



Miller's ProHeat™ 35 Induction Heating System Improves Preheat Time and Quality, Improves Productivity for Mechanical Contractor

Mechanical Contractor Heats it Up with Induction Heating

By Steve Latvis, Miller Electric Mfg. Co.



With an induction heating system, heat is created electromagnetically in the pipe wall rather than by surface heating, as is done with an open flame or resistance heating. Topp's Mechanical uses Miller's ProHeat 35 Induction Heating System.

Topp's Mechanical of Tecumseh, Neb. cut its teeth fabricating pressure vessels, process piping and support structures during the ethanol boom of the 2000s. A family-owned business, the company got its start when George Topp and his son Luke joined forces to build a full-service mechanical

contracting operation that excelled at both in-shop fabrication as well as field construction.

As its business diversified, Topp's Mechanical earned certifications with ASME and NBIC, and now holds an impressive series of code stamps—including "U", "NB", "R" and "S"—that signify its growing expertise and its demonstrated ability to meet the high standards of the industry's governing bodies. As its capabilities have expanded, Topp's Mechanical has consistently explored new techniques and practices to meet the quality demands of its customers. Like any business, it has also looked for new ways to improve productivity and safety. Specifically, Luke Topp and Dave Johnson, quality control manager, Topp's Mechanical, were looking for a more practical way to conduct pre- and post-weld heat treatment on the various vessels, structures and piping it fabricates every day.

Through induction heating Topp's Mechanical has found a solution that meets and exceeds the quality standards of its heat treatment applications while also providing strong operational benefits including:

- Faster time-to-temperature
- Consistent heating throughout the entire part
- Easier to apply/wrap heat
- Greater reliability and lower consumable costs
- More efficient use of labor
- Improved safety for employees

An Introduction to Induction Heating

While visiting ConExpo almost four years ago, Topp and Johnson watched a demonstration at Miller Electric

Mfg. Co.'s booth on induction heating. Johnson explains, "the Miller representative flipped on a machine and said 'I'll have this pipe up to 1,100 degrees in just a couple of seconds'. We didn't believe him – there was no way that could happen. But, we looked inside that pipe and it was glowing red, and sure enough he had that temperature up so fast that we were amazed."

Topp and Johnson quickly realized the significant advantages of this system for their work and purchased Miller's ProHeat™ 35 induction heating system. "There was the obvious speed increase – what would have taken us hours to heat up is done in minutes now. The set-up is so much faster too," says Topp. "You can heat the entire pipe at once and it's consistently hot all over, there are no cold spots. It's so much safer. It's cheaper to run than our other methods (flame or resistance heating), we don't have as much propane or oxyacetylene costs and we use less electricity. However, the best advantage is the increased weld quality we achieve. Because we can maintain a consistent temperature throughout our welding process, we keep the moisture out, and our welds don't crack or warp."

How Does Induction Heating Work?

With an induction heating system, heat is created electromagnetically in the pipe wall rather than by surface heating, as is done with an open flame or resistance heating. Heat is induced in the pipe by placing it in an alternating magnetic field created by the water-cooled induction heating cables. The induction cables are wrapped around the pipe and do not heat up themselves, but create eddy currents inside the part, which generates heat.



After bringing the header up to temperature, welders place a TIG root in the o-let.



Topp's Mechanical has built custom jigs that allow for the header to be set right on top of the induction cables. This helps heat the piece from the bottom and minimize wrapping time.

The process is safer, faster and easier to use than other heating methods and typically provides more uniform heating throughout the part.

When Topp's Mechanical first purchased its induction heating system, Johnson and Eric McDonald, induction heating technician and maintenance electrician, Topp's Mechanical, spent a lot of time experimenting with different applications and testing the system's performance. "We played with different ways of wrapping the pipe," says Johnson. "We also found that we not only needed to change the kilowatts for different applications, but also the ramp-up times. Just because the machine will ramp-up the pipe to 600 degrees in a certain amount of time, doesn't mean you really have to, or want to. Sometimes a little slower ramp-up works a lot better."

"We did a lot of side-by-side testing with resistance heating," says McDonald. "We found that we could actually see cold spots – where the pipe was hotter in one area than in another – on the pipes using resistance heating. But the induction heating system produces a consistent heat band. And, you could monitor the temperature so much easier. You can put two TCs (thermocouples) anywhere you want on the pipe and still be assured that the entire surface gets the same amount of heat."

