WAFCO: Reinvesting to Compete

This family-owned job shop uses annual reinvestment strategies of at least $1 million to stay current with technology and the competition.

Alfred T. Spada, Editor-in-Chief

Wisconsin Aluminum Foundry Co., Inc.
Manitowoc, Wisconsin

Year Founded:	1908.
Employees:	360.
Metals Cast:	A356 (60% of production), 319, 332, 333, 535, A206, A242, 713 and 355 aluminum; 20 different copper-base alloys (3% of production).
Processes:	Permanent Mold (55%), green sand (matchplate, cope and drag, and squeezer) and nobake molding.
Value-Added Services:	Machining, heat treating, impregnating, anodizing, painting and assembly.
Size:	170,000 sq ft.
Key Markets:	Construction; diesel and small engines; heavy truck; refrigeration, heating and cooling; marine; light vehicles; and consumer products.
2003 Shipments:	11.8 million lb (more than 15 million in 1999).
2003 Sales:	$48 million.
Corporate Officials:	Philip Jacobs, CEO; Milton Schwartz, chairman/ treasurer; James Hatt, president; Kory Brockman, vice president-finance; Bob Braun, vice president-engineering; Scott Ziarnik, vice president-operations.

Every business theory espouses the necessity of continually reinvesting in one's facility to ensure increasing productivity and efficiency levels and the ability to always meet the latest needs of the customer. Unfortunately, the problem with business theories is that they often blow over in the stiff wind of an economic downturn.

For any jobbing foundry trying to come to grips with increased global competition, this business theory must become more than theory—it must become part of its mission, during both good times and bad. Whether continual reinvestment comes in the form of a new conveyor or molding line, the end result is increased productivity and cost-efficiency, and that is the bottom line.

Privately owned by the Schwartz family since 1908, Wisconsin Aluminum Foundry Co., Inc. (WAFCO), Manitowoc, Wis., is a 380-person aluminum sand and permanent mold shop that adheres to the theory of continual reinvestment. By allocating at least $1-2 million/yr for upgrades, this casting operation is overhauling and upgrading its technology at a pace that fits its business structure and that of its current and potential customers.

"You are either moving ahead of the competition or you are behind it. Once you fall behind, you never catch up," said Jim Hatt, President. "We know that there is always new technology. If we don't stay current, we won't be around for long."

This is the key for WAFCO. The pace of technology enhancement isn't just its own—it is dictated by its customers' needs as well. While larger than the typical job shop dotting the North American landscape (80% of all North American foundries employ less than 100), WAFCO is still subject to the same pressures as other suppliers in today's economic market place. The firm believes, however, that its formula has put it in a positive position.

"With the aluminum material costs approximately 30-40% of the casting price, we feel that if we can continue to reduce labor costs 10-20% we can remain competitive in the global market," said Hatt. "Then, when customers consider our service and value-added capabilities, we become very appealing as a supplier."

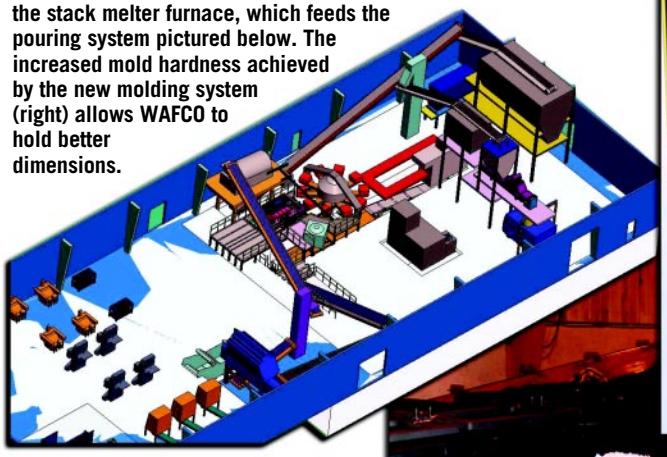
This article examines some of the recent technology advances WAFCO has installed in its two plants in Manitowoc. While these expansions may seem cost prohibitive to most job shops (despite the less than two year return on investment WAFCO cites), the key is that WAFCO believes it may not be around in the future if it doesn't continue to modernize.

