Contribution ID: **33** Type: **Poster Presentation**

Research on a New Type of Lightning Protection Device for Distribution Network Based on the Principle of Multi-Short-Gaps

Friday, 8 July 2016 14:40 (20 minutes)

The arc quenching device with multi-short-gaps introduced in this paper has the advantages such as quick and reliable action, good performance of self-restoration in insulation and low cost. The device allows the arc to be established by a lightning strike, and then the device extend arc with the high temperature and high pressure produced by arc until arc extinguishes. The duration of the arc quenching process is very short and act trip caused by relay protection devices would not happen. So the device can be widely used in distribution network to reduce the lightning trip-out rate.
To test the lightning protection performance of the device, a series tests such as impulse withstand voltage test, power frequency withstand voltage test and volt-second characteristic test have been taken. The results show that the impulse breakdown voltages of the samples are between 35˜50kV, the power frequency withstand voltages are about 30kV, the volt-second characteristic curves are all above the 10kV insulator, and the device can quench the arc very quickly. In the course of the experiments, it is found that the impulse breakdown voltage value of the device decreased after the first breakdown when the device repeatedly suffered from impulse voltage. That is, the discharge characteristic of the device is not stable. Moreover, with the increasing of the gaps number, although the power frequency withstand voltage of the device grow linearly, the impulse breakdown voltage did not have a good linear relationship with the number of the gaps. To solve the problem, a large gap is connected in series. Tests show that the discharge characteristic of the improved device is more stable.
Therefore, a conclusion can be drawn that the arc quenching device with multi-short-gaps has good capability for lightning protection of distribution network.

This work was supported by National Natural Science Foundation of China.
Project No. 51307125.

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Session Classification: Poster 3-C

Track Classification: High Voltage Design, Devices, Testing, and Diagnostics