

Dati

Vel. del riferimento

$$N = 15000 \text{ giri/min}$$

$$M_{ic} = 68 \text{ kg/s}$$

$$T_{ic} = 15^\circ\text{C} = 288,15 \text{ K}$$

$$P_{ic} = 101325 \text{ Pa}$$

$$\beta = 18$$

$$\gamma_{TT} = 0,86$$

$$C_p = 1,04 \frac{\text{kJ}}{\text{kg K}}$$

$$\gamma = 1,38$$

$$C_p = 1,040 \frac{\text{J}}{\text{kg K}}$$

P_c ?

Valori di funzionamento :

$$N = 15000 \text{ giri/min}$$

$$M_{ic} = 51,3 \text{ kg/s}$$

$$T_{ic} = 51^\circ\text{C} = 324,15 \text{ K}$$

$$P_{ic} = 101325 \text{ Pa}$$

$$P_c = M_{ic} c_p (\underline{\underline{T_{oc}}} - T_{ic})$$

$$\frac{P_{UC}}{P_{IC}} = \beta = \left(\frac{T_{UCS}}{T_{IC}} \right)^{\frac{\delta}{\delta-1}} \rightarrow$$

$$\rightarrow T_{UCS} = T_{IC} \beta^{\frac{\delta-1}{\delta}}$$

$$Z_{IT} = \frac{T_{UCS} - T_{IC}}{T_{UC} - T_{IC}} \rightarrow \textcircled{T_{UC}} = T_{IC} + \frac{T_{UCS} - T_{IC}}{Z_{IT}}$$

$$\frac{\frac{N}{\sqrt{F}}}{\left(\frac{N}{\sqrt{F}}\right)_t} \approx \frac{\frac{15'000}{\sqrt{324,15}}}{\frac{15000}{\sqrt{288,15}}} \approx \sqrt{\frac{288,15}{324,15}} \cdot \frac{15'000}{15'000} =$$

$$\approx 0,943$$

$$\approx 0,800$$

$$\frac{\frac{Mic \sqrt{Tic}}{Pic}}{\left(\frac{Mic \sqrt{Tic}}{Pic}\right)_t} \approx \frac{51,3}{68,0} \cdot \sqrt{\frac{324,15}{288,15}} \cdot \frac{1}{\frac{101325}{101325}} =$$

$$\frac{2_{TT}}{(2_{TT})_t} = 1 \quad \rightarrow \quad 2_{TT} = (2_{TT})_t = 0,86$$

$$\begin{aligned} \frac{\beta - 1}{(\beta - 1)_t} = 0,77 &\rightarrow \beta = 1 + 0,77(\beta - 1)_t = \\ &= 1 + 0,77 \times 17 = \\ &= 14,09 \end{aligned}$$

$$T_{MCS} = T_{ic} \beta^{\frac{r-1}{r}} = 324,15 \times 14,09^{\frac{0,38}{1,38}} = 671,603 \text{ k}$$

$$T_{uc} = T_{ic} + \frac{T_{MCS} - T_{ic}}{2r} = 324,15 + \frac{671,603 - 324,15}{0,86} = 728,165$$

$$P_e = M_{ic} C_p (T_{uc} - T_{ic}) = 51,3 \times 1040 \times (728,165 - 324,15) = 21.555.000 \text{ W} = 21,555 \text{ MW}$$

Doh

Valori di referensi

$$N = 3000 \text{ rpm/min}$$

$$M_{ic} = 60 \text{ kg/s}$$

$$T_{ic} = 15^\circ\text{C} = 288,15 \text{ K}$$

$$P_{ic} = 101325 \text{ Pa}$$

$$\beta = 15$$

$$Z_{\text{TT}} = 0,905$$

$$C_p = 1,023 \frac{\text{kJ}}{\text{kg K}}$$

$$= 1,023 \frac{\text{J}}{\text{kg K}}$$

$$\gamma = 1,39$$

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Valori di funzionamento:

$$\beta = 11$$

$$\eta_{TT} = 0,88$$

$$T_{ic} = 25^{\circ}\text{C} = 298,15\text{K}$$

$$P_{ic} = 103\text{ kPa} = 103000\text{ Pa}$$

$$\frac{\frac{M\sqrt{T_{ic}}}{P_{ic}}}{\left(\frac{M\sqrt{T_{ic}}}{P_{ic}}\right)_t} = 0,85 = FF^*$$

P_c ?

