, using the following levels of conformance declaration codes, where appropriate indicating if tests are type or routine tests.

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' 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.

NSP/002/015 - Specification for 11kV and 20kV Cable Joints and Terminations - I/D Paper Terminations				
	Clause / Requirements	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Connectors / Lugs	BS EN 61238-1, BS-4579 or C79			
Sheath (Earth) Connectors	C93			
Hose Clamps (Worm Drive Clips)	BS 5315:1991			
I/D Paper Terminations	**BS 7888-4.2/HD 629.2**			
- DC Withstand	Table 2 (1) (15min x $6U_0$)			
- AC Withstand	Table 2 (2) (5min x $4.5U_0$)			
- Impulse Withstand (@ elevated temp)	Table 2 (3) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- Heat Cycle at Voltage	Table 2 (4) (126 cycles x $1.5U_0$)			
- AC Withstand	Table 2 (5) (4hrs x $3U_0$)			
- Thermal S/C-screen	Table 2 (6) (2 x S_{ic})			
- Thermal S/C-conductor	Table 2 (7) (2 x S_C)			
- Dynamic S/C (Class 1)	Table 2 (8) (1 x I_d)			
- Impulse Withstand (@ ambient temp)	Table 2 (9) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Withstand	Table 2 (10) (15min x $2.5U_0$)			
- Humidity	Table 2 (12) (300hrs x $1.25U_0$)			
- Examination	Table 2 (13)			
- Range of Compliance	Clause 6 Tables 8 & 9			

NPS/002/015 - Specification for 11kV and 20kV Cable Joints and Terminations - I/D XLPE Terminations				
	Clause / Requirements	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Connectors / Lugs	BS EN 61238-1, BS-4579 or C79			
I/D XLPE Terminations	**HD 629.1**			
- DC Withstand	Table 3 (1) (15min x $6U_0$)			
- AC Withstand	Table 3 (2) (5min x $4.5U_0$)			
- PD (@ ambient)	Table 3 (3) (<10pC @ $2U_0$)			
- Impulse Withstand (@ elevated temp)	Table 3 (4) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- Heat Cycle at Voltage	Table 3 (5) (126 cycles x $2.5U_0$)			
- PD (ambient & elevated temp)	Table 3 (6) (<10pC @ $2U_0$)			
- Thermal S/C-screen	Table 3 (7) (2 x S_{ic})			
- Thermal S/C-conductor	Table 3 (8) (2 x S_C)			
- Dynamic S/C (Class 1)	Table 3 (9) (1 x I_d)			
- Impulse Withstand (@ ambient temp)	Table 3 (10) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Withstand	Table 3 (11) (15min x $2.5U_0$)			
- Humidity	Table 3 (12) (300hrs x $1.5U_0$)			
- Examination	Table 3 (13)			
- Range of Compliance	Clauses 6.1, 6.4 & 6.6 Tables 9 & 10			

NPS/002/015 - Specification for 11kV and 20kV Cable Joints and Terminations - Separable Connectors				
	Clause / Requirements	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Connectors / Lugs	BS EN 61238-1, BS-4579 or C79			
Separable Connectors				
- Bushing Profile -	BSEN 50180			
- Bushing Profile	BSEN 50181			
Separable Connectors	**HD 629.1**			
- DC Withstand	Table 7 (1) (15min x $6U_0$)			
- AC Withstand	Table 7 (2) (5min x $4.5U_0$)			
- PD (@ ambient)	Table 7 (3) (<10pC @ $2U_0$)			
- Impulse Withstand (@ elevated temp)	Table 7 (4) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- Heat Cycle at Voltage	Table 7 (5) (63 cycles x $2.5U_0$ -in air)			
- Heat Cycle at Voltage	Table 7(6) (63 cycles x $2.5U_0$ -in water)			
- Thermal S/C-screen	Table 7 (7) (2 x S_{ic})			
- Thermal S/C-conductor	Table 7 (8) (2 x S_C)			
- Dynamic S/C (Class 1)	Table 7 (9) (1 x I_d)			
- Connect/ Disconnect	Table 7 (10) (5 complete operations)			
- PD (ambient & elevated temp)	Table 7 (11) (<10pC @ $2U_0$)			

