Leaner and Greener

MINNESOTA SHOP FOCUSES ON LEAN MANUFACTURING, ENERGY CONSERVATION

By Jim Destefani
Editor

Ted Schreyer, VP of Operations at Associated Finishing Inc. (AFI), sums up business conditions for the paint and powder coating shop with a brief history lesson.

"Our biggest customer three years ago got so big they actually put in their own finishing line," he recalls. "Our biggest customer two years ago went offshore—took their parts to China. Our biggest customer last year is now looking at doing the same thing.

"Not only that, but maybe 10 years ago you had two weeks to turn a job around," continues Schreyer, a 30-year AFI veteran. "Now it's more like two days if we're lucky. So we have to be good at short runs and quick changes."

Those realities helped shape the operating philosophy of AFI, which started life in 1965 as a project engineering firm. Contract finishing had evolved into the company's main revenue source by the early 1970s, and AFI now specializes in providing fast turnaround on both liquid and powder coating jobs.

"Our twin themes are lean and green," Schreyer says. "We've had a lean manufacturing initiative going for the past three years, and our other focus has been on reducing energy costs."

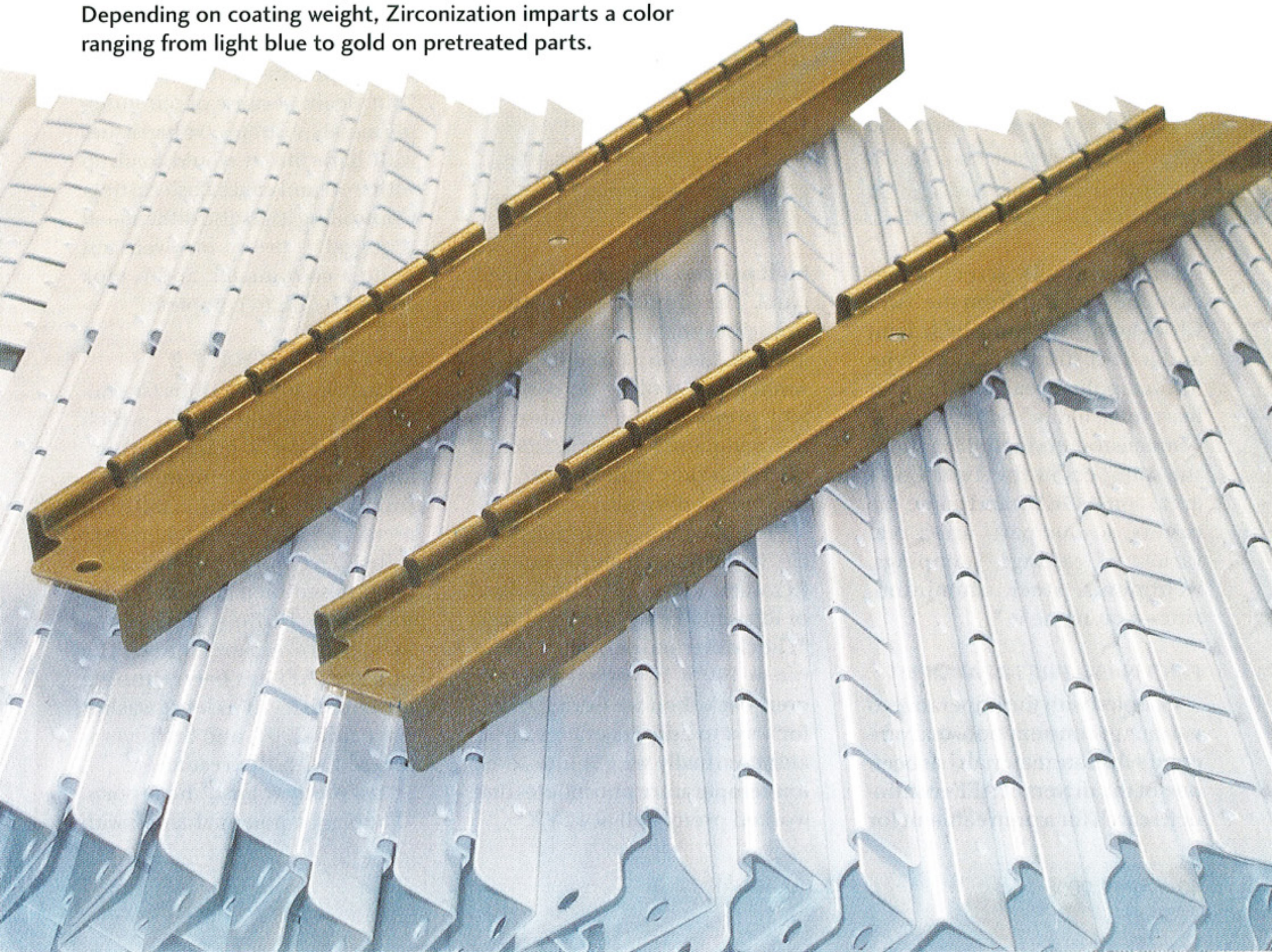
Evidence of the lean manufacturing program, including 5S organizational tools and visual manufacturing boards, is apparent throughout the shop. Less obvious are the improvements AFI has made to reduce its energy costs and improve energy use flexibility. "We put in a backup generator to cut electricity costs and a backup liquid propane system to reduce natural gas costs, and they've allowed us to cut utility costs pretty significantly," Schreyer says.

