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Combo-tool helps water utility electrician handle more tasks

Application Note

Testing Functions **Case Study**

Measuring tools: Fluke 1587 Insulation Multimeter, 62 Mini Infrared Thermometer, i400 Current Clamp, 902 HVAC Clamp Meter

Operator: Karl Smith, water utility electrician for Ward City, Arkansas

Tests conducted: Insulation, resistance Min/Max, voltage, current, frequency

Karl Smith covers a lot of territory. He's the only electrician working for the small city of Ward, Arkansas, with about 3500 inhabitants in the northern end of Lonoke County. One of his many jobs is keeping the equipment at the local water and sewer utility in good order; "I have about 51 motors out there in the field that go between three and 40 horsepower," he says. Some of these are fairly new and some are really old. And we have ten coming on line that are brand new, where we've expanded the system." They're located in 19 different plants up to five or ten miles apart, and have to be kept running 24/7. He also takes care of the controls on the water towers. But that's not all. He's in charge of 20 air conditioning units on various municipal buildings, plus the lighting, including the local ballpark.

Not bad for someone who says he's semi-retired.

The instrument Smith finds most useful is his Fluke 1587 Insulation Multimeter, which he bought as part of the 1587/ET advanced electrical troubleshooting kit that includes the 1587, a Fluke i400 Current Clamp, and a Fluke 62 Mini Infrared Thermometer. The meter itself is rated 600 V CAT IV and 1000 V CAT III, so it can be used on service entrances up to 600 V and on PWM inverter dc buses up to 1000 V. "What I really like about the new 1587 kit is, it does everything I need to do out of one box.," says Smith. He also has a Fluke 902 True-rms HVAC Clamp Meter.

Smith has been in the business for a long time—he got into an industrial electrician apprenticeship program when he got out of the military in 1977—and tends to hang onto equipment as long as it works. He got the 1587, he says, when he couldn't get the hand-cranked insulation resistance tester he bought in 1985 calibrated any more, and the 87 that he bought when it first came out (and is so old that it doesn't have a CAT rating) is now at the city automotive shop. "I let them use it since I got this 1587," he says. At home he has a Fluke 179 DMM.

Like Smith's test instruments, the equipment he maintains is a mix of new and old. "I have equipment that is 30, 35 years old," he says, "sitting right next to control units that are brand new state-of-the-art. I go everything from antiques to modern to state-of-the-art technology, all in one system.

The voltages he has to measure have a fairly wide range. Some of the plants run on 240 V three-phase, some of them on 460 or 480 volts. And the controls on the water towers use dc carried on a dedicated telephone line. "We may be operating a tower using 130 Vdc going through the telephone line to pressure switches to operate pumps that are two or three miles away from the towers," he explains.

"We measure the pressure of the tower outlet to know how full the tower is and when to bring on the pumps," he continues. "At the pump we have a dc power supply with one leg running to the pressure switch through local phone company lines. When the switch is calling, it completes the circuit to a dc relay. That in turn starts the timers for pump control." When something goes wrong, he notes, it's usually open or shorted phone lines, "but I have to prove the problem isn't in our controls before I call the phone company to fix their lines."

Predictive maintenance

Smith believes in predictive maintenance (PdM). "We don't have the option of saying, 'OK, we're going to take this water tower off line for a week and play with the motor,'" he says. "We have be ahead of the curve. I'll tell them, 'We have a problem getting ready to occur at this station, and we get a contingency plan in place so that we're able to keep everything up and running.'" He finds the 1587 very useful for that. "On all my motors and all my pumps I got a baseline log that I put in the computer; it records … the frame number, rpm, service factor, voltage it's running on, the amp draw on a certain date at a certain temperature at a certain psi, the ambient for the motor, the lug temperatures—that's where I use the temperature meter (Figure 1)—and then of course I test the insulation resistance on the motor and on the wiring between the motor starter and the motor." (See Figure 2.)

Smith uses several indicators for checking motors. First is the simple go/no go or pass/fail, but for operational motors he always wants to see at least 50,000 ohms per 100 operating volts. "Any lower that that and it is time to start scheduling repairs," he says. But he also watches for changes in the readings, as part of predictive maintenance. "If I've seen a trend of the resistance dropping (especially a sudden drop) between PdMs," he explains, "I'll start checking the motor much more often."

Many of the motors are submersible, with both motor and wiring under water (generally waste water). "I don't like surprises," he says, "and you get a little water inside one of those things, bad things occur. And that's where that insulation resistance tester is really beautiful, because I can tell instantly whether my resistance is breaking down; and especially with these wet motors, the submersible motors and the submersible wiring and stuff, I can isolate a problem before it does damage."

