

ASHRAE Data Center Environmental Standards Some Field Observations

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Mission

Advancing safe, reliable, affordable and environmentally responsible electricity for society through global collaboration, thought leadership and science and technology innovation.

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Indoor Temperature

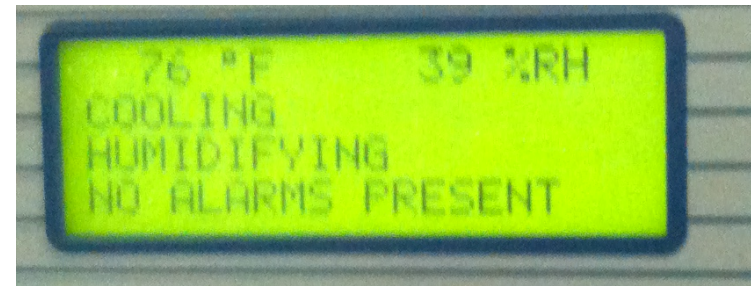
- Depends on type/criticality of data center—production; owned/colo facility; IT labs; Server room
- Indoor temperature varies as air moves through data center
- Indoor environments in most data centers are controlled on Return Air (RA)—and not on Supply Air (SA)—temperature
- It is impractical to control on SA temp with *conventional* Direct Expansion (DX) air conditioning equipment
- Air inlet temperature to IT equipment is not the same as SA temp
- Air inlet temperature varies with height of IT equipment and where it is located

Relative Humidity (RH), or Absolute Humidity?

- Indoor Relative Humidity (RH) will vary based on where you measure it; it changes with the Dry Bulb temperature
- However, Absolute Humidity—measured by Dew Point (DP) temperature—does not change with ambient temperature
- Humidity was not as tightly controlled, *even before ASHRAE expanded its range*
- Indoor Dew Point (DP) temperature would reach the same as outdoor DP with some time delay unless moisture is added (humidification) or removed (dehumidification)
- Dehumidification is automatically accompanied with cooling in most applications

