

Fans, Ducts and Air Handling Systems: Design, Performance and Commissioning Issues

Humidifiers



Instructor:

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Reasons to Humidify (or Dehumidify)

- RH level between 30 and 60 percent is optimum for comfort and disease prevention
- The influenza virus has its highest mortality rate at 50-percent RH
- Equipment may require specific humidity levels for optimum performance
- Production may require specific humidity levels to maintain manufacturing tolerance

Humidification Processes

Water added to the air stream as a vapor

- Energy to vaporize added elsewhere
- Usually the energy required to maintain the water in a vapor state at the air stream temperature is less than what was required to generate the vapor elsewhere
- The extra energy shows up as a temperature rise

Bottom Line: Both the temperature and moisture content of the airstream go up

Water added to the air stream as a liquid

- Energy to vaporize comes from the air stream
- The energy used to vaporize the water shows up as a temperature drop

Bottom Line: The temperature drops while the moisture content of the airstream goes up



A Resource on Humidifiers

HPAC June 2003 – *Active Humidification*

Humidification Processes

Water added to the air stream as a vapor

- Direct Steam Injection
- Indirect Steam Injection
- Evaporative Pan
- Self Contained Electric Electrode



Humidification Processes



Water added to the air stream
as a liquid

- Evaporative Coolers and Air Washers
- Compressed Air Driven Atomization
- Ultrasonic Atomization

Humidification Processes

Water added to the air stream as a liquid

- Evaporative Coolers and Air Washers
- Compressed Air Driven Atomization
- Ultrasonic Atomization
- Open Water Surfaces

Humidification Processes



Water added to the air stream as a liquid

- Evaporative Coolers and Air Washers
- Compressed Air Driven Atomization
- Ultrasonic Atomization
- Open Water Surfaces
- Rain

A Discussion Point

Given:

- An economizer equipped office building with a SHR of .9
- A 45°F rainy, foggy day
- A design space target of 72°F/50% RH
- An air handling system with no active humidification
- The psych chart in the next slide

What would you expect the indoor humidity level to be?

ALTITUDE: 16 FEET
BAROMETRIC PRESSURE: 29.904 in. HG
ATMOSPHERIC PRESSURE: 14.687 psia

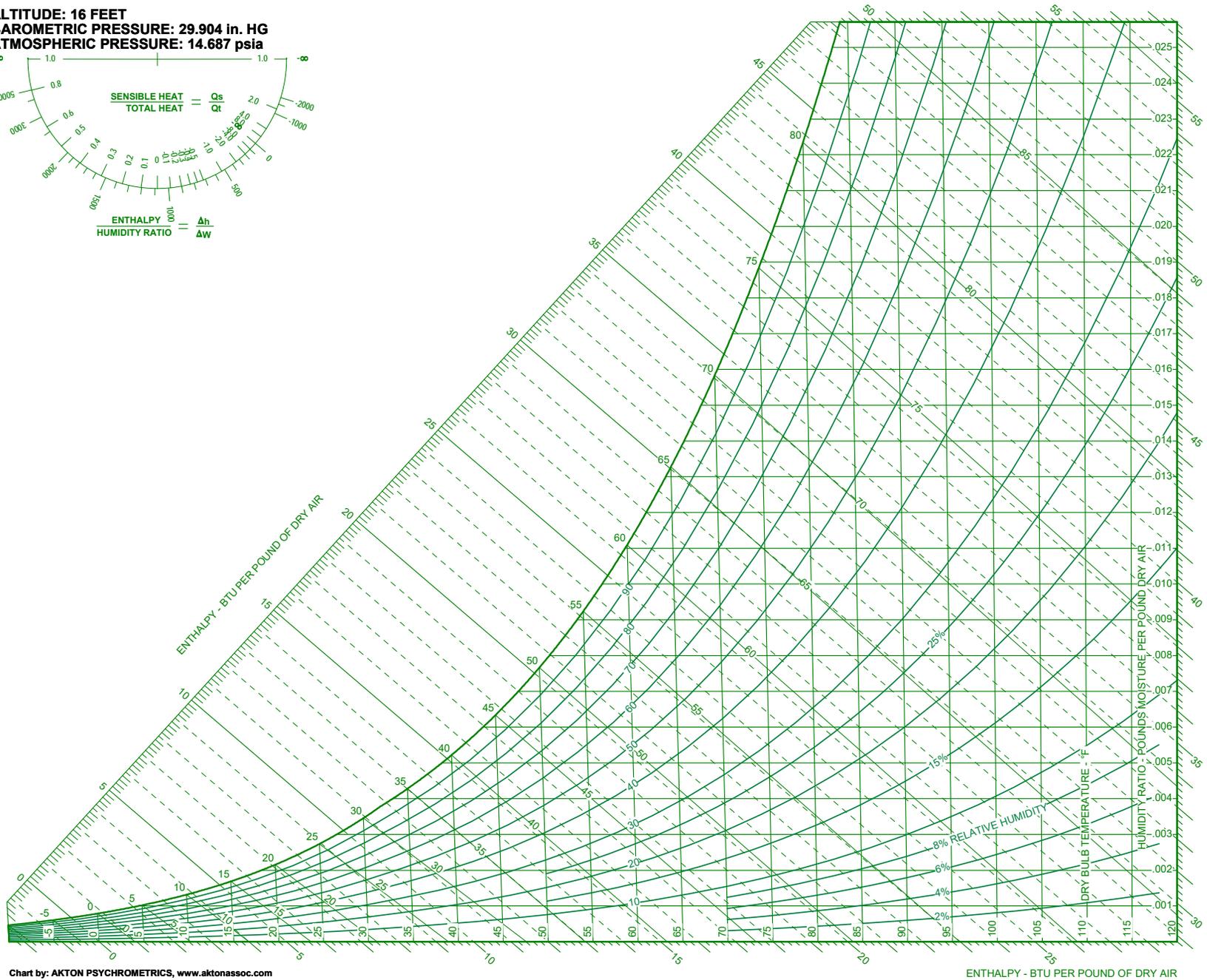
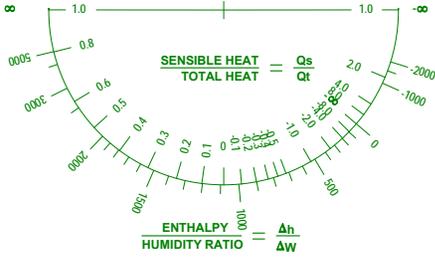


Chart by: AKTON PSYCHROMETRICS, www.aktonassoc.com

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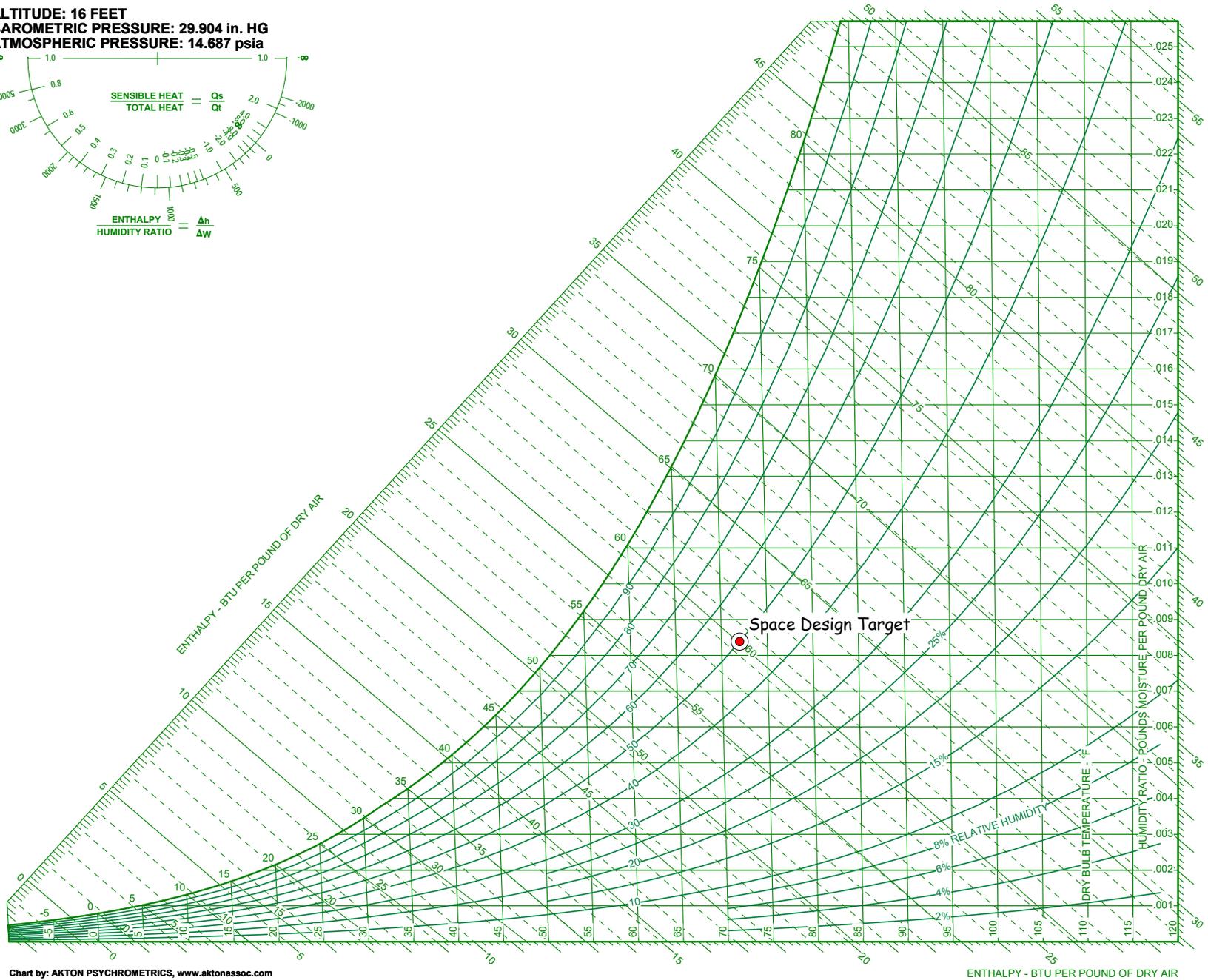
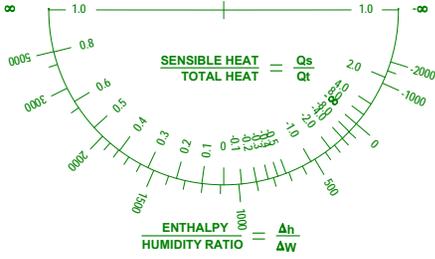