Smith also does periodic checks on the dry motors that drive the big well pumps and the blowers in the water system. "I will periodically check them as a predictive maintenance, and log in any changes that have occurred. I'll take an amp reading; I'll do an insulation resistance test on the motor and the wiring," he explains.

Compared to the hand-cranking with the old insulation resistance tester he finds the one-button test feature on the combo-tool's remote probe a real convenience.

Figure 1: Using the Fluke 62 Infrared Thermometer during predictive maintenance to check motor lugs at a water plant.

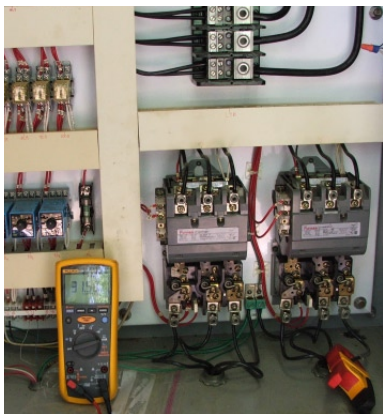

Figure 2: An insulation test using the 1587 on a 25 hp grinder motor for predictive maintenance. "Monitoring the health of our motors using this tool has really cut down time and emergency call outs," says Smith.

The thumb button on the probe initiates the insulation test sequence and applies the test voltage without having to reach back to the meter. "On quick PdM checks," says Smith, "I almost always use the gripper clamp to ground and the probe with the button to test. However if I'm looking for something or have the motor on a bench I'll usually use two gripper clamps so I don't have to hold the probe while working."

He also uses the Model 62 infrared thermometer that comes with the 1587/ET kit to check the windings and connections for heat build-up, "to see if I need to untape any of them and re-torque them, or clean up the wire where corrosion is present." Water utilities use chlorine and caustic soda, both of which can corrode metals. "These infrared meters," he says, "allow me to see inside my wiring harnesses and stuff without having to strip them down every time I go out there." And since it requires no contact, he adds, "I can do test with the power on with a full running load."

Solving the hard ones

Some of the advanced features on his test equipment have helped him solve some difficult problems, Smith says. One involved a motor on a 30 hp booster pump that would trip out from time to time for no apparent reason. It also had a strange vibration and sound, but inspection showed nothing wrong with the bearings. No one could figure out what was wrong with it until Smith hooked up the i400 Current Clamp on his 1587 (Figure 3). Using the Min/Max function, he found that the motor was causing random current spikes. It turned out that the motor had been rewound too many times, and part of the stator was loose. "There's no way you can catch that just staring at it," explains Smith, "because a standard meter display isn't quick enough, but when you turn on that Min/Max, it has a quicker response time, which was helpful in catching that."

The 1587 helped Smith catch another hard-to-find problem on a 15 hp motor. The motor would run normally, but occasionally, and for no apparent reason, trip the main circuit breaker. The insulation resistance function on the 1587 found the answer. "I was turning the armature by hand," he relates, "and I happened to be taking an insulation resistance reading periodically, and all of a sudden it wouldn't build up voltage," indicating s short to ground. It turned out that a blade on the motor's internal cooling fan was bent, "and as that impeller would go around it would just brush the windings." The motor was pulled out and repaired.

Smith's assessment of the insulation multimeter's value for troubleshooting is simple: "For troubleshooting, predictive maintenance, day-to-day field work, go/no go, etc., it is as close to perfect as I have seen."

Smith keeps his 902 HVAC Clamp Meter in his tool pouch and uses it for just about everything when working on A/C units or building maintenance. "I like the fact that it replaced two separate meters," he says, "It's true rms, and has the temp probe as well.

Figure 3: Using the Min/Max and the i400 clamp to catch an intermittent problem on a 30 hp booster pump.

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Fluke Corporation
PO Box 9090, Everett, WA USA 98206

Fluke Europe B.V.
PO Box 1186, 5602 BD
Eindhoven, The Netherlands

For more information call:
In the U.S.A. (800) 443-5853 or
Fax (425) 446-5116
In Europe/M-East/Africa +31 (0) 40 2675 200 or
Fax +31 (0) 40 2675 222
In Canada (800)-36-FLUKE or
Fax (905) 890-6866
From other countries +1 (425) 446-5500 or
Fax +1 (425) 446-5116
Web access: http://www.fluke.com

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