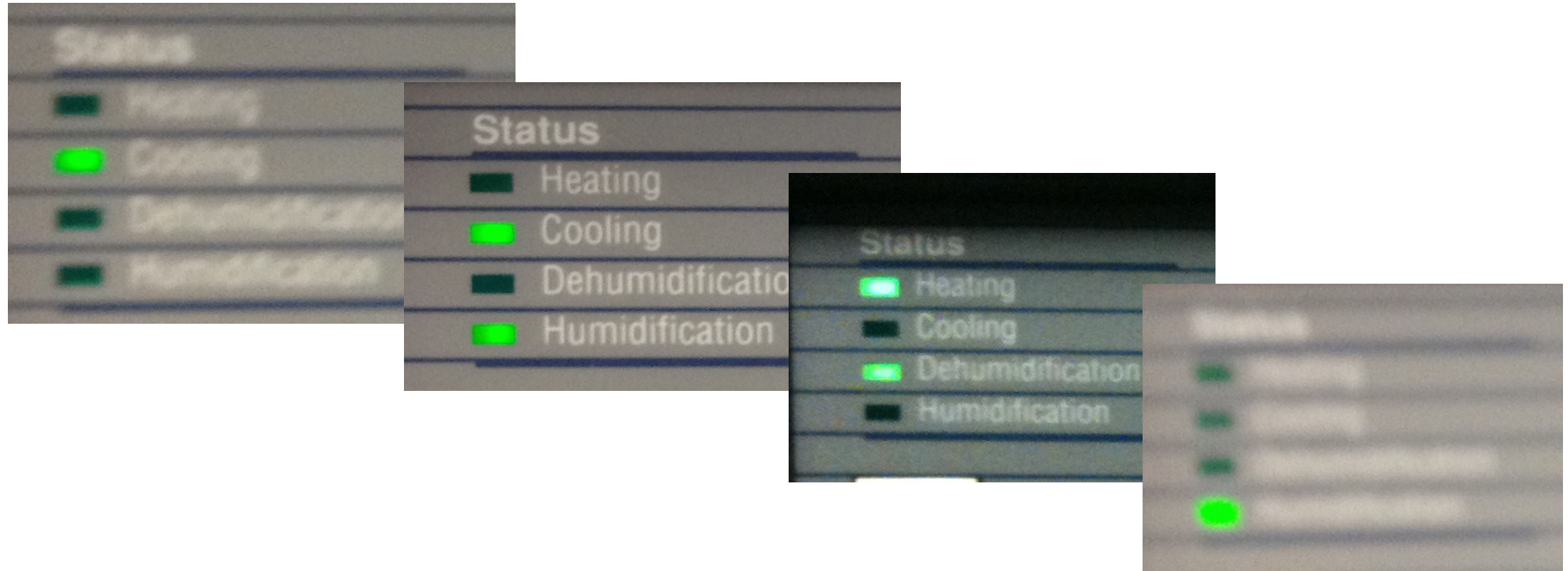
Some Field Observations-Random Sample

- These are RA conditions
- Cooling and humidifying *simultaneously!* *It must be winter.*



Cooling, Heating, Dehumidifying, Humidifying Simultaneously

- It can happen when you have multiple units that are independently controlled!

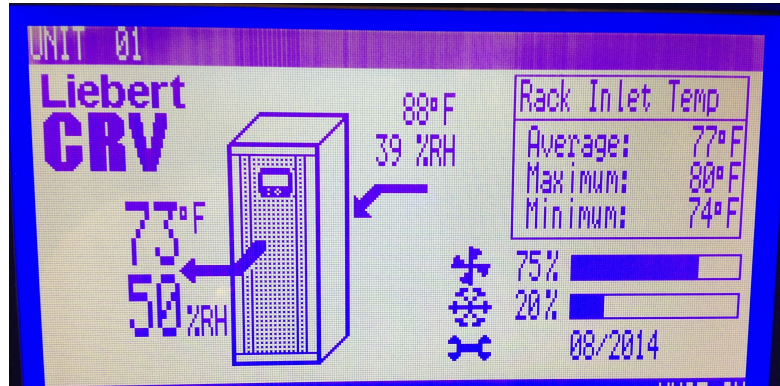


Some Extreme Conditions

- It can happen when estimated IT load does not materialize

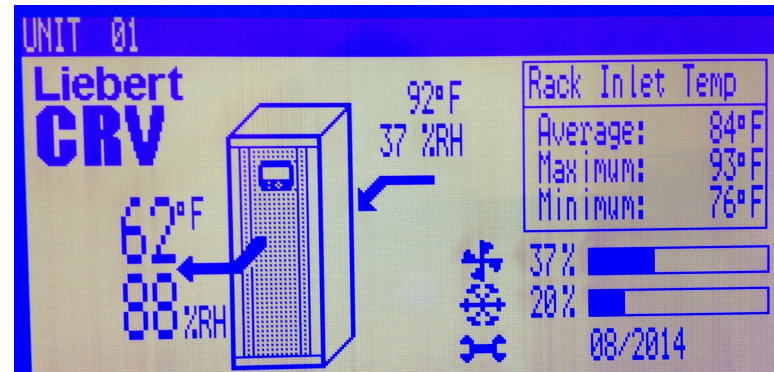
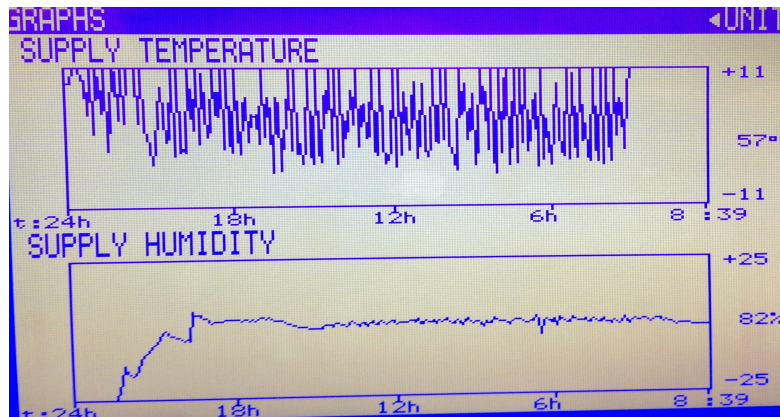


