PSYCHROMETRICS

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Western Mechanical Solutions
SUSTAINABLE HEATING COOLING

Definitions

Dry Air

Water Vapor

Moist Air

Saturation

Perfect Gas Equation

$$pV = nRT$$

Terms

Dry Bulb db – deg - Temperature of air with no evaporation occurring 72 deg

Wet Bulb wb – deg - Temperature of air at equilibrium with full evaporation occurring 56.2 deg

Relative Humidity RH – % - Percentage of moisture in the air compared to the maximum allowable AT THAT TEMPERTURE 40%

Terms

Dew Point dp – deg - Surface Temperature where Condensation Occurs 46.4

Enthalpy h – BTU/lb – Pressure x Volume Energy and Internal Energy 26.2

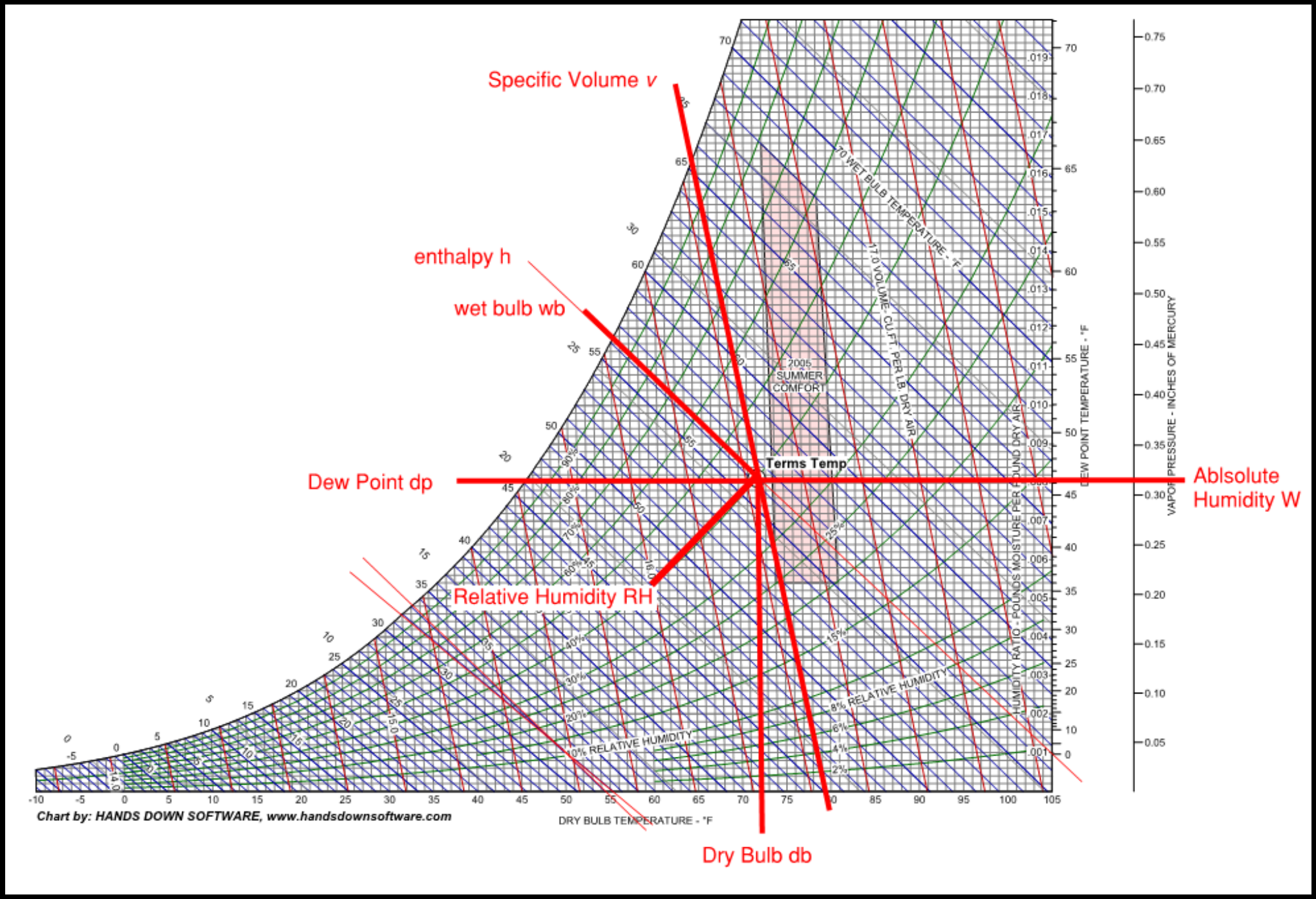
Absolute Humidity – lb/lb – general number is 0.008 lb/lb da , 1% lbs water / lb dry air