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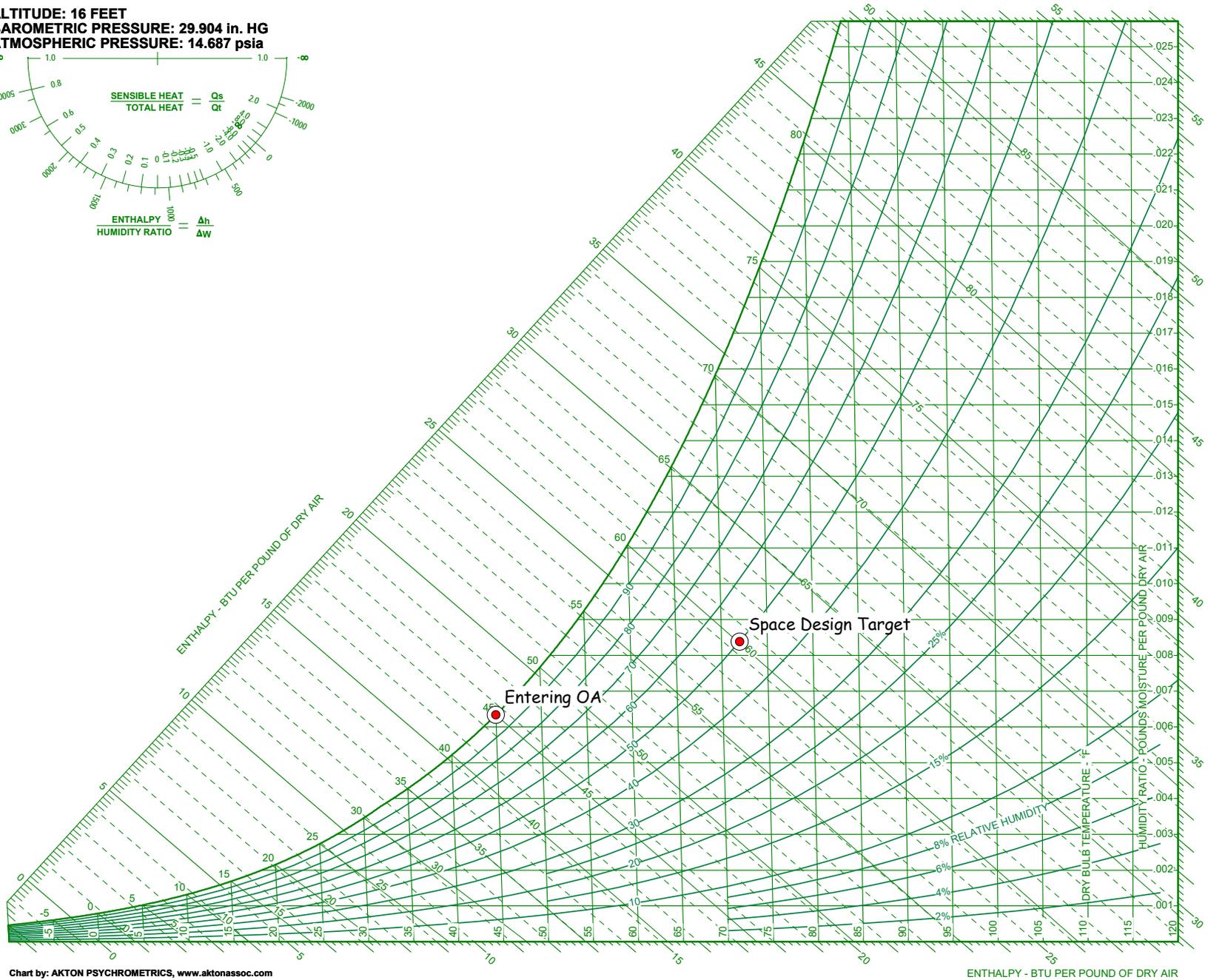
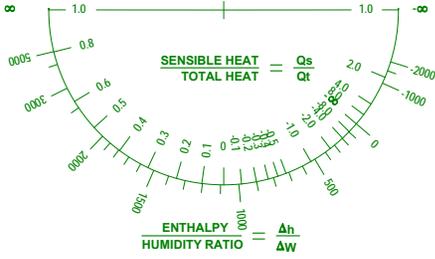


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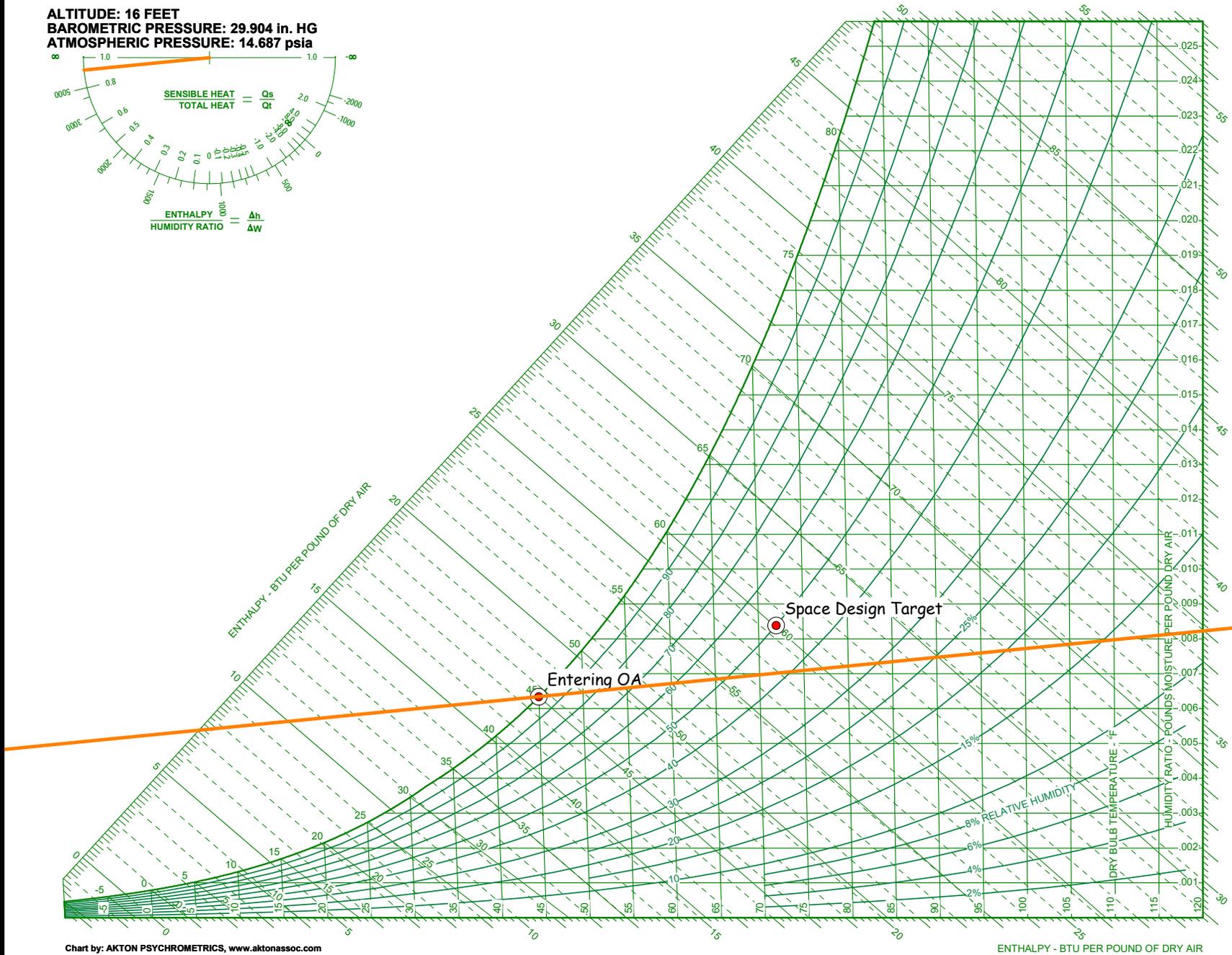
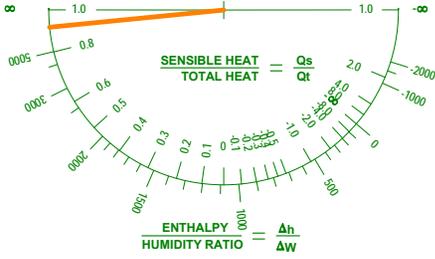


