

# Anodizing Line Produces CONSISTENCY and FLEXIBILITY at Pioneer

**P**ioneer Metal Finishing is a diverse finishing job shop with a mission that matches its name. Founded in Minneapolis, the company originally provided hardcoat and sulfuric anodizing, acid etch and bright dip services for large-volume OEMs throughout the upper Great Lakes region.

Satellite plants were established in Phoenix, Arizona, and Green Bay, Wisconsin. A fourth plant, in Monroe, Michigan, was added in 1997 to serve the company's growing business with Detroit and Toledo-area auto plants.

Like the parent, the "branch" facilities specialize in precision anodizing. Electroless nickel, along with chromate conversion coating and solid-film lubricant application, has also been added to the service mix.

Pioneer has boasted double-digit growth nearly every year since its founding. "Primarily," suggested Scott Turner, general manager of Pioneer-Monroe, "because it has kept its range of services sharply focused and specialized, while its customer base is just the opposite — widely diverse, in addition to redefining customer service within our industry."

To achieve highest repeatability, according to Mr. Turner, Pioneer has most recently focused its energies on removing the human factor from decisions related to the finishing process.

The company had long recognized the value of automation. A new, fully automated line planned for the Monroe facility, however, presented the company with an opportunity to re-think and re-learn a new way to work. A method that would allow it to comply more easily with the internal quality standards demanded by its automaker customers, as well as ISO and QS-9000 requirements.

"Pioneer has always run high-quality operations," said Mr. Turner. Still, full automation involved some radical re-learning in the way orders were handled and in the amount of legwork involved prior to running a sample. It also involved a change in mindset. "The notion of developing and running a process 'on the fly' was completely out the door," said Mr. Turner.

With the new system, everything is established prior to processing. "Where once you would give the job to your key operator and have him develop the 'first article,' now the process is set before the first item is run. The advantage is that once you move through all the steps, repeatability is nearly absolute. And the precision of repeat orders is exceptional," stated Mr. Turner.

Pioneer's partner in the design, manufacture and implementation of its landmark Monroe system was Walgren Company, Grand Rapids, Michigan. Walgren is a leading manufacturer of turnkey anodizing lines in North America. Its anodizing systems currently run production in 16 countries.

Walgren had previously manufactured several manual anodizing lines for other Pioneer facilities. "They had a solid understanding of where we were headed, what we faced competitively, and the ways in which we would need to be flexible in order to accommodate future unknowns and growth," said Mr. Turner.

This new line, according to Turner, was engineered for higher volumes and longer runs. "In reality, it is this and much more, because the control built into this system allows it to be used efficiently for small lot work."

The random system engineered for Pioneer-Monroe is, in Mr. Turner's view, an evolution of systems previously installed.



**BLACK ANODIZED** automotive parts exiting hot seal tank at Pioneer Metal Finishing, Monroe, Michigan.

"Of course, there are specifics that are proprietary to Pioneer," he added. "But this was no re-invention of the wheel, rather an evolution of a design that had been proven, perfected, and adapted to our particular needs."

The system has 73 stations, an exceptional number for an anodizing line, and 48 tank positions. Most parts see only a few stages, depending on their finish requirement and whether dye is specified. The system is 290 ft. long, with a loop one to two hours long, depending on the process.

The racking area consists of four fixed-load stations. The stations have several features that make loading convenient and ergonomically correct. Among those features is a workbar that can be raised, and lowered to below grade. This eliminates stretching and bending, and makes workbars accessible to workers of all heights. In addition, six racking transfer carts allow loads to move with minimal effort on floor-mounted tracks.

The system's six 4,000-lb. capacity automatic hoists are each equipped with a variable-speed transfer motor and a two-speed lift motor. These hoists are top running, and are capable of speeds to 200 fpm. The hoists were complete with floor-mounted superstructure and umbilical cables for power and control wiring.

Pioneer's system uses a manual overhead crane to move workbars individually from the rack area to the automated line. The bridge crane is an efficient mode of transfer that also promotes plant safety by eliminating the risk of employees being struck by carts carrying loads that can weigh up to 4,000 lbs.

Once parts are entered in the load shuttle, automation takes over and the load begins processing. The system is governed by an MSI-PC random hoist control. The random software resides on the hoist control computer, one of three PCs in the system. Each part number has a unique recipe, which Pioneer technicians develop in PC Windows format using a recipe-build screen that is easy to program and simple to modify. This



**AUTOMATED ANODIZING** line at Pioneer.

"primary" PC also provides scheduling for each job. A second PC provides programs that allow specific rectifier recipes to be tagged to each part recipe. The third PC serves as a data collector, generating workbar history.

The system is engineered for maximum water conservation. Spray and immersion are used in combination, and there are seven counterflow rinses. Tanks are 10 ft. long and 6 ft. deep, with varying widths. Tanks are mostly one-inch polypropylene, also 314 and 316 stainless steel, 10-gauge material. Stainless steel bracing on the exterior of the polypropylene tanks provides added strength.

Process steps include alkaline clean (two tanks), etch, desmut, hardcoat anodize (three tanks), sulfuric anodize, nitric dip, black dye, blue, green dye, gold dye, red dye, nickel seal, D-I seal (two tanks), and dry. An off-line strip and rinse sequence provides skipping for racks, and occasional ware.

The system has three hardcoat rectifiers rated at 8,000 amps and 80 volts. The sulfuric anodize is furnished with 5,000 amp, 24 volts. Cooling for the anodize hardcoat tanks is provided by three

200-ton at 20F glycol LWT chillers. The chillers are water cooled, and maintain 30 degrees in the three hardcoat tanks. Two 440-ton cooling towers supply condenser water. Sulfuric acid electrolyte from each tank is pumped through one side of a stainless steel plate-and-frame heat exchanger. The glycol solution is pumped countercurrent to the acid through the other side of the exchanger in order to maintain the required temperature.


The tank area above and between the two desmut tanks (including the etch) was enclosed to capture fumes generated while the workbars are in the process tanks, and during their transfer between tanks. Fumes are exhausted by a 46,600 cfm crossflow scrubber. The enclosure over the tanks is fiberglass. Exhaust ductwork is PVC; the exhaust scrubber is polypropylene.

The exhaust hoods are 316 stainless steel, and are provided as part of push-pull ventilation serving all four anodize tanks. PVC ducting exhausts the fumes through two PVC Fan/Separator units, which have a total exhaust volume of 27,000 cfm.

Walgren Company had turnkey re-

sponsibility for the design, manufacture and supply of the Pioneer system, and also provided start-up support, system de-bug and worker training. The system is one of the highest throughput automated anodizing lines in the U.S.

Pioneer benefits substantially from the throughput and repeatability of results afforded by the automated system. The company also benefits from the ability to move jobs from the automated line in Monroe to the manual lines in Green Bay when conditions, such as product geometry or customer location, warrant.

The manual system Pioneer operates in Green Bay, for example, has the ability to compensate, batch by batch, for metallurgical or dimensional variabilities in customer product. In addition, it does so in a way that is not possible with either the automated line or any conventional manual line currently available. This, in Mr. Turner's view, is a competitive advantage that is highly significant and essential to the company's position as the leader in precision automotive anodizing. 

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