Electricity Distribution

nationalgrid

Company Directive

ENGINEERING SPECIFICATION

EE SPEC: 11/0

Auto Reclosing Links for the Overhead 11kV Network

Author: **Mark Howarth**

Implementation Date: **June 2023**

Approved by

Carl Ketley-Lowe
Engineering Policy Manager

Date: **22nd June 2023**

Target Staff Group	**Staff, contractors and Independent Connection Providers (ICPs) involved with the specification, design, installation and/ or replacement of fused protection on the overhead network.**
Impact of Change	**RED: This is a brand new concept for NGED**
Planned Assurance checks	**Purchasing contract to ensure correct compliant equipment is available on the NGED Network.**

IMPLEMENTATION PLAN

Introduction

This Technical Specification sets out National Grid Electricity Distribution (NGED) requirements for HV single-phase pole mounted reclosing fuses.

Main Changes

None, this is a new document.

Impact of Changes

New auto reclosing HV fuse carrier mounted devices shall comply with the specification as laid out in this document.

Implementation Actions

This is a new document intended to identify market ready products that satisfy the NGED requirements for HV Auto Reclosing Fused Links and ensure their safe compatibility for use on the overhead network.

Implementation Timetable

This document shall be implemented once briefed and understood for use when identifying suitable products to be used as auto reclosing fused linkages on the overhead network.

REVISION HISTORY

Document Revision & Review Table		
Date	**Comments**	**Author**
June 2023	• New Document	Mark Howarth

Contents

1.0 Introduction

This Technical Specification sets out National Grid Electricity Distribution (NGED) requirements for HV single-phase pole mounted auto reclosing links that work like a fuse.

If this NGED Technical Specification is to be used for Tender purposes then unless otherwise specified in writing at time of tender, all equipment offered shall be compliant with this Technical Specification.

2.0 Scope

This specification states the general requirements for a single device or a system of devices that can provide the following functionality for pole mounted outdoor applications on HV networks with low load and fault current requirements such as those found on rural overhead line networks and associated spurs.

- Detect and automatically reconnect supply after clearing a transient fault;
- Automatically sectionalise a permanently faulted phase;
- Be capable of using a different protection curve for fault finding;
- Have a manually selectable auto reclose function for fault finding and live line working;
- Be powered by either line current or line voltage;
- Capable of being inserted into Pole Mounted Cut-outs having 380mm of contact separation, as defined in EE SPEC: EE10 Part 5;
- The device shall be designed to be maintenance free and shall not use components that need replacement, such as batteries.

The primary intelligent device shall be a recloser that could, ideally, be mounted directly into existing HV fuse mounts on an overhead line conductor, cross-arm or wood pole and can be used on either a single phase (Two wire) or three phase (Three wire) distribution network up to 12kV rating and at a frequency of 50Hz.

Information and type test evidence provided by the Supplier shall be applicable to the make, type and design of recloser that is supplied.

3.0 Glossary and Abbreviations

Term	Definition
CT	Current transformer
DOEF	Drop out expulsion fuse.
O/C	Overcurrent
PC	Personal computer
UV	Ultra violet.

4.0 General Description

4.1 Principle of Operation

The recloser shall be a self-powered, electronically controlled, single-phase fault-interrupting device utilising either a vacuum interrupter or other non SF6 filled interrupters.

The recloser shall be capable of detecting, opening on, and clearing fault current (up to 90MVA).

The recloser shall be primarily designed to provide protection for low loaded overhead lines (up to 100amps per phase), such as spurs (rated to a maximum of 52A / 1MVA). This requirement is reflected in the recloser ratings and specifications as defined within this specification.

The recloser shall be self-powered, so that the auxiliary power supply, normally provided by an external CT or VT shall not be required. Power should be taken either directly from the current or voltage flowing in the overhead line.

All the protection elements involved in operation of the device shall occur without the reliance of a battery.

All reclosers rated at 15.5kV shall be suitable for use both at 11kV and 6.6kV (50Hz) system voltages.

4.2 Design Tests and Standards Compliance

Unless stated otherwise, the recloser and ancillary devices shall be designed, manufactured and tested in accordance with the relevant parts (including amendments) of the following International Standards and/or their equivalents.

The development, design, and testing of the recloser shall be based on the requirements of **ENA TS 41-47, ENA TS 41-27, IEC 62271-1** and **IEC 62271-111** for a single-phase device.

The product shall be suitable for use outdoors in the UK with an IP68 accreditation from IEC 60529

Information and type test evidence provided by the manufacturer shall be applicable to the make, type and design of auto reclosing fused link that are supplied.

If the manufacturer proposes to make any material alterations to the auto recloser, including a change of make or type or design that could conceivably alter the information or invalidate type tests, new information and type tests shall be submitted to NGED for approval. An alternative auto recloser shall not be supplied until approval is granted by NGED.

