NPS/001/032 - Technical Specification for 11 & 20kV Pole Mounted Auto Sectionalising Links

1. Purpose

The purpose of this document is to outline the technical requirements for automatic sectionalising links (ASL's) used in drop-out expulsion fuse mounts 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/001/032	Technical Specification for 11 & 20kV Pole Mounted Auto Sectionalising Links	2.0	Sep 2015

2. Scope

This Specification details the range, design, constructional and technical requirements for pole mounted ASL's for use in conjunction with drop-out expulsion fuse mounts which are detailed separately in NPS/001/004 - Technical Specification for 11kV, 20kV and 33kV Pole Mounted Expulsion Switch, Fuse Tube and Solid Link.

The ASL's specified within this specification shall comply fully with, and meet all the requirements of, the current version of "ENATS 41-36 - Distribution Switchgear for Service Up To 36kV (Cable and Overhead Conductor Connected)", except where varied by this specification.

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3. Technical Specification

3.1. General Requirements

Auto Sectionalising Links (ASL's) shall operate after a pre-determined sequence of pulses of fault current. They are intended to operate in conjunction with pole mounted auto reclosing circuit breakers (PMAR) as specified in NPS/001/009 – Technical Specification for 11kV, 20kV and 33kV Pole Mounted Auto-reclose Circuit Breakers and Enclosed Switch Disconnectors and are used to automatically isolate permanent spur-line faults from main lines whilst at the same time reducing the risk of transient faults causing a spur–line outage.

ASL's are non-fault break single phase devices that are designed to recognise a pre-determined sequence of fault currents, to identify a permanent fault and then during a period when the upstream protective device is open, to disengage and drop-out to the isolated position.

- ASL's shall be able to discriminate between fault current, load current and high currents due to magnetising inrush when a line is re-energised from the upstream pole mounted PMAR CB.
- ASL's must be capable of operating on networks where the minimum continuous load current available at the point of installation is 300mA.
- ASL's shall be designed to be physically interchangeable with fuse carriers used in the pole mounted drop-out expulsion fuse mounts as specified in NPS/001/004 – Technical Specification for 11kV, 20kV and 33kV Pole Mounted Expulsion Switch, Fuse Tube and Solid Link.
- ASL's shall be designed to be compatible with a 380mm +/- 1mm centres fuse mount and with trunnions that have been designed to be suitable for use in a "Type C" cutout.

3.2. System Operating Conditions

Rated System Frequency	50 Hz
Rated Voltage Ur (RMS value)	24 kV (ASL's to be suitable for use on 12kV lines also)
Rated Lightning Impulse withstand voltage Up (peak)	125 kV
System Earthing	Neutral directly earthed, resistance earthed, or via arc suppression coils

3.3. Typical Protection Settings on PMAR CB's Used in Conjunction with ASL's

Typical protection settings on PMAR's used in conjunction with ASL's	Available settings on PMAR's	Typical Settings
Declared minimum time delay between fault start and contact separation on the controlling pole mounted reclosers when operating in an instantaneous trip mode.	26 mS	
Declared average minimum time delay between fault start and contact separation on the controlling pole mounted reclosers when operating in an instantaneous trip mode.	35 mS	
Recloser Operating sequences	4 x Instantaneous or 3 x Instantaneous and 1 x 50mS delay	
Dead Time	1 – 60 secs	(5)
Reclaim Time - (sec)	5 – 60	25
Overcurrent settings – (A)	50 to 600	120
Overcurrent Time Multiplier	0.1 – 1.0	0.5
Earth fault - (A)	10 – 200	80
Earth fault time delays - (sec)	0.5 – 3.0	0.05
Sensitive earth fault - (A)	**4 – 30	30

Typical protection settings on PMAR's used in conjunction with ASL's	Available settings on PMAR's	Typical Settings
Sensitive earth fault time delays - (sec)	0 – 20	3.0

