

Senior Design Project Description for FALL 2016

Project Title: Testing of SH/RH Tubing (EPRI_TUBES)

Supporter: EPRI

Supporter Technical Representative: ASSIGNED

Faculty Mentor: _____ ASSIGNED TBD (check one)

Single Team _____ Dual Team _____ (check one)

Personnel (EN/ET): _____ E, _____ Cp, _____ Cv, 5 M, _____ SE

(Complete if the number of students required is known)

Expected person-hours: (250 per student)

Description of Project:

Superheaters and reheaters (SH/RH) in power steam boilers operate at high temperatures to elevate steam to the maximum design temperature in steam Rankin power plants. These SH/RH are made of miles of tubing which are fabricated into assemblies. Power plants can have thousands of assemblies each consisting of groups of 6-10 tubes each. Attachments are welded to these tubes and interlocked using a few industry standard designs to keep them inline during operation, but these attachments can fail. If the attachment fails in the tube wall, steam is released forcing shut-down of the plant (even if just one tube fails). Thus, the performance of attachments is critical to the plants performance and utilities economics.

Over the past 3-5 years, an increasing number of welded attachments in stainless steels have experienced failures and the effects of loading conditions, welded attachment design, materials properties, welding methods, filler metal selection, and heat-treatment are not well understood. Therefore, there is a need to develop a 'structural feature test' which can be conducted in the laboratory on small segments of full-size SH/RH attachments. If such as test can re-create the failure mode experienced in the field, then the ability to design improved attachments, welding methods, or operational changes can be made to improve steam power plant reliability.

The goal of the project is to design, build, and prove operation of an innovative (one of a kind) testing machine which is capable of testing SH/RH tubing with attachments with axial loading(s) typical of those experienced in service.

Initial Project Requirements (e.g. weight, size, etc.):

The project supporter, EPRI, will provide:

- a range of required test sample geometries which the machine will need be able to accommodate
- a range of required testing conditions which the machine will need to operate under (temperature, strain, time/test duration, and inspection intervals/techniques)
- a list of optional features which would be of interest
- background information on industry failures and appearances

The project team will develop a series of preliminary designs which will be reviewed with an



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emphasis on both practicality of the design and ability to meet the testing requirements. The top one or two designs will be selected in agreement with the project supporter for detailed engineering and costing. A final design based on these results will be made and the machine will be fabricated. At least one test will be conducted to prove the utility of the design and operation.

Note: EPRI's Fossil Materials & Repair Program is prepared to purchase equipment and provide access to welding and fabrication facilities based on the needs identified after detailed engineering which may not be available at UNCC and/or is beyond the project budget. This may include, for example, the purchase of a high-temperature furnace and controller.

Expected Deliverables/Results:

The deliverable will be the completed testing machine. A report describing the machine with all supported calculations will be included. The completed machine will be tested.

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

None