FLUKE®

Temperature tools give engineering firm competitive edge

Application Note

Although heat is used to create metal, it also has the capability to destroy it. Heat or cool metal too suddenly on a ship's propeller shaft during a weld repair and you risk endangering the crew later on, when the cold water of the ocean weakens the metal and the shaft can become brittle and crack.

Everett Engineering, Inc. in Everett, Washington, routinely performs repairs on ship propeller shafts and other heavy equipment for the mill, marine, manufacturing, construction and railroad industries. This work requires the firm to precisely monitor temperature during repair to ensure that the heating and cooling of metal is done in a gradual manner that protects the integrity of the material. Recently, technicians at the company performed a weld repair on the severely worn bores of a 250-foot long commercial tuna fishing ship rudder.

After a weld repair, the welded metal is naturally different than the surrounding metal. The stress relief process serves to create a consistency in the metal structure.

During a stress relief, control technicians place thermocouples onto the metal using ceramic blocks to maintain appropriate contact. Resistance heat blankets containing ceramic beads are then placed around the welded portion of metal and the thermocouples. Power cords from a heater are attached to the resistance heat blankets as the heating source during the stress relief process. Next, the thermocouples are attached to a Fluke 54II Digital Thermometer and a Fluke 189 Digital Multimeter, which will record temperatures across the surface of the metal.

The measurements are displayed as graphs on a nearby computer screen with the use of FlukeView® Forms software. This gives technicians a "real-time" view of temperature changes.

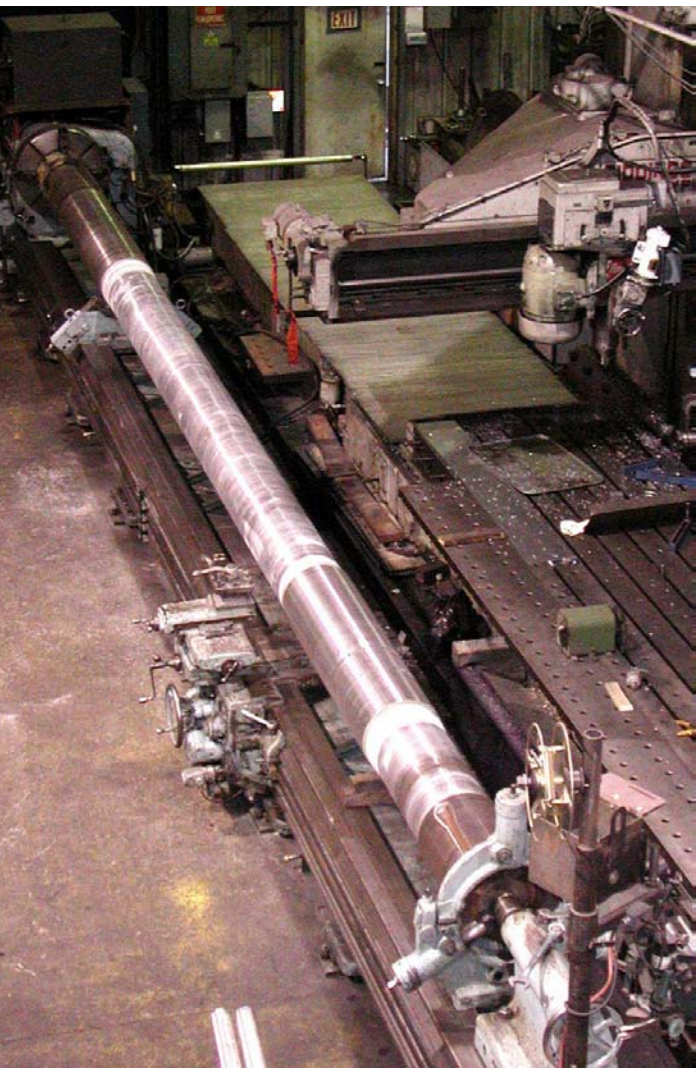
The final step before testing is placing a thick fiberglass blanket around the metal to prevent heat loss. Technicians then gradually heat the metal to about 1,175 degrees Fahrenheit over eight to ten hours. Once peak temperature is reached, it is maintained for a set period of time defined by the thickness of the weld. The metal is then slowly cooled down to ambient temperature. Temperature changes during both heating and cooling must be carefully controlled. If temperature change occurs too quickly during hourly intervals it could cause the metal to become distorted and later develop cracks that may lead to rudder failure, leaving the boat with no directional control.

