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The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

UNC Charlotte – Lee College of Engineering Senior Design Program

Senior Design Project Description

Company Name	*Ametek – Controls Southeast*	**Date Submitted**	*03/12/2019*
Project Title	*Design and Build of a Scale Model of an Operating Flow and Pressure Device* **AMETEK_PD**	**Planned Starting Semester**	*Fall 2019*

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	4	Electrical	1
Computer		Systems	
Other ( )			

Company and Project Overview:

AMETEK, Inc. is a leading global manufacturer of electronic instruments and electromechanical devices with annual sales of approximately $4.0 billion. AMETEK has more than 15,000 colleagues at nearly 150 manufacturing locations around the world. Supporting those operations are nearly 100 sales and service locations across the United States and in 30 other countries.

Ametek - CSI is a division of Ametek Corporation and is located in Pineville, NC. CSI provides thermal maintenance systems and specialized process equipment for heating, cooling and control of liquid/vapor processes in the petrochemical, chemical, and refining industries. CSI does this through a combination of proprietary products and engineering methods developed over 40+ years of practice. The flagship products are ControTrace® engineered tracing, ControHeat® jacketing and SxSeal® Sulfur Traps. As a technology-neutral supplier, CSI evaluates all aspects for each project to deliver the most optimized heating or process equipment solution available – maximizing savings for both capital and ongoing operational costs. Some product examples:

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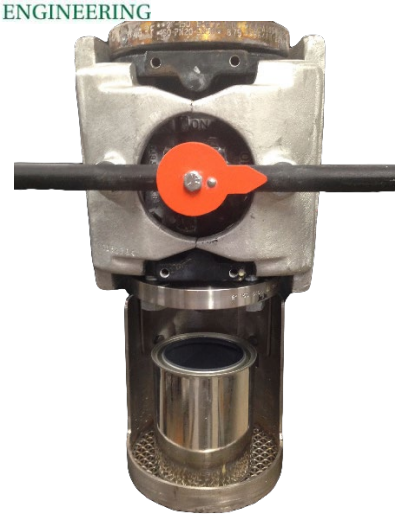
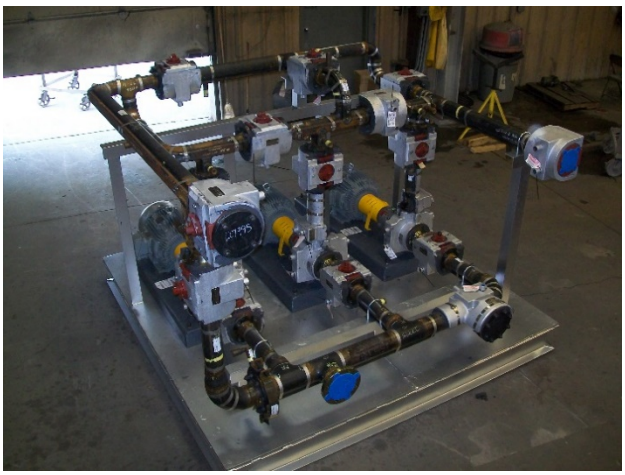
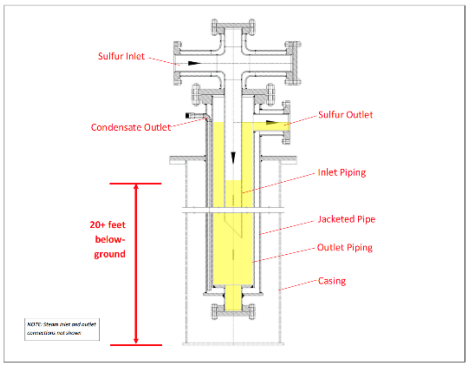
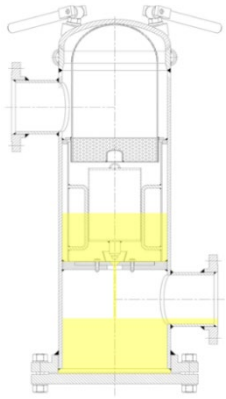


