

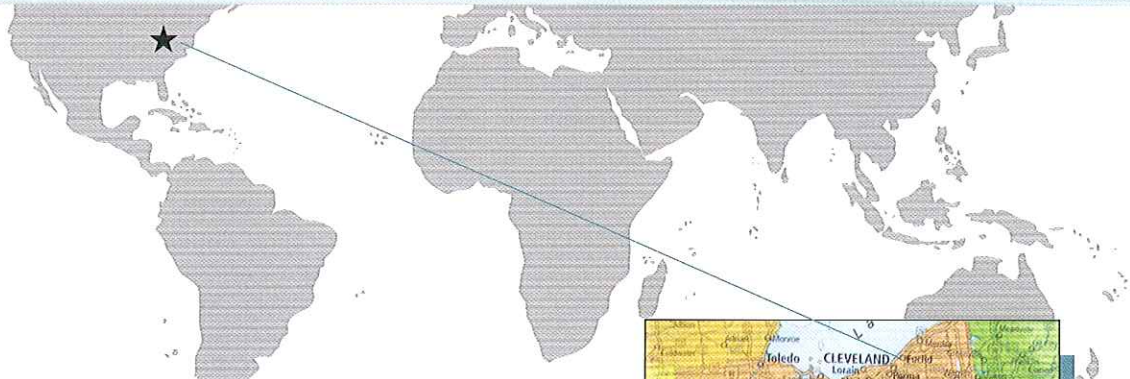
CONNECTING THE MOLDING COMMUNITY

# INJECTION MOLDING

Plant Tour

## HOT MARKETS, HOT PRODUCTS

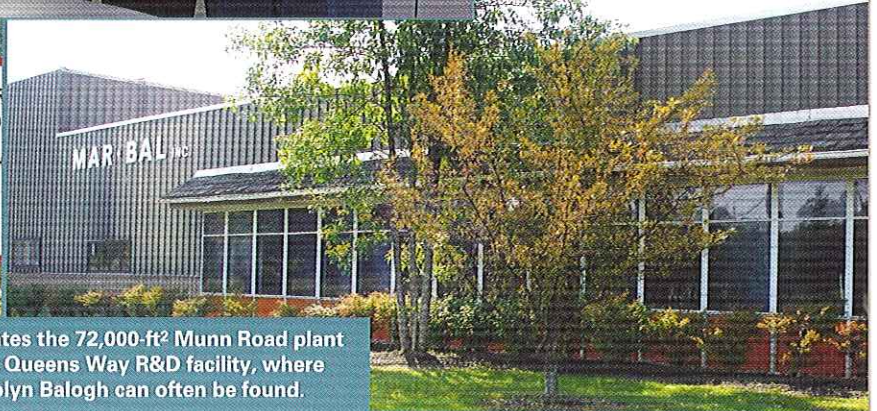
Making their own materials gives the BMC specialists at Mar-Bal a major advantage in the growing thermoset market. —Michelle Maniscalco



President Scott Balogh (left) and VP Steven Balogh stand with a switchgear bushing, a 34-lb BMC part molded in a 1000-ton press.



In Ohio, Mar-Bal operates the 72,000-ft<sup>2</sup> Munn Road plant (right) and newly built Queens Way R&D facility, where founders Jim and Carolyn Balogh can often be found.



## VITAL STATS

### Mar-Bal Inc., Chagrin Falls, OH

Facility size: 72,000 ft<sup>2</sup> at Munn Road; 23,000 ft<sup>2</sup> at the R&D Technical Center; 244,000 ft<sup>2</sup> company wide  
Annual sales: \$50 million in 2006, company wide  
Markets served: Appliance, industrial, electrical  
Capital investment: \$2 million in 2006-2007 for R&D center  
Materials processed: Polyester-based BMC  
Material production: 80 million-lb capacity (two facilities)  
No. of employees: 150 at Ohio facilities; 440 company wide  
Shifts: Three, five days/week, extended as needed  
Molding machines: 24, 200-700 tons; all but three Buchers are rebuilt Cincinnati Milacrons; 45 presses and 40 compression presses from 100-1000 tons company wide  
Internal moldmaking: No  
Quality: Six Sigma

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If you're going to specialize in thermosets, now is the time, according to SPE Thermoset Div. chairman Paul Gramman. "Energy in our industry is at an all-time high . . . it is poised for expansive growth. In addition to the Boeing 787 Dreamliner, which features primarily thermoset materials, more engineers and designers are embracing thermosets for enhanced mechanical properties, improved chemical resistance, and cost savings."

