

APPLICATION OF SURGE PROTECTION TO SUBSTATIONS AND CABLE SEALING END COMPOUNDS

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PURPOSE AND SCOPE

The policy identifies the preferred methods of over-voltage control for primary plant in substations and cable sealing end compounds. This defines where surge arresters shall be used for over-voltage control in substations on the National Grid Electricity Transmission system. Overvoltage protection for overhead lines is not addressed in this policy statement.

PART 1 – POLICY

1 GENERAL

1.1 Gapless Metal Oxide surge Arresters (MOA) shall be the preferred method, when compared with the use of co-ordinating gaps, to control lightning and switching over-voltages in substations. This applies for new build and asset replacement.

1.2 Surge arresters may also be installed to improve the availability or operability of key transmission equipment and improve network performance, where justified.

1.3 The application of surge arresters to facilitate the use of a lower basic insulation level other than that defined in NGTS 1 for 132kV, 275kV and 400kV is not acceptable, unless defined in the relevant level 2 or 3 equipment NGTS.

1.4 Overvoltage protection in the form of surge arresters or coordinating gaps shall be provided on all line terminals of power transformers, shunt reactors and series reactors, except on 13kV systems. Coordinating gaps may only be used where either;

(a) physical restrictions prevent the use of surge arresters on transformer replacements, where the transformer being replaced has coordinating gaps

(b) an insulation coordination study indicates the surge arrester operation level cannot be exceeded under all credible switching or lightning events.

Informative: Surge protection acts to not only protect the transformer from impulses on the system, but also to protect the rest of the equipment in the substation from transformer fault conditions that can generate high transient over-voltages.

Informative: New transformers are provided with facilities for attaching the surge arresters to the tank, these cannot normally be used where a noise enclosure is required.

Informative; For transformers with a tertiary winding, if the transferred surge from the HV or LV can exceed 150kV on the tertiary terminals, because of the transformer design, then surge arresters on the transformer tertiary terminals will be provided by the transformer manufacturer.

1.5 The surge protection equipment shall be located between the transformer and any possible overvoltage in-feed.

- 1.6** Transformers connected directly into GIS shall use surge arresters as the only acceptable overvoltage protection method.

Informative: Coordinating gaps cannot be used inside GIS, therefore any overvoltage protection inside a GIS enclosure must utilise GIS surge arresters.

- 1.7** Quadrature boosters and phase shifting transformers shall have surge arresters installed on all the line terminals. The surge arresters shall be rated for high energy absorption capability.

Informative: Through fault conditions can generate onerous overvoltage conditions on the terminals of quadrature boosters and phase shifting transformers.

- 1.8** Surge arresters shall be installed to control over-voltages on the following applications;

- (a) Overhead line entries to Gas Insulated Switchgear (GIS) substations.
- (b) Entries to Gas Insulated Lines (GIL)
- (c) Overhead line entries on mid line cable sealing ends (between two sections of overhead line).

- 1.9** Surge arresters shall be installed as close as reasonably practicable to the asset they are protecting.

Informative: The surge arrester maybe located at the remote end of a cable which connects into the transformer or GIS where there is insufficient space for an open terminal arrester immediately on the terminals of the transformer or GIS, but only where the condition above is met.

- 1.10** Open terminal arrester technology is the preferred option, but when its application is not reasonably practicable, GIS arresters shall be used.

- 1.11** Where gapless MOAs are installed, existing co-ordinating gaps or gapped silicon carbide (SiC) arresters associated with that plant item shall be decommissioned.

- 1.12** A DC fingerprint test shall be carried out prior to the commissioning of all new open terminal surge arresters.

Informative: A DC fingerprint test is not achievable with GIS arresters due to the GIS housing and gas zones.

- 1.13** Alternative over-voltage control measures shall not replace the use of surge arresters or coordinating gaps, but may be used in conjunction with these to further reduce the likelihood of overvoltage conditions.

- 1.14** Deviations to this policy will only be considered where their application is demonstrated to be 'not reasonably practicable' (e.g. due to space limitations) and where an alternative solution (e.g. co-ordinating gaps) is applied. This shall be done in accordance with TP188 "Transmission Construction Electricity Design Management".

2 FORMS AND RECORDS

Not applicable.