

**Pérdidas, potencias y rendimientos**

$$P = Q\rho gH$$

$$P_a = \frac{Q\rho gH}{\eta} = M\omega = \frac{2\pi nM}{60}$$

$$P_i = \frac{Q\rho gH}{\eta_v\eta_h}$$

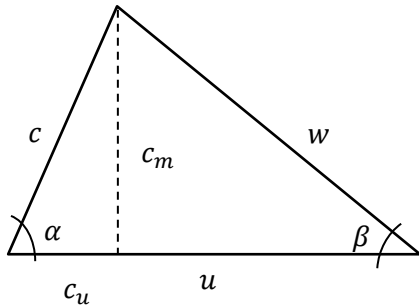
$$\eta_h = \frac{H}{H_u}$$

$$\eta_v = \frac{Q}{Q + q_e + q_i}$$

$$\eta_m = \frac{P_i}{P_a}$$

$$\eta_{tot} = \eta_i\eta_m = \eta_v\eta_h\eta_m = \frac{P}{P_a}$$

**Triángulos de velocidades**



$$c_u = c \cos \alpha$$

$$c_m = c \sin \alpha$$

$$c = \sqrt{c_u^2 + c_m^2}$$

$$c_u = u - \frac{c_m}{\tan \beta}$$

$$w = c \frac{\sin \alpha}{\sin \beta}$$

**Altura teórica y útil**

$$H = H_u - H_{rint}$$

$$H_u = \frac{u_2 c_{2u} - u_1 c_{1u}}{g}$$

$$H = \frac{P_S - P_E}{\rho g} + z_S - z_E + \frac{v_S - v_E}{2g}$$

$$H = \frac{P_Z - P_A}{\rho g} + z_Z - z_A + \frac{v_Z - v_A}{2g}$$

$$H = \frac{P_Z - P_A}{\rho g} + z_Z - z_A + H_{r-ext}$$

$$H_{r-ext} = H_{ra} + H_{ri} + \frac{v_t^2}{2g}$$

**Generalidades**

$$Q = Av = \pi D_1 b_1 c_{1m} = \pi D_2 b_2 c_{2m}$$

$$u = \frac{\pi D n}{60}$$

$$NPSH = \frac{P_A - P_{sv}}{\rho g} - H_s - H_{ra}$$

$$NPSH = \frac{P_E - P_{sv}}{\rho g} - H_s - H_{ra}$$

$$H_{smax} = \frac{P_A - P_{sv}}{\rho g} - H_{ra} - NPSH$$

$$\sigma = \frac{NPSH}{H}$$

$$n_s = 3.65 \frac{nQ^{1/2}}{H^{3/4}} = \frac{nP^{1/2}}{H^{5/4}}$$

$$M = Q\rho(r_2 c_2 \cos \alpha_2 - r_1 c_1 \cos \alpha_1)$$