IEEE/PES Transformers Committee
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Winding Temperature Measurement: Techniques, Devices and Operation

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

by Andreas Garnitschnig, Phil McClure, Lenny Shaver, Mark Teetsel and Robert Thompson

1. Abstract

Measurement of winding temperature in transformers has been necessary since transformers became widely used for power distribution, at the beginning of the 20th Century.

In the first three-quarters of the 20th Century, winding temperature indicators (WTI's) were used primarily to control cooling auxiliaries and provide an approximation of the winding temperature. Most equipment was rarely overloaded. Operating procedures led to many transformers being relatively lightly loaded routinely, or at least for long periods of time. In the last quarter of the century deregulation and other market pressures made it necessary for utilities and Regional Transmission Organizations (RTO's) and Independent System Operators (ISO's) to run their transmission and distribution assets at, and sometimes beyond their normal ratings.

With higher loading profiles, the accuracy and dependability of winding temperature measurement devices has come under much closer scrutiny. Questions have been raised regarding the ability of different types of devices to react quickly and accurately to rapid and extreme load excursions. This panel session will present the various currently available technologies and the viewpoints of transformer manufacturers, users, and winding temperature indicator manufacturers on winding temperature measurement.

2. Learning Objectives

The presentation will discuss the techniques of, and reasons for accurate winding temperature measurement from the perspectives of the user, transformer manufacturer, and WTI manufacturer. Specific subjects covered are:

- WTI types and classifications.
- Types of sensors, their construction and usage.
- Physical and electrical environmental considerations
- Bases of accuracy for the different WTI types.
- Response of various WTI types to changes in loading.
- Methods of transmitting data to local or remote collection devices.
- Alarm types, special features and supervisory schemes.
- Steps in determination of hotspot location and thermal magnitude.
- Uses for winding temperature measurement.
- Benefits of accurate winding temperature measurement.
- Consequences of inaccurate winding temperature measurement.
- Future solutions and technologies.

3. Learning Outcomes

Attendees will achieve an increased awareness of the state of the art in winding temperature measurement along with an appreciation of the limitations of legacy methods. The knowledge gained will allow users to perform these tasks more easily:

- Select a WTI system which is appropriate for a specific application.
- Provide arguments for upgrading the WTI system where necessary.
- Evaluate current vendor offerings for feature limitations and assets.
- Evaluate evolving designs for application to future needs.
- Create supervisory schemes to reduce or prevent nuisance alarms.
- Recognize environmental conditions which may affect WTI performance.

4. Presenter's Biographies

Andreas Garnitschnig: Andreas Garnitschnig is Manager, Technical Services & Monitoring at VA TECH ELIN Transformatoren in Weiz, Austria. He is responsible for all transformer monitoring activities and technical services. Before that, he was an R&D engineer at VA TECH ELIN Transformatoren for many years. Andreas Garnitschnig earned an electrical engineering degree from Technical High School in Klagenfurt, Austria in 1992.

Philip G. McClure: Phil McClure is the Chair of the Task Force on Winding Temperature Indicators of the IEEE/PES Transformers Committee and is Engineering Manager of Weschler Instruments Division of Hughes Corporation, located in Coral Springs, Florida. At Weschler he is responsible for research, design and development of analog and digital instrumentation and variable transformers. Over the passed nineteen years, Phil has designed, led design groups or consulted on instrumentation products for military, industrial, nuclear and commercial applications. His interests include imbedded intelligence and its application to communications and remote process control. Phil received his degree in computer engineering at City University of NY.

Lenny Shaver: Lenny Shaver is Product Manager for fiber optic temperature solutions at Luxtron Corporation. Lenny worked as a sensor design engineer in Luxtron's R&D department for 4 years before moving to his current position in 2000. Prior to working on temperature measurement and instrumentation systems at Luxtron, Lenny worked on the other side of the thermal equation as an engineer at a Watlow Electric division that designed and manufactured heaters. Lenny received BS degrees in mechanical engineering and engineering & public policy from Washington University in St. Louis.

Mark A. Teetsel: Mark Teetsel is Regional Utility Sales Manager, Qualitrol Corporation. His current responsibilities include sales and technical support on transformer protection and control products. He has over ten years design engineering experience for pressure and temperature products with Qualitrol prior to moving to field applications and sales. He graduated from Arizona State University in 1981 with a BS in Design and received his MBA from St John Fisher College in 1991.

Robert S. Thompson: Robert Thompson is Engineering Consultant in the Substation Engineering Group of Duke Energy - Energy Delivery Services. In his current position since 1998, he provides apparatus and system engineering as well as consulting services relating to power transformers. Prior to this position, he worked for Duke Energy for thirty years with duties which included specification writing, technical bid evaluation, failure analysis, root cause analysis, factory audits and inspections. He received a BS degree in Engineering from UNC at Charlotte in 1974 and is a registered Professional Engineer in North and South Carolina.