



Company Information

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| Company Name | PDM US, LLC | Date Submitted | 11/10/2023 |
| Project Title | Automation Design of a Copper Casting Tube Bender (PDM_BEND) | Planned Starting Semester | Spring 2024 |

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

| Discipline | Number | Discipline | Number |
|------------|--------|------------|--------|
| Mechanical | 3 | Electrical | 1 |
| Computer | 1 | Systems | |

Company and Project Overview:

Who we are:

Here at PDM we believe the pursuit to design & develop beauty in our products & services is always vindicated when we deliver with elegance, simplicity, proficiency, safety and respect for all. We are simply not just a company that produces insulated copper tubing, we aspire to much more. Please enjoy our [video](#) and remember it's a long way to the top if you want to rock and roll. PDM is always "**First in Tubes**".

PDM draws on nearly 50 years of experience in the HVAC industry from our origins in Europe. PDM was the **First** one in 2008 to introduce the polyethylene tough jacket resistant insulation to the North American market (aka white insulation); in 2013 PDM was the **First** European lineset company to establish a production in the United States and in 2017 PDM was the **First** to become UL CERTIFIED for flame and smoke rating (ASTM E84 25/50) and UL performance verified for UV resistance. In February of 2023, PDM became a copper manufacturer and the **First** fully integrated Made in USA lineset company, being able to produce its own copper tubing, its own insulation and its own pre-



insulated linesets and single rolls. PDM is always “**First in Tubes**”. Here are some PDM US products made in Rock Hill, SC:



Project Requirements:

PDM has chosen Upcast as the preferred method of casting a tube. You can see a video of the Upcasting process [HERE](#). The solidifying copper is vertically withdrawn from the melt and is bent over at the top of the casting platform to be guided to the tube coilers.

At the start of the cast the operator must manually cut off the starter bar and bend the tube over the tube guide. In the Upcasting video, this manual operation is shown starting at the 6:10 mark and ending at the 6:21 mark.

We would like to semi-automate this task and install a bending roller to take over the initial bend of the tube as well as potentially installing a stationary tube shear. The bending roller needs to be adjustable to accommodate variable bending radii.

As we can cast in 6 positions in the current configuration, the bending roller assembly should be movable to either of those positions.



INDUSTRIAL SOLUTIONS LABORATORY



These are where the 6 casting positions are



Expected Deliverables/Results:

- Concept study of best and most economic approach to bend the started tube in all 6 positions.



- Study of the most feasible degree of automation and integration.
- Design and layout of the bending roller, potentially including the tube cutter.
- Manufacture and assembly of the necessary parts.
- Integration into the machine as far as necessary.

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Material strength and bending force calculation.
- Mechanical design, detailing and machining.
- Travel to the PDM US facility in Rock Hill, SC.