FIR gyak 2016. 05. 15. (A)

$D = 2m$

$L = 3m$

$\tau = 2400\ kJ/kg$

$\bar{W} = 5\ m^3/h$

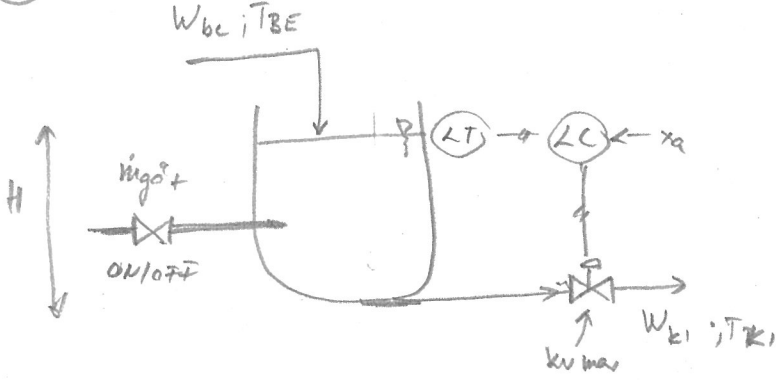
$\bar{T}_{BE} = 10°C$

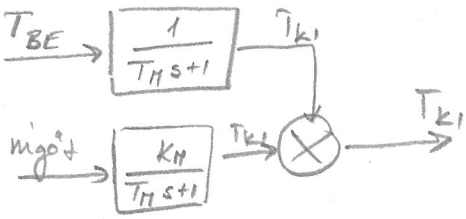
$\bar{T}_{KI} = 50°C$

$\bar{H} = 1{,}25\ m$

$K_{V\,max} = 45\ m^3/h$

$\Delta TA = 2m \in [0{,}5m\ ;\ 2{,}5m]$

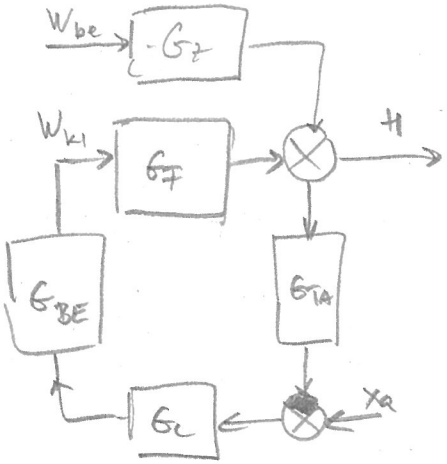



$$T_H = \frac{\bar{V}}{\bar{W}} = \frac{\frac{D^2\pi}{4}\bar{H}}{\bar{W}} = \frac{\frac{(2m)^2\pi}{4}\cdot 1{,}25m}{5\ m^3/h} = 0{,}785\ h$$

$$K_H = \frac{\tau}{\bar{W}\varrho c_p} = \frac{2400\ kJ/kg}{5\ m^3/h \cdot 1000\ kg/m^3 \cdot 4{,}18\ kJ/kg°C} = 0{,}115\ \frac{°C}{kg/h}$$

Szintszabályozó kör:




$$G_z = G_T = \frac{K_L}{T_L s + 1}$$

$$K_L = 2\frac{\bar{H}}{\bar{W}} = 2\cdot\frac{1{,}25m}{5\ m^3/h} = 0{,}5\ \frac{m}{m^3/h}$$

$$T_L = 2\cdot\frac{\bar{V}}{\bar{W}} = 2\cdot T_H = 2\cdot 0{,}785\ h = 1{,}57\ h$$

$$G_{TA} = \frac{100\% - 0\%}{2{,}5m - 0{,}5m} = \frac{50\%}{m}$$

$$G_{BE} = \frac{W_{max} - 0\ m^3/h}{100\% - 0\%}$$

$$W_{max} = K_{V\,max}\sqrt{\frac{\Delta p_{sz}/1\,bar}{\varrho_{rel}}}$$

$$\Delta p_{sz} = \varrho \cdot g \cdot \bar{H} = 1000\ kg/m^3 \cdot 10\ m/s^2 \cdot 1{,}25m = 0{,}125\ bar$$

$$\varrho_{rel} = 1$$

$$G_{BE} = \frac{K_{V\,max}\sqrt{\Delta p_{sz}/1\,bar}}{100\%} = \frac{45\ m^3/h \cdot \sqrt{0{,}125}}{100\%} = 0{,}159\ \frac{m^3/h}{\%}$$

