Overcoming High Humidity in Operating Rooms

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I got a speeding ticket!

Yes or No?

- Do you get comfort complaints from surgeons regarding the Operating Room (OR)?
- Is the relative humidity (RH) higher than 50% in your OR?
- Would you like to save as much as 40% energy cost when treating the Outdoor Air for an OR?

If you answered YES

- Let’s start with Why?

Why?

- Wasn’t the OR designed by a group of professionals – an architect and engineers?
- Didn’t those professionals rely on standards and the local code to ensure great success?
- Didn’t the plans get reviewed before construction began?
- Wasn’t the installation performed by licensed contractors?
- Didn’t someone sign off on the final product?

Standards and Codes

- **American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)**
- **Facility Guidelines Institute (FGI)**
- **Joint Commission**
- **National Institutes of Health (NIH)**
- **QUAD A (The Global Accreditation Authority)**

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- What about the surgeon?

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- What about those using the OR during the occupied period?

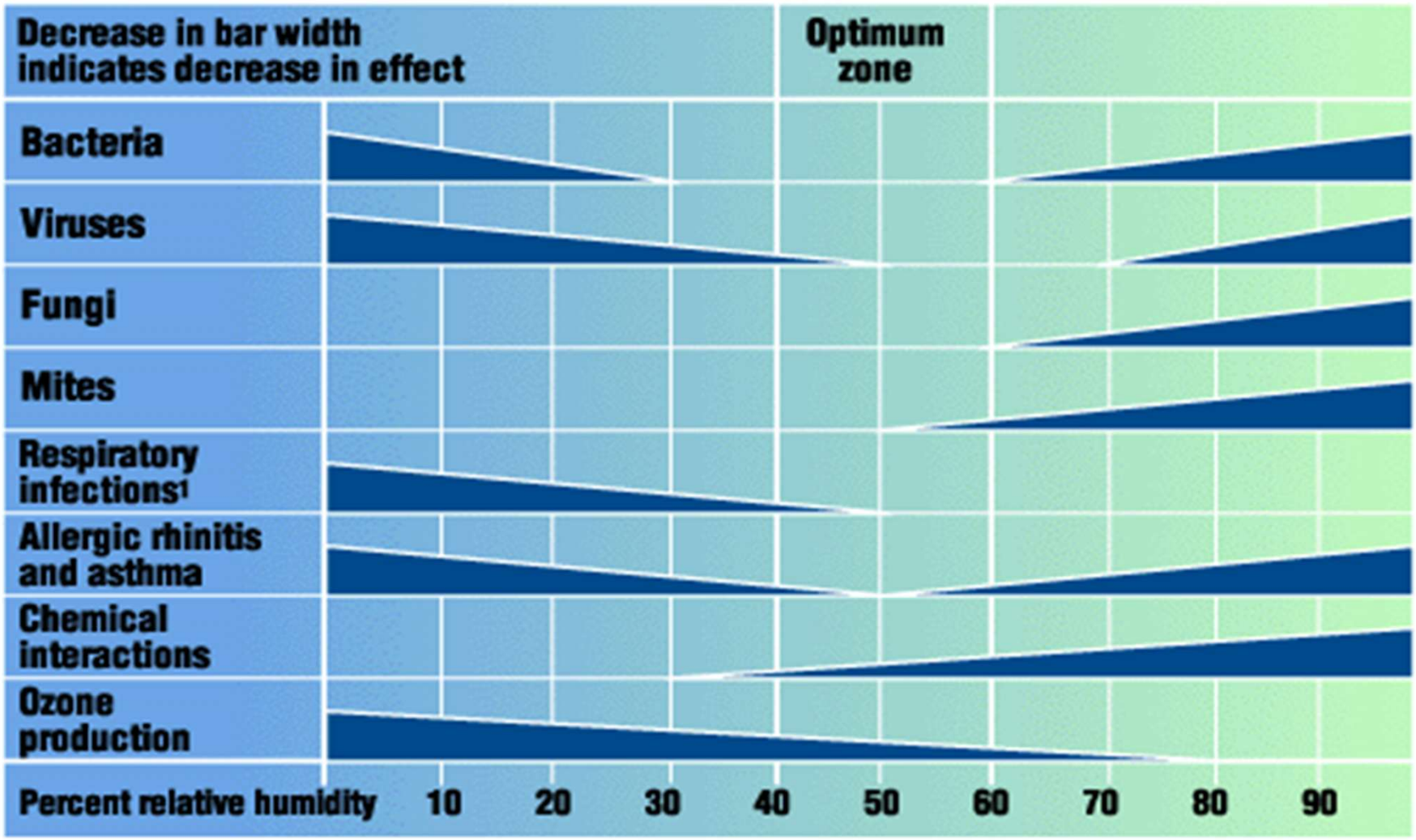
So, why is there high humidity?

- What about the surgeon?
- What about those using the OR during the occupied period?
- Did these folks get to weigh in based on their preferences/requirements?

Standards vs. Surgeon Preference

- ASHRAE Standard 170, among other things, addresses temperature and humidity and ventilation rates
  - 68 to 75 degrees F (a dry bulb measurement)
  - 20% to 60% Relative Humidity (RH)
  - 4 Outdoor Air Changes per hour
  - 20 Supply Air Changes per hour
- Surgeon preference:
  - Low to middle 60s F
  - “If 60% RH is the best we can get, okay” but…

Effect of Room Relative Humidity on Selected Human Health Parameters



[1] Insufficient data above 50% R.H.

Source: Sterling (1984) ASHRAE Transactions V. 90, Part 2.

