NPS/001/004 - Technical Specification for 11kV, 20kV and 33kV Pole Mounted Expulsion Switch, Fuse Tube and Solid Link

1. Purpose

The purpose of this document is to detail the technical requirements for 11kV, 20kV and 33kV drop-out expulsion fuse mounts, fuse carriers, current limiting fuses and solid links for use on the Northern Powergrid distribution network.

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

Document Reference	Document Title	Version	Published Date
NPS/001/004	Technical Specification for 11kV, 20kV and 33kV Pole Mounted Expulsion Switch, Fuse Tube and Solid Link	6.0	June 2021

2. Scope

This specification details the range, design, constructional and technical requirements for 11kV, 20kV and 33kV pole mounted expulsion fuse mounts, fuse tubes, current limiting fuses and solid links.

Standard Fuse mounts shall be designed and manufactured to accept fuse tubes, solid links or automatic sectionalising links (ASL's) and meet the requirements of Energy Network Association Technical Specification (ENATS) 41-36 Issue 3: 2012 with specific requirements detailed in section 8.

Current Limiting Dropout Fuse Mounts shall be designed and manufactured to only accept current limiting dropout cartridge fuses

Technical documents referenced within this specification refer to 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.

The following appendices form part of this technical specification: -

Appendix 1 - Schedule of Requirements

Appendix 2 - Addendum to Supplier Requirement

Appendix 3 - Self Certification Conformance Declaration

Appendix 4 - Technical Information Check List

2.1. Table of Contents

3. Technical Specification

3.1. General Requirements

Pole mounted fuse units are used widely to protect distribution transformers and high voltage overhead line circuits whilst providing a means of isolation for operational purposes. Fuse tubes, cartridge fuses, solid links or automatic sectionalising links (ASL's) inserts are dependent manual operation, within the limits specified to disconnect live circuits and to energise circuits believed to be healthy. Equipment should comply generally with ENA TS 41-36: 2012 and with the relevant standards referred to therein. Northern Powergrid have a preference for a single unit to satisfy both 11kV and 20kV requirements utilising composite silicon insulators.

The equipment shall be designed to provide: -

a) automatic disconnection and isolation of supply in the event of a fault occurring beyond the point of installation.

b) load-breaking disconnection (optional) - Manual

3.2. Fuse Mounts

3.2.1. Mounting Arrangement

The equipment shall be designed for manual operation using insulating operating poles not less than 4.8m long inclined at an approx. angle of 15° to the vertical. The operations required are insertion, removal, opening and closing. The maximum force applied to the link during closing is 150N.

The equipment shall comprise a vertically mounted, single pole, with the option to install removable expulsion type fuse carriers, ASL's or solid links. The insert length for accessories is 378mm for 11/20kV units and 470mm for 33kV units.

The equipment shall be suitable for mounting on the 102mm web of a channel or equivalent surface having a 14mm slotted fixing hole located with centre line between 45mm and 60mm from the upper edge. The Single hole fixing arrangements shall be designed to prevent the fuse mount swivelling from the vertical position.

The lower fixed contact assembly shall be so designed as to permit the fuse-carrier, ASL or solid link to be engaged as effortlessly as possible, using an appropriate insulated operating pole in all weather conditions.

3.2.2. Fault Mode Operation

The equipment shall be so designed and constructed such that rupturing of the fuse element, or operation of the ASL will cause the upper contact of the unit to disengage from the upper fixed contact of the fuse-mount. This shall allow the fuse-carrier or ASL to pivot under the influence of gravity to about a horizontal axis on the lower fixed contact of the fuse-mount, and come to rest hanging vertically, or near vertically, from the lower fixed contact of the fuse-mount.

3.2.3. Conductor Terminations

The upper and lower fixed contacts of the fuse-mount shall be equipped with suitable terminals to enable stranded overhead line copper conductors in the range 32mm² to 125mm² to be securely connected to them. The terminals shall be supplied complete with studs or bolts and nuts with plain and lock washers suitable for the termination of either a lug with a single hole palm, 14mm hole or alternatively to clamp stranded copper conductor.

