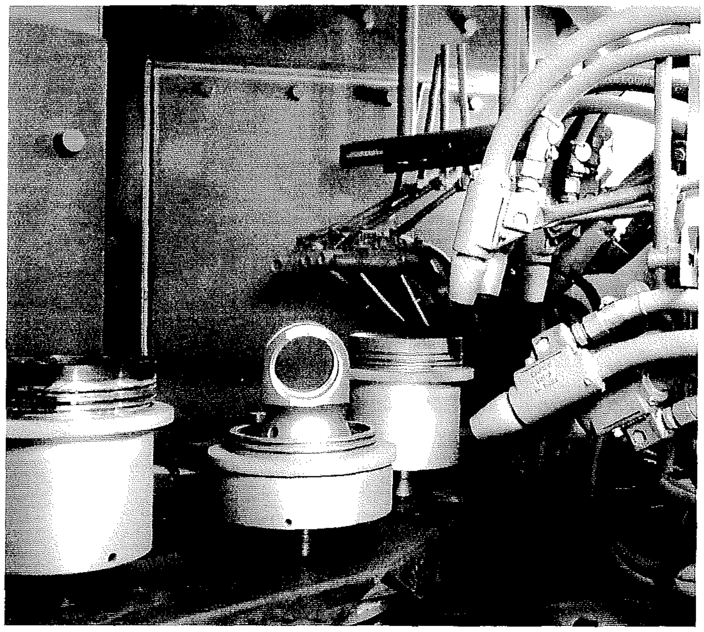
Test Blasting Finds Winning Formula For Cleaning Truck-Engine Pistons

by Robert B. Heaton
Director, Testing Laboratory
Empire Abrasive Equipment Company



Multiple guns, oscillating vertically and horizontally, ensure thorough part coverage as parts are rotated within the blast envelope.

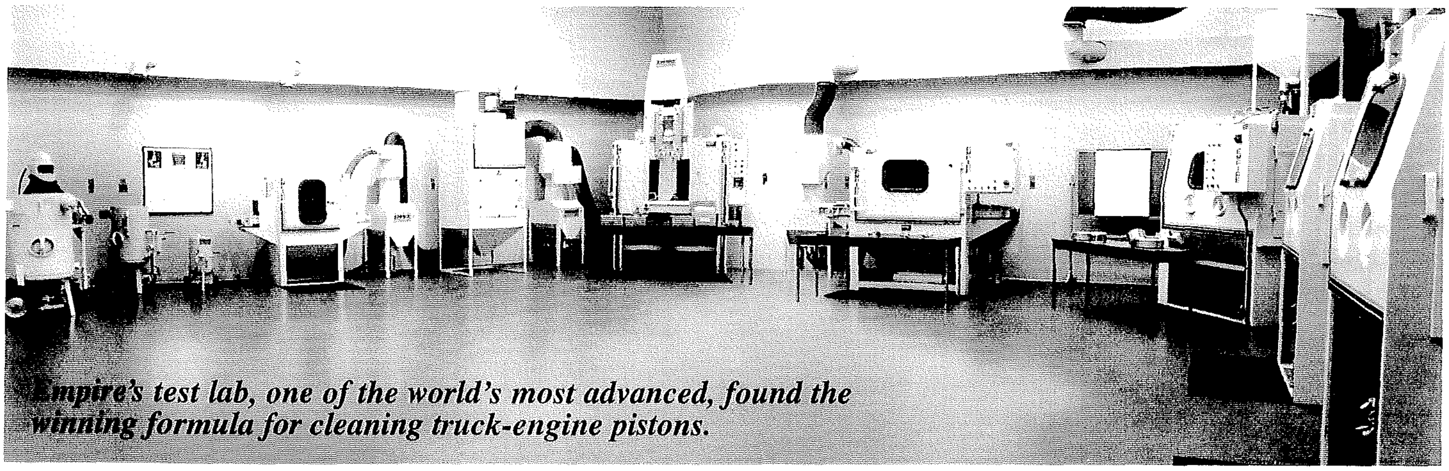
Rebuilding diesel engines to pull twenty tons of freight for a million miles presents challenges. When these overhauls are **guaranteed** for distances approaching two round trips to the moon or forty circumnavigations of the Earth, the work better be right. Skimping on any aspect of quality could damage a rebuilder's reputation and dent the bottom line.

Faced with the bright prospect of increased demand, a major USA engine rebuilder wanted to expand production capacity and improve efficiency without compromising its million-mile guarantee. We, as well as other prospective suppliers, were asked to present proposals aimed at reducing costs associated with cleaning used pistons.

