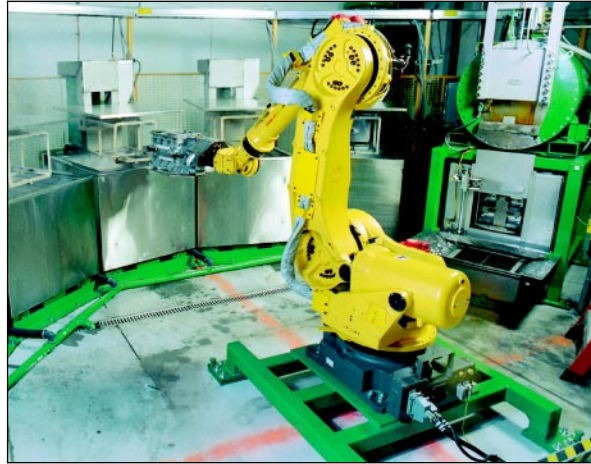


## *New Product* CFi System Defies Traditional Approach to Casting Impregnation

The traditional approach to casting impregnation has followed the line of thinking that bigger is better. Despite all of the technological advancements in the metalcasting industry in recent memory, the theory of performing casting impregnation in large batches inside of large vessels has gone relatively unchanged. As a result, casting impregnation to eliminate casting porosity defects has remained an expensive, and sometimes risky, value-added process.

But in 2001, Godfrey & Wing, Cleveland, was awarded a contract to install an impregnation facility near a General Motors Powertrain (GMPT) engine cylinder head casting machining facility in Massena, N.Y., that challenged the traditional approach. Instead of shipping large batches to an impregnation facility, GMPT decided that the impregnation vessel should be directly connected to the casting machining facility. This allowed for castings to be delivered one at a time by a conveyor, not by trucks. Out of that decision, Continuous Flow impregnation (CFi), which provides a more reliable, cost-effective solution, was born.

GMPT's desire for the impregnation and machining facilities to be close created many challenges. Coordination of Takt times and work schedules, along with labor and asset utilization, were just a few of the obstacles to overcome. In addition, the engine cylinder head casting would be completely machined, so it had to be sealed with no risk of damage or contamination. Following the traditional impregnation approach, this would have



**The impregnation system can operate with no human involvement and may be integrated into almost any manufacturing and casting scenario, occupying less than 700 sq. ft.**

been unheard of. To develop the CFi system, Godfrey & Wing set out to eliminate all of the known failure modes in the impregnation process. This included using a smaller vessel, loading the parts into the vessel from the side rather than the top and feeding them through one at a time instead of in large batches.

In the CFi system at Massena, an operator visually inspects the cylinder head castings on a rotating fixture. When the inspection is complete, a robotic arm picks up the cast component and loads it into the vessel. The impregnation chamber size is much smaller than a traditional chamber allowing for efficient removal of the air from the porosity, which is the key characteristic of the impregnation process. Once the vacuum is drawn, the component is lowered into the resin, which occupies the lower portion of the ASME impregnation pressure vessel. Once the component is covered with resin, pressure is applied

allowing for fast and deep penetration of the resin into the evacuated porosity.

Following the impregnation process, the component is centrifuged to recover the excess resin from the surface and machined features. The casting then moves to a wash station to remove any resin left on the metal. Hot water is then used to catalyze the resin to turn it into a solid.

When the process is complete, the robot moves the casting to an outbound conveyor, where an operator once again visually inspects it and places it into the shipping containers. The visual inspection (which is not related to the impregnation process) before and after the process is the only necessary human involvement. Except for the inspection requirement, the impregnation cell would operate without direct labor involvement.

In two years of operation, the system has achieved 97.4% up-time and 0 ppm for damage and contamination as a result of impregnation. Cycle times are well under 2.5 min./component. Under the traditional impregnation system, larger batches of components would require 45-60 min. for impregnation with much less control of the process. **MC**



**The CFi system was developed not only to process in singular or small lots, but to eliminate the failure modes associated with casting impregnation. The system has demonstrated a higher recovery of known leakers than that of a traditional batch system while achieving 0 ppm at the engine assembly plant.**