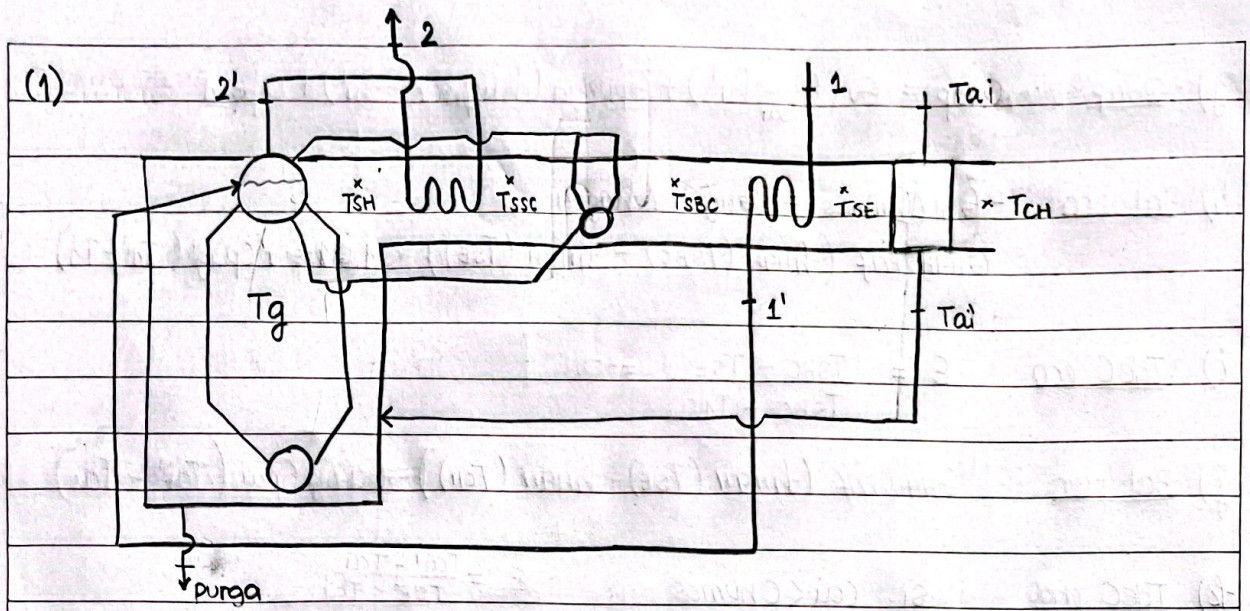
Ejercicio 1



Pto 1: Líq @ 120°C, 54 ata → h_1 = 503,8 KJ/Kg = 120,4 Kcal/Kg

Pto 2': vap sat @ 54 ata → $h_{2'}$ = 2790,7 KJ/Kg = 667,0 Kcal/Kg

Pto 2: vap @ 460°C, 54 ata → h_2 = 3335,2 KJ/Kg = 797,1 Kcal/Kg

Purga: Líq sat @ 54 ata ⇒ h_{purga} = 1179,0 KJ/KG = 281,8 Kcal/Kg

Ecuaciones

a) Bal. Gen. $Q_p^s - Q_{perd} = G_v(h_2 - h_1) + G_{HGH}[h_{HGH}(T_{CH}) - h_{HGH}(T_o)] + G_H h_{fg}(T_o) - C_{pfuel}(T_f - T_o) - G_{as} C_{pa}(T_a - T_o) + G_{purga}(h_{líq,sat} - h_1)$

b) combustión → 2 ecs
- $G_{as} = 138\alpha$
- $G_{HGH} = G_{as} + 1 - Ash$
- %CO_2 para h_{HGH}

c) Bal. Adiabático. $Q_p^s = G_{HGH}[h_{HGH}(T_{llad}) - h_{HGH}(T_o)] + G_H h_{fg}(T_o) - C_{pfuel}(T_f - T_o) - G_{as} C_{pa}(T_{ai} - T_o)$

