SPONSORED RESEARCH

PROJECT TITLE: *Turbulent Gating Effect on C89833*

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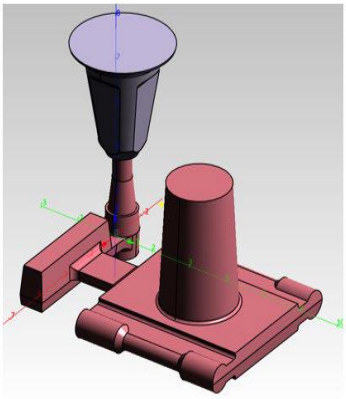
IMPACT: Patterns formerly poured with leaded brass alloys and converted to no-lead brass alloys will often run with higher scrap due to pressure testing failures; the key to lowering this scrap towards historical levels is non-turbulent gating designs.

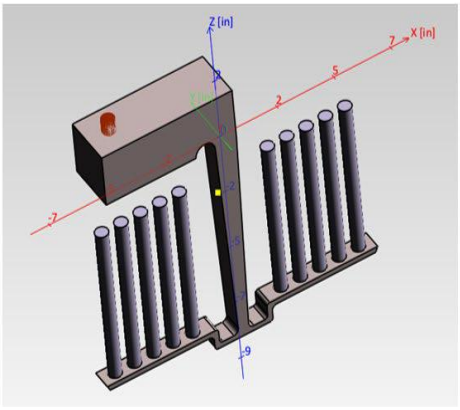
Technical Need

Brass foundries have typically seen an increase in scrap rates due to castings failing leak testing since the conversion from leaded brass alloys to no-lead brass alloys. In most cases, foundries have not made significant changes to the gating systems to address this issue with the no-lead alloys. While turbulent gating systems may not have been associated with scrap issues with leaded alloys, they may be contributing to the struggles of making pressure-tight no-lead castings. This is an investigation of the effect that turbulent gating systems have on the C89833 low-lead brass alloy.

Project Goal

To determine if turbulent gating has an impact on pressure tightness and mechanical properties of C89833 material.





Technical Approach

Two casting designs were chosen, along with two tensile bar designs. The casting designs were chosen because of their similarity to common waterworks coupling castings and their varying wall thicknesses. Both castings transitions from thick to thin wall thicknesses, resulting in different solidification patterns. The tensile bar designs were based on the standard AFS pattern design and the nonturbulent gating design described by John Campbell. Simulations indicated vertically parted molds would be optimal to reduce turbulence while filling. Horizontally parted molds were used for the turbulent gating systems. To minimize tooling cost for the project and to eliminate sand variables from effecting the test results, 3D printed molds were used.

Findings and Conclusions

Each gating system has its advantages and challenges. The standard gating is easy to mold but presents some flow challenges. The vertical gating is difficult, and possibly very costly, to mold but allows for more ideal filling. The yield of the two systems were 51% for the standard gating and 53% for the vertical gating. The turbulent gating system resulted in a significantly higher percentage of castings that failed leak test. The fractures revealed larger dendritic formation at the ingate locations and other defects that were not found with the nonturbulent gating. More cold shuts were found in castings from the turbulent gating system as well. No differences were found between the mechanical properties of the two gating systems. Simulations confirm turbulence is generated in multiple areas of a traditional horizontal gating system. While vertically parting molds may be out of reach for many foundries, attempts should be made to reduce as much turbulence as possible within the gating system. These efforts will result in more pressure-tight castings and reduced scrap rates.