NPS/001/017 – Technical Specification for Low Voltage and High Voltage Fuse Links

1. Purpose

The purpose of this document is to detail the technical requirements for high voltage (HV) and low voltage (LV) fuses for use on the distribution networks of Northern Powergrid (the Company).

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

Document Reference	Document Title	Version	Published Date
NPS/001/017	Technical Specification for Low Voltage and High Voltage Fuse Links	9.1	August 2021

2. Scope

This document applies to all fuses for use on the distribution networks of the Company. These fuses shall be manufactured in accordance with the appropriate national and international standards as detailed within the specification. The following appendixes have been included within this specification: -

- Appendix 1 - Schedule of Items
- Appendix 2 - Self certification conformance declaration
- Appendix 3 - Proof of performance
- Appendix 4 - Addendum to Supplier Requirements
- Appendix 5 - Technical Information Check List

2.1. Table of Contents

3. Technical Requirements

3.1. Range of Products

The range of products covered in this specification is included in the following sub-sections with specific dimensional requirements in Appendix 1.

3.1.1. High Voltage Current Limiting Fuses

HV current limiting fuses shall comply with the technical requirements of BS EN 60282-1 and application requirements of ENATS 12-8. They are required for operation under oil and for operation in air in normal service conditions as detailed in BS EN 60282 – 1 Section 2.1.

Fuse links are required for 11kV and 20kV systems with the rated voltage in accordance with Series 1 of BS EN 60282 – 1 Table 3 and a system frequency of 50Hz.

HV fuse links for use under oil shall conform to the dimensional requirements of BS EN 60282 – 1, Annex D Type II, dimension A = 63.5mm and two different lengths of dimension D = 256mm and also D = 361mm.

HV fuse links for use in air shall conform to the dimensional requirements of BS EN 60282 – 1, Annex D Type III, dimension A = 80mm and E = 419mm with Fig. D type fixing holes.

Fuse links rated at 24kV shall be oil-immersed type with a length of 361mm and shall have a breaking capacity of not less than 12.5kA.

All HV fuse links shall be fitted with strikers for operation of the switch fuse tripping mechanism. The striker operation shall be designed to comply with the requirements of BS EN 62271 – 105: clause 8.103. The direction of striker pin operation shall be clearly marked on the fuse link as detailed in clause 5.2

3.1.2. High Voltage Expulsion Fuse Links

HV expulsion fuse links shall be suitable for use in expulsion fuse switch equipment as detailed in ENA TS 41-47.

Fuse links are required for use on 11kV, 20kV and 33kV distribution networks and shall have a rated current breaking capacity of 8kA.

The links shall comply with BS 2692 – 2. The following variations of fuse element are required: -

- Slow blow fixed button head.
- Slow blow universal with removable NEMA button ¼" UNF head and tail on one end with removable tail at the other.

ANSI C 37-2 Type T slow blowing characteristics are required with the overall fuse lengths for all fuses that are detailed in Appendix 1.

3.1.3. High Voltage DIN Type Full Range Fuse Links

HV DIN type fuse links are for use in padmount type transformers with no associated HV switchgear. Full Range type fuse links are required in accordance with BS EN 60282 – 1, Section 3.3.5. Dimensions shall be in accordance with DIN 43 625 and are detailed in Appendix 1.

3.1.4. Low Voltage Fuse-links.

LV "J" type fuse-links for use in 400V electricity supply networks are chosen to provide, so far as reasonably practicable, short circuit protection for the cables to which they are connected. As such they shall comply with the performance and testing requirements of BS EN 60269 – 1, using the "g" full range breaking-capacity as specified in section 5.7.1.

In addition, they shall be fully compliant with the requirements of "Fuse system I – "gU fuse links with wedge tightening contacts" section in BS EN 60269-2, BS88-2 "Supplementary requirements for fuses for use by authorized persons". Dimensions shall be as detailed in Fig 905 "Dimensions for fuse links with L type and U type tags". Time-Current curves shall be as given in figures 901, 902, 903 and 904.

