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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**	*11/8/2019*
Project Title	*Design of a Mechanical Attachment Method for Pipe Heat Tracing System* **(AMETEK_HEAT)**	**Planned Starting Semester**	Spring 2020

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	
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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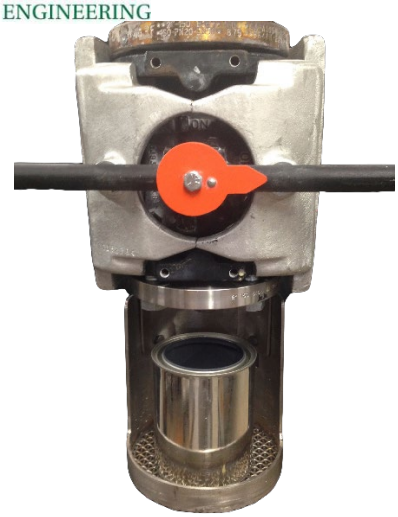

For many chemical processes, temperature control is required to maintain the integrity of the products. Heat transfer to effect this can be at any point in the process including tanks, vessels, reactors and the interconnecting pipes. Ametek CSI has developed an engineered system called "ControTrace®" which can be used to maintain critical temperatures for product flowing thorough pipe. See ControTrace® attached to pipe in the photo below:

Application of Two ControTrace elements onto a Pipe

This project will focus on the mechanical attachment method for ControTrace® onto pipes.

Project Requirements:

What is ControTrace®?

ControTrace® bolt-on heating elements have been the preferred steam tracing solutions for heating pipe, tanks, and vessels since 1980. These thermal solutions are a cost-effective alternative to fully jacketed piping and, in comparison to steam tracing, offer greater heating capacities and reliability. These heating elements also prevent cross-contamination between the heating medium and the process. Today, over five hundred miles of ControTrace® heat tracing elements are in service in plants and refineries around the globe.

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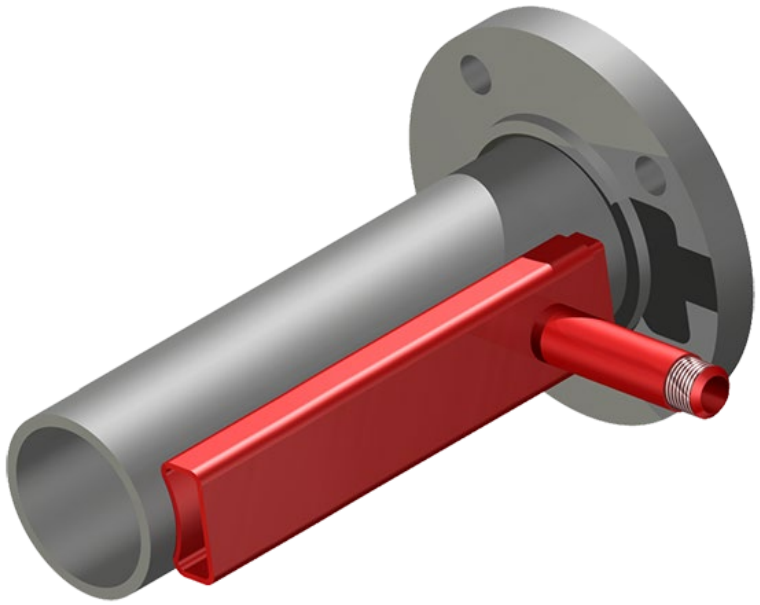

A Single Element on a Pipe

The basic configuration of a ControTrace® heat tracing element is a 2-in. by 1-in. rectangular tube formed of SA178 Grade A boiler tubing. One of the 2-in. sides is contoured to closely fit the outside diameter of the pipe or vessel onto which it will be placed. The standard wall thickness is 1/8 in., ensuring ample robustness and pressure-containing capability. These heating elements can be rated for higher pressure steam as well. Individual elements are fabricated to specific lengths. The ends of the tubing are closed (seal welded), and inlet and outlet connections are added to enable heating medium transfer. ControTrace can be applied as a single element, dual (a ControTrace element on either side of the pipe) or >2 elements. When >2 elements are required they are most often joined together in a panel configuration to minimize the number of inlet/outlet connections. ControTrace® is secured to the pipe or vessel with high-strength banding (no welding is required). Before banding, a thin layer of heat transfer compound is spread onto the surface that will be in contact with the pipe or vessel.
During operation, the heating medium (typically steam or heating fluid) flows through the heating element and transfers its heat through the heat transfer compound and into the pipe/vessel wall and into the process. The number of heating elements required depends upon the design objective and the design conditions. Most ControTrace® applications are designed to maintain a process temperature (to keep liquid flowing) or a minimum pipe/vessel wall temperature (to prevent vapor condensation). CSI utilizes finite-difference computer modeling to simulate and predict temperature profiles and heat transfer rates based upon process, ambient, piping, and insulation conditions. The computer model has been corroborated time and again with empirical field data.

How is ControTrace® currently installed?

It is compressed onto the pipe using stainless steel bands. These bands are placed around the pipe

and a tool is used to tighten the band which holds the ControTrace® tightly onto the pipe. See the installation process for the current system here:

https://youtu.be/Y22fk6JAgdI

What is shown in the video is a single CT element install, there can also be multiple elements on the pipe. As shown in the photo below:

Panel A

Panel Application of ControTrace

When multiple CT elements are joined together, they are called "panels". The current installation method for CT panels can be viewed at:

https://www.csiheat.com/-/media/ametekcsiheat/documents/fieldserviceinstallationsupport/controtrace-installation-panels-on-pipe-supplement.pdf?la=en

The objective for this project is to research, develop and test new methods for ControTrace attachment (single, dual and panel elements) onto various pipe diameters, which reduces the total cost and maintains the heat transfer properties of the engineered CT system.

Expected Deliverables/Results:

- Purpose of project is to reduce total cost (hardware + manufacturing + shipping + installation time and materials) of CT onto various pipe diameters by analyzing and improving the following areas.

  - Attachment methods and hardware
  - Installation methods, tools, and supplies
- Deliverable to be detailed recommended changes validated via prototype build and validation testing
  - Total cost reduction to be validated
  - Prototypes built and demonstrated for multiple CT configurations
  - Operational instructions documented

Disposition of Deliverables at the End of the Project:

All hardware 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.
- At the beginning of the project, students will be trained (at CSI) in the current CT attachment methods, so that they understand the current methods and can contrast to their designed solution. This training is likely to be done part-time over a few days period.
- During the second semester, due to the size and weight of pipe, the students will demonstrate, prove and validate their final solutions at the CSI installation training facility.