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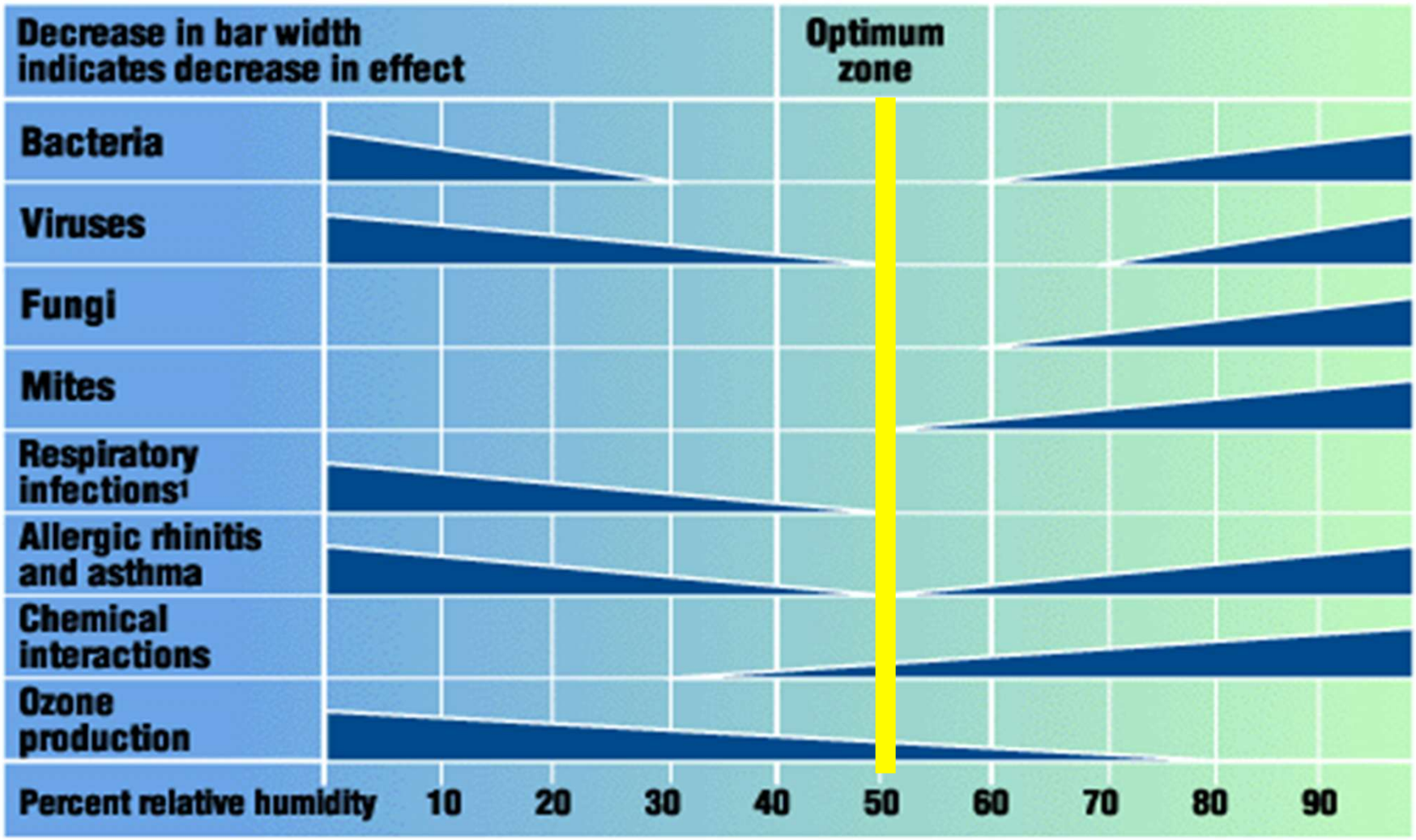

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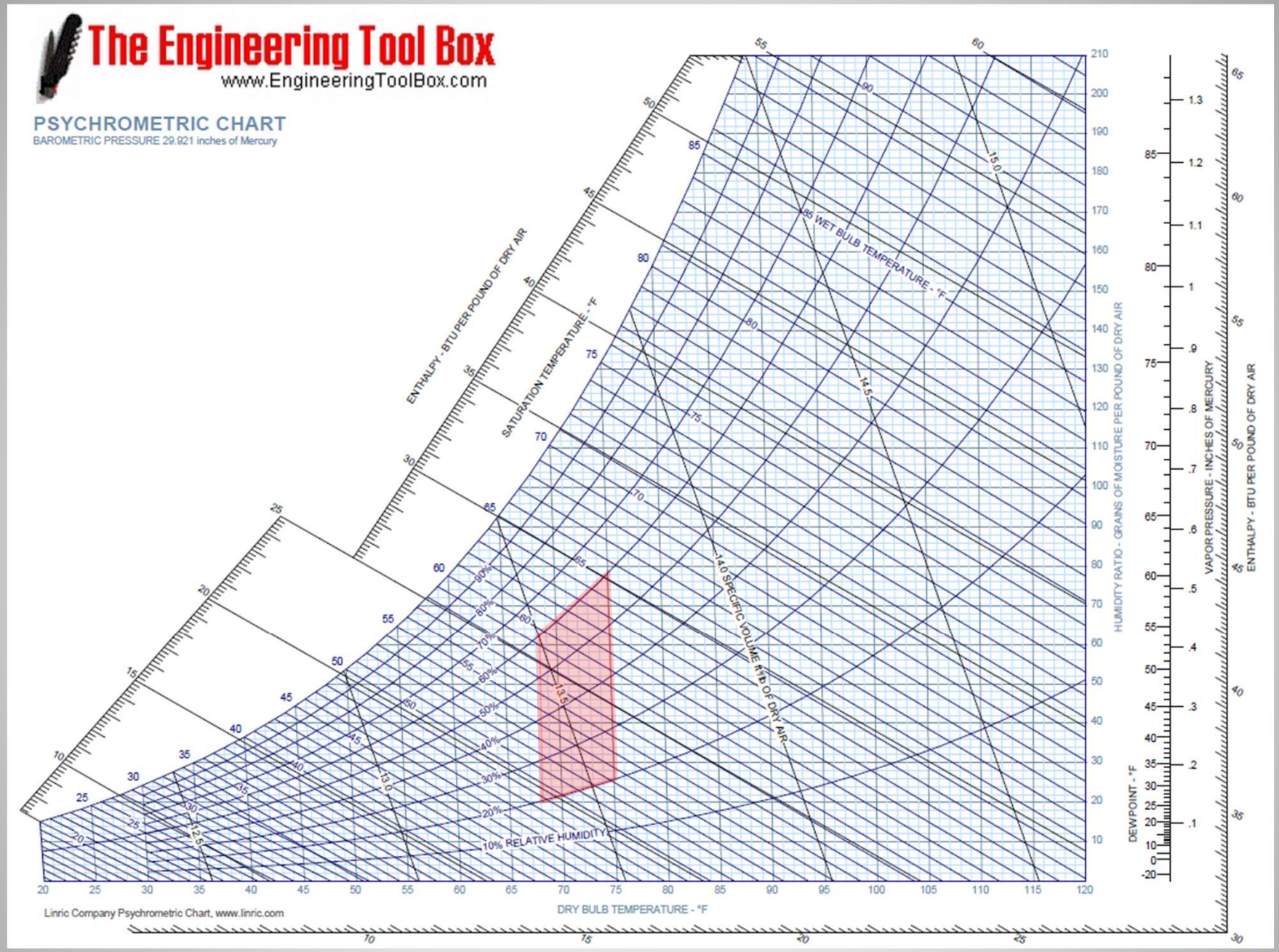
Scenarios and Outcomes