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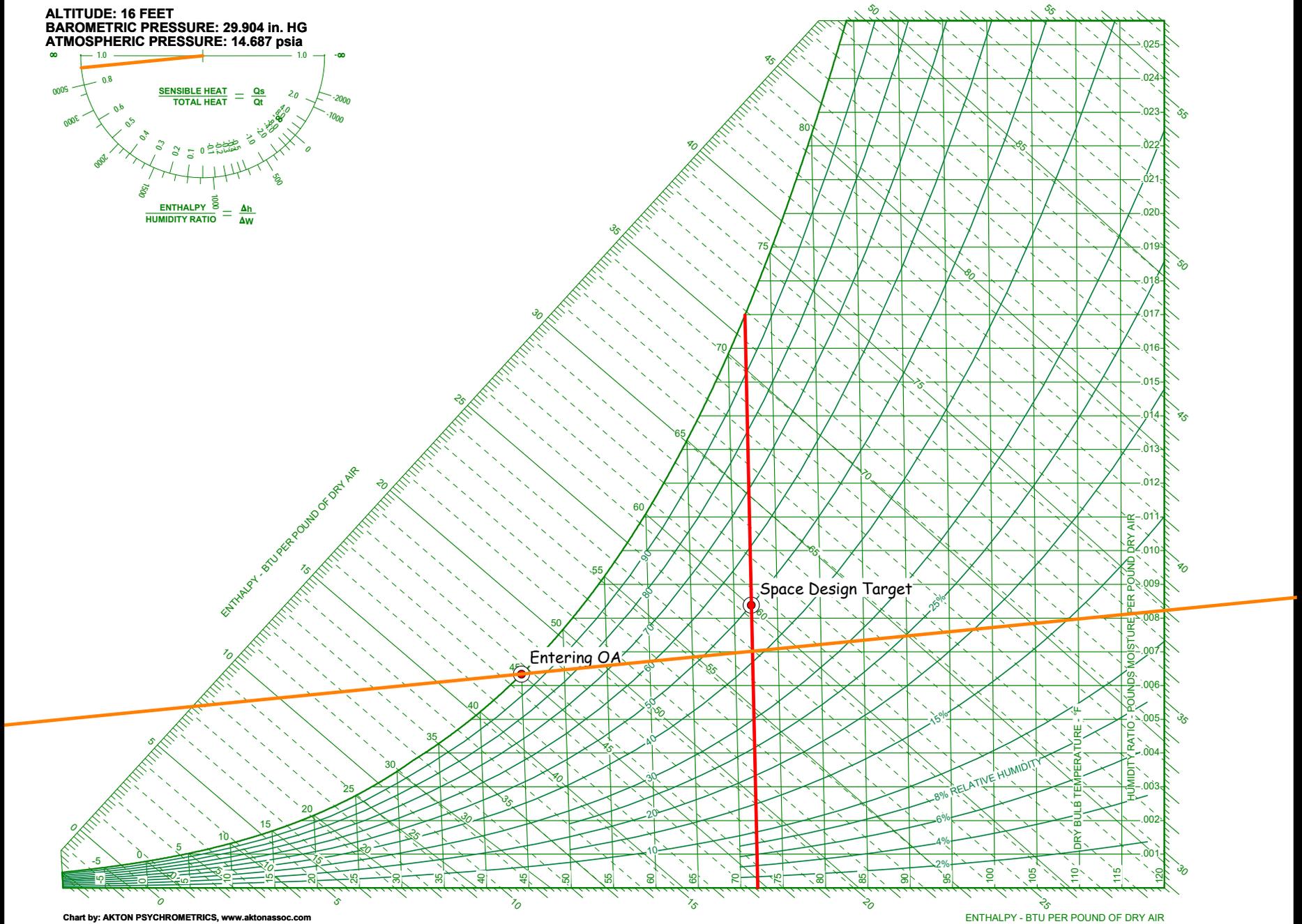
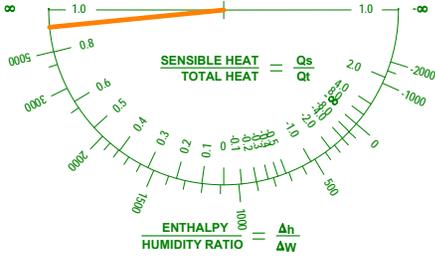


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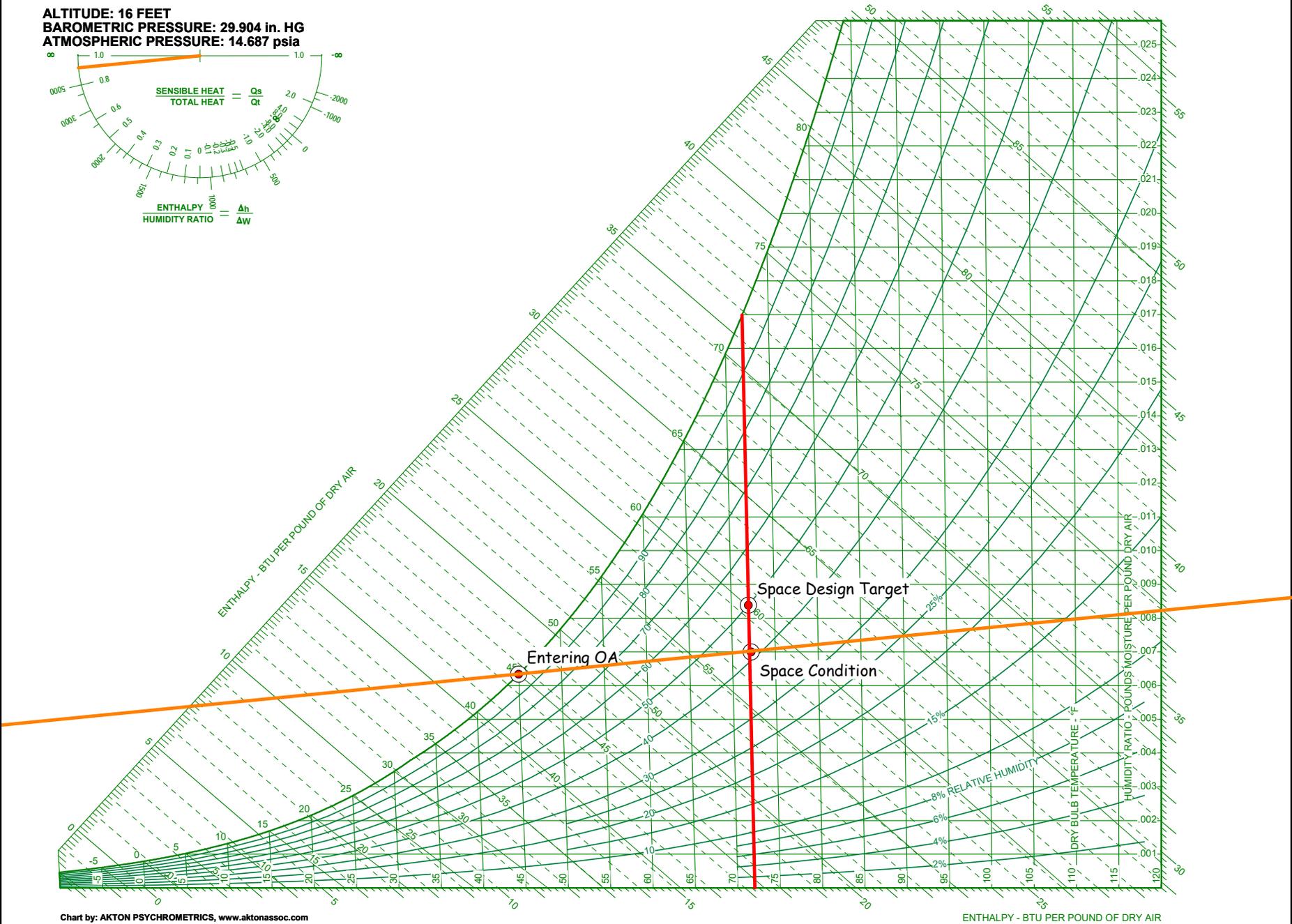
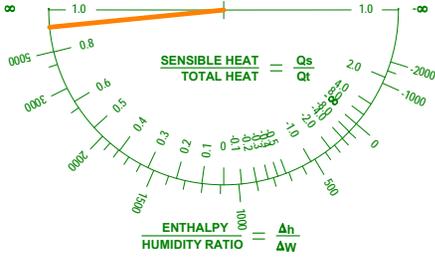


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A Discussion Point

Given:

- The same building
- It's $98^{\circ}\text{F}_{\text{db}}/76^{\circ}\text{F}_{\text{wb}}$ outside (the thunderstorm just passed through)
- The cooling coil discharge temperature is about 56°F

Do you think the space is at its design target?

If not, about what conditions do you think exist in the space?

What adjustment(s) would you need to make to get the space to its target?

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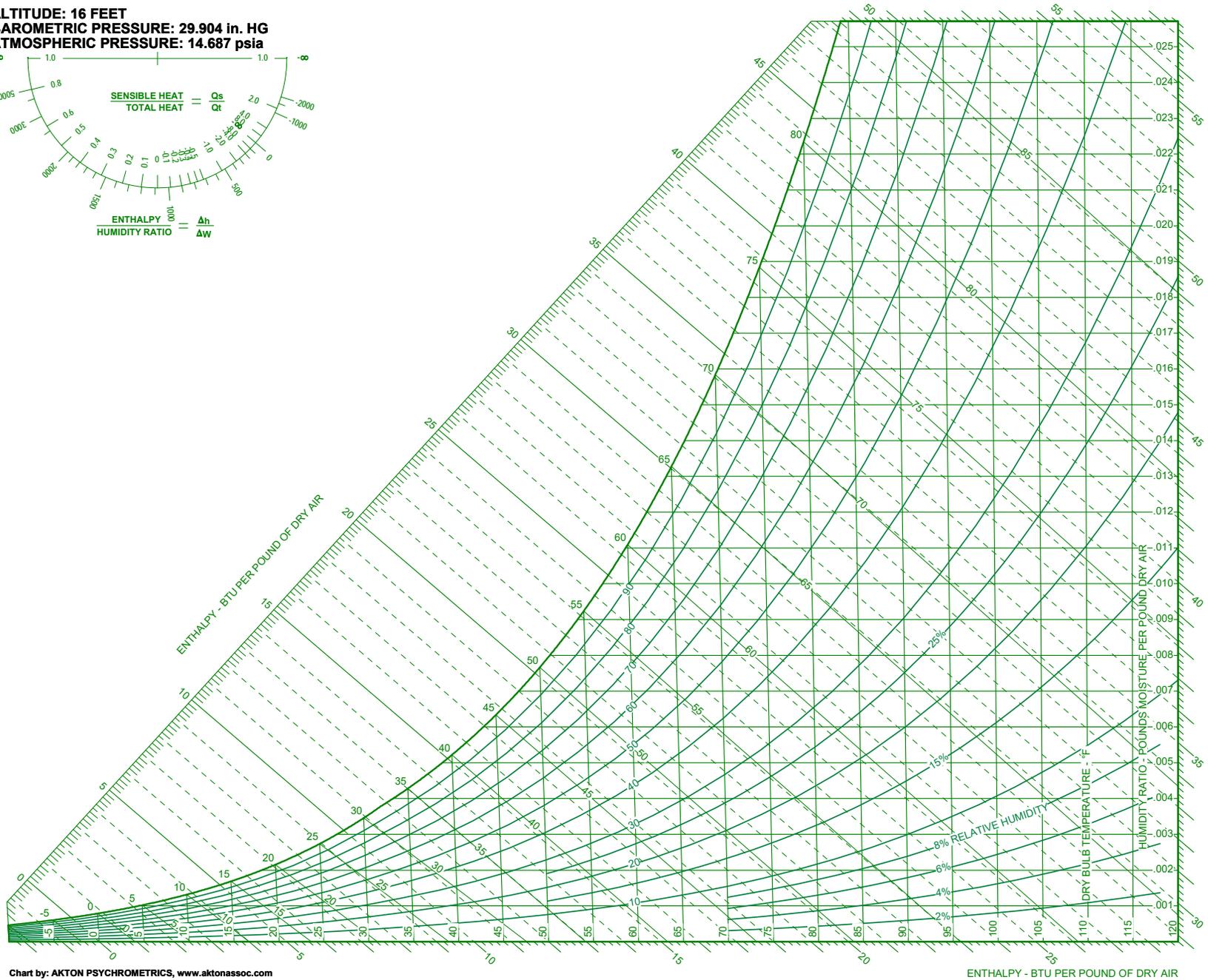
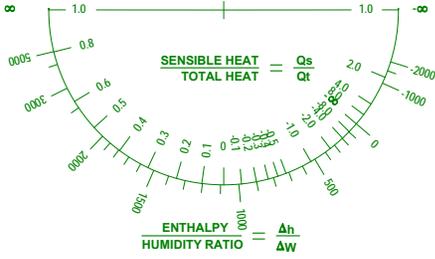