grains/lb – there are 7,000 grains in a lb

Specific Volume V – ft3/lb – 16.5 ft3/lb

Density p – lb/ft3 - 0.061 lb/ft3

Terms


Specific Volume v
enthalpy h
wet bulb wb
Dew Point dp
Relative Humidity RH
Dry Bulb db
Ablsolute Humidity W
Terms Temp
2005 SUMMER COMFORT
70 WET BULB TEMPERATURE - °F
110 VOLUME- CU.FT. PER LB. DRY AIR
DEW POINT TEMPERATURE - °F
VAPOR PRESSURE - INCHES OF MERCURY
HUMIDITY RATIO - POUNDS MOISTURE PER POUND DRY AIR
10% RELATIVE HUMIDITY
8% RELATIVE HUMIDITY
DRY BULB TEMPERATURE - °F
Chart by: HANDS DOWN SOFTWARE, www.handsdownsoftware.com

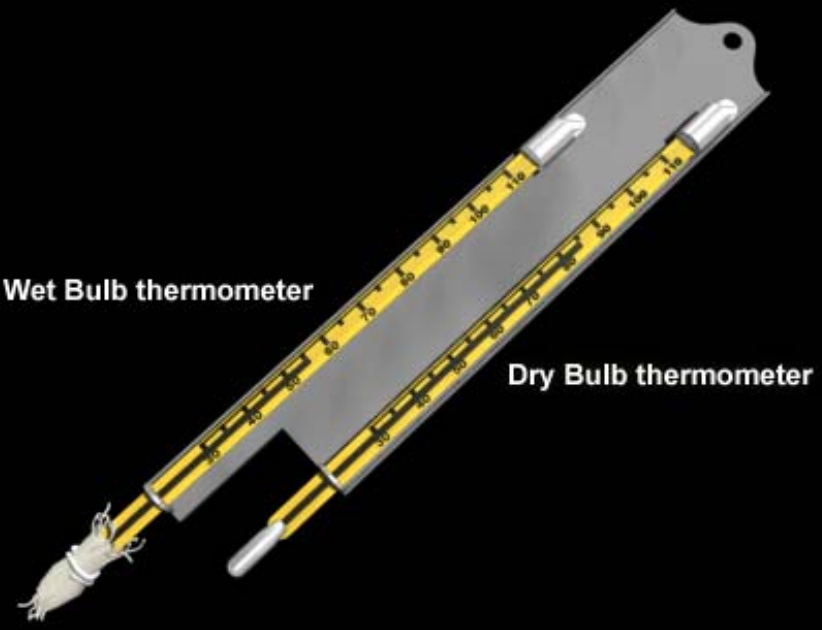
Process Terms

Sensible Heating
Sensible cooling
Dehumidification/Cooling coil line
Sensible heat load
Evaporative Cooling
Humidification
Comfort window

