



Company Information

Company Name	<i>Ward Vessel and Exchanger</i>	Date Submitted	<i>3/24/2025</i>
Project Title	<i>Design of a Nozzle Support to Prevent Weld Deformation (WARD_SUPPORT)</i>	Planned Starting Semester	<i>Fall 2025</i>

Senior Design Project Description

Personnel

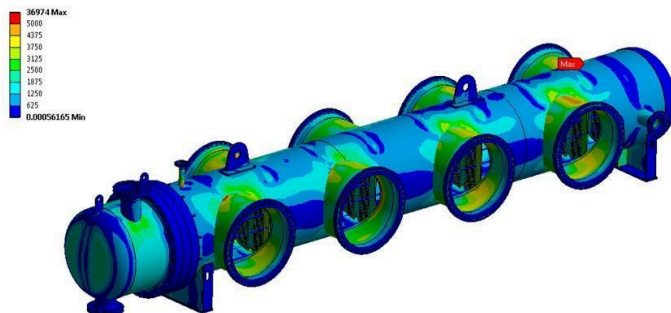
Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

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	5	Electrical	0
Computer	0	Systems	

Company and Project Overview:

Ward Vessel & Exchanger offers the design and fabrication of custom shell and tube heat exchangers and pressure vessels manufactured in accordance with ASME Code: Section VIII, Division 1. We specialize in process equipment for the chemical, pharmaceutical, food/beverage, pulp/paper, power, refinery and pure water industries. See examples of company products:





When welding nozzles into thin walled shells, there is often a significant distortion/deformation caused by the heat input from welding that causes the shell to come out of round more than what is allowed by ASME Section VIII Division 1 code, as well as the nozzle “sinking” in towards the center of the shell. The current solution is to design, cut, and weld “strong backs” as supports near the nozzle to reduce the amount of deformation caused by the heat input. These strong backs are then cut off, the remaining welds must be completely removed, and the material scrapped after use. See example of a strongback being cut off [HERE](#) (Note, this is for a large tank, not a smaller pipe or shell, but the idea is the same).



The goal of this project is to create a reusable and universal support device that will reduce nozzle shrinkage when welding in thin walled, pipe sized shells

The logo for the North Carolina Manufacturing Extension Partnership (NCMEP) features the acronym 'NCMEP' in blue, with 'North Carolina Manufacturing Extension Partnership' written below it. To the right is a blue gear icon with a red line forming a path around it. North Carolina Manufacturing Extension Partnership	This project is partially supported by a grant from the NC Manufacturing Extension partnership, an organization the helps to support business and job growth for NC companies. To learn more about the NC MEP, click on this link: https://www.ncmep.org/.
--	--

Project Requirements:

- The support shall fit inside a range of pipe sized shells, from 14" NPS (nominal pipe size) to 24" NPS, and shall be adjustable to anything in between.
- It shall directly support the nozzle being welded and shall be adjustable to a range of nozzle pipe sizes from ½" to 12".
- It will need to apply a force to the tacked-in-place nozzle prior to final welding to counteract the compressive force from the sinking caused by welding that sucks the nozzle in towards the center of the shell.
- The maximum required force that the support shall be designed to withstand shall be determined by the students and designed for using testing and data gathering methods of their choosing.
- Once the support is in place, there shall be a locking mechanism that can be easily engaged with one hand, and after welding, can be easily released, even with the compressive force that will be applied to it from the sinking nozzle.
- The support shall be weldable by one person and easy to use and maneuver.
- The contact points of the support shall be stainless steel as a minimum due to material contamination restrictions.

Expected Deliverables/Results:

- Fully tested and functional support that will minimize weld deformation of nozzles in thin walled shells within an acceptable range as defined by ASME Section VIII Division 1. Note- Ward has experts in the ASME code and will assist the students with interpretations and code applications.
- Test and verification to be done at Ward's Charlotte manufacturing facility.
- Drawing and detailed design of the support such that additional supports can be manufactured for all welding personnel.

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. It is also a mandatory part of this Program that the Industry supporter attend the 2 expos to grade their team's performance. 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):

- Machine design
- Statics and Solid Mechanics
- Basic manufacturing processes (mill, lathe, grinding, assembly, etc...)
- Ability to travel to Ward's Charlotte facility