Jim Balogh, who founded Mar-Bal, didn't foresee today's growth. He did, however, believe that serving a specialty market (and serving it with customized materials) would succeed. A bit of background on this determined plastics pioneer: After being shot and imprisoned, he escaped to Yugoslavia from his native Hungary during that country's 1956 revolution. From a refugee camp there, he made his way to the United States via a special program enlisting foreigners seeking citizenship into the armed forces. Because he served in military intelligence, the Hungarian police tracked him for many years.

Fast forward to 1970, when Mar-Bal began. Getting that first press into the first facility was a do-it-yourself job. Balogh recalls chaining the leased press to an older VW Beetle and dragging it up

“ I burned up the tires, the muffler fell off, and the engine was history, but we got the press installed. ”

a wooden ramp. He adds, "I burned up the tires, the muffler fell off, and the engine was history, but we got the press installed."

Today, Mar-Bal has grown to four facilities, and is now headed by Balogh's sons Scott and Steven. Two of the plants are located in a quiet, gentrified town called Chagrin Falls on the east side of Cleveland, OH, which is where IMM came to tour. The other two plants can be found in Cuba, MO and Dublin, VA.

### Strength in diversity

Mar-Bal serves three distinct sets of customers. The appliance market represents about 50% of its sales revenue, and for these customers, Mar-Bal specializes in high-gloss, paint-free thermoset parts. The industrial sector includes customers who are OEMs in the power distribution and insulation industry. Finally, Mar-Bal sells its own proprietary products, including electric standoff insulators, UL-recognized flame-retardant wastebaskets, and bulk molding compound (BMC) materials.

Our tour starts at the original Ohio facility, the Munn Road plant, where materials compounding and molding are the main events. Scott Balogh conducts the tour, donning thick, white gloves so that he can handle the just-molded parts. With thermosets, the heated mold and the heat generated from the crosslinking reaction cause the part to remain hot for a period of time after demolding, rather than cool down gradually as in thermoplastic molding. As a result, many of the parts must be held in postmolding fixtures to retain dimensional tolerances. In-house engineers at Mar-Bal have designed some ingenious methods, which we'll see as we continue the tour.

Scott explains that thermoset BMC material offers engineering-grade performance at a commodity price. "We can compete with the properties of high-heat materials such as PBT, PPS, and others that cost over \$2/lb with BMC that costs about \$1/lb."

On the way to the shop floor, we pass a new Zeiss CMM machine. "We needed greater PPAP capabilities," says Scott,



Proprietary Mar-Bal products include fire-resistant wastebaskets and standoff insulators, while appliance customers rely on its ability to produce high-gloss handles, control panels, and face plates.

“and this equipment provides finer tolerances along with touch-probe accuracies.”

One of the first presses we see is busy turning out bases for a Vita-Mix commercial-grade blender. It’s a 375-ton Cincinnati with a Ranger robot for part removal. Mar-Bal provides value-added assembly for its customer by molding all of the base parts and then assembling them prior to shipment.

Cincinnati presses normally used for thermoplastic molding are the standard here, but they are rebuilt with Mar-Bal’s proprietary-design barrels and screws, specifically made to handle the glass-filled BMC material. In addition, hoppers are replaced with “stuffers,” which plunge the material into the screw.

Another difference with thermosets involves heating and cooling. To avoid crosslinking before molding, thermoset BMC must be held at a cool 75°F in a climate-controlled area. Molds, instead of being cooled, are heated to 300°F, and are built with water-cooled cold runners and drops. In nearly all cases, the action of the tool degates the part.

