CIGRE Study Committee C4

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP[1]

WG C4.50	**Name of Convenor:** Bo Zhang (China)
Strategic Directions #[2]: 2	**Technical Issues #[3]: 8, 6**
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #[6]: 3, 5, 6	
Title of the Group: Evaluation of Transient Performance of Grounding Systems in Substations and Its Impact on Primary and Secondary Systems	

Scope, deliverables and proposed time schedule of the Group:

Background:

Direct lightning strikes, lightning electromagnetic waves or switching operations can all introduce high levels of transient current flow in the grounding system of substations. The probability that the substation's grounding system is subjected to such transient currents is much higher than that due to a power frequency fault. For example, with the widespread use of power electronic equipment, switching operations are frequent. Under such transient excitations, the potential distribution of the grounding grid is very uneven, especially for the EHV and UHV substations due to the very large area. At present, more attention is paid to the power frequency characteristics of grounding system, and less to the transient characteristics.

Besides the primary system, secondary systems are most likely to be affected by the transient ground potential because the secondary cables are laid over a large area, the paths taken are long, and the ability of secondary equipment to withstand the transient impact is weak. With the extensive application of electronic devices in substation, the impact of transient potentials on the secondary system is more and more serious.

By optimizing the arrangement of the grounding grid and the grounding method of the secondary system, the impact may be reduced. However, studies of the transient characteristics of grounding devices are mainly for transmission towers, not for substation. Although EMC in substation has been widely discussed over the past few decades, the effects of transient ground potential differences on secondary systems have not been adequately studied. At present, there is a lack of a systematic guide for the design of grounding grid considering its transient performance, and the impact on the primary and secondary systems. There is also no effective method to measure the transient performance of grounding systems in substations and its impact on the systems.

The objective of this working group is therefore to fill the gap in this area by formulating a clear set of guidance notes.

Scope:

1. Define and classify various transient current characteristics injected into grounding grid in substations.
2. Review and propose best available simulation methods of transient characteristics of grounding grid in substation.
3. Investigate the impact of transient ground potential difference on primary and secondary systems.
4. Review and summarize the ability of primary and secondary systems to withstand transient impact.
5. Identify and explain all available measures to protect primary and secondary systems from the impact of transient ground potential difference.

6. Review and propose measurement methods to evaluate the transient characteristic of a grounding grid and its influence on mitigation required for primary and secondary systems.

Deliverables:

☒ Technical Brochure and Executive summary in Electra

☒ Electra report

☒ Tutorial[5]

Time Schedule: start: July 2018 **Final Report**: June 2021

Approval by Technical Committee Chairman:

Date: 01/03/2018

Notes: [1] or Joint Working Group (JWG), [2] See attached Table 2, [3]See attached Table 1, [4] Delete as appropriate, [5] Presentation of the work done by the WG, [6] See attached table 3

Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

1	Active Distribution Networks resulting in bidirectional flows
2	The application of advanced metering and resulting massive need for exchange of information.
3	The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation.
4	The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation.
5	New concepts for system operation and control to take account of active customer interactions and different generation types.
6	New concepts for protection to respond to the developing grid and different characteristics of generation.
7	New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics.
9	Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network.
10	An increasing need for keeping Stakeholders aware of the technical and commercial consequences and keeping them engaged during the development of the network of the future.

Table 2: Strategic directions of the TC (ref. Electra 249 April 2010)

1	The electrical power system of the future
2	Making the best use of the existing system
3	Focus on the environment and sustainability
4	Preparation of material readable for non-technical audience

Table 3: Potential benefit of work

1	Commercial, business or economic benefit for industry or the community can be identified as a direct result of this work
2	Existing or future high interest in the work from a wide range of stakeholders
3	Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry
4	State-of-the-art or innovative solutions or new technical direction
5	Guide or survey related to existing techniques. Or an update on past work or previous Technical Brochures
6	Work likely to have a safety or environmental benefit