3.2.4. Contact Fittings

The upper fixed contact assembly shall be so designed, and if necessary equipped with appropriate and suitable guides, as to ensure as far as is reasonably practicable that the fuse-carrier, ASL or solid link will correctly engage during all closing operations under all service conditions.

The fixed contacts of the fuse-mount shall be such that a positive, high pressure, non-deteriorating electrical contact with the fuse-carrier, ASL or solid link is maintained under all service conditions.

Contacts shall provide a wiping/cleaning action on closing.

3.2.5. Current Limiting Dropout Fuses

An option is required for the provision of an additional range of current limiting dropout fuse assemblies for use in areas with fault break currents in excess of the 8kA fault break rating available from standard expulsion fuse units. Fuse assemblies shall consist of both the replaceable fault limiting cartridge fuse as detailed below and an associated fuse mount that generally mimics the requirements of clause 3.2.1 of this specification but is specifically designed to accommodate the non-standard cartridge fuse insert length of 385mm.

Insulators used in the manufacture of the fuse mount shall satisfy the material requirements detailed in clause 3.2.7 and the 125kV BIL insulation requirements detailed in clause 3.5

The higher rating fuse requirement shall be satisfied through the supply of a “single barrel full range current limiting cartridge fuse” designed to provide reliable operation for all overloads and fault currents. Generally this will require a fuse design where the element construction consists of two separate sections (low-current section and high-current section) which are self-contained within the same housing. The low-current section provides consistent, reliable clearing of all currents high enough to melt the element. The high-current section shall be a punched-hole ribbon design capable of controlling the peak arc voltage level and limits both current and energy (I2t) let-through levels during high-current fault clearing operations. The fuse shall be designed to provide a fault interrupting breaking capacity 43kA RMS Symmetrical. On clearance of low or high fault current conditions, the cartridge fuse shall mimic the fault mode operation of the standard dropout type expulsion fuses as described in clause 3.2.2.

Note – Current limiting fuse links (items 7 and 8 in Appendix 1) will be sourced via the Technical Specification for HV and LV Fuse Links – NPS/001/017

3.2.6. Interchange Ability

The upper and lower portions of the fuse shall have a shorting bar attached that will allow the fitting of a ‘shorting device’. This will allow the interchanging of fuses, solids and ASL’s thus reducing disruption to customer’s supplies.

3.2.7. Additional Requirements

Insulators used in the design of both standard and current-limiting fuse mounts shall be manufactured from composite silicon material and meet the requirements of Northern Powergrid specification NPS/001/006 - Technical Specification for Insulators for Overhead Lines up to and Including 132kV.

The mounting unit shall permit the fuse-link, cartridge fuse, ASL or solid links to be inserted and secured without the need for any additional special tooling.

The mounting unit shall be designed and constructed to prevent the accumulation of water within it under all conditions of service.

The unit shall be capable of being operated using the standard insulated operating pole and head currently in use within Northern Powergrid.

The fuse tube shall be of the expulsion type capable of accepting fuse-links having ratings of 6 to 100 amps.

3.3. Ratings

The complete fuse assembly shall have the following minimum ratings that shall be verified by appropriate type tests carried out in accordance with the requirements of BS 2692 Part 2, 1956.

Voltage (kV)	Equipment Type	Rated Current (A)	Rated Short-circuit making current [1] kA (kA peak)	Breaking capacity (kA)
12	Expulsion Fuse	100, 200 (with Fuse)	3 (7.5)	8.0
	Solid	200	4 (10)	N/a
24	Expulsion Fuse	100, 200 (with Fuse)	3 (7.5)	8.0
	Solid	200	4 (10)	N/a
36	Expulsion Fuse	100, 200 (with Fuse)	3 (7.5)	4
	Solid	200	4 (10)	N/a

Notes

1) The making and breaking ratings quoted above are confirmed by long service experience. As detailed in ENA ACE Report 75

2) The value of rated duration of short circuit shall be 3s. as detailed in ENA TS 41-36 clause 1.4.7

3.4. Automatic Sectionalising Links

The back portion shall be suitable to allow for the operation of ASL's as detailed in NPS/001/032 - Technical Specification for Auto Sectionalising Links

3.5. Insulation

The preferred rated voltage and insulation levels for this equipment shall be as detailed in ENA TS 41-36, 2012 Table 1.1b. (Northern Powergrid will accept a reduced (common value) lightening impulse withstand voltage of 125kV where 150kV is not offered as a standard option).