NPS/002/015 - Specification for 11kV and 20kV Cable Joints and Terminations - Separable Connectors (continued)				
	Clause / Requirements	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Separable Connectors	**HD 629.1**			
- Impulse Withstand (@ ambient temp)	Table 7 (12) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Withstand	Table 7 (13) (15min x 2.5U_0)			
- Operating Eye	Table 7 (14) (Axial force 1300N / 1min)			
- Impulse Withstand (@ ambient temp)	Table 7 (15) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- Examination	Table 7 (16)			
- Screen Resistance	Table 7 (17) (max 5kΩ)			
- Leakage Current	Table 7 (18) (max 0.5mA @ U_m)			
- Screen Fault I Initiation	Table 7 (19) (continuous fault current)			
- Operating Force	Table 7 (20) (< 900 N)			
- Capacitive Test Point	Table 7 (21) (test point to cable conductor >1.0 $_p$F, ratio of test point / earth & test point / cable conductor ≤12			
- Range of Compliance	Clauses 6.1, 6.4 & 6.6 Tables 9 & 10			

NPS/002/015 - Specification for 11kV and 20kV Cable Joints and Terminations - O/D XLPE Terminations				
	Clause / Requirements	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Connectors / Lugs	BS EN 61238-1, BS-4579 or C79			
O/D XLPE Terminations	**HD 629.1**			
- DC Withstand	Table 4 (1) (15min x $6U_0$)			
- AC Withstand	Table 4 (2) (5min x $4.5U_0$)			
- AC Withstand (Wet)	Table 4 (3) (1min x $4U_0$)			
- PD (@ ambient)	Table 4 (4) (<10pC @ $2U_0$)			
- Impulse Withstand (@ elevated temp)	Table 4 (5) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- Heat Cycle at Voltage	Table 4 (6) (126 cycles x $2.5U_0$)			
- Immersion	Table 4 (7) (10 cycles)			
- PD (ambient & elevated temp)	Table 4 (8) (<10pC @ $2U_0$)			
- Thermal S/C-screen	Table 4 (9) (2 x S_{ic})			
- Thermal S/C-conductor	Table 4 (10) (2 x S_C)			
- Dynamic S/C (Class 1)	Table 4 (11) (1 x I_d)			
- Impulse Withstand (@ ambient temp)	Table 4 (12) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Withstand	Table 4 (13) (15min x $2.5U_0$)			
- Salt Fog	Table 4 (14) (1000hrs x $1.25U_0$)			
- Examination	Table 4 (15)			
- Range of Compliance	Clauses 6.1, 6.4 & 6.6 Tables 9 & 10			

NPS/002/015 - Specification for 11kV and 20kV Cable Joints and Terminations - Paper & Transition Joints				
	Clause / Requirements	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Connectors / Lugs	BS EN 61238-1, BS-4579 or C79			
Hose Clamps (Worm Drive Clips)	BS 5315:1991			
Sheath (Earth) Connectors	C93			
Paper & Transition Joints	**BS 7888-4.2/HD 629.2**			
- DC Withstand	Table 4 (1) (15min x $6U_0$)			
- AC Withstand	Table 4 (2) (5min x $4.5U_0$)			
- Impact	Table 4 (3) (IR: Conductor/Screen ≥10MΩ, Screen/Water ≥50MΩ)			
- Impulse Withstand (@ elevated temp)	Table 4 (4) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- Heat Cycle at Voltage	Table 4 (5) (63 cycles x $1.5U_0$ -in air)			
- Heat Cycle at Voltage	Table 4 (6) (63 cycles x $1.5U_0$ -in water)			
- AC Withstand	Table 4 (7) (4hrs x $3U_0$)			
- Thermal S/C-screen	Table 4 (8) (2 x S_{ic})			
- Thermal S/C-conductor	Table 4 (9) (2 x S_C)			
- Dynamic S/C (Class 1)	Table 4 (10) (1 x I_d)			
- Impulse Withstand (@ ambient temp)	Table 4 (11) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Withstand	Table 4 (12) (15min x $2.5U_0$)			
- Examination	Table 4 (13)			
- Range of Compliance	Clause 6 Tables 8 & 9			
- Water Withstand	Clause 5.6 (10kPa / 0.1bar)			
Resin Encapsulation Shell	Company specific Test Requirement			
- Resin fill test	Shell and sealing accessories robustness test			

