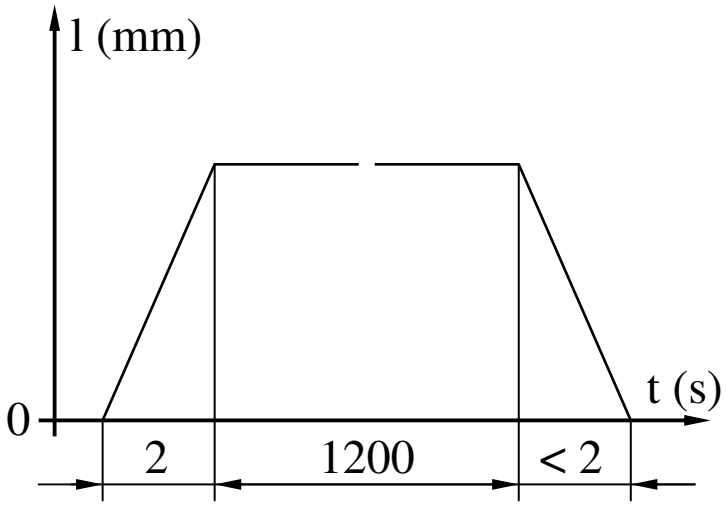
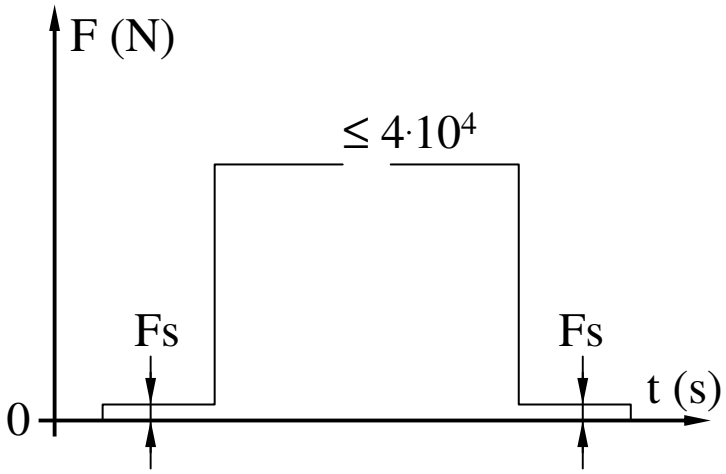
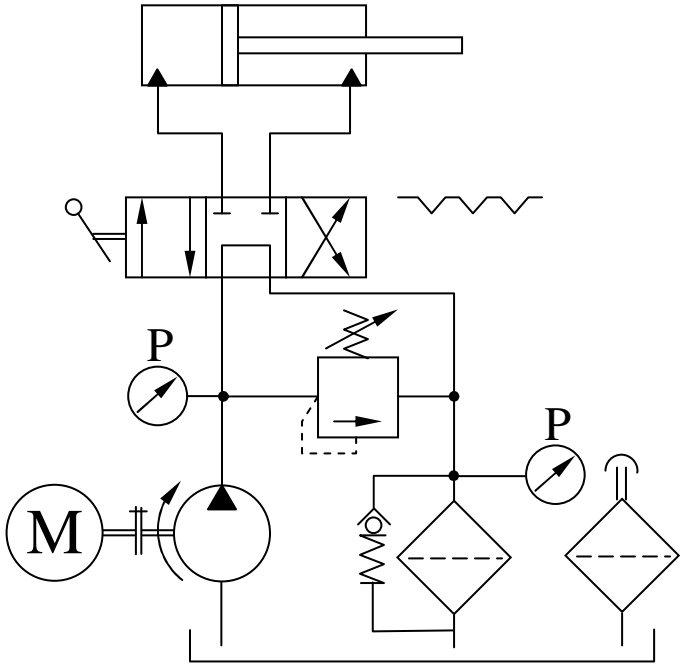
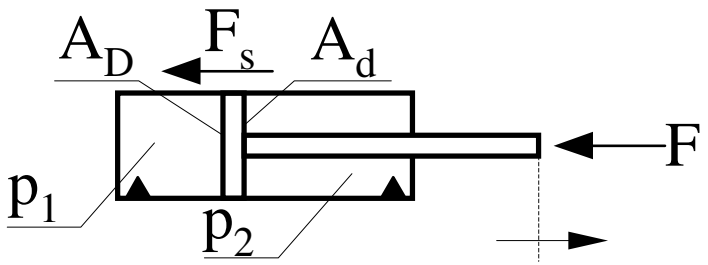
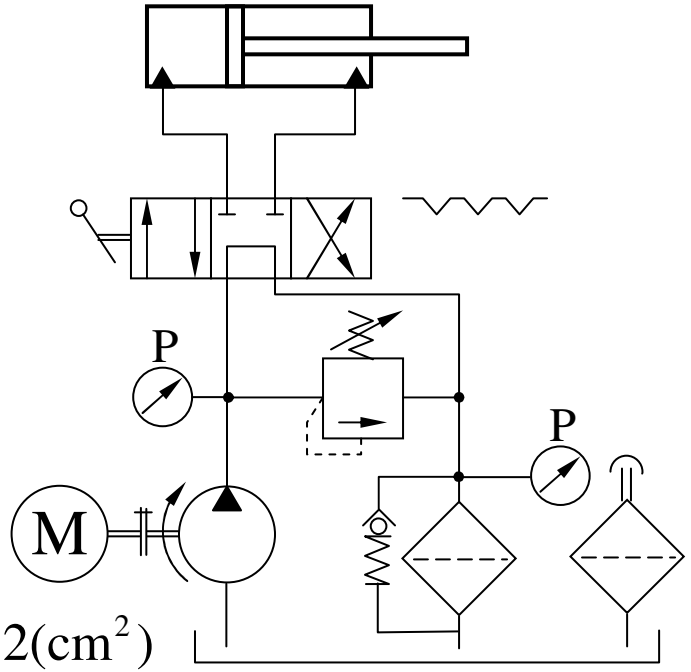