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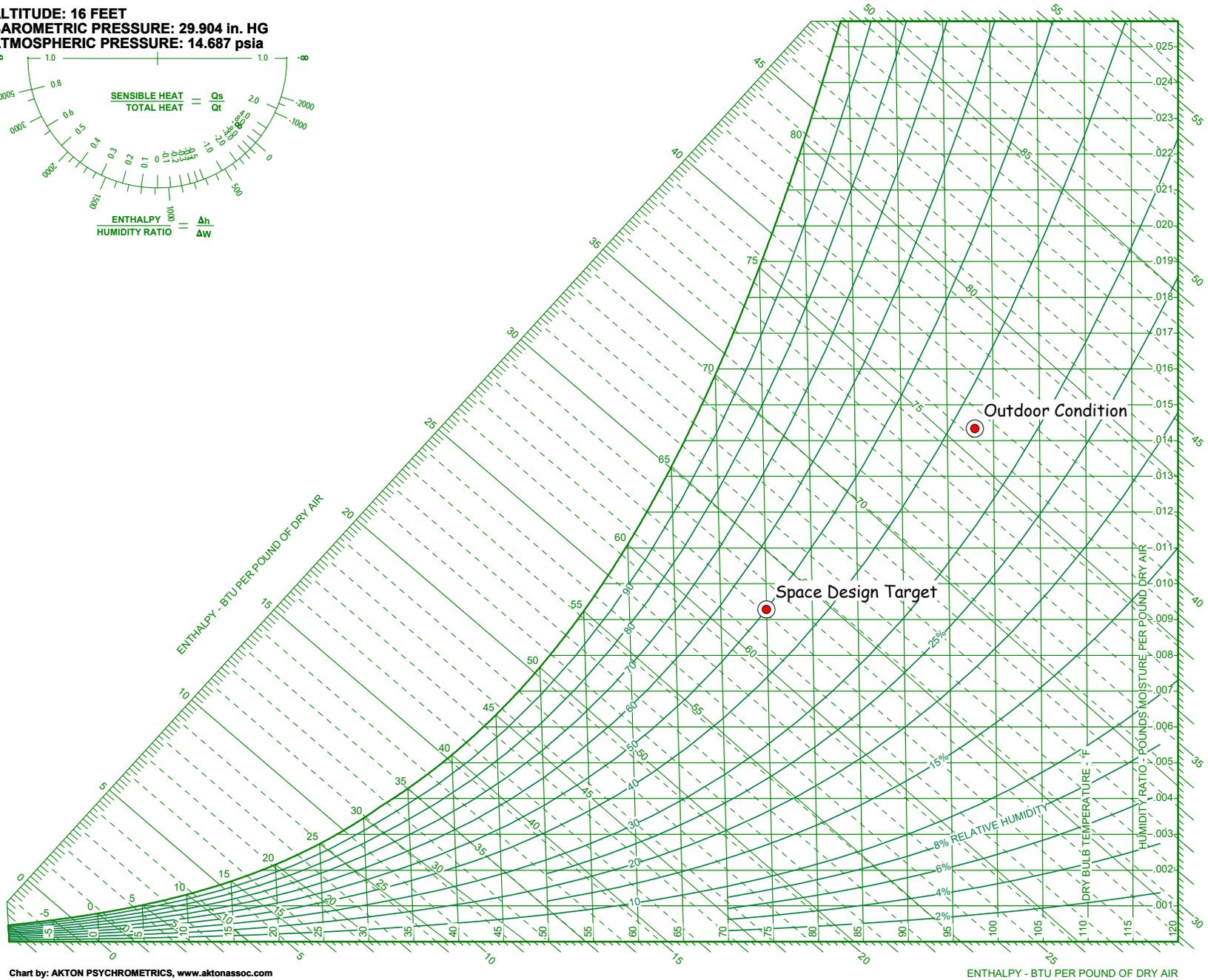
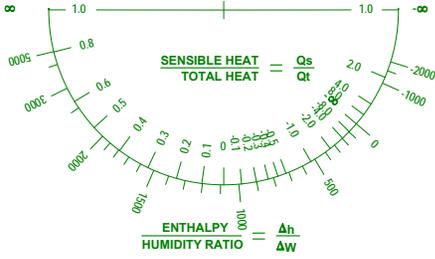


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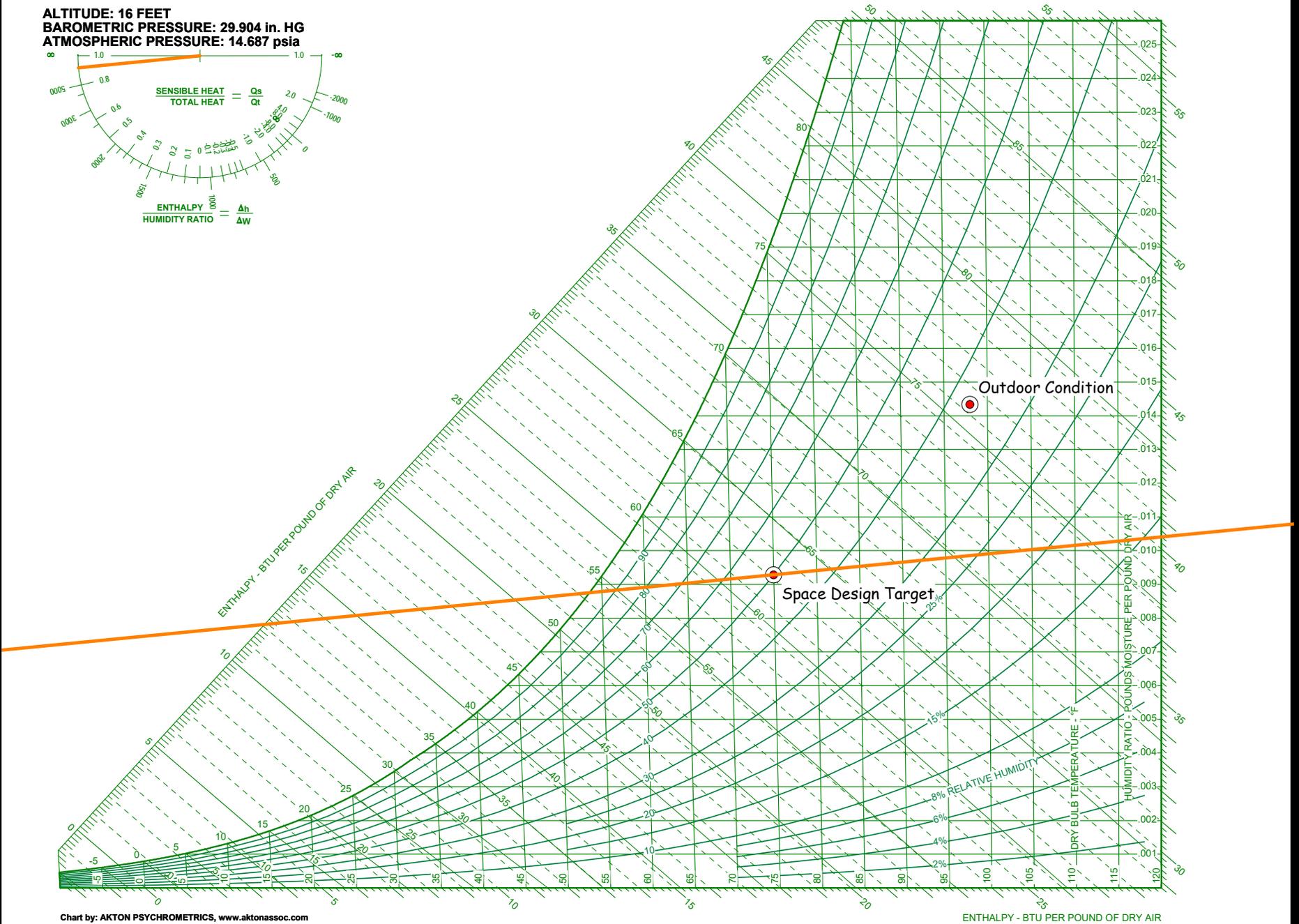
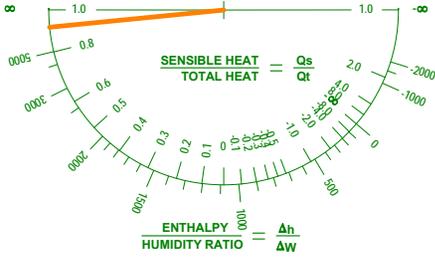


