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Fraser focuses on maintenance reliability 55

Issue **FOCUS:**

MILL MAINTENANCE

Continuous testing of intermittently running motors boosts uptime at Consolidated Papers' hydro-generation unit

BY JAHN IRONSIDE

Automatic Resistance Testers Ensure Generators Start on Demand

INSTEAD OF RELYING ON MANUAL MEG-OHM testing, electrical maintenance personnel at Consolidated Water Power Co. (CWP) are using automatic monitors to increase uptime of the facility's generators. CWP, a hydro-generation company, is a subsidiary of Consolidated Papers (CP), Wisconsin Rapids, Wis. CP manufactures a variety of other paper products and is North America's largest producer of coated printing papers.

CWP electricians began installing automatic insulation testers at the company's hydroelectric plant near Whiting, Wis., in November 1995. Nine testers, provided by Meg-Alert, are now in service there.

The testers monitor synchronous motors newly converted to generators. Winding-to-ground resistance of each is continuously monitored at current-limited full operating voltage, for as long as any generator is idle during times of reduced water flow.

READY WHEN NEEDED. Continuous testing ensures that all of the Whiting generators will come online when started. Automatic testers display the condition of idle units on a color-coded meg-ohm meter and LED panel.

It wasn't always that way. Another site, CWP's Biron hydro plant, has six horizontal generators. The lower third of each stator is in a pit which is subject to moisture accumulation. Many times over the years, stators at the Biron plant have taken on moisture. When those generators were started, there were two possible results. At best, relays would take the unit offline before damage to windings occurred. Then, a maintenance crew would dry the unit until the winding resistance to ground was acceptable. At worst, upon starting there was damage to the stator or field poles, resulting in repair costs and loss of generation during repairs. Preventing one such event will essentially cover the cost of these automatic insulation-resistance testers.

Plant personnel have identified intermittently running motors as prime candidates for monitoring with automatic insulation-resistance testers. Because of CWP's positive experience with the automatic testers at the Whiting site, the company's 1997 budget includes additional testers to protect the six horizontal generating units at the Biron plant.

MOTORS TO GENERATORS. The Whiting hydro plant installed the testers when it converted nine synchronous-motor pocket wood grinders to generators. They joined a tenth generator at the site. Since the grinders were no longer needed, running the nine motors as generators was a cost-effective way to get a return on the

Meg-Alert automatic insulation-resistance testers are being used at Consolidated Water Power Co., a hydro-generation subsidiary of Consolidated Papers. Here, electrical supervisor Jahn Ironside checks a tester mounted in one of the control panels for synchronous motors being run as hydroelectric generators.

How do automatic testers work?

Automatic insulation-resistance testers work on both AC and DC electrical equipment. The testers connect to the "B" phase at the motor contactor, or generator breaker, and to equipment ground. They apply a fixed DC voltage to the winding while the motor or generator is idle. Typical test voltages are 500, 1,000, 2,500, and 5,000 VDC, as required to approximate the full operating voltage for that equipment. The tester measures current leakage to ground, indicating the dielectric strength of equipment insulation. Testing current is limited to 350 microamperes, so insulation is not stressed by prolonged continuous application of full voltage.

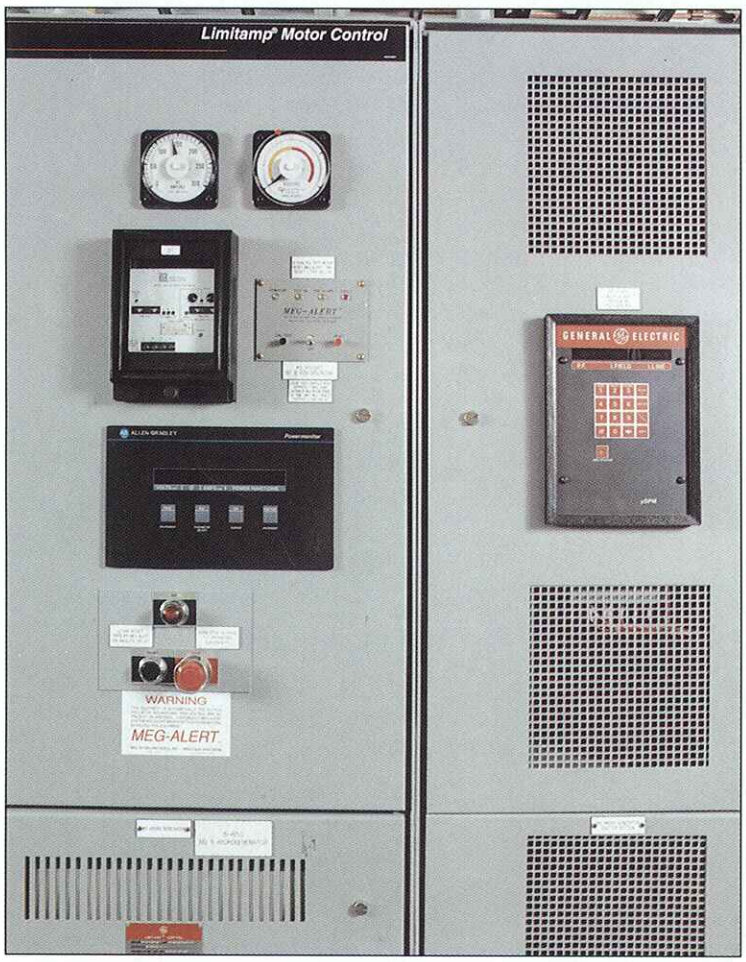
A built-in solid-state comparator circuit monitors any leakage current. It has a fault-alarm trip point adjusted to customer specifications. When leakage exceeds the set point, the tester triggers an alarm and locks out the monitored equipment. The equipment cannot be started until the fault is cleared. Alarm/fault contacts latch mechanically and remain latched until maintenance personnel press a manual reset button. Local and remote visual indications of insulation condition are available.

