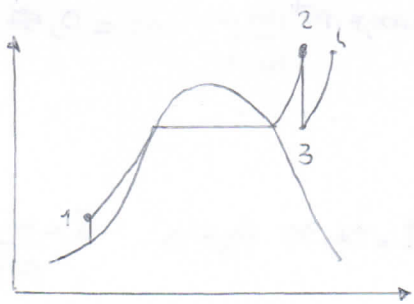
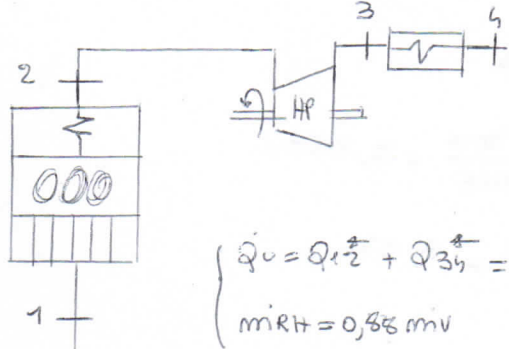


DATI: $P_{el} = 600 \text{ kW}$
 $\eta_{el} = 45\%$
 $LHV = 25 \text{ MJ/kg}$
 $\eta_{HV} = 93,5\%$
 $T_F = 140^\circ\text{C}$



STATO	$h [kJ/kg]$	$s [kJ/kgK]$
1	1328,7	3,176
2	3493,7	6,364
3	3035,3	6,449
4	3674,8	7,370

1)



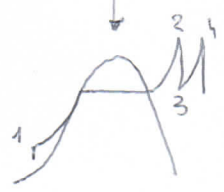
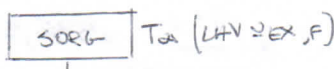
$$\eta_{el} = \frac{P_{el}}{m_{ic} LHV} \rightarrow m_{ic} = \frac{P_{el}}{\eta_{el} LHV} = 53,33 \text{ kg/s}$$

$$\eta_{HV} = \frac{\dot{Q}_U}{m_{ic} LHV} \rightarrow \dot{Q}_U = \eta_{HV} m_{ic} LHV = 1256,50 \text{ kW}$$

$$\dot{Q}_U = \dot{Q}_{12} + \dot{Q}_{34} = m_{iv} (h_2 - h_1) + m_{irH} (h_4 - h_3)$$

$$m_{irH} = 0,88 \text{ miv} \rightarrow m_{iv} = \frac{\dot{Q}_U}{(h_2 - h_1) + 0,88 (h_4 - h_3)} = 457 \text{ kg/s}$$

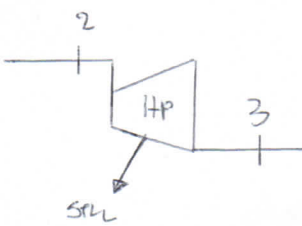
2)



$$S_{gen} - a_{ca} = -\frac{\dot{Q}}{T_{ca}} + m_{iv} (s_2 - s_1) + 0,88 m_{iv} (s_4 - s_3) = 1827,31 \text{ kW/K}$$

$$D_{mp} - a_{ca} = \frac{T_0 S_{gen}}{m_{ic} LHV} = 39,49\%$$

3)

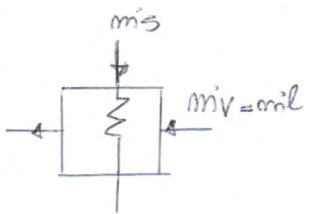


BILANCIO ENERGIA

$$\begin{cases} m_{iv} h_2 = m_{ix} h_3 - m_{is} h_4 - L \rightarrow = 0 \\ m_{ix} = m_{iv} - m_{is} = 420,58 \text{ kg/s} \\ m_{is} = 0,06 m_{iv} = 27,42 \text{ kg/s} \end{cases}$$

$$L \rightarrow m_{iv} h_2 - m_{ix} h_3 - m_{is} h_4 = 203,10 \text{ kW}$$

4)

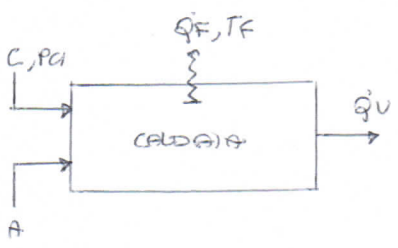


BILANCIO ENERGIA

$$m_{iv} h_{w,iv} - m_{iv} h_{w,ar} + m_{is} h_s = 0 \quad (h_w = c_w \Delta T)$$

$$\Delta T = \frac{m_{is} h_s}{m_{iv} c_w} = 24,38^\circ\text{C}$$

5)