During stress relief, technicians constantly watch the graphs rendered on the PC screen by FlukeView® Forms to insure temperatures stay within the parameters of safe stress relief.

"Being able to watch these three points of contact closely allows us to control the heat a lot better than if we didn't have those meters in place. As a result, we're able to make fine adjustments to our heater," said Paul Visocky, head electrician and quality control manager at Everett Engineering. "Monitoring the temperatures of repaired maritime machinery is much more efficient with these tools."

After a welding repair, it is essential to perform a stress relief to maintain the integrity of the steel.

Everett Engineering uses the Fluke 189 DMM because of its temperature capabilities. It offers a vital third point of contact during temperature monitoring when conducting stress relief. What's more, the Fluke 189 offers versatility for Visocky's crew, both to



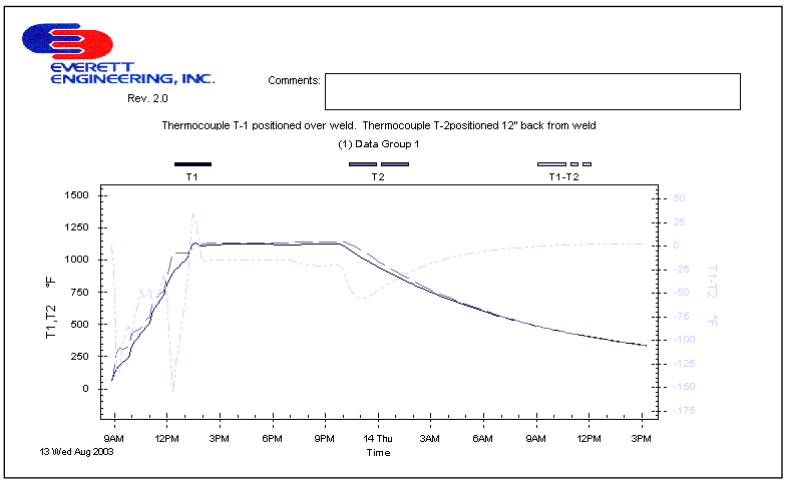
A large propeller shaft before a stress relief and after a weld repair.

conduct load testing—which gauges the pulling capacity of tugboats, for example, and to measure voltage on computers and other equipment.

Having the option of downloading their temperature readings onto a PC saved the company nearly a week of labor as they were able to adjust heat machine temperature settings immediately.

"Just being able to view the charts to show what the temperature is doing and being able to see how fast the rate is changing, really allows us to do troubleshooting right there on the spot," Visocky said. "Without these meters and FlukeView Forms software, we would have had to manually adjust the settings, and that would have taken a lot more time."

Accessing this valuable documentation is a simple process that calls for connecting the optical sensor cord from a meter to the serial port in the PC. It takes anywhere from 30 seconds to 2 minutes to download the data onto the PC.



Documentation of weld repairs is required to comply with American Bureau of Shipping (ABS) certification. Before Everett Engineering could become A.B.S. certified, it had to acquire the capability to thoroughly document its welding repairs. Specifically, it had to provide reports and graphs detailing the heating and cooling process during stress relief tests to ensure temperature changes stayed within regulatory boundaries.

Now that Everett Engineering is A.B.S. certified, they are required to document all their carbon and stainless steel shaft weld repairs. FlukeView Forms provides the critical tool for their control engineers to meet these strict accountability requirements.

And, having access to these technology-rich products enables Everett Engineering to bring an added dimension to their business. Because they can also document their weld repairs, Everett Engineering is able to take on more demanding projects.

"As of right now, we are one of very few companies in the Northwest that can do repairs to A.B.S. certified shafts, and having FlukeView Forms was pivotal in giving us that capability," Visocky said.

Fluke. *Keeping your world up and running.*

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