- Warning
- The next slides capture design conditions allowed by the standard at 68 F to 75 F and RH between 20% and 60%


The Engineering Tool Box
www.EngineeringToolBox.com
PSYCHROMETRIC CHART
BAROMETRIC PRESSURE 29.921 inches of Mercury
ENTHALPY - BTU PER POUND OF DRY AIR
SATURATION TEMPERATURE - °F
85 WET BULB TEMPERATURE - °F
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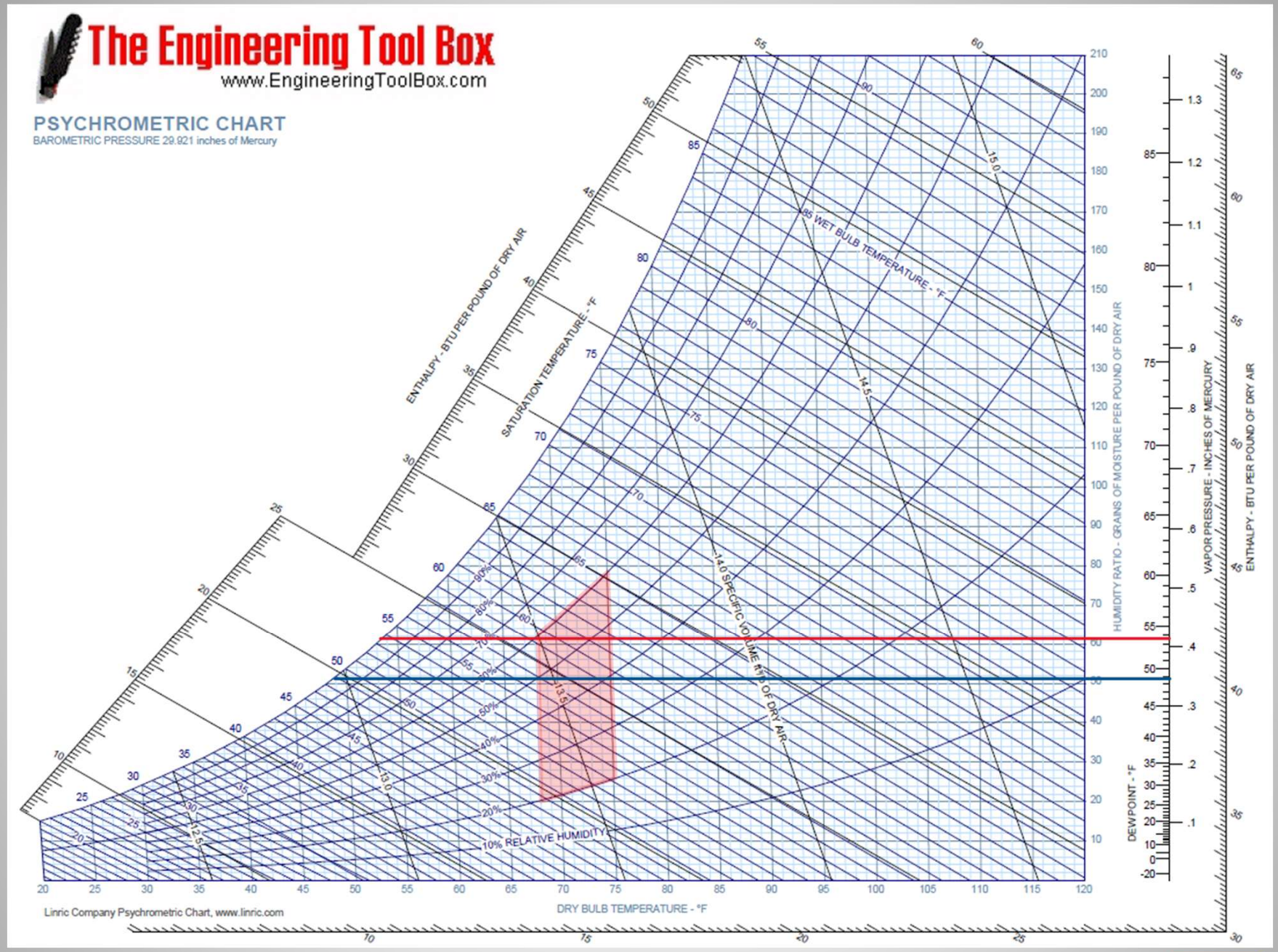
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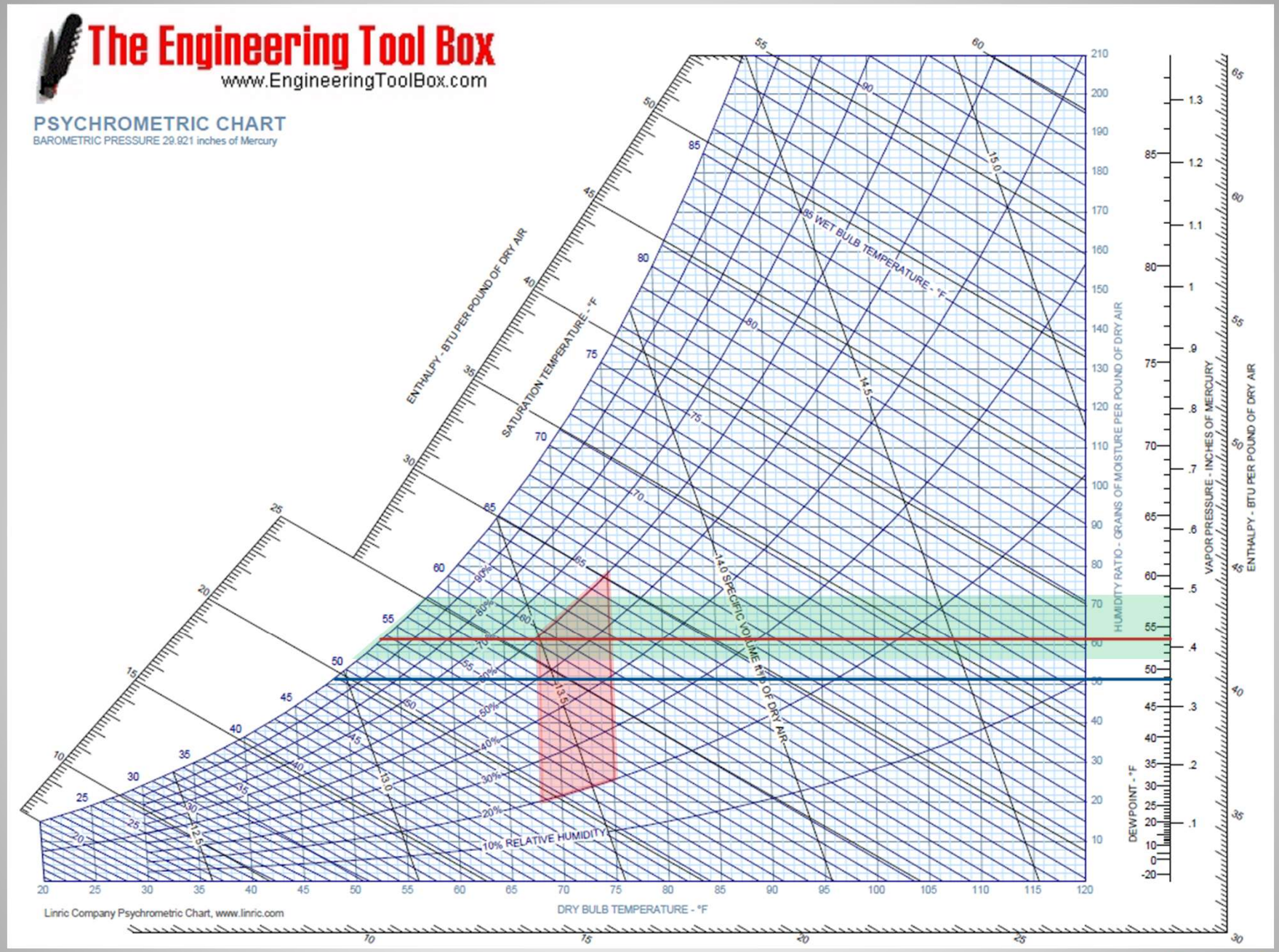
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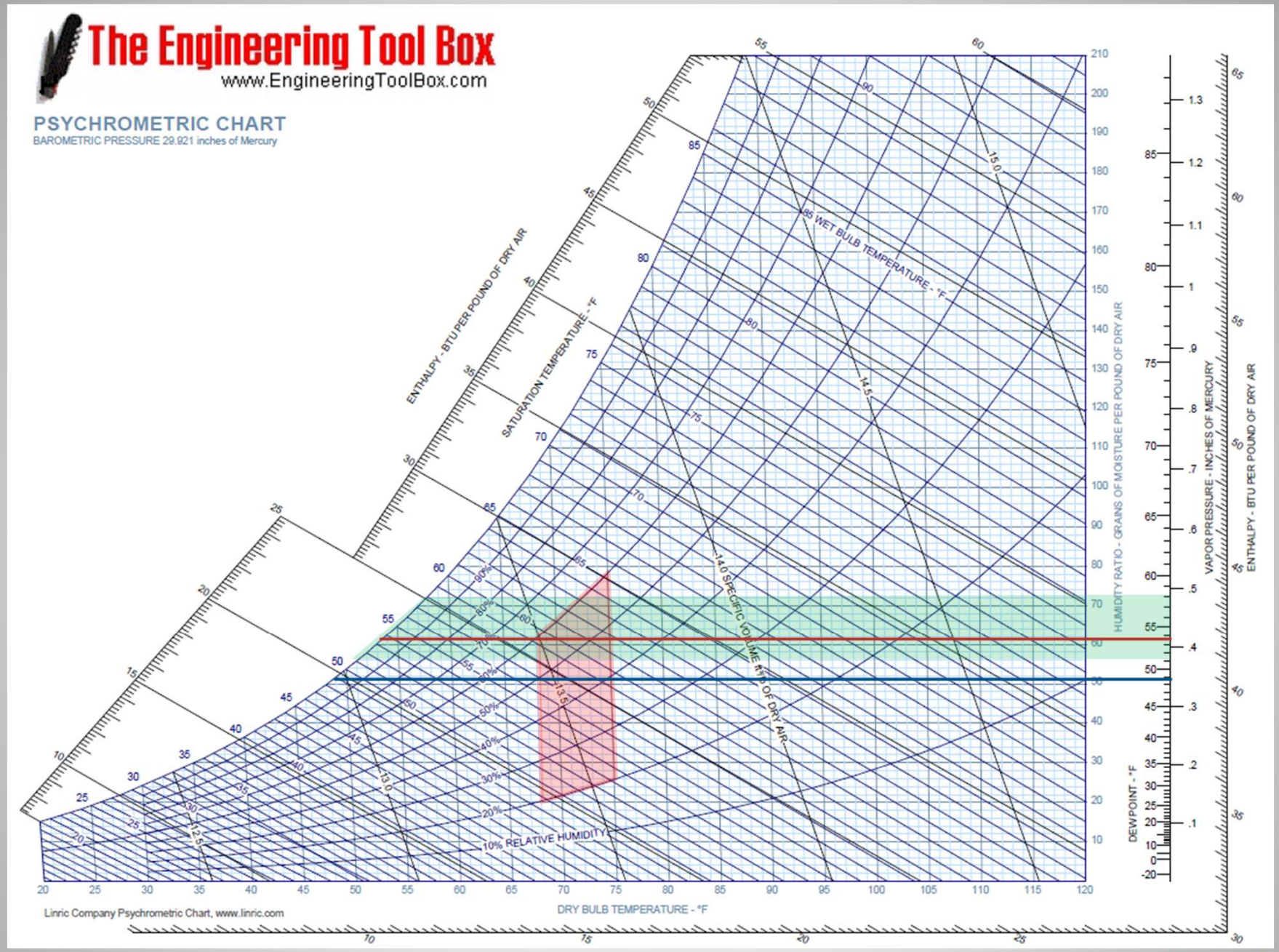