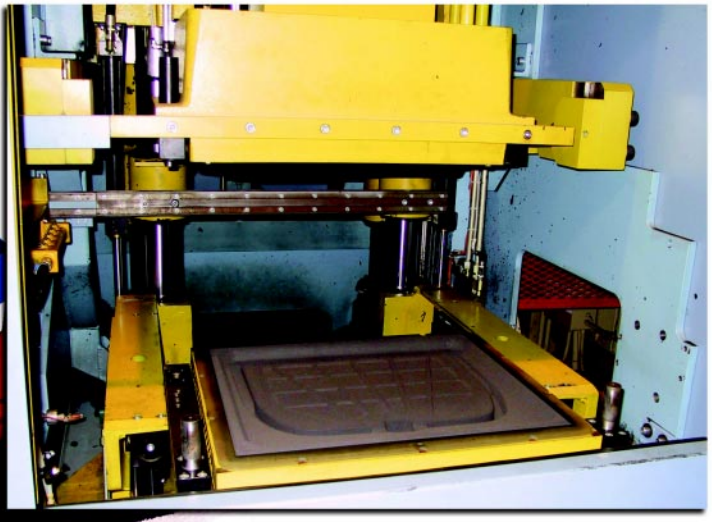
Molding A Reinvestment

The heart of any profile article on WAFCO must begin with its recent installation of a new 3000-sq-ft, more than $2 million matchplate molding system.

Previously operating with four automated matchplate molding lines (since the late '80s), the firm was becoming less competitive each year. Whether this was because of increased coring in the molds, manual pouring, maintenance costs, or too much overall labor, WAFCO's productivity on the four molding lines was not enough to maintain a low enough man hour cost per ton to compete in either the North American or global market.

"When we analyzed our matchplate operations over the previous five years, we were spending too much on the non value-added services in casting production such as manual pouring," said Bob Braun, vice president-engineering. "Our costs were up to 40% higher against some of the competi-





The CAD drawing (below) illustrates the footprint for the new matchplate molding system located next to an existing 30 in. x 32 in. matchplate line. The tower shown in the empty space of the design is the stack melter furnace, which feeds the pouring system pictured below. The increased mold hardness achieved by the new molding system (right) allows WAFCO to hold better dimensions.

tion that was using advanced technology. We had to upgrade or get out of the green sand market."

The decision was made in mid-2002 to go a new direction. With the proliferation of new matchplate systems having entered the market the previous three years, WAFCO sent principals from its manufacturing to visit four recent installations of new molding lines at foundries throughout the U.S.

According to Scott Ziarnik, vice president-operations, WAFCO's decision criteria when investigating these molding systems focused on:

- molds/hr;
- mold shift;
- repeatability;
- energy usage;
- cleanliness;
- safety;
- pattern interchangeability;
- coresetting.

After a visit to an east coast foundry, WAFCO saw its future in molding—a Disa Match 130 producing 20 x 24 in. molds.

As installed at WAFCO, this new matchplate molding line produces 166 uncored molds/hr, utilizing 20% less energy than the previous molding lines. The new molding line replaced a 20 x 24 in. matchplate molding line immediately and is scheduled to replace a second and third in the near future.

For WAFCO, one of the key decision makers for the new system was zero mold shift. "In addition, we have experienced an increase in overall mold hardness and uniformity with less finishing," said Ziarnik. Installation of the new molding system began on June 19, 2002, and the first castings were poured August 4—just five weeks later. All it took to retrofit the old patterns to the new system was the attachment of adapter plates for conversion.

The new molding system utilizes a vertical blow and squeeze mold production method. When the molding machine blows molds, the cope and drag squeeze heads are positioned in the flask to a predetermined dimension. The entire flask and squeeze assembly rotates 90° for the blow slots of the cope and drag to directly align to the blow chamber. The blow and squeeze takes place (with a pressure of 5-7 bar) and the assembly again rotates 90° for pattern stripping.

"Overall, the new matchplate molding technology produces a harder mold," said Braun. "While this presents new issues with gating, risering and venting, it also aids our goal of holding tighter tolerances on our green sand castings…Our customers are pushing to permanent mold because of the perceived tighter dimensional tolerances, but we feel we have made a definite improvement on tolerances with the new molding line."

To hold its dimensions tighter, WAFCO also has shifted to fully machined matchplate patterns for production. With production currently split between 55% permanent mold and 45% sand, the firm's goal is to move back to an even split between sand/permanent mold production.