"For the LP system, we have an 18,000 gal LP tank and a vaporizer to convert it from liquid to gas," explains facilities manage Kelly McCabe. "All our equipment can run on either natural gas or LP, so our gas provider can turn us off any time they want. They like that, so we get a better rate.

"It's the same thing with the electricity. We installed a 500-kW generator and we can be taken off the grid at any time, so we pay a lower rate."

The result of these initiatives has been annual energy costs savings of 15–20% for the 34,000-sq ft shop, which also provides contract stripping

Depending on coating weight, Zirconization imparts a color ranging from light blue to gold on pretreated parts.



About the Chemistry

Zirconization is a pretreatment process that combines low-temperature cleaning technology, transition metal formulation and rinse water quality maximization to minimize the need for process heat, eliminate phosphates, reduce cleaning system maintenance and maintain or improve product quality.

According to developer DuBois Chemicals, transition group metal such as zirconium have chemical properties similar to chromium but do not have the environmental and worker safety issues surrounding that metal. The company says fluoro-based acids have been used for aluminum pretreatment for decades. However, using similar chemistries to treat parts produced from steel and other metals resulted in unstable baths, rusty parts and lower corrosion resistance less than iron phosphate.

Improvements in transition metal pretreatment formulations resulted in introduction of several phosphate-free market. The chemicals tended to be corrosive to mild steel washers, were relatively sensitive to water quality variations and resulted in parts that were susceptible to flash rusting after treatment.

DuBois says Zirconization uses a blend of additives and accelerators to help promote rapid, tight coating formation on parts while minimizing sludge creation and flash rusting. Typical use concentration in Zirconization is 1–5%— similar to conventional iron phosphate—and the company says some users have had success with concentrations as low as 0.5%.

Bath pH should be maintained between 4 and 5, and adjustments can be made from any common alkaline source such as potassium, sodium, or ammonium hydroxide. The bath will form a coating at temperatures from ambient to 115°F, although running at a slightly higher temperature will result in higher corrosion resistance, according to the company.

services and silk screening to customers mainly from the Twin Cities area. "We run a 53-ft semi and a 24-ft straight truck to the Minneapolis area and back at least once a day," Schreyer says. "Our customers include many of the stampers in the Twin Cities area, some OEMs and some die casters, so our parts are a real variety of castings, stampings, weldments, steel, aluminum, zinc—you name it."

FOCUS ON PRETREATMENT

Coupled with the imperative to cut energy consumption, that variety of substrate materials has been one of the drivers of AFI's continued search for a pretreatment for both painted and powder coated parts. The company ran standard iron phosphate for many years and still does on a three-stage belt washer. But settling on cleaning and pretreatment chemistry in the company's larger washer, a fiberglass unit built in 1997, has been more difficult.

"Ten years ago, we ran a cleaner, city water rinse, iron phosphate, RO water rinse, and a seal rinse or RO water rinse," Schreyer says. "The cleaner and phosphate stages ran at 140°F. It worked well, but even back then we were looking for ways to address energy costs, and eventually we got into some low-temperature phosphates that worked pretty well at 120°F.

"We also tried polymeric sealers, and we tried silanes," he continues. "But silanes tend to be pretty specific to the metal and coating type you're using. We're a job shop and we run a lot of different substrate materials and coatings, so that didn't work out very well for us."

The search for a phosphate alternative gained urgency when the city of Mankato instituted a surcharge based on the amount of phosphate AFI was purchasing. "Minnesota being the Land of 10,000 Lakes, and with so much agricultural runoff of phosphate fertilizers, there's a lot of concern here about eutrophication and other effects," Schreyer explains.