3.4. ASL Requirements

ASL Requirements	Values
Rated Continuous Current (A)	15, 25, 35, 50, 70 & 100
Ratio of Pickup current to rated continuous current (Manufactures to state any additional margin for manufacturing tolerances) – (A)	1.1 – 1.6
Nominal ASL reclaim time (sec)	25
Required number of ASL Counts	2 or 3
Rated Short-time Withstand Current (kA)	* 4 (3 Sec) - Symmetrical
Rated Peak Withstand Current (kA)	* 10 Peak Asymmetric
Minimum assumed continuous load current available on system – (mA)	300
Notes * These are the preferred Northern Powergrid values but consideration will be given to accepting 4kA for 1 sec where these values are not achievable. ** Northern Powergrid do not normally reclose following an SEF trip and will therefore not require an ASL to detect fault currents as low as those stated.	

3.5. General Requirements

- The ASL's shall be designed for manual insertion and removal using insulated operating poles that are not less than 4.8m long inclined at an approx. angle of 15° to the vertical. In accordance with ENA TS 41-36 - "*Specification for Distribution Switchgear for Service up to 36 kV (Cable and Overhead Line Conductor Connected)*" clause 8.5.1, the link shall be designed to accept a maximum force of 150N applied to it during a closing action.
- The ASL's shall be so designed and constructed such that operation of the ASL, will cause the upper contact of the ASL to disengage from the upper fixed contact of the fuse-mount. Thus allowing the ASL to pivot under the influence of gravity 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.
- The ASL shall be designed and constructed to prevent the accumulation of water within it under all conditions of service.
- Electromagnetic capability - ASL's shall be compliant with the latest versions of EMC Directive 89/336/EEC and BS EN 62271
- ASL's shall be mechanically re-settable and not require the replacement of any part to reset
- Number of Counts - ASL devices shall be designed to be set to operate in at least one less count than the upstream PMAR. A range of units are required that are capable of operating after either two or three pulses of fault current. The number of pulses before operation of an individual unit may be factory set or be user set prior to installation.

3.6. Labelling of Automatic Sectionalising Links

Where ASL's are supplied with factory fixed settings they shall be marked with the following information, which may be in coded form identifiable from the manufacturer's catalogue:-

a) Manufacturer

b) Rated Voltage

c) Minimum actuation current

d) Maximum load current

e) Reclaim Time

f) Number of Counts

Sectionaliser Continuous Current rating Colour Scheme		Typical Minimum actuating currents based on a 1.6 ratio
15A	Purple	24
25A	Red	40
35A	Brown	56
50A	Green	80
70A	TBA	112
100A	White	160
200A	Orange	320

Sectionaliser Counts to operation Colour Scheme	
2	No Band
3	Green

3.7. Performance Characteristics

Manufacturers shall provide the following data:

a) The minimum value of load or pre-charge current required to flow in the protected circuit to power up the unit with sufficient energy to ensure successful operation of the ASL under fault conditions.

b) The self-discharge characteristics of the ASL - How long will the ASL retain the ability to operate correctly on fault energy alone following the removal of load current from the system in which they are installed.

3.8. Testing

3.8.1. Type Tests

3.8.1.1. General

ASL's shall comply with B.S. 2692 except that the requirements for rated breaking capacity shall not apply.

Type test requirements are listed in Appendix 2.

3.8.1.2. Operational Test for Automatic Sectionalising Links

The following series of tests shall be carried out on three sample ASL's of each type/rating being offered. The tests relate to ASL's programmed to operate after sensing two impulses of current above minimum actuating current level within the reclaim time. ASL's programmed to respond to 3 or more

pulses of current, while not covered by these tests shall also be tested by employing the same general principles, but with the stated number of current pulses modified as appropriate:

