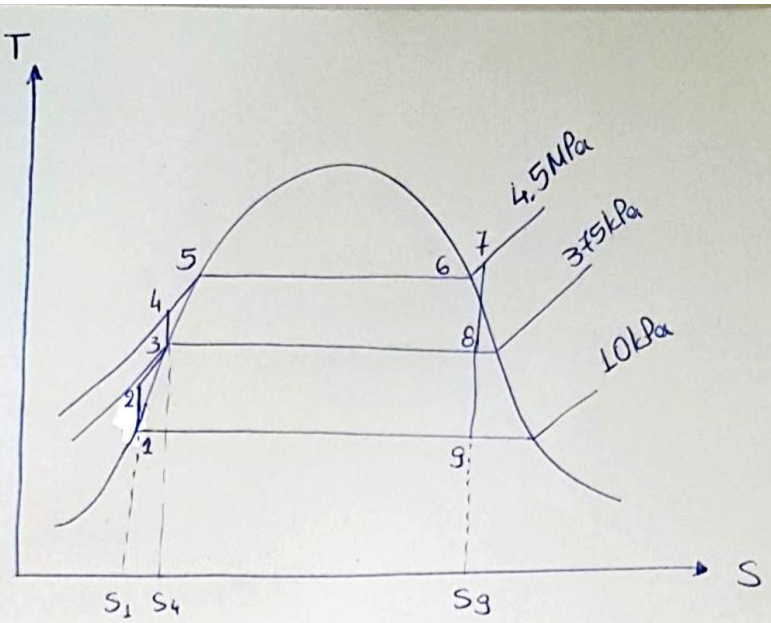
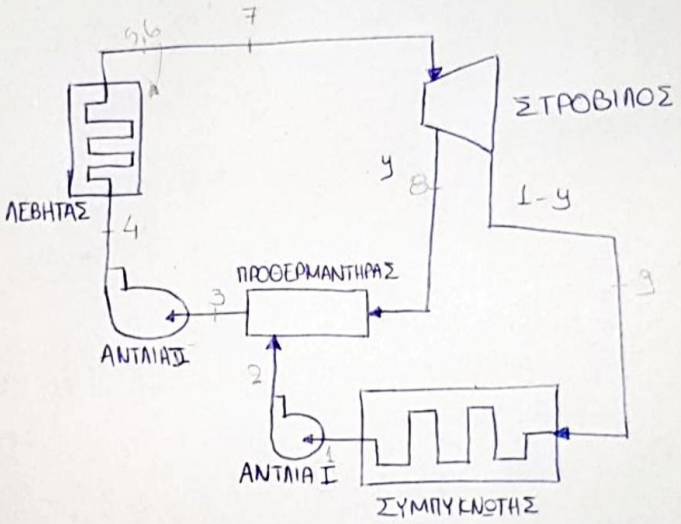
5. Β


T
S
4,5MPa
375kPa
10kPa
5
6
7
4
3
8
2
1
9
S1 S4
S9

Α


9,6
7
ΣΤΡΟΒΙΛΟΣ
y
8
1-y
ΛΕΒΗΤΑΣ
4
ΠΡΟΘΕΡΜΑΝΤΗΡΑΣ
3
9
ΑΝΤΛΙΑ II
2
ΑΝΤΛΙΑ I
1
ΣΥΜΠΥΚΝΩΤΗΣ

Γ] $P_7 = 4.5\,MPa$

$T_7 = 350°C$

f: (Quality: 0)

$P_1 = 10\,kPa$ $(=0.010\,MPa)$ ⟶

$h_1 = h_{f@10kPa} = 191.8\,kJ/kg$

$s_1 = s_{f@10kPa} = 0.6492\,kJ/(kg\,K)$

$v_1 = v_{f@10kPa} = 0.00101\,m^3/kg$

$P_2 = 375\,kPa$ $(=0.375\,MPa)$

$s_2 = s_1 = 0.6492\,kJ/(kg\,K)$

$w_{p,in} = v_1(P_2 - P_1) = \left(0.00101\frac{m^3}{kg}\right)(375\,kPa - 10\,kPa)$

$w_{p,in} = 0.36865\frac{kJ}{kg}$

$h_2 = h_1 + w_{p,in} = 191.8\frac{kJ}{kg} + 0.36865\frac{kJ}{kg}$

$h_2 = 192.17\frac{kJ}{kg}$

$P_3 = 375\,kPa$ (κορεσμένο υγρό) ⟶ ($f@0.375\,MPa$)