BILANCIO ENERGIA

$$\begin{cases} m_{ic} c_{p,c} (T_c - T_0) + m_{ir} c_{p,r} (T_r - T_0) + m_{ic} LHV = \dot{Q}_U + m_{ir} c_{p,r} (T_r - T_0) \\ HP \quad T_c \geq T_r \geq T_0 \end{cases}$$

$$m_{ir} = \frac{m_{ic} LHV - \dot{Q}_U}{c_{p,r} (T_r - T_0)} = 630,25 \text{ kg/s}$$

$$V_F \left[\frac{\text{km}^3}{\text{s}} \right] = m_{ir} \left[\frac{\text{kg}}{\text{s}} \right] \frac{1}{\rho_{\text{air}}} \left[\frac{\text{kg}}{\text{m}^3} \right] = 22,613 \left[\frac{\text{m}^3}{\text{kg}} \right] = 470,86 \frac{\text{m}^3}{\text{s}}$$

6)

$$C_{H_2O_2} = 600 \text{ ppmV}$$

$$m_{H_2O_2} = \gamma_{H_2O_2, F} \dot{m}_F = X_{H_2O_2, F} \cdot 10^{-6} \frac{\dot{m}_{H_2O_2}}{\dot{m}_F} \dot{m}_F = 0,57083 \text{ Kg/s}$$

7) $\bar{d}_{ST} = 9 \text{ [Kg]}$

$$\dot{m}_{A, EC} = \dot{m}_A - \dot{m}_{A, ST} = (\dot{m}_F - \dot{m}_C) - \bar{d}_{ST} \dot{m}_C = 96,95 \text{ Kg/s} \quad \bar{d} = \frac{\dot{m}_A}{\dot{m}_C} = 10,82$$

8) $X_{O_2, A} = 21$

$$\dot{m}_{O_2, F} = \dot{m}_{O_2, EC} \frac{\dot{m}_A}{\dot{m}_F} = X_{O_2, A} \cdot \frac{\dot{m}_{H_2O_2}}{\dot{m}_F} \dot{m}_{A, EC} = 22,53 \text{ Kg/s}$$

$$\dot{m}_{O_2, F} = \gamma_{O_2, F} \dot{m}_F = X_{O_2, F} \frac{\dot{m}_{H_2O_2}}{\dot{m}_F} \dot{m}_F \quad \rightarrow \quad X_{O_2, F} = \frac{\dot{m}_{O_2, F} \dot{m}_F}{\dot{m}_{H_2O_2} \dot{m}_F} = 3,353\%$$

$$\rightarrow \gamma_{O_2, F} = \frac{\dot{m}_{O_2, F}}{\dot{m}_F} = 3,576\%$$

$$X_{O_2, FS} = X_{O_2, F} \cdot \frac{100}{100 - X_{H_2O, F}} = 3,593\%$$

9) $C_{H_2O_2, FS} = 600 \cdot \frac{100}{96} = 625 \text{ ppmVd} \quad C_{H_2O_2, FS} \Big|_{6\% O_2} = C_{H_2O_2, FS} \Big|_{13,493\% O_2} \cdot \frac{21-6}{21-13,493} = 535,5 \text{ ppmVd}$

$$C_{H_2O_2, FS} \Big|_{6\% O_2} = \frac{535,5}{22,413} \cdot \dot{m}_{H_2O_2} = 1009,35 \frac{\text{mg}}{\text{Nm}^3 \text{ (N}_2\text{O}_2)}$$

12) $\eta_{SER} = \frac{DC_{H_2O_2}}{C_{H_2O_2}} \Big|_{6\% O_2, DEY} = 81,8\% \quad \rightarrow \quad \dot{m}_{H_2O_2} = \eta_{SER} \dot{m}_{H_2O_2, F} = 0,4743 \text{ Kg/s}$



$$\beta = \frac{\dot{m}_A}{\dot{m}_{H_2O_2}} = \frac{8}{6} \quad \dot{m}_{NH_3} = \dot{m}_{NH_3} \frac{\dot{m}_{H_2O_2}}{\dot{m}_{H_2O_2}} = \frac{8}{6} \frac{\dot{m}_{H_2O_2}}{\dot{m}_{H_2O_2}} \cdot \dot{m}_{H_2O_2} = 0,2334 \text{ Kg/s}$$