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ENTHALPY - BTU PER POUND OF DRY AIR

ALTITUDE: 16 FEET
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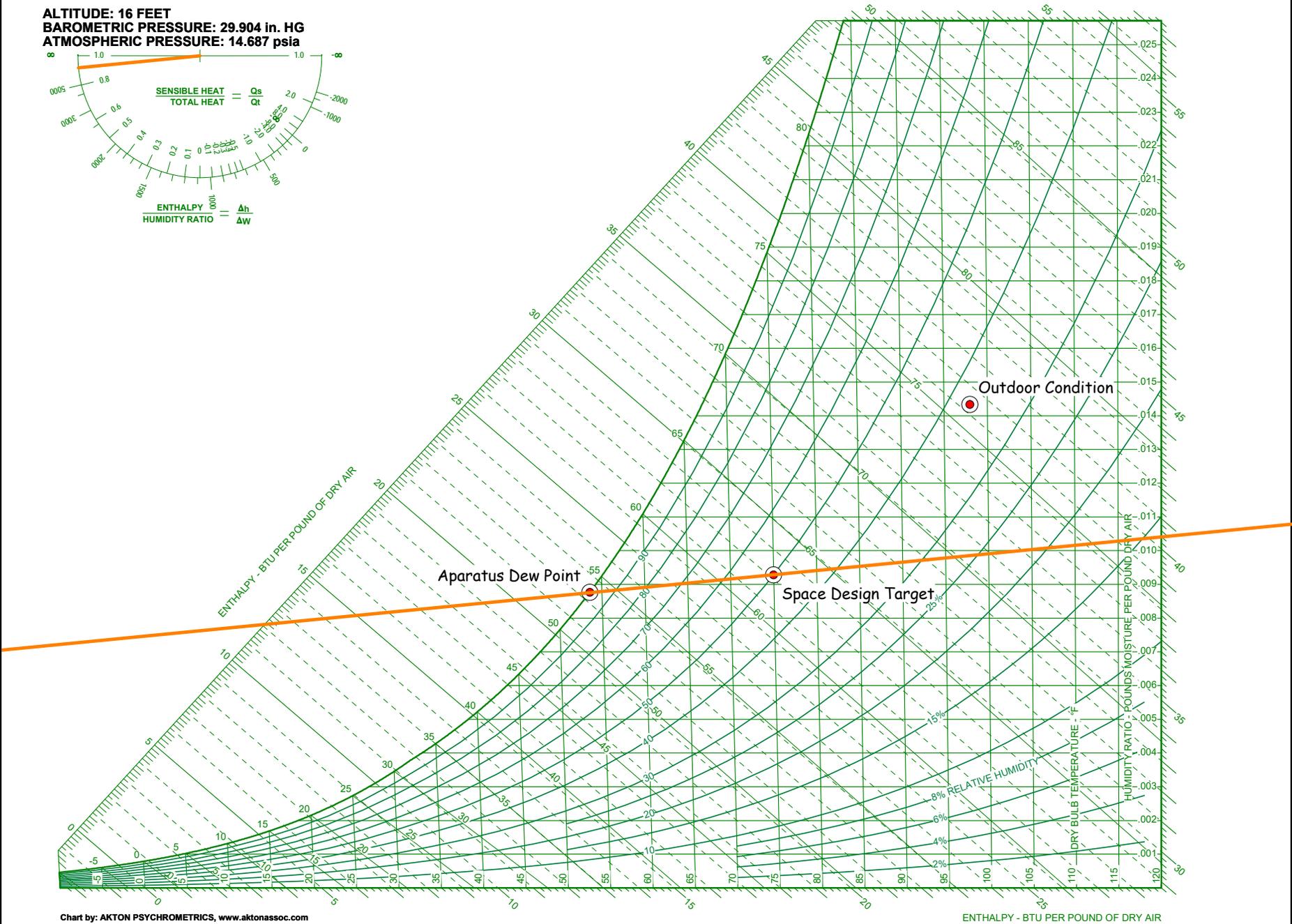
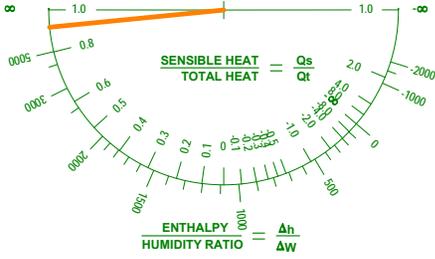


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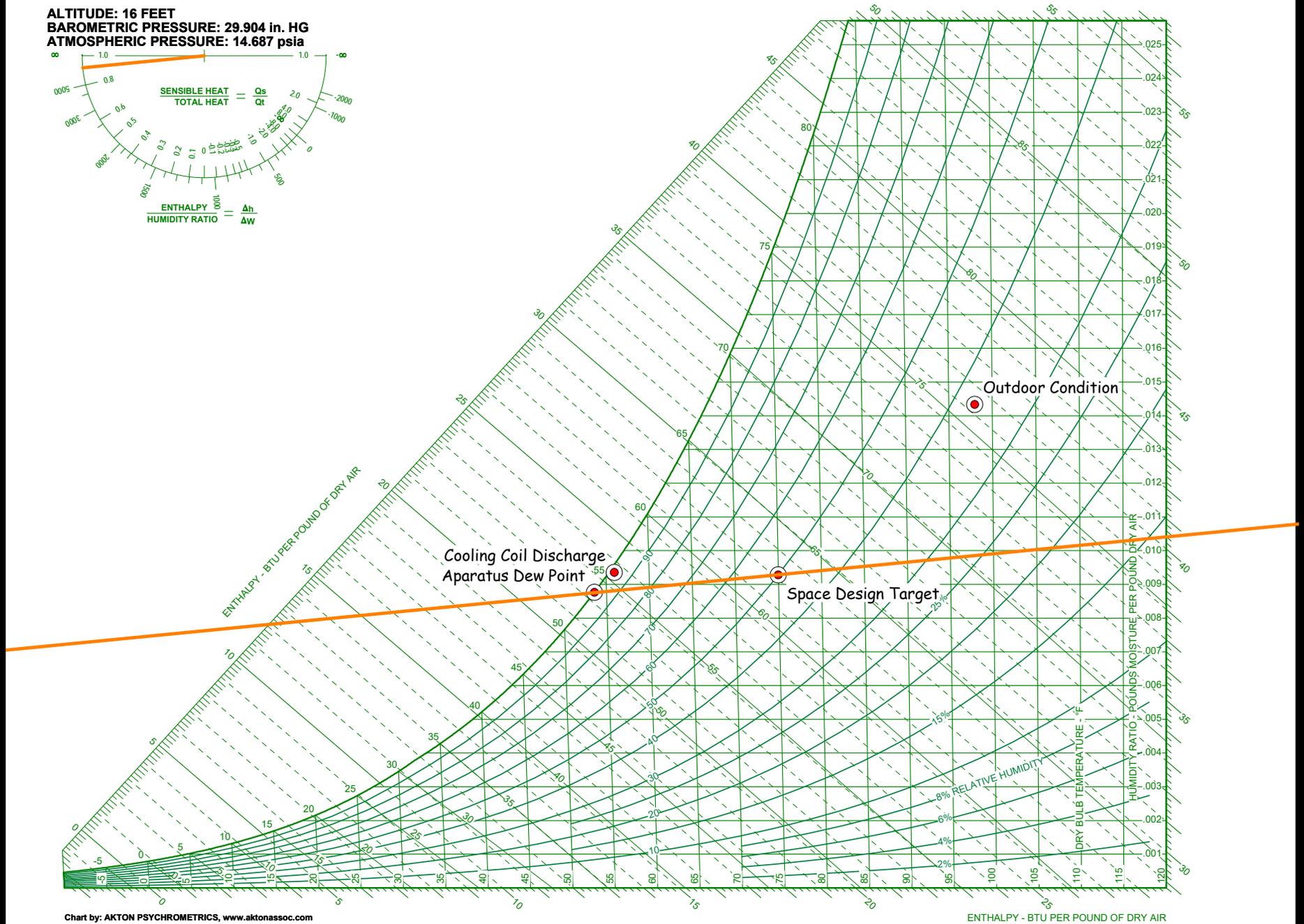
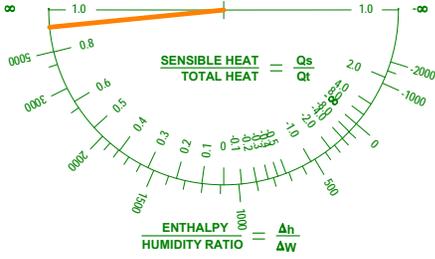