Test	Scenario	ASL Test Outcome
a	Apply a current of value 0.8 times minimum actuating current +5% for a duration of 1.0 second +0.1 second. Apply a second similar pulse of current after 3.0 seconds +0.1 second.	shall not operate
b	Apply a current of value 1.2 times minimum actuating current +5% for a duration of 1.0 second +0.1 second. Apply a second similar pulse of current after an interval corresponding to between 1.5 - 2.0 times stated reclaim time.	shall not operate
c	Apply a current of value 1.2 times minimum actuating current +5% for a duration of 0.1 second +0.02 second. Apply a second similar pulse of current after an interval corresponding to between 0.4 and 0.6 times stated reclaim time.	shall operate
d	Apply a current of 4kA r.m.s. symmetrical for duration of 0.035 second +0.02 second. Apply a second similar pulse of current after an interval corresponding to between 1.5 and 2.0 times stated reclaim time.	shall not operate
e	Apply a current of 4kA r.m.s. symmetrical for duration of 0.035 second +0.02 second. Apply a second similar pulse of current after an interval corresponding to between 0.4 and 0.6 times stated reclaim time.	shall operate
f	Repeat sequence (c) but with a value of current, following the end of the second current impulse without a break, equal to between 2 and 3 times the value of the hold-off current.	shall not operate
g	Repeat test sequences (a) to (f) a total of 3 times on each of the three sample automatic sectionalising links.	
Allow a period of time equal to 3 times the reclaim time between each test of (a), (b), (c) etc.		

3.8.1.3. Short-time Withstand Current Test

Apply the 4kA r.m.s. symmetrical test, for a duration of 3 seconds + 0.1 second. Then repeat test sequence (a), (b), (c) on the same sample.

ASL shall operate correctly and shall not suffer any damage likely to impair its further use in service.

3.8.1.4. Performance Characteristics

The manufacturer shall provide the following data:

a. Variations of reclaim time with changes in value and duration of actuating current;

b. Variation of minimum actuating current and reclaim time with variations in ambient temperature over the range -25 to +70°C.

3.8.2. Special Tests

In accordance with the latest version of ENA TS 41-36 clause 8.6.3.3 additional tests shall be carried out on the units to confirm their suitability in corrosive atmospheric, salt-laden mists and other environmental hazards not specified above.

3.8.3. Routine Tests

Routine Tests - Shall be carried out in accordance with the latest BS 2692 Part 2 - Clause 29.

4. References

4.1. External Documentation

Reference	Title
BS 2692 Part 2: 1956	Fuses for voltages exceeding 1000V AC – Expulsion Fuses
BS EN 62271: 2017	High-voltage switchgear and control gear. High-voltage alternating-current circuit-breakers
BS EN 62271-102: 2018	High-voltage alternating Current Disconnectors and Earthing Switches
BS EN 62271-105: 2012	High-voltage switchgear and control gear – Part 105: Alternating current switch-fuse combinations
EMC Directive 89/336/EEC: 1989	Electromagnetic Compatibility - the EMC Directive 89/336/EEC, 1992
ENA TS 41-36: Issue 3	Specification for Distribution Switchgear for Service up to 36 kV (Cable and Overhead Line Conductor Connected)

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
NPS/001/009	Technical Specification for 11kV, 20kV and 33kV Pole Mounted Auto-reclose Circuit Breakers and Enclosed Switch Disconnectors

4.3. Amendments from Previous Version

Reference	Description
4.1 External Documentation	Referenced standards updated
6.0 Authority for Issue	Updated to reflect current authorisation requirements
Appendix 2 – Addendum to Suppliers Requirements	Table added for manufacturers to complete summarising the technical ratings/valued of the equipment offered
Appendix 4 - Technical Information Check List	Appendix added

