



“Indoor Measurement of Transformer Noise”

**-- Technical Presentation --
Monday, October 6, 5:45-7:00 p.m.**

By Donald Chu, Dr. Ramsis Girgis, and Dr. Christoph Ploetner

1. Abstract

Power Transformers are now often installed in close proximity to residential areas, where strict noise level requirements are imposed by City and County ordinances. Hence, the demand for low and ultra-low noise transformers and reactors, has grown around metropolitan areas around the world. Accurate indoor measurement of the noise of such transformers and reactors is therefore very critical. Establishing the correct industry standard for the techniques for the appropriate methods and conditions to perform these measurements accurately is of utmost importance. For this reason, the Audible Sound & Vibrations Subcommittee is presently in the process of upgrading the IEEE Standards of transformer noise measurement to include the “Sound Intensity” method of measuring noise and also incorporates the “Wall-reflection Correction” into the Sound Pressure method. Both of these methods have already been part of the IEC Standards of noise measurement for years .

2. Learning Objectives

This tutorial is planned to:

- Provide background to why it is important to, and the challenges of, accurately measure transformer noise and its frequency spectrum.
- Review IEC Standards of sound measurement; including the “Sound Intensity” method and the “Wall-reflection Correction” Method.
- Present advantages and appropriate conditions for measuring transformer noise using the “Sound Intensity” method.
- Explain the improvement of accuracy of the “Sound Pressure” measuring method when sound wall–reflections are properly accounted for.

3. Learning Outcomes

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

- Technical challenges of measuring noise of low – noise transformers and reactors indoors.
- Sources of inaccuracies in indoor noise measurements
- Contributors to the difference between measurements using the “Sound Pressure” and “Sound Intensity” methods.
- Technical background to the development of appropriate conditions for accurate measurement of transformer and shunt reactor noise using the “Sound Pressure” and “Sound Intensity” methods.

4. Presenters' Biographies

Donald Chu: Donald is presently Section Manager of the Substation Equipment Engineering Section of Con Edison Company of New York, located in New York City, NY. Donald has over 30 years of engineering and R&D experience in distribution and substation equipment. He is responsible for the development, design, engineering, construction, failure analysis, and maintenance support for all major electrical equipment in transmission and area substations. Previously, he was Technical Specialist for power transformers responsible for providing all technical expertise to internal organizations, manufacturers, and R&D organizations. Donald received his BS degree (1975) and MSEE degree (1976) from Cornell University, New York, NY, all in electrical engineering. He is a registered Professional Engineer in State of New York and an active member of IEEE, EEI, CEATI and EPRI. He is presently the chairman of the IEEE/PES Transformers Committee's Working Group on the development of the new "Guide for Application of Monitoring of Liquid-Immersed Transformers and Components, C57.143". He is also a member of several working groups and subcommittees in the Committee.

Dr. Ramsis Girgis: Ramsis is presently the Technical Manager of ABB Power Transformer Division located in St. Louis, Missouri. He is also the leader of the ABB's global R&D activities in the area of "Transformer Core Performance" and the co-leader of the global R&D activities in the area of "Transformer Noise & Vibrations". Most recently, he has been the project leader for developing the ABB technology for designing, manufacturing, and noise testing of ultra-low noise transformers for a US utility. Ramsis received his Ph.D. degree from the University of Saskatchewan, Canada, in Electrical Power Engineering in 1978. He has over 40 years of R&D experience in the area of power, distribution, pulse power, high-frequency transformers, and rotating machines. He has published and presented over 70 scientific papers in IEEE, IEE, CIGRE, and other international journals. He was awarded the IEEE Fellow Grade in 1986. He is presently the Chair of the IEEE/PES Transformers Committee's Sub-committee on "Performance Characteristics". Ramsis co-authored chapters in two electrical engineering handbooks on transformer design and transformer noise. He is the past Technical Advisor representing the US National Committee in the IEC Power Transformer Technical Committee (14).

Dr. Christoph Ploetner: Christoph graduated from the Technical University of Ilmenau, Germany and received his Ph.D. in Electrical Engineering in 1998 from the same University during his engagement as research assistant, dealing with power transformer modeling. In 1999, he joined Siemens Power Transformer Factory in Nuremberg, Germany as a specialist for transformer modeling, magnetic, and current related issues, including noise problems. Beside other R&D projects in 2003, he was decisively participating in the design of a 65 MVA low-noise transformer without for the United States. Being increasingly involved with special technical support items for customers and suppliers and dealing with design issues, in 2005 he became Head of the Electrical Design Department in the transformer factory in Nuremberg. Dr. Ploetner is active participating in the IEEE/PES Transformers Committee and serves currently as convener for the maintenance team of the standard IEC 60076-6 "Reactors". He has written several technical papers on magnetic related problems on power transformers.