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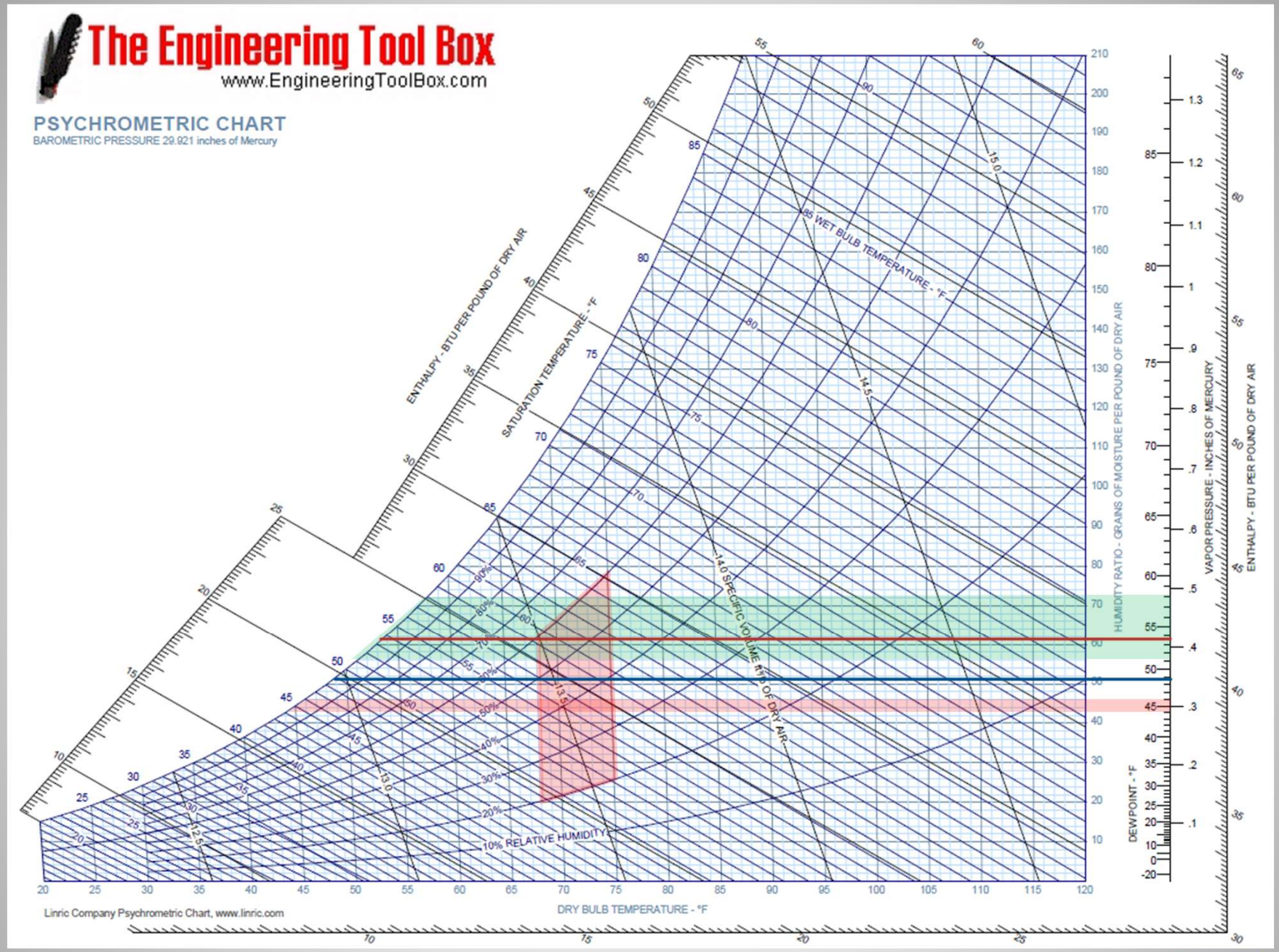
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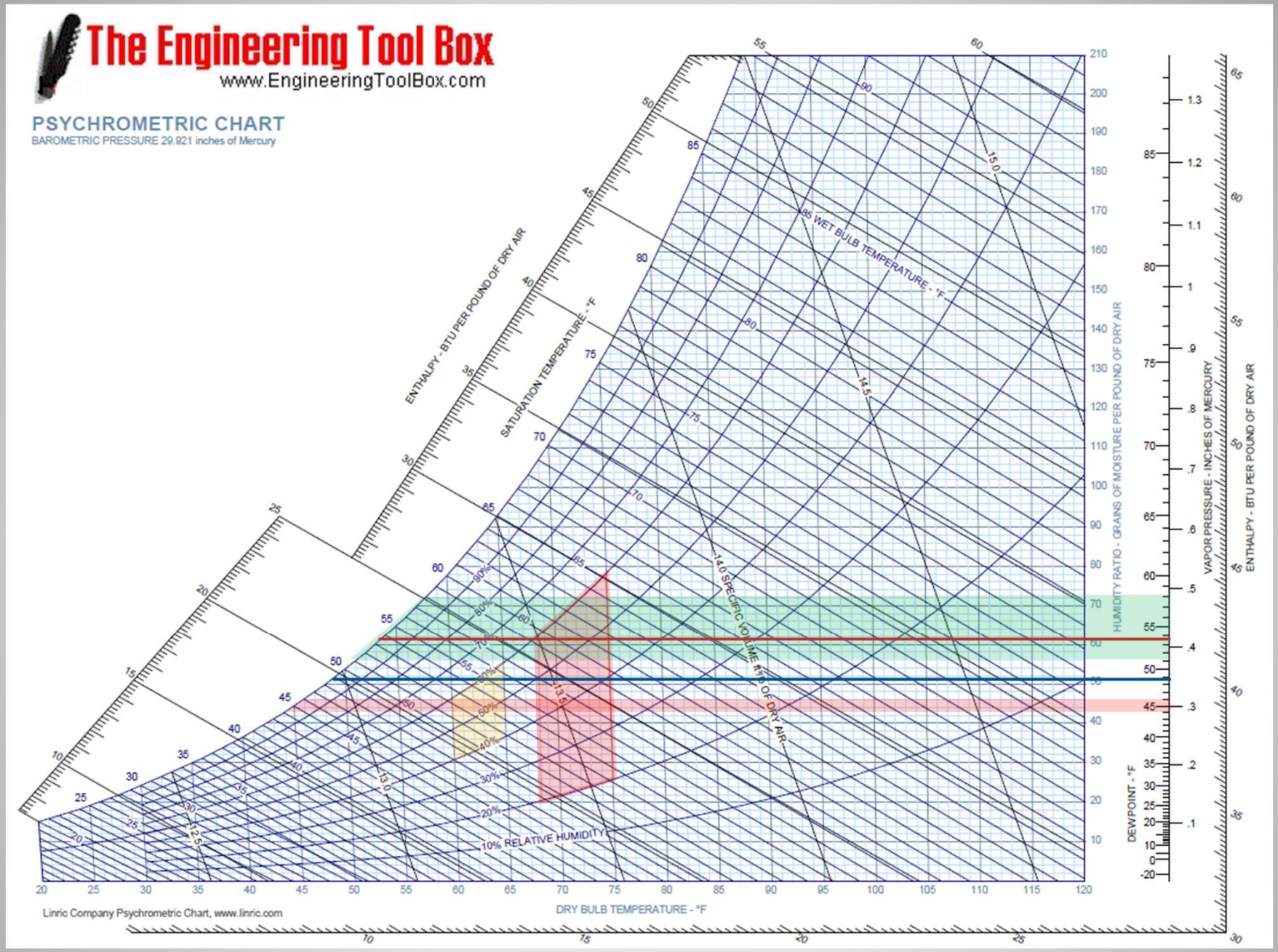
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Practical approaches to lower humidity