3.1.5. Low Voltage Domestic Fuse Links

Fuse-links for domestic and similar premises shall comply with the requirements of BS HD 60269-3, BS 88-3. The Company has a requirement for Types IIa and IIb as detailed in Figure 301 of BS 88 - 3.

Fuse-links shall be suitable for use in cut-outs designed to typical design requirement of BS 88 – 3, Figure 303.

3.1.6. Low Voltage Street Lighting Fuse-links

Fuse-links for street lighting cut-out applications shall comply with the general requirements of BS EN 60269 – 1 and specific requirements of BS 7654. The fuse shall have an offset tag with 38mm fixing centres and have a minimum breaking capacity of 16kA in accordance with Fig. 102 of BS 7654.

3.1.7. Low Voltage Industrial and Commercial Fuses

Industrial and commercial cartridge fuses shall be in accordance with BS 88 – 2 and BS EN 60269 – 1. Appendix 1 details the ratings and BS 88 – 2 references.

3.1.8. Time Limit Fuses for HV Switchgear

Time Fuse-Links (for use with Current Transformer Releases on Circuit-Breakers in accordance with ENATS 12-6 shall be designed to carry the normal rated current indefinitely without causing a permanent change in time/current characteristics and without exceeding the temperature rise permitted.

The hot resistance of time limit fuse links, when measured in accordance with ENA TS 12-6, clause 9.3 and shall not exceed the appropriate values given in Table 1.

3.1.9. Current Limiting Fuses for Dropout Expulsion Fuses on Overhead Lines

Current limiting dropout fuse assemblies are used on overhead line network circuits 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 and an associated fuse mount.

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.

Additional detail is provided in NPS/001/004 - Technical Specification for 11kV, 20kV and 33kV Pole Mounted Expulsion Switch, Fuse Tube and Solid Link, Section 3.2.5.

3.2. Markings

HV fuse links shall have identification markings in accordance with BS EN 60282 – 1, Section 5.2. LV fuse links shall have identification markings in accordance with BS EN 60269 – 1, Section 6.2.

3.3. Testing

Testing shall be in accordance with the appropriate IEC or British Standard. Suppliers shall complete the self-certification conformance declaration detailed in Appendix 2.

4. References

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

4.1. External Documentation

Reference	Title
BS 2692: 2 – 1956	Fuses for voltages exceeding 1000 V a.c. - Expulsion fuses
BS 7654:2010	Specification for single phase street lighting fuses (cut-outs) for low-voltage public electricity distribution systems. 25 A rating for highway power supplies and street furniture
BS EN 60269 – 1: 2007 +A2:2014 BS 88: 1 – 2007+A2:2014	Low-voltage fuses. General requirements
BS EN IEC 60282-1:2020	High-voltage fuses. Current-limiting fuses
BS EN 62271:105 – 2023	High-voltage switchgear and control gear. Alternating current switch-fuse combinations
BS HD 60269- 2:2013+A1:2022, BS 88: 2 – 2013+A1:2022	Supplementary requirements for fuses for use by authorised persons (mainly for industrial applications)
BS HD 60269-3:2010+A2:2022, BS88-3:2010+A2:2022	Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household or similar applications)
ENATS 12 – 6	Time fuse-links (for use with current transformer releases on circuit-breakers)
ENATS 12 – 8	The Application of Fuse Links to 11kV/425v Underground Distribution Networks
ENATS 41-47	Pole Mounted, Non-Enclosed: Switch-Disconnectors, Disconnectors, Earthing Switches, Fuse Switches (Expulsion fuses), Solid Links and Automatic Sectionalising Links (ASLs)

4.2. Internal Documentation

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

4.3. Amendments from Previous Version

Reference	Description
3 Technical Requirements	Reference to dates of external documents removed
3.1.8 Chemical Actuator	Section removed as the product discontinued
4.1 External Documentation	Table of documents referenced updated
Appendix 1 Schedule of Items	Chemical actuator removed as it has been discontinued by the manufacturer

5. Definitions

Term	Definition
Striker Pin	Mechanical device forming part of a fuse-link which, when the fuse operates, releases the energy required to cause operation of other apparatus or indicators or to provide interlocking
The Company	Northern Powergrid