Newer DX Units With Variable Cooling Capacity

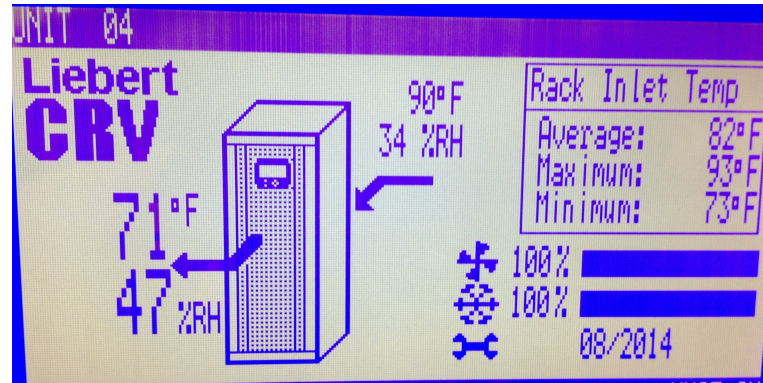


TOTAL RUN HOURS <UNIT 01>

U501	Actual Hours	Limit
U502 Fan Motor(s)	23305	0
U503 Compressor 1	5115	0
U504		
U505 Chilled Water	0	0
U506		
U507 Electric Heater	0	0
U508		
U509		
U510 Humidifier	0	0
U511 Dehumidification	0	0



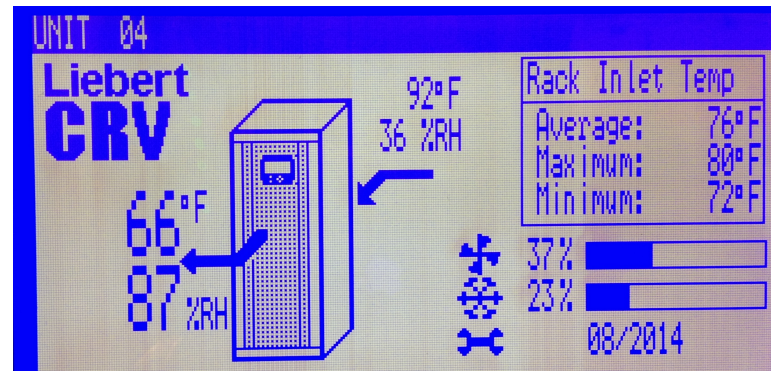
Newer DX Units With Variable Cooling Capacity



TOTAL RUN HOURS

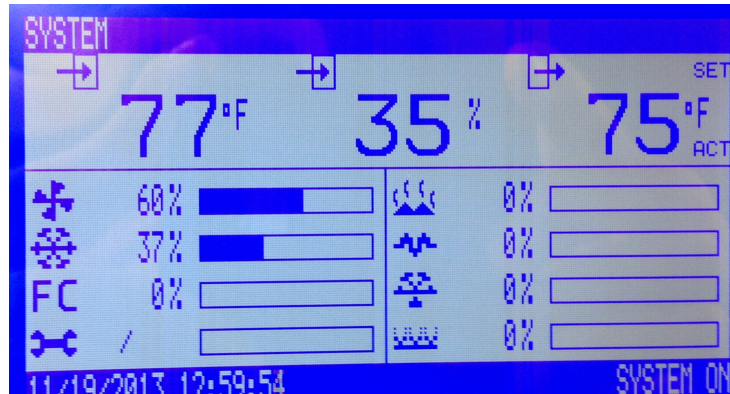
Code	Component	Actual Hours	Limit
U501			
U502	Fan Motor(s)	23656	0
U503	Compressor 1	22157	0
U504			
U505	Chilled Water	0	0
U506			
U507	Electric Heater	0	0
U508			
U509			
U510	Humidifier	0	0
U511	Dehumidification	0	0

