IEEE/PES Transformers Committee
Fall 2011 Meeting
Boston, Massachusetts USA

"Measurement of Partial Discharges in Transformers"

-- Technical Presentation --
Monday, October 31, 2011
4:45 to 6:00 pm

By Dr. Raymond Bartnikas, Dr. Alexander Kraetge, Dr. Eberhard Lemke

1. Abstract

The tutorial will cover three topics:

- History of Partial Discharge Measurements
- Fundamentals of Partial Discharge Measurements
- Modern Instrumentation and Computer Aided Interpretation of PD Signals

In the first part, Dr. Bartnikas will present a brief review of the history of partial measurements in the high voltage industry, from the early days of the RIV measurements to the more modern practices. This part will provide people with a better understanding of how this field evolved over the years.

The second topic presented by Dr. Lemke will assist HV test field engineers in a better understanding of the fundamentals of electrical PD measurements. Based on various PD models developed for explanation the characteristic PD recurrence under power frequency test voltage, the PD pulse charge transfer in HV test objects is discussed. Based on this, the design of basic circuits recommended for PD tests of power transformers as well as the calibration procedures according to IEC 60270 are discussed, where reference is made to the recently edited IEEE C57.113.

The last topic presented by Dr. Kraetge will provide participants with a short description of what information modern instrumentation and digital signal processing can add to the interpretation of PD measurements.

2. Learning Objectives

This presentation will help personnel associated with PD tests of HV equipment to familiarize with:

- Characteristic PD occurrences under power frequency test voltages
- PD Charge transfer in HV equipment
- Main quantities recommended for electrical PD measurements
- Calibration procedures for apparent charge measurements
- Modern instrumentation available today for detecting PD in transformers
- Some of the digital techniques available nowadays to help with the interpretation of the pd measurements

3. Learning Outcomes

As a result of attending this tutorial session, members will gain an understanding of the following:

- The history and evolution of pd measurements
- Design of PD measuring circuits
- Evaluation of PD test results
- Recommendations of IEEE C57.113
- Advanced techniques for interpretation of PD data

4. Presenters' Biographies

Dr. Eberhard Lemke: Dr. Lemke graduated from the Dresden University of Technology in Germany in 1962. He earned the PhD degree, focused on the breakdown of large air gaps, in 1967 and the Dr.SC. degree, focused on wide-band PD detection, in 1975. From 1978 until 1981, he joined the power cable factory KWO in Berlin where he developed the so-called LEMKE PROBE for non-conventional PD measurement. In 1987 Dr. Lemke was appointed Professor at the Department of High Voltage Engineering of the Dresden University of Technology, where he was involved in education and research for more than three decades. In 1990 he founded the company LEMKE DIAGNOSTICS GmbH, now named DOBLE LEMKE GmbH, which manufactures systems for PD diagnostics of HV equipment. Eberhard Lemke is author and co-author of several books and published a large number of technical papers. He holds various patents and is active in various working groups of CIGRE, IEC, IEEE, and VDE.

Dr. Alexander Kraetge: Dr. Kraetge is product manager for transformer testing equipment with OMICRON since 2006. His main focus is on partial discharge and SFRA testing. He was born in Berlin, Germany. After vocational education and practice as electrician he studied high voltage and power engineering at the Berlin University of Technology (Germany) and graduated in 2001 as M.E.E. Until 2006, he worked as a research engineer for power transformer condition assessment at the High Voltage Department of the same university on behalf of the German Scientific Society and received a PhD degree in engineering sciences in 2007. He is member of the German Electrical Engineering Society, Cigré, IEC TC14 and the IEEE Transformers Committee and serves as an active member of several working groups regarding testing of power transformers. He authored more than 70 technical and scientific papers about this subject.

Dr. Raymond Bartnikas: Dr. Bartnikas received his early education at St. Michael's College School in Toronto, Ontario. He obtained the B.A.Sc. degree in Electrical Engineering from the University of Toronto in 1958 and M.Eng. and Ph.D. degrees from McGill University in 1962 and 1964, respectively, also in Electrical Engineering. In 1958 Dr. Bartnikas joined the Cable Development Laboratories, Northern Electric Company, Lachine, Québec, transferring in 1963 to the Northern Electric Research and Development Laboratories in Ottawa. In 1968 he joined the Hydro-Québec Research Institute and held the position of Scientific Director of the Materials Science Department until he was named Master of Research in 1982. He is an Adjunct Professor in the Department of Electrical and Computer Engineering at the University of Waterloo, associated professor in the Department of Engineering Physics and Materials at École Polytechnique (University of Montréal) and a Visiting Professor at the University of Rome "La Sapienza". Dr. Bartnikas is the editor of the ASTM monograph/book series *Engineering Dielectrics* and two books entitled *Elements of Cable Engineering* and *Power Cable Engineering.* He is a recipient of many scientific awards, bestowed upon him in recognition for his contributions to the fields of dielectrics, electrical insulation and gaseous discharges and electrical measurements; he is a Fellow of ASTM, the IEEE, the Institute of Physics (UK), and the Royal Society of Canada (Academy of Science) and the Canadian Academy of Engineering. He held the position of Chairman of the ASTM Committee on Electrical and Electronic Insulating Materials from 1979 to 1985, served as President of the IEEE Dielectrics and Electrical Insulation Society, and is a member of the IEEE Energy and the IEEE Insulated Conductors Committees. He is currently chairperson of the International Electrotechnical Commission (IEC) Committee TC15E Endurance Tests.