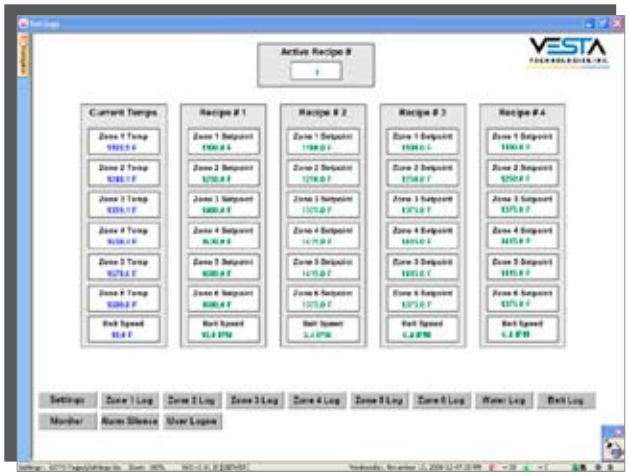
Case Study: National Rivet

National Rivet & Manufacturing Company won World War II: Virtually every aluminum rivet on U.S. aircrafts came from the Waupun, Wisconsin-based company, which conducted all of the final sorting and much of the heat treating and finishing on the rivets. The fourth-generation, family-owned company began manufacturing fastening components for brake linings and eventually expanded its offerings to include applications that range from very low-tech—such as brass rivets for a horse harness—to very high tech, including precision electronics, appliances, automotive, furniture, consumer products, recreational vehicles and aerospace; in fact, the company's rivets were featured on the Apollo spacecrafts.

One of the most extensive cold heading manufacturers in America, National Rivet does annealing, a treatment that uses both heating and cooling to produce metal that is softer, relieves internal stresses and improves the cold-working properties of each rivet. When the system that operated the company's annealing furnace began to fail, there was no viable replacement or technical support for it, so National Rivet sought an entirely new solution from Trend Control Systems, installed by Vesta Technologies Inc.



Trend's 963 Supervisor Server software enables National Rivet technicians to monitor and control up to four recipes at a time for the countless types of rivets the company produces.

Every manufacturer is held to exacting standards for the calibration and repeatability of their manufacturing process; with annealing, National Rivet is held to even higher standards. The annealing furnace's conveyor belt takes the rivets through six heating, one air cooling, and seven water-jacketed cooling zones for a total of 14, each zone timed to the exact second for treating the rivet. A series of solenoids and a vacuum pump allows the Trend system to

The annealing furnace at National Rivet & Manufacturing Company comprises 24 separate electric heating elements—with temperatures reaching as high as 1650 degrees F—all controlled by a Trend IQ3 system with pinpoint accuracy.

sample the dew point from five key areas during the process. This, combined with individual modulating control of the 24 electric heating elements and conveyor belt speed, provides unmatched control of the annealing process.

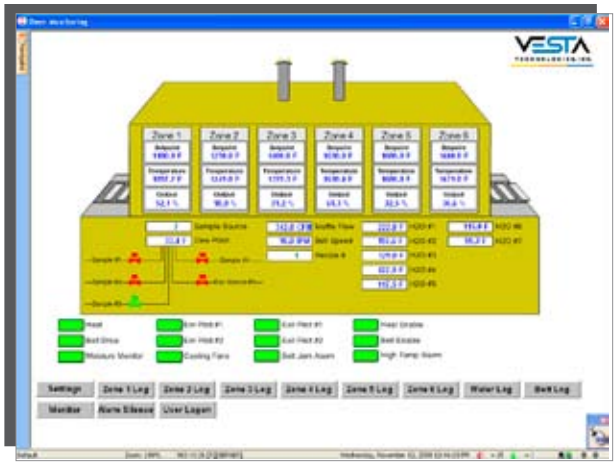
Metallurgy requires a great deal of atmospheric control, with oxygen being the greatest threat to the integrity and look of the finished product. Oxidation causes metal parts to blacken, which must be removed with acid that can attack the base metal and create pits in the product. Monitoring and controlling the ratio of gases, therefore, was critical not only for product quality, but for workplace safety as well, since many of the gases are combustible.