l (mm)
t (s)
0
2
1200
< 2


F (N)
≤ 4·10⁴
Fs
Fs
t (s)
0


P
P
M





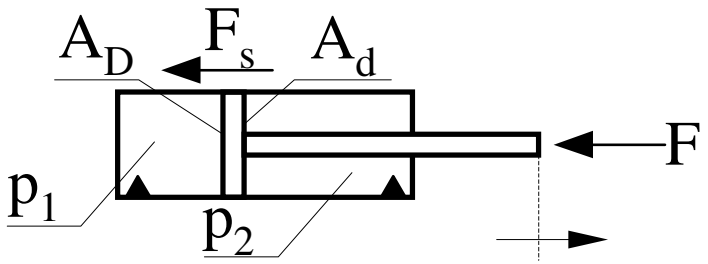
$$p_1 A_D - F_s - F = 0, \qquad F_s + F = \frac{1}{\eta_m} F$$

$$A_D = \frac{F}{p_1 \eta_m} = \frac{4 \cdot 10^4}{0{,}92 \cdot 160 \cdot 10^5} = \underline{0{,}272 \cdot 10^{-2}}\,(\mathrm{m}^2) = \underline{27{,}2}\,(\mathrm{cm}^2)$$

$$D = \underline{5{,}88 \cdot 10^{-2}}\,(\mathrm{m}) \approx \underline{59}\,(\mathrm{mm})$$

Kiválasztott munkahenger:

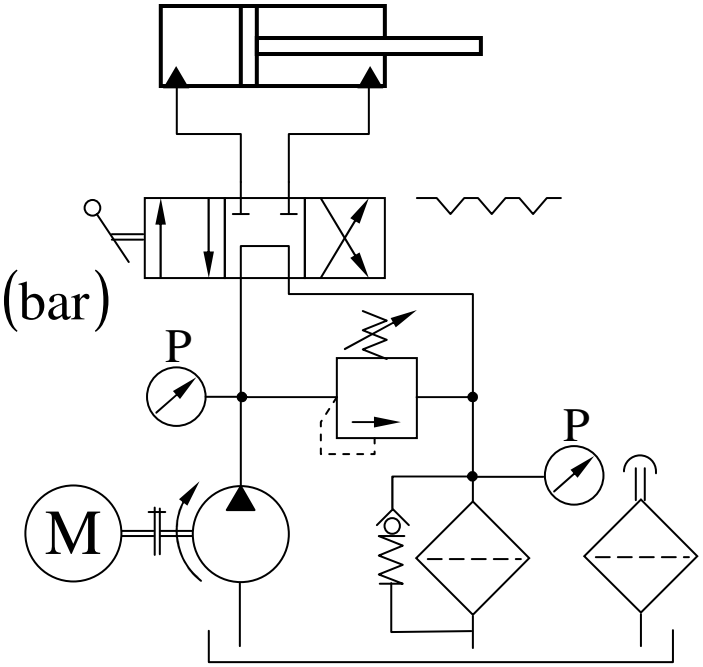
$\underline{\varnothing 63/\varnothing 36\text{-}125} \Rightarrow A_D = 31{,}2 \cdot 10^{-4}\,(\mathrm{m}^2);\ \varphi = 1{,}4$



$$\underline{p_1} = \frac{F}{\eta_m A_D} = \frac{4 \cdot 10^4}{0{,}92 \cdot 31{,}2 \cdot 10^{-4}} = \underline{1{,}39 \cdot 10^7}\,(\text{Pa}) = \underline{139}\,(\text{bar})$$

$$\underline{V_D} = A_D \cdot L = 31{,}2 \cdot 10^{-4} \cdot 0{,}1 = 31{,}2 \cdot 10^{-5}\ (\text{m}^3)$$

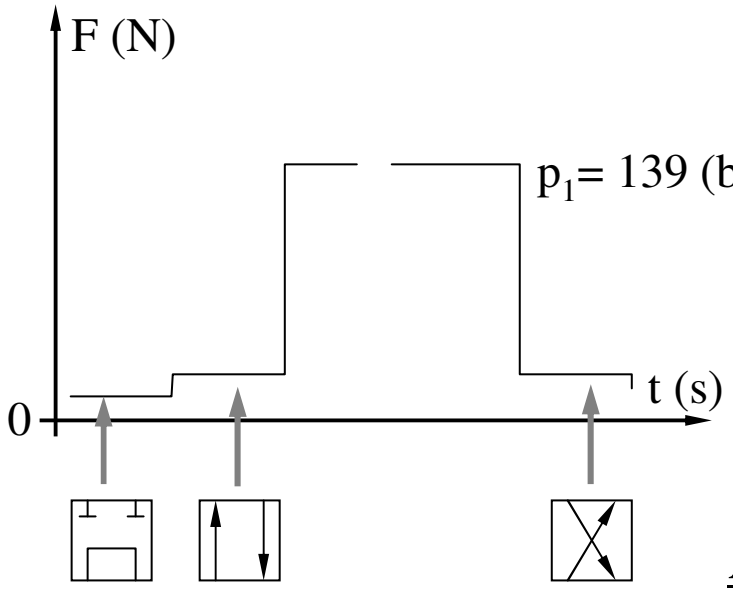
$$\underline{q_v} = \frac{V_D}{t_1} = \frac{31{,}2 \cdot 10^{-5}}{2} = \underline{15{,}6 \cdot 10^{-5}} \left(\frac{\text{m}^3}{s} \right)$$



$$\underline{V_g} = \frac{q_v}{n} = \frac{156}{24} = \underline{6{,}5}\,(\text{cm}^3)$$

Kiválasztott szivattyú:
<u>1PF2G2-4x</u> $\Rightarrow$ $V_g = 8{,}2\,(\text{cm}^3)$

$$\underline{q_v} = \eta_v V_g n = 0{,}95 \cdot 8{,}2 \cdot 10^{-6} \cdot 24 = \underline{18{,}7 \cdot 10^{-5}} \left(\frac{\text{m}^3}{s} \right)$$



