CATERPILLAR CASE HISTORY

CH-CATIPILLAR00607 MASTER

CASE HISTORY OVERVIEW:

As the result of Empire having the original system at their one facility for diesel engine piston cleaning, the customer requested our assistance with this project. The goal was to lower cleaning costs of diesel pistons for engine rebuild at their plant in Mississippi. Due to an increase in production, additional or new equipment was needed to meet the ever-increasing demand.

The customer's **main** goal was to obtain a new system or process to lower cleaning costs and replace the existing airblast equipment to meet their increased production needs. The HIGH PRODUCTION work cell was to be revamped to meet the increased production and ultimately lower cleaning costs. Several main issues had to be addressed. The foremost issue was for Caterpillar to research a lower cost-cleaning alternative for their pistons other then airblast, if available. If not, pursue an upgrade to their old airblast system and obtain a state-of-the-art fully automated blast unit to replace their existing labor-intensive system.

They had two major concerns with their older air blast unit. Media cost were high and labor was excessive per unit produced. Their ultimate goal was 20 to 60 seconds each or 60 to 180 per hour. Knowing the variety of conditions the parts could be presented to the system, they required that the new system must be able to continually produce their wide range of parts with a 95% minimum effective cleaning rate. This equated to 95 properly cleaned parts out of 100 or 50 reworks out of 1000 parts.

By staying within this time frame and the 95% effective resultant production guidelines, they would be able to produce clean pistons with minimal part damage. Their previous production method was 100% clean and no rework. Up front this may look good, however, as much as 60 % of the parts were being over blasted. Resulting in a higher part damage rate that was unacceptable. Also, media usage and labor cost per part was too high.

In final cost comparison, the 100% production method on their old unit would be 30 to 40 % higher than the 95% part clean consideration, even after doing the reworks.

After many months of looking at alternate cleaning methods from chemical, dry ice, vibratory to wheel systems, air blast with ceramic won with lowest overall initial cost and lower average operating cost. This included best final part clean results with the least amount of part damage.

As a result, the **new project objective** was to develop a STATE-OF-THE-ART air blast system to clean their parts at the required production rate with minimal setup and down times.

Project Information:

- **Customer:** Caterpillar, Job E-03016
- Location: Mississippi
- Product: Diesel Engine parts
- Part: Pistons
- Part Size: Average 3.5" dia. X 3.2" high to 6.5" dia. X 7.1" high
- Substrate: Aluminum and steel, with and without skirts
- Process: Clean entire outside surface of carbine deposits
- Media: Ceramic or Glass Bead
- Requirement: 100% clean with minimal part damage
- Production: 60 to 180 parts per hour

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Customer's Original Equipment:

Nozzles: 4 – **Arcing** 5/16" Carbide pressure nozzles

Cabinet: 4836, two (2) Station cart with part rotation

# of parts: 2 Part Rotation Stations, one up – one down

Part Rate: 60 to 85 sec. per part (with load/unload – 20 to 60 per hour)

Part Loading: One (1) Station manual pull out cart load and unload station

Handling: Hand load – turn part - unload

Air required: **400 to 450 cfm** @ 80 psi plus blow-off

Empire's Proposed System For Increased Capability In A Single Unit:

Nozzles: 16 – **Movable** 5/16" Suction Guns

Cabinet: TT-48, Twelve (12)-Station Indexing Turntable

Part Rate: Ultimate Rate -30 to 60 sec. per cycle (2 part index)

Part Loading: Two (2) Stations load and unload (Dual part index)

# of units: One (1) System for entire cell

Processor: Allen Bradley PLC System Controls with storage #'s.

Oscillation: Independent X and Y nozzle movement for specific part cleaning

Handling: Hand load initially, retrofit Robotic load in the future

Blast Sys: Dual independently controlled eight (8) gun suction blast centers

Air required: **520 to 580 cfm** @ 80 psi plus blow-off per system

Twelve Station INDEXING TURNTABLE System Advantages:

- Lowered Capital Cost -
    1. Lowered capital requirement by 15 %
    2. Reduced floor space needed
- Reduced operational costs -
    1. Overall - Lower per piece cost
    2. Reduced labor requirement
    3. Future expansion capability for part change over
    4. Better cleaning uniformity and reduced surface damage

Customer's history and Concerns:

Empire task was to develop a specialized system to process their parts with minimal setup time, as well as, to meet their ultimate production goals. In the initial stages, the original blast system used Bicarbonate of Soda with a pressure blast technique. The entire process was later converted to Glass

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Bead. Our sales representatives were made aware of their system requirements and ultimate objectives. Empire proceeded to process samples to determine and prove the effectiveness of the Ceramic Bead over Glass Bead using suction guns verses pressure nozzles. At the same time develop a totally new system concept to effectively process their parts using the 95% production scenario with minimal operator intervention.

First Empire and customer tested parts using glass bead and ceramic. Both medias were tested with a pressure and suction feed blast systems. From all the test results, we determined ceramic and our suction gun would perform the best, which included a faster clean with less base material erosion.

As result of all the testing done, several important items were determined. First, due to the way ceramic breaks down compared to glass bead, the resultant working mix has little to no sharp edged partials that cause surface damage. As to cost, the ceramic's initial cost was somewhat higher. However, with Empire's tunable reclaim system and ceramic's longer life benefit, overall operational cost was lower even with the higher cost abrasive.

Empire incorporated the dual oscillation blast stations with independent controls. Sixteen 5/16" Boron Carbide suctions were supplied with eight (8) being a part of each oscillation system. The Vertical oscillation did the sides and skirt of the piston as well as some of the top. The top and inside area was processed by the horizontal oscillator.

With the two-station index, two pistons were presented to each oscillator unit. In each case, four (4) guns would do the assigned area of the piston at four (4) different stations. All in all, the 16 suction guns provided excellent coverage with no major amount of operator involvement for setup. Part change over was quick and setup time adhered to the customer's expectations. Change over for machine setup only required recalling a part process by inputting a number to the PLC and replacing the fixture bases to handle different part sizes.

Summary: Empire's main objective was to provide the customer with a system that would best meet their ultimate production goals, to include reliability, future expandability and lower operating costs. The customer was pleased with the ultimate per part cost savings using the ceramic and multiple blast guns controlled by separate oscillators.

Any time we see limitations in a particular process or a better concept, it is our obligation to look at the issue and determine how it can best be addressed or resolved. In this case, Empire **successfully** presented a system concept with many advantages and long-term benefits. By doing this, the customer was able to select the system that would meet his direct and future needs all in one unit. This turned out to be a win-win situation for all concerned.