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"Analyzing Condenser #2-600 ton Single Effect Carrier Absorber"

f\$='Steam_lapws'

m\$='AirH2O'

P_atm=14.7 [psia]

"Chilled water loop"

V_dot_CH2_EVAP= 1668.8 [GPM]*convert(GPM, ft^3/s) "Placeholder"

V_dot_CH2_SM= 138.9 [ft^3/s] "Placeholder"

"!State 1 water entering the primary pump"

P_CH2[1]= 55 [psi] "Placeholder"

T_CH2[1]= 53 [F] "Placeholder"

h_CH2[1]=enthalpy(f\$,P=P_CH2[1],T=T_CH2[1])

x_CH2[1]=0 "Assumption"

"!State 2 water leaving the primary pump"

P_CH2[2]= 60 [psi] "Placeholder"

T_CH2[2]= 55 [F] "Placeholder"

x_CH2[2]= 0 "Assumption"

h_CH2[2]= enthalpy(f\$,P=P_CH2[2],T=T_CH2[2])

rho_CH22=Density(f\$,T=T_CH2[2],P=P_CH2[2])

"!State 3 water entering the chiller"

T_CH2[3]= 53.0 [F] "Placeholder"

P_CH2[3]=75 [psi] "Placeholder"

h_CH2[3]=enthalpy(f\$,T=T_CH2[3], P=P_CH2[3])

x_CH2[3]= 0 "Assumption"

"!State 4 water leaving the chiller"

T_CH2[4]= 44.6 [F] "Placeholder"

P_CH2[4]= 80 [psi] "Placeholder"

h_CH2[4]=enthalpy(f\$,T=T_CH2[4], P=P_CH2[4])

x_CH2[4]= 0 "Assumption"

"!State 5 steam entering the chiller"

T_CH2[5]= 120 [F] "Placeholder"

P_CH2[5]= 90 [psi] "Placeholder"

h_CH2[5]=enthalpy(f\$,T=T_CH2[5], P=P_CH2[5])

x_CH2[5]= 1 "Assumption"

"!State 6 steam leaving the chiller"

T_CH2[6]= 160 [F] "Placeholder"

P_CH2[6]= 100 [psi] "Placeholder"

h_CH2[6]=enthalpy(f\$,T=T_CH2[6], P=P_CH2[6])

x_CH2[6]= 1 "Assumption"

"Condenser water loop"

V_dot_CH2_CON=1668.3 [GPM]*convert(GPM,ft^3/s) "Placeholder"

m_dot_CH2_CON=V_dot_CH2_CON*rho_CH27

"!State 7 water entering the primary pump"

rho_CH27=Density(f\$,T=T_CH2[7],P=P_CH2[7])

T_CH2[7]= 53 [F] "Placeholder"

P_CH2[7]= 60 [psi] "Placeholder"

h_CH2[7]=enthalpy(f\$,T=T_CH2[7], P=P_CH2[7])

x_CH2[7]=0 "Assumption"

"!State 8 water leaving the primary pump"

T_CH2[8]= 55 [F] "Placeholder"

P_CH2[8]= 68 [psi] "Placeholder"

h_CH2[8]=enthalpy(f\$,T=T_CH2[8], P=P_CH2[8])

x_CH2[8]=0 "Assumption"

"!State 9 water entering the chiller"

T_CH2[9]= 53.0 [F] "Placeholder"

P_CH2[9]=80 [psi] "Placeholder"

h_CH2[9]=enthalpy(f\$,T=T_CH2[9], P=P_CH2[9])

x_CH2[9]= 0 "Assumption"

"!State 10 water leaving the chiller"

T_CH2[10]= 102.3 [F] "Placeholder"

P_CH2[10]= 82 [psi] "Placeholder"

h_CH2[10]=enthalpy(f\$,T=T_CH2[10], P=P_CH2[10])

x_CH2[10]= 0 "Assumption"

"Cooling Tower States"