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
Deb Dovinson	Governance Administrator	26/03/2024

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: 7 years	Reason: Based on the standard contract period.
Should this document be displayed on the Northern Powergrid external website?		Yes

		Date
Steve Salkeld	Policy and Standards Engineer	02/07/2024

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
Aaron Chung	Policy and Standards Engineer	11/04/2024

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	Head of System Engineering	22/05/2024

Appendix 1 – Schedule of Items

HV Current Limiting Fuses in Oil (Section 3.1.1)

System Rated Voltage (kV)	Current Rating (A)	ENA TS 12-8 rating Ref.	Length -Dimension D (mm)	Commodity Code
6.6	50	O6	359	287612
11	80	O4	359	287788
11	90	O5	359	287805
11	80	O4	254	038620
11	31.5	O2	254	287699
11	40	O3	254	083604
11	63	O4	254	038612
11	50	O3	254	287716
11	20	O1	254	288009
20	10	N/A	361	280011
20	20	N/A	361	287824
20	31.5	N/A	361	287839
20	50	N/A	361	287843

HV Current Limiting Fuses in Air (Section 3.1.1)

System Rated Voltage (kV)	Current Rating (A)	ENA TS 12-8 rating Ref.	Length -Dimension D (mm)	Commodity Code
11	6.3	A1	359	362207
11	10	A1	359	362194
11	20	A1	359	287595
11	31.5	A2	359	287608
11	50	A3	359	287612
11	71	A4	359	287627
11	90	A5	359	287665
11	100	A5	359	361789

HV Expulsion Fuse Links (Section 3.1.2)

Current Rating (A)	Fuse Type	System Voltage (kV)	Length (mm)	Commodity Code
100	Slow Blow, Fixed Button Head	11	550	037879
100	Slow Blow, Fixed Button Head	33	800	037895
6	Slow Blow, Universal	11, 20, 33	787	245840
10	Slow Blow, Universal	11, 20, 33	787	245037
12	Slow Blow, Universal	11, 20, 33	787	245041
15	Slow Blow, Universal	11, 20, 33	787	245056
Current Rating (A)	Fuse Type	System Voltage (kV)	Length (mm)	Commodity Code
25	Slow Blow, Universal	11, 20, 33	787	245018
30	Slow Blow, Universal	11, 20, 33	787	242518
40	Slow Blow, Universal	11, 20, 33	787	245060
50	Slow Blow, Universal	11, 20, 33	787	245111

65	Slow Blow, Universal	11, 20, 33	787	245446
80	Slow Blow, Universal	11, 20, 33	533	259114
100	Slow Blow, Universal	11, 20, 33	533	259129

HV DIN Type Fuse Links (Section 3.1.3)

System Voltage (kV)	Current rating (A)	DIN 43 625 Length (mm)	Commodity Code
11	6.3	292	362207
11	10	292	362194
11	20	292	362175

LV Fuse-links – "J" Type Cylindrical (Section 3.1.4)

Current Rating (A)	Dimensions	Commodity Code
100	Length 45.7mm – Diameter 38.7mm (no tag)	031625
150	Length 45.7mm – Diameter 38.7mm (no tag)	031633
200	Length 45.7mm – Diameter 38.7mm (no tag)	031641
100	76mm - Dimension A - BS 88-2 Fig. 905	280524
160	76mm - Dimension A - BS 88-2 Fig. 905	280543
200	76mm - Dimension A - BS 88-2 Fig. 905	280562
63	76mm - Dimension A - BS 88-2 Fig. 905	280702
80	82mm - Dimension A - BS 88-2 Fig. 905	280596
100	82mm - Dimension A - BS 88-2 Fig. 905	280721
160	82mm - Dimension A - BS 88-2 Fig. 905	280740
200	82mm - Dimension A - BS 88-2 Fig. 905	280774
250	82mm - Dimension A - BS 88-2 Fig. 905	280628
315	82mm - Dimension A - BS 88-2 Fig. 905	280632
355	82mm - Dimension A - BS 88-2 Fig. 905	280416
400	82mm - Dimension A - BS 88-2 Fig. 905	280666
500	82mm - Dimension A - BS 88-2 Fig. 905	035568
630	82mm - Dimension A - BS 88-2 Fig. 905	034876
80	92mm - Dimension A - BS 88-2 Fig. 905	280717
100	92mm - Dimension A - BS 88-2 Fig. 905	280789
160	92mm - Dimension A - BS 88-2 Fig. 905	280793
200	92mm - Dimension A - BS 88-2 Fig. 905	280825
250	92mm - Dimension A - BS 88-2 Fig. 905	280384
315	92mm - Dimension A - BS 88-2 Fig. 905	280844
355	92mm - Dimension A - BS 88-2 Fig. 905	280399
400	92mm - Dimension A - BS 88-2 Fig. 905	280863
500	92mm - Dimension A - BS 88-2 Fig. 905	280878
630	92mm - Dimension A - BS 88-2 Fig. 905	280952

