IEEE/PES Transformers Committee
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Power System Over-voltage Requirements and Their Impact on Transformer Design

-- Panel Discussion, Monday, October 6, 4:45 p.m. --

by Donald Chu, Ramsis Girgis, Harold Moore, Bipin Patel, and Gustav Preininger

1. Abstract

Recently, it was recognized that the over-voltage requirements at full load, as specified by the ANSI C57.12.00 Standard could, in some cases, result in a larger transformer than necessary because of the impact of these requirements on transformer core excitation. In an effort to understand the different aspects of this issue, this tutorial session has been organized by the PCS. Presentations will attempt to explain the following relevant topics:

1. Influence of system conditions on excitation of transformer cores
2. Influence of core excitation on core design
3. Over-voltage requirements and system operating parameters for GSUs and Autos
4. Experience with Utilities specifications, system operations, and impact on core over-excitation
5. Recommendations

Subsequent to this tutorial, a TF of representatives from users, manufacturers, and consultants will be formed to decide on what changes to what specific Standards are necessary. The TF will also develop the text for the changes agreed upon by the TF.

2. Learning Objectives

Attendees of this tutorial session will be learning about how power system conditions (system voltage, load, and impedance) impact transformer core excitation in both core-form and shell- form transformers. Also, how core excitation impacts core design to provide proper cooling for the core and to limit the core hot spot temperature. Attendees will also learn what over-voltage requirements, which different utilities have and what system operating parameters they work with for Generator Step-Up transformers as well as for step-up and step-down system transformers.

3. Learning Outcomes

The information in this session should help utility and manufacturers attendees in two different ways:

1. Utility Attendees: Should be able to go back and review their own over-voltage requirements and evaluate what changes there might be necessary in their existing transformer specifications.
2. Manufacturers Attendees: Should be able to go back and review their own design practices in light of a better understanding of customer over-voltage requirements. They will also be able to discuss such requirements with their customers at the time of quotation and, hence, arrive at proper transformer designs.

4. Presenter's Biographies

Donald Chu: Mr. Chu is presently Section Manager of Substation Equipment Engineering Section of Consolidated Edison Company of NY. Currently, he is responsible for the specification, procurement, engineering, installation, maintenance, and failure analysis of substation equipment. He was previously a Technical Specialist responsible for all power transformers rated greater than 15 MVA. He is a registered engineer in New York State and active in EPRI, EEI and the IEEE/PES Transformers Committee.

Dr. Ramsis S. Girgis: Dr. Girgis (F'93) is presently the Technical Manager of ABB Power Transformer Division located in St. Louis, Missouri. He is also the leader of the global ABB R&D activities in the "Transformer Core Performance" area. Ramsis received his Ph.D. degree from the University of Saskatchewan, Canada, in Electrical Power Engineering in 1978. Dr. Girgis has over 35 years of R&D experience in the area of power, distribution, and high frequency transformers, rotating machines, and pulse power components. His main areas of interest are electro-magnetics and noise of electric power equipment. He has published and presented over 70 scientific papers in IEEE, IEE, CIGRE, and other international journals. He is presently the chairman of the Subcommittee on "Performance Characteristics" of power and distribution transformers within the IEEE/PES Transformers Committee. He is also a member of several working groups and subcommittees in that Committee. He 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.

Harold R. Moore: Mr. Moore (F'97) is an independent consultant and founder of Harold Moore & Associates, Inc. Previously, he was employed with Westinghouse Electric Corporation for over 37 years. Mr. Moore received his BSEE from Mississippi State University in 1951 and his MSEE from University of Pittsburgh in 1957. He is a member of IEEE and CIGRE, a past Chairman of the Subcommittee of Dielectric Tests of the IEEE/PES Transformers Committee, and a past US Representative for CIGRE Committee 12. Mr. Moore is author of many technical articles and a coauthor of "Transformers for the Electric Power Industry", a book published by McGraw Hill. He is a Registered Professional Engineer and an author of 16 US patents.

Bipin K. Patel: Mr. Patel has been employed with the Southern Company for 29 years. Currently he is a Principal Engineer in transformer applications area. He has been active in the IEEE/PES Transformers Committee activities for more than 20 years.

Dr. Gustav Preininger: Dr. Preininger received the Dipl. Ing. and Dr. techn. degree from the Technical University in Graz in 1954 and 1962, respectively. His thesis dealt with voltage stresses in transformer windings caused by transients. In 1954, he joined ELIN-Union AG in Weiz, Austria and worked until 1957 in the Transformer Design Department. He then became deputy manager of the High Voltage Laboratory. After a re-organization of the company in 1969, Dr. Preininger became division manager of the Transformer Division, and in 1990 when ELIN Transformatoren GmbH was founded, he was appointed managing director of the new company. At the end of 1992, Dr. Preininger retired from his position and now works as a consultant. Dr. Preininger has been member of CIGRE since 1969 and member of the IEEE since 1997, and was as Austrian delegate member of SC12 of CIGRE from 1969 to 1990. He is a Registered Engineer in Austria and holds patents on transformers and reactors.