On grounded generator systems, ground interrupters are added to disconnect the neutral leads from ground when testing is underway. Two safety circuits ensure ground reconnection after testing and before the generator can produce voltage.

In the case of motors where connection of an insulation tester would result in an alarm because a capacitive load is present, a brief time delay in the tester permits circuit charging before active monitoring begins.

Automatic testing of equipment is also recommended for equipment running 24 hours a day. Even in such cases, normal operations usually include brief interruptions. Then, these automatic insulation-resistance testers permit quick preventive-maintenance checks of integrity from the equipment control panel.

Some models of this automatic tester have scanning capabilities. In that way, one tester can monitor insulation resistance of multiple motors sequentially.



Automatic testers display unit conditions on a meg-ohm meter. This automatic testing equipment replaces the hand meg-ohm-testing approach for determining whether a generator can be started safely.

original investment in the motors and water turbines.

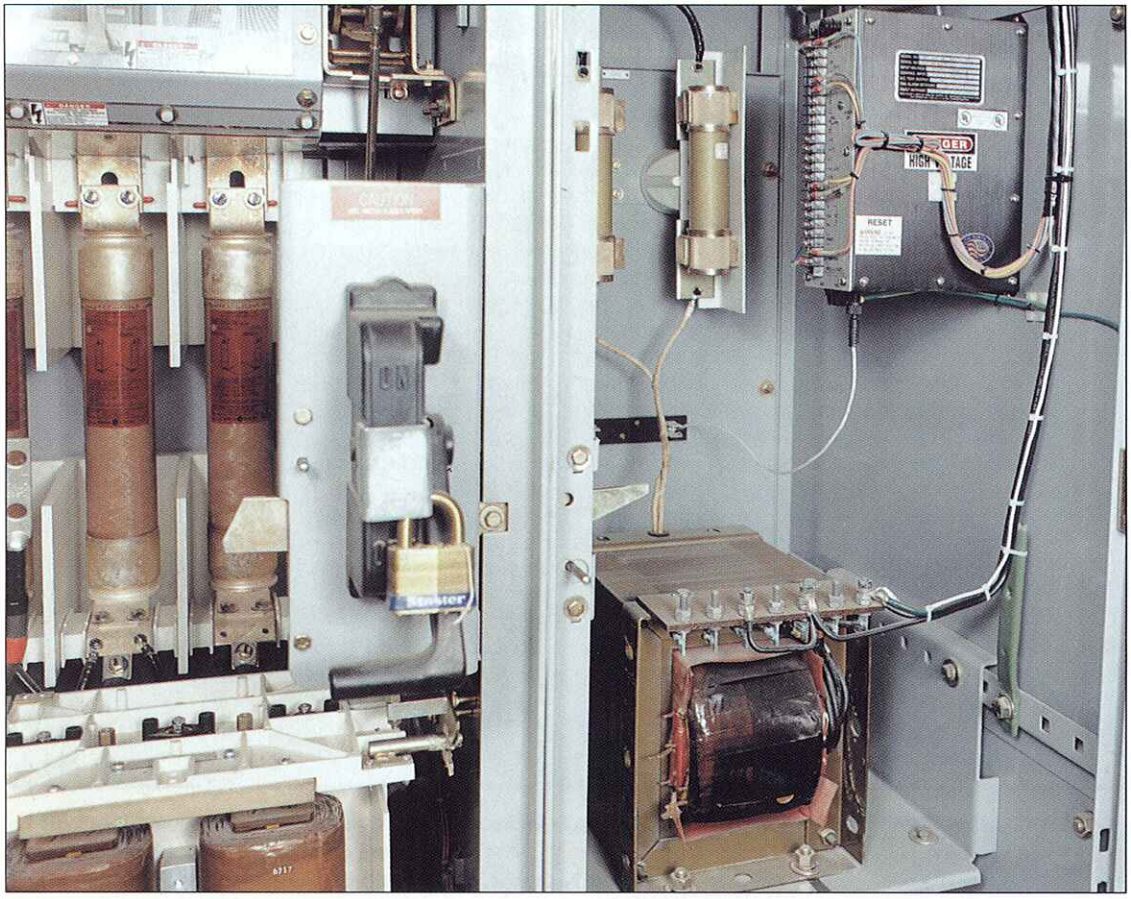
Pocket grinders have a horizontal shaft with the grinder in the middle. Motor and water wheel are at opposite ends. Normally, water power drives the grinders. The motor was backup for periods of low water flow. The grinder cutters now are removed and the grinder water wheels drive the motors as 2,300-volt generators, each delivering 500 kilowatts.