Domestic fuse Links (Section 3.1.5)

Current Rating (A)	End Cap Diameter – BS 88 - 3 Table 301 (mm)	Type – BS 88 - 3 Table 301	Commodity Code
5	22.23	IIa	282318
25	22.23	IIa	181051
30	22.23	IIa	031088
40	22.23	IIa	282360
60	22.23	IIa	282394

80	22.23	IIa	282407
30	30.16	IIb	031203
40	30.16	IIb	031204
60	30.16	IIb	282430
80	30.16	IIb	282426
100	30.16	IIb	282411

Street Lighting Fuse Links (Section 3.1.6)

Current rating (A)	Dimension G – BS 7654 Fig. 102 (mm)	Tag Description	Commodity Code
6	38	Offset tags with 1 axial and 1 lateral slot	282750
5	38	Offset tags with 1 axial and 1 lateral slot	289069
10	38	Offset tags with 1 axial and 1 lateral slot	282765
16	38	Offset tags with 1 axial and 1 lateral slot	282784
20	38	Offset tags with 1 axial and 1 lateral slot	282799
25	38	Offset tags with 1 axial and 1 lateral slot	030718
32	38	Offset tags with 1 axial and 1 lateral slot	030726

LV Industrial Fuse Links (Section 3.1.7)

System Voltage (V)	Current Rating (A)	Tag Arrangement	Commodity code
440	400	BS 88-2 Special Offset 92.5mm Centres With Open Double Slot	032813
440	630	BS 88-2 Special Offset 94.0mm Centres With Open Double Slot	032870
415	6	BS 88-2 Ref. F1	032078
415	10	BS 88-2 Ref. F1	032094
415	16	BS 88-2 Ref. F1	032102
415	32	BS 88-2 Ref A2	032508
415	63	BS 88-2 Ref A2	032573
415	315	BS 88-2 Ref C1	034169
415	400	BS 88-2 Ref C1	034157
415	400	BS 88-2 Ref B4	032902
415	500	BS 88-2 Ref C2	034322

HV – Time limit Fuses (Section 3.1.9)

Current Rating (A)	Description	Commodity Code
3	3A Time limit fuse to ENATS 12.6 (XF3)	289054
5	3A Time limit fuse to ENATS 12.6	289069
7.5	7.5A Time limit fuse to ENATS 12.6 (XF7.5)	289073
10	10A Time limit fuse to ENATS 12.6 (XF10)	289088
12.5	12.5A Time limit fuse to ENATS 12.6 (XF12.5)	289092
15	15A Time limit fuse to ENATS 12.6 (XF15)	289105

Current Limiting Fuses for Dropout Expulsion Fuses on Overhead Lines (Section 3.1.10)

System Voltage (kV)	Description	Supplier Reference	Commodity Code
11kV	25A, 11kV, Single Barrel, ELF Current Limiting DOEF's	FAK44W25	259030
20kV	20A, 20kV, Single Barrel, ELF Current Limiting DOEF's	FAK45W20	259035

Replacement fuses for REZAP and Kelvatek

System Voltage (kV)	Supplier Reference	Commodity Code
415 V	86TT710	280010
415 V	500RJ31	280885

Appendix 2 - Self Certification Conformance Declaration

LV and HV fuse links are covered by IEC and British Standards and shall comply with the latest issues.