Sampling the dew point—the temperature at which water vapor condenses into water—is critical in heat-treating metal. The dew point is an excellent indicator of oxidation: The lower the dew point inside the annealing furnace, the less oxygen there is and, subsequently, the better the look and quality of the metal product. The new monitoring system would need to be able to sample the dew point during the annealing process and provide accurate, real-time data.

National Rivet had another, two-part requirement of its new system. First, with so many different temperature profiles for the wide variety of rivets it manufactured, the company had to be able to make quick changes to the annealing furnace's speed and temperatures.

"Almost all our products are customer application-specific—we make 3,400 rivets for 1,400 different customers—so versatility is important to us," said Drew Zeratsky, vice president of operations.

6670 185th Avenue Northeast, Redmond, WA 98052 USA • Tel: 425.897.3900 • Fax: 425.869.8445 • ttc.trendcontrols.com



National Rivet programmed 963 to monitor and control temperatures in the six heating zones of its annealing process.

Second, the new system would also need to integrate, monitor and control other building systems, such as heating, ventilating and air conditioning (HVAC).

Finally, the company needed to avoid any downtime during the retrofit of its new system. That meant minimizing shutdowns during installation, commissioning and maintenance.

> *Being able to control processes, do it at a reasonable cost, in a timely fashion, and enjoy the quality of control that we now have was way beyond our expecations.*
>
> *Drew Zeratsky,*
> *Vice President of Operations*
> *National Rivet & Manufacturing Company*

Vesta Technologies installed a Trend system that entirely replaces the failing, oudated PLC, and effectively monitors the heating and cooling zones inside National Rivet's annealing furnace. The system includes one Advantech panel mounted touchscreen running Trend's 963 Supervisor software as the front end, one IQ3xcite controller with seven expansion modules and 13 Omega TX13 thermocouple transmitters.

A variable speed DC motor drives the conveyer belt through the furnace. The end of the motor shaft is fitted with a sprocket that triggers a proximity switch each time a tooth of the sprocket passes by. The Trend system utilizes this pulse train in conjunction with the DC motor to precisely control the rate at which that product moves though the furnace. Technicians can simply program the desired feed rate through the touchscreen HMI. If the conveyer belt jams, the technicians are given an audible alarm and the belt is disabled.

To eliminate oxidation, National Rivet operates an atmosphere generator that burns natural gas to create rich exothermic gas. Exothermic gas contains a mixture of carbon dioxide, carbon monoxide, methane, hydrogen and nitrogen, which are used to prevent oxygen from entering the furnace. Vesta Technologies integrated the Trend system with the generator to monitor the gas flow inside the furnace, where temperatures reach between 950 and 1650 degrees Fahrenheit. Pinpoint accuracy guarantees the metal retains the structural properties required for each rivet and maintains the safety of the facility and staff.

Vesta Technologies also programmed the Trend system to sample the dew point from the five ports along the conveyor belt during the annealing process. Using the graphic displays on the 963 Server software, a technician can select any one of the ports with a single screen touch and take a sample from the dew point sensor to determine if any unwanted oxidation occurred.

For National Rivet, the most important outcome of retrofitting the system that controls their annealing process is a solution that has already exceeded expectations and will last as long as the company needs it. With Web access, technicians can also remotely monitor and troubleshoot the system.

The Trend system delivers such precision control that there is virtually zero variations in the annealing furnace's calibration—a vital requirement when dealing with extreme heat and combustible gases.

"The equipment calibrates much closer than it ever did before," Zeratsky said. "It's nearly to the point of perfection."

When its old system failed, National Rivet faced a lengthy manufacturing shutdown. By installing a Trend system, the company was able to replace a failing system and update several other operating systems in one fell swoop.

"Had we not found Vesta with their Trend solution, the work would have meant a two-week interruption," Zeratsky said. "Instead it was a day and a half."

Project Scope

- 963 Server Supervisor software
- 1 IQ3xcite expandable controller
- 7 IQ3xcite I/O modules
- 1 panel-mount computer with touchscreen interface
- 13 Omega smart thermocouple transmitters