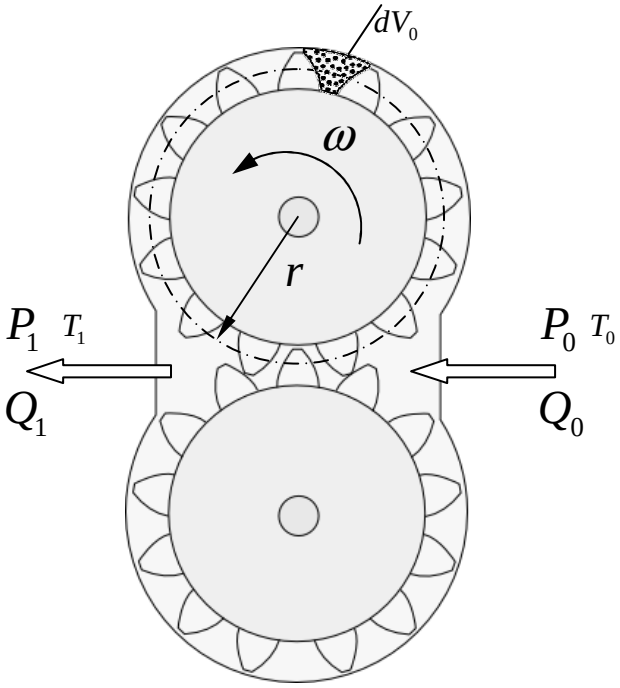
Pompe à engrenages externes

Compression adiabatique :

$$P_1 \cdot dV_1^{\frac{7}{5}} = P_0 \cdot dV_0^{\frac{7}{5}}$$

$$dV_1 = \frac{P_0^{5/7}}{P_1^{5/7}} \cdot dV_0$$



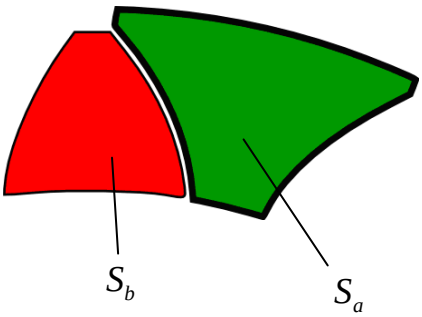
Débit :

$S =$ surface pérpendiculaire d'une dent

$$Q_0 = \frac{dV_0}{dt} = S \cdot r \cdot \omega \cdot k$$

$$\boxed{Q_1 = \frac{dV_1}{dt} = S \cdot r \cdot \omega \cdot k \cdot \frac{P_0^{5/7}}{P_1^{5/7}}}$$

k rapport entre : le volume entre les dents et le volume total



$$k = S_a / S_a + S_b$$

Q_j: Débit $\left[m^3/s \right]$

P_j: Pression $[Pa]$

T_j : Température $[K]$

ω : Vitesse angulaire $\left[rad/s \right]$

M: Couple $[Nm]$

Relation entre le couple et la pression :

$$\boxed{P_1 = \frac{M}{S \cdot r}}$$

Variation de la température :

$$T_1 = dV_1 \cdot \frac{P_1}{n \cdot R} = \frac{P_0^{5/7}}{P_1^{5/7}} \cdot dV_0 \cdot \frac{P_1}{n \cdot R} = \frac{P_0^{5/7}}{P_1^{5/7}} \cdot \frac{n \cdot R \cdot T_0}{P_0} \cdot \frac{P_1}{n \cdot R} = \frac{P_0^{2/7}}{P_1^{2/7}} \cdot T_0$$

Rendement :

$$P_1 \cdot Q_1 = S \cdot r \cdot \omega \cdot k \cdot \frac{P_0^{5/7}}{P_1^{5/7}} \cdot \frac{M}{S \cdot r} = M \cdot \omega \cdot k \cdot \frac{P_0^{5/7}}{P_1^{5/7}}$$

$$\boxed{\eta = k \cdot \frac{P_0^{5/7}}{P_1^{5/7}}}$$