Once produced, the matchplate mold is presented to the machine operator for inspection and core setting (for

Shown is the new matchplate molding line installation at WAFCO. The 3000-sq-ft system incorporates automatic pouring and increased mold production levels.

more information on the molding machine, see *MODERN CASTING*, August 2003, "The Best of Green Sand Matchplate Molding"). Initially, WAFCO is using manual core setting on the line, but plans to install an automated core setter later this year.

Beyond the molding machine, WAFCO has innovated its melt operation for this new molding line with a Modern Equipment 3300 lb/hr tower furnace for melting and a Stotek automatic dosing pump (distributed in the U.S. by Meltech, Inc.) for pouring. The Stotek pump uses vacuum technology to draw aluminum from the holding chamber into the mold. Within the holding chamber, the melt is under a nitrogen atmosphere to reduce oxidation. During pouring, an electrode in the furnace senses that the pump is full and the vacuum is released. This allows excess aluminum in the pump to flow back into the holding chamber, ensuring that the starting level in the system's pump and holding chamber is always constant for proper mold fill levels. The system's pump also uses low air volume, making the use of inert gases, such as nitrogen, economical. The pouring system can fill up to 180 molds per hour.

Feeding the pouring pump for the new molding system is the stack melting furnace, whose reverb bath was designed to accommodate the pouring pump. The key to this furnace is its vertical integration as the charge is electrically lifted in 600-700 lb bundles to the top of the furnace's stack and dumped. With the hearth for melting at the bottom of the furnace, the extra heat generated during melting flows up and, instead of escaping, begins to warm the charge and eliminate any moisture. This furnace's orientation is designed to increase efficiency and reduce energy consumption as it operates at 980 Btu/lb with less than 1.5% melt loss.

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—Jim Hatt, President

The molding machine feeds a 60-flask mold handling system from Summit Foundry Systems, Inc., that is designed to handle up to 180 molds/hr and performs mold jacket cleaning. The sand system for this line contains a 100 ton/hr muller. As part of the overall control of the molding system, each component—mold machine, handling system and furnaces—are networked through a central computer system to allow continual oversight of all the system's operations.

The initial benefits WAFCO has received from the new technology is illustrated in the numbers:

- a reduction in casting costs;
- a 50% reduction in labor.

But the bottom line is that they are competitive.

Currently, WAFCO has 150 jobs set up on the new matchplate line—65% of capacity. However, due to the line's

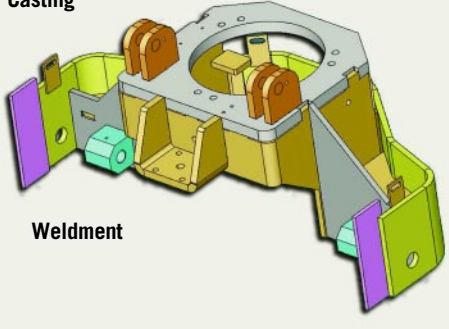
Conversions: A Necessity for Job Shops

Competition strictly based on price is a bad proposition for today's jobbing foundries. The value-added services foundries provide from a customer service standpoint are what will win customers' hearts in the long run.

WAFCO has been following this direction by working with its customers to convert steel, iron and plastic components to aluminum castings.

"Together it is a win-win situation," said Braun. "Our engineers spend time in the development stages with our customers to optimize designs for castability. Our customers appreciate the information and the potential cost savings. While we don't always win every job, the commitment sets us up for future work."

Casting



Weldment

One example of a conversion currently in the early stages of production is a powerhead for a pallet truck. Originally designed as a 21-piece steel weldment, this component, which serves as the mount for the drive motor/transmission and the pivot interface with the main body of the pallet truck, was redesigned to a one-piece, 45-lb A356-T6 aluminum casting. Cast in green sand, the redesign to casting realized a 45% weight savings to the part, a 15% assembly time reduction (no more welding) and an 18% overall cost savings for the customer.

"We developed a 3-D CAD model of both the cast and the machined version of the part using optimum foundry design rules while maintaining the guidelines provided by the end user," said Braun. "The customer assembled the component in the end product and extensive testing was performed to validate the integrity of the aluminum casting. With the exception of two minor dimensional adjustments, the aluminum casting passed all requirements with ease." ***MC***

increased productivity, its current product mix for matchplate molding when fully allocated to the new line would only account for 65% of production. WAFCO has to sell the other 35%.