$$\underline{P_{ki}} = F \cdot v = \underline{0!}$$

$$\underline{P_{hidr} = P_{veszt}}$$

$$P_{veszt} = q_v \cdot p_1 = 18{,}7 \cdot 10^{-5} \cdot 1{,}39 \cdot 10^{5}$$

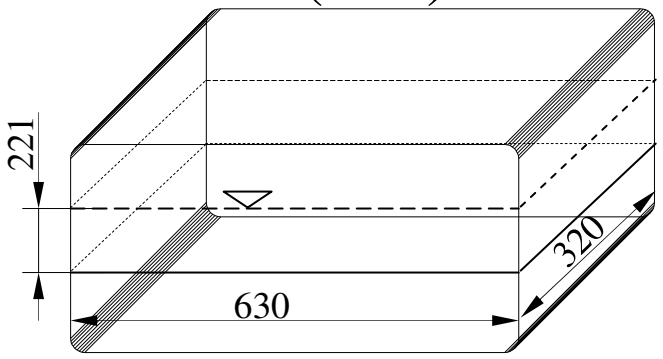
$$P_{veszt} = 2{,}599 \cdot 10^{3}\,(W) \approx 2{,}6(kW)$$

$$\underline{A} = 0{,}63 \cdot 0{,}32 + 2 \cdot 0{,}63 \cdot 0{,}221 + 2 \cdot 0{,}32 \cdot 0{,}221$$

$$\underline{A} = \underline{0{,}62}\,(m^2)$$

Kiválasztott tartály:

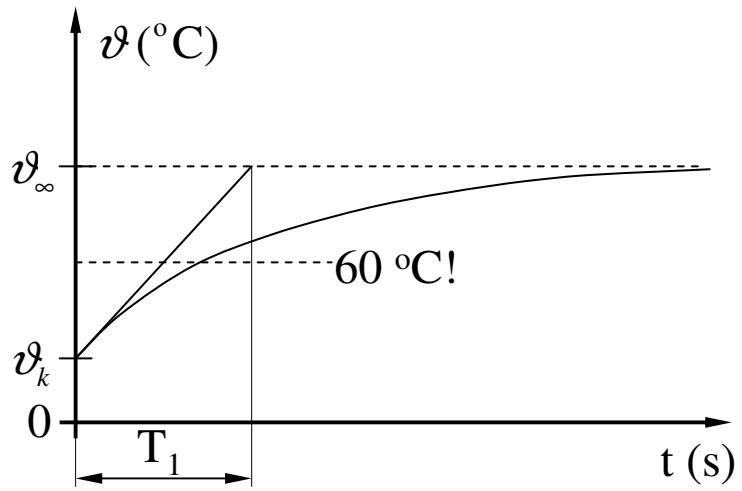
$V = 40\,(dm^3)$



$$k = 12\left(\frac{J}{m^3 \cdot c \cdot s}\right);\ \rho = 0{,}85 \cdot 10^{3}\left(\frac{kg}{m^3}\right)$$

$$C = 2 \cdot 10^{3}\left(\frac{J}{kg\,^{o}C}\right);\ V = 40\left(dm^3\right)$$

$$A = 0{,}62\left(m^2\right);\quad \vartheta_k = 20(^{o}C)$$



$$\underline{\Delta\vartheta_\infty} = A_W P_V = \frac{1}{kA} P_V$$

$$\underline{\Delta\vartheta_\infty} = \frac{1}{12 \cdot 0{,}62} \cdot 2{,}6 \cdot 10^3 = \underline{349{,}46}\ (^\circ\mathrm{C})$$

$$\underline{\vartheta_\infty} = \vartheta_k + \Delta\vartheta_\infty = \underline{369{,}46}\ (^\circ\mathrm{C})$$

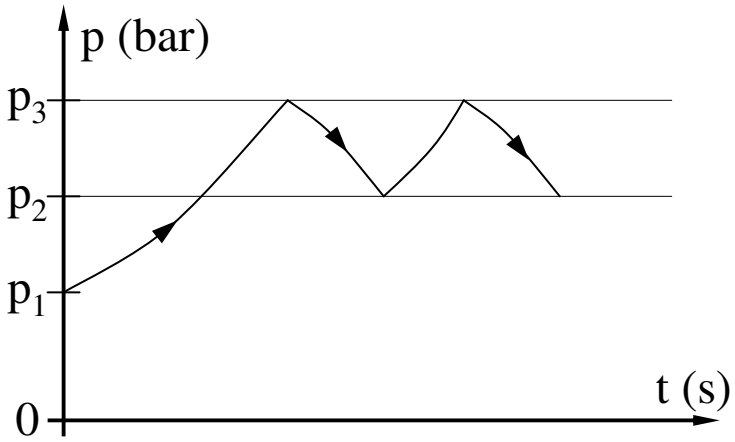
$$\underline{T_1} = \frac{\sum(m\,c)}{k\,A} = \frac{\rho\,V\,c}{k\,A} = \frac{0{,}85 \cdot 10^3 \cdot 40 \cdot 10^{-3} \cdot 2{,}1 \cdot 10^3}{12 \cdot 0{,}62} = \underline{9596{,}7}\ (\mathrm{s})$$

