

Flow Between Tanks
Hydraulics Laboratory
August, 2006
John Walton

Goals:

The goals of this exercise are to a) familiarize the student with application of the energy equation, b) learn to estimate flow rates, c) compare frictionless with more realistic flow projections, and d) compare experimental and measured flows.

Methods:

The experiment consists of an upper and lower reservoir of water and a tube connecting both reservoirs. Students should break up into 5 different groups and each group should perform the experiments separately. If the TA can procure enough equipment two groups may work simultaneously.

Experiment a: Run the tube from near the bottom of the upper reservoir to near the bottom of the lower reservoir. Measure tube length, tube inside diameter, and all the elevations. Measure the flow rate for 15 seconds (change as needed) through the tube three times and average the result. Since the water level in the reservoirs will change during the experiment, use the average of the before and after water levels.

Experiment b: Repeat experiment (a) after moving the tube in the upper reservoir to near the top of the water.

Experiment c: Repeat experiment (a) but let the lower end of the tube flow into the air prior to entering the lower reservoir.

Experiment d: Repeat experiment (c) after moving the tube up half way to the upper reservoir.

Note: the four experiments above can be modified if one or more of the groups wishes to be creative. Must have TA authorization.

Analysis:

Apply the energy equation to all of the experiments, show your work and list assumptions. Estimate the flow for all of the experiments assuming frictionless flow. Note: for frictionless flow you still use the entrance/exit loss coefficients, but the friction factor is zero. Estimate the flow for all of the experiments using the Moody Diagram. Create table comparing frictionless flow, friction flow, and measured flow. Discuss the results.