44. Mercury enters the steady flow, steady state, adiabatic turbine of a starship warp drive system as a saturated vapor at 300 psia and exits the turbine with a quality of 75.0% at 1.00 psia. Determine
a. The mass flow rate of mercury required to produce 100. hp of turbine output power.
b. The inlet flow area if the inlet velocity is 1.00 ft/s.

\[
\dot{m} \left( h_1 - h_2 \right)
\]

\[
\dot{m} = \rho_0 R \frac{V_i}{v_i}
\]

\[
h_1 = h_g c_{ps} = 157.7 \text{ Btu/lbm}
\]

\[
h_2 = h_f + x_2 h_{fg} = 133.96 + .75 (126.72) \text{ (Btu/lbm)}
\]

\[
h_2 = 109 \text{ Btu/lbm}
\]
"Problem 6.44"

"Station #1"
P[1] = 300[psia]
x[1] = 1
h[1] = 157.7[Btu/lbm]
ρo[1] = (1/2.276)[lbf-ft^3]
V[1]=1.00[ft/s]

"Station #2"
P[2]=1[psia]
x[2] = .75
h2f = 13.959[Btu/lbm]
h2fg = 126.724[Btu/lbm]
h[2] = h2f + x[2]*h2fg

"1st Law"
wdot = 100[hp]
wdot = mdot[1]*(h[1]-h[2])*convert(Btu/s,hp)

SOLUTION
Unit Settings: Eng F psia mass deg
h2f = 13.96 [Btu/lbm]           h2fg = 126.7 [Btu/lbm]           wdot = 100 [hp]

No unit problems were detected.

Arrays Table: Main

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