PROJ99P2P1.TEX

UNIVERSITY OF WATERLOO
DEPARTMENT OF MECHANICAL ENGINEERING

ECE 309 Thermodynamics and Heat Transfer

SPRING 1999 July 14, 1999

M.M. Yovanovich

Project 2, Part 1. This part of Project No. 2 must be handed in at the end of the lecture on Friday, July 23.

You may consult the TAs and you may discuss the project with other students, but you must be the sole contributor to the material which you hand in.
Part 2 of Project 2 will be given to you during the lecture hour on Friday, July 23. You will be given 15 minutes to work on Part 2. It will be handed in at the end of that lecture hour. Part 1 will count 8 points and Part 2 will count 2 points.

An insulated 5 cubic meter tank is initially evacuated, and it is connected through a valve to a steam line at pressure 4 MPa and temperature $650\,^0$C. The valve is opened and steam fills the tank. The pipe and valve which connect the steam line to the tank are also insulated and their total volume is negligible relative to the tank volume.

Use the general continuity and energy equations developed for a control volume to:

(a) derive appropriate relation(s) in symbolic form,

(b) determine the final temperature T_f of the steam in the tank,

(c) determine the final mass M_f of the steam in the tank.

Your solution should show all assumptions made and all steps taken in the solution procedure. Use steam properties given in the tables found in the text of Reynolds and Perkins. Accurate values of T_f and M_f are required. Summarize the results. Provide a physical interpretation for the observed value of the final temperature.