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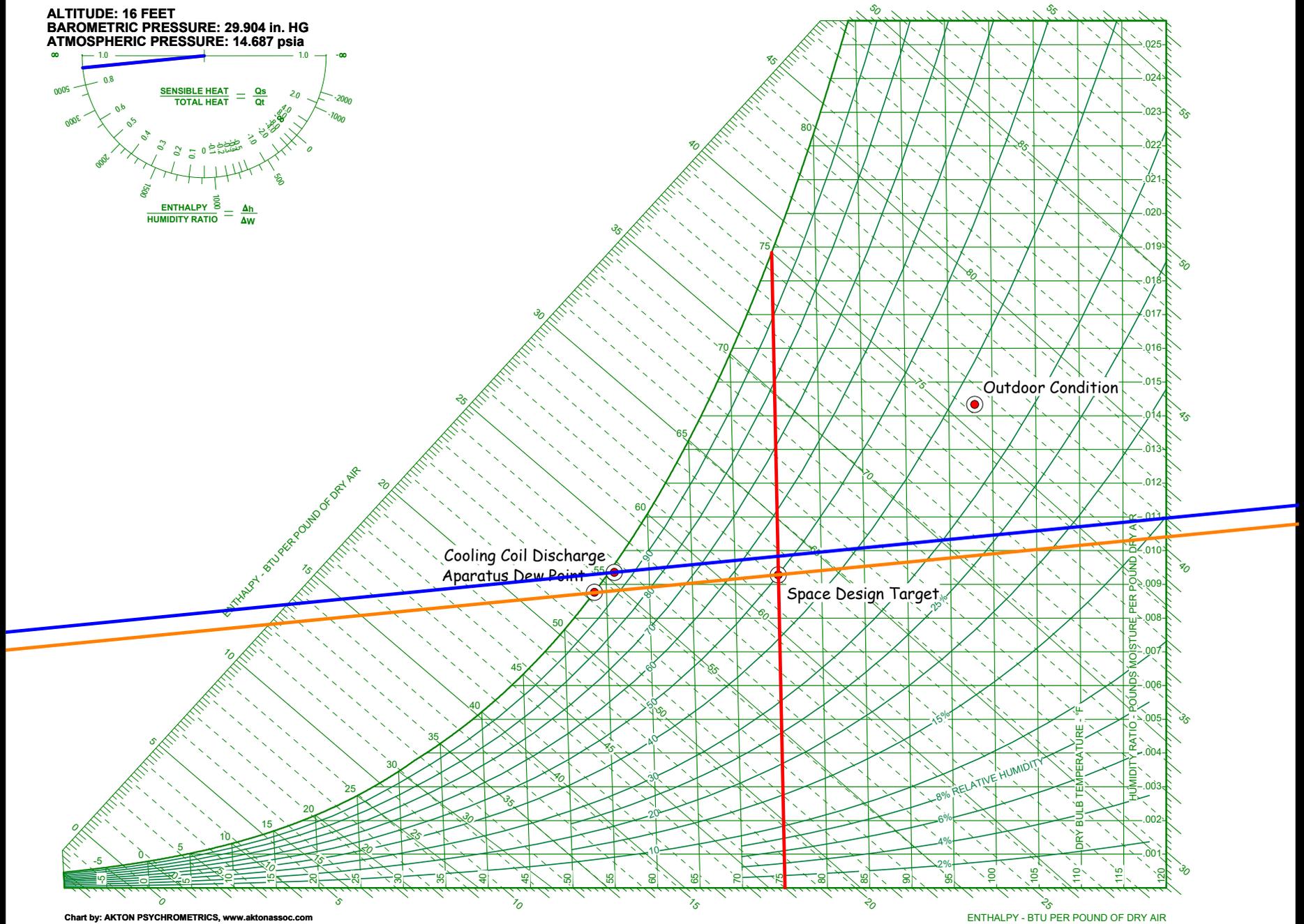
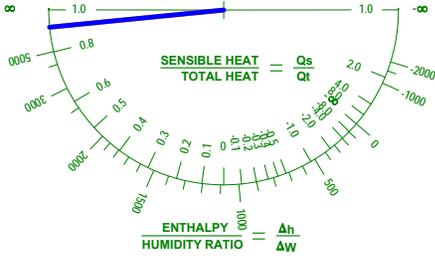


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