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## 7. Irrigation System Pressure Surge

You work for Oxfam to supply low-cost irrigation systems for farms in the third world. The typical plumbing arrangement is shown in the figure below. Water from available sources (stream, well, etc.) is pressurized by a pump/accumulator system to feed the irrigation line, which supplies water to the water spray for the crops. (The accumulator is there just to maintain a steady fluid pressure to the supply line.) When the valve of the irrigation line is turned off quickly, a pressure surge is observed in the supply line. To minimize the cost of the system, the supply line typically consists of thin wall plastic tubing, and therefore the surge pressure is of concern.

Your job is to understand the factors contributing to the surge pressure, and to determine how it scales with the system parameters (driving pressure, line length, etc.) The surge pressure also depends on how fast the valve is closed off. Therefore, you should obtain the results by closing the valve aggressively.

The bench scale experiment was set up with a water supply pressurized by the shop air. Performing tests to a maximum pressure of 400 kPa gauge would be adequate. In the set up, there are several supply lines with different lengths and diameters. To minimize water waste, water is only turned on when you hold the solenoid valve open (i.e. holding down the red button on the control panel).