$G_c = A_{Pc}$

(30 pont)

FIR gyak 2014.05.15. (A)

b)

$$\frac{\bar{w}}{w_{max}} = \frac{H}{H_{max}} = h = ?$$

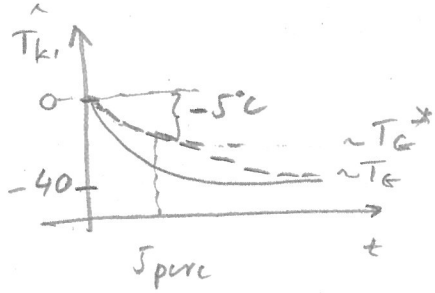
$$w_{max} = k_{vmax}\sqrt{\Delta p_{sz}/1\,bar} = 45\,m^3/h \cdot \sqrt{0{,}125\,bar} = 15{,}9\,m^3/h$$

$$h = \frac{5\,m^3/h}{15{,}9\,m^3/h} = 31{,}4\,\%$$

(10 pont)

c)

A zavarás ugrás: $\Rightarrow \hat{T}_{k1} = K_H \cdot a \left(1 - e^{-\frac{t}{T_H}}\right)$




$\hat{T}_{k1}(10\,perc) := -5°C$

ez $T_H^* = \frac{V^*}{\bar{W}}$ esetén teljesül

Zavarás mértéke:

$$\hat{T}_{k1}(\infty) = K \cdot a$$

$$-40°C = 0{,}115\,\frac{°C}{kg/h} \cdot a \Rightarrow a = -347{,}8\,kg/h$$

Visszahelyettesítve:

$$-5°C = \underbrace{0{,}115\,\frac{°C}{kg/h} \cdot (-347{,}8\,kg/h)}_{-40°C} \left[1 - e^{-\frac{10\,perc}{T_H^*}}\right]$$

$$e^{-\frac{10\,perc}{T_H^*}} = 0{,}875 \Rightarrow \boxed{T_H^* = 74{,}89\,perc = 1{,}25\,h}$$

$$T_H^* = \frac{V^*}{\bar{W}} \Rightarrow V^* = T^* \cdot \bar{W} = 1{,}25h \cdot 5\,m^3/h = 6{,}25\,m^3$$

$$V^* = \frac{D^2\pi}{4} \cdot H^* \Rightarrow H^* = 2\,m$$

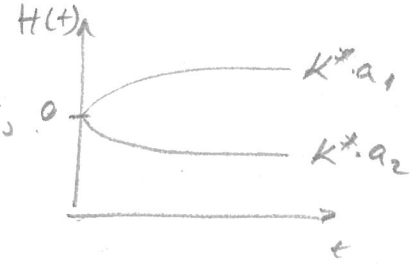
(15 pont)

FIR gyak 2014.05.15 (4)

d,

$$G^* = \frac{H}{W_{be}} = \frac{G_z}{1 + G_7 \cdot G_{TA} \cdot G_c \cdot G_{BE}}$$

$a_1 = +95\ m^3/h$ $\quad a_2 = -0{,}5\ m^3/h$ ugrás




$$\hat{H}(\infty) = \lim_{s \to 0} \left[ s \cdot G^* \cdot \frac{a_1}{s} \right]$$

$$G^* = \frac{\frac{0{,}5\ m/m^3/h}{1{,}57h\,s + 1}}{1 + \frac{0{,}5\ m/m^3/h}{1{,}57h\,s+1} \cdot 50\ \frac{\%}{m} \cdot A_{Pc} \cdot 0{,}159\ \frac{m^3/h}{\%}}$$

Beholyettesítve:

$$2\,cm \equiv 0{,}02\,m = \lim_{s \to 0} \left[ s \cdot \frac{\frac{0{,}5}{1{,}57s+1}}{1 + \frac{9{,}5}{1{,}57s+1} \cdot 50 \cdot 0{,}159 \cdot A_{Pc}} \cdot \frac{0{,}5}{s} \right]$$

$$0{,}02 = \frac{0{,}5 \cdot 0{,}5}{1 + \underbrace{9{,}5 \cdot 50 \cdot 0{,}159 \cdot A_{Pc}}_{3{,}975\,A_{Pc}}}$$

$$12{,}5 = 1 + 3{,}975\,A_{Pc} \quad \Rightarrow \quad \underline{\underline{A_{Pc} = 2{,}89\ \frac{\%}{\%}}}$$

(15 pont)

$a_2$-re ugyanez az eredmény