UTILITY MAINTENANCE

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MOTOR INSULATION TESTERS

TURBINE GENERATOR OUTAGE PLANNING

MAINTENANCE AND OPERATING PERSONNEL CHECK METER ON SWITCHGEAR PANEL FOR INDICATION OF THE CONDITION OF INSULATION ON CRITICAL-DUTY MOTORS BEFORE STARTUP.

(PHOTOGRAPH COURTESY MEG-ALERT INC.)

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UTILITY MAINTENANCE

Motor Insulation Testers Help Ready Power Plant for Startup

At the Entergy/Gulf States Utilities Nelson Plant in Westlake, LA, personnel bring a coal, gas, or coke-fired unit on line in response to a dispatcher's call in 6 to 12 hours. All equipment must be ready, especially the large electric motors that drive the generating unit fans and pumps. A malfunction in a critical-duty motor can force a unit to run at partial load, or keep it off line entirely, for several hours.

Since 1993, the plant has used automatic motor insulation testers to help ensure that critical motors start without incident when a generating unit is brought back into service. Meg-Alert in-line testers, manufactured by Meg-Alert, Inc., of Minocqua, WI, automatically monitor the integrity of motor winding insulation and trigger alarms to signal a weakness, allowing the maintenance staff to take corrective steps before the insulation degrades to an unsafe level.

The 1400 MW plant includes one 550 MW coal-fired unit, one 500 MW gas-fired supercritical boiler, one 150 MW drum-type gas-fired steam turbine, and two 100 MW coke-fired, fluidized bed boilers. The coke-fired units receive fuel from the byproducts of nearby oil refineries and, in turn, supply the refineries with electricity and process steam.

During 1993 and 1994, testing units were ordered and installed on 83 critical-duty motors with operating voltages of 2400 V or higher. Most of these motors are 4160 V rated to 4000 hp. Dallas Tharpe, process superintendent, says the motors are used to power equipment including boiler feed pumps, condensate pumps, circulating water pumps, cooling tower makeup pumps, forced draft fans, induced draft fans, and primary air fans.

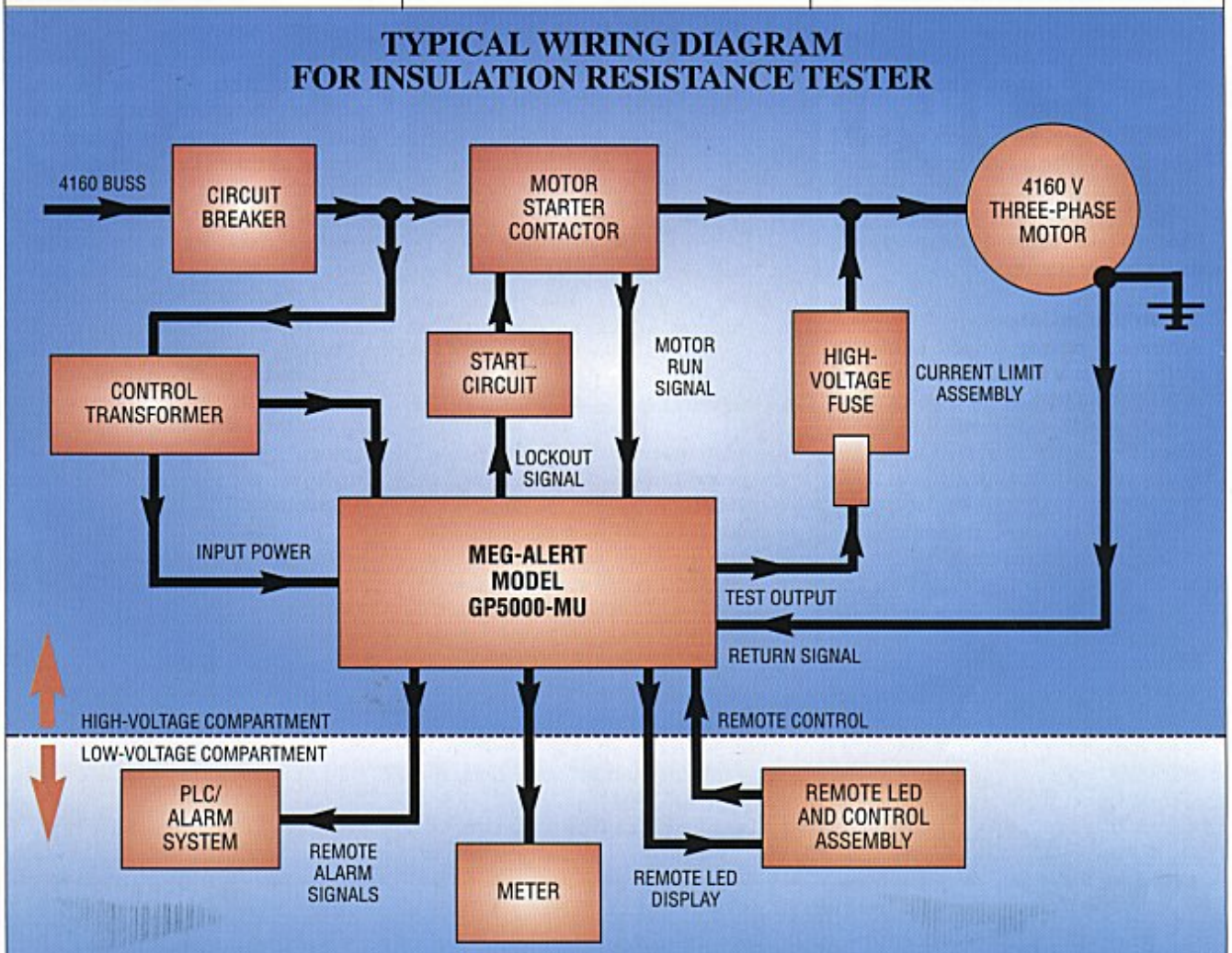
The test devices keep all equipment in peak condition for startup, help save motor repair and replacement costs and motor maintenance, and enhance worker safety through no-hands-on insulation testing.