"We ran up against the dilemma of whether to sell the molding line before it was installed or after," said David Hilburger, sales manager. "We ended up doing a lot of both."

A Core Reinvestment

Until recently, WAFCO fed its mold lines with only shell cores produced on nine different core machines. The firm believed the precision offered by shell cores, coupled with the ease of shakeout, was the best fit for its customer base on both the green sand and permanent mold sides of the foundry.

In October 2001, however, the foundry decided to diversify with the installation of new coldbox coremaking technology suited for job shops—a SCC 90 Core Center from Roberts Sinto Corp. (a second machine was added in the fall of 2002). The basis of the decision to diversify the company's coremaking was based in three principles:

- reduction of tooling set-up time;
- reduction in core shooting time;
- increased safety for workers.

The coldbox and shell cores both feed sand and permanent mold lines. These systems are capable of producing cores from a few ounces to 130 lb and allow WAFCO flexibility to run coldbox cores for short, prototype runs and large production.

Typical production levels for WAFCO and its 2000 active patterns fall between 100-30,000 castings per year, however, the firm does produce one-piece prototypes at the request of customers. This prototyping and low production run responsibility typically falls on the firm's small nobake molding operation with two 300 lb/min. sand mixers.

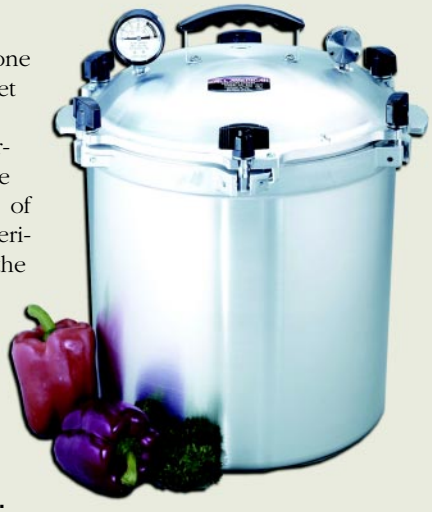
Clean Reinvesting

As a job shop, automation outside of the coremaking, molding and melting departments can be difficult because the production runs often don't appear to provide as quick of a return on technology investment as hoped. According to WAFCO, if the technology investment makes sense, the return on investment almost always is there if calculated correctly. Job shops just have to be prepared for two to three year returns in some cases.

Direct to the Consumer

Satisfying an OEM customer is one thing. Satisfying today's gourmet consumer is another.

One of WAFCO's leading market segments is consumer products for the home cook as the firm produces a line of pressure canners under the name All American and a line of cast cookware under the name Chef's Design. For these products, the focus is as much on functionality as aesthetics, forcing the foundry to focus as much on surface finish as mechanical properties. ***MC***

