NPS/003/015 – Technical Specification for 33kV, 66kV and 132kV Post Insulators

1. Purpose

This document is the technical specification for 33kV, 66kV and 132kV post insulators for use in Northern Powergrid (the Company) substations.

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

Document Reference	Document Title	Version	Published Date
NPS/003/015	Technical Specification for 33kV, 66kV and 132kV Post Insulators	3.1	July 2012

2. Scope

This specification details the requirements for 33kV, 66kV and 132kV post insulators for use in open terminal substations on the Company's network. It will be necessary to consider and include any project specific requirements as detailed in Appendix 3, Addendum to Supplier Requirements.

2.1. Table of Contents

3. Technical Requirements

3.1. General Design Requirements

Station post insulators shall comply with the requirements of BS 3297-2 designation "C" and Appendix 1 of this specification.

The insulators shall be manufactured from a grey Polymeric Silicon Rubber material that has been tested in accordance with BS EN 62231:2006 and BS EN 62217.

Appendix 2 contains a declaration of performance which must be completed for each post type offered.

Appendix 3 contains an Addendum to Supplier Requirements which lists any project specific requirements.

Appendix 4 contains a self-certification declaration which must be completed for each insulator type.

3.1.1. Material Requirements Associated with Silicon Rubber Elastomeric Housings

Hollow composite insulators consist of an insulating tube manufactured from high strength glass fibre reinforced plastic bearing the mechanical load which is protected by an elastomeric housing.

Silicon rubber is a very generic term with many formulations. Variations in the composition of this material can adversely affect its long term performance to provide the following very important properties:-

- UV resistance
- Tracking Resistance
- Hydrophobicity

As a result a range of good practice characteristic values have been included within this specification

Material Composition	Minimum % per weight
Silicone Polymer (Polydimethylsiloxane) (PDMS)	30 %
Filler (ATH Aluminium tri hydrate and fumed silica)	64 %
Additional parts (pigments, crosslinkers)	1 %

Where manufacturers differ from this characteristic composition, they shall provide supporting evidence about the long term experience of their product formulation.

The following table provides a list of characteristic properties that result from the above formulation. Manufacturers shall provide details of their characteristic properties for consideration.

Minimum acceptable values are detailed below.

Property	Minimum Value
Density	1.5g/cm
Passing Voltage Level of IEC 60587	4.5kV
Flammability Class of IEC 60695-11-10 of 3mm specimen	VO
Tensile Strength (Din 53504-S1)	6 N/mm2
Break Elongation (Din 53504-S1)	300%
UV resistance @ 300nm the energy of UV wavelength that equates to a molecular energy breakdown level of 398 kJ/mole *	445 kJ/Mole

* assumed wavelength of UV light (sun) 290 – 350nm

All silicon rubber insulators shall be manufactured using the HTV (high temperature vulcanising) and shall ensure that the interface between the housing and the core is chemically bonded.

Flash or mould lines shall not exceed 1mm in height.

All glass fibre re-enforced plastic tubes shall be covered by an even concentric layer of silicon rubber that has a minimum insulation thickness of 3mm over the tube.

3.2. Mechanical Ratings

Mechanical ratings for Station Post Insulators have been selected to be compliant with the design methodology stated in BS61936. Manufactures shall confirm compliance with these requirements.

3.3. Creepage Requirements

Creepage requirements for Station Post insulators shall be compliant with IEC 60815 Class III.

3.4. Flange Requirements

Flange requirements for the top and bottom of the insulator shall be in accordance with Appendix 1 and NPS/003/028 - Technical Specification for Tubular Busbars, Busbar Connectors and Terminal fittings.

4. References

4.1. External Documentation

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

Reference	Title
BS 3297-2 1993	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V
BS 61936-1:2010	Power Installations Exceeding 1 kV a.c.
BS EN 62217:2013	Polymeric Insulators for indoor and outdoor use with a nominal voltage >1000V – general definitions, test methods and acceptance criteria.
BS EN 62231-2006	Composite Station Post insulators for substations with a.c. voltages >1000V up to 245kV - – general definitions, test methods and acceptance criteria.
IEC 60815	Guide for the selection of insulators in regard of polluted conditions.

4.2. Internal Documentation

Reference	Title
NPS/003/028	Technical Specification for Tubular Busbars, Busbar Connectors and Terminal fittings

4.3. Amendments from Previous Version

Reference	Amendment
Whole Document	References to Porcelain Insulators removed
3.1.1	Additional information added for polymeric insulator composition
4.1	Document references updated

5. Definitions

Term	Definition
The Company	Northern Powergrid

6. Authority for Issue

6.1. CDS Assurance

I sign to confirm that this document has been assured for issue on to the CDS system

		Date
Liz Beat	Governance Administrator	06/06/2023

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 & Reason	
No	Period: 5 Years	Reason: Update will be dictated by contact 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 McAdoo	Senior Policy and Standards Engineer	07/06/2023

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.