A Practical Use of Induction Heating

Topp's Mechanical has welding procedures that allow them to weld up to eight inches thick. The company has built tanks that are 131-feet tall and 10-feet across and some that are even bigger. Working on the large vessels and thick pipes is where the induction heating system really makes a difference in time and money. Although much of its work requires pre-heat temperatures of just 200 degrees and post-heat temperatures (hydrogen bake-out) of 500 or 600 degrees, the company has required and reached stress relieving temperatures of 1,409 degrees for projects using P5B – and the induction heating system worked very efficiently.

One of Topp's Mechanical's current projects is for a company in Idaho that requires welding o-lets on 32 P1 carbon pipe headers approximately 10-feet long. The process includes a TIG root, then two Flux-Cored passes with a gas-shielded wire, and then sub-arc for the fill and cap. Rather than wrapping the coils on the pipe, the company has built custom jigs for the induction coils to lie in. This allows for the headers to simply be set within the jig and eliminates the time associated with wrapping the headers in induction coils. The machine is set to heat the header at the bottom, which brings the weld-o-let joints at the top of the assembly to the desired 200 degrees. Insulation blankets are wrapped along top to keep heat within the header and



Once the TIG root is placed, welders switch to a gas-shielded Flux-Cored wire before eventually switching to sub-arc welding.

protect welders from the heat coming off the raw material. Johnson and Topp estimate that they save 25 to 50 percent in time using the induction heating process in this application versus their previous heating option.

“Our guys are knocking out these pipes with 10 inch welds in about an hour,” says Johnson. “The great thing is that if the guys still have 15 more welds to do on a piece and the day is done, we can keep the ProHeat running all night and it will keep the piece at 200 degrees. Then the guys can pick right up again in the morning – with no sacrifice to the weld quality.”

The ability to maintain a constant temperature is critical. “With the way the holes are cut in the top of the header, you don’t want it to fold in on itself (lose its shape) because of the loss of material,” says Johnson. “Until we get that material back in there and reestablished, we think with keeping heat and pressure on it, we can prevent it from doing that.”

Johnson estimates that induction heating saves his company days worth of work on this project alone.

“We’ll do this project in about 10 weeks or less,” he says. “(Resistance heating) would add 2-3 days to the process just because of the time it takes to heat up. I don’t know that we would be able to build a jig like we’ve done with induction heating and be able to change the headers out at will. It’s so much quicker, it’s unbelievable.”

He estimates propane heating would be even less effective.

“Heating a thick piece of pipe with a propane torch takes a long time,” he says. “You’d have a guy standing there with a torch, he’d heat up right around the area that was to be welded. With this application (of induction heating), the whole piece is going to be up to temperature, you’ve driven out all of the moisture, and you’re going to have a better weld.”

Induction Heat Means Cool Savings

In addition to the superior weld quality that is achieved by using the induction heating system for pre- and post-weld heat treatment, Topp’s Mechanical also realizes other advantages. One of its previous heating methods involved using propane torches which burned approximately 500 gallons of propane (currently about \$1.50 wholesale) every two months. This cost has virtually been eliminated. Ceramic tiles used in resistance heating burn up and wear out. With its Miller ProHeat™ 35, Topp’s has decreased these consumable costs – in fact, the company is still using the original cables that were purchased with the system 4 years ago. Johnson also believes that on many projects it has reduced electrical costs by half.

“The time that it takes to heat up a thick piece of pipe has decreased from hours to minutes,” he says. “So, we know our electrical costs are decreasing at a comparable rate. We also have smaller power sources, smaller cords, and less to carry around than we did with our resistance system.”

Topp’s has seen improvements in how it allocates its labor based on the more efficient system. “We used to have to pay a guy simply to stand and monitor the temperature of the pipe,” says McDonald. “Now the guys can monitor the temperature, and do their other jobs. Also, I know we’ve had guys standing with a propane torch for 40 minutes trying to get the piece up to 400 degrees, especially if we were outside dealing with weather issues. Now it takes 15 minutes to heat the pipe and our guys are welding and getting the job done.”

Westermans International Ltd - Groby LE6 0FS
E: welding@westermans.com W: www.westermans.com



MillerWelds.com

259656