V_dot_CH2[18]= 10000 [cfm]*convert(cfm,ft^3/s) "Volumetric flow rate of the dry air entering CT-2"

m_dot_CH2[18]=V_dot_CH2[18]/nu_av_CH2[18] "Mass flow rate of the dry air entering CT-2"

"!State 11 water entering the cooling tower"

T_CH2[11]= 97.8 [F] "Placeholder"

h_CH2[11]=400 [Btu/lb_m] "Placeholder for value that will be given with sensor"

x_CH2[11]=0 "Assumption"

"!State 12 water leaving the cooling tower"

T_CH2[12]= 85.9 [F] "Placeholder"

h_CH2[12]=200 [Btu/lb_m] "Placeholder for value that will be given with sensor"

x_CH2[12]=0 "Assumption"

"!State 14 water entering secondary pump 1"

T_CH2[14]= 44.6 [F]

P_CH2[14]=60 [psi]

h_CH2[14]=enthalpy(f\$,T=T_CH2[14], P=P_CH2[14])

"!State 15 water leaving secondary pump 1"

T_CH2[15]= 44.8 [F]

P_CH2[15]=65 [psi]

h_CH2[15]=enthalpy(f\$,T=T_CH2[15], P=P_CH2[15])

"!State 16 water entering secondary pump 2"

T_CH2[16]=44.6 [F]

P_CH2[16]=65 [psi]

x_CH2[16]=0 "Assumption"

h_CH2[16]=enthalpy(f\$,T=T_CH2[16], P=P_CH2[16])

"!State 17 water leaving secondary pump 2"

T_CH2[17]=44.8 [F]

P_CH2[17]=65 [psi]

x_CH2[17]=0 "Assumption"

h_CH2[17]=enthalpy(f\$,T=T_CH2[17], P=P_CH2[17])

"!State 18 dry air entering CT-2"

$\phi_{CH2[18]} = 0.5$ "Humidity of the air entering CT-2"

$T_{CH2[18]} = 70$ [F]

$\nu_{av_CH2[18]} = \text{volume}(m\$, P=P_{atm}, T=T_{CH2[18]}, R=\phi_{CH2[18]})$

$\omega_{CH2[18]} = \text{humrat}(m\$, P=P_{atm}, T=T_{CH2[18]}, R=\phi_{CH2[18]})$

$h_{CH2[18]} = 100$ [Btu/lb_m] "(Placeholder until sensor reading) Enthalpy of the moist air entering CT-2"

"!State 19 Moist air leaving CT-2"

$\phi_{CH2[19]} = 0.7$ "Humidity of the air leaving CT-2"

$T_{CH2[19]} = 90$ [F]

$\omega_{CH2[19]} = \text{humrat}(m\$, P=P_{atm}, T=T_{CH2[19]}, R=\phi_{CH2[19]})$

$h_{CH2[19]} = 200$ [Btu/lb_m] "(Placeholder until sensor reading) Enthalpy of the moist air leaving CT-2"

"!State 13 Makeup water at the bottom of the cooling tower"

$T_{CH2[13]} = 80$ [F] "Placeholder"

$x_{CH2[13]} = 0$ "Assumption"

"!CT-2 Performance of Blue loop"

"Mass Flow Rate of Blue Loop"

$\dot{m}_{CH2_EVAP} = V_{dot_CH2_EVAP} \cdot \rho_{CH2}$ "Mass flow rate of the water leaving the primary pump (Assumption until the data has been collected)"

"Work of the Primary Pumps of the Blue Loop"

$W_{dot_ppCH2} = \dot{m}_{CH2_EVAP} \cdot (h_{CH2[1]} - h_{CH2[2]})$ "Calculated work of the pump (Assumption until data has been collected from manual)"

