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                                conden
c                               Chapter VIa - Section 4.1
c
c                               CONDEN.FOR
c   To design condensers given, qdot,Psteam,Twater, Vwater, di/do
c   To find Uo and Tsurface. Also, N if L given.
c   implicit real*8 (a-h,o-z)
c
c   Nomenclature:
c   To:      Steam saturation temperature at inlet
c   Qdot:     Total rate of heat transfer (Btu/hr)
c   Vi:       Cooling water velocity (ft/s)
c   Tia:      Cooling water temperature at inlet (F)
c   Tib:      Cooling water temperature at outlet (F)
c   di:       tube inside diameter (in)
c   do:       tube outside diameter (in)
c
c   data gc,pi,foul/32.2,3.1415927,0.0/
c   data Qdot,hfg,To,Tia,Vi,aL/6.824E9,1024.5,122,68.,6.683,29.59/
c   data di,do,aks/0.984,1.,10.00/
c---
c   data Qdot,hfg,To,Tia,Vi,aL/3.0708E9,973.6,207,78,6,28/
c   data di,do,aks/1.18,1.25,10.00/
c---
c   data Qdot,hfg,To,Tia,Vi,aL/7.308E6,1020.,129.2,68.,4.593,12.14/
c   data di,do,aks/0.55,0.613,63.56/
c---
c   data foul/0.0005/
c   data Qdot,hfg,To,Tia,Vi,aL/1.E9,1036.4,101.14,75.,7.,50./
c   data di,do,aks/0.902,1.0,10.00/
c----
c   data foul/0.0005/
c   Ts=0.5*(Tia+To)
c   di=di/12.00
c   do=do/12.00
c   Vi=Vi*3600.00
c   aflow=pi*di*di/4.00
c   asurf=pi*do*aL
1   continue
c   i=i+1
c   Call intrpl(Tavi,cpfi,cpgi,amufi,amugi,akfi,akgi,prfi,prgi,
1       sigfi,betafi,rofi,rogi,anufi,anugi,vfi,vfgi,vgi)
c   Call intrpl(To,cpfo,cpgo,amufo,amugo,akfo,akgo,prfo,prgo,
1       sigfo,betafo,rofo,rogo,anufo,anugo,vfo,vfgo,vgo)
c
c   Rei=rofi*Vi*di/amufi
c   aNui=0.023*(Rei**0.8)*(Prfi**0.4)
c   hi=(akfi/di)*aNui
c
c   hfgp=hfg+(3./8.)*cpfo*(To-Ts)
c   anom=(gc*3600.00*3600.00)*rofo*(rofo-rogo)*akfo**3*hfgp
c   dnom=amufo*(To-Ts)*do
c   ho=0.729*sqrt(sqrt(anom/dnom))

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# conden

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c      Res=(do/(di*hi))+do*dlog(do/di)/(2.*aks)+foul+(1./ho)
      Uo=1./Res
      C1=rofi*Vi*aflow*cpfi/(Uo*asurf)
c
      X=(To+(C1-0.5)*Tia)/(C1+0.5)
      go to 3
      n=0
2     continue
      n=n+1
      fox=(To-X)+C1*(X-Tia)*(dlog((To-Tia)/(To-X)))-(To-Tia)
      fpx=-1+C1*(dlog((To-Tia)/(To-X)))+C1*((X-Tia)/(To-X))
      eps=-fox/fpx
      if(abs(eps).le.1E-4.or.n.gt.30) go to 3
      X=X+eps
      go to 2
3     continue
      Tib=X
c      if(n.gt.30) print *, ' Did not converge on Tib'
c      if(n.gt.30) go to 5
      Tavi=0.5*(Tia+Tib)
      Tsn=0.5*(Tavi+To)
      eps=abs(Ts-Tsn)/Ts
      if(eps.lt.1E-4.or.i.gt.30) go to 4
      Ts=Tsn
      go to 1
4     continue
      if(i.gt.30) print *, ' Did not converge on Ts'
      if(i.gt.30) go to 5
      DT_LMTD=((To-Tia)-(To-Tib))/dlog((To-Tia)/(To-Tib))
      aN=Qdot/(rofi*Vi*aflow*cpfi*(Tib-Tia))
c      Printing Qdot, dmi, dmo, and Rei in Million units.  Vi in ft/s.
      dmi=(rofi*Vi*aflow*aN)/1E6
      Qdotp=Qdot/1.E6
      dmo=Qdotp/hfg
      Rei=Rei/1.e6
      Vi=Vi/3600.00
      di=di*12
      do=do*12
      write(*,7)
      write(*,6) di,do,aL,aN
      write(*,6) aflow,asurf,Vi,foul
      write(*,6) To,Tia,Tib,Ts
      write(*,6) hi,ho,Uo,Rei
      write(*,6) Qdotp,DT_LMTD,dmi,dmo
      print *, ' '
5     continue
6     format(4f17.4)
7     format(//,' di,do,aL,aN',//,' aflow,asurf,Vi,foul',//,' To,Tia,Tib,T
1s',//,' hi,ho,Uo,Rei',//,' QdotP,DT_LMTD,dmi,dmo',/)
      stop
      end

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[illegible]