During low-water periods in July and August, only as many generating units as can be run from the existing flow are operated. The rest are shut down. The lost capacity is made up by outside purchase of energy. Some generating units are usually idle again from December through March. At these times, stators take on moisture and so the automatic insulation-resistance testers are needed to monitor the shutdown units.

A 2.4 kV test voltage delivered by each tester is applied to the load side of the main disconnect. Consequently, during maintenance the disconnect is open and locked out, assuring that no line voltage is applied to the stator windings.

A tester reading of less than 3.5 meg-ohms to ground triggers the fault alarm and initiates generator lock-out. A flashing red LED indicates the fault.

For preventive maintenance, each tester also has an adjustable pre-alarm warning set point. Set to 20 meg-ohms for this site, the tester's flashing yellow LED alerts maintenance personnel of the need to schedule service, although the unit still can be started without undue risk. A yellow warning LED at the generator control panel alerts personnel that test voltage is present on the generator system. A green "power-on" LED alerts them when the Meg-Alert system is available for operation. Warning labels are installed on the generator connection boxes to also warn that the generator is being automatically tested.



Inside a GE motor control enclosure, the testing unit electronics and high-voltage power supply are in the module mounted high on the right sidewall of the cabinet.

In the past, insulation resistance was checked by 5,000-volt DC hi-pot testing. That practice will continue, but at three-year intervals for trend analysis. No longer will maintenance personnel need to repeatedly access the 2,300-volt panels simply to make sure a generating unit can be put online.

Now, the automatic insulation-resistance testers continuously do that job at full operating voltage, when the equipment is idle and at all hours, providing immediate local and remote indication of unit readiness. This even makes it practical to start units remotely, at any time, from a control center 20 miles away.

When all hydro generators are operating, they supply 6% of the mill's electrical energy requirements. The savings in utility bills show up in Consolidated Papers' bottom line. This kind of preventive maintenance helps keep the savings coming. ■

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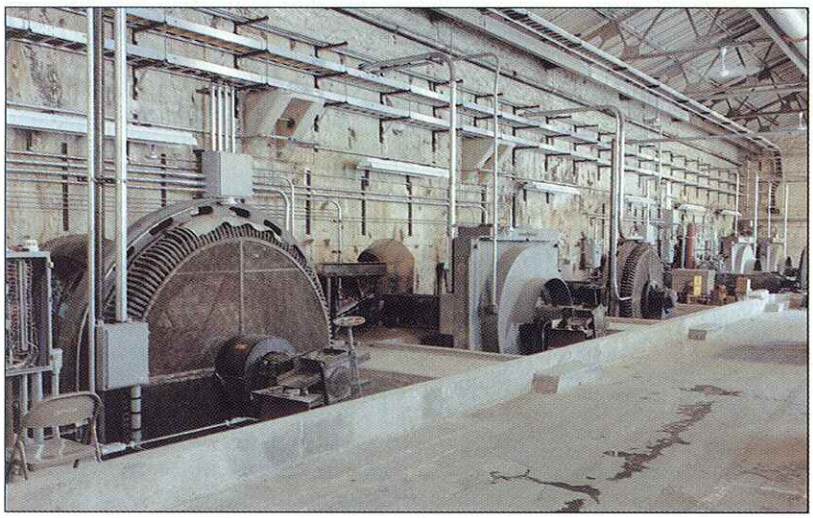

Generating units are idle during periods of low water flow. Stators take on moisture during these times, so automatic insulation-resistance testers are needed to continuously monitor shutdown units.

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