Definitions

Dry Bulb

Wet Bulb



Dry Bulb

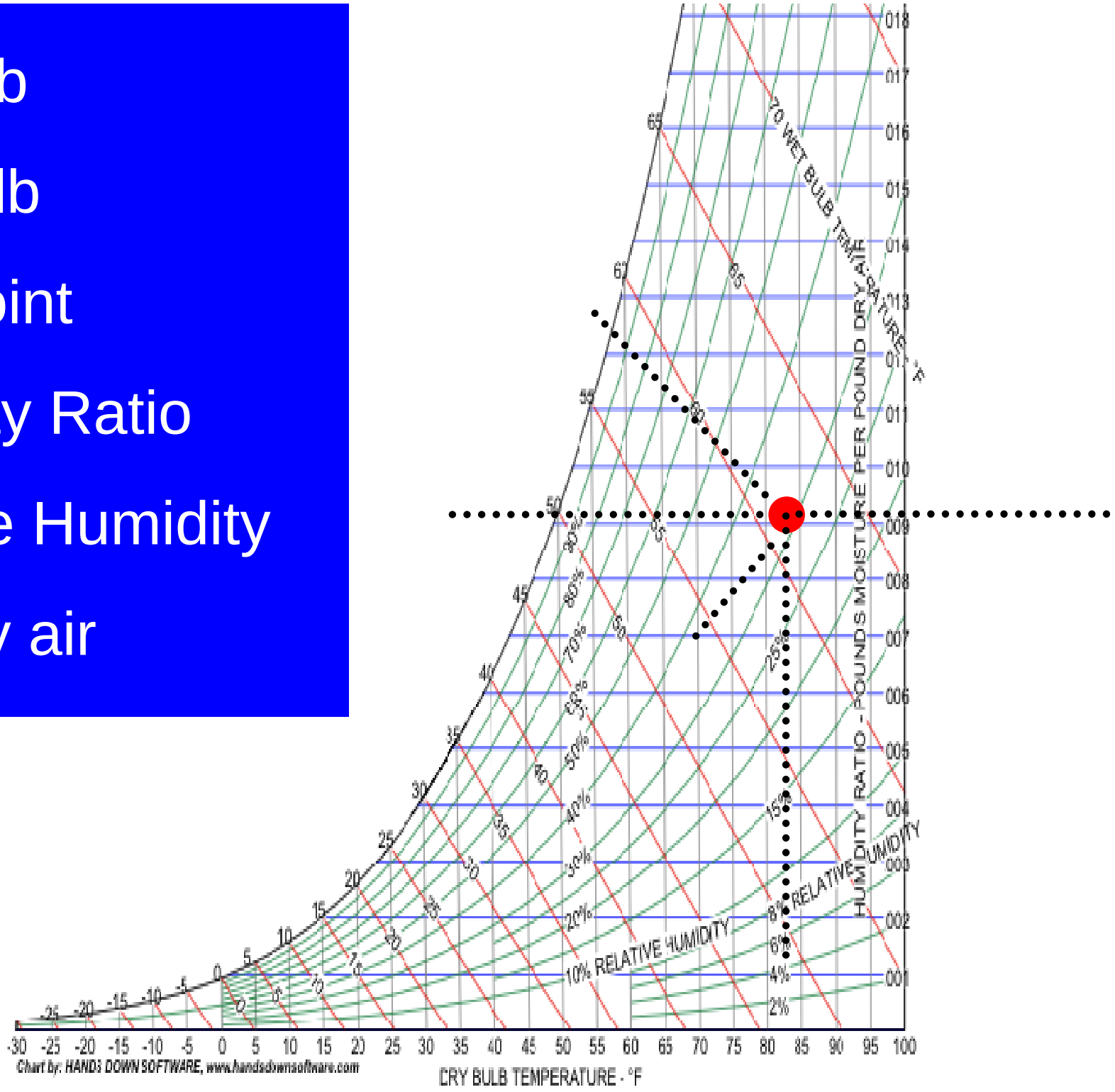
Wet Bulb

Dew Point

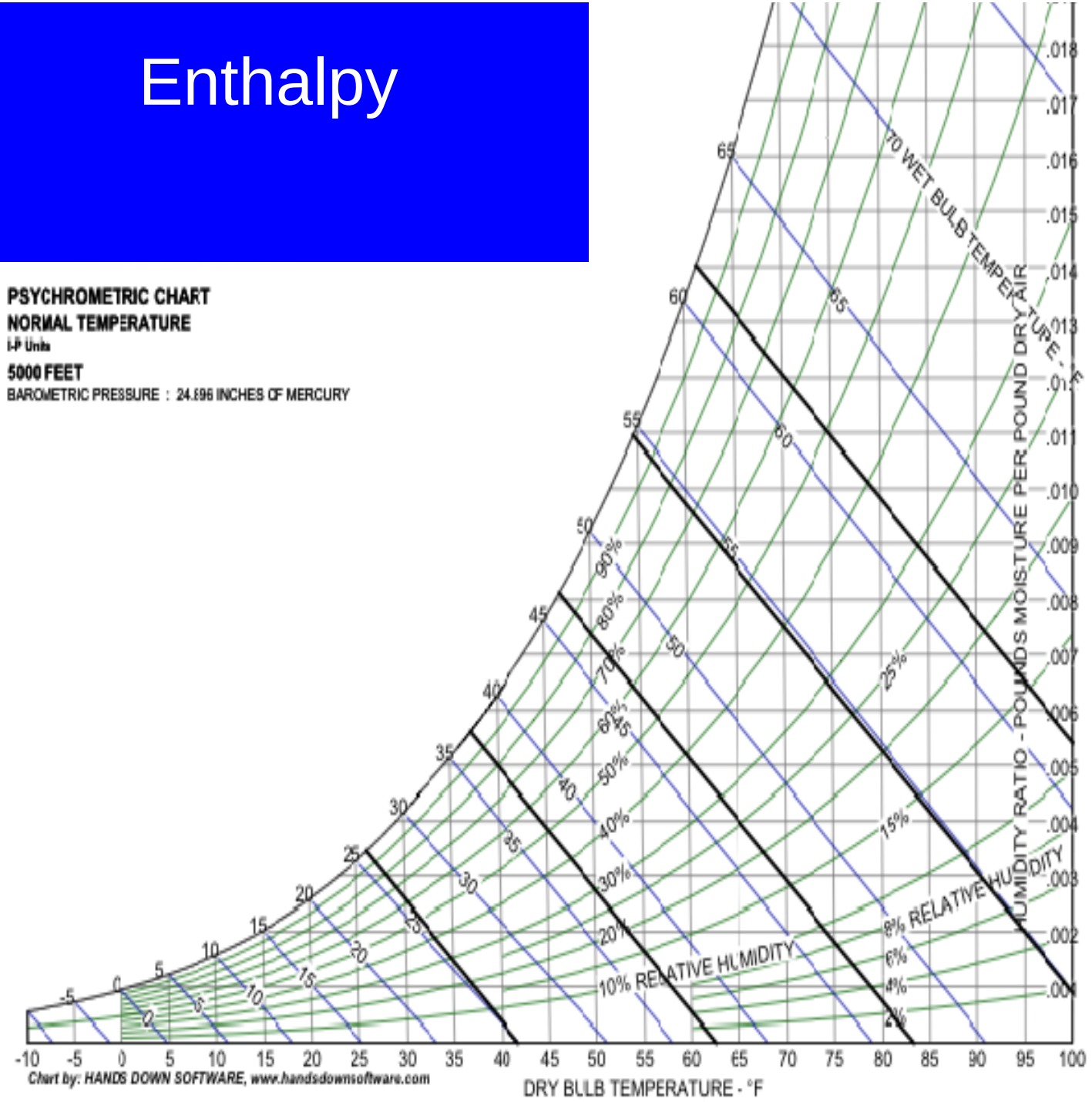
Humidity Ratio

Relative Humidity

lb of dry air



Enthalpy


PSYCHROMETRIC CHART
NORMAL TEMPERATURE
I-P Units
5000 FEET
BAROMETRIC PRESSURE : 24.896 INCHES OF MERCURY
70 WET BULB TEMPERATURE - °F
HUMIDITY RATIO - POUNDS MOISTURE PER POUND DRY AIR
90% RELATIVE HUMIDITY
10% RELATIVE HUMIDITY
DRY BULB TEMPERATURE - °F
Chart by: HANDS DOWN SOFTWARE, www.handsdownsoftware.com

