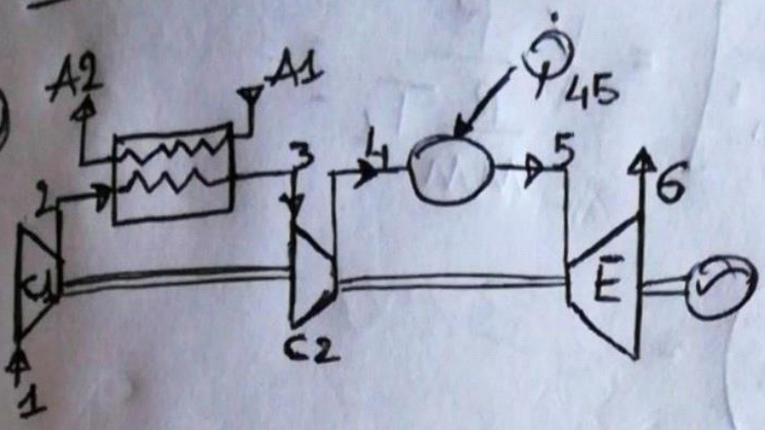
ESAME 29/08/2020

SISTEMI ENERGETICI PER INGEGNERIA FISICA

(1)



$P_2 = \beta_{C1} \cdot P_1 =$

C1 → compressione ISENTROPICA

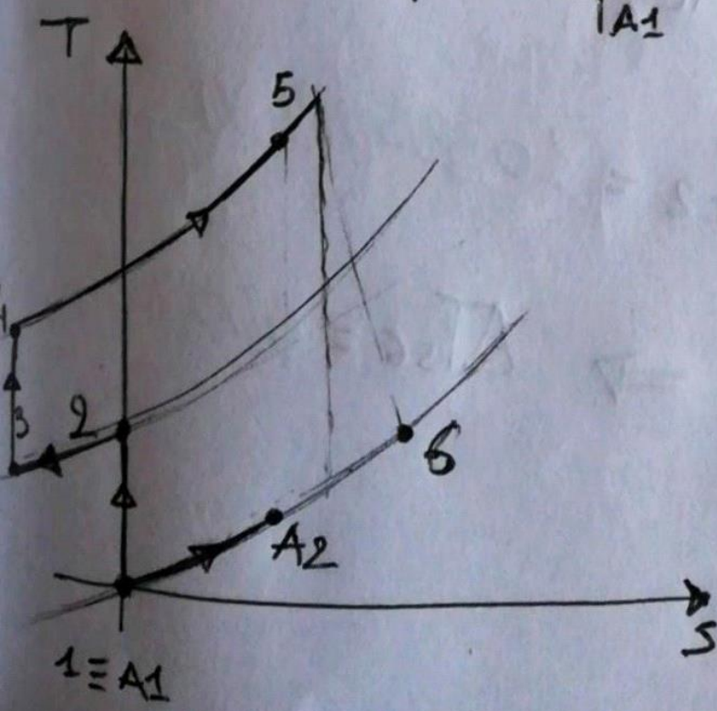
$$\frac{T_2}{T_1} = \beta_{C1} = \beta_{C1}^{\frac{\gamma-1}{\gamma}} \Rightarrow T_2 = 456{,}4\ K$$

$s_2 = 0\ J/kg/K = s_1$

$T_{A2} = T_{A1} + \Delta T_{A2-A1} = 115°C$

$P_{A2} = P_{A1} = 1\ bar$ (ISOBARA)

$$s_{A2} = s_{A1} + c_p \ln \frac{T_{A2}}{T_{A1}} = 300\ J/kg/K$$



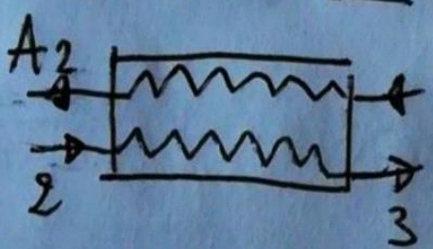
$$P_{C1} = \dot{m}_1 c_p (T_2 - T_1) = 2043\,kW$$

$$\dot{m}_1 = \dot{V}\left[\frac{m^3}{s}\right] \rho\left[\frac{kg}{m^3}\right] = \dot{V} \frac{P}{\frac{R}{MM} T_1} = 12{,}06\,\frac{kg}{s}$$

$$P_{C2} = \dot{m}_1 c_p (T_4 - T_3) = 2291\,kW$$

$$T_4 = T_3 \beta_{C2} = 511{,}8\,K$$

- Pontata aria A1 ?



$$\dot{m}_{A1} c_p (T_{A2} - T_{A1}) = \dot{m}_2 c_p (T_2 - T_3)$$

$$\dot{m}_{A1} = \frac{\dot{m}_2 (T_2 - T_3)}{\dot{m}_{A1} (T_{A2} - T_{A1})} = 16{,}07\,\frac{kg}{s}$$

- ΔT_{56} ?

$$\dot{W}_{NETTA} = P_{ESP} - P_{C1} - P_{C2}$$

$$P_{ESP} = \dot{W}_{NETTA} + P_{C1} + P_{C2} = 10335{,}4\,kW$$

$$P_{ESP} = \dot{m}_5 c_p \Delta T_{56} \Rightarrow \Delta T_{56} = 850{,}8\,°C$$

• T_5 ?