Finally, in 2006, AFI tried one of the new, non-phosphate, nanotechnology-based pretreatment formulations based on transition metal chemistry. "You didn't have to heat it, it didn't sludge, and it worked pretty well," Schreyer says. "But, again because of our multiple metal substrates, we had issues with bath life. It would load up with iron and cause flash rusting. Controlling it was also difficult—it required a pretty involved test using a colorimeter, and it took about 20 min to complete."

NANOTECH, PHASE 2

Early in 2007, DuBois Chemicals (Sharonville, OH), which had been AFI's main pretreatment supplier for many years, rolled out its own transition metal pretreatment chemistry called Zirconization (see sidebar). Based on a good relationship with DuBois representatives, Schreyer agreed to try the product. AFI has been running the chemistry in its large washer since mid-2007, and Schreyer is pleased with the results.

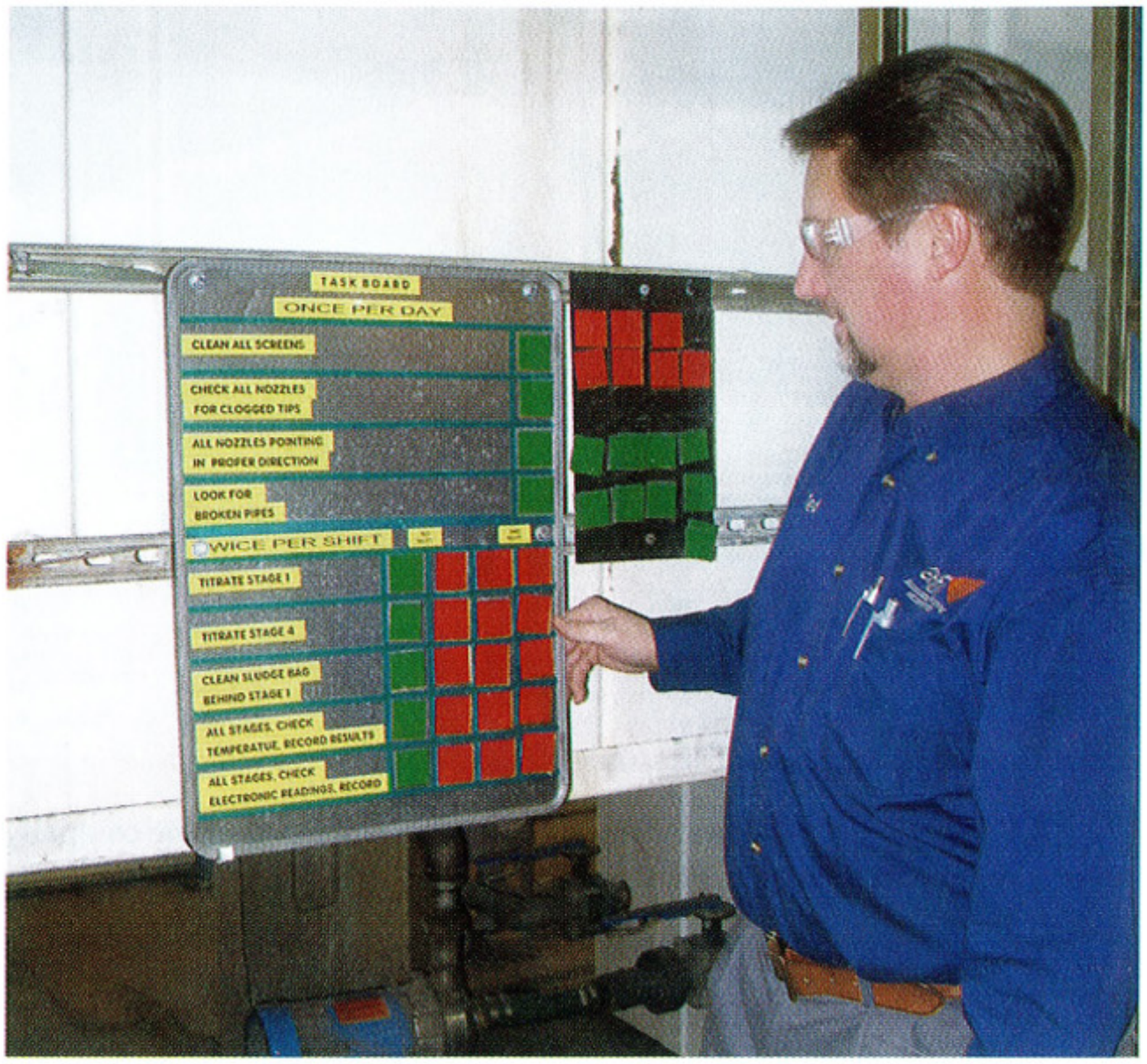
"It's pretty robust," he reports. "The biggest potential issue is with

flash rust. If you have parts in the washer and the line stops, you will have rusting. So it's sensitive to slow-downs or stoppages."

