

Metodo Bell- Delaware

DATOS PARA ANALISIS DE COEFICIENTE GLOBAL

DIMENSIONES DEL INTERCAMBIADOR ANALIZADO

Tubos

$N_t = 9$ Número de tubos del intercambiador

$d_i = 0.01655$ Diámetro interno de tubo

$d_o = 0.01905$ Diámetro externo de tubo

$L_t = 3.54$ Longitud de tubo

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

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

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

$$L_{tp} = \frac{15}{16} \cdot 0.0254$$

$$D_{ctl} = D_{OTL} - d_o$$

$$S_m = L_{bc} \cdot \left[L_{bb} + \frac{D_{ctl}}{L_{tp}} \cdot (L_{tp} - d_o) \right] \text{ Area de flujo cruzado}$$

FLUIDO EN LOS TUBOS -AGUA DE ENFRIAMIENTO-

$R\$ = \text{'Water'}$ string variable used to hold name of refrigerant

$t_1 = 21.4$

$t_2 = 23.9$

$P_p = 101.325$

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

Propiedades del fluido frio

$$k_1 = k [R\$, T = T_p, P = P_p]$$

$$\rho_1 = \rho [R\$, T = T_p, P = P_p]$$

$$\mu_1 = \text{Visc} [R\$, T = T_p, P = P_p]$$

$$Pr_1 = Pr [R\$, T = T_p, P = P_p]$$

$$cp_1 = Cp [R\$, T = T_p, P = P_p]$$

$$h_1 = h [R\$, T = T_p, P = P_p]$$

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

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

Lectura de rotámetro lado tubo

$$V_{\text{rotámetro}} = 8 \text{ [GPM]}$$

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

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

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

$$A_i = \pi \cdot \left[\frac{d_i}{2} \right]^2 \text{ Area transversal tubo}$$

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

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

Temperaturas de agua solar caliente

$$T_1 = 33.3$$

$$T_2 = 27$$

$$T_p = \frac{T_1 + T_2}{2}$$

Propiedades del fluido caliente

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

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

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

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

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

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

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

Lectura del rotámetro lado coraza

$$V_{\text{rot}} = 4 \text{ [GPM]}$$

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

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

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

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

$$Re_c = \frac{d_o \cdot G_c}{\mu_2} \quad \text{Reynolds de coraza}$$

Calculo de factor de fricción con la ecuación de Konakov

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

Calculo de Nusselt a través de f y Re_t

$$N.u_t = \left(\frac{f}{8} \right) (Re_t - 1000) Pr_1 / \left(1 + 12.7 \left(\frac{f}{8} \right)^{1/2} \left(Pr_1^{2/3} - 1 \right) \right) \left(1 + \frac{d_i}{L_t} \right)^{2/3}$$

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

Calculo de coeficiente de convección interior -tubos-

$$h_i = N.u_t \cdot \frac{k_1}{d_i}$$

$$h_{io} = h_i \cdot \frac{d_i}{d_o} \quad \text{corrección por area}$$

Calculo de coeficiente global de tubos ideal h_{oi}

$$J_i = 0.02713 + 0.00001492 \cdot [Re_c - 800] \quad \text{Factor de corrección } J_i$$

$$J_i = 0.0233 - 5.201e-6 \cdot (Re_c - 1000)$$

$$h_{ci} = h_{oc}$$

$$h_{oc} = cp_2 \cdot G_c \cdot J_i \cdot Pr_2 \left[\frac{-2}{3} \right] \cdot 1000 \cdot 0.6$$

$$\frac{1}{U_{teórico}} = \frac{1}{h_{io}} + \frac{1}{h_{oc}}$$

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

$$A_{TC} = \pi \cdot d_o \cdot L_t \cdot N_t$$

$$DT_1 = T_2 - t_1$$

$$DT_2 = T_1 - t_2$$

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

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

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 = 5.6
DT ₂ = 9.4	DT _{ml} = 7.337	D _{OTL} = 0.13 [m]
f = 0.03862	G _c = 37.12	G _t = 259.968
h _{ci} = 849.5	h _i = 1486.035	h _{io} = 1291
ho _c = 849.5	Ji = 0.02846	Lt = 3.54
L _{tp} = 0.02381	L _{bb} = 0.01	L _{bc} = 0.21
\dot{m} = 0.503325 [kg/s]	\dot{m}_2 = 0.250913	\dot{m}_t = 0.05592
N.u _t = 41.63	Nt = 9	Pp = 101.3
\dot{Q} = 5264	R\$ = 'Water'	Re _c = 889.2
Re _t = 4575.574	S _m = 0.0067599	T1 = 33.3
T2 = 27	Tp = 22.65	t ₁ = 21.4
t ₂ = 23.9	T _p = 30.15	U _{experimental} = 376.3
U _{teórico} = 512.4	\dot{V} = 5.047E-04	\dot{V}_2 = 0.0002523
V _{rot} = 4 [GPM]	V _{rotámetro} = 8 [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	95.01	0.5907	0.0009403	6.658	997.6	0.3338
2	4.183	126.4	0.6032	0.0007952	5.514	997.3	0.3338
3						995.6	
4						994.4	