



Réseau de transport d'électricité

# Special Operating Modes at RTE... ...for High Voltage Live Working

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new procedures and techniques

Subject 0030

# Purpose of special operating modes

The purpose of Special Operating Modes is to provide an additional level of safety to operators during live-working operations :

- Firstly by limiting the effect of short-circuit currents on live working site,
- Secondly by limiting the switching overvoltages to ensure they are compatible with live working distances.

We have special operating modes for many years but RTE re-examines its practice regularly to improve the safety of live-workers.

# Management of switching overvoltages

The switching overvoltage level is the ultimate statistical event since it is dependent on many parameters.

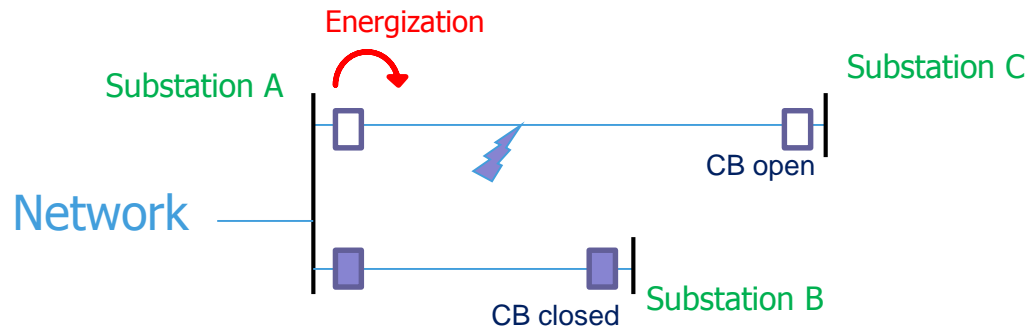
RTE network is too large (3,000 electrical substations and 7,000 lines) to model the entire network and calculate the level of switching overvoltage encountered prior to the work.

The method chosen by RTE therefore consists of :

- Considering a simplified and restrictive network in terms of overvoltage,
- Calculating the overvoltages for different types of re-closing,
- Identifying the various levers for the reduction of overvoltages (materials, topology, shutdown of automatons) and calculating their effect to reduce this level of voltage surge,
- Selecting only some of these levers so as to keep a frame of reference that is simple enough to be applied.

# Management of switching overvoltages

The simplified network used is the following

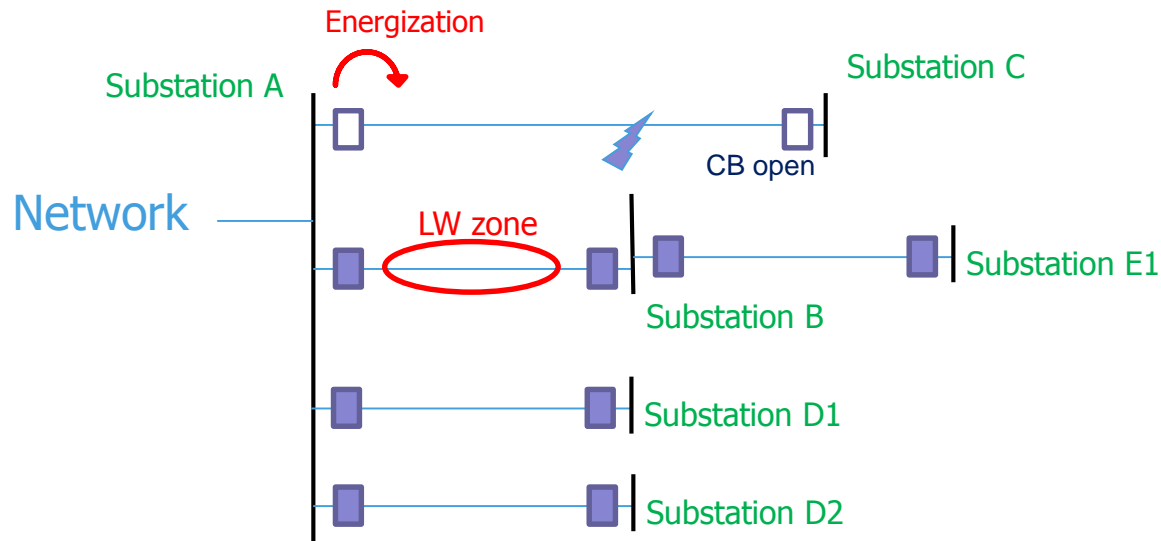


The levels of overvoltages are therefore calculated for different kind of fault and energisation (single phase, three phases):

- At the substation where the line is switched on (substation A on the diagram),
- At the defective line - this is actually at extremity C of the defective line, since it is at this point that the overvoltage is at the highest level (except in the presence of surge-arresters at the end),
- At the neighbouring line - this is actually at extremity B of the neighbouring line, since it is at this point that the overvoltage is at the highest level (except in the presence of the surge-arresters at the end),

# Management of switching overvoltages

## Consideration on topology



### Two effect of topology :

- Dispersion of overvoltages with lines AD1, AD2, ...
- Take away the overvoltages from the LW zone with line BE1, ...

# Management of switching overvoltages

## Levers to manage switching overvoltages

- The network equipment:
  - the inductive voltage transformers which very quickly discharge the line, thus preventing the phenomenon of trapped charge, which significantly increases the level of overvoltages
  - and the use of surge-arresters which enables the local reduction of overvoltages, something that is particularly beneficial when the LW is carried out in the substations.
- Topology:
  - The connection of one or more lines on the same electrical nodes as the line on which the live-working is taking place enables the overvoltages to be dispersed and notably reduces the levels of overvoltages. Taking into account the grid topology requires the network to be observed, in order to interrupt the work in the case of a risk that modifies the topology,
- Automation:
  - As re-closure is the cause of the main switching overvoltages, the shutdown of re-closure enables this cause of these overvoltages to be removed at the source. These levers are particularly interesting when these automatons are remote-controlled.

# Conclusion

As illustrated in this article,

- Building a frame of reference to define special operating modes is a complex task,
- It needs a good knowledge of the network, its equipment but also its topology.

Tools and skills to simulate the levels of switching overvoltages enable us to set out the most relevant and efficient levers to use in order to manage the levels of voltage surges without penalising the operation of the network.