Using Airless Blast Cleaning Effectively

Foundrymen increasingly are turning to airless blast cleaning of castings to cut labor costs while improving casting appearance and fatigue life and reducing porosity. Modern machines are more efficient and require less maintenance, but many are not used properly.

By JACK C. MISKE / Editor

AIRLESS BLAST CLEANING is a relatively widespread method of cleaning casting surfaces, particularly when large volumes must be handled, but there’s question whether foundrymen take full advantage of its potential. There is no doubt at all that many foundrymen who use the process don’t use it as effectively as they could.

In the latest inventory of foundry equipment made by FOUNDRY, reported in 1976, 4,201 airless blast cleaning units were in use in about 2,001 foundries in the U.S. and Canada, out of a total of just over 4,800 plants operating at that time. The 4,201 machines represented an increase of 220 from the 3,981 listed in the inventory reported by FOUNDRY ten years earlier, in 1968.

Since airless blast cleaning machines are essentially self-destructive, it’s important to note that the 1978 inventory reported only 15% were under five years old and only 37% under ten years old. Any still in use today obviously are seven years older.

Annual business outlook surveys made by FOUNDRY since the last inventory consistently have shown substantial numbers of foundrymen—about 15% or more each year—planning to buy airless blast units, but poor business conditions and reduced capital spending in recent years probably have deferred some of those projected purchases, increasing overall average age of units in place.

The combination of self-destructive operation and aging equipment points clearly to a need for first-rate maintenance. In fact, however, such maintenance is rare and a lot of blast cleaning is performed poorly as a result. Common causes of ineffective cleaning include 1) lack of preventive maintenance, 2) poorly trained operators, and 3) obsolete equipment.

Unfortunately, those problems apparently still are common. One supplier notes that it’s not unusual, for example, to find only some of the wheels on a machine working. Even worse, he adds, castings sometimes are run through machines that don’t contain any abrasive and therefore do nothing at all.

If American foundrymen are as serious about improving casting quality, raising productivity, and increasing cost effectiveness as they say they are, they need to do a lot better job of cleaning.

The first step should be an in-plant study of blast cleaning equipment currently in use. If it isn’t working properly, it should be repaired. If it can’t be repaired, it should be replaced. Even if it’s working properly, if it’s old enough, it may not be capable of doing the job that’s required in the modern marketplace, and replacement may be the route to take.

Actually, well maintained equipment probably can handle many jobs regardless of its age, provided that it can meet the volume and casting size and finish requirements involved in jobs to be processed.

Benefits of Modern Equipment—Efficiency and cost effectiveness are another matter entirely. Even smaller foundries can take advantage of automation, partial automation, and other benefits of modern technology to reduce or eliminate labor content, improve quality, and increase throughput. Manufacturers of airless blast equipment have something for everybody.

Highly mechanized foundries today use continuous-flow barrels that can process tons per hour of small and medium-sized castings with no manpower involved. Some high-production plants use automated blast barrels that process measured loads of castings that arrive on oscillating

WHEEL SPEEDS PRODUCTION, CUTS MAINTENANCE

At Union Foundry Co., a division of McWane Inc., Anniston, Ala., a 34-cu-ft tumbler blast used in the cleaning room couldn’t keep up with increased casting production. As it considered purchase of a new unit of the same size, company management learned about a wheel said to speed up the production rate of existing machines while cutting wheel maintenance costs.

As a result, it replaced a 60-hp, V-belt-driven wheel 19½ in. in diam and 5 in. wide, rotating at 2,250 rpm with the new wheel, also 60-hp, which is direct-driven, reversible, 24 in. in diam by 3 in. wide, and rotates at 1,760 rpm. Vice President and General Manager L. R. Spivey reports that blast time was cut in half and maintenance costs reduced about 75%. Because it doubled the production rate, plans to buy a new tumble blast were dropped.

Subsequently, Union Foundry installed another of the new 60-hp wheels to replace two 60-hp, belt-driven wheels on a continuous-flow tumble blast barrel. Eliminating 60-hp saved $9,600 a year in electricity costs (4¢ per operating hour, two

shakes a day, 50 weeks a year). Maintenance costs were cut to 25% of what they had been, although production was the same. —Courtesy Watts Equipment & Supply Co.
Many of the maintenance problems encountered with airless blast cleaning machines can be avoided by watching a few fundamental points that entail minimum costs, but yield maximum effectiveness.

1. Paper—Keep paper, cardboard, wood, rag, and similar materials out of the blast cleaning area in general and out of the blast system in particular.

2. Abrasive Feed—Add abrasive every operating shift and never let the hopper get below two-thirds full.

3. Flapper Valves—Never operate without flapper valves on all separator or trash discharge pipes.

4. Replacement Parts—Be certain to keep a safety level of critical parts in stock.

5. Blast Patterns—Check blast patterns at least once a month. Improper patterns result in cleaning some parts while others are not touched.