### Materials in the mixer

Before we have a chance to view the rest of the molding floor, Scott directs us to the materials compounding area. “The advantage of being vertically integrated with BMC material production is that it gives us greater control over both cost and speed to market,” he says. “We’re able to customize compounds to meet specific requirements, and there is no wait time to sample new formulas.”

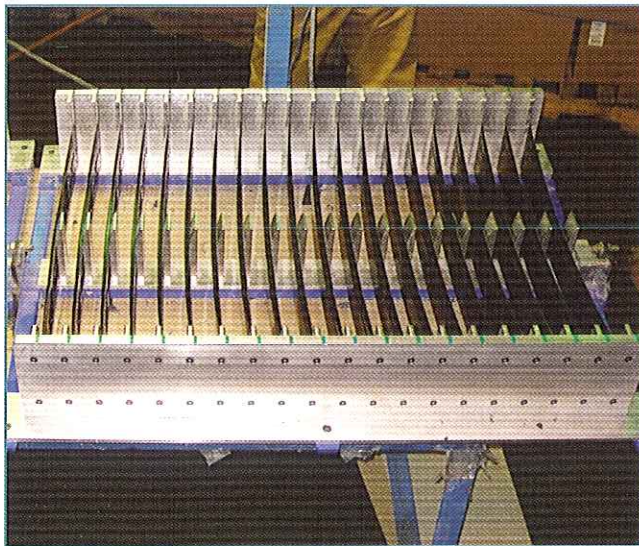
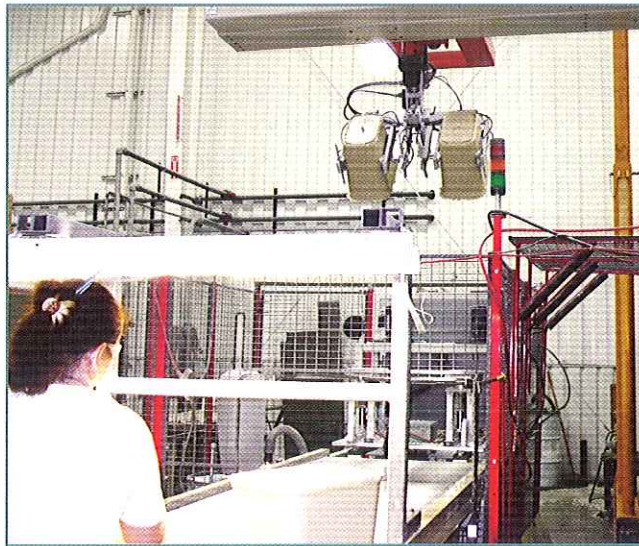
Typical BMC compounds at Mar-Bal consist of 50% mineral filler, 25% polyester, 20% glass, and 5% pigments and additives. These components are added to a mixer, which is not unlike an industrial-strength version of a kitchen mixer. When the mixture is complete, it looks a lot like fibrous Play-Doh, and is wrapped in plastic film while still warm to keep it from drying out.

Steven explains that the compounding operation has also given Mar-Bal the opportunity to experiment with different chemistries. “For example, we have been able to replace painted appliance parts with unpainted ones because we have developed specific compounds with superior high gloss to match the aesthetic of paint.” Other advantages include quality assurance measures such as assigning batch numbers for traceability and performing in-house QA tests on performance, cure analysis, spiral flow, dimensional change, and specific gravity.

Steven also shares with us that Mar-Bal is working on a strategic development: a licensing arrangement with the company’s Chinese partner that includes both parts and materials. Mar-Bal also plans to use it to target its next step: Europe.

### Technical advances

Back in the molding area, we find what looks like a small Ferris wheel next to a 500-ton press molding oven handles. These aren’t just any handles, however. They are high-gloss white parts that don’t need the traditional secondary paint process, molded from a proprietary BMC material. Incorporated in the design are finger grips on the back of the handle, a feat that Scott says no other BMC molder has been able to achieve. “This was both a design and processing challenge. We were able to find a means of eliminating voids and other aesthetic issues on the grip side of the handle, where the ridges made the part hard to fill.”



