General Motors Phase Lead Welding

Overview
Copper phase leads must be lift arc TIG welded by an automated TIG welder to copper wires during the development of the type 'A' stator used in general motor electric vehicles. Currently the method used to crimp the phase lead to the wire prior to being sent into the automated TIG welder often does not produce a sufficient ground for the TIG welder to start an arc.

Objectives
To develop a method by which a copper phase lead is able to be lift arc TIG welded to a copper wire by an automated TIG welder without arc faults occurring by improving the ground between the phase lead and wire. Also reduce the cumulative trauma disorder risk incurred by the operator using the crimping tool.

Approach
• We performed preliminary research on TIG welders, properties of copper, and use of crimpers
• Through communication with General Motors we were able to understand their desires for the outcome of the project, and how they prioritized these desires.
• We visited the General Motors plant to observe how the current process was executed, and gather necessary data including specifications of the automated TIG welder used
• We brainstormed several potential solutions to this issue including an electric crimper, hydraulic crimper, electrostatic gel, and the use of copper or other metal dust
• After conversation with our sponsor the electrostatic gel, and hydraulic crimper were the two potential solutions we decided to develop and test
• We developed a CAD model of the custom die to be used in the hydraulic crimper
• Custom dies made of 1010 were machined to these specifications
• These dies along with the hydraulic crimper act as a functioning prototype that can be used on the line in the General Motors plant as well as a basis for future crimping tools.
• We developed a testing method simulating an automated TIG welder
• Testing resulted in a 100% success rate when using the hydraulic crimper with custom dies, and eliminated the possibility of using electrostatic gel
• We evaluated our results statistically on a six sigma level

Outcomes
• A sufficient ground between the copper wire and copper phase lead is achieved 100% of the time
• The CTD risk of operating the new tool is 1.00 compared to a CTD risk of 1.68 from operating the old tool.