$$\underline{T_1} = \underline{2{,}67}\ (\text{óra})$$

$$\underline{\Delta\vartheta} = \vartheta - \vartheta_k = 60 - 20 = \underline{40}\ (^\circ\mathrm{C})$$

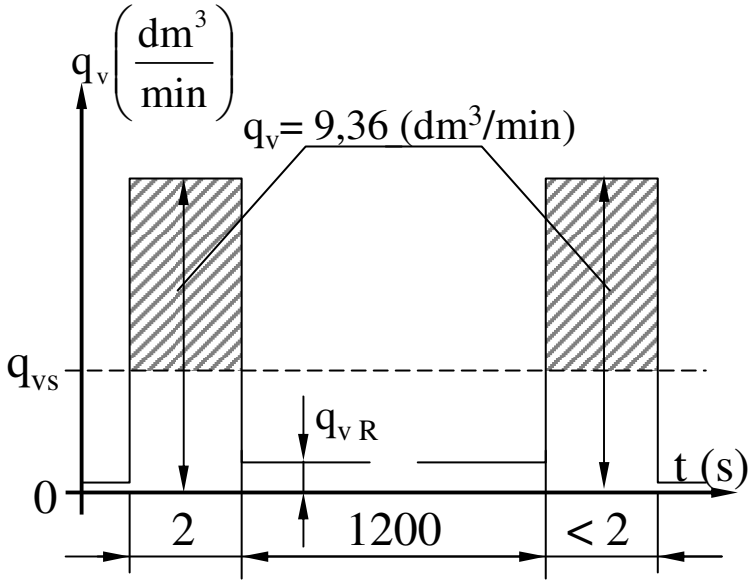
$$\frac{\Delta\vartheta}{\Delta\vartheta_\infty} = 1 - e^{-\frac{1}{T_1}t} = \frac{40}{349{,}46} = 0{,}115 \quad \Rightarrow e^{-\frac{1}{T_1}t} = 0{,}886$$

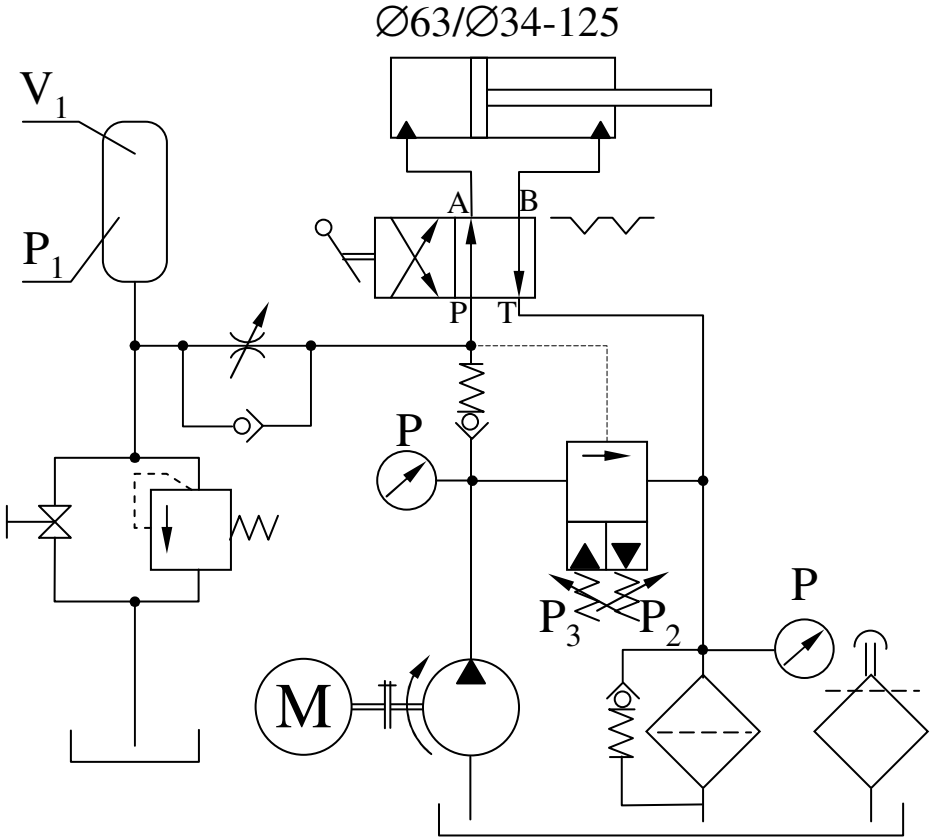
$$e^{+\frac{1}{T_1}t} = 1{,}129 \rightarrow \frac{1}{T_1}t = 0{,}122 \rightarrow t = 1166\ (\mathrm{s}) = 19{,}4\ (\mathrm{min}) < 20\ (\mathrm{min})$$