$v_3 = 0.001081\,m^3/kg$

$h_3 = 594.8\,kJ/kg$

$s_3 = 1.753\,kJ/(kg\,K)$

$w_{pII,in} = v_3(P_4 - P_3) = \left(0.001081\frac{m^3}{kg}\right)(4.500\,kPa - 375\,kPa)$

$w_{pII,in} = 4.46\,kJ/kg$

$h_4 = h_3 + w_{pII,in} = 594.8\,kJ/kg + 4.46\,kJ/kg$

$h_4 = 599.26\,kJ/kg$

$s_4 = s_3 = 1.753\,kJ/(kg\,K)$

$P_5 = 4.5\,MPa$ } $V_5 = V_{f@4.5MPa} = 0.001269\ m^3/kg$
κορ. υγρό $h_5 = 1120.5\ kJ/kg$
$s_5 = 2.858\ kJ/(kgK)$

$P_7 = 4.5\,MPa$ } $h_7 = 3081\ kJ/kg$
$T_7 = 350°C$ $s_7 = 6.513\ kJ/(kgK)$
$V_7 = 0.0584\ m^3/kg$

$P_6 = 4.5\,MPa$ } $V_6 = V_{g@4.5MPa} = 0.04461\ m^3/kg$
κορ. ατμός $h_6 = 2797.5\ kJ/kg$
$s_6 = 6.0215\ kJ/(kgK)$

$P_8 = 375\,kPa$
$s_8 = s_7 = 6.513\ kJ/kgK)$
$s_{f@375kPa} = 1.753\ kJ/(kgK)$
$s_{g@375kPa} = 6.917\ kJ/(kgK)$
} $s_8 = s_f + x_8 s_{fg}$

$x_8 = 0.92$

$h_8 = h_f + x_8 h_{fg} = 594.8\ \frac{kJ}{kg} + 0.92(2736 - 594.8)\ \frac{kJ}{kg}$

$h_8 = 2564.7\ kJ/kg$

$V_8 = V_f + x_8 V_{fg} = 0.001081\ \frac{m^3}{kg} + 0.92(0.4914 - 0.001081)\ \frac{m^3}{kg}$

$V_8 = 0.4522\ m^3/kg$

$P_9 = 10\,kPa$
$s_9 = s_8 = s_7 = 6.513\ kJ/(kgK)$
$s_{f@10kPa} = 0.6492\ kJ/kgK)$
$s_{g@10kPa} = 8.15\ kJ/(kgK)$
} $s_9 = s_f + x_9 s_{fg}$

$x_9 = 0.78$

$h_9 = 2058.5\ kJ/kg$
$V_9 = 11.44\ m^3/kg$

Ενεργειακό Ισοζύγιο στον προθερμαντήρα

$$\dot{E}_{in} = \dot{E}_{out} \qquad \left(y = \frac{\dot{m}_8}{\dot{m}_3}\right)$$

$$\dot{m}_8 h_8 + \dot{m}_2 h_2 = \dot{m}_3 h_3$$

$$y h_8 + (1-y) h_2 = 1 h_3$$

$$y h_8 + h_2 - y h_2 = h_3$$

$$y(h_8 - h_2) = h_3 - h_2$$

$$y = \frac{h_3 - h_2}{h_8 - h_2} = \frac{594.8 - 192.17}{2564.7 - 192.17}$$

$$y = 0.1697$$

Ε] $W_{turb,out} = (h_7 - h_8) + (1-y)(h_8 - h_9)$

$W_{turt,out} = (3081 - 2564.7) + (1 - 0.1697)(2564.7 - 2058.5)$

$W_{turb,out} = 936.598 \text{ kJ/kg}$

$q_{in} = h_7 - h_4 = (3081 - 599.26)\text{kJ/kg} = 2481.74 \frac{\text{kJ}}{\text{kg}}$

$q_{out} = (1-y)(h_9 - h_1) = (1 - 0.1697)(2058.5 - 191.8)\frac{\text{kJ}}{\text{kg}}$

$q_{out} = 1549.92 \text{ kJ/kg}$

$\eta_{th} = 1 - \frac{q_{out}}{q_{in}} = 0.3755$ ή 37.55%