METAL CASTING

Project Fact Sheet

CLEAN CAST STEEL

BENEFITS

Cleaner steel castings will result in reduced energy requirements and reduced cost per unit produced, higher productivity, and higher quality castings. Project partners are finding that a reduction in welding requirements is leading to a number of benefits including:

- Time and material savings
- Less defect excavation
- Fewer weld deposits
- Less chance of inducing a weld-related defect
- Less weld bead arcing and less cosmetic grinding of welds

APPLICATIONS

These findings are being applied in the steel foundry industry and will improve quality in virtually all steel castings. Participating foundries are already seeing dramatic results. Additional information dissemination will be conducted through an instructional video and other accelerated technology transfer methods.

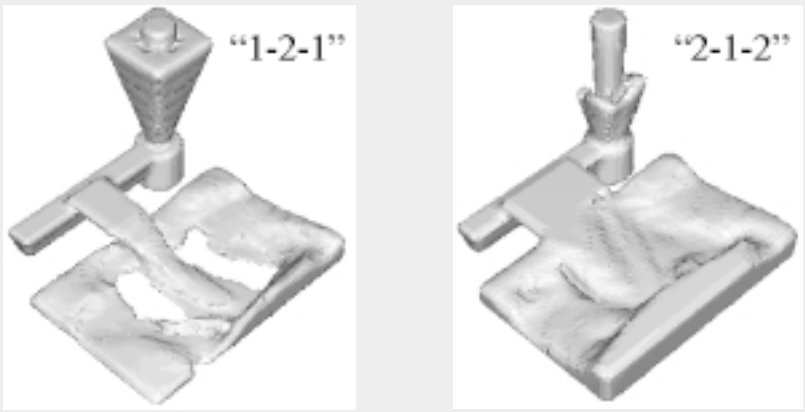
METHODS IDENTIFIED TO PRODUCE CLEANER STEEL CASTINGS

The purpose of this research is to identify the significant causes of macroinclusions in steel castings and devising methods to minimize or eliminate their occurrence.

All foundries have oxide macroinclusions in their regular production castings. Macroinclusions can significantly degrade the machining of parts -- even to the point of breaking tools. This is costly on high-speed machining lines and reduces plant productivity. Macroinclusions serve as initiation sites for failures in the casting. Macroinclusion removal and weld repair typically adds 25% to the cost of casting production.

This research, being performed by the University of Alabama - Birmingham and with a team of industry partners, is resulting in significant findings. Participating foundries have seen measurable improvements in reducing dirt and the number of welds requiring repair. In one foundry, for example, the number of welds requiring repair dropped from an average of 21.1 per casting to 3.7 per casting -- an 82% improvement.

EFFECT OF GATING SYSTEMS ON METAL FLOW



Gating trials to develop steel casting gating guidelines are ongoing. Further work is needed to understand the important factors in producing a good gating system. Graphics illustrate the effect of two different gating systems on metal flow into a small test plate.

Project Description

Goal: *To improve cast product quality by removing or minimizing oxide defects that require weld repair.* Specific objectives are to deliver clean metal into the mold cavity, remove oxides prior to or during pouring, and to prevent oxide formation during pouring. This will enable the production of higher integrity steel castings. In addition, project performers are planning to accelerate the transfer of clean steel findings to the steel casting industry.

Progress and Milestones

Phase I has been completed:

- Testing has been conducted on the gating system. Pouring tests have been performed.
- Initial procedures for improving machinability and for obtaining cleaner castings have been identified.
- A shroud that will seal against the bottom of the ladle has been developed -- significantly reducing defects. Participating foundries have poured more than 2000 tons of castings using this technique. This is reclaiming work that had gone to forgings. Additional foundries have begun trials with ladle shrouds.

Phase II is underway:

- Test plates are being obtained from participating foundries for machinability tests. These tests will be performed at UAB.
- A Final Report on the machinability of clean cast steel was submitted in the 4th Quarter of 1999.
- An instructional video on clean cast steel has been produced and made available to industry in December 1999.
- A spreadsheet calculator is being tested to allow steel foundries to optimize metal quality for acid refractory furnace practice.
- Thermodynamic relationships between metal quality and basic refractory furnace practice are being developed.
- Computer models of metal flow and fill have been generated for a number of steel gating systems.
- Gating systems have been rated using numerical values of turbulence and surface area calculated from the computer model.
- Guidelines are being developed from foundry trials and computer modeling for gating steel castings.

Project Partners

American Magotteaux, Pulaski, TN
American Steel Foundries, Granite City, IL
Atchison Casting Corp., Atchison, KS
Dominion Castings Ltd., Ontario, Can.
Electric Steel Castings, Indianapolis, IN
Falk Corporation, Milwaukee, WI
Harrison Steel Castings, Attica, IN
Keokuk Steel Castings, Inc., Keokuk, IA
Maynard Steel Castings, Milwaukee, WI
National Castings, Cicero, IL
Sawbrook Steel Casting, Lockland, OH
Selee Corporation, Hendersonville, NC
Stainless Foundry & Engineering, Milwaukee, WI
Steel Founders' Society of America, Des Plaines, IL
University of Alabama - Birmingham, Birmingham, AL
Wisconsin Centrifugal, Milwaukee, WI

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