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Modified Blast Cabinets: Cost-Effective Solutions for Specialized Finishing

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Air blasting is a powerful and versatile technology used for finishing, cleaning, peening, surface profiling, etching, deburring, deflashing, and various other tasks such as frosting glass and engraving stone. These jobs are normally performed with one of four basic types of equipment: portable blasters, blast cabinets, blast rooms, or automated blast systems.

Sometimes, however, none of these equipment approaches is quite right. As examples, the capital costs for full-scale automation or a blast room may be too high. Uncontained blasting with a portable unit may be environmentally unacceptable; or, the workpiece won't fit into a standard blast cabinet. Modified blast cabinets, which expand the capabilities of standard equipment, offer application-oriented enhancements while minimizing costs for custom engineering.

STANDARD AIR-BLAST EQUIPMENT

To better understand the role of modified cabinets, we start by looking at the strengths and weaknesses of standard air-blast equipment.

Portable units, commonly known as sandblasting pots, are available in many sizes for jobs ranging from do-it-yourself auto restoration to stripping rust from girders supporting the world's longest bridges. The operator shoots abrasives from a suction-blast gun or pressure-blast nozzle (see "Blast Guns and Nozzles Explained" side bar) to remove old coatings and rust based on the progress observed through a protective helmet. The process is crude, highly dependent on the skill of the operator, and unsuitable for in-door applications unless properly confined. Also, because of growing concerns about silicosis, using sand as an abrasive is now taboo in the United States, meaning operators must move up to more expensive single-pass abrasives or find ways to recycle durable blast media.

Blast rooms provide one answer (Fig. 1). These enclosures prevent particulate matter from escaping to the environment while one or more operators, working within the room and wearing protective gear, air blast parts. Rooms are available in many sizes, ranging from smaller prefabricated units designed for quick assembly to massive custom enclosures constructed on site. Blast rooms most often include powered floors that transport reusable media and debris to a reclamation device, which removes dust and fines before returning "good" media to the blast process. For larger parts, rooms offer the advantages of reduced media costs and environmental compliance. But because a room must contain an operator as well as a workpiece, it's normally larger and more expensive than a system permitting the operator to work from outside the blast enclosure.

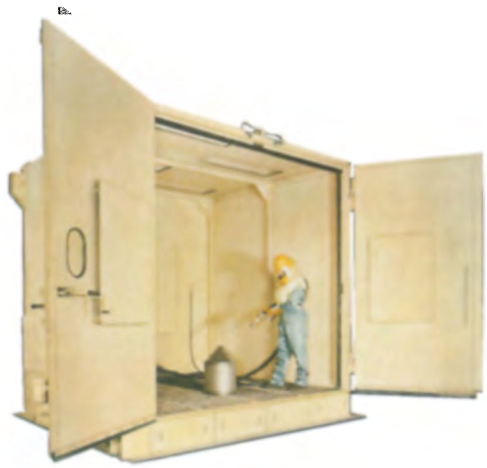


Figure 1. Blast rooms—WITH DOORS CLOSED— provide an isolated zone for finishing larger parts while reducing media replacement and disposal costs.

Automated blasting technology continues to grow in terms of capability and versatility. When first introduced, these systems suffered from "target fixation." Gains in speed and repeatability were counteracted by inflexibility. If a user wanted to blast different types of workpieces with a single machine, time had to be invested in reorienting blast nozzles and fine-tuning other blasting parameters. With increasing use of programmable controls, many automated blast systems (Fig. 2) can now accommodate part changeovers in a matter of minutes. Once blasting instructions for a specific part have been established and entered into the system, they can be

Figure 2. With programmable controls and adjustable fixturing, an automated blast system can now handle a variety of parts without time-consuming changeovers.

recalled and activated with push-button ease. Other advances currently available — and often critical in applications such as aerospace shot peening — include default sensors, which shut down the system if processing varies from specified tolerances, and retrievable histories documenting actual blast parameters on individual parts. Although impressive, these innovations, because of high cost, are normally reserved for precision applications. Likewise, automated blasting must be evaluated in terms of capital costs versus savings in labor and gains in quality.

Blast cabinets, in the most basic configuration, consist of an enclosure with a viewing window and sealed gloves enabling the operator to manipulate the blast gun (or nozzle) and the workpiece. Cabinets can be equipped with either suction or pressure blast systems and, at a minimum, should include a dust collector if operated near personnel not protected by hood respirators connected to a clean air source. In production applications, media reclaimers are normally included for reasons of quality and economics. By removing unwanted debris from the blast process before returning good media to the cycle, reclaimers, as mentioned previously, improve consistency while reducing media-replacement costs. Higher-quality cabinets (Fig. 3) return recycled media to the blast process automatically, thereby freeing the operator from the task of manual refills.

Figure 3. Standard blast cabinets, designed for production applications, include dust collectors and media-recycling equipment

CONTAINING LARGE PARTS

Although standard cabinets come in sizes with blast enclosures exceeding 140 ft^3, many parts, such as 10-foot lengths of pipe, are beyond their capacity. Further, the capital and space costs of moving up to a blast room or automated system may be impossible to justify for an application like rust removal and/or surface profiling prior to coating, particularly on short runs.

Modified cabinets offer a variety of solutions to this problem. One option consists of a dual-cabinet setup (Fig. 4) joined by a center expander. The expander is equipped with its own glove set and foot-treadle control, which operates one of the system's two blast guns. Blast controls work independently, enabling two operators to air blast a single piece simultaneously.

Figure 4. Two standard blast cabinets, joined by an expander, provide a method for finishing long parts without major investments in custom engineering.

Another approach relies on a single cabinet with facing feed and exit points (Fig. 5). Dual-baffle plates in the entrance and exit vestibules contain dust and debris as the operator air blasts the part in sections. With the addition of powered rollers and a feed mechanism, the operator can work continuously as the pipe spins and progresses through the cabinet.