**Top** An automated workcell produces wastebaskets, with molding controlled by a SmarTrac system. **Middle** Appliance parts receive the white glove treatment. **Above** An in-house cooling rack ensures dimensional stability.

The Ferris wheel is an example of the in-house cooling fixtures mentioned earlier. Handles are molded in a four-cavity tool in a fully automated workcell. After the robot has placed the handles on a cooling conveyor, a technician places them in the cooling fixture so that dimensions do not change as final crosslinking and cooling is completed.

At the next fully automated workcell, where a 700-ton press is molding fire-resistant wastebaskets, a unique cure monitoring system keeps track of material crosslinking at the molecular level, according to Steven. "On every shot, a dielectric sensor reads the degree of cure. The system is integrated with the press to control the opening of the mold at a specific point on the cure curve to avoid undercure conditions. We plan to equip other presses with this system in the near future," he adds. The Signature Controls SmarTrac system also enables technicians to optimize the process for variations in ambient heat, material, process, and mold heat recovery.

A large tooling department provides space to perform preventive maintenance and to fabricate components. A bead blasting unit uses recycled plastic as media cleans the tool interiors without scratching or abrading the surface. Tools are also modified here to optimize cycle times and part performance.

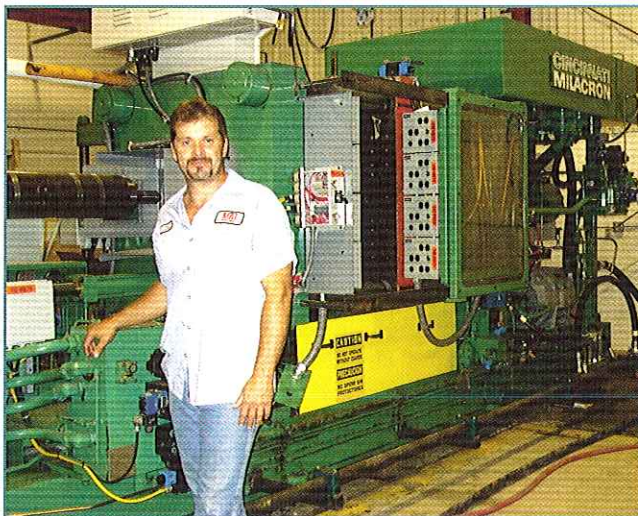
### New R&D technology center

Corporate offices and an integrated Technology Center at the Queens Way facility, Mar-Bal's most recent investment, are a mere 60-second drive away from the Munn Road plant. This newly built facility provides corporate, sales, and marketing staff with offices up front, and also supplies a much-needed separate space for engineering services and technical development.

Chuck Berry, engineering supervisor, oversees rebuilding of the presses for all three plants at this new location. "We purchase Cincinnati Milacron frames from the mid-'80s to early '90s, and then add our own retrofits," he says. The rebuild includes a new wire harness, pump retrofit, closed-loop control for velocity and pressure, safeties, robots, and stuffers. A single rebuild on a 500- to 700-ton press takes two to three months. In addition, Mar-Bal designs and builds its own customized end-of-arm tooling for the Ranger robots on which it has standardized.

Design services are also located here, and Berry says that they are intrinsic to the company's mission. "We can redesign parts for greater molding efficiency, design tools using our vast experience with BMC, innovate, and take cost out for our customers."

Also at Queens Way, new quarters were under construction for the materials compounding laboratory at the time of our visit. Steven, who handles the materials side of the business, explains that the lab will increase R&D capabilities for materials development as well as perform electrical and mechanical tests and house the analytical services including FTIR, DSC, and TGA. ■



**Top** Oven handles are robotically removed from four-cavity mold  
... **Middle** ... and then manually placed in this cooling cage.  
**Above** Chuck Berry manages the art of rebuilding presses for BMC use.

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