

# **BODYCOTE CASE HISTORY**

## **CH-BODYCOTE00602 MASTER**

**CASE HISTORY OVERVIEW:** Our local representative presented this project to Empire with the goal to shot peen heat-treated truck transmission gears to a relatively high Almen Intensity.

The customer's **main** goal was to obtain an **AUTOMATIC PEENING SYSTEM** as part of their new High Volume Heat Treating Cell. The HIGH PRODUCTION work cell was a state-of-the-art fully automated heat-treating system. Initially, they needed to produce between 100 to 140 gears per hour. Once in full operation, they would be looking at twice that output – 200 to 280 per hour.

The objective was to develop a controlled shot peening system to peen the parts at the initial required production rate and they would purchase a second unit once their production ramped to full capability.

### **Project Information:**

- **Customer:** Bodycote, Job E-00032
- **Location:** Mass.
- **Product:** Truck Transmission Components
- **Part:** Gears
- **Part Size:** Average 4.5" dia. X 2.5" high to 5.75" X 2.75" high
- **Substrate:** Case Hardened Steel
- **Process:** Shot Peen Gear teeth to 0.018 – 0.024 A Intensity, 125 % coverage
- **Media:** CC-24 Conditioned Cut Wire Shot
- **Requirement:** Shot Peen leading and trailing tooth face plus filet
- **Production:** 100 to 140 parts per hour (200 to 280 In full production)

### **Customer's Original Equipment Request:**

Nozzles: 4 – **FIXED** 5/16" Carbide  
Cabinet: TT-36, six (6) Station Indexing Turntable  
# of parts: 6 Part Rotation Stations  
Part Rate: 36 to 25 sec. per part (100 to 140 ph)  
Part Loading: One (1) Station load and unload  
# of units: Two (2) Systems – (Two separate lines)  
Handling: Hand load initially, retrofit Robotic load in the future  
Air required: **400 to 450 cfm @ 80 psi** plus blow-off per system  
(a total of 800 to 900 cfm for both units)

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



<b><u>Nozzles:</u></b>	8 – <b><u>Movable</u></b> 1/4" Carbide Nozzles for different sized gears
<b><u>Cabinet:</u></b>	TT-36, Twelve (12)-Station Indexing Turntable
<b><u>Part Rate:</u></b>	Ultimate Rate -36 to 25 sec. per cycle (Two parts per cycle)
<b><u>Part Loading:</u></b>	Two (2) Stations load and unload (Dual part index)
<b><u># of units:</u></b>	One (1) System for entire cell
<b><u>Processor:</u></b>	Allen Bradley PLC System Controls with storage capabilities
<b><u>Controls:</u></b>	Closed Loop shot flow, speed monitors and air pressure controls
<b><u>Oscillation:</u></b>	X AND Y nozzle movement for AUTOMATIC part size change
<b><u>Handling:</u></b>	Hand load initially, retrofit Robotic load in the future
<b><u>Blast Sys:</u></b>	Continuous Automatic Refill Blast Pressure Blast System
<b><u>Air required:</u></b>	<b>520 to 580 cfm @ 80 psi plus blow-off per system</b>

### Twelve Station Single Unit Pressure System Advantages:

- Lowered Capital Cost -
  1. Lowered capital requirement by 35 %
  2. Reduced floor space needed
- Reduced operational costs -
  3. ¼" nozzle reduces air usage by 17% to 20%
  4. Reduced labor requirement
  5. Future expansion capability for part change over
- Better uniformity and surface peening consistency

### Customer's history and Concerns:

In the initial visits to Bodycote, our sales representatives were made aware of their system requirements for peening of gears to a high intensity, 18 to 24 A and their projected future production needs. The peening systems would be part of a High Volume Automated Heat Treating Cell.

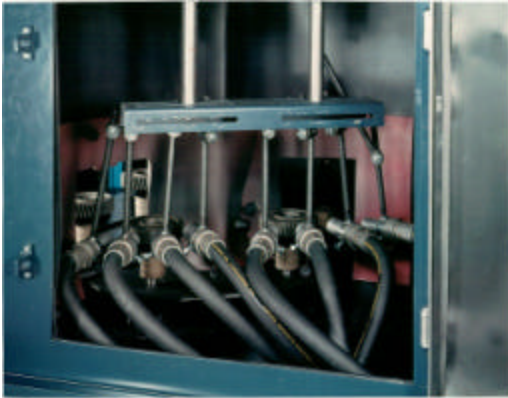
It was imperative that the various gear sizes be uniformly peened to a high intensity and 125% coverage. The main production size was 5" diameter X 2.5" high. However, the systems had to handle parts as large as 5.75 inches in diameter and down to the smallest of 4.5 inches.

In the preliminary stages, our customer, being new to shot peening, was basing all their equipment needs from a quotation they had obtained from another Blast Equipment Supplier. The customer sent in a variety of gears for evaluation along with a system specification.

The gears were to be peened using CCW- 24 Conditioned Cut Wire Shot to intensities between 18 to 24 A. Empire processed the parts with the cut wire shot at the required intensity to prove out the time/intensity relationship - coverage. Being able to achieve the production rate at the required INTENSITY and COVERAGE using ¼" versus 5/16" nozzles was confirmed.

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With the X – Y Nozzle Positioner (shown to left and below) and the PLC controls, part processes could be programmed for future use once finalized and confirmed. When the customer entered the Process Number, the pressure and the position of the nozzles would change to maintain the proper relationship for uniform part peening every time.



With the closed loop controls and system feed back for air pressure, speeds and shot flow rates, the operator would be warned if a problem occurred in “REAL TIME” and system would shut down. Once resolved, the system

could be placed back into service and the parts would be peened to the same high degree of accuracy.

Each blast station had four (4) ¼” nozzles flowing 6 to 8 pounds of shot per minute. Due to the volume of shot, the system included a bucket elevator (shown to right) to recycle the shot to the VIBRATORY SIZE SEPARATOR and on to the pressure vessel.



For the future addition of robot loading, a precision indexer was incorporated as part of the indexing drive train. With this feature, the parts were presented to the load area with  $\pm 0.03$  “ repeatability.



To help maintain the rate of production on a continual basis, Empire proposed and the customer purchased the **Continuous Refill Option**, (shown to left). With this option, the operator never has to stop for the pressure vessel to refill. It includes state-of-the-art electronic level sensors to monitor media levels and initiate a refill when needed. In conjunction with the auto refill, they selected the “MAKE UP HOPPER” to replenish the system with shot, as needed (shown to right).

**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. Even including the cost of the flow monitors and the bucket elevator, the customer was pleased with the ultimate capital cost saving using one system and the operational cost savings realized with the smaller nozzles.

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 was a win-win situation for all concerned.