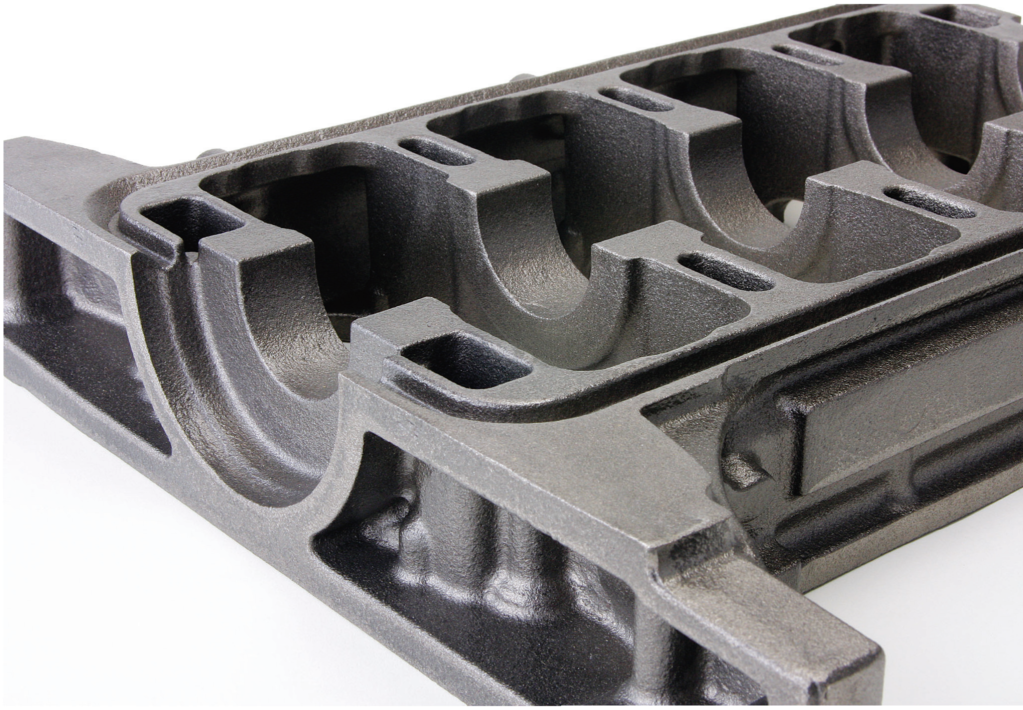
Waupaca's Mold Innovation

Waupaca Foundry found a way to double the number of castings it could make per mold for a complex bedplate job. **A MODERN CASTING STAFF REPORT**



Waupaca Foundry produces this gray iron engine bedplate for a small passenger car via its vertical green sand molding process.

Waupaca Foundry Inc., Waupaca, Wis., is no stranger to change.

Several years ago, the iron casting giant was forced to idle one of its six facilities in the face of slowing demand. In 2011, it reopened the plant as business began to rebound. In May of the same year, it received word from its parent company, ThyssenKrupp AG, Essen, Germany, that the metalcasting division was going up for sale.

The sale of the company to a private equity group was finalized in June.

Operations pressed on through it all, and Waupaca Foundry continued to move forward. The company has long served the automotive market with its high-production green sand casting lines, a market which requires innovation to stay competitive.

Waupaca Foundry produces a 23-lb., 14.715 x 14.291 x 2.402-in. casting for a hybrid car engine bedplate through just such innovation. Using a splitter core slipped between two vertical molding cavities, Waupaca met the automotive customer's cost and lead time requirements while maintaining the necessary quality.

"The innovation that Waupaca has done and continues to do is what drives this and other products," said James Newsome, Waupaca Foundry director of marketing. "[It's not just tied to] this particular part, but more to Waupaca's culture."

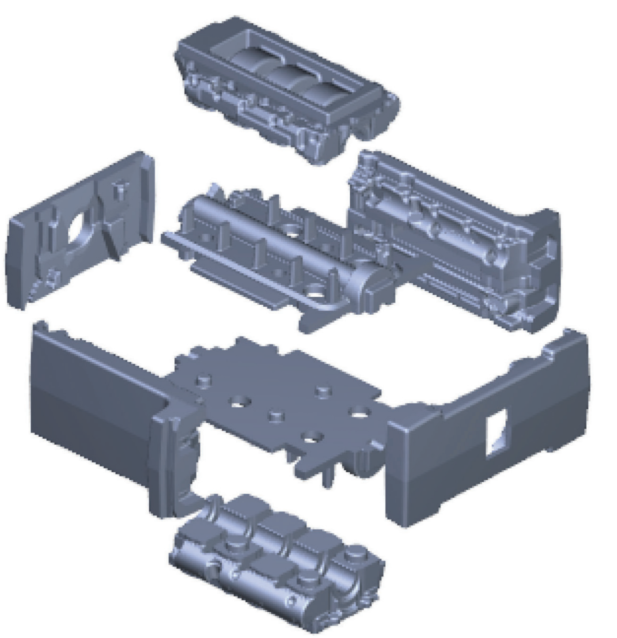
Benefitting the Customer

Waupaca Foundry uses splitter cores on a variety of parts, but the bedplate casting offered unique challenges, according to Plant 2/3 plant manager, Jeff Walters.

"This core package really allowed us to put two parts within a smaller space because of the design of the splitter core," he said.

The total number of castings in one green sand vertical molding chamber increased from two to four. Previously, one casting was produced using six cores. The new design requires eight total cores for two castings. This allowed Waupaca Foundry to reduce its internal processing time for the casting.

