Solutions in Automated Blast Cleaning

The following article is reprinted from the *ZERO Update* newsletter and covers the work of Herb Tobben, the manager of ZERO's Sample Processing Lab.

Herb Tobben creates solutions to customer problems at ZERO's Sample Processing facility.

LIMITED BUDGET DEMANDS SIMPLE SOLUTION

A small shop landed a contract to paint 1,000 lightweight aluminum-alloy bicycle frames per week. The company was using two suction blast hand cabinets, but because the frames were difficult to maneuver within the cabinets, surface preparation quickly became a bottleneck in production.

Each frame had to be thoroughly blasted with glass bead to create a uniform surface profile all over the bicycle's tubular frame. The company was happy with the quality of the surface preparation provided by blasting in the manual cabinets, but looked into automation to speed production. Because this was a limited-term contract, the company was not willing to spend a lot of money for the new system.

Solution

Bicycle frames are rather intricate structures. To ensure a good all-over, all-angle automated blast, either the nozzle has to follow the part's contours or the part has to tumble in front of stationary nozzles.

Tumbling was quickly ruled out because the frames could damage each other if they came into contact. To cover the frames with a moving nozzle would require expensive computer controls; possibly even robotics. Because hand blasting created a satisfactory surface, we decided to recommend continued hand blasting, while speeding the loading, rotation, production rate, and unloading of the frames.

The company purchased a modified BNP 720 with slots cut in both sides and the top. Bicycle frames hang from a monorail on non-powered rotating fixtures. The frames pass through a brush seal on the entry side. The freely rotating fixture allows the operator to maneuver the frame within the cavernous enclosure with little effort.

The frames exit through another brush seal en route to the paint booth. The system includes a pressure blast machine that increased production to 25 frames per hour.

YOU LOAD SIXTEEN GUNS, AND WHAT DO YOU GET?

(If I told you the name or the industry of this customer, I'd have to kill you. Let's just say they're particular about cleanliness and have the resources to acquire the best equipment available.)

The customer had an existing belt cabinet equipped with 16 guns to clean zirconium alloy plates, but it was just too slow. After blast cleaning, the plates traveled to a pickling bath that removed any remaining surface impurities and left a perfectly clean surface. This customer desperately needed to speed things up.

The customer visited Washington, MO., to watch as their sample plates were processed. Based on that visit, that customer quickly upgraded their old cabinet with ZERO automated guns. The ZERO guns gave more uniform coverage and higher production rate than the original guns in their blast cabinet, so they produced a better looking surface, but the process was still too slow.

Solution

The new cabinet is actually two mirror-image cabinets with a pass-through split belt conveyer. The first cabinet uses 20 ZERO automatic guns to clean the top, bottom, and edges of the plates and 40-60 mesh silicon carbide abrasive. This super-hard media, coupled with overlapping blast patterns, thoroughly cleans the plates in one pass at the rate of 2 to 3 feet per minute. The plates travel directly into the second cabinet, where another 20 automatic guns delivers a uniform blast of 100-120 mesh silicon carbide. The fine abrasive leaves a perfectly clean, uniform surface free of impurities.

With 40 guns putting out up to 23,000 cubic feet of costly silicon carbide media per hour, the twin 3,600-cfm ZERO reclaimers had to be precisely tuned after installation to clean the media without excessive carryover.

Once the new system proves it can consistently produce clean plates over months of operation, the customer plans to eliminate the pickling operation.

The system operators have dubbed the ZERO cabinets the "Speed Blaster".

CLEANING CARBON FROM TRUCK PARTS

A remanufacturer asked ZERO to develop an economical and environmentally safe way to remove carbon buildup from T-wheels, C-wheels, and bearing housings in diesel turbochargers. Ironically, these same parts are de-burred by a ZERO automated system when they are newly manufactured. The used parts arrive at the remanufacturer's plant after hundreds of thousands of miles in service. The challenge to ZERO was to remove the carbon quickly and efficiently, without changing the part's texture. Years ago, the company removed the carbon with chemicals such as methyl ethyl ketone (MEK). But the EPA has classified MEK, and most other cleaning chemicals, as hazardous materials, making it cost prohibitive to use

them and dispose of them. For the past several years, the company has used #10 glass beads and a hand cabinet, but the manual operation could not keep up with the need to clean four parts every minute. A switch to aluminum oxide cleaned the parts more quickly, but imparted a slight texture that customers found objectionable. Complicating the problem, the company's compressor is operating near capacity, so available compressed air is limited.