According to Schreyer, both the cleaner and the pretreatment run very well at low temperatures. "We run it between 85 and 100°F, but we can go higher as well," he reports. "We get good clean parts. We do a lot of water break testing, mainly because I have a hard time believing it cleans as well as it does at those temperatures.

"We actually have to change the temperature control on the cleaning stage heater, because right now the control we have on there bottoms out at 120°F," he continues. "We're manually turning it off and on to keep the temperature down. The Zirconization actually likes things cooler, because you don't want parts to dry off between stages."

Schreyer says the product also has other advantages compared with the previous nanotechnology pretreatment. "The DuBois product has a better concentration, so I'm using less," he says. "There are additives that allow it to be controlled using a normal titration, so I can test it in 30–40 sec."



AFI VP Ted Schreyer examines a task board that provides quick visual confirmation of needed checks on the pretreatment line.

AFI's main cleaning line now consists of five stages: cleaner, city water rinse, reverse osmosis (RO) water rinse, Zirconization and RO rinse. Concentration in both the cleaner and pretreatment stages is 2%, and the system usually requires only 1–2 gal per day of makeup. "Shops that run higher line speeds might run higher concentrations, but our philosophy is based more on part density on the line and quick changeovers," Schreyer explains. "Our line speeds run 3–5 fpm. Many shops would say that's slow, but it saves a lot on utilities and floor space."

That approach also dovetails well with AFI's other equipment, which includes multiple manual paint and powder booths, batch curing ovens and a 75-ft U-shaped main oven that uses convection with an IR boost to provide curing temperatures to 400°F. "Our specialty is short runs, so we don't get the big orders that allow us to set up automatic guns and things like that," Schreyer says. "We do color changes usually in less than five minutes depending on the color. From a black to a black, for example, we can be ready to go in less than a minute."

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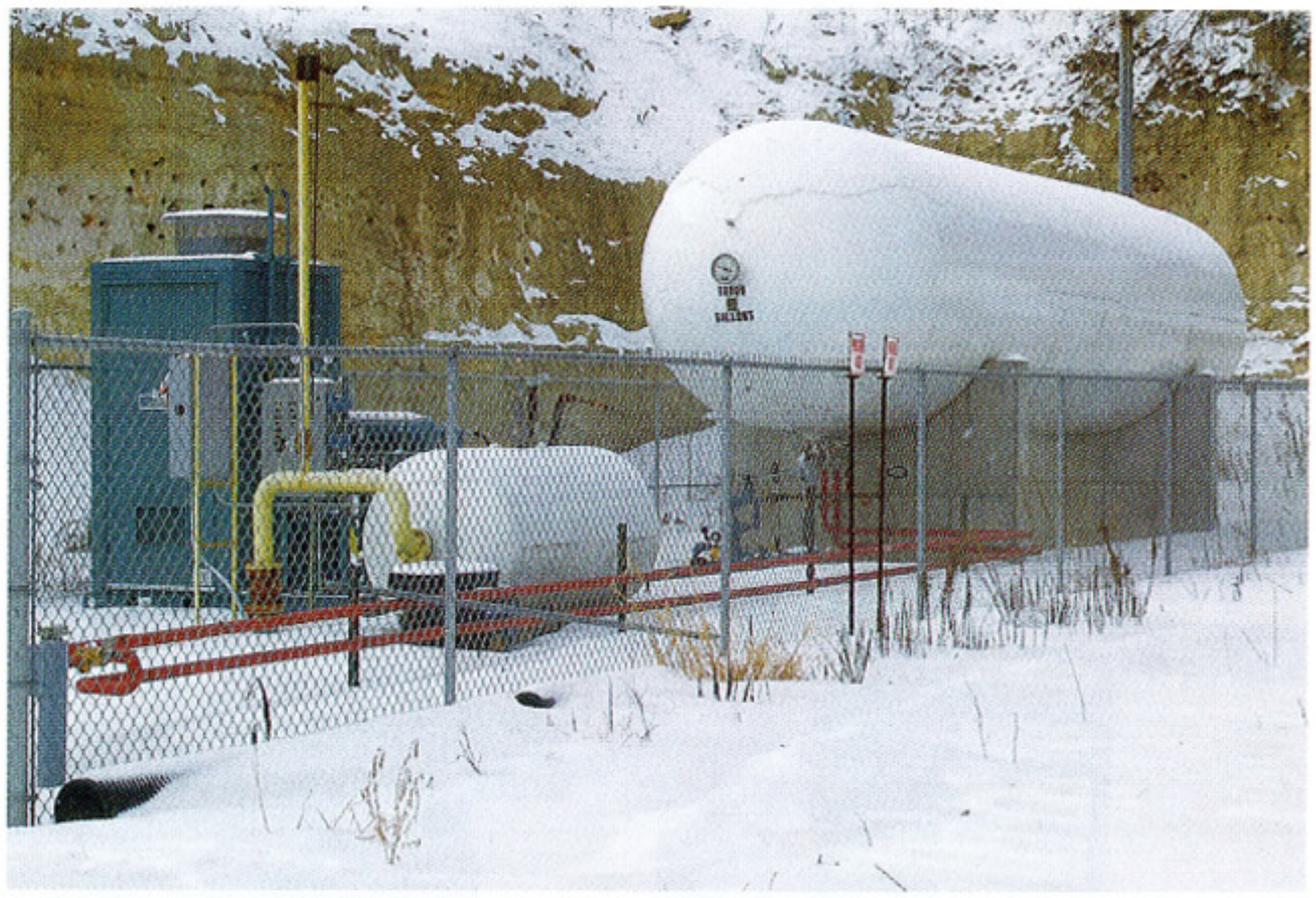
REDUCED MAINTENANCE