STANDARD	DESCRIPTION
ENA TS 41-47	Technical requirements for pole mounted, air insulated switch disconnectors, disconnectors, earthing switches, drop out expulsion fuses, solid links and automatic sectionalising links (ASLs)
ENA TS 41-27	Outdoor Distribution Switchgear for Service up to 36kV (Overhead Conductor Mounted)
IEC 62271-1	High-voltage switchgear and control gear - Part 1: Common specifications for alternating current switchgear and control gear
IEC 62271-111	High-voltage switchgear and control gear - Part 111: Automatic circuit reclosers for alternating current systems up to and including 38kV.
BS EN ISO 9000	Quality management systems – Fundamentals and vocabulary
BS EN ISO 9001	Quality management systems – Requirements

5.0 Quality of Materials, Components and Workmanship

The construction of the equipment shall be of a robust design capable of withstanding any environment to which it is designed to operate within. Not forgetting locations near the sea.

Technical and service support facilities shall be readily available.

Suppliers and Manufacturers of auto reclosers shall satisfy the requirements of BS EN ISO 9000 and BS EN ISO 9001 for all products supplied. Conformity certificates covering the full range of products shall be provided at the time of any tender.

Where applicable, HV fuse carrier mounted auto reclosers shall satisfy the requirements of the EMC directive.

5.1 Materials and Components

All materials, and electrical and mechanical components used in the equipment shall be new, unused, and of a quality and class most suitable for working under the conditions specified.

All materials, components and devices rated at the voltage, current and frequency (50Hz) of the network to which it is to be connected and include any protective devices necessary for the full and adequate functioning of the equipment in that location.

In addition, all material including electrical and mechanical components of the equipment, shall withstand the variations of temperature and atmospheric conditions that may arise under normal working conditions it may experience exposure to.

This shall be done without any distortion, deterioration or production of undue stresses in any part of the device, which may be detrimental to its mechanical strength or suitability for the operation of any part that effects its lifetime performance.

5.2 Minimum requirements for external components

Table 5-1 details the minimum technical requirements for all external components:

Table 4-1

Parameter	Requirement
External metallic housing and conductive parts	Ratable to IP68 or greater.
Polymeric housings	A polymeric material with fire retardant, UV and vermin resistant properties
Ingress Protection	IP 68 or greater

5.3 Manufacturing Workmanship

The equipment shall be manufactured to a quality standard and should be available to inspection by NGED upon request.

Unique serial numbers should be added during manufacture and carried beyond, which could highlight them at a later date should that be needed.

Records of assembly quality and testing should be kept by the manufacturer and made available to NGED upon request.

It will be the decision of NGED Engineering Policy Department whether or not to accept refurbished/ repaired equipment and none should be returned to NGED without authorisation from a NGED Engineering Policy team member.

5.4 Service Conditions

The recloser and its associated ancillary components shall be designed and manufactured for outdoor conditions, and shall be suitable for operating under those conditions experienced in coastal or polluted environments. It shall be designed so that during its life no regular running maintenance is required.

The recloser shall be capable of operating under the service condition parameters declared in Tables 5-2 and 5-3.

Ratings shall be in compliance with ENATS 41-27

Table 4-2 – Electrical system parameters

Parameter	Value
Rated Voltage (kV)	12
Frequency (Hz)	50
Rated lightning impulse withstand voltage U_p (kV)	125

Table 4-3 – Load and fault current conditions

Load	Value
Minimum line current for Operation (A)	0.5
Rated Current (A)	400
Rated short-circuit breaking current (kA)	6

6.0 Design and Construction

6.1 Size and Weight

The recloser shall be compact and easy to handle by a single operator. Its weight shall be no greater than the following:

Table 6-1 –Recloser size and weight requirements

Parameter	Value
Weight of Recloser (per unit)	<15 kgs

6.2 Recloser Insulation

The recloser shall meet the following specifications for the electrical insulation surrounding the vacuum interrupter:

Table 6-2 – Recloser insulation system parameters

Parameter	Value
Rated lightning impulse withstand voltage U_p (kV)	125
Creepage distance (mm)	279

6.3 Integrated Electronic Controller

The recloser shall have a fully integrated electronic control module providing the protection, control and monitoring functions and have a means of interrogation and setting of all the parameters.

6.4 Position Indication

The recloser shall have visible and clear indication of its open position.

Clear indication of the Open position shall be provided to an operator standing on the ground.

Once in the Open position the recloser shall have the ability to be made into a Point Of Isolation from the Ground.

6.5 Live-Line Work Mode

The recloser shall have a means by which an operator operating from ground level using NGED Approved switching rods can change the protection settings rendering it suitable to use for live-line work downstream of the recloser. The unit shall also have the capability of turning off load, prior to manual opening.