$$\Delta T_{56} = \Delta T_{5\,6,15} \cdot \eta_{15} = (T_5 - T_{6,15})\,\eta_{15} \Rightarrow \Delta T_{5\,6,15} = 24,5°C$$

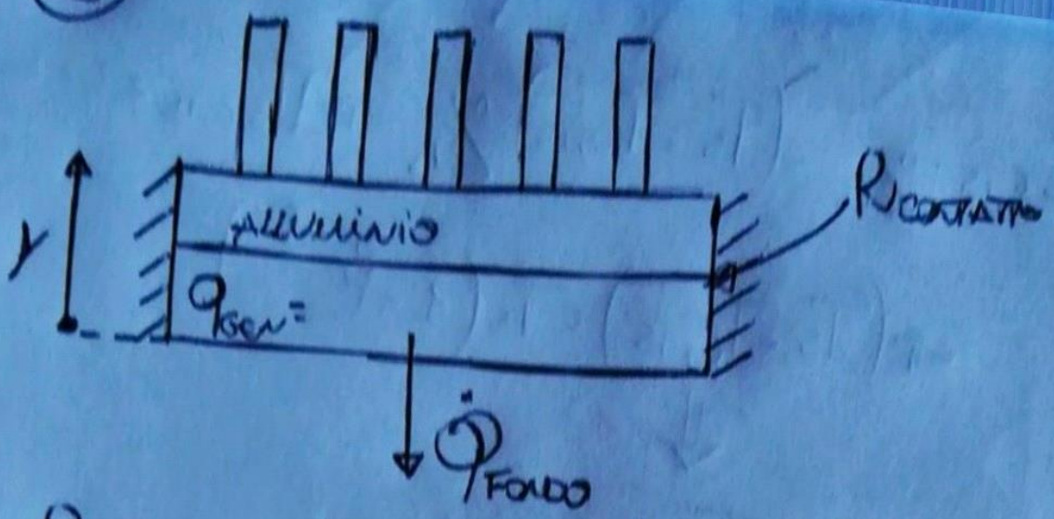
$$\frac{T_5}{T_{6,15}} = \underbrace{\beta_{ESR}}_{25}^{\Theta} \Rightarrow (T_5 - T_{6,15}) = T_5\left(1 - \beta^{-\Theta}\right)$$

$$\Downarrow$$

$$T_5 = 1299°C$$

• η ?

$$\eta = \frac{W_{NETA}}{\dot{m} c_p (T_5 - T_4)} = 0,47$$



- $R_{COND,Al}$?

$$R_{COND,Al} = \frac{S_{ALL}}{K_{Al} \cdot A_{BASE}} = 0{,}0367\ K/W$$

- $T_{BASE,ALETTA}$?

$$\dot{\Phi}_{GEN} = \dot{q}_{GEN} \cdot V_{CHIP} = 28\ W$$

$$\dot{\Phi}_{FONDO} = \dot{\Phi}_{GEN} \cdot \alpha = 5{,}6\ W$$

$$\dot{\Phi}_{TOP} = \dot{\Phi}_{GEN} - \dot{\Phi}_{FONDO} = 22{,}4\ W \quad (\text{DISSIPATA DAL DISSIPATORE})$$

$$\eta_{ALETTA} = \frac{\dot{\Phi}_{TOP}}{\dot{\Phi}_{ISO,T}} = \frac{\dot{\Phi}_{TOP}}{h_{CONV} \cdot S_{DISS} (T_{BASE} - T_\infty)}$$

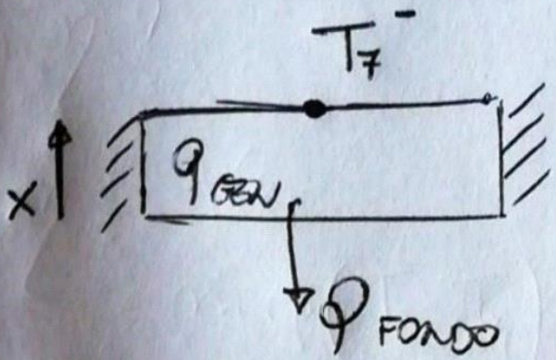
$$T_{BASE,ALETTA} = \frac{\dot{\Phi}_{TOP}}{\eta_{ALETTA}\, h_{CONV} \cdot S_{DISS}} + T_\infty = 70{,}34\ °C$$

• Profilo T $y\,[0;\ 12\ mm]$

$$T_{7\,mm}^{+} = T_{BASE} + R_{cond,Al} \cdot \varphi_{TOP} = 71{,}12°C$$

$$T_{7\,mm}^{-} = T_{7\,mm}^{+} + R_{CONTATTO}\,\varphi_{TOP} = 72{,}24°C$$

ALL'INTERNO DEL CHIP GENERAZIONE DI POTENZA



$$\frac{d^2T}{dx^2} = -\frac{q_{GEN}}{K}$$

$$\frac{dT}{dx} = -\frac{q_{GEN}}{K}x + C_1$$

$$T(x) = -\frac{q_{GEN}x^2}{2K} + C_1x + C_2$$

~~$T(0) = T_7$~~

$$\left.\frac{dT}{dx}\right|_{x=0} \cdot K_{CHIP}\,S = \varphi_{FONDO} \Rightarrow C_1 = 160\ \frac{K}{W}$$

$$T(7\,mm) = 72{,}24°C \Rightarrow C_2 = 73{,}712°C$$