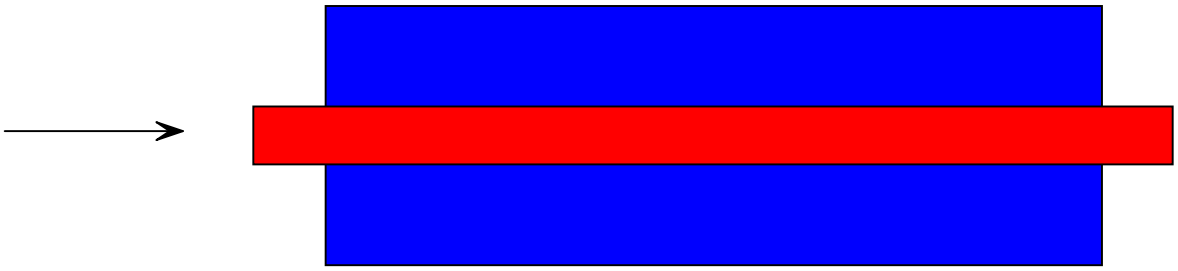

$U_{Gk}$ = ???? [W/m$^2$-K] $U_{exp}$ = ???? [W/m$^2$-K]

```
{Intercambiador de calor de tubos y coraza}
"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=(15/16)* 0.0254  {(15/16in)}

Dctl= D_OTL-do
S_m= L_bc*(L_bb+( Dctl/Ltp)*(Ltp-do)) "Area de flujo cruzado"


"FLUIDO EN LOS TUBOS -AGUA DE ENFRIAMIENTO-"
R$='Water'            "string variable used to hold name of refrigerant"
t_1=21.3
t_2=23.9
Pp=101.325
Tp=(t_1+t_2)/2   " Temperatura de película fluido tubos"

"Propiedades del fluido frio"
```

```
k[1]=Conductivity(R$,T=Tp,P=Pp)
rho[1]=Density(R$,T=Tp,P=Pp)
mu[1]=Viscosity(R$,T=Tp,P=Pp)
Pr[1]=Prandtl(R$,T=Tp,P=Pp)
cp[1]=Cp(R$,T=Tp,P=Pp)
h[1]=Enthalpy(R$,T=Tp,P=Pp)
s[1]=entropy(R$,h=h[1],P=Pp)

rho[2]=Density(R$,T=t_2,P=Pp)

"Lectura de rotámetro lado tubo"
V_rotámetro= 9 [GPM]
V_dot=V_rotámetro*(3.785)/60/1000
m_dot= V_dot* rho[2]   "Flujo total"
m_dot_t=m_dot/Nt "Flujo por cada tubo"
Ai= pi*(di/2)^2  "Area transversal tubo"
G_t= m_dot_t/Ai  "Masa velocidad de tubo"
Re_t= (di*G_t)/mu[1]   "Reynolds de tubo"

"Temperaturas de agua solar caliente"
T1= 33.7
T2= 26.7

T_p=(T1+T2)/2
"Propiedades del fluido caliente"
h[2]=Enthalpy(R$,T=T_p,P=Pp)
s[2]=entropy(R$,h=h[1],P=Pp)
k[2]=Conductivity(R$,T=T_p,P=Pp)
rho[3]=Density(R$,T=T_p,P=Pp)
mu[2]=Viscosity(R$,T=T_p,P=Pp)
Pr[2]=Prandtl(R$,T=T_p,P=Pp)
cp[2]=Cp(R$,T=T_p,P=Pp)

"Lectura del rotámetro lado coraza"
V_rot=3 [GPM]
V_dot_2=V_rot*(3.785)/60/1000
rho[4]=Density(R$,T=34,P=Pp)
m_dot_2= V_dot_2* rho[4]   "Flujo total"
G_c= m_dot_2/S_m  "Masa velocidad de la coraza"
Re_c= (do*G_c)/mu[2]  "Reynolds de coraza"


"Calculo de factor de friccion con la ecuación de Konakov"
f=(1.8*log10(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 *Re_t^(0.8)*Pr[1]^(0.4)
"Calculo de coeficiente de convecciòn interior -tubos-"
hi= N.u_t*k[1]/di
hio=hi*(di/do)  "corrección por area"


"Calculo de coeficiente global de tubos ideal ho_i"
Ji=0.02713+1.492e-5*(Re_c-600) "Factor de correcciòn Ji"
"Ji=0.0233-5.201e-6*(Re_c-1000)"
```

hci=ho_c
ho_c= cp[2]*G_c*Ji*(Pr[2]^(-2/3))*1000*0.60

(1/U_teórico)= ((1/hio)+(1/ho_c))

Q_dot= m_dot*cp[1]*(t_2-t_1)*1000
A_TC=PI*do*Lt*Nt
DT_1=T2-t_1
DT_2=T1-t_2

DT_ml=(DT_1-DT_2)/ LN(DT_1/DT_2)
Q_dot= U_experimental*A_TC*DT_ml

{Datos para tubos concentricos
"De=(D_o^2-do^2)/do"
"A_an=(pi/4)*(D_o^2-do^2)"
"hi=Cp[1]*G_t*Ji*(Pr[1]* (2/3))"

"N.u_an=0.032*((Re_an^0.8)*(Pr[2]^0.4))*(D_o/do)
ho= N.u_an*k[2]/De"

"Ds= 0.21"}

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

| | | |
|---|---|---|
| Ai = 0.0002151 | $A_{TC}$ = 1.907 | Dctl = 0.111 |
| di = 0.01655 | do = 0.01905 | $DT_1$ = 5.4 |
| $DT_2$ = 9.8 | $DT_{ml}$ = 7.383 | $D_{OTL}$ = 0.13 [m] |
| f = 0.03727 | $G_c$ = 27.84 | $G_t$ = 292.464 |
| hci = 630.4 | hi = 1631.954 | hio = 1418 |
| $ho_c$ = 630.4 | Ji = 0.02814 | Lt = 3.54 |
| Ltp = 0.02381 | $L_{bb}$ = 0.01 | $L_{bc}$ = 0.21 |
| $\dot{m}$ = 0.566240 [kg/s] | $\dot{m}_2$ = 0.188185 | $\dot{m}_t$ = 0.06292 |
| $N.u_t$ = 45.73 | Nt = 9 | Pp = 101.3 |
| $\dot{Q}$ = 6158 | R$ = 'Water' | $Re_c$ = 667.6 |
| $Re_t$ = 5141.461 | $S_m$ = 0.0067599 | T1 = 33.7 |
| T2 = 26.7 | Tp = 22.6 | $t_1$ = 21.3 |
| $t_2$ = 23.9 | $T_p$ = 30.2 | $U_{experimental}$ = 437.5 |
| $U_{teórico}$ = 436.4 | $\dot{V}$ = 5.678E-04 | $\dot{V}_2$ = 0.0001893 |
| $V_{rot}$ = 3 [GPM] | $V_{rotámetro}$ = 9 [GPM] | |

**Arrays Table**

| | $cp_i$ [kJ/kg-K] | $h_i$ [kJ/kg] | $k_i$ [W/m-K] | $\mu_i$ [kg/m-s] | $Pr_i$ | $\rho_i$ [kg/m³] | $s_i$ [kJ/kg-K] |
|---|---|---|---|---|---|---|---|
| 1 | 4.183 | 94.8 | 0.5907 | 0.0009414 | 6.667 | 997.7 | 0.3331 |
| 2 | 4.183 | 126.6 | 0.6033 | 0.0007943 | 5.508 | 997.3 | 0.3331 |
| 3 | | | | | | 995.6 | |
| 4 | | | | | | 994.4 | |