

SYSTEM FOR LOCK-OUT OF DELAYED AUTOMATIC RECLOSURE FOR FEEDER CIRCUITS WITH SECTIONS OF CABLE OR GIB/GIL

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PURPOSE AND SCOPE

The Technical Specifications for all new plant, equipment, apparatus and services, for use on the National Grid UK Electricity Transmission system are contained in a three level hierarchy of documents. Level 1 covers ratings and general requirements, Level 2 covers major plant categories and Level 3 covers specific related plant functions.

This document is a Level 3 specification, which describes the functional and performance requirements for a system to lock-out delayed automatic reclosure (DAR) sequences following the occurrence of a cable, gas insulated busbar (GIB) or gas insulated line (GIL) fault on a composite overhead line (OHL) and cable/GIB/GIL circuit.

PS(T) 010 , Application and Protection Setting Policy for the National Grid UK Transmission System defines when cable/GIB/GIL lockout should be applied. It must be emphasised that the default position for any particular installation is not to apply a DAR lockout system, it should only be applied where a suitable risk assessment has determined there is an unacceptable level of danger to National Grid staff or the General Public from a potential reclosure onto a faulted cable or GIL/GIB section.

This specification refers to Cable DAR Lockout in the sections below; it is equally applicable to GIB or GIL DAR Lockout.

PART 1 – GENERAL REQUIREMENTS

1 FUNCTIONAL REQUIREMENTS

A complete system shall be provided for the detection of faults within the cable section of each primary circuit and to subsequently lock-out the Delayed Auto Reclose on that circuit.

The system shall comprise the following items;

- a) Current Transformers. These shall be located at each cable sealing end.
- b) Cable Fault Detector Relay. This shall be a unit protection system or an overall protection system.
- c) Lockout Signal Send System. This shall be used to send a lockout signal from the location of the Cable Fault Detector Relay to the location of the Cable DAR Lock-out Relay.
- d) Cable DAR Lock-out Relay. This shall lock-out the local DAR, sustain any intertrip sent and initiate a revertive intertrip to the remote end(s).

A typical arrangement of these items is illustrated in Appendix A.

The facilities to be provided in respect of cable fault detection shall be as follows:-.

1.1 Current Transformers

One set of current transformers should be located within each cable sealing end.

For new installations the current transformers should be of the cable slip over type and meet the requirements outlined within TS 3.02.04, Current Transformers for Protection & General Use.

For GIB/GIL applications the current transformers shall be fitted adjacent to the bushings at each end of the section.

Where the Cable Fault Detector Relay is a unit protection system the current transformers should be of type Class PX-A and where it is an overall protection system the current transformers should be of type Class PX-B.

For retrospective application to existing cable sections split core current transformers may be used.

Where existing systems using post type current transformers are being replaced/refurbished these current transformers should be reused.

1.2 Cable Fault Detector Relay

A single unit protection system shall be provided for the detection of faults within the cable section of each primary circuit. A complete protection system shall be installed, including associated relays, whether integral units or not, at the end of each cable section.

If the cable section is relatively short (under 500m) an overall protection system may be used for the Cable Fault Detector.

The sensitivity of the cable fault detector shall be such as to ensure positive operation of the relays located at both ends of the cable for a single end fed fault condition, i.e. it shall be self intertripping.

The Cable Fault Detector Relay shall meet the requirements of TS 3.24.18, Unit Feeder Main Protection or TS 3.24.65, Overall Protection depending on the system fitted. The Cable Fault Detected output shall have a minimum reset time to allow a sufficient period for the Cable DAR Lock-out Relay to positively latch.

1.3 Lockout Signal Send Facility

The Lockout Signal Send Facility should comprise of a Direct Transfer Trip (DTT) system to transmit the Cable DAR lock-out signal from the cable sealing end compound to the appropriate circuit end. This is usually the nearest substation to the cable sealing end compound but will be determined by the individual application. The signalling equipment should meet the requirements of TS 3.24.36, Teleprotection. The maximum operating time of the Signalling equipment shall be 40ms (i.e. Class T40).

Where the Lockout Signal Send facility is operating a low burden Cable DAR Lock-out relay the initiation must be double pole switched.

Where the cable sealing end is located at or adjacent to one of the substations at one of the circuit ends it is permissible to operate the Cable DAR Lock-out relay utilising a direct wire system.

1.4 Cable DAR Lock-out Relay

The Cable DAR Lock-out Relay shall be of the electrically reset, latching type. A type registered low burden tripping relay to TS 3.24.87, Trip Relays shall be employed for this function when the relay is initiated by Teleprotection equipment.

When the Cable DAR Lock-out relay is operated via a direct wire tripping system it shall be a high burden tripping relay to TS 3.24.87, Trip Relays.

The Cable DAR Lock-out Relay shall be reset from a 70s Trip Relay Reset Timer to ensure that the local DAR is locked out and the remote end DAR is locked out via a sustained intertrip and/or a revertive intertrip & the remote DAR Lock-out (ID) timer.

1.5 Cable DAR Lock-out System

Operation of the Cable Fault Detector Relays shall be arranged to operate the Cable DAR Lock-out Relay, either directly or via a Direct Transfer Trip channel at one or more ends of the associated primary circuit.

1.5.1 Operation of the Cable DAR Lock-out Relay shall:

- a) Lock-out the local feeder DAR. On feeders associated with mesh corners only the feeder DAR should be locked out, i.e. a feeder fault shall cause the DAR equipment to isolate the feeder & restore the mesh corner and any other plant connected to the mesh corner. The revertive intertrip shall not be conditioned by the local line disconnector position to ensure it is sent when the local circuit end is open.
- b) Lock-out the remote end DAR by causing a sustained intertrip by inhibiting local trip relay reset
- c) To cater for a fault occurring when the circuit is closed up from an end not equipped with a cable DAR lock-out facility the Cable DAR Lock-out Relay shall cause a revertive intertrip to be sent to the remote end(s). A revertive intertrip is sent if the local substation end is receiving an intertrip from the remote end(s) and the Cable DAR Lock-out Relay has operated. This signal is not conditioned by the local line disconnector position.
- d) The Cable DAR Lock-out Relay must not directly send a Lock-out signal to the remote end(s).
- e) Initiate a 'CABLE PROT – OPTD/RESET' (for cables) or 'GIL PROT – OPTD/RESET' (for GIL & GIB) alarm to the Substation Control System to show the DAR Lock-out relay has operated.

1.5.2 Failure of any of the individual components or the dc supplies to the Cable DAR Lock-out system shall lockout the circuit DAR. The requirements are detailed below.

1.5.3 Operation of the Cable Fault Detector watchdog contact or a failure of either the associated communication path or dc supply shall cause:

- a) A 'DAR INHIBIT - FLTY/HLTHY' alarm to be sent to the Substation Control System.
- b) A Lock-out signal to be sent to the Cable DAR Lock-out Relay.

1.5.4 Failure of the Lock-out Signal Send channel or equipment shall cause:

- a) A 'DAR INHIBIT - FLTY/HLTHY' alarm to be sent to the Substation Control System.