

BACK-UP PROTECTION GRADING ACROSS NETWORK OPERATOR INTERFACES

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PURPOSE AND SCOPE

This Policy defines protection grading at interfaces between NGET and Network Operators to ensure that adequate discrimination of NGET back-up protection with that of Network Operators is achieved.

This Policy applies to the Network Operators overcurrent and earth fault protections and it sets out the protection settings requirements which when applied, will ensure compliance with The Grid Code requirements on protection discrimination.

PART 1 - POLICY

- a) Protection settings, and other information, which are to be used for protection grading purpose, shall be exchanged between NGET and the Network Operators as required to ensure the secure and reliable operation of the combined networks.
- b) When the required grading given in this document cannot be achieved, reference should be made to NGET.

1 SUPERGRID/132 KV AUTO-TRANSFORMERS

1.1 Overcurrent protection on the outgoing feeders and transformers at 132 kV

- a) Overcurrent protection shall be set to provide both current and time grading with NGET back-up overcurrent protection installed at incoming Supergrid/132 kV autotransformer on a 1:1 basis.
- b) Current grading shall be achieved to ensure that the current setting deployed on the Network Operator plant (outgoing feeder, transformer, reactor etc.) protection is smaller than the SGT overcurrent protection. In cases where overcurrent protection is also installed on the 132kV side of an auto-transformer, the DNO current setting shall be smaller than the lower of the HV and LV SGT overcurrent protection. The Network Operator current setting shall take into account relay and CT errors.
- c) Time grading shall be achieved by using an adequate minimum grading margin. Minimum grading margin shall be maintained throughout the protection characteristic curve (protection operating time versus fault), starting from the pick-up fault current all the way through to the maximum allowable 3-phase fault level.
- d) NGETs policy is to set Stage 1 of the 2-Stage HV overcurrent protection (Stage 1 trips the 132 kV circuit breaker) such that its operate time is not greater than 2.4 seconds for a 3-phase fault on the 132 kV busbar/bushing (this is due to a 3 seconds 132 kV switchgear rating). The Network Operator overcurrent protection on a feeder or transformer shall be set such as to provide adequate minimum grading margin with the SGT overcurrent protection at the SGT maximum allowable let through fault. The grading shall be on a 1:1 basis.

1.2 Earth fault protection on the outgoing feeders and transformers at 132 kV

- a) Earth Fault protection shall be set to provide both current and time grading with residually connected earth fault protection installed at the 132 kV side of the incoming Supergrid/132 kV auto-transformer. Grading shall also be provided with the NGET backup overcurrent (Stage 1 of the HV 2-Stage overcurrent protection), and with the SGT LV overcurrent protection, where installed. Grading shall be on a 1:1 basis-
- b) Current grading shall be achieved to ensure that the current setting deployed on the Network Operators plant (outgoing feeder, transformer, reactor etc.) protection is smaller than the SGT earth fault protection setting. In cases where overcurrent protection is also installed on the 132kV side of an auto-transformer, the Network Operators current setting shall be smaller than the lower of the HV and LV SGT overcurrent protection setting. The Network Operators current setting shall take into account relay and CT errors.
- c) See clause (c), section 1.1.1, for the time grading principle.
- d) Minimum grading margin shall be maintained throughout the protection characteristic curve, starting from the pick up fault current all the way through to the maximum allowable earth fault level.
- e) NGETs policy is to set the 132 kV residually connected earth fault protection such that its operate time is not greater than 2.4 seconds for a 132kV single phase to earth fault at the transformer LV terminals. The Network Operators earth fault protection on a feeder or transformer shall be set so as to provide adequate minimum grading margin with the SGT earth fault and overcurrent protection at the SGT maximum allowable single phase to earth let through fault. The grading shall be on a 1:1 basis-

2 SUPERGRID/66 KV OR LOWER VOLTAGE DOUBLE-WOUND TRANSFORMERS

2.1 Overcurrent protection on the outgoing feeders and transformers at 66 kV or lower voltages

- a) Overcurrent protection shall be set to provide both current and time grading with the SGT backup overcurrent protection installed at incoming Supergrid/66 kV Double-Wound Transformers on a 1:1 basis (See clause c, section 1.1.1, for current grading principle, clause d, section 1.1.1, for the time grading principle and clause e, section 1.1.1, for the minimum grading margin).
- b) NGETs policy is to set Stage 1 of the 2-Stage HV overcurrent protection such that its operate time is not greater than 2.4 seconds for a 3-phase fault on the LV busbar/bushing. The Network Operators overcurrent protection on a feeder or transformer shall be set so as to provide adequate minimum grading margin with the SGT overcurrent protection at the SGT maximum allowable let through fault. The grading shall be on a 1:1 basis.

2.2 Earth fault protection on the outgoing feeders and transformers at 66 kV or lower voltages

- a) Earth fault protection shall be set to provide both current and time grading with the SGT 2-stage unrestricted earth fault protection (Standby Earth Fault) on the LV side of the transformer. (See clause d, section 1.1.1, for time grading principle and clause e, section 1.1.1, for the minimum grading margin).
- b) Current grading shall be achieved to ensure that the earth fault setting deployed on the Network Operators plant (outgoing feeder, transformer, reactor etc.) protection is smaller than the stage 1 unrestricted earth fault setting and must take into account relay and CT errors.
- c) NGET's policy is to set the SGT stage 1 unrestricted earth fault protection to achieve an operate time of 5 seconds (using long time inverse characteristics – LTI) for an

earth fault at the transformer LV terminals. DNO earth fault protection shall be set so as to provide adequate minimum grading margin with the SGT unrestricted earth fault protection on a 1: 1 basis.

3 GRADING WITH THE NGET OWNED 132KV OR LOWER VOLTAGE BUS SECTIONS AND COUPLERS

3.1 Overcurrent protection on the outgoing feeders and transformers at 132 kV or lower voltages

- a) Overcurrent protection shall be set to provide both current and time grading with NGET overcurrent protection on the bus sections/couplers (see clause d, section 1.1.1, for the time grading principle and clause e, section 1.1.1, for the minimum grading margin).
- b) Current grading shall be achieved to ensure that the current setting deployed on the Network Operators plant (outgoing feeder, transformer, reactor etc) protection is smaller than the overcurrent protection on the NGET 132 kV or Lower Voltage Bus Sections/Couplers.
- c) The Network Operators current setting shall take into account relay and CT errors.

3.2 Earth fault protection on the outgoing feeders and transformers at 132 kV or lower voltages

- a) Earth fault protection shall be set to provide both current and time grading with NGET earth fault protection on the bus sections/couplers (see clause d, section 1.1.1, for the time grading principle and clause e, section 1.1.1, for the minimum grading margin).
- b) Current grading shall be achieved to ensure that the current setting deployed on the Network Operators plant (outgoing feeder, transformer, reactor, etc) protection is smaller than the current setting on the NGET 132 kV or Lower Voltage Bus Sections/Couplers. The current setting shall also be smaller than the current setting of the bus section/coupler overcurrent protection. The Network Operators current setting shall take into account relay and CT errors

4 FORMS AND RECORDS

Not applicable

PART 2 – DOCUMENT HISTORY

5 AMENDMENTS RECORD

Issue	Date	Summary of Changes / Reasons	Author(s)	Approved By (Inc. Job Title)
1	September 2014	New Document.	Richard Poole Network Engineering	GCRP

5.1 Procedure Review Date

5 years from publication date.

PART 3 - GUIDANCE NOTES AND APPENDICES

6 REFERENCES

Not applicable

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