Detailed description: This screen displays the total run hours for various components. The 'Actual Hours' column shows the cumulative hours of operation, and the 'Limit' column shows the maximum allowed hours. The Fan Motor(s) and Compressor 1 have the highest run times at 23,656 and 22,157 hours respectively. Other components like Chilled Water, Electric Heater, Humidifier, and Dehumidification have zero hours.



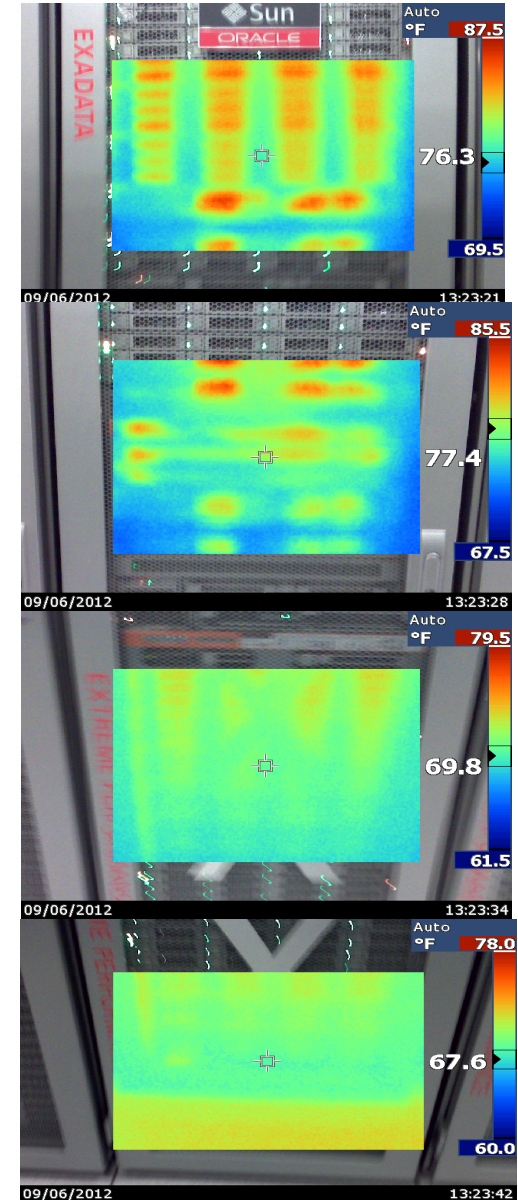
Newer units screens and one off measurements

- Supplement data with hand held measurements



Rack Inlet Air Temperature Profile

- Thermal plot for a rack under no containment and overhead air delivery
- Temperature variation of ~5-10 F from bottom to top of the rack
- Average temperature rise across IT equipment is ~15-18 F