d) Rendimiento $\eta = \frac{G_v(h_2 - h_1)}{Q_{ps}}$

e) Bal. Hogar $Q_p^s = Q_H + G_{HGH}[h_{HGH}(T_{SH}) - h_{HGH}(T_o)] + G_H h_{fg}(T_o) - C_{pfuel}(T_{fuel} - T_o) - G_{as} C_{pa}(T_{ai} - T_o)$

f) TdeC Hogar $\dot{Q}_H = 4{,}9\, F_H \varepsilon_p \varepsilon_{11} \left[\left(\frac{T_g}{100}\right)^4 - \left(\frac{T_p}{100}\right)^4\right]$ con $T_g = \frac{T_{SH} + T_{llad}}{2}$, $T_p = T_{sat} + 20°C$

g) Qvap $Qvap = G_v (h_{2_{sat}} - h_1') + G_{purga} (h_{liq,sat} - h_1') + Q_{perd}$

h) Bal. eco $-\dot{G}_h \Delta h_{humos} = \dot{G}_{agua} \Delta h_{agua}$

$G_{H9H} \cdot \dot{m}_f \left(h_{H9H}(T_{SBC}) - h_{H9H}(T_{SE}) \right) = 1{,}01\, \dot{G}_v\, c_{pag} (T_1' - T_1)$

i) TdeC eco $\varepsilon = \dfrac{T_{SBC} - T_{SE}}{T_{SBC} - T_1}$

j) Bal. prec. $G_{H9H} \cdot \dot{m}_f \left(h_{H9H}(T_{SE}) - h_{H9H}(T_{CH}) \right) = G_a \dot{m}_f c_{pai} (T_{ai}' - T_{ai})$

k) TdeC prec Si $c_{ai} < c_{humos}$: $\varepsilon = \dfrac{T_{ai}' - T_{ai}}{T_{SE} - T_{ai}}$

Si $c_{humos} < c_{ai}$: $\varepsilon = \dfrac{T_{SE} - T_{CH}}{T_{SE} - T_{ai}}$

l) $Q_H = 0{,}64\, Q_{vap}$

m) $Q_{BC} = Q_{vap} - Q_H = G_{H9H} \cdot \left(h_{H9H}(T_{ssc}) - h_{H9H}(T_{SBC}) \right)$

Incógnitas: $\dot{m}_{fuel}$, G_{H9H}, T_{CH}, G_{as}

T_{llad},

Q_H, T_{SH}, T_{ai}' 14 ecs y 14 inc.

F_H,

Q_{vap},

T_{SBC}, T_{SE}, T_1'

T_{ssc}

2) $\dot{m}_{fuel}$: de ec. ⓓ $0{,}82 = \dfrac{G_v (797{,}1 - 120{,}4)}{10300}$

$G_v = 12{,}5 \ \frac{kg_{vap}}{kg_{fuel}}$

$\dot{G}_v = 75 \ ton/h$

$\Rightarrow \boxed{\dot{m}_{fuel} = 6000 \ \frac{kg_{fuel}}{h}}$

T_{CH}: Resuelvo combustión ⇒ de ec. ⓑ G_a y G_{H9H} → de ec. ⓐ T_{CH}

$C_{\frac{0{,}81}{12}} H_{0{,}13} O_{\frac{0{,}04}{16}} N_{\frac{0{,}015}{14}} + \alpha (O_2 + 3{,}76 N_2) = \beta CO_2 + \gamma H_2O + \mu N_2 + \nu O_2$

$E = 0{,}15$

⇒ $\beta = 0{,}0675$ kmol CO_2/kgf

$\gamma = 0{,}065$ kmol H_2O/kgf

$\mu = 0{,}4275$ kmol N_2/kgf

$\nu = 0{,}01481$ kmol O_2/kgf

$\alpha = 0{,}11356$ kmol O_2 in/kgf

ec. ⑥ ⇒ $Ga = 15{,}67$ kgai/kgf

$G_{HGH} = 16{,}67$ kg HGH/kgf

$\%\ CO_2\ _{bs} = 13{,}2\ \%$

→ ec. ⓐ :

$$0{,}98 \cdot 10300 = 12{,}5(797{,}1 - 120{,}4) + 16{,}67\left[h_{HGH}(T_{CH}) - h^{\circ}_{HGH}(T_0)\right] + 682{,}6 - 47{,}5 + 0{,}01 \cdot 12{,}5\,(281{,}8 - 120{,}4)$$

