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Transformer Bushing Overloads: Innovative Solutions to Increase Overload Capability for Oil and Dry Types

— Technical Presentation —
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1. Abstract

The growing energy demand, driven by EV-charging, electrification of many industrial processes in combination with the increasing decentralized energy generation by solar and wind, leads to significantly more fluctuation of power flow and possible overloads of transformers in all areas of the transmission and distribution network.

This technical presentation will demonstrate the effect of overloads on transformers and the equipment first, focusing on possible countermeasures to cop the overloads for the transformer and affected accessories.

Bushings, as the connecting elements between the transformer and the other parts of the network infrastructure, are key components to ensure adequate overload capability. A detailed examination of the thermal behavior of oil-type and dry-type bushings is the starting point of describing measures to manage overloads. For oil-type bushings, the focus is on material change and the positive effects on the thermal properties and ratings. For dry-type bushings, on the other hand, material changes, but also the application of the well-known heat pipe principle (used for years in highly loaded HVDC bushings) lead to higher overload capabilities.

The overloads of the bushings can thus be managed by increasing the bushing rating or by applying innovative solutions.

2. Learning Objectives

This tutorial provides opportunities to learn about the following:

- Transformer overloads and related components and accessories
- Oil impregnated bushing technology (OIP) and overload behavior
- Ester fluids in liquid-filled bushings and overload behavior
- Dry-type bushing technology (AC and DC application)
- Heat pipe technology application for dry-type bushings and overload behavior

3. Learning Outcomes

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

- Possible related transformer components and accessories in case of overloads
- Overload behavior of oil impregnated bushings and design concepts
- Overload behavior of ester impregnated bushings
- Overload behavior of dry-type bushings and design concepts
- Function and benefit of overload capability optimization for dry-type bushings with heat pipes

4. Presenters' Biographies

Esseddik Ferdjallah-Kherkhachi is the technical manager of high voltage laboratories for bushing manufacturing at Siemens Energy. He started working with high voltage equipment in 2015 as a development engineer working on the electrical design of bushings and instrument transformers. Esseddik also participated in the development of new innovative insulation technologies, bushings monitoring solutions and sustainable process projects. He is an active member of CIGRE and CIGRE NGN. Esseddik earned his engineering degree from Ecole Polytechnique d'Alger in Algeria and his PhD from Nantes university in France, where he worked on the monitoring of insulation system for hydrogenators.

Kurt Kaineder is head of research and development for bushings, instrument transformers and coils at Siemens Energy. He started in the transformer business more than 20 years ago and held several positions in engineering. Kurt was head of the engineering department at Siemens Austria, Transformers in Linz and led the electrical design activities within the global technology group for medium power transformers. In this function, he was responsible for the electrical and mechanical design of transformers and reactors and special transformers. Kurt is an active member of the IEEE PES Transformers Committee, including several working groups and subcommittees. Additionally, he is participating in IEC and CENELEC standards development. He received a Dipl.-Ing. Degree in power engineering from the Vienna University of Technology, Austria and an MBA degree.

Alfons Schrammel is a senior manager in the engineering department of the Siemens Energy large power transformer plant in Weiz, Austria. He is in charge of electrical design of large power transformers, including shunt reactors and phase shifting transformers. Alfons started in 1986 as a design engineer for large power transformers at ELIN. In 1990, he changed to technical project management and was responsible for special projects, such as the first 500kV phase shifter. From 1996 onwards, he managed the electrical design department. From 2012 through today, Alfons is responsible for engineering in the business function Global Technology Center for Large Power Transformers at Siemens. He graduated from the Graz University of Technology.