# 3-in-1 Core Blowing Technology

The development of **Equipment Merchants International Inc.'s (EMI) new patented 3-in-1 technology** that simplifies the blow, tamp and curing cycle started with an analysis of core-blowing cycle times, and how to cure a core efficiently. Through experience, EMI has found the cost of manufacturing core machines is directly proportional to the cycle-time or throughput requirements that customers' demand. Not only is dry cycle important, but the process times related to exhaust, gas and purge times also directly effects the final throughput of the core system.

As foundries consolidate core families into single designs, this consolidation requires larger core machine capacities to meet larger single-piece cores to be blown. This is also the case with newer casting processes gravitating to larger, more integrated, blown-sand packages, such as the precision sand process. These high core machine costs, consisting of sheer floor space, higher utility requirements, and maintenance costs, put the return-on-investment (ROI) for these types of core machine solutions out of the reach for most competitive foundries.


**EMI's new core machine is a pneumatic design with an air-over-oil circuit, a 75-lb blow capacity using an 18x18-inch blow plate, new tooling, and a drag roll-out cart with an external ejection system.**

EMI's approach to this new 3-in-1 technology centered on developing a simpler design that could be easily transferable to existing core machines and tooling packages. The design efforts began to center around a common method of blowing, tamping, and gassing in a simplified manner. The tamping of the core was critical to eliminating any post-blowing core processes, such as the sanding or filling of these areas.

From these criteria EMI developed the concept of a sliding blow tube inside of a sealing tube, with a non-transferring gassing manifold that provided a solution to all of these issues.

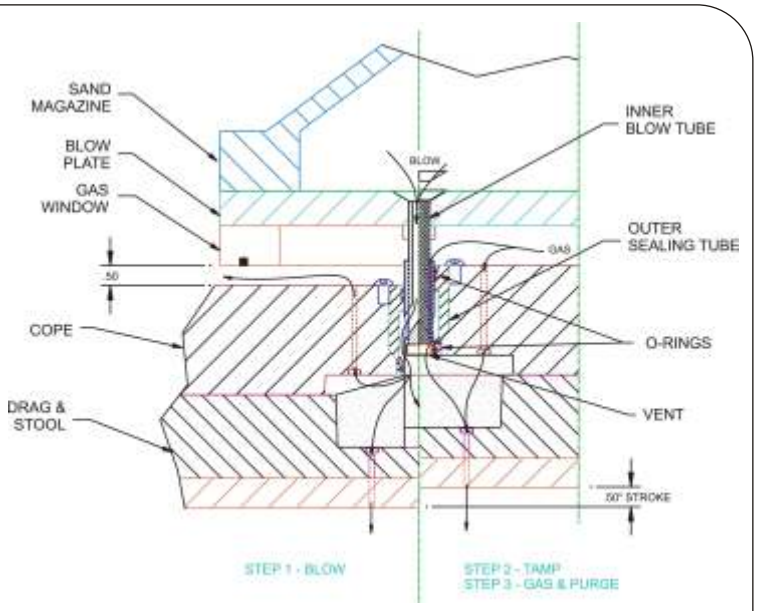
This new process would allow the core (or mold) to be blown, after which the continuously clamped drag-and-cope assembly would be allowed to move approximately a half-inch to tamp and then cure. The inner tube allowed the passing of the sand from the sand magazine to the core box. At the tip of this inner blow tube is a vent that allows the catalyst to pass through during cure. The outer tube, which was mounted in the cope, allowed for sealed interfaces between the inner and outer tube, where the blown sand in the tube is isolated from the catalyst.

The gassing manifold is de-coupled from the typical transfer mechanism and is integrated onto the perimeter of the blow plate. With no gas shuttle required, this eliminates the lowering of the core box, the transferring of the gassing manifold, and the raising of the box back up to gas. In fact, the clamp table stroke is reduced and the only stroke required is what is necessary to extract the core from between the cope and drag (or clear for drag out) plus a half-inch. This results in a compact machine with minimal dry cycle times and core box motions.

EMI designed and manufactured a new R&D machine with motions that could be run automatically for further testing. The machine built was a pneumatic machine with an air-over-oil circuit, a 75-pound blow capacity using an 18×18-inch blow plate, new tooling, and a drag roll-out cart with an external ejection system. EMI made a set of tooling based on a two-part mold for 505 test bars, and also incorporated some stock equipment and used a batch mixer, scrubber, and a 4-kW gas generator for testing.

EMI wanted a robust design that passed high-stress bench testing and endured the real-life conditions of a foundry, where sand will invade every space and component. In almost every foundry application, wear is expected. With this R&D machine, EMI was able to further address the geometries of the inner and outer tubes.

**The 3-in-1 core machine is centered on a single, straight, inner tube, a solid outer tube, and commercially available O-rings to seal the interface. All the components have been proven to be durable enough to withstand the abrasive effects of sand blowing.**




**EMI theorized that leaving a slight back-pressure in the blow head during gas and purge, would prevent undesired migration of catalyst into the inner tube. A back- pressure regulator valve was installed in the blow circuit.**

Different styles were tested before settling on what is essentially a straight, inner-tubular design that minimizes the amount of sand to be tamped. In addition, further work was done on tube materials that could withstand the sand eroding affects of blowing. The final design also includes a solid outer tube with O-rings that have proven quite resilient, and are easy to change, too.

Through rigorous testing, EMI found that by keeping a slight back-pressure in the blow head addresses any minor wear or leaks. Testing uncovered that if at least an equal amount of back-pressure in the blow head was applied during the gas and purge cycle, it would eliminate any undesired migration of catalyst into the undesired areas of the inner tubes.

Now, rather than exhausting after the blow, EMI just needed to reduce the back-pressure in the blow head to a pressure greater than the gas generator. This solved any issues associated with eventual wear between the interface of the inner blow tube and O-ring seal and extended its life cycle. Since the back-pressure is relieved during core extraction, this eliminates the time delay required for an exhaust cycle.

Another benefit for foundries is that all critical alignments are done through the tooling, as the blow plate and cope never separate in the machine and the cope and drag only become separated during the core extraction operation. The machine is simple resulting in minimal maintenance requirements. Foundries will rely on their pattern and tooling shops, and less on engineer support, to run and troubleshoot their core making equipment.

When the operating times for the entire machine are considered in perspective, EMI has substantially reduced both the dry cycle and process times. Additionally, with shorter clamp-table strokes, no delay due to the typical exhaust time delay, and elimination of the gassing manifold transfer, the machine has been simplified considerably. We see overall cycle-time reductions of 28-36 percent versus comparable machines in the field.

By decreasing or eliminating most of these motions, the power unit requirements are reduced drastically. In fact, since the clamp motion is the main power consumer, this opens up opportunities for electromechanical devices in lieu of hydraulics. Smaller table stroke eliminates the need for a pit or any special foundation requirements, regardless if a picker or drag-out style of machine is manufactured. Without a gassing shuttle extending the machine envelope, its footprint is reduced, too.

EMI's new patented 3-in-1 technology will lead to reduced MTBF (Mean Time Between Failures), and MTTR (Mean Time to Repair), while showing improved LCC (Life Cycle Costs) and OEE (Overall Equipment Efficiencies) over the conventional core machines in the field today. When comparing all the benefits of this simpler machine design, this new EMI 3-in-1 core machine will quickly become the industry benchmark for performance and throughput.

**Gerald B. Senk is the president of EMI; Greg Piontkowski is the firm's vice president. Visit www.emi-inc.com**