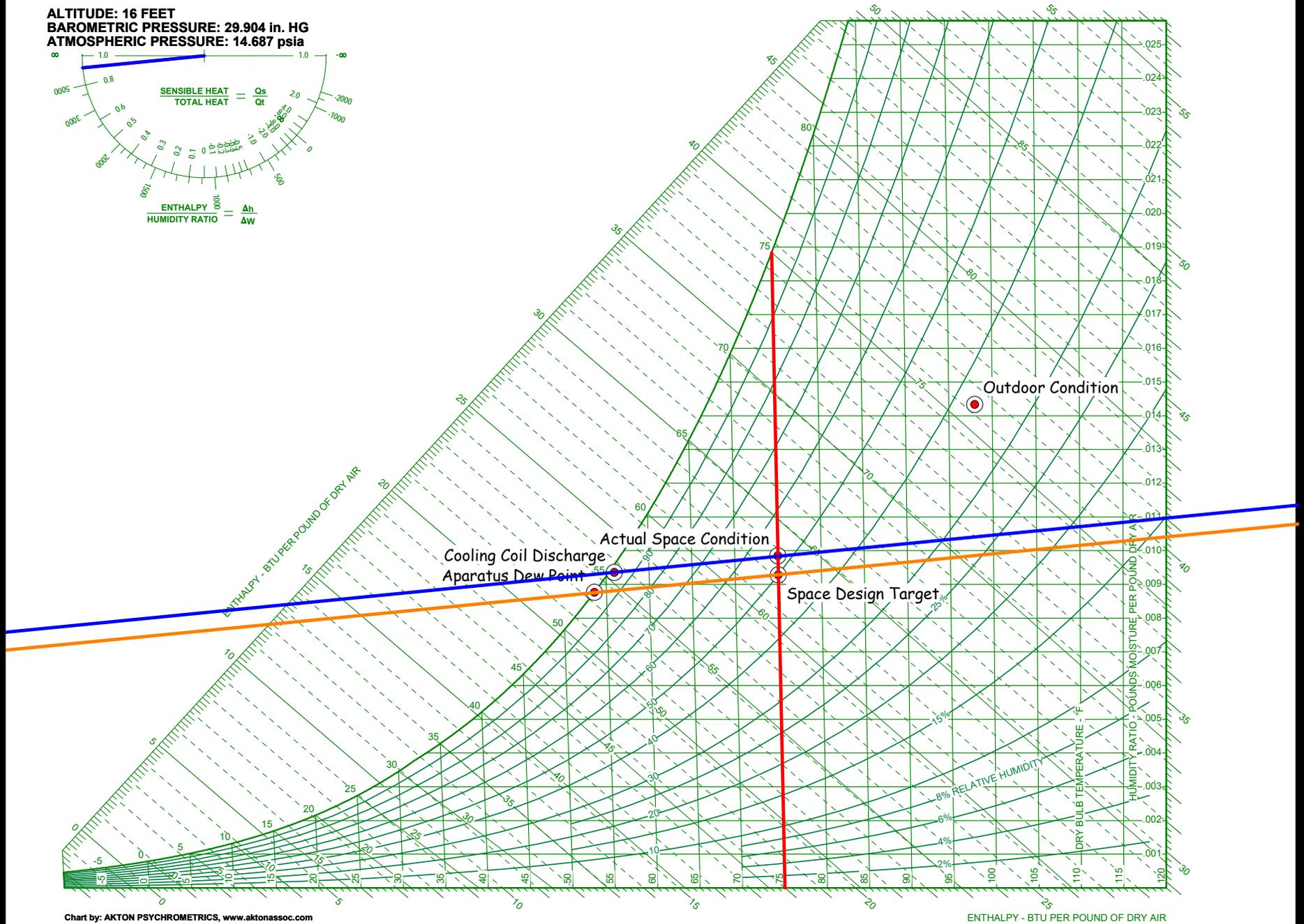
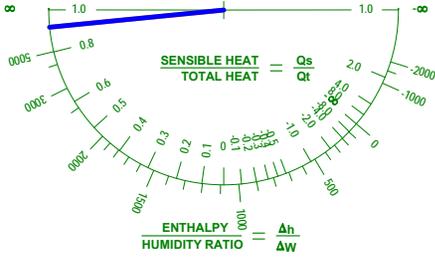
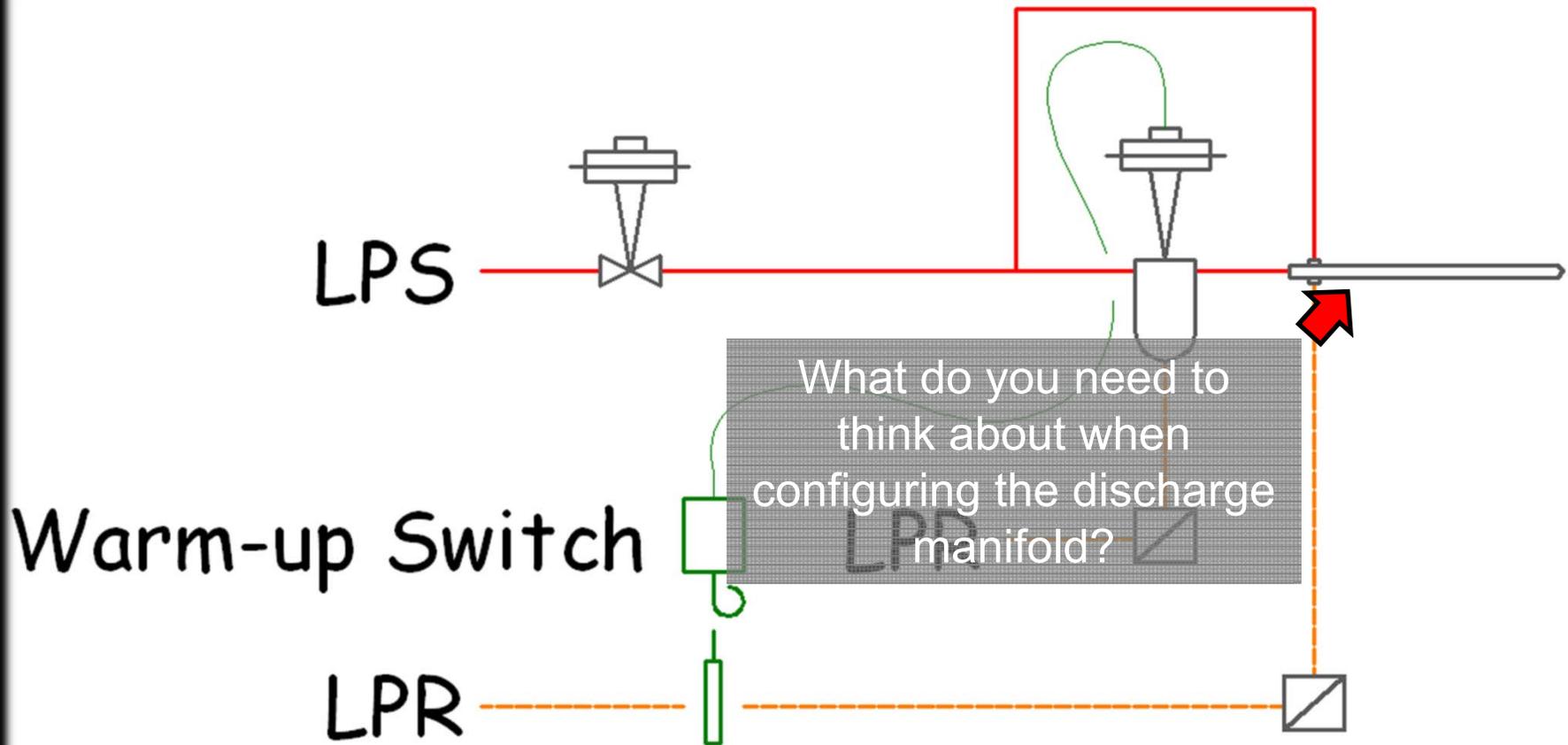
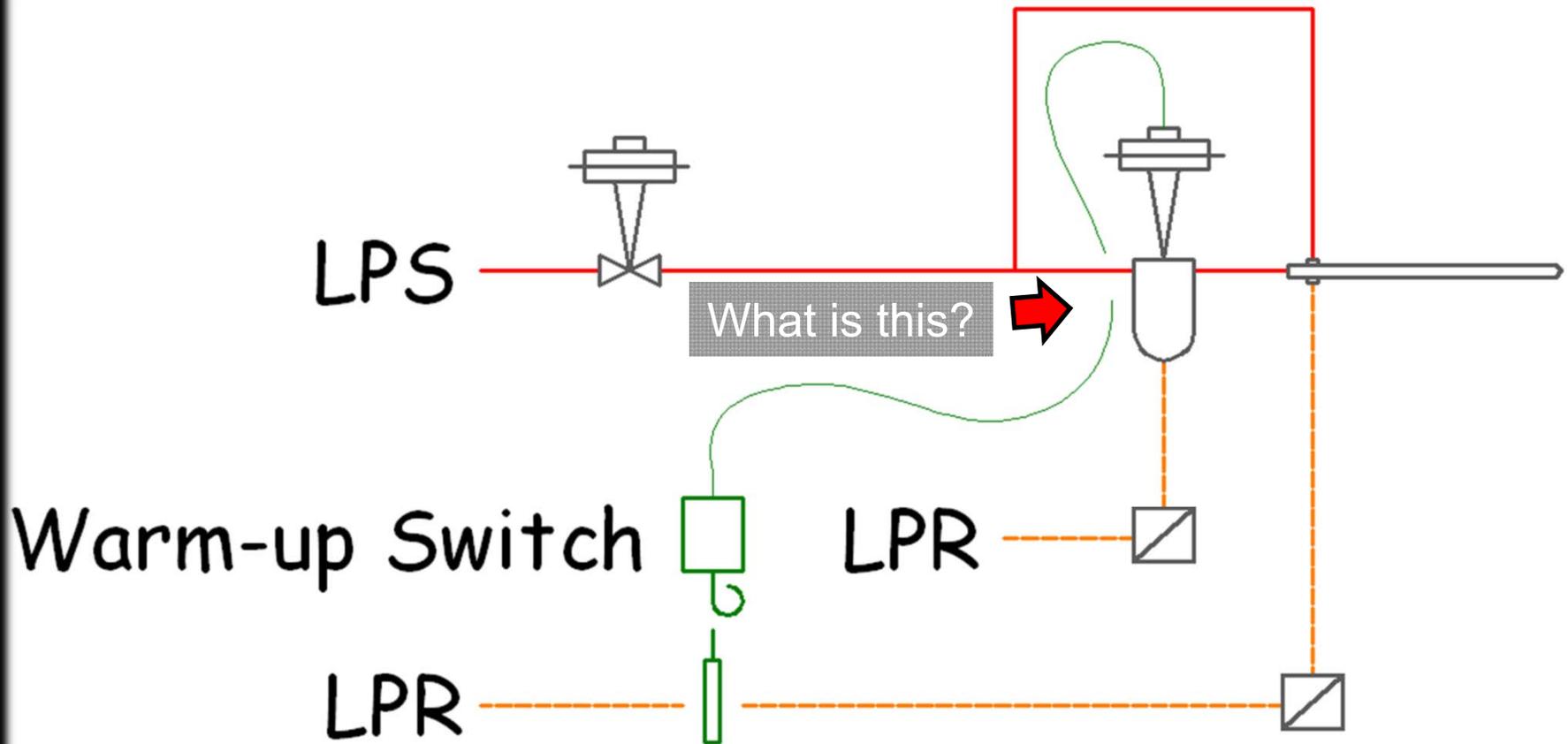


