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HIGH VOLTAGE OF (OIL FILLED) CABLES– OPTIMIZATION OF THE TIME FOR GROUNDING CONSIDERING SAFETY ASPECTS

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SUMMARY

When a maintenance procedure in a transmission class Oil Filled Cable or in its associated equipment is performed, a common situation found in practice is the necessity of to ground the electrical equipment, considering safety aspects of the maintenance crew and equipment. In those situations, after the disconnection of the OF Cable from power source, a minimum amount of time is required for safely ground transmission class (88/138kV, 230kV and 345kV) Oil Filled AC Cables (OF Cables), by connecting the live parts of the circuit to the substation grounding grid. This time for grounding are practiced by many utilities around the world and can be a costly procedure, reaching around a few hours in some cases. The aim of this work is to optimize this time for grounding, by means of studying the discharging behavior of transmission class Oil Filled AC Cables (OF cables), after disconnection from power source, considering the electrical modelling of cable installations, and measurements at the field. Considering the electrical modelling of the cable and associated network elements, computer simulation using the Alternative Transients Programs – ATP [1] were performed, in order to theoretically estimate the discharging time of the cable.

For the measurements, a special arrangement was conceived, for not to change the circuits' time constant. For this purpose, a conventional capacitive voltage divider was employed. Considering the normal procedures of cable operation, situations are present in which only load of capacitive nature, or no other equipment, are directly connected to the cable during disconnection. Realizing that the situations present in this research consider measurements of DC voltages (and very low frequencies), a conventional arrangement of capacitive voltage divider wouldn't measure properly, an adaptation had to be made. In this way, in the secondary arm of the capacitive voltage divider an electrostatic voltmeter where employed, considering its negligible leakage current. In some circuit types, where it was expected higher frequency voltage signals (kilohertz range), a conventional transient recorder was employed.

The results obtained in the computer modelling and simulation using the program ATP – Alternative Transients Program, showed good agreement with field measurements, as expected.

Considering the obtained results, the period of time for grounding the equipment, put into practice at present, would possibly be safely reduced. The worst situation would be the case of a long (i.e., a few kilometers long) underground transmission line, 345 kV class. It was demonstrated, that this safe time for grounding, could be reduced from 4 hours, in the worst case as practiced now, to a few minutes.

KEYWORDS

Oil Filled cable; underground cable, underground transmission line.

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