



Capacitive Arc Model

Accurate estimation of VFTO in GIS substations

CONTEXT

Switching of Bus-charging currents are common operations in HV substations normally performed by the disconnectors (DS), it consists on the switching operation of an AC voltage source from an unloaded section of busbar and it causes several dielectric breakdowns to occur across the gap during the switching process.

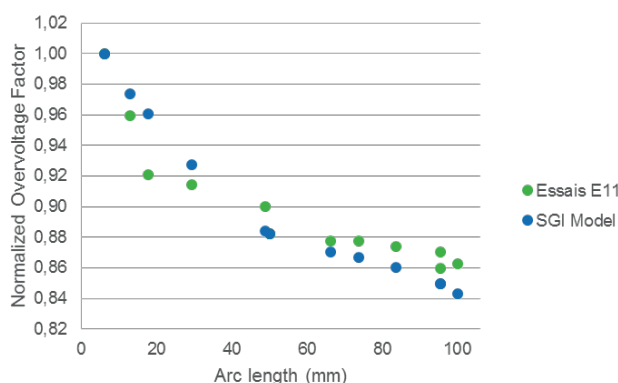
These breakdowns produce the so called Very Fast Transient Overvoltages (VFTO) phenomena that travels towards all of the connected equipment. VFTO peak voltage is normally obtained by electromagnetic transient calculations before deciding whether or not mitigation systems are required to protect the disconnector and adjacent equipment. The accurate modelling of every element of the substation including the electric arc is key for a good estimation of VFTO.

TECHNOLOGY DESCRIPTION

A capacitive arc model was developed from several high voltage tests in which VFTOs were measured for variable pressures, electric field, gas gaps among others. A large reduction in VFTO peak is observed with the increasing length of the gas gap and the influence of pressure in rise time is also taken into the account in the developed model. The model was validated during tests for a large range of field configurations and arc lengths.

This model is ready to be used in any EMTP-ATP calculation and can also be implemented in any other desired software with the given formula of arc resistance vs time.

Comparison between tests results and calculations with arc model. Overvoltage factors are normalized by the overvoltage factor at the lowest arc length



APPLICATION DOMAIN

UHV -AC Substations
Insulation Coordination
VFTO Studies

ADVANTAGES

- *Delivered as a turnkey solution
- *Easy to Implement and easy to use
- *Compatible with open source software and any circuit simulation tool

TRL SCALE



Model tested and validated for arc lengths up to 100mm in real GIS disconnector during capacitive-like tests

DELIVERABLES

Arc model formula
EMTP-ATP Arc model
Technical and test reports