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Humidifier Details

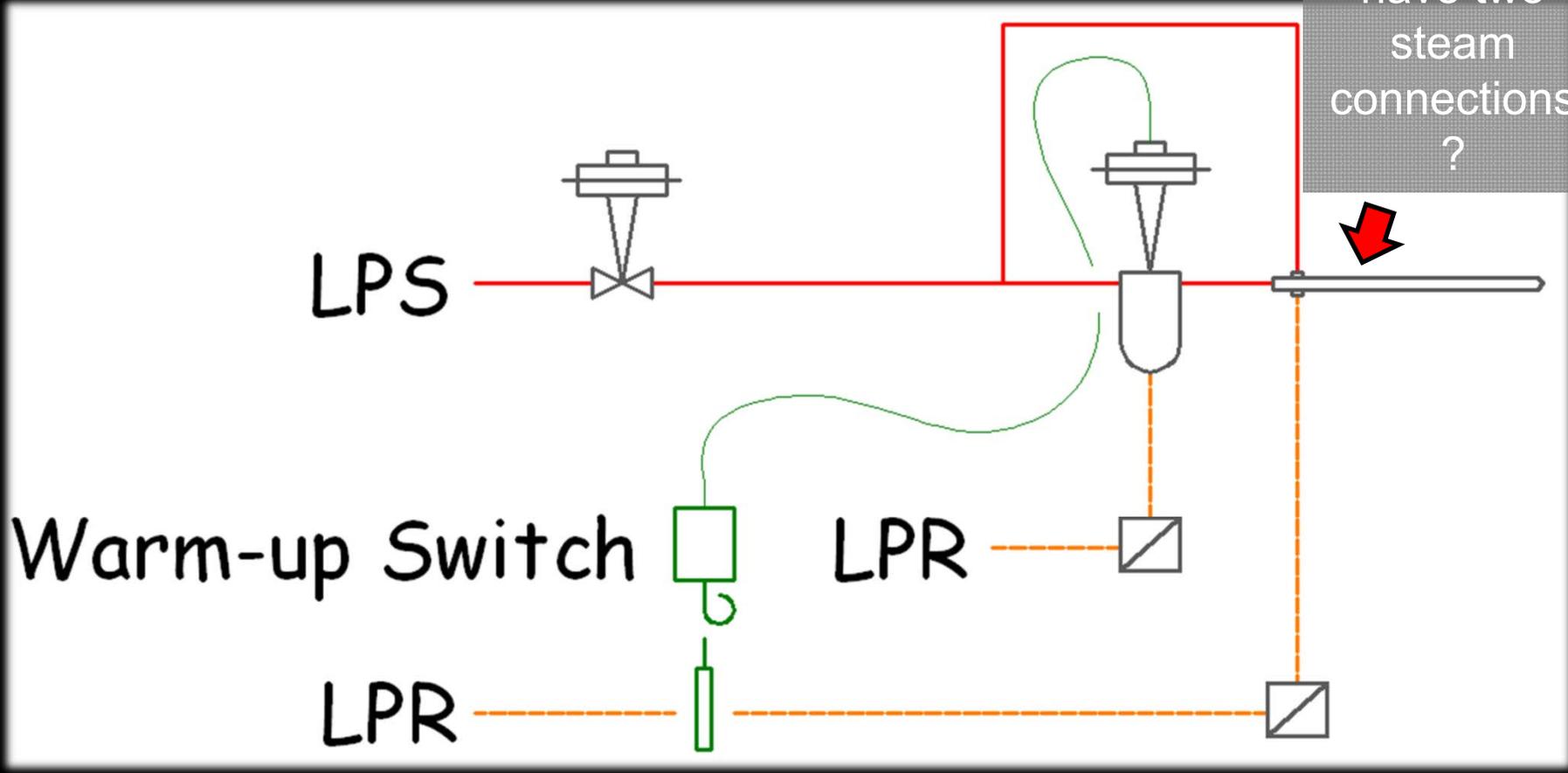


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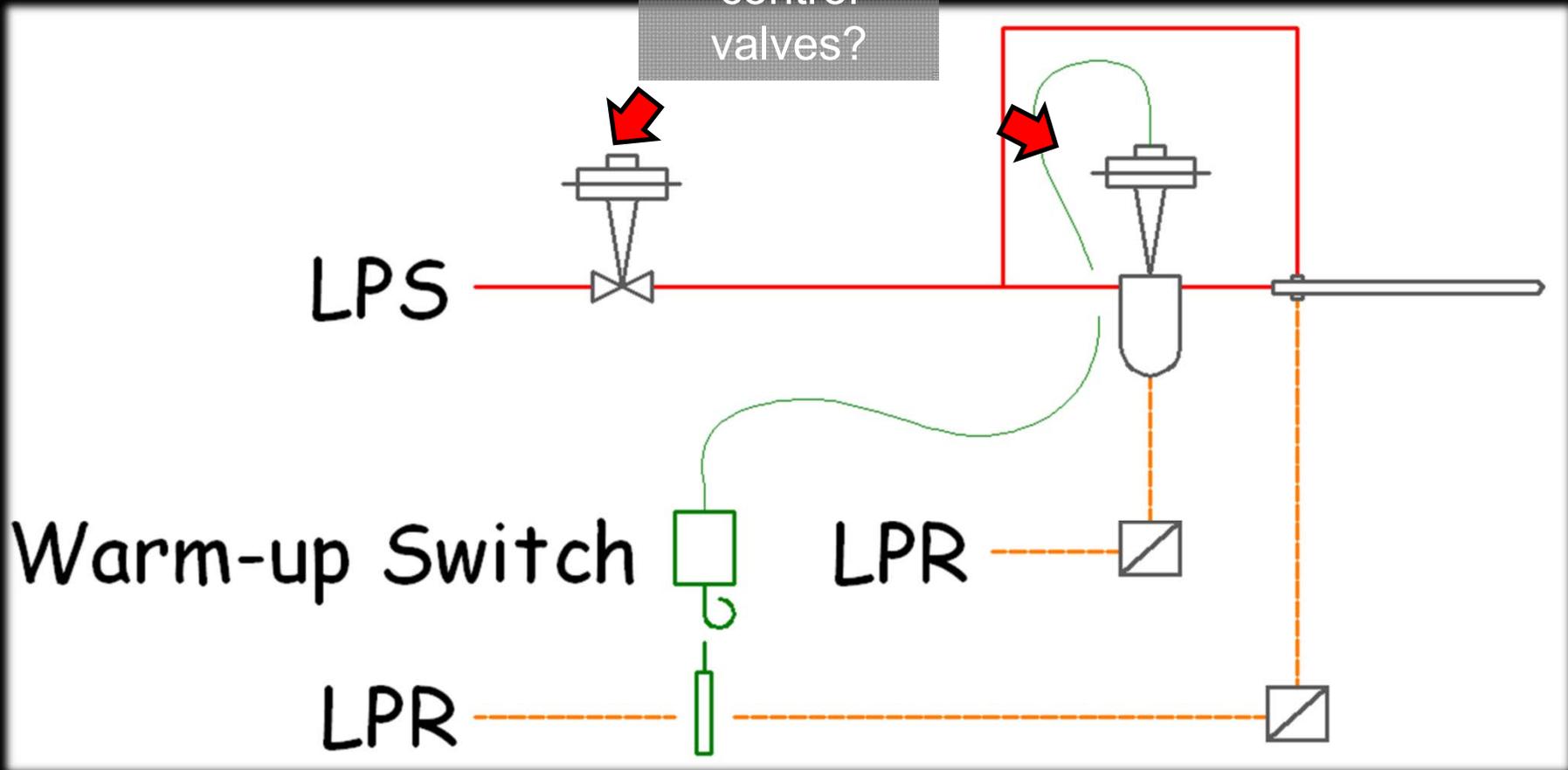
Humidifier Details

Why does the manifold have two steam connections ?

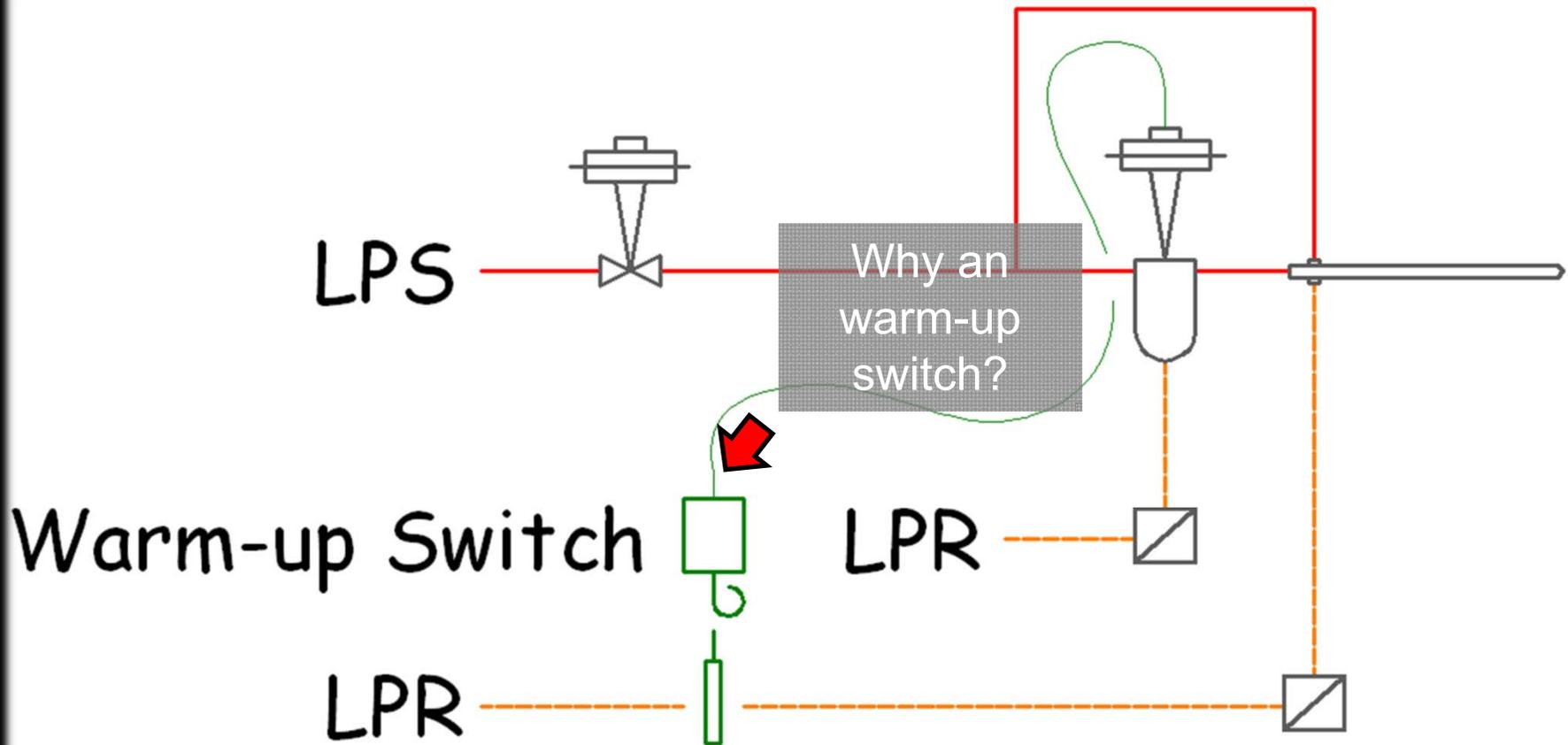


Humidifier Details

Why two control valves?

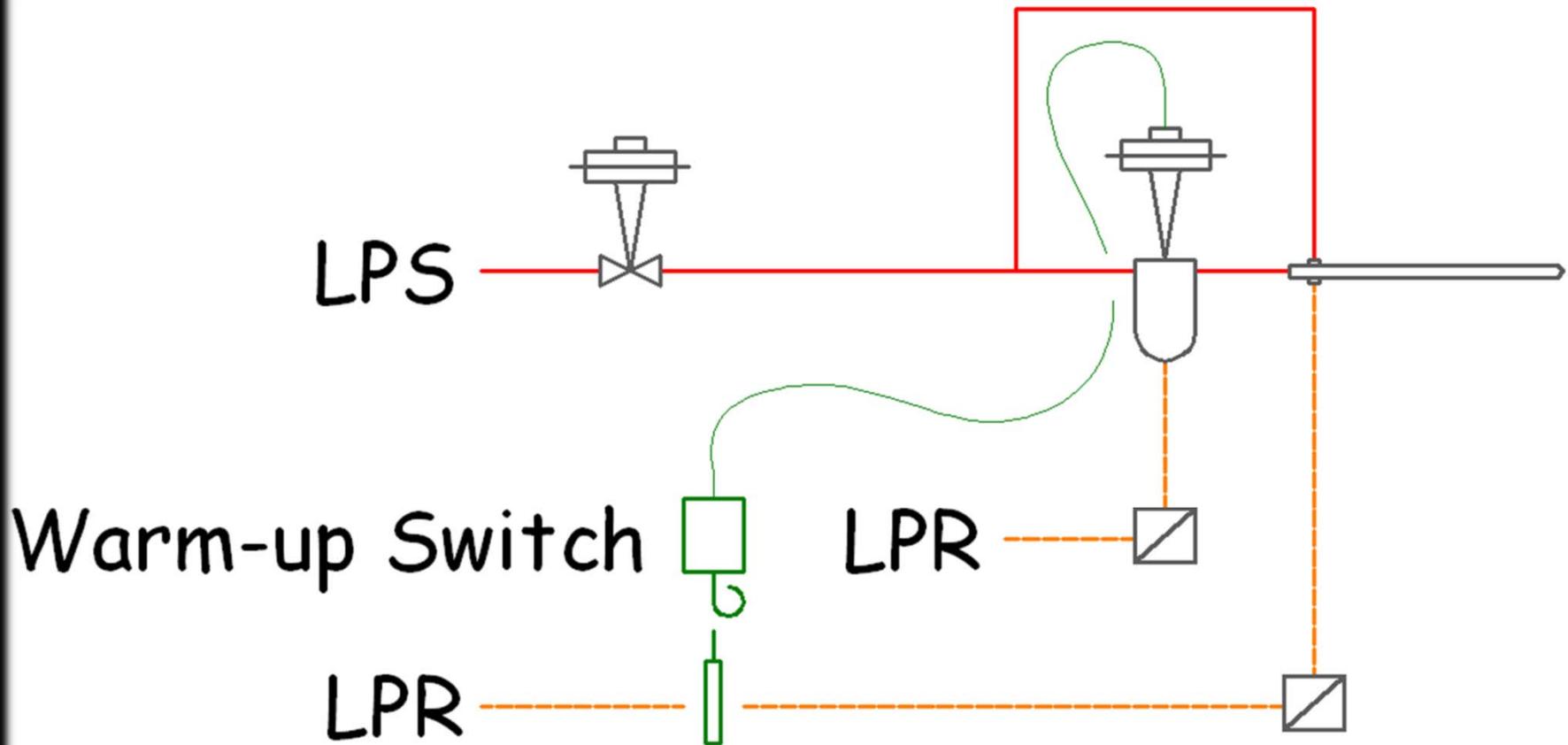


Humidifier Details



Humidifier Details

What would you need to consider in terms of interlocks if you were developing a control sequence?



Humidifier Details

What input would you use to control capacity modulation and why?

