Experiment-5

Bernoulli's Theorem Demonstration

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Objective

The objective of the present experiment is the parameterization of a Venturi tube through of experimental determination of its discharge coefficient.

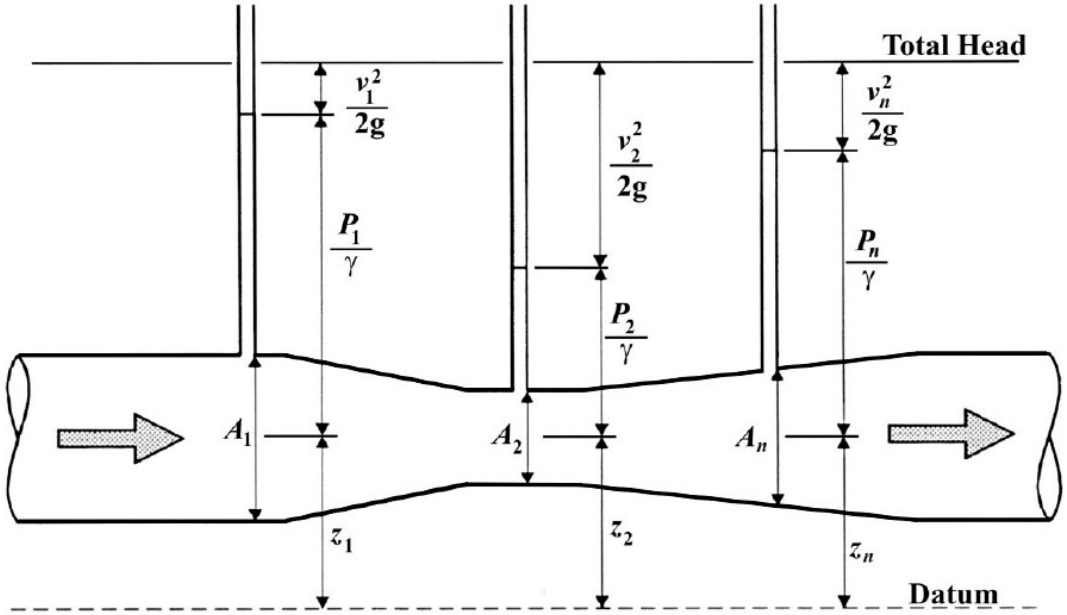
Theory of the Venturi Meter

Bernoulli's theorem:

$$h_1 + \frac{v_1^2}{2g} = h_2 + \frac{v_2^2}{2g} = h_n + \frac{v_n^2}{2g}$$

Continuity equation:

$$v_1 A_1 = v_2 A_2 = v_n A_n = Q$$



Head distribution for ideal conditions in a Venturi Meter

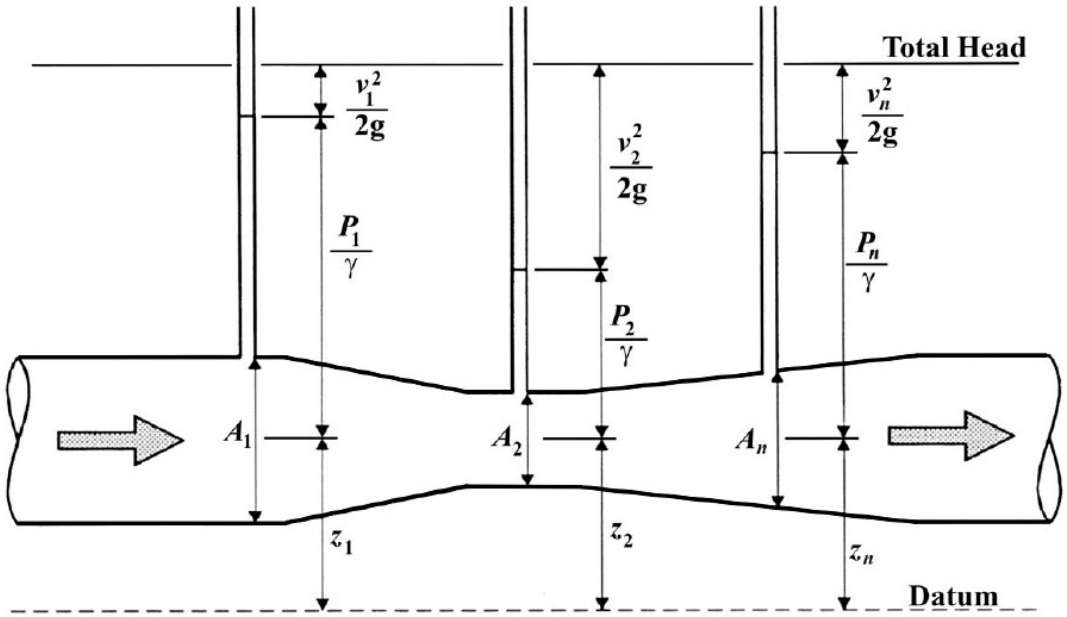
Theory of the Venturi Meter

Velocity in the throat

$$v_2 = \sqrt{\frac{2g(h_1 - h_2)}{1 - \left(\frac{A_2}{A_1}\right)^2}}$$

Volume flow rate

$$Q = A_1 A_2 \sqrt{\frac{2g(h_1 - h_2)}{A_1^2 - A_2^2}}$$



Head distribution for ideal conditions in a Venturi Meter

$$Q_a = C_d Q$$

$$0.92 \le C_d \le 0.99$$

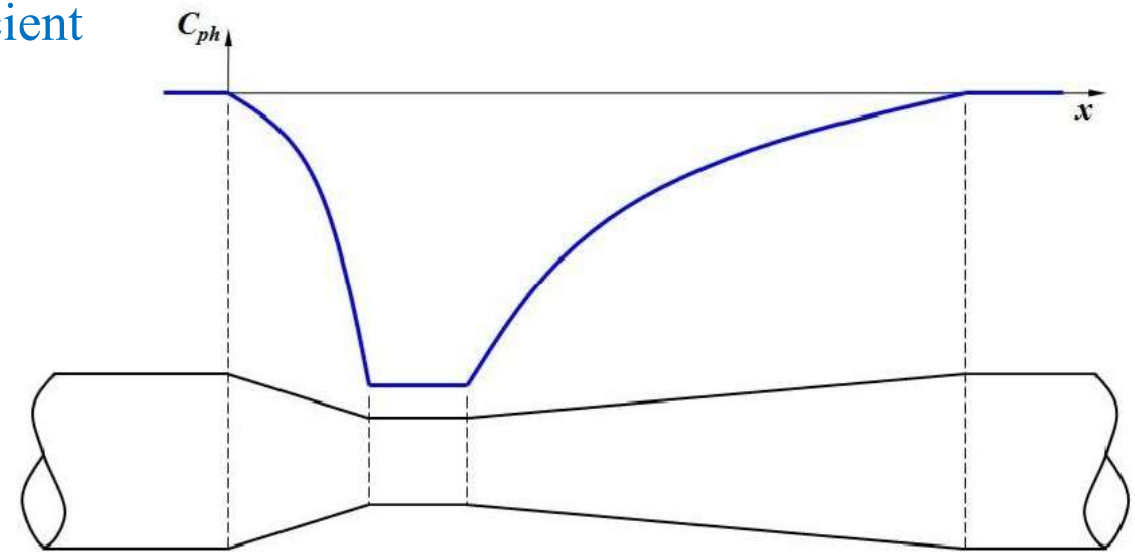
Theory of the Venturi Meter

Piezometric head coefficient

$$C_{ph} = \frac{h_n - h_1}{\frac{v_2^2}{2g}}$$

$$C_{ph} = \left(\frac{A_2}{A_1}\right)^2 - \left(\frac{A_2}{A_n}\right)^2$$

$$C_{ph} = \left(\frac{D_2}{D_1}\right)^4 - \left(\frac{D_2}{D_n}\right)^4$$



Piezometric head coefficient C_{ph} in a venturi tube