Always ready

Moisture buildup caused by high humidity (typical for the Gulf Coast region) is the major enemy of motor insulation at the plant. Condensation can cause fault conditions, even in insulation that is otherwise sound. Although the motors are

The insulation resistance tester display mounts in the switchgear panel. Readings are shown on a color-coded meter.

A variety of critical equipment, such as this boiler feedwater pump, is monitored to prevent motor failures and to ensure that the equipment starts without incident when a generating unit is brought into service.



equipped with heaters to drive off moisture, heater failures can occur.

Before the automatic insulation testers were installed, critical motor insulation was tested with a 2500 V motor-driven megohm tester. The staff tested any motor that had been idle for more than 24 hours before startup; in a wet climate, it does not take long for a motor to collect enough moisture to cause a failure on startup. Several hours before startup, plant personnel check the Meg-Alert indicators to make sure that critical motors are dry and ready to go.

The testing device was selected for its ability to test at the equipment's full operating voltage. The staff felt a lower voltage test might not detect an insulation weakness that could result in a failure. Testing at full voltage would provide a more realistic reading of insulation condition.

Testers are installed on 83 critical-duty motors. Alarms trigger LEDs to alert maintenance personnel to problems.

By applying fixed, current-limited dc voltage to the windings and by measuring the leakage current to ground, the devices continuously test motor insulation while equipment is idle. Readings in megohms are displayed on a green-yellow-red color-coded meter mounted in the switchgear.

Each unit has separate programmable pre-alarm and fault alarm contacts. The pre-alarm contact activates at a higher megohm value than the fault alarm contact. It signals a potential insulation problem and triggers a yellow flashing LED on the switchgear panel, alerting the maintenance staff to inspect for moisture or insulation breakdown.

The fault alarm contact activates if a serious insulation weakness is detected; it triggers a red flashing LED and locks out the motor's start circuit, preventing an imminent motor burnout. A manual reset feature ensures that the affected motor can return to operation only after the fault condition has been corrected.

By monitoring readings while generating units are out of service, maintenance technicians can detect a potential problem such as moisture in a motor and take appropriate action to drive the moisture off. Equipment remains in suitable condition for startup when needed. In addition, readings track trends in insulation deterioration

and predict when motors are likely to require reconditioning. Work can be accomplished during scheduled outages.

In the future, Meg-Alert's RS-232 capability will be used to track the units throughout the plant's central control system. The control room supervisor can then take remote readings on each motor before startup.

Repair and maintenance

Automatic testing helped eliminate motor failures at the facility and allowed development of a planned program of motor reconditioning that results in significant savings. Repair or replacement of a large 4160 V motor can cost up to $140,000, depending on size and application. By contrast, reconditioning motor insulation before burn-through can be accomplished for about $15,000, even on a large motor.

Automatic insulation testing also eliminated the time-consuming and costly task of manual testing with a megohmmeter. Although the manual test procedure generally required 5 to 10 minutes per motor, off-duty maintenance personnel were often called to perform the work because the maintenance staff is not always available 24 hours a day. If a unit had to be started on short notice, maintenance personnel were called in to do the testing.

Automatic testing of motor insulation reduces the risk of injury to maintenance workers.

Automatic testing reduces the risk of injury to maintenance workers. Manual testing involved racking out large circuit breakers to isolate the equipment for testing, and then racking them back in. On-line testers minimize the amount of time plant personnel interface with equipment.

"Management is well aware of the possible risk of injury any time employees are working on and around high-voltage equipment," Tharpe says. "On average, we test insulation in large motors at least three or four times a year, depending on how often a given generating unit is started. By eliminating the tasks of hand meggering the motors, we reduce the time our employees are working with this kind of equipment."

Information supplied by Meg-Alert Inc., 8766 Frank Dr., Minocqua, WI; (715) 356-1499.

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