

MEASURING MOISTURE CONTAMINATION IN HYDROGEN-COOLED ELECTRIC GENERATORS

Hydrogen is used to cool the bearings and other rotating parts of large stationary electric generators. Hydrogen is the best choice for a cooling gas because of its unique combination of high thermal conductivity and low viscosity. To maintain these favorable properties, the hydrogen must be kept dry.

Moisture is a contaminant that reduces the thermal conductivity and increases the viscosity of the gas. The presence of moisture indicates that either the system was not purged adequately after the last maintenance cycle or that there is an ambient leak, which can be a very hazardous condition.

MEASURING MOISTURE IN THE SYSTEM

The cooling hydrogen is continuously circulated through the generator and then through a molecular sieve dryer. To be certain that the hydrogen is dry, a sample tap is installed in the return line from the generator to the dryer.

A second measuring point at the dryer outlet will provide a control signal for dryer switching. This additional measurement will maximize dryer life, provide an indication of dryer efficiency, and minimize the possibility of a dryer upset affecting the generator's operation.



3050-AP MOISTURE ANALYZER



3050-OLV MOISTURE ANALYZER



3050-RM RACK MOUNT MOISTURE ANALYZER

EQUIPMENT

Moisture measurements have been taken with everything from lithium chloride hygrometers, in-line psychrometers, electrolytic moisture sensors, and aluminum oxide probes. These technologies have proven to require high maintenance or to be unreliable due to the basic technology or the effects of hydrogen on the different analytical techniques.

A better option is a moisture analyzer using Quartz Crystal Microbalance (QCM) sensing technology. A technique based on quartz crystal is suitable for this application provided the sample pressure meets the analyzer's minimum inlet requirement.

The choice of analyzer should be based upon both the hazardous area classification and whether the customer desires a display. Electrolytic sensors are not suitable due to the recombination errors that occur in hydrogen atmospheres. Metal-oxide probes should also be avoided as the reducing hydrogen atmosphere may react with the probe's oxide layer, resulting in a loss of sensitivity and calibration stability.

ADVANTAGES OF QCM

With a quartz crystal-based moisture analyzer the actual moisture concentration in the cooling gas is easily, and accurately measurable. These analyzers are highly reliable and require little maintenance. AMETEK's QCM moisture analyzers include on-line verification to ensure the user of the analyzer's accuracy upon demand. In addition, the performance of this technology is very stable over long periods of time, thereby increasing operator confidence in the system.

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