- We observed that DX and chilled water systems alone cannot get space relative humidity low enough to be in an acceptable range of the standard – especially when surgeons are asking for lower OR temps
- A low temp chiller can get you there with a 65 degree space temp – using a lot of energy!
- But there is a real solution…

Desiccants!

Desiccants

- What is a desiccant?
- Why desiccants?
- Types of desiccant:

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- Why desiccants?
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- Types of desiccant:
  - Liquid
  - Solid

Types of solid desiccant systems

- Passive
- Active

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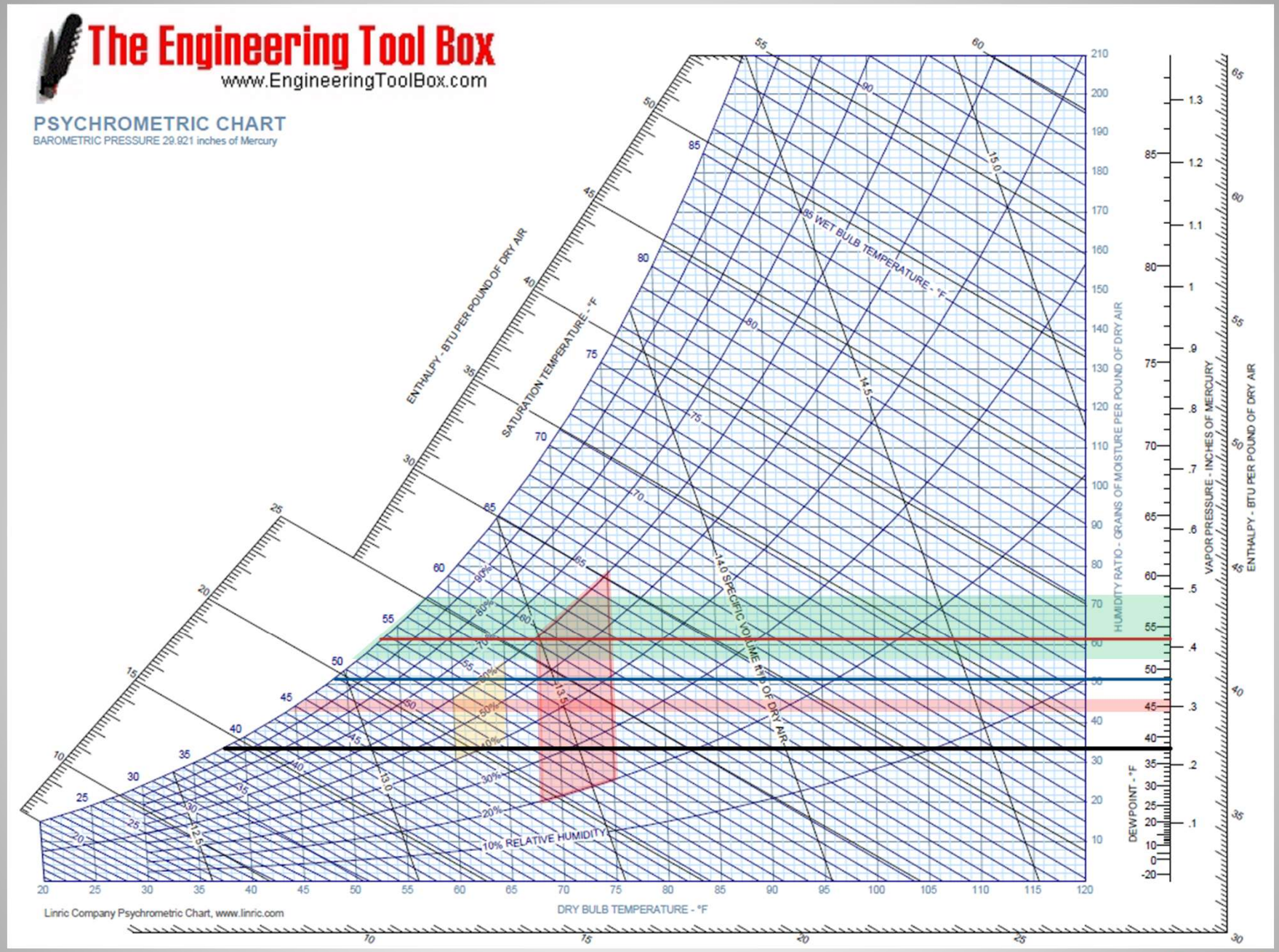
  - Limited dewpoint depression 8 – 12 grains
- Active

Types of solid desiccant systems

- Passive
  - Limited dewpoint depression 8 – 12 grains
- Active
  - Removal of 40 or more grains, or
  - Reduction in dewpoint - around 19 degrees!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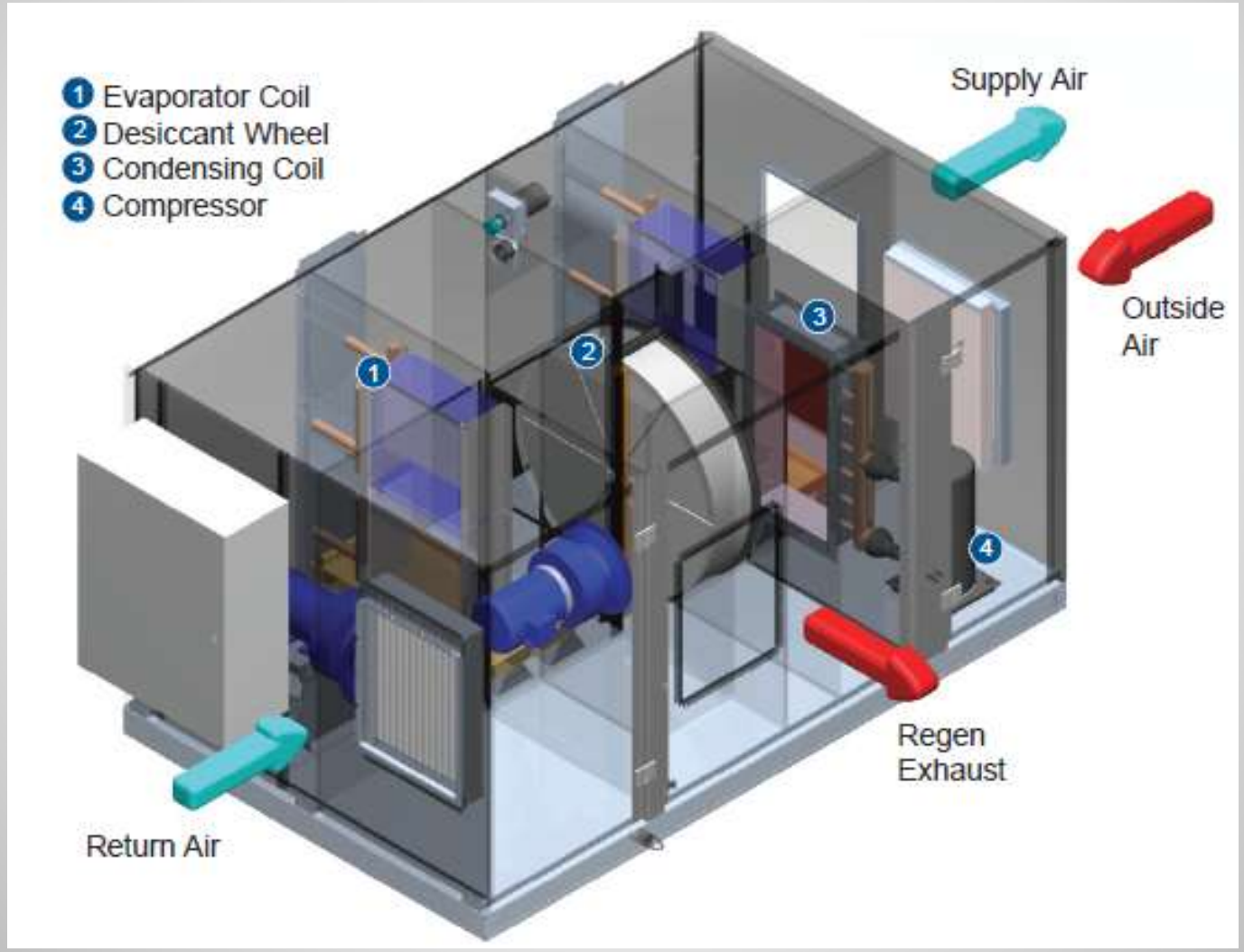
Active regeneration with condenser heat