$$\underline{p_3} = p_{(max)} = \underline{155}\ (\text{bar})$$

$$\underline{p_2} = p_{(min)} = \underline{130}\ (\text{bar})$$





$$\underline{v_2} = \varphi \frac{1}{t_1} = 1{,}4 \frac{0{,}1}{2}$$

$$v_2 = \underline{7 \cdot 10^{-2}} \quad \left(\frac{m}{s}\right) \rightarrow t_2 = 14{,}3(s)$$

Ha $V_g = 1{,}2\ (cm^3)$,

$q_{vs} = \eta_v V_g n = 0{,}95 \cdot 1{,}2 \cdot 10^{-3} \cdot 24 = 27{,}36 \cdot 10^{-3}\ (cm^3/s) = 1{,}64\ (dm^3/min)$

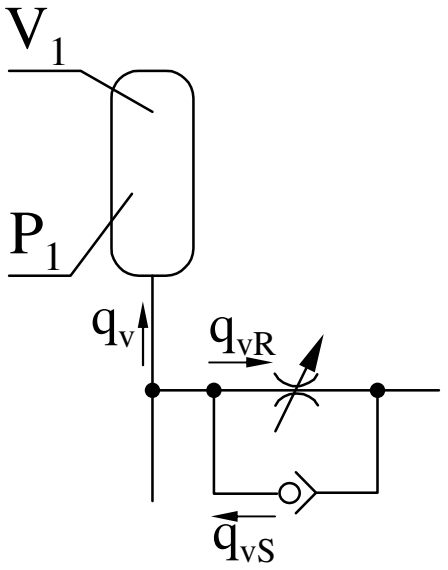
$$\underline{\Delta V} = \sum q_v \cdot t = 2\,(q_v - q_{vs}) - 1200\, q_{VR} + 1{,}43(q_v - q_{vs}) =$$
$$= 3{,}43\,(15{,}6 - 2{,}66) \cdot 10^{-5} + 1200 \cdot 0{,}7\ 10^{-6} =$$
$$= 44{,}38 \cdot 10^{-5} + 84 \cdot 10^{-5} = \underline{128{,}38} \cdot 10^{-5}\ (m^3)$$

$$\frac{p_2}{p_1} \geq 1{,}7 \rightarrow p_1 \leq \frac{p_2}{1{,}1} \leq 118{,}2\ (bar) \rightarrow p_1 = \underline{100}\ (bar)$$

$$V_1 = \frac{\Delta V}{\frac{p_1}{p_2} - \frac{p_1}{p_2}} = \frac{128{,}38 \cdot 10^{-5}}{\frac{100}{130} - \frac{100}{155}} = 9{,}87 \cdot 10^{-3}\,(m^3) = \underline{9{,}87}\,(dm^3)$$