The rebuilder was already familiar with air-blast technology. Initially, in fact, the company had relied on a pressure-blast system using bicarbonate of soda. Though this light abrasive has the advantage of virtually eliminating substrate damage, it works slowly compared to heavier media and cannot be recycled economically. In an effort to boost production and reduce media costs, the company converted its existing system to glass beads – a more aggressive, reusable abrasive – and added recycling equipment. As a result, media costs dropped and cleaning rates increased significantly to between 20 and 60 parts per hour. (This wide spread in production rates was, and still is, a function of part size, not erratic equipment performance. Dimensions of the various pistons being cleaned ranged from 3.5 to 6.5 inches in diameter and 3.2 to 7.1 inches in height.) On the negative side, 60% of the parts were being "over-cleaned" in an effort to avoid rework. More specifically, the level of carbon deposits varied significantly from one piston to the next so the "one-fits-all" approach was causing unacceptable substrate damage.

To meet its new goal of tripling cleaning rates while reducing part damage, within the confines of a high-production work cell, the company undertook an extensive evaluation of its current cleaning technology as well as alternative methods, including chemical, dry ice, vibratory and wheel systems. Clearly, the current blast system with only four nozzles had reached its limits and could not be upgraded to achieve the company's objective of cleaning between 60 and 180 pistons per hour, a three-fold increase in speed. Nevertheless, air-blast technology again proved to be the most productive solution, with Empire's system proposal finishing first in terms of lowest capital cost, lowest operating cost and best results with least part damage.

The problem of part damage was addressed in two ways. Some serious number crunching showed that attempting



Empire's test lab, one of the world's most advanced, found the winning formula for cleaning truck-engine pistons.

to clean all pistons – the dirtiest and the cleanest – in a single pass was counterproductive. In other words, rework on a few parts was far less costly than "overblasting," which not only wastes energy and abrasives, but also accelerates substrate erosion. By reducing blast pressure and duration to clean only 95% of its parts on a single pass, the company was able to reduce per-unit costs by over 30%, even after factoring in rework.

Discoveries in our testing facility contributed to these positive results. For starters, our experiments revealed that moving up to a more expensive abrasive was, surprisingly, a more economical choice. In comparing glass beads to ceramics, we determined that ceramics, unlike glass beads, broke down with few, if any, of the sharp-edged fragments that previously caused damage to pistons when recycled into the work mix. Ceramics are also more durable than glass beads. Less damage and longer media life added up to long-term customer savings with ceramics despite higher initial cost.

Next, we found that a suction-blast system would be the most cost-effective approach for covering the curves and facets of pistons. Whereas the previous pressure system, relying on just four nozzles, operated surgically by gradually tracing part profiles in three dimensions, we compressed the operation to two dimensions for increased speed and economy.

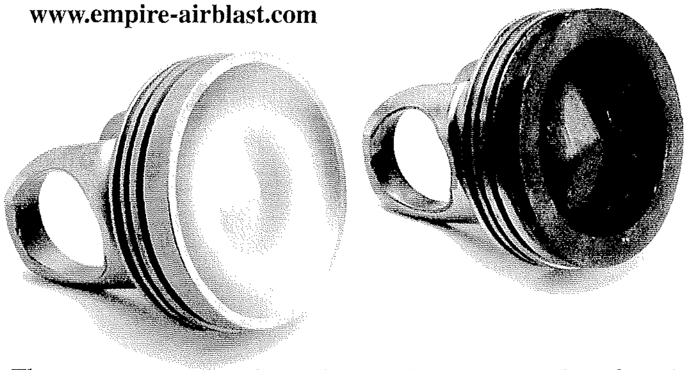
More specifically, we employed two oscillators oriented vertically and horizontally to control the movement of sixteen blast guns positioned above an indexing turntable with rotating work stations. Eight guns are attached to each oscillator. Those moving vertically clean the sides and skirts of pistons. The ones making horizontal sweeps clean tops and interiors. This sixteen-gun setup, combined with part rotation, provides thorough blast coverage.

Meanwhile, the part changeovers required to clean different-size pistons within one machine is expedited with programmable controls, which enable blast parameters for specific parts to be recalled with push-button ease.

Clearly, our test laboratory, which demonstrated the advantages of suction and ceramics, played a central role in finding a winning formula for engine-rebuilds.

For more information about:

- Empire Abrasive Equipment Company's test-blasting services, call Robert Heaton at (215) 752-8800, ext. 352, or E-mail **rheaton@empire-airblast.com**
- Empire's automated air-blast capabilities, call Jerry Conover at (215) 752-8800, ext. 306, or E-mail **jconover@empire-airblast.com**
- Empire's complete line of air-blast equipment, visit **www.empire-airblast.com**



The correct mix of media and controls removes carbon deposits (right) without damaging base metals (left).