

IEEE Guide for Dielectric Frequency Response Measurements on Bushings

— Technical Presentation —
Thursday, October 26, 2023

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1. Abstract

This tutorial will cover four topics:

- Overview of the Guide for Dielectric Frequency Response (DFR) on Bushings C57.12.200
- Best practice for field testing of DFR on bushings
- Influence of creep current and importance of temperature correction
- Case study - Bushing DFR from a utility perspective

To start, Poorvi Patel will provide a review of the newly published IEEE C57.12.200: IEEE Guide for Dielectric Frequency Response Measurements on Bushings. Poorvi's presentation will include the difference between 50/60Hz PF, capacitance vs. DFR and interpretation guidelines for DFR test results.

Evgenii Ermakov will discuss general DFR measurement test practice and measurement considerations. He will also share some interesting cases from the field.

Peter Werelius will guide us through factors that could influence DFR measurements in the field that are not bushing related but, instead, due to influence of bushing surface creep currents, nearby energized units and temperature differences.

Finally, Ismail Guner will provide participants with a utility perspective of performing DFR. He will share a case study in which DFR helped Hydro Quebec identify problematic bushings in the field and develop a prioritization program for bushing replacement.

2. Learning Objectives

This presentation will help attendees get familiar with DFR test techniques for factory or field bushing testing. It will also provide practical application examples and case studies on how to use the test, perform the test and analyze the results as an optional FAT and maintenance test.

3. Learning Outcomes

By attending this tutorial, attendees will gain an understanding of the following:

- IEEE C57.12.200: Guide for Dielectric Frequency Response Measurements on Bushings
- How to test and analyze DFR on bushings and identify possible problematic bushings

4. Presenters' Biographies

Evgenii Ermakov, Ph.D. in high voltage technology, R&D Principal Engineer at Hitachi Energy Sweden AB, member of SEK TC14, Senior IEEE Member. Evgenii began his professional career in 2006 and joined Hitachi Energy (formerly ABB) in 2011. He is involved in transformer condition, life and risk assessments and leads research and development projects in the field of transformer condition assessment and monitoring. Evgenii also actively participates in relevant IEEE, CIGRE and IEC working groups and task forces. He is the author of more than 30 technical publications and is a key contributor for the C57.12.200 DFR guide for bushings. Evgenii received his Ph.D. from Saint-Petersburg State Polytechnical University, Russia, optimizing the methodology for diagnostics of high voltage power transformers.

Ismail Guner currently holds the position of power transformer engineer at Hydro-Québec, previously working as a power transformer electrical design engineer at ABB. He is an active member of the IEEE Transformers Committee and received his Bachelor of Science Degree in Electrical Engineering from École Polytechnique de Montréal, Canada.

Poorvi Patel is a strategic insight manager at EPRI and technical expert in power transformers and bushings. Her current research area focuses on emerging technologies to accelerate the decarbonization of the power sector. Poorvi joined EPRI in August of 2018. Before joining EPRI, she worked for 20 years at ABB TRES. During that period, she led research and development within transformer on-line monitoring solutions, such as gas monitor development and asset management development. She also performed R&D in transformer advanced diagnostic tools and analytical methods, such as dielectric frequency response (DFR) and sweep frequency response analysis (SFRA) technologies. Poorvi has been a member of the Power Engineering Society of the IEEE since 2007 and is actively involved in the work of the IEEE PES Transformers Committee. She is the key contributor of the C57.161 DFR guide and C57.12.200 DFR guide for bushings and chair of the IEEE Dielectric Subcommittee. She is also vice chair for the revision of IEEE monitoring guide and vice chair for the IEEE SFRA guide. Poorvi received her Ph.D. at Lund University in Sweden and her MSc degrees in Mechanical Engineering from the University of Luleå, Sweden.

Peter Werelius works for Megger Sweden as a senior application specialist with responsibilities related to research, product development, product sustainability and training for the Megger Global organization. He began his professional career by starting up a spin-off company, WaBtech, in 1996, where he manufactured the first DFR field test equipment, after which he was responsible to improve and further develop DFR technology and its applications under WaBtech, Programma, GE, Pax Diagnostics and now Megger. Peter is a member of SEK TC14, IEEE and CIGRE and actively participates in working groups and task forces, especially those related to FDS/DFR and SFRA. Throughout his career, he has participated in relevant technical conferences, authored technical papers and received patents. Peter earned his Ph.D. in Electrical Engineering from Kungl, Tekniska Högskolan, Sweden, developing the Dielectric Frequency Response (DFR) technique for diagnosis of medium voltage XLPE cables.