Cool weather needs humidification



ASHRAE PSYCHROMETRIC CHART NO.1
NORMAL TEMPERATURE
BAROMETRIC PRESSURE: 25.627 INCHES OF MERCURY

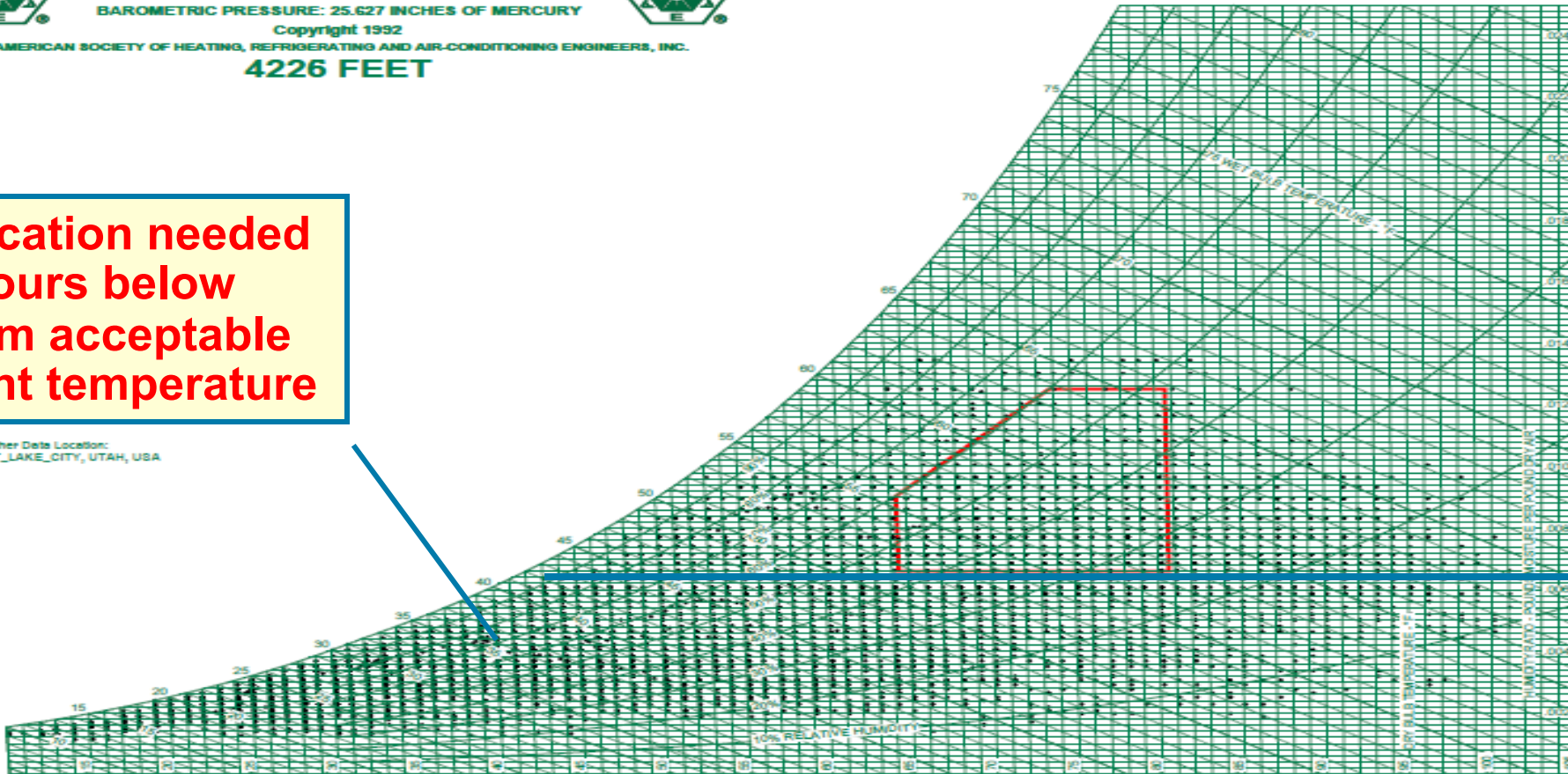