$W_{dot_sp1CH2} = \dot{m}_{CH2_EVAP} \cdot (h_{CH2[14]} - h_{CH2[15]})$

$W_{dot_sp2CH2} = \dot{m}_{CH2_EVAP} \cdot (h_{CH2[16]} - h_{CH2[17]})$

"Heat Transfer Rate of the Evaporator of Chiller 2"

$Q_{dot_CH2_EVAP} = \dot{m}_{CH2_EVAP} \cdot (h_{CH2[3]} - h_{CH2[4]})$

"Heat Transfer Rate of the Condenser of Chiller 2"

$Q_{dot_CH2_CON} = \dot{m}_{CH2_CON} \cdot (h_{CH2[9]} - h_{CH2[10]})$

"COP_c Performance"

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$COP_c_{CH2} = (Q_{dot_CH2_EVAP}) / (Q_{dot_CH2_CON} + W_{dot_ppCH2} + W_{dot_sp1CH2} + W_{dot_sp2CH2})$

"!Cooling Tower Performance of Blue Loop"

$Q_{dot_load_CT2} = \dot{m}_{CH2_CON} \cdot (h_{CH2[11]} - h_{CH2[12]})$

$Q_{dot_CH2} = \dot{m}_{CH2[18]} \cdot (h_{CH2[19]} - h_{CH2[18]})$ "Heat transfer rate of the air through CT-2"

$h_{CH2_prime_19} = \text{enthalpy}(m\$, P=P_{atm}, T=T_{CH2[19]}, W=\omega_{CH2[18]})$

"Dimensionless parameters of the Cooling Tower"

"Sensible Heat Ratio"

$-SHR_{CH2} = (h_{CH2_prime_19} - h_{CH2[18]}) / (h_{CH2[19]} - h_{CH2[18]})$

"Cooling Tower Effectiveness (heat)"

$\epsilon_{CT2_1} = (h_{CH2[19]} - h_{CH2[18]}) / (\text{enthalpy}(m\$, P=P_{atm}, T=T_{CH2[11]}, R=1) - h_{CH2[18]})$

"Cooling Tower Effectiveness (mass)"

$\epsilon_{CT2_2} = (\omega_{CH2[19]} - \omega_{CH2[18]}) / (\text{humrat}(m\$, P=P_{atm}, T=T_{CH2[11]}, R=1) - \omega_{CH2[18]})$

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"Analyzing Condenser #3"
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"Chilled water loop"

V_dot_CH3_EVAP= 1668.8 [GPM]*convert(GPM, ft^3/s) "Placeholder"

V_dot_CH3_SM= 138.9 [ft^3/s] "Placeholder"

"!State 1 water entering the primary pump"

P_CH3[1]= 55 [psi] "Placeholder"

T_CH3[1]= 53 [F] "Placeholder"

h_CH3[1]=enthalpy(f\$,P=P_CH3[1],T=T_CH3[1])

x_CH3[1]=0 "Assumption"

"!State 2 water leaving the primary pump"

P_CH3[2]= 60 [psi] "Placeholder"

T_CH3[2]= 55 [F] "Placeholder"

x_CH3[2]= 0 "Assumption"

h_CH3[2]= enthalpy(f\$,P=P_CH3[2],T=T_CH3[2])

rho_CH32=Density(f\$,T=T_CH3[2],P=P_CH3[2])

"!State 3 water entering the chiller"

T_CH3[3]= 53.0 [F] "Placeholder"

P_CH3[3]=75 [psi] "Placeholder"

h_CH3[3]=enthalpy(f\$,T=T_CH3[3], P=P_CH3[3])

x_CH3[3]= 0 "Assumption"

"!State 4 water leaving the chiller"

T_CH3[4]= 44.6 [F] "Placeholder"

P_CH3[4]= 80 [psi] "Placeholder"

h_CH3[4]=enthalpy(f\$,T=T_CH3[4], P=P_CH3[4])

x_CH3[4]= 0 "Assumption"

"!State 5 steam entering the chiller"

T_CH3[5]= 120 [F] "Placeholder"

