

# PULP & PAPER

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**Fraser focuses  
on maintenance  
reliability 55**

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

BY JAM HENSEL

## Automatic Resistance Testers Ensure Generators Start on Demand

**I**NTENSIVE TESTING ON MAJOR INSULATION testing, electrical maintenance personnel at Consolidated Paper Power Co. (CPP) are using automatic testers to increase uptime of the facility's generators. CPP is a hydro-generation company, a subsidiary of Consolidated Paper Corp., Wisconsin Rapids. CPP manufactures a variety of other paper products and is North America's largest producer of coated printing paper.

CPP electrical began installing automatic insulation testers at the company's hydroelectric plant near Whiting, Wis., in November 2009. The testers, provided by Megatron, are used to inspect them.

The testers monitor synchronous motors newly connected to generators. Windings ground resistance of each is continuously monitored at constant-rated full operating voltage, for as long as any generator is life during times of reduced water flow.

**READY WHEN NEEDED.** Continuous testing ensures that all of the Whiting generators will come online when needed. Automatic testers display the condition of life with-on a color-coded/impulse meter and LED panel.

It isn't always that easy, another day, CPP's Whiting hydro plant, has six hydroelectric 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 Whiting plant have taken on moisture. When these generators were started, there were the possible results. At best, water would take the unit offline before damage to windings occurred. There, a maintenance crew would dry the unit until the winding resistance is good and 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.

After personnel have identified intermittently running motors as prime candidates for monitoring with automatic insulation-resistance testers, because of CPP's positive experience with the automatic testers at the Whiting site, the company's 2007 budget includes additional stators to protect the six hydroelectric generating units at the Whiting plant.

**WINDING TO GENERATOR.** The Whiting hydro plant installed the stator when it converted stator systems over-water jacket wood grinders to generators. They joined a sixth generator at the site, since the grinders were no longer needed, causing the stator stators to generate was a contribution way to get a return on the

Meg Atlat automatic insulation-resistance testers are being used at Consolidated Paper Power Co., a hydro-generation subsidiary of Consolidated Paper.

Here, electrical supervisor John Kowalski checks a meter mounted in one of the control panels for synchronous motors being run at hydroelectric generators.



## How do automatic testers work?

AutoTec insulation-resistance testers work on both AC and DC electrical equipment. The testers connect to the "T" phase of the motor conductor or generator circuit, 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 300 microamperes, so insulation is not stressed by prolonged continuous application of full voltage.

A built-in adjustable comparator circuit monitors any leakage current. If it has a fault-sensing 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 furnish latched unit-maintenance personnel with a manual reset button. Local and remote visual indications of insulation condition are available.

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

In the case of motors where connection of an insulation tester would equate to an alarm because a capacitive load is present, a 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, the tester can monitor insulation resistance of multiple motors individually.

critical operations in the motor and water services.

Water grinders have a horizontal shaft with the grinder in the middle. Motor and water wheels are at opposite ends. Normally, water power drives the grinders; the motor was backup for periods of low water flow. The grinder motors were air-motored and the grinder water wheels drive the motor at 1,800 rpm generation, each delivering 900 horsepower.

During low-water periods in July and August, only a few generating units are run to use those the existing flow are operated. The rest are shut down. The fuel capacity is made up by outside purchase of energy from generating units air usually idle again from December through March. At those times, water intake monitors and to the automatic insulation-resistance testers are needed to monitor the shutdown units.

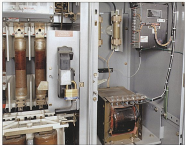
A 24 kV line voltage delivered by each motor is applied to the lead side of the main circuit-breaker. Consequently, during maintenance the circuit-breaker is open and locked-out, assuring that no line voltage is applied to the water windings.

A timer setting of less than 0.5 seconds to ground triggers the lock alarm and initiates generator lock-out. A flashing red LED indicates the fault.

For preventive maintenance, each motor also has an adjustable pressure warning set point. Set to 20 megapascals for this site, the motor's flashing yellow LED alerts maintenance personnel of the need to schedule service, although the unit will continue to run without notice until 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 those when the HighAlert system is available to the operator. Warning labels are installed on the generator connection boxes to also warn that the generator is being automatically tested.



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



Inside a 60 motor control enclosure, the testing unit electronics and high-voltage power supply are in the mobile mounted high on the right sidewall of the cabinet.

In the past, insulation resistance was checked by 1,000-volt DC bridge testing. That practice will continue, but at three-year intervals for asset analysis. No longer will maintenance personnel need to repeatedly access the 2,500-volt panels simply to make sure a generating unit can be put online.

Now, the automatic insulation-resistance tests automatically do that job at full operating voltage, when the equipment is idle and at all hours, providing immediate local electronic indication of unit condition. This event 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 water bills show up in Consolidated Paper's bottom line. This kind of preventive maintenance helps keep the savings coming. ■

**JERRY MONDIE** is electrical supervisor at Consolidated Paper Plant Co., Wisconsin Rapids, Wis.



Generating units are idle during periods of low water flow. Safety takes on importance during these times, so automatic insulation-resistance testing are needed to continuously monitor generator units.

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