3.6. Electrical Clearances

A test voltage shall be applied across the terminals of the fuse mount with the carrier removed in accordance with BS 2692 Part 2 clause 22 to confirm that the fuse mount is capable of providing isolation properties in line with the electrical values stated in clause 3.5 above. Additionally fuse mounts shall be designed to comply with the "basic electrical clearance" (Phase to Earth) values detailed in BS EN 61936-1: 2010 - Power installations exceeding 1 kV a.c. Common rules.

Gaps between live and earthed metalwork of complete equipment's shall be adequate to avoid short circuits by the presence of the operating rod.

3.7. Testing

3.7.1. Type Tests – General

Complete assemblies shall comply with BS 2692 Part 2 except that the requirements for rated breaking capacity shall not apply to automatic sectionalising links and solid links.

3.7.2. Routine Tests

Routine tests shall be carried out in accordance with BS 2692 Part 2 - Clause 2.9.References

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 2692 – Part 2: 1956	Fuses for voltages exceeding 1000 V a.c. Expulsion fuses
BS EN 61936 – 1: 2010 + A1: 2014	Power installations exceeding 1 kV a.c. Common rules
BS EN 62271 – 102: 2018	High-voltage switchgear and control gear. Alternating current disconnectors and earthing switches
ENATS 41-36, Issue 3: 2012	Distribution switchgear for service up to 36kV (cable and overhead conductor connected)

4.2. Internal Documentation

Reference	Title
NPS/001/006	Technical Specification for Insulators for Overhead Lines up to and Including 132kV
NPS/001/017	Technical Specification for Low Voltage and High Voltage Current Limiting Fuse Links
NPS/001/032	Technical Specification for Auto Sectionalising Links

4.3. Amendments from Previous Version

Reference	Description
Appendix 1 – Schedule of Requirements	Changes as requested via email by Steve Salkeld 03/08/2021 259031 - 27kV, 125kV BIL Polymer DOEF back portion for use with Single Barrel, 11 & 20kV ELF Current Limiting DOEF's 259030 - 25A, 11kV, Single Barrel, ELF Current Limiting DOEF's 259035 - 20A, 20kV, Single Barrel, ELF Current Limiting DOEF's

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	12/05/2021

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:** To tie in with 5 year contract period
Should this document be displayed on the Northern Powergrid external website?		Yes
		Date
Steven Salkeld	Policy and Standards Engineer	12/05/2021

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
Ged Hammel	Senior Policy and Standards Engineer	24/05/2021
Joseph Helm	Policy and Standards Manager	17/06/2021

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Greg Farrell	Head of System Engineering	26/05/2021

Appendix 1 – Schedule of Requirements

Item	Northern Powergrid Commodity Code	Description
1	245944	Fuse Isolator 11kV/20kV Back Portion
2	245955	Fuse Isolator 33kV Back Portion
3	246947	11/20kV Fuse Tube
4	245956	33kV Fuse Tube
5	245164	11kV/20kV Solid Link
6*	259031	27kV, 125kV BIL Polymer DOEF back portion for use with Single Barrel, 11 & 20kV ELF Current Limiting DOEF's
7**	259030	25A, 11kV, Single Barrel, ELF Current Limiting DOEF's
8**	259035	20A, 20kV, Single Barrel, ELF Current Limiting DOEF's

* Items 6, 7 and 8 are a stand-alone current limiting set with an insert length of 385mm

** Items 7 and 8 are listed in this table for information only and will be sourced via the Technical Specification for HV and LV Fuse Links – NPS/001/017

Appendix 2 - Addendum to Supplier Requirements

Supporting evidence of compliance with type tests shall be submitted with the completed tender document.