According to Schreyer, the new pretreatment also has fewer maintenance requirements than previous systems, and provides product quality equal to or better than conventional iron phosphate. Daily maintenance consists of checks of cleaner pH and rinse water conductivity once per shift and titration of the pretreatment tank at least once per shift.

"We control conductivity in the third stage rinse water pretty



This 18,000-gal LP tank allows AFI's natural gas provider to shut the company off at any time, resulting in substantially lower gas costs per therm.

Lean Manufacturing at AFI

Associated Finishing has been involved with lean manufacturing for about three years, when several managers attended a training session. "We decided right away that the only way lean would work is if we could make it sustainable," recalls process engineer Alan Baer, who spearheads AFI's lean efforts. "It's a real culture change. You don't just call a meeting and say, OK, we're going to be doing lean manufacturing now."

One way AFI keeps things moving forward is with regular meetings of a steering committee, which evaluates possible projects based on input from employees. The program has resulted in several operating improvements, according to Baer.

"On the main line, we developed a spreadsheet that lets supervisors play 'what-if' with racking, line speed and other process parameters," he explains. "Basically, it lets us know in advance how much money we'll make if we run a job a certain way."

Another success is the company's in-house inspection training program, which has been running nearly two years. "It's a home-grown program that people did on their own time, and it results in a pay increase for people who complete it," Baer says. "We've now got about 35 people trained.

"At the start of each job, we hang a paint coupon. It's the first thing that comes off the line, and our inspectors check coating thickness, adhesion, color and other attributes. Then we send the coupon and a certification to the customer and record results in a database. The first year, customer rejects went down 56%, so it was substantial."

Another lean manufacturing project just getting off the ground is a focus on preventive maintenance, according to Kelly McCabe. "I'm currently working with a computer program to minimize unplanned maintenance, reduce downtime, and cut our maintenance costs," he says.

closely," Schreyer explains. "If it gets much above about 200 ppm total dissolved solids, we add water. Temperature control is also important, especially in the summer. So we monitor and record pH and temperature for the cleaner stage, conductivity in second and third stages, titration and pH for the fourth, and conductivity in the final rinse.

"We dump stage four about every two months, and that's worked well," he continues. "The big benefit there is, there's really no sludge in the tank—just a little bit of residue that rinses out. The chemistry also reduces scale in the washer and clogged nozzles."

As always, the bottom line is the bottom line. "It used to cost us about $55,000/yr to run iron phosphate, including chemicals, utilities and maintenance costs," Schreyer says. "We're estimating the Zirconization process is going to cost us about $22,000 annually. That's a substantial savings."

For more information on Zirconization pretreatment from DuBois Chemicals (Sharonville, OH), phone 513-326-8800 or go to www.pfonline.com.

For more information on paint, powder coating, stripping and other services from Associated Finishing Inc. (Mankato, MN), phone 507-345-5861 or go to www.associatedfinishing.com.

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Pretreatments: The Next Generation

This article describes one shop's experience with a nanotechnology pretreatment chemistry. To find out more about how these pretreatments are formulated and their benefits, read "Pretreatment: The Next Generation" at:

pfonline.com/articles/070702.html