DIE CASTING ENGINEER

Zinc Die Caster Doubles Production With New Heat Transfer Fluid System

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Bauer Products, Inc. in Grand Rapids, MI is a manufacturer of die cast zinc locking and non-locking handles for the die casting industry. For the last 40 years, the company has been using municipal water to control mold temperatures in their die casting machines. However, because of persistent quality and production problems, they recently decided to experiment with a Mokon HTF hot oil temperature control unit charged with Paratherm NF® heat transfer fluid. The results have been impressive. Quality has dramatically improved, scrap rates have diminished and the finished units per eight-hour shift have increased from 600 to 1100 or 1200.

Bauer is a family owned company that has been in the die casting business since 1958. Bruce Bacon, president of engineering, said there are currently 20 employees, including several highly skilled tool and die makers.

Bauer operates four 30-year-old die casting machines. Two hours before workers arrive each morning, the casting process starts with the automatic ignition of two gas-fired pots, each containing 650 lbs of zinc. By the time the molten zinc has reached the 750°F casting temperature, workers are on the floor. One of the workers can then trigger a plunger inside a gooseneck from the pots to force molten zinc into the dies through three ports. The cycle time is approximately 10 seconds with the fill taking from one to 1.5 seconds and the chill time taking eight seconds (see figure 3). After mold release, the parts that measure up to Bauer's meticulous quality inspection are buffed and polished and prepared for chrome plating.

Several of the die cast zinc handles are used on metal office cabinets and the tool chests that fit into the back of pick-up trucks. These handles have been, as Bacon puts it, "problem children." The finished cast parts tend to be of poor quality because of high porosity and poor surface finish. This makes them difficult to buff and polish and Bauer ends up with a high rejection rate. These quality problems mean the company often fails to meet its 600 finished parts per eight-hour shift, per-machine goal.

"Basically, the difficulties are the result of an inability to adequately control the die temperature with city water," Bacon said. "Incoming water temperatures range from 60°F to 65°F, which makes it difficult to accurately regulate die temperatures." Another major problem with water is the lime and calcium mineral deposits, which build up in the channels and cause scaling. As these deposits thicken, they begin acting almost like a ceramic insulator, which further diminishes cooling efficiencies. Bacon also noted that even careful tweaking of the valves in a water-cooled system could not provide properly controlled temperatures. "Whatever we do, there have been too many stuck castings. The re-start takes 20 to 25 minutes and the resulting loss in productivity

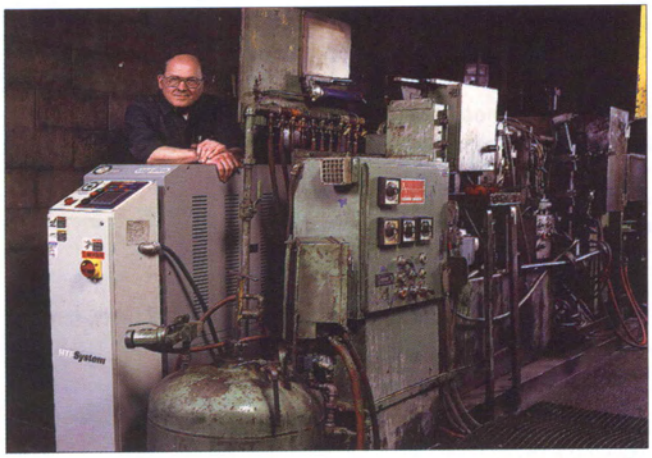

Fig. 1 — *Changing from a water cooled system to heat transfer fluid can dramatically improve quality and productivity.*

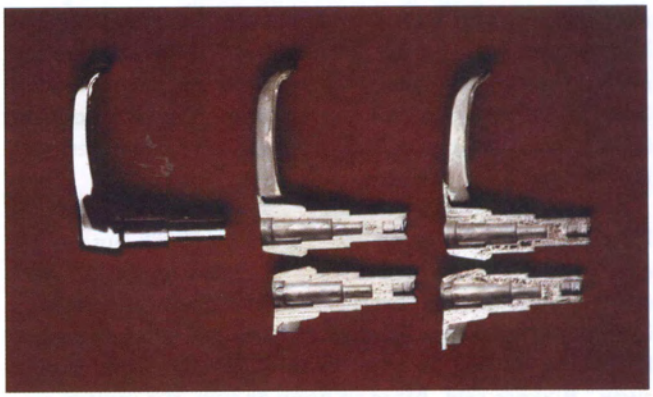

Fig. 2 — *A finished and chrome plated handle; (l to r) acceptable porosity that results when dies are heated and cooled with heat transfer fluid; porosity that results when dies are improperly heated before molten zinc is forced into them.*