$$\underline{\underline{V_1 = 10\ (dm^3)}}$$

Töltési idő



$$q_{vs} - q_v - q_{vR} = 0 \qquad \Rightarrow q_v = q_{vs} - q_{vR}$$

$$\Delta V = q_v \cdot t_{tölt} = (q_{vS} - q_{vR}) \cdot t_{tölt}$$

$$\Delta V = V_1 \left[\left(\frac{p_1}{p_2} \right)^{\frac{1}{\kappa}} - \left(\frac{p_1}{p_3} \right)^{\frac{1}{\kappa}} \right] \qquad (\kappa = 1{,}4)$$

$$\underline{t_{tölt}} = \frac{V_1 \left[\left(\frac{p_1}{p_2} \right)^{\frac{1}{\kappa}} - \left(\frac{p_1}{p_3} \right)^{\frac{1}{\kappa}} \right]}{q_{vS} - q_{vR}} = \frac{10 \cdot 10^{-3} \left[\left(\frac{100}{130} \right)^{\frac{1}{1{,}4}} - \left(\frac{100}{155} \right)^{\frac{1}{1{,}4}} \right]}{(2{,}66 - 0{,}07) \cdot 10^{-5}}$$

$$\underline{t_{tölt}} = \underline{39{,}38}\ (s)$$

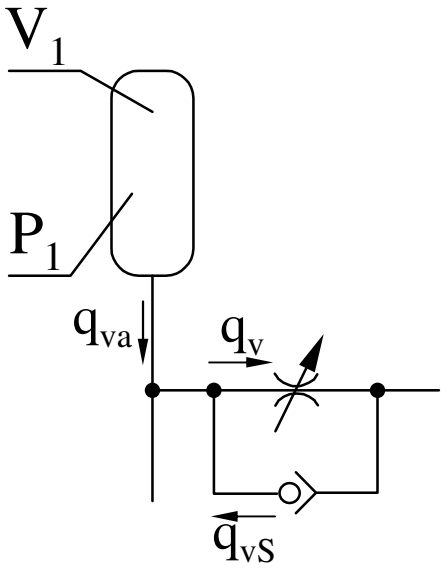
Ürítési idő

$$\Delta V = q_{vR} \cdot t_{ü} = V_1 \left(\frac{p_1}{p_2} - \frac{p_1}{p_3} \right)$$

$$\underline{t_{ü}} = \frac{V_1 \left(\frac{p_1}{p_2} - \frac{p_1}{p_3} \right)}{q_{vR}} = \frac{10 \cdot 10^{-3} \left(\frac{100}{130} - \frac{100}{155} \right)}{0{,}07 \cdot 10^{-5}}$$

$$\underline{t_{ü}} = 1857 \, (s)$$

Megindulási idő



$$q_{va} + q_{vS} - q_v = 0 \qquad \Rightarrow q_{va} = q_v - q_{vS} = \underline{12{,}94}\cdot 10^{-5}$$

$$\underline{\Delta V} = q_{va}\cdot t_1 = 12{,}94\cdot 10^{-5}\cdot 2 = \underline{25{,}84}\cdot 10^{-5}\ (m^3)$$

$$\Delta V = V_1\left[\left(\frac{p_1}{p_2}\right)^{\frac{1}{\kappa}} - \left(\frac{p_1}{p_3}\right)^{\frac{1}{\kappa}}\right] \qquad (\kappa = 1{,}4)$$

$$\left(\frac{p_1}{p_2}\right)^{\frac{1}{\kappa}} = \frac{\Delta V}{V_1} + \left(\frac{p_1}{p_3}\right)^{\frac{1}{\kappa}} = \frac{25{,}88\cdot 10^{-5}}{10\cdot 10^{-7}} + 0{,}833 =$$

$$= 0{,}0259 + 0{,}833 = \underline{0{,}8589} \approx \underline{0{,}86}$$

$$\frac{p_1}{p_2} = 0{,}86^{1{,}4} = 0{,}809 \rightarrow p_2 = \frac{1}{0{,}809}\,p_1 = 1{,}235\,p_1 = 123{,}5\ (\text{bar})$$

$F_{min} = \underline{3,55} \cdot 10^4$ (N)

$$P = \frac{1}{\eta_{ö}} q_{vs} \cdot p_3 = \frac{1}{0,8} \cdot 2,66 \cdot 10^{-5} \cdot 155 \cdot 10^5 \text{(W)}$$

WZ8or4