P_CH3[5]= 90 [psi] "Placeholder"

h_CH3[5]=enthalpy(f\$,T=T_CH3[5], P=P_CH3[5])

x_CH3[5]= 1 "Assumption"

"!State 6 steam leaving the chiller"

T_CH3[6]= 160 [F] "Placeholder"

P_CH3[6]= 100 [psi] "Placeholder"

h_CH3[6]=enthalpy(f\$,T=T_CH3[6], P=P_CH3[6])

x_CH3[6]= 1 "Assumption"

"Condenser water loop"

$V_{\text{dot_CH3_CON}}=1668.3 \text{ [GPM]} * \text{convert}(\text{GPM}, \text{ft}^3/\text{s})$ "Placeholder"
 $m_{\text{dot_CH3_CON}}=V_{\text{dot_CH3_CON}} * \rho_{\text{CH37}}$

"!State 7 water entering the primary pump"

$\rho_{\text{CH37}}=\text{Density}(f\$, T=T_{\text{CH3[7]}}, P=P_{\text{CH3[7]}})$
 $T_{\text{CH3[7]}}=53 \text{ [F]}$ "Placeholder"
 $P_{\text{CH3[7]}}=60 \text{ [psi]}$ "Placeholder"
 $h_{\text{CH3[7]}}=\text{enthalpy}(f\$, T=T_{\text{CH3[7]}}, P=P_{\text{CH3[7]}})$
 $x_{\text{CH3[7]}}=0$ "Assumption"

"!State 8 water leaving the primary pump"

$T_{\text{CH3[8]}}=55 \text{ [F]}$ "Placeholder"
 $P_{\text{CH3[8]}}=68 \text{ [psi]}$ "Placeholder"
 $h_{\text{CH3[8]}}=\text{enthalpy}(f\$, T=T_{\text{CH3[8]}}, P=P_{\text{CH3[8]}})$
 $x_{\text{CH3[8]}}=0$ "Assumption"

"!State 9 water entering the chiller"

$T_{\text{CH3[9]}}=53.0 \text{ [F]}$ "Placeholder"
 $P_{\text{CH3[9]}}=80 \text{ [psi]}$ "Placeholder"
 $h_{\text{CH3[9]}}=\text{enthalpy}(f\$, T=T_{\text{CH3[9]}}, P=P_{\text{CH3[9]}})$
 $x_{\text{CH3[9]}}=0$ "Assumption"

"!State 10 water leaving the chiller"

$T_{\text{CH3[10]}}=102.3 \text{ [F]}$ "Placeholder"
 $P_{\text{CH3[10]}}=82 \text{ [psi]}$ "Placeholder"
 $h_{\text{CH3[10]}}=\text{enthalpy}(f\$, T=T_{\text{CH3[10]}}, P=P_{\text{CH3[10]}})$
 $x_{\text{CH3[10]}}=0$ "Assumption"

"Cooling Tower States"

$V_{\text{dot_CH3[18]}}=10000 \text{ [cfm]} * \text{convert}(\text{cfm}, \text{ft}^3/\text{s})$ "Volumetric flow rate of the dry air entering CT-2"
 $m_{\text{dot_CH3[18]}}=V_{\text{dot_CH3[18]}} / \nu_{\text{av_CH3[18]}}$ "Mass flow rate of the dry air entering CT-2"

"!State 11 water entering the cooling tower"

$T_{\text{CH3[11]}}=97.8 \text{ [F]}$ "Placeholder"
 $h_{\text{CH3[11]}}=400 \text{ [Btu/lb_m]}$ "Placeholder for value that will be given with sensor"
 $x_{\text{CH3[11]}}=0$ "Assumption"

"!State 12 water leaving the cooling tower"

$T_{\text{CH3[12]}}=85.9 \text{ [F]}$ "Placeholder"
 $h_{\text{CH3[12]}}=200 \text{ [Btu/lb_m]}$ "Placeholder for value that will be given with sensor"
 $x_{\text{CH3[12]}}=0$ "Assumption"