This check sheet identifies the clauses of the aforementioned Standards relevant to LV and HV fuse links for use on the Company distribution network.

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 'ENATS' as appropriate

Manufacturer:

Product Reference:

Name:

Signature:

Date:

HV Current Limiting Fuses (Section 3.1.1) – BS EN 60282-1

Clause/Sub-clause	Requirement	Conformance Code	Evidence Ref	Remarks
2.0	Service Conditions			
4.0	Ratings			
5.0	Design Construction and Performance			
5.2	Identifying Markings			
6.0	Type Tests			
6.5	Temperature Rise Tests			
6.6	Breaking tests			
6.7	Tests for time-current characteristics			
6.8	Tests of strikers			
7.7	Oil Tightness Tests			
Annex D	Dimensions			

High Voltage Expulsion Fuse links (Section 3.1.2) – BS2692-2

Clause/Sub-clause	Requirement	Conformance Code	Evidence Ref	Remarks
4.0	Voltage Rating			
5.0	Current rating			
6.0	Breaking Capacity Ratings			
7.0	Marking of Fuse Links			

12.0 Section 7 20	Tim/current characteristics Type tests Temperature Rise tests			
• ANSI C 37-2				
various	Dimensions			

High Voltage DIN Type Full Range Fuse Links (Section 3.1.3) - DIN 43 625 & BS EN 60282 - 1

Clause/Sub-clause	Requirement	Conformance Code	Evidence Ref	Remarks
various	Dimensions			

LV Fuse Links (Section 3.1.4) - BS EN 60269 - 1

Clause/Sub-clause	Requirement	Conformance Code	Evidence Ref	Remarks
4.0 5.7 6.2 8.0	Classification Breaking Range and Capacity Marking of Fuse Links Testing			
• **BS 88 - 5**				
5.9	Dimensions			

Domestic Fuse Links (Section 3.1.5) – BS88-3

Clause/Sub-clause	Requirement	Conformance Code	Evidence Ref	Remarks
4 5 6	Classification Characteristics of fuses Markings			

7 8	Standard conditions for construction Tests			

Street Lighting Fuse Links (Section 3.1.6) - BS EN 60269 - 1

Clause/Sub-clause	Requirement	Conformance Code	Evidence Ref	Remarks
4.0 5.7 6.2 8.0	Classification Breaking Range and Capacity Marking of Fuse Links Testing			
• **BS 7654**				
5.9	Figure 102 – Dimensional Requirements			

Industrial and Commercial Cartridge Fuses (Section 3.1.7) - BS EN 60269 - 1

Clause/Sub-clause	Requirement	Conformance Code	Evidence Ref	Remarks
4.0 5.7 6.2 8.0	Classification Breaking Range and Capacity Marking of Fuse Links Testing			
• BS 88 - 2				
Figure 1	Dimensions for Reference A, B, C and D Types			

HV – Time limit Fuses (Section 3.1.9) - ENA TS 12-6

Clause/Sub-clause	Requirement	Conformance Code	Evidence Ref	Remarks
4.0 9.1 9.2	Marking Temperature Rise Time / Current Characteristics			

9.3 9.4	Resistance Duty			

Appendix 3 - Proof of Performance

Proof of performance evidence shall be submitted for each type of fuse link offered. This shall include Time/Current characteristics and curves in compliance with the relevant IEC and British Standards.

A sample of each product group offered may be requested for assessment.

Appendix 4 - Addendum to Supplier Requirements

Packaging/delivery information

Details of how this product will be packaged and delivered shall be provided.

Project specific requirements

Any project specific requirements will be provided by the Company for inclusion in this appendix.

Appendix 5 - Technical Information Check List

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

Requirement	Provided (Y/N)
Full product descriptions and part number/reference	
Appendix 1 – Completed technical schedules	
Appendix 2 – Completed self-certification conformance declaration	
Appendix 3 – Proof of performance – Time/Current characteristic curves	
Complete set of drawings for each variant and data sheets	
Type test evidence	
Routine test/quality plan (example)	
Packaging/delivery information	