DATA SHEET

Date:__________________________ Run ID:____

Dynamometer Reading:______________________________

Turbine Speed: ________________________________ rpm

Cooling Water Flow:

Volume Measured _______________________gal Time Interval ___________________________

Condensate (Steam) Flow:

Mass Measured __________________________lbm Time Interval ___________________________

Pressures & Temperatures:

State	Description	Pressure	Temperature (^oF)
3	Separator Outlet / Throttle Inlet	psig	
4	Turbine Bowl / Nozzle Inlet	psig	
5	Turbine Exhaust	in Hg (vac) or psig	
6	Condensate / Condenser Outlet	psig	
7	Cooling Water Inlet	psig	
8	Cooling Water Outlet	psig	
Room	Ambient Conditions in Room	in Hg(abs) or psia	

$$\text{Shaft Power in hp} = (\text{Dynamometer Reading}) \times \frac{(\text{Turbine Speed in rpm})}{1000}$$

= ________________________ × ______________________

= _________________________ hp

PROPERTY CALCULATION SHEET

Run ID:____

State 1 - Water Supply to Boiler Feed Pump

P_1 = ________________ psig = ____________________psia

$T_1 = T_7$ = ________________^oF

Phase________________________________ Quality _________________________

h_1 = ___________________________ Btu/lbm s_1 = __________________________Btu/(lbm·^oR)

State 2 - Boiler Inlet

$P_2 = P_3$ = __________________psig = ____________________psia

$s_2 = s_1$ = ________________________Btu/(lbm·^oR) assuming 100% efficient pump

Phase________________________________ Quality _________________________

h_2 = ___________________________ Btu/lbm T_2 = ______________________^oF

State 3 - Separator Outlet / Throttle Valve Inlet

P_3= ________________ psig = _____________________ psia

T_3 = __________________ ^oF

By design, this must be a saturated vapor or a superheated vapor (assume that temperature is the most accurate measurement).

Phase ____________________ Quality _____________________

h_3 = _____________________ Btu/lbm s_3 = _______________________ Btu/(lbm-^oR)

State 4 - Throttle Valve Outlet / Turbine Bowl (Turbine Nozzle Inlet)

P_4= ________________ psig = _____________________ psia

$h_4 = h_3$ = _________________________Btu/lbm (from energy balance on throttle)

Phase _____________________ Quality ______________________

T_4 = _______________________ ^oF s_4 = _______________________ Btu/(lbm-^oR)

State 5 - Turbine Exhaust

If pressure is less than atmospheric pressure, then

P_5 = ______________________in Hg vacuum

= ______________________psig

= ______________________psia

If pressure is greater than atmospheric pressure

P_5 = ____________________psig

= ____________________psia

T_5 = _________________ ^oF

Phase _______________________________________

If superheated vapor, state 5 properties can be determined directly from T and P:

h_5 = ____________________ Btu/lbm s_5 = ______________________ Btu/(lbm-^oR)

If compressed liquid, the readings are in conflict with the physics and you should assume that state 5 is a two-phase liquid-vapor mixture and continue to the next paragraph.

If two-phase liquid-vapor mixture, h_5 (and hence state 5) can only be found using an energy balance on the steam side of the condenser. Before you can do this you must *skip this step for now* and return after you have completed the rest of the calculations

$$h_5 = h_6 + \frac{\dot{Q}_{cw,in}}{\dot{m}_{Condensate}} = \_\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_\_\_$$

= ____Btu/lbm

$x_5 = x(T_5, h_5)$ = ______________________________ (Assumes T_5 is more accurate than P_5)

$s_5 = s(T_5, h_5)$ = _____________________________Btu/(lbm-^oR)

State 5s - Hypothetical Turbine Exhaust State assuming Turbine is Adiabatic and Internally Reversible

$P_{5S} = P_5$ = _______________ psig = ____________________ psia

$s_{5S} = s_4$ = _________________________Btu/(lbm-^oR)

Phase ________________________ Quality _________________________

$h_{5S} = h(P,s)$ = _______________________ Btu/lbm T_{5S} = ______________________^oF

State 6 - Condensate (Condenser Outlet)

p_6 = __________________ psig = _______________________ psia

T_6 = ____________________ ^oF

Phase ______________________________ Quality __________________________

h_6 = _____________________________ Btu/lbm s_6 = ___________________________ Btu/(lbm·^oR)

$$\dot{m}_{Condensate} = \frac{(\text{Mass of water})}{(\text{Time Interval})} =$$ _______________________ = ______________________ lbm/s

States 7 and 8 - Cooling Water Loop

Inlet Water: T_7 = __________________ ^oF P_7 = ______________ psig = ________________ psia

Phase ______________________________ Quality _____________________________

h_7 = _______________________________ Btu/lbm

Outlet Water : T_8 = _________________ ^oF P_8 = ______________ psig = ________________ psia

Phase ______________________________ Quality _____________________________

h_8 = _______________________________ Btu/lbm

Measured Volume = ___________________________ = ____ ft^3

Time interval = ________________________________

Specific volume υ_7 = ____________________________ lbm/ft^3

$$\dot{V}_{cw} = \frac{(\text{Measured Volume})}{(\text{Time Interval})} =$$ ______________________________ = ___________________ ft^3/s

$$\dot{m}_{cw} = \frac{\dot{V}}{\upsilon_7} =$$ ____________________________________ = ____________________ lbm/s

$$\dot{Q}_{cw,in} = \dot{m}_{cw} c\left(T_8 - T_7\right) \text{ or } \dot{m}_{cw}\left(h_8 - h_7\right) =$$ ____

= ____________________________________ Btu/s