

# AMC

AMERICAN METALCASTING CONSORTIUM

## IMPROVING SUPPLY CHAIN TOOLS: VALIDATING WELD REPAIR FOR ALUMINUM ALLOY CASTINGS



Under the AMC Supply Chain Tools, Standards & Specification program, the American Foundry Society conducted research to provide statistical properties for Cast E357 Aluminum. Casting design engineers need properties that are not based upon typical or average properties but ones that are representative of the variation in manufacturing techniques, different section thickness and cooling rates encountered in the production of complex casting designs procured from multiple supply sources. Currently, most casting alloys have little statistical validation and cannot be considered for replacement or new design without developing this data on a component by component basis.

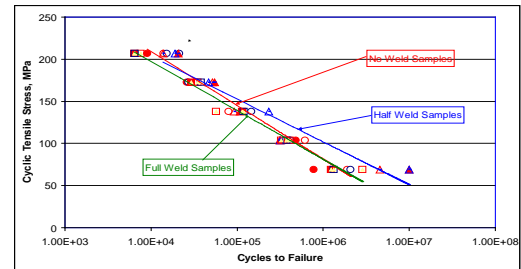
This project developed statistical basis A & B design allowable properties for sand cast E357 in several section thicknesses for inclusion in Metallic Materials Properties Development and Standardization (MMPDS) Handbook. The research was also intended to consolidate knowledge of weld repair for aluminum-silicon hypo-eutectic alloys, develop mechanical properties to demonstrate the efficacy of weld repair, and develop statistical data that facilitates acceptance of weld practice.

## SUCCESS STORY

**Problem:** Historically, properly accomplished weld repair has been considered to have little or no effect on the mechanical and physical properties of aluminum cast metal components. However, there is little validated technical information on the effect of weld repair. The issue has been debated for many years and some casting purchases do not allow welding under the assumption that welding may degrade strength and fatigue properties.

**Solution:** Research was conducted to provide validated data on the effect of weld repair on static and dynamic tensile properties of aluminum castings. Standard test bars were excised from aluminum castings in welded and as cast conditions and mechanical property and fatigue tests were performed. The results demonstrated that the presence of weld repair had little or no effect on tensile, yield, percent elongation values or fatigue properties.

**Benefits:** This study should provide confidence for casting users that, when using proper weld repair material and process parameters for an aluminum sand castings, there will little negative effect on either tensile or fatigue properties. Results also suggest that properly accomplished, welding may be appropriate for joining sand casting components to each other or attachment of wrought aluminum components to aluminum castings. It is feasible to expect a 10-20% scrap reduction rate on complex castings.



"Castings offer the most unique solution to our design options. We need to reduce the barriers for their use. This project offers the community of caster-designer-end user an opportunity by working together to create the answer." –David Jakstis – Spirit Aerosystems

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Advanced Technology International

CONTACT AMC:

(843) 760-3483; AMC@ATI.ORG

[HTTP://AMC.ATI.ORG](http://AMC.ATI.ORG)

This AMC project is sponsored by the DLA Troop Support, Philadelphia, PA and the Defense Logistics Agency Research & Development (R&D) Office, Ft. Belvoir, VA.

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