

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 bafle 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

$t_1 = 20$

$t_2 = 22.6$

$P_p = 101.325$

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

Propiedades del fluido frio

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

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

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

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

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

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

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

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

Lectura de rotámetro lado tubo

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

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

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

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

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

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

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

Temperaturas de agua solar caliente

$$T_1 = 34$$

$$T_2 = 24.2$$

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

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}

$$J_i = 0.02713 + 1.492e-5 \cdot (Re_c - 800)$$

Factor de corrección J_i

$$J_i = 0.0233 - 0.000005201 \cdot [Re_c - 1000]$$

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

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

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

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

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

$$DT_1 = T_2 - t_1$$

$$DT_2 = T_1 - t_2$$

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

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

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

Ai = 0.0002151

di = 0.01655

DT2 = 11.4

f = 0.0489

hci = 703.8

hoc = 703.8

Ltp = 0.02381

m = 0.251742 [kg/s]

N.u_t = 23.65

Q = 2738

Re_t = 2216.202

T2 = 24.2

t₂ = 22.6

U_{teórico} = 358.4

V_{rot} = 4 [GPM]

A_{TC} = 1.907

do = 0.01905

DT_{ml} = 7.211

G_c = 37.12

hi = 840.801

Ji = 0.02398

L_{bb} = 0.01

m₂ = 0.250913

Nt = 9

R\$ = 'Water'

S_m = 0.0067599

Tp = 21.3

T_p = 29.1

V = 2.523E-04

V_{rotámetro} = 4 [GPM]

Dctl = 0.111

DT₁ = 4.2

D_{OTL} = 0.13 [m]

G_t = 130.025

hio = 730.5

Lt = 3.54

L_{bc} = 0.21

m_t = 0.02797

Pp = 101.3

Re_c = 869.5

T1 = 34

t₁ = 20

U_{experimental} = 199.1

V₂ = 0.0002523

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	89.37	0.5884	0.000971	6.903	998	0.3147
2	4.183	122	0.6015	0.0008132	5.655	997.7	0.3147
3						995.9	
4						994.4	