Solution

An automated cabinet (ZERO A-200-3) delivers a ten-second blast of #10 glass beads at 80 PSI. Because of the limited availability of compressed air, only nine of the cabinet's 12 guns blast at any one time. A computer program by ZERO activates the nozzles in sets to assure complete coverage.

The cabinet's operator-fed indexing table processes five parts per minute— a rate that's 25 percent higher than the company had hoped.

CREATING CONSISTENT PROFILES ON ALUMINUM

A copier manufacturer needed to achieve a consistent surface profile of 150 to 220 AA (Arithmetic Average) profile on aluminum rollers to allow bonding of a synthetic rubber roller surface. We can immediately rule out ferrous metals, such as steel grit, because they can be imbedded in the aluminum roller. In the highly charged environment inside a copier those imbedded steel particles could produce magnetic fields that create havoc with the toner. The company needs to process 600 parts per day, or one every 45 seconds. The needs for consistent profile and high production obviously call for automation.

The desired profile is relatively fine on a substrate that can be easily damaged. No operator could provide uniform results and high production with a hand-held blast gun. Even with automation, the trick is to strike a balance between media aggressiveness and mesh size.

Solution

Use 80 mesh aluminum oxide at 80 PSI in the ZERO A-200 automated cabinet. The indexing table's satellites rotate at 40 RPM to assure even coverage by the cabinet's six vertically oscillating nozzles. A 30-second blast produced the desired profile and results in a doubling of the production rate to 2 per minute. Close profile tolerances will be maintained initially by spot-checks of every fifth roller. If profiles start to fall outside the acceptable range, the operator can increase or decrease the blast duration by adjusting the cycle timer.

BIG WHEELS DEMAND SPECIAL TREATMENT

A manufacturer of heavy earthmoving equipment had a very weighty problem. Its trucks and wheel loaders, with capacities up to 240 tons, operate in dust, dirt, mud, water, and sand. If contamination gets into the wheel bearings, work grinds to a halt. Between the bearings and the outside elements stands a set of rubber O-rings wrapped around the inner shaft of the stainless steel wheel. The O-rings tend to slide on the smooth stainless steel, reducing their effectiveness, so the company sends the wheels to an outside company to roughen the area with a blast of aluminum oxide. The outside company manually blasts 15 wheels of various sizes per day in a large cabinet. The area to be blasted is deep in the wheel, so the operators blast them in the blind, stop, blow off the media and dust, inspect their work, then repeat the process until they get the desired finish. Placed on their sides for blasting, the wheels and components measure from 15 to 51 inches tall and weigh up to 5,000 pounds, so transporting them offsite gets expensive.

Solution

Blasting blind areas is a great application for automation. Once you get the desired result, you keep everything the same and repeat the process for successive parts.

The machine approved by the customer has a 7,500-pound capacity motorized turntable work car. A crane loads one wheel onto the work car, making sure it's centered. The work car carries the part into a 300-cubic-foot blast enclosure.

A single blast gun is fitted to an end effector (a pivoting hand on a robotic arm) at the end of a vertical arm that can move up and down and diagonally within the enclosure.

A blast operator uses remote controls to position the single suction gun. The gun mounting pivots through a 90-degree range.

Once the operator teaches the machine the correct position, computer controls can return the gun to that exact position over and over. The computer remembers the correct positions, travel paths, and blast durations for up to 12 parts.

The single Number 6 automatic gun blasts G80 steel grit at 80 psi, via a standard nozzle. The gun has a boron carbide nozzle liner and a nine-inch extension made from hardened tool steel.

The system features a full opening, pneumatically-operated guillotine door, rubber lining throughout, full-floor M-Section recovery, an 1,800 cfm reclaimer, and RPH 4L dust collector. Normally the use of steel grit demands mechanical recovery and air wash separation but, with just one blast gun, cyclonic separation handles the sparse media load. On site, the blast enclosure sits in a pit to put the work car on the same level as the company's existing parts handling system.

Before this purchase, the customer already owned several ZERO automated cabinets, manual cabinets and blast rooms. During a run-off five years ago, one of the company's representatives saw a ZERO machine that cleaned aircraft wheels and he mentioned that he might have an application for a larger version. A diligent Distributor sales representative followed up—working with our technical sales staff to provide budget estimates, quotations, and drawings. The sale took more than three years from initial estimate to delivery, due to the customer's changing needs. The customer says the machine, even with its six-figure price tag, will pay for itself in less than one year. ●