A P P L I C A T I O N N O T E

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Title: Temperature Measurement of High-Tension Parts
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Summary:
Optimizing equipment in the electrical industry requires constant temperature monitoring at certain critical points of the electrical components in order to avoid overheating. However, conventional temperature measuring instruments are not suitable for these applications because they are affected by electromagnetic interference (EMI). **The fiber optic gages by FISO Technologies, Inc.**, entirely made of dielectric materials, offer complete immunity to EMIs. They are ideal for direct and precise temperature measurement on parts undergoing high tension and/or a strong electrical current.

Text:
In the electrical industry, optimizing equipment, especially transformers, has become essential. However, overheating can occur, causing serious damage. Temperature monitoring is the best way to determine the state of the equipment in real time when in operation, therefore avoiding breakdowns.

The fiber optic gages by FISO Technologies, Inc. are entirely made up of dielectric materials, therefore providing complete immunity to electromagnetic interference (EMI). They can then be directly installed on high-voltage parts, for example. Both sturdy and precise, they are the best choice for direct and reliable measurement of major electrical production equipment parts while in operation.

Experiments
In 2001, a Canadian public electric utility company used FISO Technologies gages in order to monitor the thermal behavior of various components of a hydroelectric production unit, commonly called power generation unit. This unit is made up of an alternator, busbars, and a power transformer (see drawing 1 below). The study consists in measuring various parameters such as voltage, current, power, the flow rate of the alternator cooling water, as well as the temperature at four different points: three test points on low-voltage bushings as well as a test point on a busbar section (see drawing 2). The experiment consists in adjusting the alternator power to various values and to record the different parameters.

All the parts to be measured undergo a voltage of up to 8000V and a current of up to 8800A. The four fiber optic temperature gages were directly installed on the parts to be measured. The temperature range is to the order of 100°C with a maximum of 150°C. The FISO Technologies temperature gages can easily measure up to 250°C and in some cases up to 350°C.

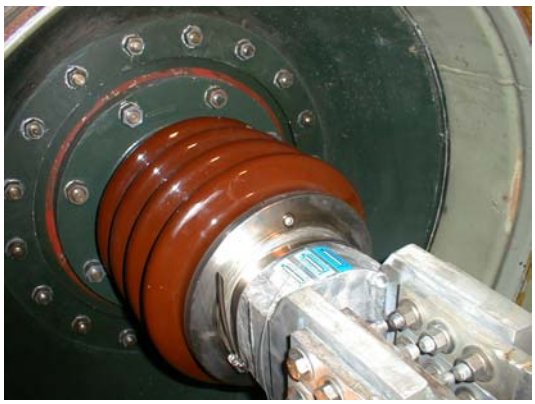
Installation

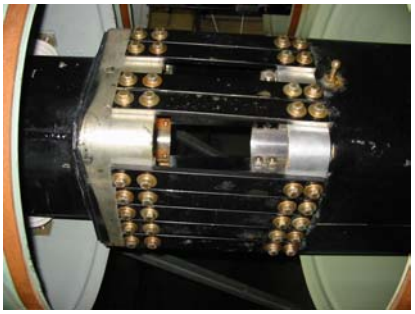
The low-voltage bushing transfers energy from the busbar to the transformer coil. “Low voltage” means that this bushing is on the transformer’s primary side, therefore at a lower voltage than the secondary side. Because the bushing is made of porcelain, it has a thermal limit. Surpassing this limit risks cracking its structure. The first three gages are attached to the upper portion of the conductors as close as possible to the beginning of the bushings in order to measure the highest temperature.

The fourth gage is installed on a flexible joint of the busbar. These flexible joints allow for the thermal expansion of the busbar during heating caused by the current circulating in it.

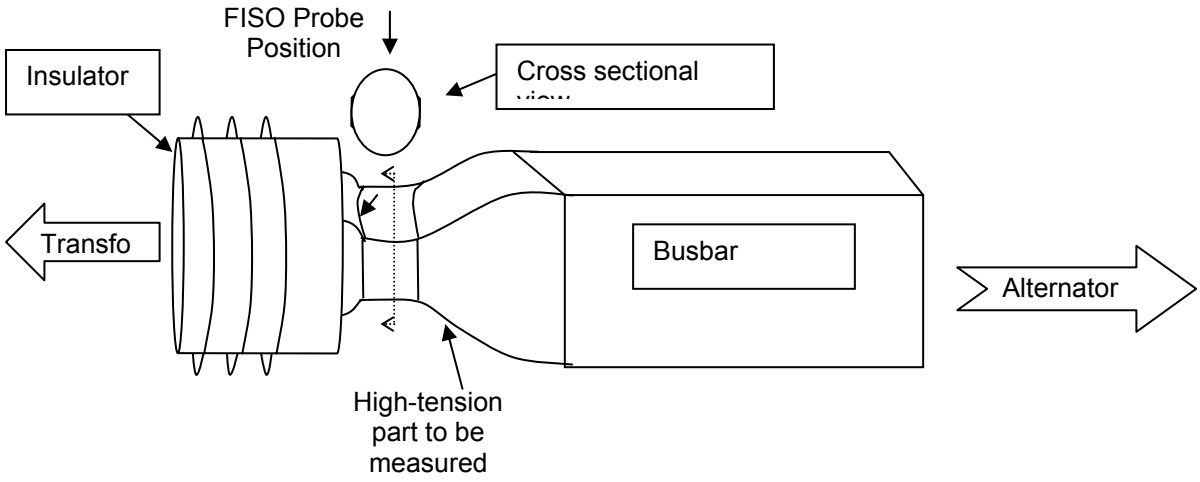
A fifth gage was used in order to monitor the thermal behavior of the transformer’s cooling water. The gage was placed on the cooling system pipe assembly, then isolated from the ambient temperature using a thermal conductivity paste.

Photographs:

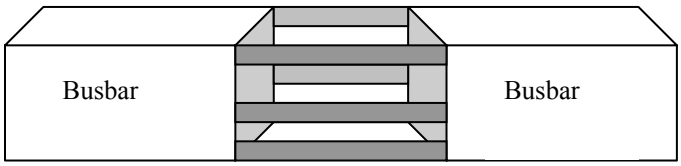




Graphics:

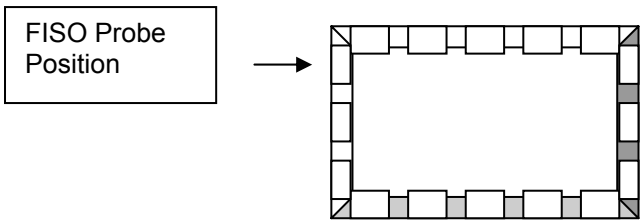


Drawing 1: Low-Voltage Bushing



Flexible joint

Cross sectional view of the flexible joint



Material used:

- 5 FOT-L temperature gages
- UMI-8 signal conditioner (up to 32 channels available)