IEEE PES Transformers Committee
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New Revision of IEEE C57.163 GIC Guide and Recommended GIC Specification Requirements

— Technical Presentation —
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1. Background

Geomagnetically induced currents (GIC) can cause part-cycle core saturation depending on the GIC magnitude and the transformer design. This core saturation leads to additional VAR demand and injects current harmonics into the grid. When large enough, a geomagnetic disturbance (GMD) can result in voltage instabilities and subsequent blackouts. Another consequence of part-cycle core saturation is additional heating of transformer windings and structural parts.

In 2015, the Transformers Committee produced the first GIC Guide, IEEE C57.163-2015. Since then, new information on the characteristics of GIC and its impact on transformers has emerged. For this reason, a working group was formed to produce a revision of this guide, incorporating emerging knowledge. Revision of the IEEE C57.163 GIC Guide is complete and approved for publication.

2. Learning Objectives

This tutorial provides opportunities to learn about the following:

- Details of revisions made to IEEE C57.163-2015.
- Recommended GIC requirements in customer specifications.

3. Learning Outcomes

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

- Main updates made to the GIC guide:
  - Replaced original simplified GIC signature with reference GIC signature per NERC TPL-007 Standard to be used for performing GIC thermal assessment of power transformers.
  - Relocated simplified GIC signature from the main text to Annex A for historical reference.
  - Updated guide's GIC thermal assessment sections based on NERC reference GIC signature.
  - Thermal impact of GIC on shell form transformers.
  - GIC thermal capability of different power transformer types and designs.
  - GIC thermal impact on tertiary windings in autotransformers.
  - More details on magnetic response of transformers to GIC.
  - Opportunities for on-line monitoring of GIC and its thermal impact on a transformer in real time.
- Appropriate GIC requirements to be incorporated in customer specifications for performing GIC magnetic and thermal assessment of a transformer.

4. Presenters' Biographies

Daniel Blaydon, P.E. is a principal engineer in substation engineering, design and standards at Baltimore Gas & Electric, where his primary responsibilities are the specification and purchase of power transformers. He has been an IEEE PES Transformers Committee member since 2010 and served as chair of the working group for the Revision of C57.163-2015. He received his Bachelor of Science Degree in Electrical Engineering from Penn State University and is a licensed professional engineer in Maryland.

Dr. Ramsis Girgis is an IEEE Life Fellow Member and the leader of Hitachi Energy's global R&D activities in the areas of transformer core performance, GIC, and low noise transformers. He led Westinghouse's, ABB's, and now Hitachi Energy's investigations in the area of magnetic and thermal effects of GIC on power transformers since the 1989 GMD event. Over the past 15 years, he has contributed to the activities of the NERC GMD task force, was a main contributor to the original IEEE GIC guide and, until recently, was the vice chair of the working group updating the IEEE GIC guide with latest information on the subject.