



# Technology creates new efficiencies in refractory, welding

If we learned anything from the labor crunch caused by the record number of refinery shutdowns and turnarounds this past summer, it should be that we need new technologies to improve productivity. Fortunately, recent innovations in refractory and welding are having a dramatic and positive impact on schedules.

## Precast shapes in less than an hour

Making precast refractory shapes traditionally requires fabricating wood or steel forms, which take days or weeks to build. If no blueprints exist, the process takes even longer. Digital solutions are changing this scenario.

To start, portable 3-D laser scanners can scan complex shapes, including burner tiles, tunnel covers, lintels, peep sights and other refractory elements, in seconds. When paired with CAD-CAM software, the entire process of creating 3-D renderings can be completed in hours.

Next, the design file can be fed into a computer-controlled forming machine, which can produce a refractory shape in less

than an hour — even when it is very detailed and large. This frees scarce labor for other tasks, such as running digitally controlled refractory anchor welding systems.

## Combating the welder shortage

According to the American Welding Society (AWS), the industry predicts a shortage of 450,000 skilled welding professionals by 2022, which could present a real challenge when shielded metal arc ("stick") welding is required on refinery projects. But fortunately, now we have an alternative: computer-driven stud welding systems.

These innovative welding systems don't require qualified welders because operating simply involves putting the anchor in the right spot and pulling the trigger. Contractors can train any available labor for the task. In addition, the process is up to 800-percent more productive. A two-person crew can make 2,600 stud welds in 12 hours, whereas it would take 16 people to achieve the same results using conventional technology. Finally, state-of-the-art stud welding systems reduce the error rate to

0.5 percent because they incorporate feedback loops that monitor and adjust welding output to ensure consistent fusion. (Older stud welding systems can have an error rate that exceeds 10 percent, which is why some contractors shied away from them.)

Digital systems are fully programmable and easily adjustable, providing the flexibility to accommodate thinner shell linings as well as different materials and types of refractory anchors. In addition, new anchor designs can reduce the required number of anchors by 44 percent, compared to hex mesh anchors, while also improving refractory abrasion resistance.

As an added benefit, modern stud welding systems can eliminate the need for respiratory protection and ventilation during welding. They generate as little as 0.059 micrograms per cubic meter of hexavalent chromium, far less than the permissible exposure level of 5 micrograms per cubic meter.

## Proven success

Computer-controlled stud welders

demonstrated their efficiency at a Houston refinery this past summer when a planned furnace repair project turned into a complete reline. The scope expanded from 4,000 to 14,000 square feet and a total of 244,000 anchors; crew size went from 37 to 137 workers per shift. Using digital technology and new anchor designs, the turnaround was completed in six weeks. To accomplish the work using stick welding would have required a shift size of 155 to 160 people — if those additional welders could even be found during peak season — and would likely have added five to eight days to the schedule.

Precast refractory shapes, computer-controlled stud welding systems and new anchor designs are just a few examples of how new technology can transform jobs and enhance safety and productivity. If you want to increase efficiency on your next turnaround, it would be worth your while to check them out.

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