"!State 14 water entering secondary pump 1"

$T_{\text{CH3[14]}}=44.6 \text{ [F]}$
 $P_{\text{CH3[14]}}=60 \text{ [psi]}$
 $h_{\text{CH3[14]}}=\text{enthalpy}(f\$, T=T_{\text{CH3[14]}}, P=P_{\text{CH3[14]}})$

"!State 15 water leaving secondary pump 1"

$T_{\text{CH3[15]}}=44.8 \text{ [F]}$
 $P_{\text{CH3[15]}}=65 \text{ [psi]}$
 $h_{\text{CH3[15]}}=\text{enthalpy}(f\$, T=T_{\text{CH3[15]}}, P=P_{\text{CH3[15]}})$

"!State 16 water entering secondary pump 2"

$T_{\text{CH3[16]}}=44.6 \text{ [F]}$
 $P_{\text{CH3[16]}}=65 \text{ [psi]}$

x_CH3[16]=0 "Assumption"
h_CH3[16]=enthalpy(f\$, T=T_CH3[16], P=P_CH3[16])

"!State 17 water leaving secondary pump 2"

T_CH3[17]=44.8 [F]
P_CH3[17]=65 [psi]
x_CH3[17]=0 "Assumption"
h_CH3[17]=enthalpy(f\$, T=T_CH3[17], P=P_CH3[17])

"!State 18 dry air entering CT-2"

phi_CH3[18]= 0.5 "Humidity of the air entering CT-2"
T_CH3[18]= 70 [F]
nu_av_CH3[18]=volume(m\$, P=P_atm, T=T_CH3[18], R=phi_CH3[18])
omega_CH3[18]=humrat(m\$, P=P_atm, T=T_CH3[18], R=phi_CH3[18])
h_CH3[18]= 100 [Btu/lb_m] " (Placeholder until sensor reading) Enthalpy of the moist air entering CT-2"

"!State 19 Moist air leaving CT-2"

phi_CH3[19]= 0.7 "Humidity of the air leaving CT-2"
T_CH3[19]=90 [F]
omega_CH3[19]=humrat(m\$, P=P_atm, T=T_CH3[19], R=phi_CH3[19])
h_CH3[19]= 200 [Btu/lb_m] "(Placeholder until sensor reading) Enthalpy of the moist air leaving CT-2"

"!State 13 Makeup water at the bottom of the cooling tower"

T_CH3[13]= 80 [F] "Placeholder"
x_CH3[13]=0 "Assumption"

"!CT-2 Perfomance of Blue loop"

"Mass Flow Rate of Blue Loop"

m_dot_CH3_EVAP=V_dot_CH3_EVAP*rho_CH32 "Mass flow rate of the water leaving the primary pump
(Assumption until the data has been collected)"

"Work of the Primary Pumps of the Blue Loop"

W_dot_ppCH3=m_dot_CH3_EVAP*(h_CH3[1]-h_CH3[2]) "Calculated work of the pump (Assumption until
data has been collected from manual)"

W_dot_sp1CH3=m_dot_CH3_EVAP*(h_CH3[14]-h_CH3[15])

W_dot_sp2CH3=m_dot_CH3_EVAP*(h_CH3[16]-h_CH3[17])

"Heat Transfer Rate of the Evaporator of Chiller 2"

Q_dot_CH3_EVAP=m_dot_CH3_EVAP*(h_CH3[3]-h_CH3[4])

"Heat Transfer Rate of the Condenser of Chiller 2"

Q_dot_CH3_CON=m_dot_CH3_CON*(h_CH3[9]-h_CH3[10])

"COP_c Perfomance"

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COP_c_CH3=(Q_dot_CH3_EVAP)/(Q_dot_CH3_CON+W_dot_ppCH3+W_dot_sp1CH3+W_dot_sp2CH3
)

"!Cooling Tower Performance of Blue Loop"

