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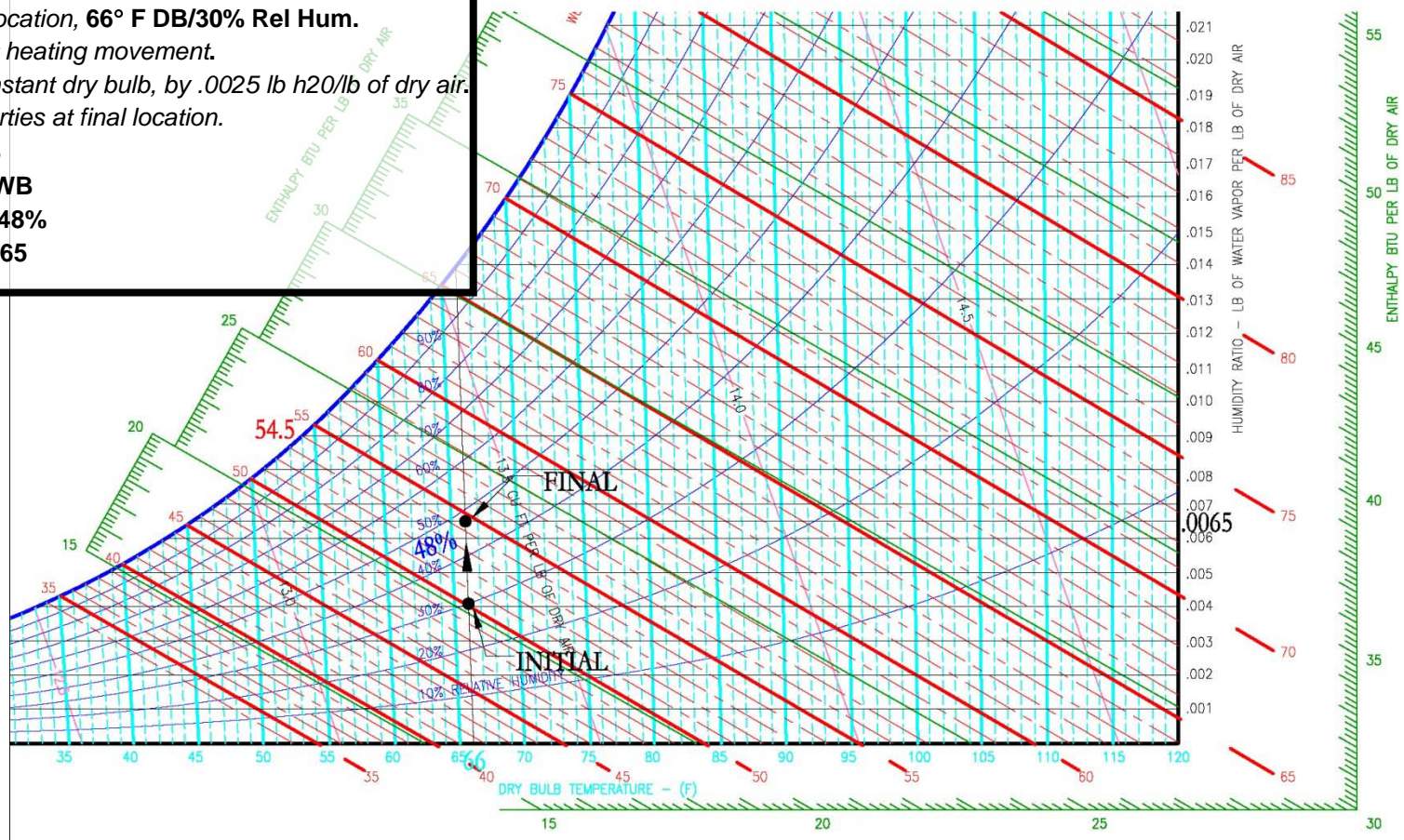
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$$w_{final} \left[\frac{\text{lb of H}_2\text{O}}{\text{lb of dry air}} \right] = .0065$$

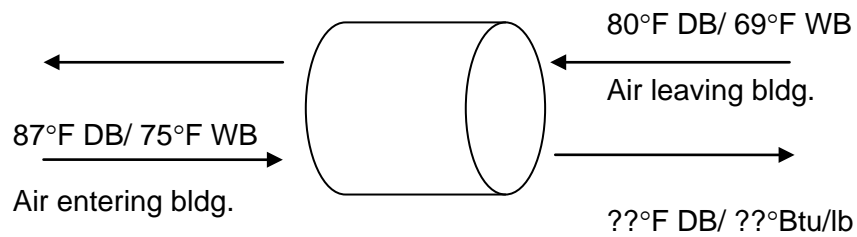
We now know the final humidity ratio and since the air has only undergone latent heating, there is no change in dry bulb temperature, dry bulbs are equal $T_{db,final} = T_{db,initial}$. In order to get the final conditions of the air, the psychrometric chart must be used. Knowing two values allows the other 5 properties to be determined, see below.

Step 1: Find initial location, **66° F DB/30% Rel Hum.**
Step 2: Show latent heating movement.
 Movement up at constant dry bulb, by **.0025 lb h₂O/lb of dry air.**
Step 3: Read properties at final location.
Dry Bulb = 66° F DB
Wet Bulb = 54.5° F WB
Relative Humidity = 48%
Humidity Ratio = .0065



PROBLEM 9 - ENTHALPY WHEEL

Background: An enthalpy wheel is used to transfer energy (enthalpy) from one air stream to another. 2,000 CFM of air leaving a building at 80°F DB/69°F WB is used to pre-cool and pre-dehumidify 2,000 CFM of air at 87°F DB/75°F WB prior to the air entering the building HVAC system. Assume the enthalpy wheel is 80% effective. What is the resulting temperature of the air entering the building HVAC system after the enthalpy wheel?



- (a) 80°F DB/32.5 Btu/lb
- (b) 81.4°F DB/34.2 Btu/lb
- (c) 85.6°F DB/35.8 Btu/lb
- (d) 87°F DB/37.1 Btu/lb

SOLUTION 9 - ENTHALPY WHEEL

The enthalpy wheel will be able to transfer the enthalpy from one air stream to the other.

$$h_{entering} = 38.5 \frac{Btu}{lb \text{ of dry air}}; h_{leaving} = 33.1 \frac{Btu}{lb \text{ of dry air}}; \text{ from psych. Chart.}$$

$$h_{entering,after} = h_{entering} - E(h_{entering} - h_{leaving}); \text{ where } E = \text{effectiveness}$$

$$h_{entering,after} = 38.5 - 0.8(38.5 - 33.1)$$

$$h_{entering,after} = 34.2 \frac{Btu}{lb \text{ of dry air}}$$

$$T_{entering,after} = T_{entering} - E(T_{entering} - T_{leaving}); \text{ where } E = \text{effectiveness}$$

$$T_{entering,after} = 87^{\circ}\text{F DB} - 0.8(87^{\circ}\text{F DB} - 80^{\circ}\text{F DB})$$

$$T_{entering,after} = 81.4^{\circ}\text{F DB}$$