Manufacturers may provide alternative tenders for items not complying with the above specification. This shall be clearly stated together with detailed descriptions of any variation from the specification, together with drawings and test results.

The supplier shall provide with the tender full technical details of the equipment offered and shall indicate any divergence from these standards or specifications.

Maintenance and Inspection

Suppliers shall provide details of the recommended periodic inspection and maintenance requirements to be undertaken during the lifetime of their product. Detailed inspection and maintenance instructions shall be also be provided.

Logistical Requirements

To enable Northern Powergrid to store the product(s) in accordance with the manufacturer's recommendations the supplier 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 supplier 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. Suppliers shall submit details of the proposed packaging (i.e. materials composition and structure) to be used for each product. Where the supplier 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 and/or serial number
* Northern Powergrid product code
* Weight

Appendix 3 - Self-Certification Conformance Declaration

Expulsion fuse switches covered by ENATS 41-36 shall comply with the latest issues of the relevant International and British Standards. ENATS 41-36 is intended to amplify and/or clarify the requirements of those Standards.

This check sheet identifies the clauses in ENATS 41-36 and the clauses of the aforementioned Standards relevant to common specifications for high-voltage switchgear and control gear 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 test conforms fully with the requirements of this clause
Cs2 = The test conforms partially with the requirements of this clause
Cs3 = The test does not conform to the requirements of this clause
Cs4 = Test not performed, but alternative evidence/ technical case offered

Instructions for completion

- When Cs1 code is entered provide evidence reference
- When any other code is entered the reason for non-conformance shall be entered
- Prefix each remark with the relevant 'IEC' or 'ENATS' as appropriate

Manufacturer:

Product Reference:

Name:

Signature:

Date:

IEC 62271-102, B.S. 2692:Part 2				ENATS 41-36 Section 8				
Clause / Sub-clause IEC 62271-102 BS 2692 : Part2		Requirement	Confor - mance code	ENATS 41-36 Clause / Sub-clause	Requirement	Confor - mance code	Evidence Reference	Remarks
1	Section 1	General		8.1	General			
2	Section 4	Normal and special service conditions		8.2	Normal and special service conditions			
3	Section 1	Definitions		8.3	Definitions			
4	Section 2	Ratings		8.4	Ratings			

IEC 62271-102, B.S. 2692:Part 2				ENATS 41-36				
Clause / Sub-clause IEC 62271-102 BS 2692 : Part2		Requirement	Confor-mance code	ENATS 41-36 Clause / Sub-clause	Requirement	Confor-mance code	Evidence Reference	Remarks
4.1	Section 2 cl4	Rated voltage		8.4.1	Rated voltage			
4.2		Rated insulation level		8.4.2	Rated insulation level			
4.3		Rated frequency		8.4.3	Rated frequency			
4.4	Section 2 cl5	Rated current		8.4.4	Rated current / minimum actuating current			
4.5		Rated short-time withstand current		8.4.5	Rated short-time withstand current			
4.6		Rated peak withstand current		8.4.6	Rated peak withstand current			
4.7		Rated duration of short-circuit		8.4.7	Rated duration of short-circuit			
	Section 2 cl6			8.4.8	Breaking capacity			
				8.4.9	Reclaim time			
	Section 3	Marking						
	Section 5	Operation in service						
	Section 6	Construction		8.5	Design and construction			
				8.5	General			
				8.5	Manual operation min 4.8m at 15°			
				8.5	Max force 150N			
				8.5	Clearance for operating pole head			
				8.5	Pivot interlock			
				8.5	Operating eye/hook			
				8.5	Fuse link length tolerance			

