NPS/003/028 – Technical Specification for Tubular Busbars, Busbar Connectors and Terminal Fittings

1. Purpose

The purpose of this document is to detail the requirements of Northern Powergrid in relation to the tubular busbar systems and associated fittings detailed within this document.

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

Document Reference	Document Title	Version	Published Date
NPS/003/028	Technical Specification for Tubular Busbars, Busbar Connectors and Terminal Fittings	3.1	Feb 2019

2. Scope

The scope of this document covers open terminal busbar systems and associated connectors for use within outdoor primary substations up to and including 132kV. The products described within this specification shall comply with all current versions of the relevant industry, national and international standard specifications.

New installations shall be manufactured from aluminium tube. Extensions to existing Copper arrangements should be carried out with copper tube unless there is an identifiable break in the existing busbar system where the arrangement is broken by an item of plant. It would therefore be permissible to install an extension to that system in aluminium tube.

The following appendices form part of this technical specification:-

- Appendix 1 - Logistical Requirements
- Appendix 2 - Self Certification Conformance Declaration
- Appendix 3 - Technical Information Checklist

2.1. Contents

3. Technical Requirements

3.1. Busbars

Busbars are used to inter-connect plant and equipment within a substation compound area as detailed in BS EN 61936-1 - Power Installations exceeding 1kV ac-They shall take into account short circuit currents, wind loading and other forces detailed in BS EN61936-1 section 4.3.

New installations shall be supplied in accordance with ENA TS 41-11 using aluminium tube with a continuous current rating of either 1250 amps or 2000 amps. Extensions to existing busbar installations shall match the existing type with all the options available shown in the table below.

Busbar Type Hard Drawn Bare Copper (HDBC) Aluminium (Al)	**Continuous Current Rating (Amp)**	**Max Unsupported Span (mm)**	**Approximate weight per metre (kg)**
New Installations			
Al. 90mm Dia, 6mm Wall Thickness	2000A	10400 or 6000*	4.320
Al. 60mm Dia, 4mm Wall Thickness	1250A	6700 or 3500*	1.950
Historic Installations to be Supported			
50mm HDBC x 14swg	1050A	5485	3.013
50mm HDBC x 12swg	1140A	5485	3.174
75mm HDBC x 14 swg	1500A	7620	3.757
75mm HDBC x 12 swg	1700A	7920	4.854

* Restriction due to end fixing type (see table 5.1 of ENATS 41-11)

All busbar systems and fittings shall have a single phase short circuit time (3s) current rating of 25 kA r.m.s.

3.2. Fittings for Open Terminal Systems

All fittings shall be designed as specified in ENA TS 41-11 for aluminium systems or ENATS 41-16 for copper systems. Joints, clamps and conductor fittings, shall be designed to avoid the possibility of deforming the tube conductor. Materials used shall be compatible with the conductor and associated equipment terminal.

All terminal fittings for tubular open terminal systems covered by this specification shall employ current carrying half clamps. The number of complete clamps to be used on all sliding fittings shall be determined by the current rating of the fitting. In all cases two complete clamps shall be used on all fixed fittings irrespective of current rating (the additional clamp on fixed fittings is for mechanical reasons.)

The design of the fittings and any special tools to be used in their assembly shall be such as to reduce to a minimum the possibility of incorrect assembly and erection.

Where a copper to aluminium connection is to be made precautions shall be taken to avoid electro-chemical deterioration of the connecting surfaces.

3.3. Support Insulators

Busbar support insulators shall be supplied in accordance with Northern Powergrid specification NPS/003/015 - Technical Specification for 33kV, 66kV and 132kV Post Insulators.

3.4. Support Structures

Support Structures shall be supplied in accordance with Northern Powergrid Material specification NPS/003/033 - Technical Specification for Substation Support Structures.

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 Network Association Technical Specifications (ENATS) current at the time of supply.

Reference	Title
BS EN 61936-1	Power Installations exceeding 1kV ac: Part 1 Common Rules
ENATS 41-11 Issue 2 1982	Tubular Aluminium Busbars, Connection and Terminal Fittings for 132kV Outdoor Substations
ENATS 41-16 Issue 2 1989	Apparatus terminations, conductor sizes and associated fittings (Copper) used in indoor and outdoor substations.

4.2. Internal Documentation

Reference	Title
NPS/003/015	Technical Specification for 33, 66 and 132kV Post Insulators
NPS/003/033	Technical Specification for substation support structures

4.3. Amendments from Previous Version

Reference	Description
3.1	The stated Continuous Current Rating for Al. 60mm Dia, 4mm Wall Thickness busbar has been updated from 1200 to 1250A following confirmation of increased capacity from manufactures

5. Definitions

Term	Definition
n/a	

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	24/06/2021

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
Ged Hammel	Senior Policy & Standards Engineer	25/06/2021

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
Steve Salkeld	Policy & Standards Engineer	25/06/2021
Joe Helm	Policy & Standards Manager	25/06/2021

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Greg Farrell	Head of System Strategy	30/06/2021

Appendix 1 - Logistical Requirements

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

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

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

The Tenderer shall ensure that each item is suitably packaged and protection 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/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.

Palletised goods shall be supplied on standard 1200mm x 1000mm pallets.

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

* Manufacturer's trademark or name
* Supplier's trademark or name
* Description of item
* Date of packaging and/or batch number
* Northern Powergrid product code (where applicable)
* Weight

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

Appendix 2 - SELF CERTIFICATION CONFORMANCE DECLARATION

Tubular bus-bars, bus-bar connectors and terminal fittings shall comply with the latest issues of the relevant national and international standards, including ENATS 41.11 and ENATS 41-16. Additionally this technical specification is intended to amplify and/or clarify requirements relating to these Standards.

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

Manufacturer:

Product Reference:

Name:

Signature:

Date:

NOTE: One sheet shall be completed for each item or variant submitted.

Tubular aluminium bus-bars, bus-bar connectors and terminal fittings

- **ENATS 41-11 - 1992**

Clause/Sub-clause	Requirement	Conformance Code	Remarks
8.2 - 8.2.1	Current carrying connections and fitting constructed of material as specified in Table 8.1		
8.2 – 8.2.2	Screws, plates, bolts, studs and washers manufactured from galvanized mild steel		
8.2 – 8.2.4	Copper and/or Copper alloys of an electrical quality high conductivity material.		
8.2 - 8.2.7	Brass for Bi-metal joints 60% copper & 40% tin.		
8.2 – 8.2.8	Assembly grease to be of an approved type.		
8.3 – 8.3.1	Cold bending of the bends in aluminium tubes.		
9.4	Adaptors and Bi-metal fittings shall have a continuous rating of 200A		

Tubular copper bus-bars, bus-bar connectors and terminal fittings

- **ENATS 41-16 - 1989**

Clause/Sub-clause	Requirement	Conformance Code	Remarks
3.1	Terminals – General		
4.1	Tubular Conductors		
4.3	Clamps		
5.0	Materials		
6.0	Identification		

Appendix 3 - 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
Appendix 2 – completed self-certification conformance declaration	
Full product descriptions and part number/reference	
Complete set of drawings for each item	
Type test evidence	
Manufacturing routine test plan	
Packaging information	
Instructions/Manuals installation, maintenance and end of life disposal	
Spares availability list	