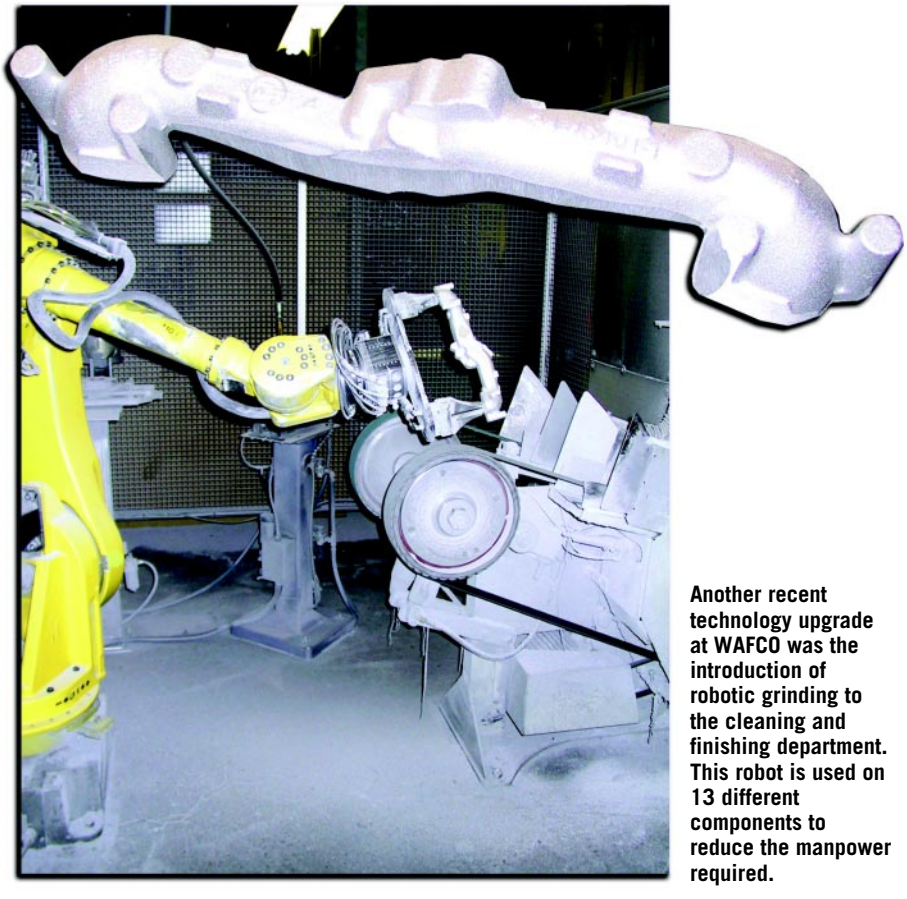


One of WAFCO's consumer products is its line of pressure canners.

In late 2001, WAFCO attacked its cleaning and finishing department with the addition of a robotic grinding cell. Faced with the prospect of hand grinding 350,000 A356 aluminum small engine manifolds/yr, the firm decided to be one of the first job shops in the U.S. to invest in robotics for casting finishing. The manifolds are hand loaded into a conveyor that presents the components to the robot for grinding.

"In some cases up to 40% of a casting's cost can be directly related to cleaning and finishing," said Braun. "Lowering that cost by reducing labor and injuries is a wise investment."

This cell has been upgraded since its installation to accommodate an additional 12 parts—another 200,000 components per year. With an initial investment of $175,000 to install the robotic cell, WAFCO recouped its investment



Another recent technology upgrade at WAFCO was the introduction of robotic grinding to the cleaning and finishing department. This robot is used on 13 different components to reduce the manpower required.

within the first 18 months of operation.

Permanent Reinvestment

The cell concept is an important cost controller for WAFCO and was taken one step further in its two permanent mold casting operations.

WAFCO opened its plant 2 in 1997 and dedicated it strictly to three tilt-pour permanent mold cells (throughout both plants, WAFCO has a total of 17 permanent mold casting machines). One of the cells in plant 2 currently is used to produce 356 aluminum castings for the heavy truck market. Five employees are dedicated to this cell to cast components on four different tilt pour systems and then process them through saw-off, trim press, grinding, 100% pressure test, final inspection and package for shipping.

When this cell initially was developed for a different cast component, more than 25 workers were required to support the cell and ramp-up production. Utilizing lean manufacturing techniques, the addition of conveyors, trim presses and the reorganization of work flow, manpower efficiency was maximized to the current level and this cell's return on investment was reached in two years.

According to Braun, Wisconsin Aluminum is committed to lean manufacturing and has had 25% of its workforce attend lean manufacturing classes. The firm also took the workers for this cell to visit the main customer in New York so they could realize what scrap parts meant to the customer on its assembly line.

Currently, workers rotate every four hours through each of the cell's operations, and work four 12-hr days per week. This cell produces more than 300,000 castings/yr with production times of 30 min. from the pouring of metal to the casting being ready for shipment. While WAFCO has been producing the heavy truck component since 1989 and is on its fourth generation design, the re-engineering of production for permanent mold that occurred in the late '90s was critical to the relationship the caster had with its customer to reduce casting production costs while improving the total value of the component.

Reinvesting for the Future

The future for WAFCO is much of the same. It plans to convert its older nobake core system into newer molding technology and install thermal sand reclamation. In addition, the firm wants to incorporate further robotic automation into cleaning and finishing. The key is to approach the innovation and upgrades in technology in manageable steps on a year-by-year basis.

"It is our commitment to investment that allows us to compete," said Hatt. ***MC***

Pictured are various stages of the permanent mold casting cell in which WAFCO produces the charge air cooler casting (shown above). Shown are permanent mold casting (top l), cutoff (top r) and leak testing (l).