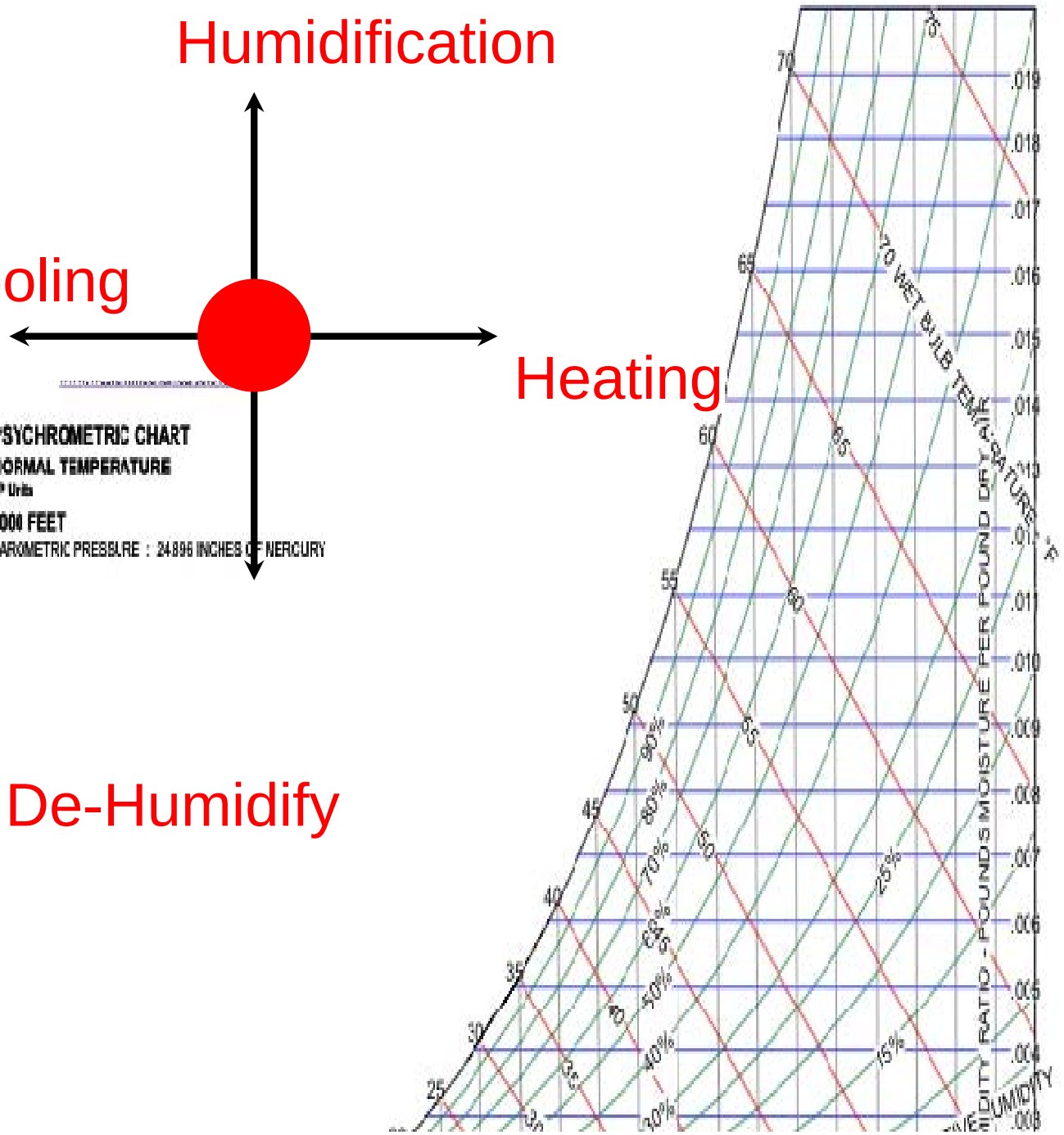
Basic Processes

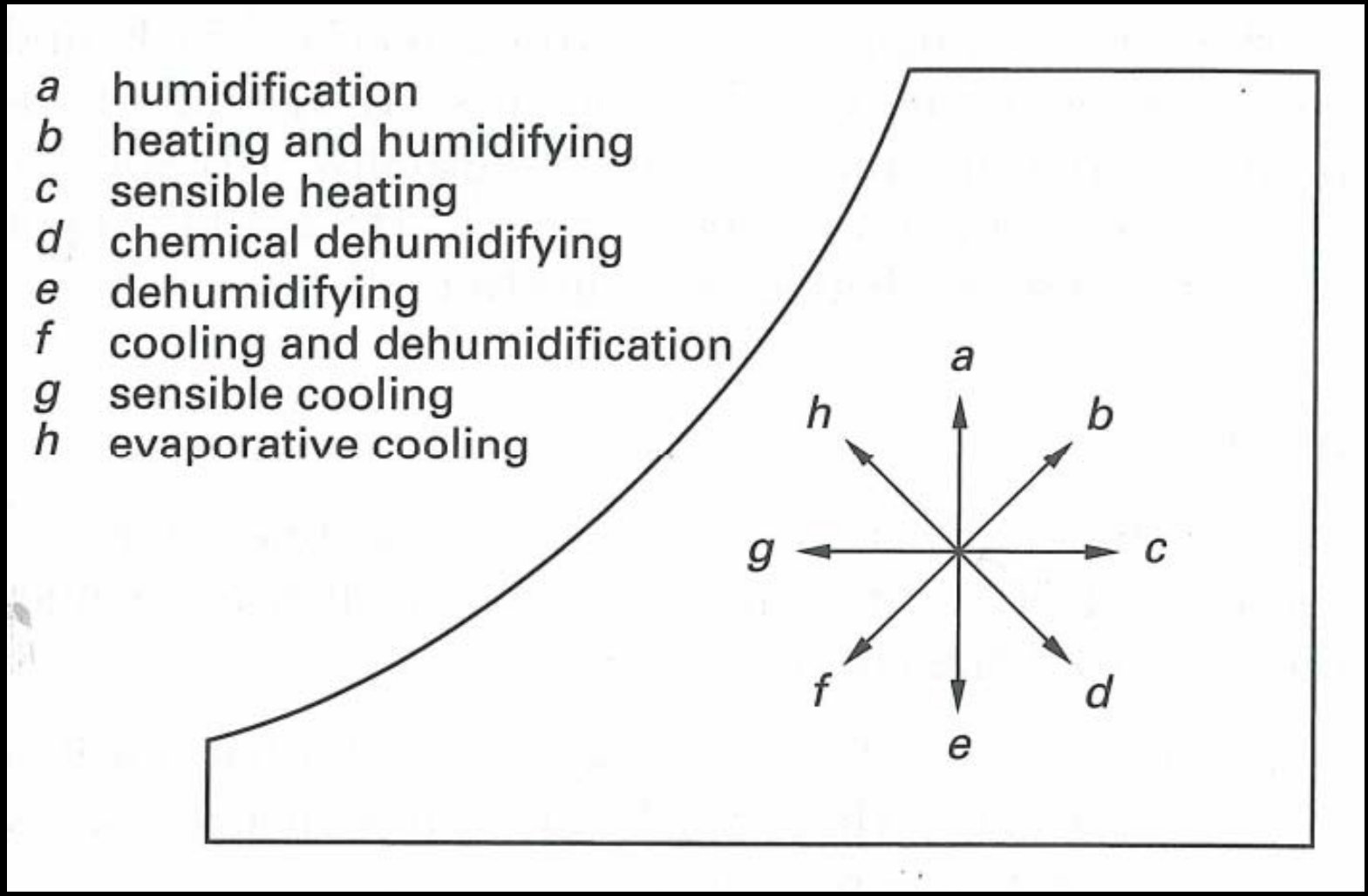
Humidification

Cooling

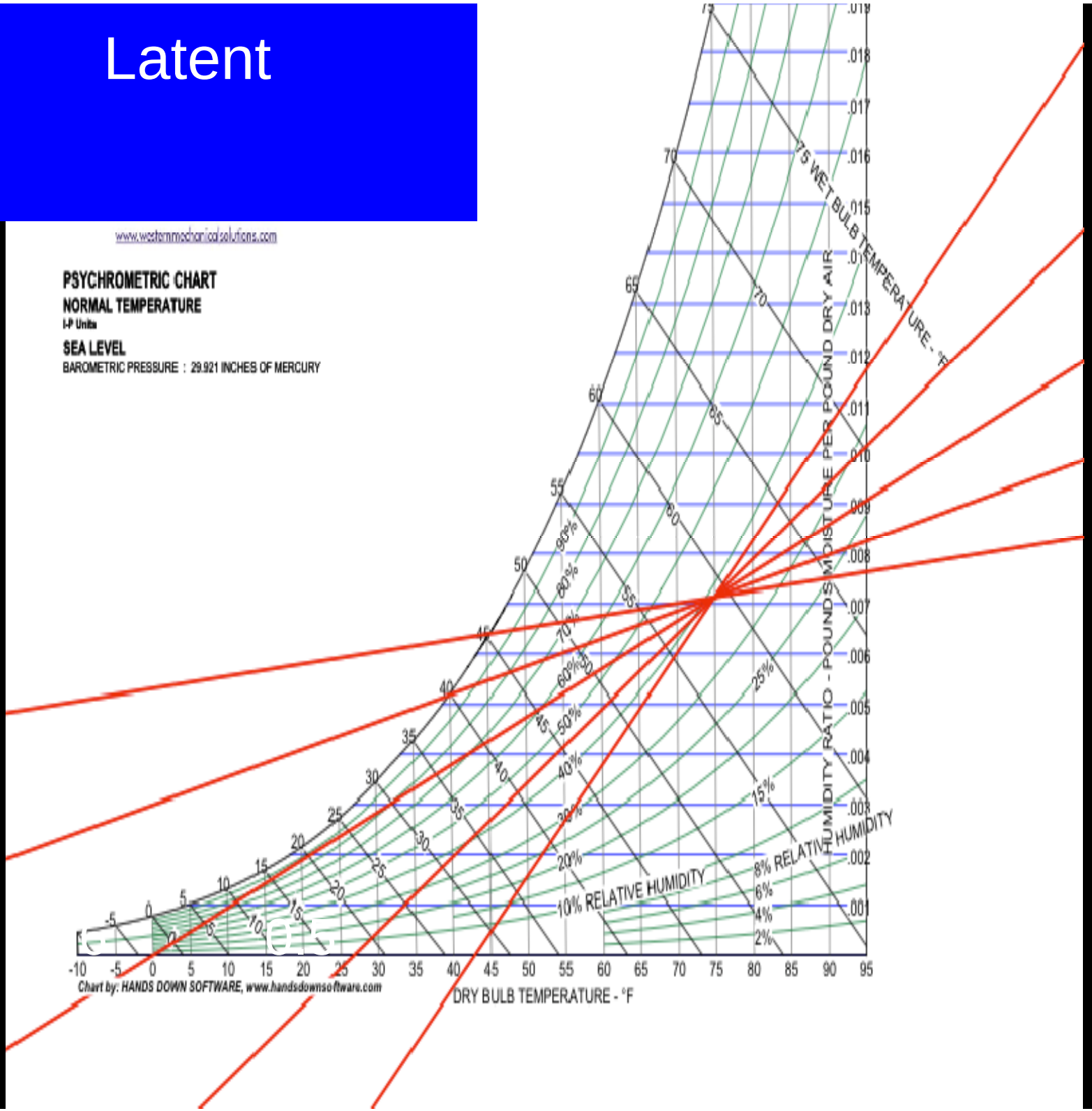
Heating

De-Humidify




a humidification
b heating and humidifying
c sensible heating
d chemical dehumidifying
e dehumidifying
f cooling and dehumidification
g sensible cooling
h evaporative cooling
a
h
b
g
c
f
d
e

Latent



0.9

0.8

0.7

Refrigeration Study Class – Formula's

- Air heat of absorption / rejection Sensible
- **Generally at sea level**
  - qs = CFM * 1.08* (t1-t2) = Btu/hr