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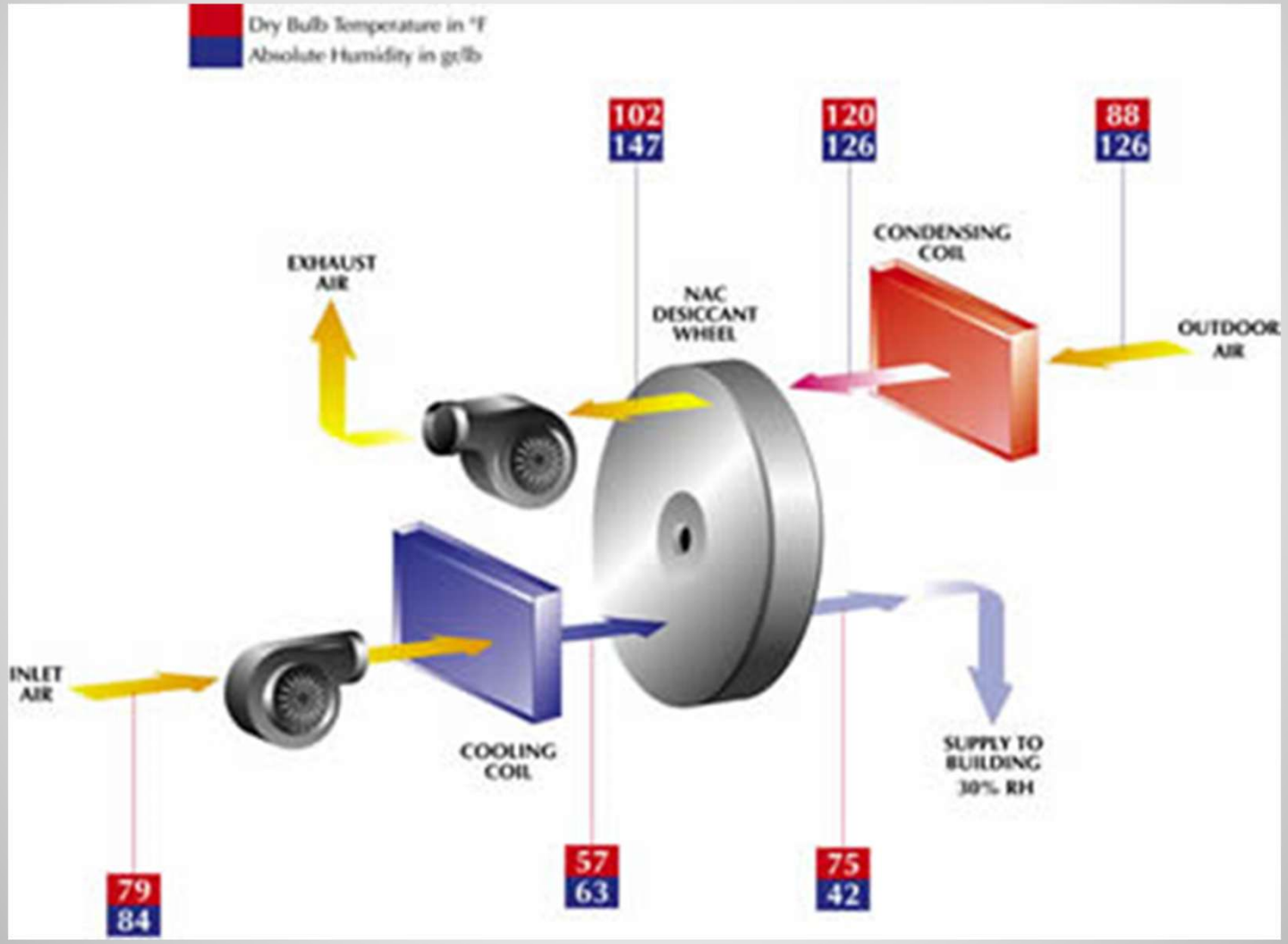

- Active desiccant systems are ideal for retrofit or new construction
- Offer 40% reduction in compressor chilled water capacity and are more efficient if incorporating energy recovery
- DX or CW
- Condenser heat or other heat sources to regenerate the desiccant wheel

Questions?

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