



Lean, Efficient Technology:

A Paradigm Shift in Vacuum Impregnation

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For the vast majority of people who know anything about the process of sealing porosity in castings, known as vacuum impregnation, it typically conjures the image of a technology by which product is batch loaded into a series of large, multi-purpose tanks. Until recently (the past decade) this was not just the perception, but the reality. In general, the process was inefficient, bulky, and difficult to control, making it undesirable or impossible to introduce into a modern manufacturing environment. This created a distinct mindset among manufacturers that the process was capable of producing sporadic results, and was managed best by a small community of specialized impregnation service businesses. Few who rely on vacuum impregnation have ever wanted ownership of what was a bulky and cumbersome process.

The use of batch type vacuum impregnation equipment continues to serve the industry and will always have a place. However, for the vast majority of applications there's a new reality, which is relatively unknown to most, for delivering this process. The latest breed of impregnation systems are lean, well-adapted for present day manufacturing facilities, and a technological quantum leap over the historical methods. These systems are cellular in design, and focus on conserving valuable resources including labor, power and floor space while improving ergonomics and safety. Most importantly they have been developed intentionally to deliver world class quality to the customers who depend on them.

This technological evolution began little more than a decade ago with the development of a fully automated

system known today as a Continuous Flow Impregnation (CFi) system. The system, which has now been implemented in numerous automotive engine and transmission assembly plants, can be fully integrated into advanced machining and assembly lines. These systems utilize robotic part handling that eliminates the need for labor and can reach takt times as low as 90 seconds. Tight, repeatable process controls along with robust process steps (such as vacuum levels of less than 5 torr, centrifuging parts up to 250 rpm, and highly effective wash systems) have led to drastically improved results over what used to be the industry standard. Where the world used to accept an 80% part recovery, rates of better than 99.8% are fast becoming the new norm. Repeatable, self-contained, cellular production has replaced non-value added inspection and handling.

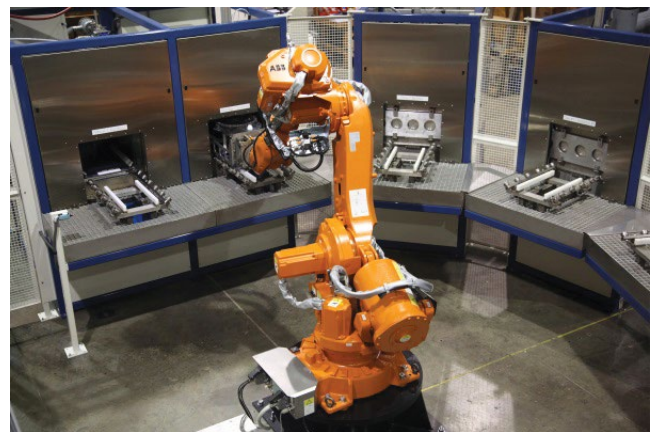


Figure 1 – Fully Automated Continuous Flow Impregnation System.

With success of the CFi technology came the realization that there were a relatively finite number of customers, needing this level of process integration, automation, and production capacity. Manufacturers with smaller volumes such as die casters or machine shops were not prepared to devote the capital needed for a fully integrated unit. At the same time these manufacturers required the improved quality and lean approach, provided by the CFi. So the superior technology of the CFi system was re-engineered into a much smaller and more affordable envelope. This new style front loading system's name denotes its purpose of sealing porosity in high value castings at a relatively low volume. The High Value, Low

Volume (HVLV) system utilizes the same process and controls as the CFi, maximizing the percentage of sealed, conforming components. However, the semi-automated HVLV replaces the robotic payload conveyance with an attendant. The combination is a unit capable of delivering 15 high-quality cycles per hour versus the 38+ cycles of its big brother, the robotically tended CFi.

In general the lean, efficient HVLV system features smaller front-loading modules, eliminating the need for overhead hoists and cranes. The smaller, versatile modules are designed and engineered to accommodate a wide range of components. The lean, compact HVLV makes short work of payloads containing six cylinder engine blocks, transmission cases and a multitude of smaller fully machined castings. Using a flexible, universal 600mm x 450mm x 350mm processing basket, one HVLV owner commented that the system “gobbles parts”. The compact design occupies only 84 square feet of floor space, allowing manufacturers to locate their impregnation solution directly in or near their manufacturing cells. Installation is as easy as connecting a few utilities. This small footprint was achieved, in part, by skillfully integrating the impregnation chamber with the centrifuge. This is just one aspect of the HVLV system that sets it apart from all other impregnation systems.

Like a CFi the HVLV delivers a highly controlled and repeatable process. Also like the CFi the process steps have been painstakingly engineered to eliminate failure modes and provide world class quality. The result is a system with a proven record of producing better than 99.5% sealed functional parts. All this delivered in a package that is lean and affordable engineered for just about anyone with a need for impregnation.

Whether you're in the business of manufacturing hundreds of transmission cases a day or thousands of air compressor housings, it's all about reducing costs by recovering castings after numerous value added processes have already been worked into the product. This is what makes vacuum impregnation such a necessary and valuable process. New lean systems such as the CFi and HVLV are empowering today's lean manufacturing world to own vacuum impregnation. In doing so, businesses are able to maintain better quality control over their products by keeping everything in their care and custody, eliminating all costs associated with logistics, dramatically improving recovery rates, and minimizing or eliminating labor. At the end of the day these systems provide superior quality at literally a fraction of the cost of replacing non-conforming parts. Like most lean processes, they “drive down” the overall cost of manufacturing, increasing your company's competitiveness in the marketplace.

In addition to their cost effectiveness, this new generation of vacuum impregnation systems have been developed with the operator and maintenance personnel in mind. The systems utilize PLC controls that can be easily tied to plant or remote monitoring systems, incorporating full self-diagnostics that make operation and troubleshooting simple.



Figure 2 – Lean and Efficient Front Loading HVLV Impregnation System.

So what about the environmental impact of these new cellular systems? Impact to the environment has been at the forefront of the CFi and HVLV designs. To meet the most stringent environmental standards, emphasis was placed on developing technology to recover sealant for re-use via a high speed centrifuge before the sealant enters the wash system. This maintains the recovered sealant in its original and purest state and allows for its repeated use. By recovering sealant inside the impregnation chamber the surrounding area is not contaminated with residual sealant, eliminating housekeeping concerns associated with traditional impregnation equipment.

Typical applications are found in the automotive, defense and aerospace markets with a broad range of precision castings such as transmission cases, hydraulic housings and other cast components required to hold pressure. Additionally, manufactures of over-molded connectors, cables and other electrical composite components are utilizing impregnation as an effective way to replace costly, manual “potting processes” for sealing harnesses and connector assemblies.

Lean, front loading systems like the CFi and HVLV make vacuum impregnation feasible for advanced manufacturing environments. From automotive and industrial OEMs to contract manufacturers to die casters and foundries, vacuum impregnation is, for the first time, a viable, in-house solution for producing pressure tight components thereby eliminating scrap, transportation and work-in-process, while at the same time driving down the overall cost of manufacturing.

To learn more about lean, front loading vacuum impregnation systems and if this type of system is the right solution for your business and application, please contact Godfrey & Wing at 1.800.241.2579 or visit www.godfreywing.com.