MEMO

From: F. Baneyx
To: Team D
Subject: Friction Factors

As a part of our recycling policy at the Seattle Labs we are evaluating the possibility of re-using some existing pipes, control valves and various fittings that have been stored in our facilities. The schedule 40 and stainless steel pipes have been mounted in a water flow test system to determine their capabilities.

Objectives:

- Determine the friction losses for water flow through at least two standard schedule 40 pipes and a stainless steel tube at 25%, 50%, 75% and maximum flow rate.
- Determine if frictions factors agree with the Blasius equation to within 10%.
- Determine if there is significant fouling of the pipes.
- Determine the K value (number of velocity head lost by various pipe fittings).
- Measure the valve coefficient and other characteristics of a pneumatic control valve.

We also need information on the "inherent characteristics" of the control valve that is currently installed in a 1 inch pipe of the system. The recommended procedure is to first measure the pressure drop across the valve when the valve is wide open using the pressure taps on the valve. The equation defining the valve coefficient, C_V, for water flow is:

$$Q = C_V f(x)\sqrt{\Delta P},$$

in which Q is the volumetric flow rate (gpm), f(x) is the position of the valve [f(x) = 1 for a wide open valve], and ΔP is the pressure drop in psi. The coefficient, C_V, in the U.S. convention has the units of $gpm/psi^{1/2}$, so it is not a true discharge coefficient, which would be dimensionless.