

## In site Diagnosis Technique for HV Current Transformers

Roberto Liñán and Noé R. Colorado  
Instituto de Investigaciones Eléctricas (IIE)  
Reforma 113, Col. Palmira, C.P. 62490  
Cuernavaca, Morelos

**Keywords:** Instrument Transformers (IT's), Current Transformers (CT's), Frequency Dielectric Spectroscopy (FDS), Dielectric properties, Moisture Content.

### Abstract

The number of faults in HV instrument transformers around the world has increased in the last ten years. These faults generally come together with fire and explosions, endangering substation personnel, and generating economic losses due to the interruption in power supply, damage in peripheral equipment, replacement of faulty equipment and environmental damages for oil leaks. The estimated cost of a catastrophic failure of a 400 kV current transformer is close to 1 million USD.

Surveys carried out worldwide, by The Centre for Energy Advancement through Technological Innovation (CEATI International, Inc), show that there is no methodology able to efficiently diagnose oil-paper insulation condition of the CT's. Also, this survey concludes that moisture content in HV CT's is the main root cause of failure of these equipment.

Since 2008 the Instituto de Investigaciones Eléctricas (IIE) developed a new methodology that classifies the condition of oil-paper insulation system of HV CT's into four risk zones. This classification is based on correlations of dielectric properties measurements and oil tests. The methodology is based in long term testing using experimental sets representing the insulating system of HV CT's. Also, different samples of 230, and 400 kV CT's (new and old) were tested to know the behavior of different dielectric parameters as a function of moisture content and temperature.

To assess the dielectric properties, the Frequency Dielectric Spectroscopy (FDS) was used. Properties such as  $\tan \delta$ , capacitance, resistivity and permittivity were considered as the most representative parameters to evaluate the insulation system of HV CT's. Also, moisture content, dielectric strength and dissolved gases in oil were considered to obtain the new diagnosis methodology.

The methodology was applied in 384 HV CTs installed in 21 substations of the CFE transmission network. This methodology allows to CFE to reduce the number of failures in substations where it was applied.