

CIGRE Working Group A3.30 “Substation Equipment Overstress Management” carried out investigation to identify practices for detecting and mitigating potential overstresses to substation equipment.

An important definition let clear in TB 816 is the difference between “overstress” and “ageing”. While ageing is the consequence of the deterioration of equipment’s withstand capabilities overstress is a consequence of the worsening of the stresses the equipment is subjected to during operation. In other words, overstresses can be defined as stresses beyond HV equipment withstand, as defined by standards and/or by technical specification.

The results WG A3.30 investigation was published in CIGRE Technical Brochure (TB) 816, where detailed description of the subject is provided. The three main parts of the work cover the following subjects:

- main kinds of overstress applied to HV equipment;
- utility checks for the possibility of HV equipment be submitted to overstresses of electrical, environmental and human kinds;
- adapt utility asset management process to mitigate overstress consequences.

Need for future investigation in the field of overstresses was identified by WG A3.30 and it is worth to highlight them:

- Operation voltage above ratings and temporary overvoltage. This is a subject of major importance for transmission & distribution systems having very long lines or with high penetration of renewables, generally submitted to high voltage profiles during light load periods. The recently created JWG A3/A2/A1/B1.44 - Consequence of High Voltage Equipment operating exceeding highest system voltages – is a right answer for this lack of more detailed information on equipment performance under this kind of overstress.
- Controlled switching for MV switchgear. There is an increasing discussion on the benefits of controlled switching could also bring to MV networks. Cost is still a concern. The possibility to create a future WG to investigate the feasibility of this kind of application is under discussion in SC A3.
- Instrument transformers performance: Before TB 816 was published the WG A3.42 was created and is untitled “Failure Analysis and Risk Mitigation for Recent Incidents of AIS Instrument Transformers”. This is an important contribution for the clear understand the stresses applied to IT, the consequences to the equipment and to define applicable mitigation measures.
- Overstress due to pandemic, abnormal environmental events and malicious acts. These 3 groups of less conventional overstresses are gaining importance and shall be carefully studied in the next future. They should be considered in a broader analysis of resilience concepts for power system infrastructure, which affects a big number of CIGRE Study Committees. A bibliographic review on resilience applied to power systems show that this concept is well explored in the field of system operation (SC C2). On the other hand, the resilience concepts for the grid infrastructure still asks for a more comprehensive discussion for the proposal of applicable concepts.

The influence of pandemics in equipment asset management operation processes is covered by several recent papers, including papers presented in CIGRE Session 2022. A large experience was gained in this field in the last 2 to 3 years.

Abnormal environmental conditions is for sure a topic of major importance. The changing characteristic of this kind of stresses can impose stresses to HV equipment above standard values and ,therefore, cares for more detailed investigation (wind, rain, sand-storm, earth-quake, atmospheric discharges, tsunami, flood, etc). SC A3 is discussing the possibility to create a new WG to investigate it.

The consequences of malicious act can be to certain extent avoided, depending on its nature. Cyber attacks, for example, are under continuous discussion, counter measures are defined and this is a quite dynamic subject. Physical attacks to the grid infrastructure can be difficult to avoid, but the power system industry must be prepared to provide a fast recovery in case of an event. This falls under the umbrella of resilience and shall be treated in a broader sense, including different actors beyond the industry, like local and Federal authorities, Regulator, etc.