NPS/002/015 - Specification for 11kV and 20kV Cable Joints and Terminations - XLPE Joints				
	Clause / Requirements	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Connectors / Lugs	BS EN 61238-1, BS-4579 or C79			
Sheath (Earth) Connectors	C93			
XLPE Joints	**HD 629.1**			
- DC Withstand	Table 5 (1) (15min x $6U_0$)			
- AC Withstand	Table 5 (2) (5min x $4.5U_0$)			
- PD (@ ambient)	Table 5 (3) (<10pC @ $2U_0$)			
- Impact	Table 5 (4) (IR: Conductor/Screen ≥10MΩ, Screen/Water ≥50MΩ)			
- Impulse Withstand (@ elevated temp)	Table 5 (5) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- Heat Cycle at Voltage	Table 5 (6) (63 cycles x $2.5U_0$ -in air)			
- Heat Cycle at Voltage	Table 5 (7) (63 cycles x $2.5U_0$ -in water)			
- PD (ambient & elevated temp)	Table 5 (8) (<10pC @ $2U_0$)			
- Thermal S/C-screen	Table 5 (9) (2 x S_{ic})			
- Thermal S/C-conductor	Table 5 (10) (2 x S_C)			
- Dynamic S/C (Class 1)	Table 5 (11) (1 x I_d)			
- Impulse Withstand (@ ambient temp)	Table 5 (12) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Withstand	Table 5 (13) (15min x $2.5U_0$)			
- Examination	Table 5 (14)			
- Range of Compliance	Clauses 6.1, 6.4 & 6.6 Tables 9 & 10			
- Water Withstand	Clause 5.6 (10kPa / 0.1bar)			
Resin Encapsulation Shell	Company specific Test Requirement			
- Resin fill test	Shell and sealing accessories robustness test			

NPS/002/015 - Specification for 11kV and 20kV Cable Joints and Terminations - Paper Stop Ends				
	Clause / Requirements	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Sheath (Earth) Connectors	C93			
Paper Stop Ends	**BS 7888-4.2/HD 629.2**			
Hose Clamps(Worm Drive Clips)	BS 5315:1991			
- DC Withstand	Table 5 (1) (15min x $6U_0$)			
- AC Withstand	Table 5 (2) (5min x $4.5U_0$)			
- Impulse Withstand	Table 5 (3) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Voltage (air)	Table 5 (4) (500hrs x $1.5U_0$)			
- AC Voltage (water)	Table 5 (5) (500hrs x $1.5U_0$)			
- Impulse Withstand	Table 5 (6) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Withstand	Table 5 (7) (4hrs x $3U_0$)			
- Examination	Table 5 (8)			
- Range of Compliance	Clause 6 Tables 8 & 9			
- Water Withstand	Clause 5.6 (10kPa / 0.1bar)			

NPS/002/015 - Specification for 11kV and 20kV Cable Joints and Terminations - XLPE Stop Ends				
	Clause / Requirements	**Conformance Code**	**Evidence Reference**	**Remarks / Comments**
Sheath (Earth) Connectors	C93			
XLPE Stop Ends	**HD 629.1**			
- DC Withstand	Table 6 (1) (15min x $6U_0$)			
- AC Withstand	Table 6 (2) (5min x $4.5U_0$)			
- PD (@ ambient)	Table 6 (3) (<10pC @ $2U_0$)			
- Impulse Withstand	Table 6 (4) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Voltage (air)	Table 6 (5) (500hrs x $2.5U_0$)			
- AC Voltage (water)	Table 6 (6) (500hrs x $2.5U_0$)			
- PD (@ ambient)	Table 6 (7) (<10pC @ $2U_0$)			
- Impulse Withstand	Table 6 (8) (10 impulses of each Polarity – 95kV (11kV) & 125kV (20kV))			
- AC Withstand	Table 6 (9) (15min x $2.5U_0$)			
- Examination	Table 6 (10)			
- Range of Compliance	Clauses 6.1, 6.4 & 6.6 Tables 9 & 10			
- Water Withstand	Clause 5.6 (10kPa / 0.1bar)			

Appendix 5 – Addendum to Supplier Requirements

Work Instructions

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, such as hV cables used at lower voltage (e.g. 33kV cable used for 11kV applications, 11kV 6-core cables etc). 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 number 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 the 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. Where available the Tenderer should provide indicative prices applicable to the recommended tooling.

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 the product(s).

Detailed inspection and maintenance instructions shall be provided.

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.

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	