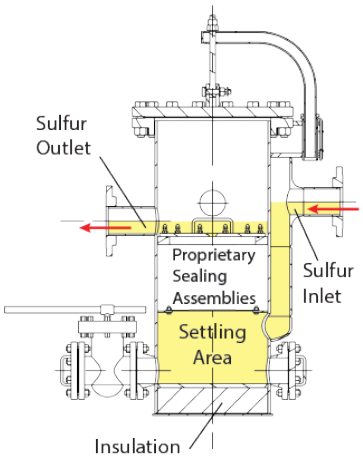


In oil and gas refining, it is necessary to remove sulfur from the refining stream to comply with environmental regulations that help to prevent “acid rain”. During the sulfur removal process, it is necessary to have process equipment that separates the high pressure section of the sulfur recovery unit from the atmospheric sulfur storage container which can be an in-ground pit or a tank. CSI

provides the refining industry with the widest available choice in sulfur sealing devices through their patented SxSeal® Product line. Choices are provided for below ground (shown on the left below) and two above ground (the two right drawings below) devices.







The above ground SxSeal's have experienced significant growth in the past 5 years as the features of the product have led to a market share leading product line. The device shown on the far right of the above diagram is the SxSeal 2000. This device represents the newest technology in Sulphur sealing devices and is proprietary to CSI. As the device is newest to the market and uses a novel technology, it can take time for process engineers and other refinery personnel to understand how exactly the product works. While this new technology has many advantages over the older units, the lack of understanding of the mechanics of operation can be a barrier to adopting it. Due to the high capital investment in the refining industry, very strong concern for safety and desire to avoid downtime, engineers are reluctant to convert to any technology that they don't fully understand. The objective of this project will be to address this knowledge gap in order to facilitate understanding of how the SxSeal 2000 operates.

Project Requirements:

The SxSeal 2000 is a mechanical flow control device that allows liquid sulfur to drain from pressurized refinery equipment but blocks the passage of vapor into the downstream tanks and pits. These vapors can be highly toxic, so this is an important capability of the device. You can see more information about this device at: (https://www.csiheat.com/what-we-do/process-equipment/sxseal-2000-sulfur-trap)

The device is normally 2ft diameter, 4 ft tall, operates at 300°F, with a flow rate of ~10 gpm and a pressure of ~8 psig. The flow control is accomplished via a float-activated valve mechanism. This is in the diagram area called "proprietary sealing assemblies". The operation of the float is based on a combination of pressure and flow rate.

As mentioned in the Overview, in order to have refineries adopt a new technology, they must thoroughly understand how it operates. The best way to do this is to actually witness a physical model in operation. Since the units are large, heavy, very hot and working with a dangerous substance (sulfur and sulfur vapor) it is difficult to do physical demonstrations for refinery

personnel in their offices or at trade shows. The objective of this project is to create a functioning table-top model of the SxSeal 2000 that is portable, safe and conveys the operating principles to the audience. The table top model is expected to utilize water, operate at ambient temperature, and low pressure. The pressure of operational model and water flow rate shall be adjustable within specifications to be agreed with the supporter. The model must include a working internal mechanism and transparent housing to allow viewing of the internals in operation. A pump and reservoir will be required to circulate the water, a compressor will be required to maintain the operating pressure, and the system must be portable. As a device to be displayed at trade shows, the model must be visually appealing and professional in appearance.

Expected Deliverables/Results:

- A table top scale model of a SxSeal 2000 that visually demonstrates the operation of a unit using water instead of molten sulfur.
- Professional appearance of model suitable for use in a trade show
- Dimensions to be agreed with supporter and documented in SOW/SPEC
- Pressure and flow rate to be adjustable
- Sealing mechanism operation to mimic flow results that an operator would see through the upper site port.
- Model to be leak-proof
- Model to be able to withstand regular vibration and shock that would be expected in international shipment.

Disposition of Deliverables at the End of the Project:

Model to be delivered to CSI after the conclusion of the Expo

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

- Supporter desires design reviews to be at CSI (Pineville, NC) , unless otherwise agreed by CSI, Faculty Mentor and Student team.
- Travel to CSI will be required to witness operation of a full scale unit and understand its operation.