Infrared testing keeps the U.S. Navy under full steam

Application Note

Testing Functions
Case Study

Measuring tools: Fluke 561 Infrared Thermometer

Operator: Leonard Bernard, U.S. Navy, HVAC Technician

Inspections: Infrared temperature of steam systems

From the Smithsonian Institution to the National Museum of Natural History, Leonard Bernard's job takes him to places high on any tourist's itinerary. But for Bernard, it's no vacation. It's a full-time job that's gotten a little easier, thanks to infrared thermometers from Fluke.

While the tourists kick back, Bernard is working full time to save energy at federal government facilities, from the great museums of Washington, D.C. to naval stations. As operations and maintenance project manager for energy service company NORESCO, Bernard is part of a team of 25 HVAC techs devoted to squeezing energy consumption and cost from the operations of 20 buildings and bases.

For NORESCO and Bernard, it's all about energy: helping customers understand where their energy is going, and maintaining, operating and upgrading facilities to ensure that less energy goes to waste. Under the Energy Policy Act of 1992, federal facilities are mandated to reduce energy usage by at least 35 percent from 1985 levels. Recent concerns about high energy prices—the cost of steam has tripled in two years, according to Bernard—and global warming have underscored the value of energy savings.

With limited capital improvement budgets and few energy experts on staff, government agencies have signed Energy Savings Performance Contracts with NORESCO as the best way to achieve energy savings while simultaneously upgrading their energy infrastructure. Money saved through careful system management and maintenance is used to upgrade the energy infrastructure. Those improved, more efficient systems then deliver long term energy savings.

Because he has 20 complex facilities to cover, saving time is almost as important for Bernard as saving energy. At the naval station, for instance, some 20 miles of high pressure steam lines deliver energy from gas-fired steam generation facilities to ships and buildings. Routed through tunnels and below docks or hung overhead, those steam lines must be inspected four times each year. But Bernard has a secret weapon.

All steamed up

Why steam? When you hear a vintage locomotive chuff away with a string of railroad cars in tow, you understand the power of steam. Steam made the industrial age possible, but steam is no antique. Steam drives the turbines in electrical generation plants powered by nuclear and fossil fuels. Steam heats buildings and serves in countless industrial processes. And when the Navy's Nimitz-class nuclear carriers charge into the wind at 30 knots to launch their aircraft, the turbines that drive their propellers with 260,000 horsepower are powered by steam.

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When they return to port and tie up at the docks at the naval station, the big carriers and many smaller ships still need steam to run their mechanical systems. Rather than generate that steam onboard they rely on shore systems to deliver steam at a minimum of 150 psi at the valve where the ships hook up, according to Bernard. Maintenance for those 20 miles of steam distribution lines must take into account the unique characteristics of steam.

Steam moves energy through as both heat and pressure. For saturated steam, the relationship between pressure and temperature is exact: you can look it up using a steam pressure-temperature table. At sea level (atmospheric pressure 14.696 psi, or zero psig), water boils at 100 °C (212 °F). (Because virtually all pressure gauges are calibrated to zero at sea level, the measure psig—pounds per square inch gauge—is used for pressures above sea level.) Steam at 150 psig will have a temperature of 185.5 °C (365.9 °F). Higher pressures = higher temperatures.

It's a great way to move energy, but steam has its peculiarities. Its high temperature and pressure pose a significant safety hazard. And, because chemical reactions such as corrosion accelerate as temperatures rise, system monitoring and maintenance are continuing chores. The lines and pumps at Naval Station Norfolk are built with high tensile stainless steel to minimize problems, but inspection is essential. Not easy, however, especially when steam lines are located in tunnels that require a special confined space permit to enter. The hundreds of steam traps that remove water from the steam lines are a particular maintenance issue, and that's where Bernard has developed a special bond with the Fluke 561 multipurpose infrared thermometer.

Working 'quickly and efficiently'

When working properly, steam traps produce a slight drop in steam pressure and temperature downstream of the trap. Bernard reads the temperatures from a distance with his Fluke 561—no need to get up close with a contact probe. Comparing the upstream and downstream readings gives Bernard a quick indication of whether the trap is functioning correctly. If there's no temperature drop, he schedules the trap for maintenance.

"It's ideal for inspecting steam traps that are located in tunnels or under piers," Bernard said. "Before having the 561, you would need a confined space permit, climb into the tunnel (making sure the tide was out) and inspect the trap and steam system. Now I can get to the side of the pier and using the laser sighting, pinpoint the trap or steam component and verify operation quickly and efficiently."

The Fluke 561 saves more time when Bernard checks the function of HVAC chiller units. "We know what the operating parameters are," he said. "If a chiller should be producing 44 °F water, we can instantly read what it is actually doing." He also uses the Fluke 561 and the Fluke Ti20 Thermal Imager to check electric panels for hot spots that could indicate a high-resistance connection that requires attention.

"Infrared is a very vital part of our tool kit," Bernard said. There is just one minor issue for Bernard's secret weapon.

"The only thing is that the holster looks like a pistol holster," he laughed. "On military bases, the guards always want to verify what I have. I take it out and have it in plain sight approaching a secure location. Keeps my job interesting."

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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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