MET 466 – THERMAL PROCESSES LAB

LAB #4 – Groups 1 & 2 Performance Characteristics of Pumps

> Assigned: 4/9/08 & 4/16/08 Due: 4/23/08

Location of Equipment:

The apparatus for this experiment are located in the EPS 008.

Description of Experiment:

Two pumps are mounted on a vertical free-standing water tank. Descriptions of the pumps follow:

- 1. Centrifugal Pump 1
 - 2 HP 208V single phase electric motor (painted blue)1-1/4 inch schedule 40 pipe at outlet0-160 psi pressure gage with restriction at outlet
- 2. Centrifugal Pump 2
 - 1-1/2 HP 208V electric motor (painted green)1-1/2 inch schedule 40 pipe at outlet0-100 psi pressure gage at outlet

The pressure gages on both of the centrifugal pumps contain a restriction to steady the pressure reading and to protect the gage movement. These gages will require about a minute to measure the correct steady-state operating pressure.

A mercury thermometer with 30 to 240°F range is provided to measure the temperature of the water in the tank.

Flow regulation for all pumps is by means of ball valves and a 1-1/4 inch globe valve. All pumps utilize a 1-1/4 inch bore turbine flowmeter to measure the volumetric flow rate. For the entire useful range of the flowmeter (7.95 to 129 GPM), the average calibration constant is 432.09 cycles/gallon. Detailed calibration data for the flowmeter is attached to the water tank. The frequency output of the flowmeter is displayed on a digital counter.

The electric power input to both the centrifugal pumps is measured using a modified single phase wattmeter. To prevent damage to the wattmeter movement, the voltage selector switch on the wattmeter must be in the OFF position when the pump motor

is started. The current selector switch must be in the 20A position during operation of the centrifugal pump. After the pump motor is operating, select the 200V position on the voltage selector switch. The modified wattmeter has a scale which reads in percent with a full scale reading corresponding to 4000W for the indicated choices of voltage and current settings, i.e., 200V and 20A.

The water tank should be filled to within approximately 8 inches from the top prior to starting any of the pumps. Drain the water tank after use.

The centrifugal pumps are self-priming after the tank is filled.

Additional information will be provided by the instructor as a demonstration.

Results:

For the purposes of this experiment, the pump inlet is taken to be the free surface of the water in the tank and the pump outlet is the discharge at the elevation of the pressure gage. The power input used in calculations will be the power input to the electric motor rather than the power input to the pump itself. Therefore, some of the piping and the electric motor are considered part of the system tested.

- 1. For centrifugal pump 1, plot head (feet), power input (horsepower), and efficiency as functions of flow rate (GPM). Over what range of flow rates will the system provide at least 80% of its peak efficiency?
- 2. For centrifugal pump 2, plot head (feet), power input (horsepower), and efficiency as functions of flow rate (GPM). Over what range of flow rates will the system provide at least 80% of its peak efficiency? This pump is designed for irrigation applications and is intended for relatively high flow rates, but low head service.
- 3. Find the manufacturer pump curves and plot your collected data on them for both of the centrifugal pumps.