6. Recordkeeping—Record both new and reclaimed abrasive additions each shift, keep track of replacement parts used, and record wheel-hour readings.

7. Work Mix Screen Analysis—Check the work mix size distribution at least weekly so that you’re sure it will produce the desired finish in optimum blast cycle time.

The conveyor, are blast cleaned, and go on to subsequent processing, all without operators.

Smaller foundries—producing as little as 6 tons of castings per day—can put partial automation to work. In a typical operation, a worker at a preceding, adjacent operation loads the skip, hits a button, and goes back to his job while the machine takes over automatically. The work conveyor moves, the loader dumps the castings into the blast compartment, the door closes, and blast action begins. In five minutes or so, the same worker unloads the castings.

One blast cleaning equipment manufacturer claims that new machines obsolete those built just a few years ago, even without automation. Higher wheel horsepower, for example, throw more abrasive and can clean more castings in fewer man-hours. Large barrels can throw up to 100 tons or more of abrasive per hour. At the same time, equipment suppliers have improved the efficiency and capacity of abrasive cleaning and recycling systems, which are at the heart of effective operation.

Manufacturers add that new design provides heavier construction that reduces maintenance costs and downtime problems. Premium alloy wear-resistant wear plates also make an essential contribution in these areas. The wear-resistant steel alloys reportedly last as much as 100 times longer than mild steel.

How It Works—Airless blast cleaning basically is a simple process. It consists of using compressed air or centrifugal force to propel abrasive particles against a workpiece to clean the surface of a casting. A consistent decline in pneumatic blast units and an accompanying increase in airless blast machines has been documented, however, in the last three inventories of foundry equipment conducted by FOUNDRY, in 1964 (April, p. 1:24, May, 1968 (May, p. 20), and 1978 (April, p. 54). An accompanying box shows details. This report is confined to a discussion of airless blast cleaning.

Blast cleaning with metallic shot or grit is a relatively modern surface finishing technique, descended from the older sandblasting process. In airless blast cleaning, abrasive hurled by centrifugal force from a bladed wheel onto the workpiece removes such contaminants as residual sand and oxide scale, and it also deburrs.

An additional benefit is shot peening, which can reduce porosity and improve fatigue strength characteristics. As pellets strike a casting surface, they make slight indentations.
New applications for blast cleaning in foundries continue to be developed. Among them in recent years have been core finishing and casting definning.

On cores, fins can produce thin sections or can break off and create blockages or burn-in areas. Avoiding such problems traditionally involved manual inspection and finishing of individual cores. A new approach uses a lightweight plastic media blast that reportedly can handle any binder system, any size or shape of core, including delicate cores, and typical light fin conditions. Fast savings on direct labor costs are said to permit fast payback on the equipment involved.

On the left above are before and after views of a core with 40 small slots that was finished automatically with blast cleaning in 10 sec.

Similarly, experimental work has indicated that castings can be definned at low wheel speeds and operating mixes of shot that cause plastic flow and stretching of the surface fibers of the metal. An relatively recent blast cleaning application that should be noted is the reclamation of no-bake sands, which have found increasing acceptance, particularly for moldmaking, since the 1960s.

Actually, blast cleaning is being used to perform four essential steps: 1. Disintegrating molds and simultaneously cleaning castings. 2. Removing metalics such as flash, rodding, and abrasive from the sand. 3. Granulating sand and reducing binder buildups. 4. Cooling sand to near-ambient temperature.

The first core-knockout blast cleaning machines were introduced about 1960. They eliminated manual core removal by blasting cores from castings while collecting and separating sand and abrasive. Special airwash separators were incorporated in the machines to do the job. In the years since, machines have been developed that can handle heavier sand loads and reclaim no-bake molding sands.

**Using Airless Blast Cleaning**

Equipment suppliers note that essentials of the metal abrasive blast cleaning process don’t change, although product development and modern technology have made blast machines more versatile, more efficient, and more cost effective.

Components of a blast cleaning system remain substantially what they have been for years: wheel units, abrasive cleaning and recycling, dust collection, cabinet, work conveyors, and controls and instrumentation. Various manufacturers have improved the design and operation of virtually all of them, but no equipment is any better than the way it’s used.

One supplier lists this indictment of failure to control the blast cleaning process:

1. Seven out of ten blast cleaning operations waste an average of 15 to 25% of usable abrasives because of improper separator operation.
2. Seven out of ten blast cleaning operations experience poor or slow cleaning because of out-of-balance work mixes.
3. Seven out of ten blast cleaning operations do not maintain current, accurate data on abrasive consumption or on cost of parts replacement and downtime.

