JICABLE'07
Rapporteur's Session Report

A.5 SESSION : DIAGNOSTICS (2)

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The session included six papers. Four were dedicated to diagnostics in cables based on chemical (dissolved gas analysis) and electrical (dielectric losses and partial discharges) measurements.
Two others deal with current sensor development and temperature distribution measurement.
Diagnostics in cables based on chemical and electrical methods

Paper A.5.1. dealt with a technique called dissolved gas analysis (DGA) -largely used for transformers- that was implemented for different types of taped cables employed in the US. It was found that the technique was sensitive to different types of cables and has a high sensitivity to thermal and electrical stresses.

Paper A.5.2. focussed on the variation of dielectric losses of oil in 66 kV to 500 kV oil-impregnated paper cables. Dielectric losses evolution has been investigated in a range of electric field from 0.1 to 20 kV/mm and in a temperature range from 0 to 120°C. Decrease of losses upon field increase was interpreted by a temperature dependence of the mobility (so-called Garton effect) and by absorption of ions in oil on the insulating paper. These effects were clearer in mineral oil.

Paper C.7.2.5 dealt with off-line PD-diagnosis on MV cables and discussed the actual rules and their limitation for asset decision. The important parameters for PD diagnosis and the main factors leading to PD in cables and joints were reviewed. The study underlined the importance of data base pertaining to PD patters for different components and for different types of defects (defect initiation, growth, failure). From this point, condition based-maintenance index can be linked to required maintenance actions.

Paper A.5.4. focussed on a diagnostic method developed for detection of cable sections with failure risk due to the presence of joints with water penetration. Loss measurement technique at a frequency of 0.1 Hz was used for this purpose but its drawback as regards the objective of a replacement campaign (relevance of decision, accuracy of recommendation) was pointed out. On-line rather than off-line diagnosis techniques are needed and methods based upon PD measurements will be evaluated in a near future.

A general discussion on the four papers was organized. Specific points were raised on the specific techniques, but the question of how to relate the remaining life of the cable to the measured quantities was set as the main objective for future study in the domain of cable diagnosis.
Current sensor and temperature distribution

Paper A.5.5 introduced an optical fibber current sensor based on the Faraday effect. Up to now, the technology was slow down by unstable characteristics of the sensors and its electronics. The paper presents progress realized to obtain a reliable system, describes its characteristic and underlines its advantages (compacity, immunity form EM interference, long distance transmission). A fault section locating system for underground power cable lines has been developed for 66 kV and 275 kV voltage level cables.

Paper A.5.6. dealt with the transient thermal behaviour of underground cable that is specially critical in current overload conditions. The approach relies on analysis of the problem, its modelization and simulation, the feedback from measurements and the final software version. It is reported that the temperature distribution depends critically on the environmental parameters of the cables (soil nature, cable position in the tube, etc.).
Following the presentation, a general discussion on the two papers was organized and specific points were raised.

Chairman conclusion of the session
Conditions assessment should remain a priority, both for liquid-filled and extruded insulation, but much more has to be understood to reach the goal.