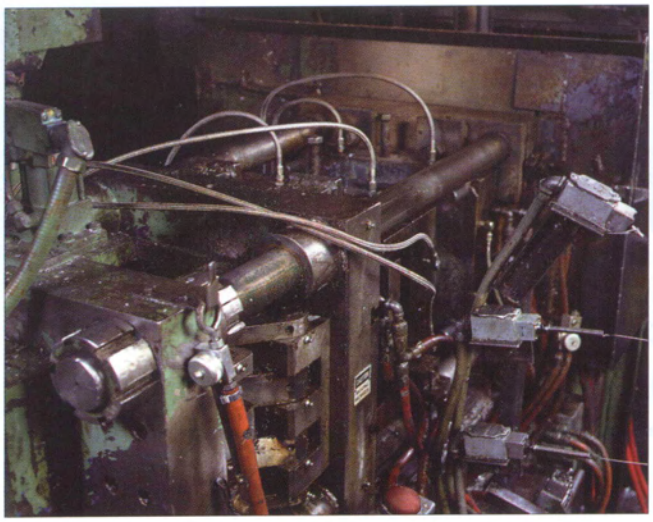

Fig. 3 — *Die casting machine in closed position.*

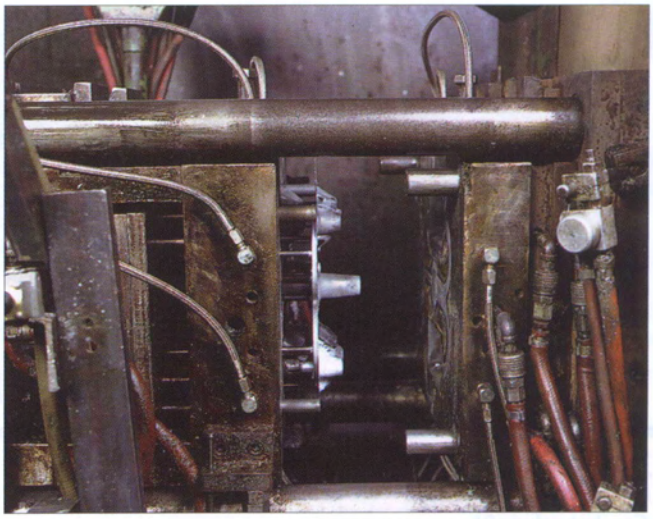

Fig. 4 — *Die casting machine in open position. The zinc handle has been cast and is ready for the finishing and buffing that proceeds chrome plating.*

can be significant," Bacon said.

About a year ago, Bacon decided something had to be done. After researching the options, he decided to convert the water-based temperature control system on a single die casting unit to a system based on heat transfer fluid. He contacted Don Peyser, a manufacturer's representative with Bronson & Associates of Astabula, OH. Peyser recommended the installation of a Mokon HTF 500 Series single-zone hot oil unit.

"In competitive heat transfer hot oil units, all 12 kilowatts are bundled as a single heating element. The Mokon 12 kilowatt unit that Bauer bought is designed with 12 separate one-kilowatt elements," Peyser said. "This generates greater turbulent flow and higher heating efficiency. As a result, the die is heated faster. Plus, if a Mokon element has to be replaced, the system can continue to run until the end of the shift with 11 elements. When the single 12 kilowatt element fails in a competitive hot oil unit, the equipment must be completely shut down until the element is replaced," Peyser said.

Fortunately, the Mokon system was able to use the original plumbing and heat transfer channels that were already integrated into the die casting units for the water. All Bauer had to do was clean the accumulated scale out of the channels.

Tom Valentine, Mokon's vice president of sales and marketing, said his company recommended that Bauer charge the new system with Paratherm NF heat transfer fluid. "We've been recommending Paratherm for more than 10 years and our customers consistently find it effective and trouble-free. In an industry like die casting, exact temperatures are critical. Paratherm's ability to deliver precise uniform temperature control improves quality and increases output."

Bob Rikkers, die casting supervisor at Bauer, noted that Paratherm NF is rated to operate above 600°F, but the die casting units did not require that kind of heat. "At the start of the day we heat the Paratherm to 350°F and then circulate it through the system. Getting the dies heated before casting begins means we can start to turn out usable parts right away," Rikkers said. After an hour or two, the molten zinc flowing into the dies establishes the correct thermal equilibrium, and heat transfer fluid operating temperatures can be lowered to between 125°F and 150°F. "With the water cooled system, there was always a lot of scrap at start-up, and the waste and inefficiency continued until the system was properly heated. Moreover, water bills had been going up to the point where they have become a significant cost factor," Rikkers said.

The new thermal fluid system has only been in operation for several months, but it is already considered a major improvement. Because of the consistent temperature control of the hot oil, Bauer has been able to increase molten zinc charge weights going into the dies by .4 of an ounce — 10% of the finished part's weight.

"The better fill in the dies, makes final polishing and buffing far easier and less time consuming," Bacon said.

In the now rare instance of stuck castings, the mold can be re-started in five minutes instead of the 20 to 25 minutes it generally takes with a water-cooled system. Bacon also noted the cleanness of the thermal fluid system. "With Paratherm NF there is no build-up or coking in the system — a big difference from the deposits that build up from city water."

In summary, the benefits of the new hot oil system are fast pre-heat, elimination of life-shortening temperature shock to dies, reduced scrap rates, faster cycle times and ending the need for regular shut downs to clean the channels. Clearly Bauer's changeover to Mokon equipment and Paratherm NF hot oil has been a total success. The company plans to change all the other water-cooled systems to heat transfer fluid systems as soon as possible.

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