The same supplier points out these results of improper operation, in terms of costs:

1. When a work mix is either too coarse or too fine, it can increase cleaning cycle time by as much as 30%. Longer cycle time means greater abrasive consumption and unnecessary machine wear and tear.
2. Wear of equipment parts can be increased 50% or more by as little as
Some high-production foundries make castings that can't be tumbled, but must have core sand, core wash, and other contaminants removed entirely. A system currently being installed to process gray iron automotive engine blocks and heads illustrates how such requirements can be met with modern blast cleaning equipment, even though applications for this equipment are limited.

The system equipped with 11 wheel units, each powered by 40-hp, 1800-rpm electric motors with V-belt drive that provides rotational speed of about 2,250 rpm. Wheel units are mounted strategically as well as symmetrically on walls, roof, and underneath the blast cabinet. That arrangement provides coverage on castings as they are conveyed through the oscillating work conveyor.

A vibrating feed conveyor at the entrance end of the machine delivers 600 blocks or 1,200 heads per hour. Castings are conveyed through the entrance vestibule and into the blast chamber by a 15-hp oscillating conveyor, also powered by a 15-hp electric motor, and are discharged onto an abrasive shakeout system.

The entrance and exit vestibules are designed with profile plates and rubber curtains that assist in containing abrasive in the cabinet. The castings themselves also become part of the seal filling the void of the work conveyor. The blast cabinet is constructed of 1/8-in., thick steel plate lined with manganese plate 1/2 in. thick. Cast liners are mounted m-inine and opposite the wheel blast.

The abrasive reclaim system consists of lower gravity hoppers and two oscillating reclaim conveyors that transport contaminated abrasive to a scalping deck.

At that point, larger contaminant, such as fins and core butts, are removed from the lighter, smaller material. Abrasive and finer contaminants are fed into a steel bucket, rubber belt elevator.

Carridge is carried up the elevator and discharged into upper screw conveyors that convey the media to a rotary screen 24 in. in diam and a 96-in. double-flap airwash separator. After the abrasive has been cleaned, it drops to a screw conveyor that carries it to storage hoppers.

Modern design has permitted these special features: 1. No part fixtureing. 2. No load mechanism. 3. No 'forced' loading. 4. No moving parts in the blast chamber other than the shakeout conveyor, also powered by a 15-hp electric motor, and are discharged onto an abrasive shakeout system.

The system incorporates blast cleaning as an integral, continuous operation, from pouring to surface grinding or machine finishing.—Courtesy Wheelabrator Corp.

BLAST CLEANING BLOCKS AND HEADS

2% sand contaminant in the work mix.

3. Abrasive consumption can be increased by as much as 25% if the size of the separator take-out abrasive is increased by only one shot/grit size—about .005 in.

4. Perhaps most importantly, improperly balanced work mixes will not produce an acceptable finish if the blast-cleaned profile must meet rigid specifications.

It's clear that effective blast cleaning is a combination of efficient machine operation and maintenance plus selection of the right work mix. Moreover, the two are interactive.

So far as the machine is concerned, planned maintenance programs are essential, and equipment manufacturers provide comprehensive instruction manuals. They emphasize the aspects of maintenance that are important to maintaining the quality of surface preparation and achieving economical operation.

One supplier notes that only normal maintenance is required as long as the work handling system delivers the workpieces properly to the blast of the wheel. With self-destructive equipment, however, even 'normal' maintenance can be considerable. In the cabinet, he says, the entry and exit seals must be maintained, and ventilation must be adequate to provide 1) a positive flow of air from the outside to the interior and 2) positive withdrawal of dust to the collector.

Unfortunately, the evidence overwhelmingly is that many foundrymen simply run the equipment, giving little attention to either its efficiency or the effectiveness of the work mix. Similarly, many don't get worked up about the work mix they use—either in its original form or in terms of what happens to it after first use, separation, classification, disposal of residues, and re-use. The results can be disastrous.

Blast Cleaning Abrasives—Although the blast cleaning machine does the work, results depend heavily on abrasive choice and application. Choice of abrasives is the first step. In addition to metallic types, abrasives include fine flour, aluminum oxide, glass beads, quartz, and silica, among others. The most widely used types, however, are chilled iron (58 Re), annealed iron (38 Re), and cast steel (45 Re).

Each of the ferrous materials requires a different manufacturing procedure to achieve a consistent result, involving chemical composition, melting temperature, sputtering, quenching, drying, and heat treatment temperature and time. The objective is to produce solid, as-nearyround-as-possible particles with the desired microstructure and hardness. The as-cast abrasive is shot.
sive, suppliers say, because of its hard-
contribute to rapid breakdown and to
State-of-the-art equipment now is
extending into new areas of perfor-
mane and product quality. An ac-
accompanying box describes an instal-
lation currently going in at the
foundry of an automotive company.
Equipment of this scope is limited in
application, but serves to illustrate
the capability of modern airless blast
cleaning equipment.

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AC&CCI Contributes $3,000
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