

METAL CASTING

Project Fact Sheet



HEAT TREATMENT PROCEDURE QUALIFICATION FOR STEEL CASTING

NEW PROCEDURES ASSIST STEEL FOUNDRIES ENSURE CASTING PERFORMANCE

BENEFITS

- Reduces energy requirements due to reduced requirements for reheat treatment and recleaning
- Estimated annual energy savings of 0.29 trillion Btu by 2010 and associated reduction in emissions
- Improves performance and quality of cast steel components
- Reduces shut downs for reheat treatment
- Improved service to customers

APPLICATIONS

The results of this project can be applied throughout the steel foundry industry where carbon, low alloy, and high alloy steel castings are produced. The resulting monograph of procedures will be disseminated throughout the steel casting industry through technical committees of the Steel Founders' Society of America.

Heat treatment qualification procedures can be used by steel foundries to assure casting performance for carbon, low alloy, and high alloy steels. At the present time, specifications for steel castings do not address the heat treatment procedure control necessary to assure casting performance. This is true for high alloy steel castings where proper heat treatment is the key to obtaining corrosion performance and for carbon and low-alloy steels where proper heat treatment is the key to obtaining mechanical performance. However, an estimated 20 percent of carbon and low alloy steel castings must be re-heat treated to reach casting property requirements. This project will develop simple but robust "heat treatment qualification procedures" that can be performed by foundries to demonstrate and assure casting performance. This documented proof of process control will give steel casting customers confidence that the castings are fit for service.

Researchers from the Pennsylvania State University are working with the steel foundry industry to evaluate heat treatment fundamentals and practice guidelines to identify key process control strategies. Current customer heat treatment specifications are being used as a starting point. Laboratory testing and foundry trials are being used to document the necessary qualification tests that must be performed to qualify casting performance for both high alloy, carbon, and low alloy steels. The success of this project is founded in the cooperation of a large number of steel foundries as well as an improved understanding of the sensitivity of heat treatment response to critical heat treatment process control variables.

CASTINGS INSTRUMENTED FOR HEAT TREATMENT STUDIES



Photo courtesy Pacific Steel Casting Company.



Project Description

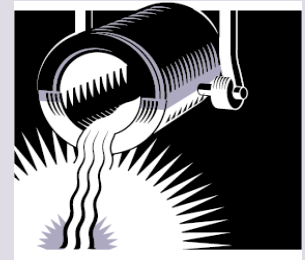
Goal: The goal of this project is to develop, test, and validate heat treatment qualification procedures that can be effectively used by steel foundries to assure casting performance for carbon, low alloy and high alloy steels.

Progress and Milestones

This three year project began in October 1999. Specific tasks include:

- Development of Science-based Heat Treatment Qualification Parameters - This task is determining which aspects of composition control, section size sensitivity, heat treatment process control, microstructure control and property control are essential for qualification procedure development. Factors being assessed include: furnace heating rates, furnace loading, furnace transfer time, furnace temperature uniformity, quenchant type, quenchant start temperature, quenchant finish temperature, quenchant velocity, part temperature at end of quench, and test piece size.
- Comprehensive Qualification Assessment - Complete process and property characterization of castings/test blocks is being conducted with participating foundries. This includes all testing that will be part of the qualification procedures including mechanical testing, corrosion testing, and composition measurements.
- Development of Heat Treatment Qualification Procedures - A procedure qualification monograph will be developed based on the experimental work. It will include the concise procedures qualification developed as well as supporting documentation to justify the methodologies.
- Validation of Heat Treatment Qualification Procedures - Qualification testing will be performed at foundry locations by foundry personnel to evaluate the effectiveness and robustness of the recommended qualification procedures. This critical assessment will be the basis for correcting or modifying initial procedure qualifications.

Technology transfer will be accomplished through the active role of the Steel Founders' Society of America (SFSA) research steering committee and the participating steel foundries. The research results will be broadly disseminated through the trade press, conferences, and other methods both for foundries and steel casting customers.



PROJECT PARTNERS

Pennsylvania State University
University Park, PA

Steel Founders' Society of America
Barrington, IL

ABC-NACO, Richmond, TX

The Harrison Steel Castings, Attica, IN

Milwaukee Steel, Milwaukee, WI

Missouri Steel Castings, Joplin, MO

Pacific Steel Castings Company, Berkeley, CA

Quaker Alloy, Meyerstown, PA

Sawbrook Steel Castings, Cincinnati, OH

Sivyer Steel Corp., Bettendorf, IA

Southern Alloy Corp., Sylacauga, AL

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