  - qs – Sensible heat transfer
  - CFM = ft3/min
  - Voa – Specific volume – ft3/lbm
- **Generally at altitude**
  - qs = CFM * 0.89* (t1-t2) = Btu/hr
  - Density at sl = 0.075, Alt = 0.062
  - Density Ratio is 0.062/0.075= 0.827
  - Multiply 0.827 * 1.08 = 0.89

Refrigeration Study Class – Formula's

- Air heat of absorption / rejection Latent
  - qt = Moa * (W1-W2) * Hfg = Btu/hr
  - qt = **CFM** * (W1-W2) * Hfg **/ Voa** = Btu/hr
  - qt – total heat transfer
  - Moa = mass of air lbm/hr
  - W1 – W2 = Difference in design humidity ratio
  - Hfg – latent heat of vaporization at indoor conditions – BTU/lbv
  - Voa – Specific volume – ft3/lbm

Refrigeration Study Class – Formula's

- Air heat of absorption / rejection - Total
- **Generally at sea level**
  - qt = CFM * 4.5* (h1-h2) = Btu/hr
  - qt – Total heat transfer
  - h1 = entering Enthalpy (BTU/lb)
  - h2 = leaving Enthalpy (BTU/lb)
- **Generally at altitude**
  - qt = CFM * 3.72 * (t1-t2) = Btu/hr
  - Density at sl = 0.075, Alt = 0.062
  - Density Ratio is 0.062/0.075= 0.827
  - Multiply 0.827 * 4.5 = 3.72