

# MAINTENANCE TECHNOLOGY

THE MAGAZINE OF PLANT EQUIPMENT MAINTENANCE AND RELIABILITY MANAGEMENT



A MANAGEMENT GUIDE TO BALANCING  
CONTROLLING MAINTENANCE INVENTORY  
COMBINING TPM AND RCM

# Automatic Electrical Insulation Testers Monitor Critical Motors

**A**t San Diego Gas & Electric Co. (SDG&E), automatic insulation resistance testers serve as insurance against motor insulation breakdown and provide an advance warning when investigation is warranted. The system automatically tests winding-to-ground resistance on critical electric motors driving auxiliary equipment.

SDG&E installed automatic testing because the reliability of its medium-voltage motors, rated 2400 V

From the readout panels of the automatic testers, operators can determine the up-to-the-minute condition of critical motors.

and 4160 V, was becoming a problem. At \$20,000 to \$40,000 to service a motor, catching a potential motor insulation problem before it escalates into damage is well worth the effort.

Operations staff no longer dispatch

Critical 4160 V motors driving auxiliary equipment are monitored from their main and control panels. Senior engineer Don Skland uses automatic electrical insulation tester readings.



electricians to determine whether the condition of auxiliary motors will permit a generating unit to be started. From the readout panels of the automatic testers, operators can determine the up-to-the-minute condition of critical motors versus idle units.

The automatic testers are a development of Meg-Alert, Inc., Minocqua, WI.

"Before going to automatic insulation resistance testing, portable megohmmeters were used," explains Dan Eklund, SDG&E senior engineer. "Some of our most critical motors are on circulating water pumps which are outdoors on a deck next to the ocean. They have canvas covers and heaters but the motors are always subject to the salt-fog atmosphere. Without a

heater, insulation resistance can go to zero overnight.

"Any time a large- or medium-voltage motor was going to be started after being down for more than 24 hours, an electrician checked the motor's insulation resistance by hand. Making sure the circuit breaker is open and locked out and getting the electrician to the site costs time, dollars, and inconvenience. Eliminating the by-hand megohm readings reduces the electrician's exposure to the motor circuit and the chance of an accident."

A committee of engineers and maintenance people met to study repeated motor problems at the Encina and South Bay power plants. After product evaluations, the committee decided to retrofit all medium-voltage motors

on each unit with the automatic insulation resistance monitors. They also selected five critical 480 V motors on each of nine generating units to receive the automatic devices. Motors for circulating water pumps, hot well pumps, turning gear for turbines, fire pump motors, and service water pumps were deemed critical. Results led to installation of additional testers, one in each motor control panel.

Considering results to date, Eklund says, "While there have probably been a dozen times when the automatic devices have locked out motors, we can't be absolutely certain that each time the motor would have failed if started, or that the old hand-reading method would not have detected the low resistance." But now the monitor-

## HOW AUTOMATIC ELECTRICAL INSULATION TESTERS WORK

The automatic insulation resistance testers monitor either ac or dc rotating electrical equipment. Testers connect to the "B" phase at the motor contactor, or generator breaker, and to equipment ground.

Testers apply a fixed dc test voltage to the winding while the motor or generator is idle. Typical test voltages are 500, 1000, 2500, or 5000 V dc. The voltage selected approximates the full operating voltage for that equipment. The tester measures current leakage to ground, which corresponds to the dielectric strength of equipment insulation. Test current is limited to 350 microamperes to not overstress insulation by prolonged application of full voltage.

A built-in solid-state comparator circuit monitors any leakage current. The tester's fault-alarm trip point can be set from 15 to 50 megohms to suit the application. 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 reset button.

The pre-alarm trip point setting

can be from 0.5 to 30 megohms. It gives advance notice that an investigation by maintenance personnel should be scheduled. However, the motor continues to be available for duty, for the time being, without risk of tripping a breaker or damaging the motor. A pre-alarm is for information only.

Local and remote visual indications of insulation condition are available. Light emitting diodes show motor status. Flashing green shows that testing is underway for an off-line motor. Flashing yellow signifies a pre-alarm condition. Flashing red indicates a fault and activation of an automatic lock-out of the motor-starting circuit. A meter displays the actual leakage-resistance value.

Testers can come with 1 or 2 percent accuracy panel meters. Logging meter readings during periodic testing permits efficient scheduling of the maintenance of critical motors or generators, avoiding expensive emergency repairs and costly downtime.

A self-test/calibrate feature lets maintenance or operating personnel check the testers, quickly confirming correct operation.

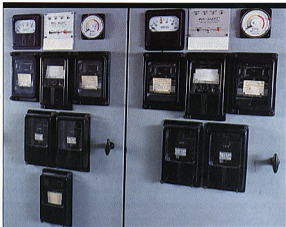
Some motor circuits include

capacitive loads. In these cases, there is no false alarm during the brief period while motor-circuit charging occurs. A momentary time delay allows charging to take place before the tester begins continuous insulation resistance monitoring.

Companies find that motors which operate around the clock also are candidates for automatic insulation resistance testing. Pauses and brief interruptions in operations are almost inevitable. At those times, automatic insulation resistance testers permit quick preventive maintenance checks of insulation integrity from the equipment control panel, reducing the likelihood of unanticipated and costly surprises in the immediate future when motor operation is critical.

Safety is a further benefit. When personnel can test and monitor rotating electrical equipment with such automatic devices, safety is enhanced.

Some 500 V dc models of this automatic tester have scanning provisions. Where scanning is appropriate, one central monitoring unit tests insulation resistance of multiple motors, or generators, sequentially. Scanning rate averages 30 seconds/cycle.



*Automatic electrical insulation resistance testers (top of photo) monitor the critical motors.*

ing is continuous and automatic for idle motors.

The system also works in other applications. "In one instance, there was work going on in the switchgear room where automatic testers are installed. The doors were open overnight so there was moisture in the switchgear. The tester detected it and triggered the alarm because the tester measures the entire circuit," Eklund explains.

Results have met SDG&E's expectations. Maintenance and repair costs are reduced, time is saved, and the inconvenience of dispatching electricians with portable insulation testers has ended. Today, SDG&E has more than 100 automatic testers operating.

*Information supplied by Meg-Alert, Minocqua, WI; (800) 778-5689; e-mail [megalert@megalert.com](mailto:megalert@megalert.com)*

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