6.6 Recloser Mounting

The recloser shall be capable of being inserted into the NEMA style Pole Mounted Cut-out having 380mm of contact separation.

6.7 **Manual Switching**

The supplier shall indicate how the units need to be operated so as to disconnect normal load.

The following local switching controls shall be provided to an operator using live-line switching rods.

- Trip
- Close
- Reclose suppression
- Protection operation shall allow for a change from the standard recloser setting to a single shot fuse curve (for HV fault finding).

The recloser shall have the ability to drop open and allow visual isolation once in that open position.

6.8 **Self Powering**

The recloser shall be powered by the HV line having the following requirements:

Rated Current (A)	Energising Current (A)	Remain On (A)
40	1	0.5
100	4	1.5
200	8	3

When dormant (standby) the unit should still retain the ability to functionally protect against any detected fault currents with a maximum wake up speed of less than 1 second.

6.9 **Battery**

The recloser shall not use batteries that require maintenance and or replacement.

6.10 Connectivity

The recloser shall be able to have its settings changed and updated. The method of update shall consider current best practice for ensuring the device software can only be accessed and updated by authorised and approved operatives.

Any software for the purpose of updating or maintaining the device shall be provided free of charge.

Any associated communication links or software systems shall be designed, installed and maintained to:

- Mitigate risks to network security and information systems supporting essential functions
- Protect against Cyber Attack
- Detect Cyber Security events

In order to satisfy these requirements any associated communication links and software systems shall comply with:

- National Cyber Security Centre (NCSC) guidance
- The US National Institute of Standards and Technology (NIST) cybersecurity framework
- The Network and Information Systems (NIS) Regulations 2018

Once a format or version is accepted no cyber updates will be permitted without first being scrutinised then authorised by NGED Cyber Security teams.

7.0 Protection Features

7.1 Overcurrent (O/C)

The overcurrent protection shall provide the following elements with associated performance specification:

Table 7-1

Parameter	Requirement
Minimum achievable time from start of fault current to the Recloser to fully open, including protection pick-up on instantaneous operation.	<30ms
Time in between reclose operations	1 – 5s
Protection Sequence Reset time	0.5 - 1000 Seconds
Minimum pick-up of fault current	5 amps

The recloser must be capable of at least two protection setting groups. Each protection setting group must be completely independent and have separately programmable O/C protection elements.

The recloser shall have a minimum operational life of 300 operations at 6kA interrupting, with a minimum of 2000 mechanical (Close/Open) operations.

The recloser shall have an inrush restraint (Anti-Pumping) feature that is always enabled (this prevents nuisance tripping of the recloser caused by 2nd harmonic current when being closed).

It shall satisfy where applicable the requirements of IEEE C 37-42 (see Section 1.4)

IEC Standard Inverse, Very Inverse and Extremely Inverse Characteristics

Curve	Curve Parameters		
	Pick up Current (A)	A	*
IEC Standard Inverse	100	0.14	0.02
IEC Very Inverse	100	13.5	1.00
IEC Extremely Inverse	100	80.0	2.00
Type K (fast blow) fuse	108	5.60106	2.00
Type T (slow blow) fuse	91	13.95696	2.00

$$t(I) = TMS\left(\frac{A}{(I/Is)^{*} - 1}\right)$$

7.2 **Auto-reclose**

The recloser shall have a configurable dead time between the trip and reclose. The selectable options should range between 1 to 5 seconds in steps no greater than 1 second.

7.3 **Event Logging**

The recloser shall have a date and time stamped event capture capability to record the following events:

- Protection Operations and Fault Data (fault magnitude and faulted phase);
- Local trip/close events;

7.4 **Short Interuptions**

A method of reporting the amount of recloses the device has completed shall be provided along with the recloser. The short interruptions shall meet the regulatory reporting requirements detailed within Ofgem guidance.

7.5 **Network Data**

Any available, though not a requirement, data logging capabilities should consider the following:

- The number of fault cleared events recorded;
- The number of permanent fault events recorded;
- The total duration of outages due to permanent fault events.

7.6 **Dormant to Active**

Following any state of energy saving or status power down, the unit should re-energise itself, recognise and protect against fault conditions within:

Fault Current (A)	Time (s)
50	0.28
75	0.19
100	0.14
200	0.08
300	0.045
400	0.035

APPENDIX A

SUPERSEDED DOCUMENTATION

This is a new document and no document is superseded by its issue.

APPENDIX B

RECORD OF COMMENT DURING CONSULTATION

Comments – EE SPEC: 11/0

APPENDIX C

ASSOCIATED DOCUMENTATION

ENA TS 41-47	Technical requirements for pole mounted, air insulated switch disconnectors, disconnectors, earthing switches, drop out expulsion fuses, solid links and automatic sectionalising links (ASLs)
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APPENDIX D

KEY WORDS

Auto Reclosing fused links