		Date
Steven Salkeld	Policy & Standards Engineer	07/06/2023

6.4. Authorisation

Authorisation is granted for publication of this document

		Date
Paul Black	Head of System Engineering	21/06/2023

Appendix 1 - Technical specification for 33kV, 66kV and 132kV post insulators for use in open terminal substations

System Voltage	Unit	33kV	66kV	132kV
Rated lightning impulse withstand voltage	kV	200	325	650
Rated short duration power frequency withstand voltage	kV	90	140	275
Pollution Class		Class 3 Heavy	Class 3 Heavy	Class 3 Heavy
Minimum phase to earth creepage distance Dm<300mm	mm	950	1600	N/a
Minimum phase to earth creepage distance Dm>300mm	mm	N/a	N/a	3350
Minimum length	mm	445	770	1500
Minimum cantilever failing load	kN	4.0	4.0	4.0
Minimum tensile failing load	kN	State	State	State
Minimum torsional failing load	kNm	1.2	2.0	3.0
Maximum operational dead weight of conductors (inc. ice and connectors)	kg	40	60	120
Fixing arrangement				
Pitch circle diameter	mm	76	127	127
Thread size		M12	M16	M16
Metal fittings (internal/external)		External	External	External

Appendix 2 - Declaration of technical specification for 33kV, 66kV and 132kV post insulators for use in open terminal substations

System Voltage	Unit	33kV	66kV	132kV
Manufacturer				
Type reference				
Pollution class				
Insulations levels				
Rated lightning impulse withstand voltage	kV			
Rated short duration power frequency withstand voltage	kV			
Minimum phase to earth creepage distance Dm<300mm	mm			N/a
Minimum phase to earth creepage distance Dm>300mm	mm	N/a	N/a	
Insulator length	mm			
Minimum cantilever failing load	kN			
Minimum tensile failing load	kN			
Minimum torsional failing load	kNm			
Maximum operational dead weight of conductors (inc. ice and connectors)	kg			
Fixing arrangement				
Pitch circle diameter	mm			
Thread size				
Metal fittings (internal/external?)				

Appendix 3 - Addendum to Supplier Requirements

Project specific and installation requirements will be provided by Primary Engineering Projects to be included in this appendix.

Appendix 4 - Self Certification Conformance Declaration

Station Post insulators shall comply with the latest issues of the relevant international and British Standards.

This check sheet identifies the clauses in IEC 62231 and IEC 62217 and the clauses of the aforementioned Standards relevant to Station Post insulators for use on Northern Powergrid UK Networks.
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 no remark is necessary
- When any other code is entered the reason for non-conformance shall be entered
- Prefix each remark with the relevant 'BS EN' or IEC' as appropriate

Manufacturer:
Product Reference:

Name: **Signature:** **Date:**

Table 1

BS EN 62231:2006			
Clause / Sub-clause	Requirement	Conformance Code	Remarks
9.1	Verification of dimensions		
9.3.2	Tension load test		
9.3.3	Compression and buckling withstand test		

Table 2

BS EN 62231:2006			
Clause / Sub-clause	Requirement	Conformance Code	Remarks
9.2.1	Dry Lightning impulse withstand voltage test		
9.2.2	Wet switching – impulse withstand voltage test		
9.2.3	Wet power frequency withstand voltage test		

Table 3

BS EN 62231:2006			
Clause / Sub-clause	Requirement	Conformance Code	Remarks
10.2	Verification of dimensions		
10.3	Galvanising test		
10.4	Verification of specified mechanical loads		

Table 4

BS EN 62217 – Design tests (Composite Insulators)			
Clause / Sub-clause	Requirement	Conformance Code	Remarks
9.2	Tests on interfaces and connections of end fittings		
9.2.7.3	Steep front impulse voltage test		
9.2.7.4	Dry power frequency voltage test		
9.3.3	1000 h salt fog test		
9.3.4	Flammability test		
9.4.1	Dye penetration test		
9.4.2	Water Penetration tests		

The tests listed in table 4 are only applicable to composite insulators

Appendix 5 – Technical Information Check List

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

Requirement	Provided (Y/N)
Full product descriptions and part number/reference	
Appendix 2 – completed technical schedules	
Appendix 4 – completed self-certification conformance declaration	
Complete set of drawings for each variant	
Type test evidence	
Routine test evidence and product quality plan	
Pre-commissioning inspection requirements	
Recommended periodical inspection and maintenance requirements	
Packaging/delivery information	