$h_{HGH}(T_{CH}) = 58{,}8$ kcal/kg

FO, $CO_2 = 13\%$

$\Rightarrow$ $\boxed{T_{CH} \cong 252\,^{\circ}C}$

3) Precalentador con ⓙ y ⓚ ⇒ T_{SE}, T_{ai}'

$C_{aire} = 22564{,}8\ \frac{kcal}{h\,K}$, $C_{HUMOS} = \frac{100020\,(h_{HGH}(T_{SE}) - 58{,}8)}{T_{SE} - 252}$

$T_{SE} \rightarrow C_{HUMOS}$ $\xrightarrow{C_{ai} < C_{HUMOS},\ ⓚ}$ T_{ai}' $\xrightarrow{ⓙ}$ $h_{HGH}(T_{SE}) \rightarrow T_{SE}$

$\xrightarrow{C_{hum} < C_{ai},\ ⓚ}$ T_{SE} ⇒ uso ⓙ para T_{ai}' dsp de cerrar T_{SE}

T_{SE}	C_{HUMOS}	T_{ai}' ⓚ	$h_{HGH}(T_{SE})$ ⓙ	T_{SE}
350	26842	122,5	80,8	335
330	26736	116,5	80,8	335
333		117,4	79,6	330

→ $\boxed{T_{SE} \cong 332\,^{\circ}C}$

$\boxed{T_{ai}' \cong 117\,^{\circ}C}$

Economizador: con ⓘ T_{SBC}: $0,4\,(T_{SBC} - 120) = T_{SBC} - 332$

$$\boxed{T_{SBC} = 473,3\,^\circ C}$$

ⓗ T_1': $16,67.6000(119,3 - 79,6) = 1,01.75000.(T_1' - 120)$

$$\boxed{T_1' = 172,4\,^\circ C} \qquad (T_{sat} = 268,8\,^\circ C)\ \checkmark$$

Banco de convección: con ⓖ $Q_{vap} = 12,5(667 - 174) + 0,01.12,5(281,8 - 174) + 0,02.10300$

$$Q_{vap} = 6382,0\ \frac{kcal}{kg_f}$$

ⓜ $Q_{BC} = 0,36\,Q_{vap} = 2297,5 = 16,67\,(h_{HgH}(T_{SSC}) - 119,3)$

$$h_{HgH}(T_{SSC}) = 257,1\ \frac{kcal}{kg} \Rightarrow \boxed{T_{SSC} = 937\,^\circ C}$$

Bal. Hogar: con ⓛ $Q_H = 4084,5\ kcal/kg_f$

en ⓔ $10300 = 4084,5 + 16,67\,(h_{HgH}(T_{SH}) - h_{HgH}(T_0)) + 682,6 - 47,5 - 346$

$$h_{HgH}(T_{SH}) = 355,5\ KJ/Kg \Rightarrow \boxed{T_{SH} = 1248\,^\circ C}$$

4) $\dot{Q}_H = 24.507.000\ kcal/kg$

ⓕ $\dot{Q}_H = 4,9\,F_H\,\varepsilon_p\,\varepsilon_{II}\left[\left(\frac{T_g}{100}\right)^4 - \left(\frac{T_p}{100}\right)^4\right]$

T_{llad} de ec. ⓒ: $h_{HgH}(T_{llad}) = 600,5\ \frac{kcal}{kg} \Rightarrow T_{llad} = 1985\,^\circ C$

$T_g = 1616,5\,^\circ C$

$T_p = 288,8\,^\circ C$

$$\Rightarrow \boxed{F_H = 125,5\ m^2}$$