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4226 FEET

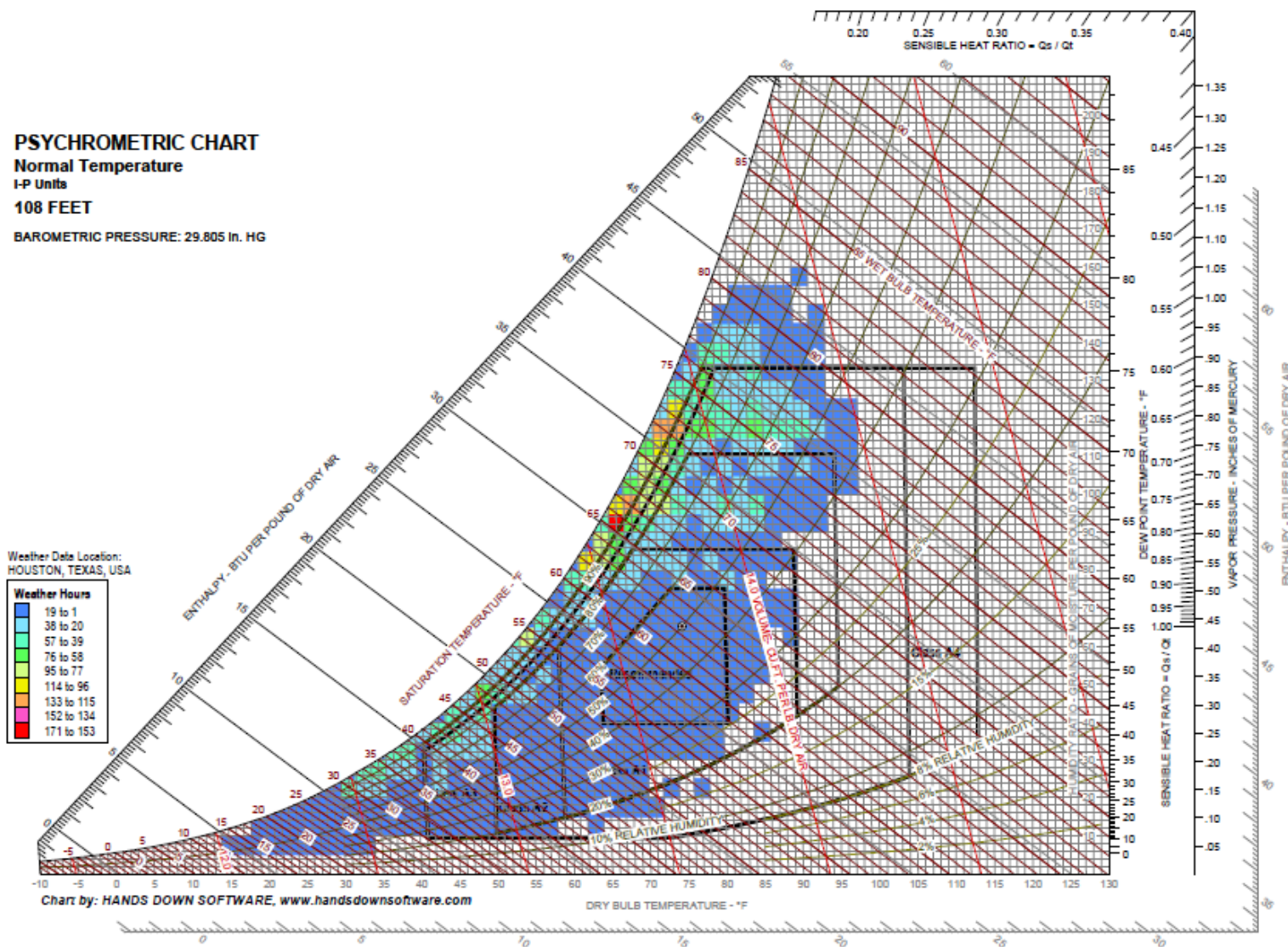
**Humidification needed
for hours below
minimum acceptable
dew point temperature**