$$P_c = \underline{\underline{M_{ic}}} \cdot C_p \cdot (\sqrt{V_{ic}} - \underline{\underline{V_{uc}}})$$

$$M_{ic} = FF^* \cdot \left(\frac{M_{ic} \sqrt{V_{ic}}}{P_{ic}} \right) \cdot \frac{P_{ic}}{\sqrt{V_{ic}}} =$$
$$= 0,85 \cdot 60 \cdot \frac{103000}{101325} \cdot \sqrt{\frac{288,15}{298,15}} =$$
$$= 51 \frac{\text{kg}}{\text{s}}$$

$$T_{uc} \approx T_{ic} + \frac{T_{uc_s} - T_{ic}}{2\pi}$$

$$2\pi \approx \frac{T_{uc_s} - T_{ic}}{T_{uc} - T_{ic}}$$

$$T_{uc_s} \approx T_{ic} \beta^{\frac{\delta-1}{\delta}} \approx 298,15 \cdot 11^{\frac{0,39}{1,39}} \approx$$

$$\approx 584,28 \text{ K}$$

$$T_{uc} \approx 298,15 + \frac{584,28 - 298,15}{0,88} \approx 623,30 \text{ K}$$

$$P_c \approx M_{ic} c_p (T_{uc} - T_{ic}) \approx 51 \times 10^23 (623,30 - 298,15) \approx$$

$$\approx 16.964.000 \text{ W} \approx 17 \text{ MW}$$

Dati

Valori di riferimento

$$N = 28'000 \frac{\text{giri}}{\text{min}}$$

$$M_{ic} = 35 \frac{\text{kg}}{\text{s}}$$

$$T_{ic} = 60^\circ\text{C} = 333,15 \text{ K}$$

$$P_{ic} = 280000 \text{ Pa}$$

$$\beta = 7$$

$$z_{TT} = 0,85$$

$$C_p = 1,023 \frac{\text{kJ}}{\text{kg K}} =$$
$$= 1,023 \frac{\text{J}}{\text{kg K}}$$

$$\gamma = 1,39$$

(3)

Valori di funzionamento

$$\beta = 10$$

$$z_{TT} = 0,75$$

$$T_{ic} = 45^{\circ}\text{C} = 318,15 \text{ K}$$

$$P_{ic} = 250.000 \text{ Pa}$$

$$FF^* = \frac{M \sqrt{P_{ic}}}{P_{ic}} / \left(\frac{M \sqrt{P_{ic}}}{P_{ic}} \right)_t = 1,05$$

$$N_{hid}^* = \frac{N}{\sqrt{P_{ic}}} / \left(\frac{N}{\sqrt{P_{ic}}} \right)_t = 1,10$$

$$N \approx N_{\text{rad}}^* \cdot \left(\frac{N}{\sqrt{\Delta T_{ic}}} \right) \cdot \sqrt{\Delta T_{ic}} \approx$$

$$\approx 1,10 \cdot 28'000 \cdot \sqrt{\frac{318,15}{333,15}} \approx$$

$$\approx 30'099 \text{ giri/min}$$

$$P_c \approx \underline{\underline{M_{ic}}} C_p (\underline{\underline{T_{oc}}} - \Delta T_{ic})$$

$$\begin{aligned}
 M_{ic} &\approx FF^* \left(\frac{M_{ic} \sqrt{\gamma_{ic}}}{P_{ic}} \right) \cdot \frac{P_{ic}}{\sqrt{\gamma_{ic}}} \\
 &\approx 1,05 \times 35 \times \frac{250'000}{280'000} \cdot \sqrt{\frac{333,15}{318,15}} \\
 &\approx 33,6 \frac{\text{kg}}{\text{s}}
 \end{aligned}$$

$$T_{uc} = T_{ic} + \frac{T_{uc_s} - T_{ic}}{2\pi}$$

$$T_{uc_s} = T_{ic} \beta^{\frac{k-1}{\gamma}} = 318,15 \times 10^{\frac{0,39}{1,39}} =$$

$$\approx 607,03 \text{ K}$$

$$T_{uc} = 318,15 + \frac{607,03 - 318,15}{0,75} = 703,32 \text{ K}$$

$$P_c = \dot{M}_{ic} c_p (T_{uc} - T_{ic}) = 33,6 \times 1023 \times (703,32 - 318,15) =$$

$$\approx 13'239'400 \text{ W} = 13,239 \text{ MW}$$