IEC 62271-102, B.S. 2692:Part 2				ENATS 41-36				
Clause / Sub-clause IEC 62271-102 BS 2692 : Part2		Requirement	Confor-mance code	ENATS 41-36 Clause / Sub-clause	Requirement	Confor-mance code	Evidence Reference	Remarks
	Section 6	Construction		8.5	Robust/corrosion free links			
				8.5	Link adjustment instructions			
				8.5	Ease of replacement of actuators			
				8.5.2	Mounting arrangement			
				8.5.3	Terminals			
				8.5.5	Marking of voltage rating			
				8.5.6	Labeling -information (a) to (g)			
	Section 7	Type tests		8.6	Type testing			
	Section 7 cl 20	General		8.6.1	General - Table 8.2			
	Section 7 cl 21	Test for temperature rise						
	Section 7 cl 22	High-voltage test						
	Section 7 cl 23	Impulse-voltage test						
	Section 7 cl 26	Weatherproofing test						
	Section 7 cl 27	Test for breaking-Capacity						

IEC 62271-102, B.S. 2692:Part 2				ENATS 41-36				
Clause / Sub-clause IEC 62271-102 BS 2692 : Part2		Requirement	Confor-mance code	ENATS 41-36 Clause / Sub-clause	Requirement	Confor-mance code	Evidence Reference	Remarks
	Section 7 cl 28	Criteria of failure in tests for breaking capacity						
				8.6.2	Tensile test			
				8.6.3.1	Operation tests (a) to (g)			
				8.6.3.2	Short-time withstand current test			
				8.6.3.3	Special tests			
				8.6.3.4	Performance characteristics			
	Section 8			8.7	Routine tests			

IEC 62271-102, B.S. 2692: Part 2				ENATS 41-36				
Clause / Sub-clause IEC 62271-102		Requirement	Confor-mance code	ENATS 41-36 Clause / Sub-clause	Requirement	Confor-mance code	Evidence Reference	Remarks
9				8.8	Information to be given with enquiries, tenders and orders - schedule 8.1			
10				8.9	Rules for transport, storage, erection, operation and maintenance			
11				8.10	Safety			

Appendix 3 - Type tests for overhead conductor connected expulsion fuses and solid links.

Fuse tubes and solid links covered by ENATS 41-36 shall comply with the latest issues of the relevant International and British Standards. ENATS 41-36 is intended to amplify and/or clarify the requirements of those Standards.

This check sheet identifies the clauses in ENATS 41-36 1 and the clauses of the aforementioned Standards relevant to common specifications for high-voltage switchgear and control gear 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 test conforms fully with the requirements of this clause
Cs2 = The test conforms partially with the requirements of this clause
Cs3 = The test does not conform to the requirements of this clause
Cs4 = Test not performed, but alternative evidence/ technical case offered

Instructions for completion

- When Cs1 code is entered provide evidence reference
- When any other code is entered the reason for non-conformance shall be entered
- Prefix each remark with the relevant 'IEC' or 'ENATS' as appropriate

Manufacturer:

Product Reference:

Name:

Signature:

Date:

Test Requirement	Specification and standards	Rated value	Test req'd Y or N	Conformance *	Test value	Date of test	Test station Report / Cert No	Witness I, M or ENA **	Remarks
High-voltage test	B.S. 2692 : Part 2, Clause 22 Table 1.1b of ENATS 41-36								
Impulse-voltage test	B.S. 2692 : Part 2, Clause 23 Table 1.1b of. ENATS 41-36								
Temperature Rise	B.S. 2692 : Part 2, Clause 21								
Test for breaking capacity ***	B.S. 2692 : Part 2, Clause 27								
Short-time withstand current and peak	IEC 62271-102. Sub-clause 6.6.								
Verification of protection	IEC 62271-102. Sub-clause 6.7, Sub-clause 1.5.13 of ENATS 41-36.								
Tensile test on expulsion fuse-link	Test method described in sub-clause 8.6 2 of ENATS 41-36								

Appendix 4 - 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 3 – completed self-certification conformance declaration	
Complete set of drawings for each item	
Type test evidence	
Manufacturing quality plan	
Packaging information	
Instructions/Manuals for transportation & handling, installation, maintenance and disposal	
Spares availability list	
ISO:9001, ISO:14001 and ISO:18001 certificates	