Efficiency was increased by streamlining the assembly on this complicated part. Waupaca Foundry underwent what production teams called the most precise core package design ever undertaken. To meet tight tolerances and customer demand, significant process changes were made to the core production cycle, resulting in a casting with fewer core components, and increased quality.



The core assembly package is shown here. Two splitter cores, which enable the bedpates to be cast with a single core package, are in the center of the depicted assembly.

"The development process was three to four months," Walters said. "We met here, and our customer's customer came in with them to meet with their engineers and ours."

Cost guidelines for the project required the production team to create a production control process that would optimize the number of castings made in one mold and streamline the core assembly. The key was to cast the bedplate vertically, but this required additional precision in creating multiple core assemblies.

The eight components of the core assembly previously were assembled manually, requiring time and manpower to handle

Reducing human touches on the core assemblies ensured the surface of the core would not be damaged, resulting in a superior casting surface finish.

"We are removing the process of human hands touching the core assembly and automating handling."

—Jeff Walters, Waupaca Plant 2/3 plant manager

each component, de-fin and assemble. To streamline the process, the production team installed a conveyor belt between two robotic cells, which now produce the core package.

Reducing human touches also increased the quality of the core assembly and, ultimately, the casting. Prior to using a conveyor belt, cores were stacked on a rack, which increased the likelihood of dings and damage. The conveyor, in effect, protected the surface of the core assembly. A vacuum plate used to extract core assemblies proved more consistent than human workers and ensured the surface of the core would not be damaged. Using robotics to de-fin the core was more precise and contributed to a higher quality core and casting.

"Because we have the ability to integrate this part into the cell in-house, we were able to accomplish getting this to an economical level for the customer and meeting their timeline," Walters said.

Using Casting's Capabilities

Waupaca Foundry's key to creating a casting with the quality and efficiency expected was vertical green sand molding. Engineering teams designed a core assembly that allowed two bedplates to be cast with a single core package through the use of a splitter core between the mold cavities. In addition to needing fewer cores to produce each casting, Waupaca Foundry improved pouring yield. Due to the detail and complexity of the core assembly, the production team used a coldbox coremaking process to ensure accuracy and precision in the final casting. Once created, the splitter core was used to piggyback two castings in the vertical green sand molding process.

"We normally would not consider this piggyback design for a part this complex in vertical molding," said Randy Hillskotter, production manager. "But the innovative core assembly allowed us to do it successfully."

Waupaca Foundry's Plant 2/3 reengineered the core production process to include a vacuum end effector for use in extracting, core de-finning and the partial assembly of the core package. Once extracted, core components were placed on a plate for robotic de-finning, similar to a cookie cutter.

"We worked with the engineering

Robotic vacuum extractors handled the core assemblies throughout the process.

Two robotic cells produce the core assemblies for the hybrid car engine bedplate casting at Waupaca Foundry.

group and designed the robotics and automation into the cell to accommodate this part," Walters said. "We also can use it on other parts, but we took our engineering people and did our own automation…to take this package and produce it on that cell using robotics and vacuum tooling."

Engineering teams designed a robotic vacuum end-effector specifically for the project because existing robotic pick-offs wouldn't work with the core's intricacy and need for precision alignment. In addition to lifting the core components, the vacuum robotics placed them on a custom-designed plate for defining and partial assembly.

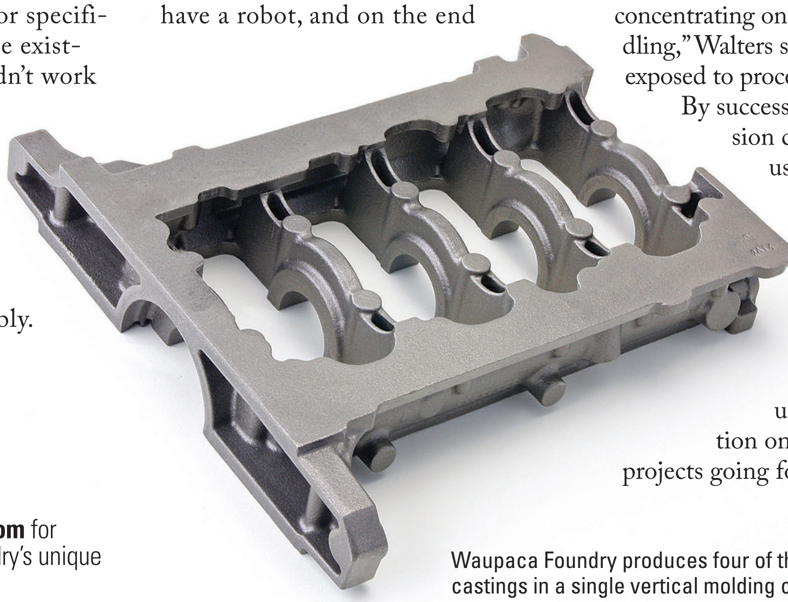
Some human touch was still needed in a portion of the core assembly, but using the robotics decreased production time and significantly increased core assembly (and ultimately casting) quality.

"When you pick up a core, you traditionally have a person who picks it up. If you can picture it, we have a robot, and on the end of the robot, we have a fixture that uses a vacuum to pick up the core and hold it tight without damaging it," Walters said.

The robot manipulates the core through the process until vacuum release, when the part is disengaged.

"We are removing the process of human hands touching the core and concentrating on automating handling," Walters said. "The cores are less exposed to process damage."

By successfully creating precision core assemblies and using robotic solutions to assemble the components, Waupaca Foundry was able to create a best practice in core production. The company expects to use this process innovation on equally complicated projects going forward. MC



Waupaca Foundry produces four of these 23-lb. gray iron castings in a single vertical molding chamber.

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