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

$t_1 = 15.5$

$t_2 = 19.7$

$Pp = 101.325$

$$Tp = \frac{t_1 + t_2}{2}$$ 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

$V_{rotámetro} = 4$ [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

$T1 = 29$

$T2 = 20$

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

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

$Ji = 0.02713 + 0.00001492 \cdot [Re_c - 600]$ 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]

$Ai = 0.0002151$ $A_{TC} = 1.907$ $Dctl = 0.111$
$di = 0.01655$ $do = 0.01905$ $DT_1 = 4.5$
$DT_2 = 9.3$ $DT_{ml} = 6.612$ $D_{OTL} = 0.13$ [m]
$f = 0.05047$ $G_c = 37.12$ $G_t = 130.108$
$hci = 812.5$ $hi = 805.553$ $hio = 699.8$
$ho_c = 812.5$ $Ji = 0.02989$ $Lt = 3.54$
$Ltp = 0.02381$ $L_{bb} = 0.01$ $L_{bc} = 0.21$
$\dot{m} = 0.251903$ [kg/s] $\dot{m}_2 = 0.250913$ $\dot{m}_t = 0.02799$
$N.u_t = 22.92$ $Nt = 9$ $Pp = 101.3$
$\dot{Q} = 4426$ $R\$ = 'Water'$ $Re_c = 785$
$Re_t = 2023.959$ $S_m = 0.0067599$ $T1 = 29$
$T2 = 20$ $Tp = 17.6$ $t_1 = 15.5$
$t_2 = 19.7$ $T_p = 24.5$ $U_{experimental} = 351$
$U_{teórico} = 376$ $\dot{V} = 2.523E-04$ $\dot{V}_2 = 0.0002523$
$V_{rot} = 4$ [GPM] $V_{rotámetro} = 4$ [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	73.89	0.5817	0.001064	7.65	998.7	0.2618
2	4.183	102.8	0.5939	0.0009007	6.344	998.3	0.2618
3						997.2	
4						994.4	