Similar arrangements are used for hard-to-handle metal and glass plates. In these cases, entrance and exit slots replace the circular load/unload stations.

HANDLING HEAVY PARTS

Cabinets can be modified to handle parts of almost

Figure 5. Pipe or other long, cylindrical parts can be finished using a compact cabinet equipped with baffled entrance and exit vestibules.

any weight: up to 10,000 pounds for example. The addition of powered work carts that move parts in and out of the blast enclosure expedite loading and unloading. Processing can be facilitated with a powered turntable controlled by an external foot treadle. Other typical enhancements include tilting turntables that enable operators to adjust the orientation of heavier workpieces (Fig. 6).

CONSERVING SPACE

As indicated previously, production-quality cabinets are normally supported by a media reclaimer and dust collector, which adds up to three pieces of equipment. Modified cabinets contain all three ele-

Figure 6. Tilting turntables provide easier access to heavier parts.

Figure 7. Modified basket blaster not only automates batch processing; it also protects workpieces from exposure to other metal surfaces.

ments within a single enclosure, resulting in a smaller footprint plus the ability to move the entire system between work areas in a matter of minutes.

ADDING AUTOMATED FEATURES

Cabinets can be modified to automate one, some, or all of the following functions: part loading and unloading, part movement, blast gun (or nozzle) travel, operating sequences, blast duration, blast intensity, etc. Control devices range from simple stroke counters to sophisticated programmable controls. While some of these features target labor costs, others aim at improved repeatability.

Designed for batch processing of small parts, one of the most basic automated arrangements replaces a static work area with a rotating basket and four oscillating guns (Fig. 7). As parts tumble within the basket, the moving blast streams assure even coverage. Timers control blast duration and blow-off cycles. An unloading chute can be added to simplify part removal.

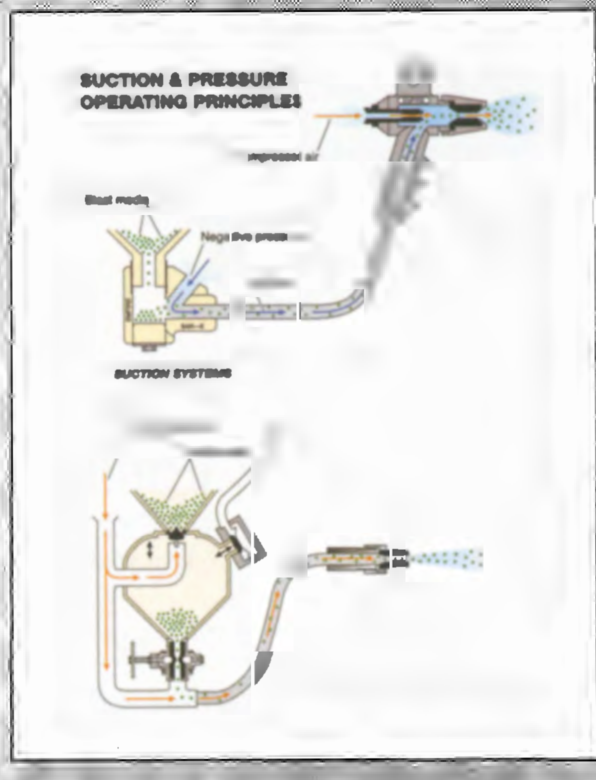
Figure 8. Stainless-steel construction reduces the chances of contamination from other types of steel.

BLAST GUNS AND NOZZLES EXPLAINED

Air-blast equipment employs guns in suction systems and nozzles in pressure systems.

Reference to the accompanying drawing shows how suction systems rely on compressed air, delivered through a blast gun, to create a low-pressure area that draws blast media through a feed line. When the gun is triggered, escaping air siphons abrasives from a storage hopper and then propels the particles through an orifice aimed at the work surface. Suction systems are normally less expensive and easier to maintain than pressure equipment. Plus, they simplify the piping required for multiple blast guns and continuous operation.

Pressure blasting pushes harder than suction, normally resulting in more efficient use of compressed air. In these systems, abrasives or shot are stored in a vessel operating at a pressure equal to that in the feed line. When the system is actuated, the working medium is gravity-fed into the line, from which point it continues to accelerate before exiting the blast nozzle. Beyond reducing energy costs, pressure systems enable more precise control of media flow at both high and low operating pressures.



To finish the interior of hollow, cylindrical workpieces, a powered lance, propelling abrasives at a 90° angle to its stroke, can be positioned above a rotating part fixture. By coordinating the stroke of the lance with the rotation of the part, quite precise results are achieved with programmable controls — at a cost far less than full-scale automation.

These are only examples. Almost any aspect of the air-blast process can be automated within the context of a modified cabinet.

DOING THE ODD JOBS

Part-specific loading devices that eliminate the need for manual masking represent only part of the picture. In cases where carbon-steel contamination is unacceptable, stainless-steel construction solves the problem (Fig. 8). There are many other niche jobs where modified cabinets can boost productivity and reduce capital costs.

Yet, modified cabinets should not be confused with custom equipment. They are more like a suit that's been altered than one tailored from scratch. Their development is driven by specific customer requirements, not some bright new-product idea. Instead of replacing traditional air-blast methods, modified cabinets draw on the strengths of each to meet specialized finishing requirements at a fraction of the cost required for custom- engineering systems. *mf*

ABOUT THE AUTHOR

Daniel Herbert started in the finishing-equipment industry as a Design Engineer more than 17 years ago. On his way to becoming Manager of Empire Abrasive Equipment Company's two cabinet divisions, he also gained valuable hands-on experience during 9 years in the company's application-engineering department.