Q_dot_load_CT3=m_dot_CH3_CON*(h_CH3[11]-h_CH3[12])

Q_dot_CH3=m_dot_CH3[18]*(h_CH3[19]-h_CH3[18]) "Heat transfer rate of the air through CT-2"

h_CH3_prime_19=enthalpy(m\$, P=P_atm, T=T_CH3[19], W=omega_CH3[18])

"Dimensionless parameters of the Cooling Tower"

"Sensible Heat Ratio"

-SHR_CH3=(h_CH3_prime_19-h_CH3[18])/(h_CH3[19]-h_CH3[18])

"Cooling Tower Effectiveness (heat)"

epsilon_CT3_1=(h_CH3[19]-h_CH3[18])/(enthalpy(m\$,P=P_atm,T=T_CH3[11],R=1)-h_CH3[18])

"Cooling Tower Effectiveness (mass)"

epsilon_CT3_2=(omega_CH3[19]-omega_CH3[18])/(humrat(m\$,P=P_atm,T=T_CH3[11], R=1)-omega_CH3[18])

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"Analyzing Condenser #4-1200 ton York"

W_york=18.3 [KW]*convert(KW,Btu/s) "Placeholder"

"Chilled water loop"

V_dot_CH4_EVAP= 1668.8 [GPM]*convert(GPM, ft^3/s) "Placeholder"

V_dot_CH4_SM= 138.9 [ft^3/s] "Placeholder"

"!State 1 water entering the primary pump"

P_CH4[1]= 55 [psi] "Placeholder"

T_CH4[1]= 53 [F] "Placeholder"

h_CH4[1]=enthalpy(f\$,P=P_CH4[1],T=T_CH4[1])

x_CH4[1]=0 "Assumption"

"!State 2 water leaving the primary pump"

P_CH4[2]= 60 [psi] "Placeholder"

T_CH4[2]= 55 [F] "Placeholder"

x_CH4[2]= 0 "Assumption"

h_CH4[2]= enthalpy(f\$,P=P_CH4[2],T=T_CH4[2])

rho_CH42=Density(f\$,T=T_CH4[2],P=P_CH4[2])

"!State 3 water entering the chiller"

T_CH4[3]= 53.0 [F] "Placeholder"

P_CH4[3]=75 [psi] "Placeholder"

h_CH4[3]=enthalpy(f\$,T=T_CH4[3], P=P_CH4[3])

x_CH4[3]= 0 "Assumption"

"!State 4 water leaving the chiller"

T_CH4[4]= 44.6 [F] "Placeholder"

P_CH4[4]= 80 [psi] "Placeholder"

h_CH4[4]=enthalpy(f\$,T=T_CH4[4], P=P_CH4[4])

x_CH4[4]= 0 "Assumption"

"!State 5 steam entering the chiller"

T_CH4[5]= 120 [F] "Placeholder"

P_CH4[5]= 90 [psi] "Placeholder"

h_CH4[5]=enthalpy(f\$,T=T_CH4[5], P=P_CH4[5])

x_CH4[5]= 1 "Assumption"

"!State 6 steam leaving the chiller"

T_CH4[6]= 160 [F] "Placeholder"

P_CH4[6]= 100 [psi] "Placeholder"

h_CH4[6]=enthalpy(f\$,T=T_CH4[6], P=P_CH4[6])

x_CH4[6]= 1 "Assumption"

"Condenser water loop"

$V_{\text{dot_CH4_CON}}=1668.3 \text{ [GPM]}*\text{convert}(\text{GPM},\text{ft}^3/\text{s})$ "Placeholder"
 $m_{\text{dot_CH4_CON}}=V_{\text{dot_CH4_CON}}*\rho_{\text{CH47}}$

"!State 7 water entering the primary pump"

