

Design of Toyota Sleeve Changing Device

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EXTENDED ABSTRACT

Bodine Aluminum, Inc., a Toyota company, changes 750-lb shot sleeves in high pressure die casting machines 120-130 times annually as part of the manufacturing of its Camry V6 and V8 engines. The current device used for changing shot sleeves needs engineering modification or redesign for performance improvement. Weaknesses that need improvement include intensive manual labor, safety and ergonomic issues, and large time consumption. Bodine Aluminum communicated a need for improvement to the Union University Engineering Department. Project objectives are to design a device and/or process that will safely and ergonomically remove a shot sleeve and install a new shot sleeve while reducing the cycle-time by 50%. Upon completion, project's financial savings of \$264,000 annually due to reduced downtime. The payback period is expected to be 2 months. The most significant result, however, will be eliminating all ergonomically unsound processes from the shot sleeve change procedure.

This poster presentation will focus on the design of the internal support arm and the experience of selecting, designing, engineering and building an industry-sponsored capstone project.

Internal Support Cantilever Beam

One key change of the new design is to utilize an internal support arm inside the sleeve rather than allowing the shot sleeve to rest on an external support platform for insertion and removal. This support arm will be a cantilevered beam that fits inside the shot sleeve. The selection of the material and size of the cantilever beam will be done based on mathematical and computational simulation and analysis.

Project Structure

The design team worked closely with both Bodine Aluminum and its contracted machine shop in selecting, designing, engineering, and building this project. The experience was educational in real-life applicability, project management, engineering methodology (Design cycle, why-why diagram, Gantt Chart, etc). This design project utilized consensus management techniques for decision making, with a single liaison for communicating with the representative groups. The group consisted of a small team of five senior engineering students in the Major Design class.