5. Definitions

Term	Definition
ASL's	Automatic Sectionalising Links
Drop-out Expulsion Fuse	An expulsion fuse in accordance with the latest version of BS 2692 Part 2 in which the fuse carrier automatically drops into a position providing an isolating distance after the fuse has operated and can be operated as a disconnector by means of a portable operating rod.
Hold-off current	The maximum line current in milliamperes below which the ASL infers that the upstream protective device is open
Mechanically Resettable Actuator	A type of spring loaded mechanism used to actuate the drop out action of the sectionaliser where the energy used to trip the mechanism is obtained from one or more CTs that are integral to the unit. Following operation of the actuator this type of mechanism can be manually re-set without the replacement of any part.
Minimum actuating current	The threshold current in amperes above which the ASL commences its operational sequence
PMAR	Pole Mounted Auto Reclosers
Rated Peak Withstand Current (kA)	Note -The rated peak withstand current shall be equal to 2.5 times the rated short-time withstand current
Rated Short-time Withstand Current (kA)	Where the values quoted are the prospective symmetrical short-circuit currents for test duty 1 in the latest version of IEC 62271-105, sub-clause 6.103.1
Reclaim Time	The period of time in seconds, starting when the line current has fallen to a value below the minimum actuating current for the ASL link to reclaim its original pre-determined number of main current pulses from any part of an incomplete sequence

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	19/11/2020

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 align with the contract period of 5 years
Should this document be displayed on the Northern Powergrid external website?		Yes

		Date
Steven Salkeld	Policy and Standards Engineer	19/11/2020

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	07/12/2020
Mick Emsley	Policy and Standards Manager	23/11/2020

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Greg Farrell	Head of System Engineering	29/12/2020

Appendix 1 – Schedule of Requirements

Item No	Cat Number	Rating	Counts
1	246839	15A	2
2	247297	15A	3
3	246824	25A	2
4	247140	25A	3
5	247263	35A	2
6	247314	35A	3
7	247441	50A	2
8	247511	50A	3
9	247315	70A	2
10	247516	70A	3
11	247317	100A	2
12	247318	100A	3

Appendix 2 - Addendum to Supplier Requirement

Technical Schedule

Manufacturers shall complete the table below providing the rated values of the products offered:

ASL Technical Parameters	Values/Ratings Offered
Rated Continuous Current (A)	
Ratio of Pickup current to rated continuous current (Manufactures to state any additional margin for manufacturing tolerances) – (A)	
Nominal ASL reclaim time (sec)	
Number of ASL Counts	
Rated Short-time Withstand Current (kA)	
Rated Peak Withstand Current (kA)	
Minimum assumed continuous load current available on system – (mA)	
Rated System Frequency	
Rated Voltage Ur (RMS value)	
Rated Lightning Impulse withstand voltage Up (peak)	

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

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

Type tests for overhead conductor connected automatic sectionalising links.

ASL's 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 - Part 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 reference document evidence
- 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:
Cs3 = The test does not conform to the requirements of this clause
Cs4 = Test not performed, but alternative evidence/ technical case offered

Manufacturer:
Product Reference:
Name:

Signature:

Date:

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

Type Tests

	Test Requirement	Specification and standards	Rated value	Test req'd Y or N	Confor mance	Test value	Date of test	Test station Report/ Cert No	Witness I, M or ENA	Remarks
1	High-voltage test	B.S. 2692 : Part 2, Clause 22 Table 1.1b of ENA TS 41-36.								
2	Impulse-voltage test	B.S. 2692 : Part 2, Clause 23 Table 1.1b of ENA TS 41-36.								
3	Temperature Rise	B.S. 2692 : Part 2, Clause 26								
4	Short-time withstand current and peak	BS EN 62271-102. Sub-clause 6.6.								
5	Verification of protection	BS EN 62271-102. Sub-clause 6.7, Sub-clause 1.5.13 of ENATS 41-36.								

	Test Requirement	Specification and standards	Rated value	Test req'd Y or N	Confor mance	Test value	Date of test	Test station Report/ Cert No	Witness I, M or ENA	Remarks
6	Operational test for ASL's	Test method described in sub-clause 3.8.1.2 of this specification								
7	Ageing test for outdoor composite bushings and insulation materials – minimum of 5,000 hours	Annex C of BS EN 61109								

Appendix 4 – 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)
Full product descriptions and part number/reference	
Appendix 2 – Completed self-certification conformance declaration	
Complete set of drawings and data sheets for each variant	
Type test evidence	
Routine test and/or quality plan	
Packaging/delivery information	