Lightning Impulse test requirement for HVDC transmission systems

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To enable the planned production of renewable energy according to EU:s energy policy objectives development of the national grids is necessary. Due to challenges of getting permissions for overhead lines, the need of more environmental friendly ways of transmitting electrical power on land have increased which have resulted in transmission systems where overhead lines are combined with underground cable.

Transmission systems consisting of overhead lines are exposed to lightning strikes. When cables are a part of the system, the cable system will also be exposed to lightning strikes. For AC transmission systems, relevant standards specify test voltage levels for lightning impulse, but for DC systems the relevant standards specify that the cable system should be tested at voltage levels corresponding to the conditions of the specific project.

In order to establish such test voltage levels studies on the overvoltages in mixed DC transmission systems after a lightning strike have been conducted. The studies conclude that general statements on test voltages, related to the rated voltage, cannot be given. The studies show that the overvoltages may be significantly different both in terms of voltage level and polarity from what is commonly seen in specifications of HVDC cable projects. The lighting impulse overvoltages of a HVDC system are dependent on project specific parameters such as region specific ground flash density, overhead line tower configuration, grounding conditions and surge reflections at the transition point between overhead line and cables. The studies also conclude that it may be relevant with different lightning impulse test requirements in different part of the system due to attenuation of the surge along the cable.

In order to get relevant lightning impulse test requirement of a HVDC transmission system, a project specific study is required to establish relevant type test parameters. Even during the planning phase of a transmission system project, simulations may give relevant result for specifying test voltages to use for contract preparation.