Metodo Bell- Dellaware

DATOS PARA ANALISIS DE COEFICIENTE GLOBAL

DIMENSIONES DEL INTERCAMBIADOR ANALIZADO

Tubos

$Nt = 9$ Número de tubos del intercambiador

$di = 0.01655$ Diámetro interno de tubo

$do = 0.01905$ Diámetro externo de tubo

$Lt = 3.54$ Longitud de tubo

$L_{bc} = 0.21$ Distancia de bafle central

$L_{bb} = 0.01$ distancia entre dotl y los tubos

$D_{OTL} = 0.13$ [m] Diametro exterior de haz de tubos

$$Ltp = \frac{15}{16} \cdot 0.0254$$

$$Dctl = D_{OTL} - do$$

$$S_m = L_{bc} \cdot \left[L_{bb} + \frac{Dctl}{Ltp} \cdot (Ltp - do) \right]$$ Area de flujo cruzado

FLUIDO EN LOS TUBOS -AGUA DE ENFRIAMIENTO-

R$ = 'Water' string variable used to hold name of refrigerant

$t_1 = 21.9$

$t_2 = 23.7$

$Pp = 101.325$

$$Tp = \frac{t_1 + t_2}{2}$$ Temperatura de película fluido tubos

Propiedades del fluido frio

$k_1 = \mathbf{k}[R\$, T=Tp, P=Pp]$

$\rho_1 = \rho[R\$, T=Tp, P=Pp]$

$\mu_1 = \mathbf{Visc}[R\$, T=Tp, P=Pp]$

$Pr_1 = \mathbf{Pr}[R\$, T=Tp, P=Pp]$

$cp_1 = \mathbf{Cp}[R\$, T=Tp, P=Pp]$

$h_1 = \mathbf{h}[R\$, T=Tp, P=Pp]$

$s_1 = \mathbf{s}[R\$, h=h_1, P=Pp]$

$\rho_2 = \rho[R\$, T=t_2, P=Pp]$

Lectura de rotámetro lado tubo

$V_{rotámetro} = 12$ [GPM]

$\dot{V} = V_{rotámetro} \cdot \frac{3.785}{60 \cdot 1000}$

$\dot{m} = \dot{V} \cdot \rho_2$ Flujo total

$\dot{m}_t = \frac{\dot{m}}{Nt}$ Flujo por cada tubo

$Ai = \pi \cdot \left[\frac{di}{2}\right]^2$ Area transversal tubo

$G_t = \frac{\dot{m}_t}{Ai}$ Masa velocidad de tubo

$Re_t = \frac{di \cdot G_t}{\mu_1}$ Reynolds de tubo

Temperaturas de agua solar caliente

$T1 = 33.4$

$T2 = 26.9$

$T_p = \frac{T1 + T2}{2}$

Propiedades del fluido caliente

$h_2 = \mathbf{h}[R\$, T=T_p, P=Pp]$

$s_2 = \mathbf{s}[R\$, h=h_1, P=Pp]$

$k_2 = \mathbf{k}[R\$, T=T_p, P=Pp]$

$\rho_3 = \rho[R\$, T=T_p, P=Pp]$

$\mu_2 = \mathbf{Visc}[R\$, T=T_p, P=Pp]$

$Pr_2 = \mathbf{Pr}[R\$, T=T_p, P=Pp]$

$cp_2 = \mathbf{Cp}[R\$, T=T_p, P=Pp]$

Lectura del rotámetro lado coraza

$V_{rot} = 4$ [GPM]

$\dot{V}_2 = V_{rot} \cdot \frac{3.785}{60 \cdot 1000}$

$\rho_4 = \rho[R\$, T=34, P=Pp]$

$\dot{m}_2 = \dot{V}_2 \cdot \rho_4$ Flujo total

$G_c = \frac{\dot{m}_2}{S_m}$ Masa velocidad de la coraza

$Re_c = \frac{do \cdot G_c}{\mu_2}$ Reynolds de coraza

Calculo de factor de friccion con la ecuación de Konakov

$f = [1.8 \cdot \log(Re_t) - 1.5]^{-2}$

Calculo de Nusselt a traves de f y Re_t

$N.u_t=(((f/8)*(Re_t-1000)*Pr_1)/(1+12.7*((f/8)^{(1/2)})*((Pr_1^{(2/3)})-1)))*(1+(di/Lt))^{(2/3)}$

$N.u_t = 0.023 \cdot Re_t^{0.8} \cdot Pr_1^{0.4}$

Calculo de coeficiente de convecciòn interior -tubos-

$hi = N.u_t \cdot \frac{k_1}{di}$

$hio = hi \cdot \frac{di}{do}$ corrección por area

Calculo de coeficiente global de tubos ideal ho_i

$Ji = 0.02713 + 0.00001492 \cdot [Re_c - 800]$ Factor de correcciòn Ji

$Ji=0.0233-5.201e-6*(Re_c-1000)$

$hci = ho_c$

$ho_c = cp_2 \cdot G_c \cdot Ji \cdot Pr_2^{\left[\frac{-2}{3}\right]} \cdot 1000 \cdot 0.6$

$\frac{1}{U_{teórico}} = \frac{1}{hio} + \frac{1}{ho_c}$

$\dot{Q} = \dot{m} \cdot cp_1 \cdot [t_2 - t_1] \cdot 1000$

$A_{TC} = \pi \cdot do \cdot Lt \cdot Nt$

$DT_1 = T2 - t_1$

$DT_2 = T1 - t_2$

$DT_{ml} = \frac{DT_1 - DT_2}{\ln\left[\frac{DT_1}{DT_2}\right]}$

$\dot{Q} = U_{experimental} \cdot A_{TC} \cdot DT_{ml}$

Unit Settings: [kJ]/[C]/[kPa]/[kg]/[degrees]

Ai = 0.0002151
A_{TC} = 1.907
Dctl = 0.111
di = 0.01655
do = 0.01905
DT_1 = 5
DT_2 = 9.7
DT_{ml} = 7.092
D_{OTL} = 0.13 [m]
f = 0.03419
G_c = 37.12
G_t = 389.971
hci = 849.5
hi = 2058.956
hio = 1789
ho_c = 849.5
Ji = 0.02846
Lt = 3.54
Ltp = 0.02381
L_{bb} = 0.01
L_{bc} = 0.21
$\dot{m}$ = 0.755024 [kg/s]
$\dot{m}_2$ = 0.250913
$\dot{m}_t$ = 0.08389
$N.u_t$ = 57.66
Nt = 9
Pp = 101.3
$\dot{Q}$ = 5685
R$ = 'Water'
Re_c = 889.2
Re_t = 6887.962
S_m = 0.0067599
T1 = 33.4
T2 = 26.9
Tp = 22.8
t_1 = 21.9
t_2 = 23.7
T_p = 30.15
$U_{experimental}$ = 420.4
$U_{teórico}$ = 576
$\dot{V}$ = 7.570E-04
$\dot{V}_2$ = 0.0002523
V_{rot} = 4 [GPM]
$V_{rotámetro}$ = 12 [GPM]

Arrays Table

	cp_i [kJ/kg-K]	h_i [kJ/kg]	k_i [W/m-K]	μ_i [kg/m-s]	Pr_i	ρ_i [kg/m^3]	s_i [kJ/kg-K]
1	4.183	95.64	0.591	0.000937	6.632	997.6	0.3359
2	4.183	126.4	0.6032	0.0007952	5.514	997.4	0.3359
3						995.6	
4						994.4	