

Date: Thursday, January 15, 2009
To: Ch.E. 434 Class
From: David C. Drown
Subject: Startup & Performance Certification of Double-Pipe Water Heaters.

Two double-pipe water heaters are installed and ready for operation; steam supply plumbing changes have just been completed. **Determine the range of operability of the exchangers** (each group will be assigned a specific steam pressure between 3 and 15 psig). What is the maximum cooling water flowrate and temperature at maximum cooling water flowrate that the units will produce? Develop a predictive curve of outlet water temperature as a function of water flow rate at the assigned steam pressure. What is the minimum cooling water flowrate that the units will operate at without boiling? What is the steam pressure required to obtain an outlet temperature of **175°F** when the flowrate is set to **0.90 GPM**? **Experimentally certify that both heat exchangers will perform as designed and the steam pressure required to achieve 175°F at 0.90 GPM.** (A correct prediction is to be considered the design performance specification; report to plant management whether each unit is acceptable in performing the required heat transfer duty and if not, what specifically is the cause of the malfunction and what should be done to remedy the situation.)

These heat exchangers are a U-tube design. Each unit is based on a 70 inch long heated section of 3/8 inch O.D. copper tube (~0.066" wall thickness) inside a 2 inch O.D. brass pipe (1/8" wall, ~3 feet long) shell. Water is to be run inside the tube, while steam is to be run through the shell. **Please prepare a proposal, a test plan, startup instructions, and operating procedures for these units.** (*Note* -- A group of technicians will be assigned to run your operating procedure, test plan, and collect the data for you. You will analyze the data collected by the technicians; you may not be running the experiment yourself and might not even be present. You will be the 'technicians' for some other group and be running their experiment for them. See attached handout for proposal "How to" instructions.)

Submit a final draft of your performance prediction, operating procedures, and proposed experimental test plan **before 5 PM Friday, January 23, 2009.** Revised predictions, procedures, and test plans before are due **before 5 PM Thursday, January 29, 2009.** Any group which has not submitted an acceptable proposal will not be allowed to schedule the experiment until their proposal is approved.

Your final report recommendations **MUST** include specific conclusions **and** detailed specifications on what modifications/repairs, if any, should be made. Your conclusions and recommendations are needed two weeks after your experimental plan is conducted.