$\rho_{\text{CH47}}=\text{Density}(f\$,T=T_{\text{CH4[7]}},P=P_{\text{CH4[7]}})$
 $T_{\text{CH4[7]}}=53 \text{ [F]}$ "Placeholder"
 $P_{\text{CH4[7]}}=60 \text{ [psi]}$ "Placeholder"
 $h_{\text{CH4[7]}}=\text{enthalpy}(f\$,T=T_{\text{CH4[7]}},P=P_{\text{CH4[7]}})$
 $x_{\text{CH4[7]}}=0$ "Assumption"

"!State 8 water leaving the primary pump"

$T_{\text{CH4[8]}}=55 \text{ [F]}$ "Placeholder"
 $P_{\text{CH4[8]}}=68 \text{ [psi]}$ "Placeholder"
 $h_{\text{CH4[8]}}=\text{enthalpy}(f\$,T=T_{\text{CH4[8]}},P=P_{\text{CH4[8]}})$
 $x_{\text{CH4[8]}}=0$ "Assumption"

"!State 9 water entering the chiller"

$T_{\text{CH4[9]}}=53.0 \text{ [F]}$ "Placeholder"
 $P_{\text{CH4[9]}}=80 \text{ [psi]}$ "Placeholder"
 $h_{\text{CH4[9]}}=\text{enthalpy}(f\$,T=T_{\text{CH4[9]}},P=P_{\text{CH4[9]}})$
 $x_{\text{CH4[9]}}=0$ "Assumption"

"!State 10 water leaving the chiller"

$T_{\text{CH4[10]}}=102.3 \text{ [F]}$ "Placeholder"
 $P_{\text{CH4[10]}}=82 \text{ [psi]}$ "Placeholder"
 $h_{\text{CH4[10]}}=\text{enthalpy}(f\$,T=T_{\text{CH4[10]}},P=P_{\text{CH4[10]}})$
 $x_{\text{CH4[10]}}=0$ "Assumption"

"Cooling Tower States"

$V_{\text{dot_CH4[18]}}=10000 \text{ [cfm]}*\text{convert}(\text{cfm},\text{ft}^3/\text{s})$ "Volumetric flow rate of the dry air entering CT-2"
 $m_{\text{dot_CH4[18]}}=V_{\text{dot_CH4[18]}}/\nu_{\text{av_CH4[18]}}$ "Mass flow rate of the dry air entering CT-2"

"!State 11 water entering the cooling tower"

$T_{\text{CH4[11]}}=97.8 \text{ [F]}$ "Placeholder"
 $h_{\text{CH4[11]}}=400 \text{ [Btu/lb_m]}$ "Placeholder for value that will be given with sensor"
 $x_{\text{CH4[11]}}=0$ "Assumption"

"!State 12 water leaving the cooling tower"

$T_{\text{CH4[12]}}=85.9 \text{ [F]}$ "Placeholder"
 $h_{\text{CH4[12]}}=200 \text{ [Btu/lb_m]}$ "Placeholder for value that will be given with sensor"
 $x_{\text{CH4[12]}}=0$ "Assumption"

"!State 14 water entering secondary pump 1"

$T_{\text{CH4[14]}}=44.6 \text{ [F]}$
 $P_{\text{CH4[14]}}=60 \text{ [psi]}$
 $h_{\text{CH4[14]}}=\text{enthalpy}(f\$,T=T_{\text{CH3[14]}},P=P_{\text{CH3[14]}})$

"!State 15 water leaving secondary pump 1"

$T_{\text{CH4[15]}}=44.8 \text{ [F]}$
 $P_{\text{CH4[15]}}=65 \text{ [psi]}$
 $h_{\text{CH4[15]}}=\text{enthalpy}(f\$,T=T_{\text{CH4[15]}},P=P_{\text{CH4[15]}})$

"!State 16 water entering secondary pump 2"

$T_{\text{CH4[16]}}=44.6 \text{ [F]}$

P_CH4[16]=65 [psi]
x_CH4[16]=0 "Assumption"
h_CH4[16]=enthalpy(f\$, T=T_CH4[16], P=P_CH4[16])

