IEEE/PES Transformers Committee
Spring 2009 Meeting
Miami, Florida

"Transformer Paralleling"

-- Technical Presentation --
Tuesday, April 21, 4:45 to 6:00 p.m.

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1. Abstract

Multiple power transformers are often installed for extended parallel operation at different locations on the power system. Several methods of specialized control features are available for proper transformer paralleling operation. The misapplication of these methods in various application system configurations can create operating conditions with results ranging from inaccurate bus voltage regulation to transformer failure due to tap position "hunting". It is necessary to understand each method and to consider ALL possible operating configurations including normal, emergency or contingency conditions. These changing system conditions are continuously affected by automatic operations on the transmission and distribution systems, such as protective relay operations or load management techniques. Paralleling control misapplication also includes improper control settings and commissioning practices, which will also be discussed in this tutorial.

2. Learning Objectives

This tutorial presentation is planned to provide background for the practice of paralleling power transformers in distribution and transmission substations, provide specific information on system configurations and control factors to be considered and the need for a detailed application guide.

It will include:

- Providing an overview on the advantages of paralleling transformers, guidelines on their use and the various methods of transformer paralleling available today.
- Reviewing requirements for specialized control algorithms and the system and transformer variables that effect paralleling application performance.
- Reviewing five of the most utilized paralleling control methods and illustrating the typical operation and the performance of each under typical contingency system conditions.
- Preview of Initiatives within Working Group for the IEEE Transformer Paralleling Guide, PC57.153.

3. Learning Outcomes

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

- The technical challenges of applying paralleled transformers on electrical utility systems.
- The limitations of different paralleling control schemes and techniques.
- The versatility and flexibility of system design using correct paralleling techniques.
- The importance of control settings and commissioning practices in proper operation.
- A "burning desire" to join and contribute to the WG for the IEEE Paralleling Guide.

This understanding will assist the members in specifying the transformer characteristics important to the proper operation of a paralleling system.

This knowledge will allow members to more intelligently choose, or assist in choosing, the proper paralleling method, the proper setting priorities and the proper commissioning of the paralleling system.

Knowledge of the versatility and flexibility of paralleling system methods can be useful in the overall T&D system design and planning.

4. Presenters' Biographies

E. Tom Jauch: Tom Jauch graduated from Bradley University in Peoria, IL in 1963. Tom has 45 years of utility experience including Central Illinois Light Company, General Electric's Electric Utility System's Engineering Department and Beckwith Electric Company. Currently, Tom acts exclusively as a Consultant for Control Applications & Training for Beckwith Electric Co. Tom is a former instructor at GE's Power System Engineering Course (PSEC), the Graduate School of Electrical Engineering at Rensselaer Polytechnic Institute and Union College in New York as well as Auburn University. He has authored numerous technical papers and magazine articles on power transformers, controls, and protective relaying including "Electric Utilities Systems and Practices" and the McGraw Hill "Standard Handbook for Electrical Engineers". Presently, Tom is a Life Senior Member of the IEEE and the IEEE Power & Energy Society, is active in the IEEE/PES Transformers Committee, and is the Chair of the Committee's Working Group for a Guide to Transformer Paralleling.

James W. Graham: Jim Graham is an Electrical Engineer and Substations and Transformer Equipment Specialist at Alliant Energy in Cedar Rapids, Iowa. He was a consulting engineer for 5 years and a utility substation design engineer for 26 years in Missouri, Arizona and Iowa. Jim received his BSEE from Iowa State University. He is a member of IEEE, the IEEE Power and Energy Society, the IEEE Standards Association, and is an active member of the IEEE/PES Transformers Committee.

H. Jin Sim, PE: Jin has a BSEE from Dankook University in Korea. He attended two graduate schools for Engineering and one graduate school for Business Administration. He has been in the transformer industry for over 30 years in design, development, manufacturing, testing, and management. Currently, Jin is VP and Chief Technology Officer for Waukesha Electric Systems. Jin has been active in the Electric Power industry as a past chair of several Working Groups and Subcommittees. Recently, he was the Chairman of the IEEE/PES Transformers Committee during 2002-2003, and currently chairs several working groups and task forces. He is a member of the US Technical Advisory Group for IEC Technical Committee 14, Power Transformers and an individual member of the CIGRE. He was a member of the NEMA and IEEE delegation to the ASC C57 Committee before it was discontinued.