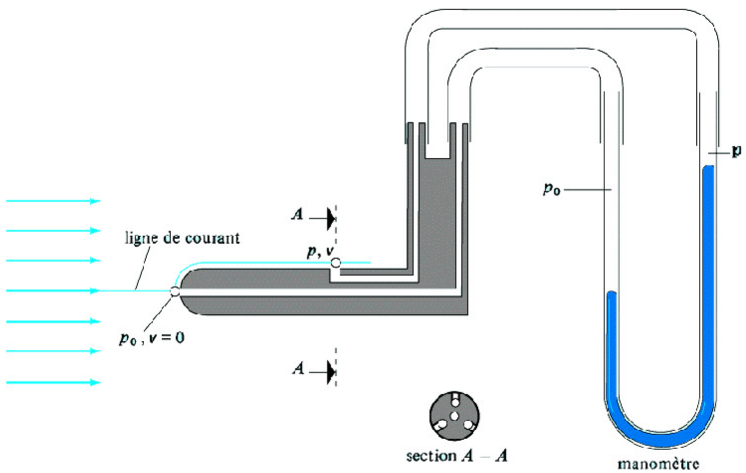
Pitot tube



$$\frac{1}{2}v^2 + \frac{p}{\rho} = \frac{p_0}{\rho}, \quad v = \sqrt{\frac{2(p_0 - p)}{\rho}}$$

$$\frac{1}{2}v^2 + \int \frac{dp}{\rho} = \frac{1}{2}v^2 + \frac{a^2}{\gamma - 1} = \frac{a_0^2}{\gamma - 1}$$

$$\frac{a_0^2}{a^2} = \frac{\gamma R T_0}{\gamma R T} = \frac{p_0}{\rho_0}\frac{\rho}{p} = \left(\frac{p_0}{p}\right)^{1-1/\gamma}$$

$$p_0 = p\left[1 + \frac{\gamma - 1}{2}M^2\right]^{\frac{\gamma}{\gamma - 1}}$$
$$= p\left[1 + \frac{1}{2}\gamma M^2 + \frac{1}{8}\gamma M^4 + O(M^6)\right]$$

$$\frac{1}{2}\gamma p M^2 = \frac{1}{2}\frac{\gamma p}{\gamma R T}v^2 = \frac{1}{2}\rho v^2$$