"!State 17 water leaving secondary pump 2"

T_CH4[17]=44.8 [F]
P_CH4[17]=65 [psi]
x_CH4[17]=0 "Assumption"
h_CH4[17]=enthalpy(f\$, T=T_CH4[17], P=P_CH4[17])

"!State 18 dry air entering CT-2"

phi_CH4[18]= 0.5 "Humidity of the air entering CT-2"
T_CH4[18]= 70 [F]
nu_av_CH4[18]=volume(m\$, P=P_atm, T=T_CH4[18], R=phi_CH4[18])
omega_CH4[18]=humrat(m\$, P=P_atm, T=T_CH4[18], R=phi_CH4[18])
h_CH4[18]= 100 [Btu/lb_m] " (Placeholder until sensor reading) Enthalpy of the moist air entering CT-2"

"!State 19 Moist air leaving CT-2"

phi_CH4[19]= 0.7 "Humidity of the air leaving CT-2"
T_CH4[19]=90 [F]
omega_CH4[19]=humrat(m\$, P=P_atm, T=T_CH4[19], R=phi_CH4[19])
h_CH4[19]= 200 [Btu/lb_m] "(Placeholder until sensor reading) Enthalpy of the moist air leaving CT-2"

"!State 13 Makeup water at the bottom of the cooling tower"

T_CH4[13]= 80 [F] "Placeholder"
x_CH4[13]=0 "Assumption"

"!CT-2 Perfomance of Blue loop"

"Mass Flow Rate of Blue Loop"

m_dot_CH4_EVAP=V_dot_CH4_EVAP*rho_CH42 "Mass flow rate of the water leaving the primary pump
(Assumption until the data has been collected)"

"Work of the Primary Pumps of the Blue Loop"

W_dot_ppCH4=m_dot_CH4_EVAP*(h_CH4[1]-h_CH4[2]) "Calculated work of the pump (Assumption until
data has been collected from manual)"
W_dot_sp1CH4=m_dot_CH4_EVAP*(h_CH4[14]-h_CH4[15])
W_dot_sp2CH4=m_dot_CH4_EVAP*(h_CH4[16]-h_CH4[17])

"Heat Transfer Rate of the Evaporator of Chiller 2"

Q_dot_CH4_EVAP=m_dot_CH4_EVAP*(h_CH4[3]-h_CH4[4])

"Heat Transfer Rate of the Condenser of Chiller 2"

Q_dot_CH4_CON=m_dot_CH4_CON*(h_CH4[9]-h_CH4[10])

"COP_c Perfomance"

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COP_c_CH4=(Q_dot_CH4_EVAP)/(Q_dot_CH4_CON+W_dot_ppCH4+W_dot_sp1CH4+W_dot_sp2CH4
+W_York)

"!Cooling Tower Performance of Blue Loop"

Q_dot_load_CT4=m_dot_CH4_CON*(h_CH4[11]-h_CH4[12])

Q_dot_CH4=m_dot_CH4[18]*(h_CH4[19]-h_CH4[18]) "Heat transfer rate of the air through CT-2"

h_CH4_prime_19=enthalpy(m\$, P=P_atm, T=T_CH4[19], W=omega_CH4[18])

"Dimensionless parameters of the Cooling Tower"

"Sensible Heat Ratio"

-SHR_CH4=(h_CH4_prime_19-h_CH4[18])/(h_CH4[19]-h_CH4[18])

"Cooling Tower Effectiveness (heat)"

epsilon_CT4_1=(h_CH4[19]-h_CH4[18])/(enthalpy(m\$,P=P_atm,T=T_CH4[11],R=1)-h_CH4[18])

"Cooling Tower Effectiveness (mass)"

epsilon_CT4_2=(omega_CH4[19]-omega_CH4[18])/(humrat(m\$,P=P_atm,T=T_CH4[11], R=1)-omega_CH4[18])

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