

Novel approaches to assess the mechanical reliability of toughened glass insulators used in transmission lines

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Abstract-

Toughened glass insulators installed in overhead lines play a key role in maintaining the reliability and safety of power systems. The singular properties of toughened glass make this material particularly suitable for this application on account of its excellent dielectric properties, high mechanical strength and easiness of inspection. If the glass was damaged, it would shatter completely leaving the remaining part of the insulator, called stub, still providing mechanical connection and being easily detectable from the ground by a visual inspection. In this paper, the mechanical reliability of toughened glass insulators is investigated through the analyses of experimental data obtained from laboratory tests. First, the mechanical strength of the toughened glass in insulators and the relationship between its failing load and the geometry of the insulator are investigated by means of a novel analytical approach. Afterwards, the risk of mechanical failure of glass insulators and stubs, with the shell broken off, is analysed. The results show the mechanical reliability of glass insulators for different string configurations and for large and complex systems deployed in 220 kV and 400 kV transmission lines. Finally, the effect of the shattering rate on the reliability is studied under the most adverse conditions.

Index Terms- Insulators , mechanical reliability , shattering , toughened glass , transmission lines

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