Weather Data Location:
SALT LAKE CITY, UTAH, USA



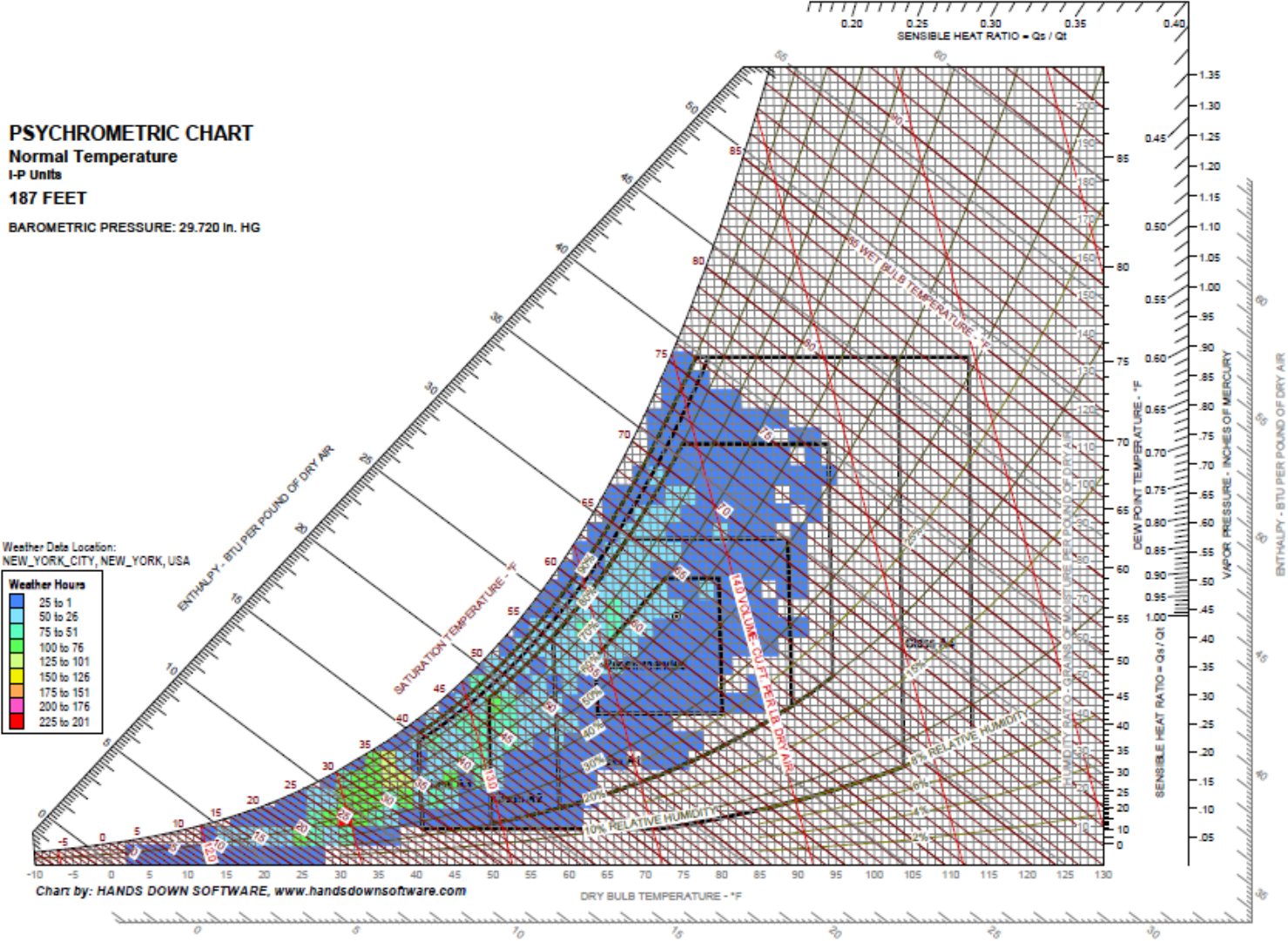
Houston Climate

- Winter humidification and summer dehumidification needed for a few hours only



New York City

- Winter humidification needed for a few hours only





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