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Flexible Magnetic Flux Probe

A new inexpensive, light and thin probe improves generator rotor diagnostics accuracy and reduces maintenance costs

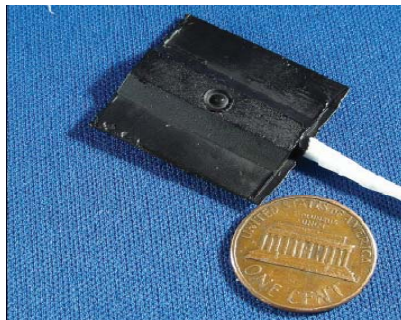
What Is The Problem?

Early detection of deteriorating insulation can minimize repair costs for large scale hydro-electrical generators. The rotors in large electric generators, such as those in Reclamation's hydroelectric powerplants, contain numerous rotor poles, each made up of many loops of insulated wire. As the wire insulation deteriorates with age, short-circuits can develop within the rotor windings reducing electricity production, eventually resulting in an extended shutdown of the generator for rewinding of the rotor poles.

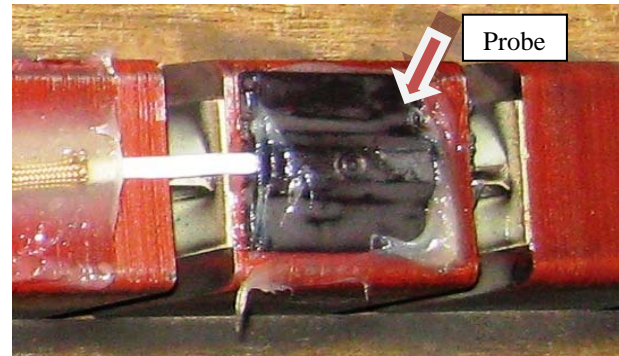
Magnetic flux probes can be used to locate shorted rotor poles during generator operation. The probes are mounted within the air gap between the stator and rotor where they measure the time-varying magnetic flux. Conventional devices used to detect and diagnose these insulation problems during operation are relatively expensive, ridged, and could damage the generators. Also, conventional magnetic flux probes must be calibrated before use to obtain accurate measurements

What Is The Solution?

Reclamation's Hydropower Technical Services Group has developed and patented (#6466009) a flexible magnetic flux probe that overcomes problems with conventional probes. The inexpensive, small, flat, flexible probe accurately measures total air gap magnetic flux and can be mounted without rotor removal. The probe consists of a thin, flexible pickup coil on the back side with an electrostatic shield on the front side. The pickup coil, which is used to measure the magnetic flux, is composed of printed circuit board traces etched onto a flexible substrate. The flexible substrate is very light and thin allowing easy installation into the air-gap. If the probe would happen to come loose during generator operation, the flexible substrate would not damage the generator.



This, new, commercially available magnetic flux probe provides for consistent and uniform electrical and magnetic characteristics thus eliminating the need for calibration. The probe is constructed using multiple layer flexible printing circuit technology to produce a relatively inexpensive and disposable device.



Flexible Magnetic Flux Probe Mounted on Generator Stator

Who Can Benefit?

Powerplant owners and operators can benefit through more efficient and cost-effective generator diagnostics, improved unit reliability, and reduced offline maintenance requirements.

Where Have We Applied This Solution?

Flexible magnetic flux probe prototypes were tested at Reclamation's Crystal and Shasta Powerplants, and commercial models are installed at Reclamation's Flatiron Powerplant. Reclamation has a non-exclusive license agreement with Iris Power LP and numerous probes have been sold in the U.S. to improve generator reliability and reduce maintenance costs. The probe is used with the Iris RFAII series of portable instruments and FluxTracII series of continuous monitors.

Future Development Plans

Reclamation is exploring new generator diagnostics and protection applications using the flexible magnetic flux probe technology that would significantly increase the electrical protection of hydro generators.

More Information

Additional information on Iris' commercially available probe is available at http://www.irispower.com/turbo_flux_tfprobe.aspx. For more information on licensing opportunities, please contact Samantha Zhang, Reclamation Technology Transfer Coordinator, at 303-445-2126 or szhang@usbr.gov.

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Collaborators

Reclamation Science and Technology Program and Iris Power LP