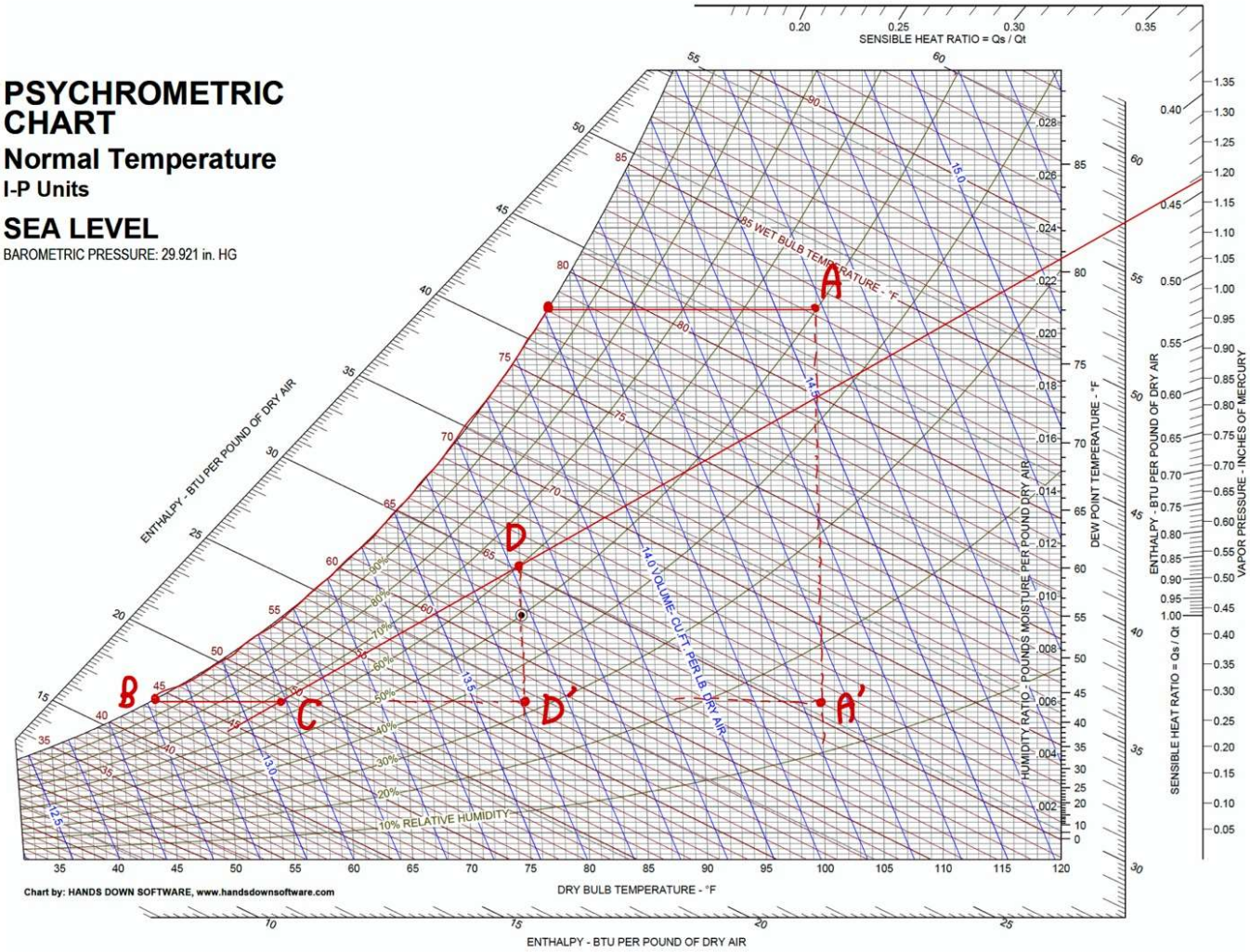
ARC 523, Fall 2023
Seungmin Lee

Assignment #4
Due: Oct. 26th, 2023

COOLING ENERGY CALCULATIONS

1) The air conditioning cycle on the Psychrometric chart



2) The table

State Point	Tdb (°F)	Twb (°F)	Tdp (°F)	RH (%)	h (Btu/ lb_a)	v (ft^3/lb_a)	W (lb_w /lb_a)	m (lb_a/hr)	Q (ft^3/min)
A	100	83.03	78	50	46.97	14.57	0.0208	14413.18	3500
A'	100	65.93	44.05	14.97	30.72	14.23	0.0060	14413.18	3418.32
B	44	44	44.05	100	17.12	12.81	0.0060	14413.18	3077.21
C	54.5	48.88	44.05	67.68	19.65	13.08	0.0060	14413.18	3142.07
D	75	65.21	60.23	60	30.16	13.71	0.0112	14413.18	3293.41
D'	75	57.34	44.05	33.08	24.65	13.61	0.0060	14413.18	3269.38

3) (3500 CFM) / (14.57 ft^3/lb_a)* (60min/hr) = **14413.18 lb_a/hr**

4) A : **3500 ft^3/min**

B : (12.81 ft^3/lb_a) * (14413.18 lb_a/hr) / (60 min/hr) = **3077.21 ft^3/min**

5) (40000 Btu/hr) / (90000 Btu/hr) = **0.44**

6) **54.5 °F**

7) C : (13.08 ft^3/lb_a) * (14413.18 lb_a/hr) / (60 min/hr) = **3142.07 ft^3/min**

   D : (13.71 ft^3/lb_a) * (14413.18 lb_a/hr) / (60 min/hr) = **3293.41 ft^3/min**

8) For the cooling coil:

   a. Cooling loads (A-B) : (46.97 – 17.12) * 14413.18 = **430233.42 Btu/hr**

   b. Cooling loads (A-A') : (46.97 – 30.72) * 14413.18 = **234214.18 Btu/hr**

   c. SHF for the cooling coil : 234214.18 / 430233.42 = **0.54**

   d. 14413.18 * (0.0208 – 0.006) = 213.31 lb_w /hr

      213.31 / 8.34 / 60 = **0.42 GPM**

9) For the reheat coil:

   a. The total reheat load (B-C) : (19.65 – 17.12) * 14413.18 = **36465.35 Btu/hr**

   b. **1.0** (No latent cooling loads)

10) For the space :

   a. The total cooling loads (C-D) : (30.16 – 19.65) * 14413.18 = **151482.52 Btu/hr**

   b. The sensible cooling loads (C-D') : (24.65 – 19.65) * 14413.18 = **72065.9 Btu/hr**

   c. Compare calculation results with the given space loads.

      i. No, they don't match. The calculated result shows a greater amount of energy.

      ii. By reducing the supply air amount, the cooling load can be reduced because the mass flow rate of the air value is lowered. Alternatively, increasing the cooling coil set temperature can reduce the cooling load because the enthalpy difference is lowered.

   d. The SHF for the space : 72065.9 / 151482.52 = **0.47**

   e. 14413.18 * (0.0112 – 0.006) = 74.94 lb_w /hr

      74.94 / 8.34 / 60 = **0.14 GPM**