Munters
Your Perfect Climate

• Humidity & Customer Problems

Martin Ginty – DCVMN Workshop Hanoi 25th Nov 2015

Munters Group

Key facts

- Munters began trading in 1946 and incorporated in 1955
- 3,000+ employees
- 16 major Manufacturing Plants
- 5 Logistics and Assembly Hubs
- 53 sales and service centres serving customers in more than 30 countries
- Headquarters in Stockholm, Sweden
- Over 300,000 air treatment systems installed

Munters Group


Agriculture


Automotive


Chemical Processing


Commercial & Public Buildings


Construction


Data Center & Telecom Cooling


Defense & Aerospace


Education


Electronics


Food & beverage


General Industry/Production


Greenhouse


Healthcare


Oil, Gas & Petroleum


Pharmaceutical


Power Generation & Distribution


Pulp, Paper & Printing


Recreation & Leisure


Retail & Supermarkets


Shipbuilding & Marine

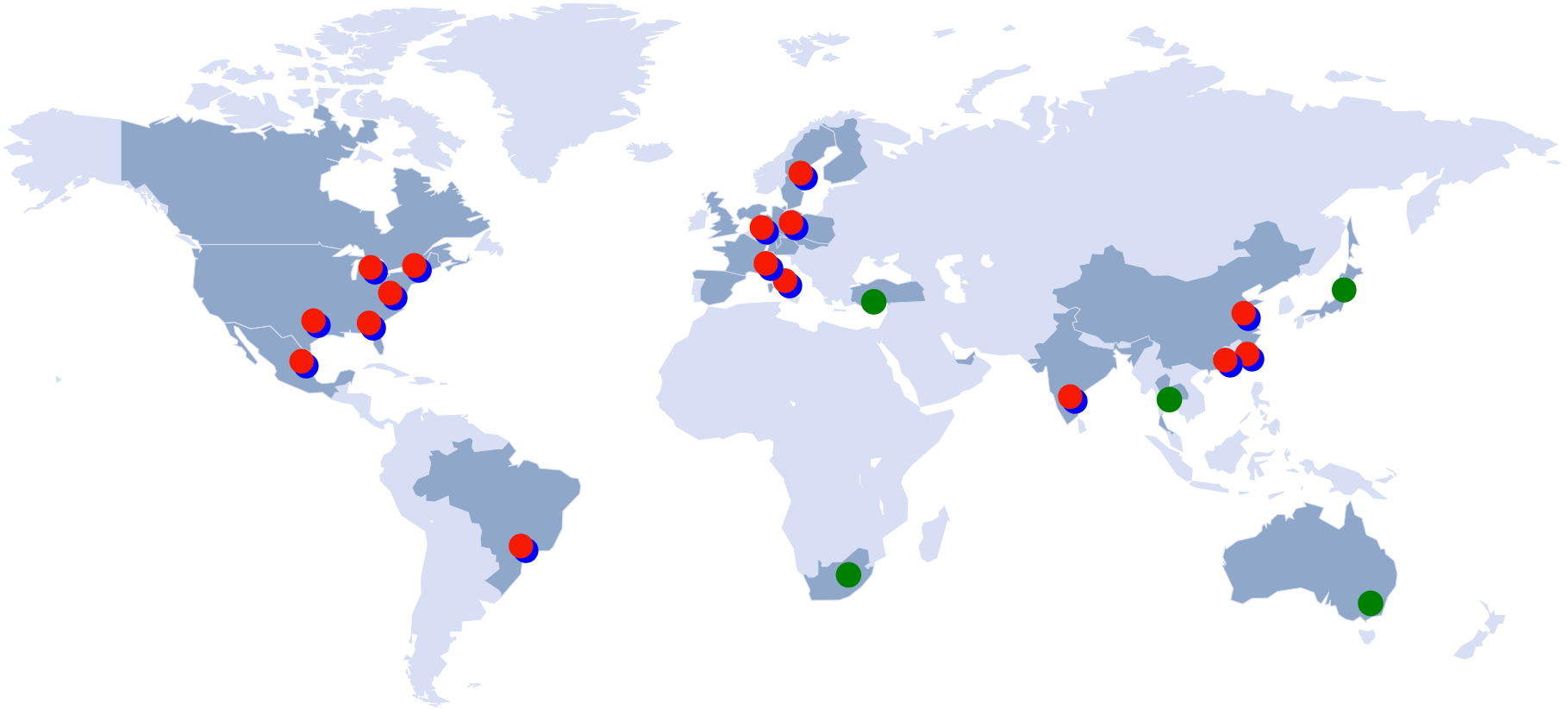

Steel Industry


Storage, Preservation & Archives


Temporary Structures


Water & Waste Water

Global Manufacturing & Logistics Support

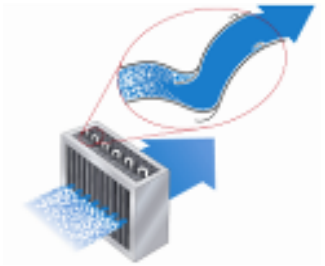


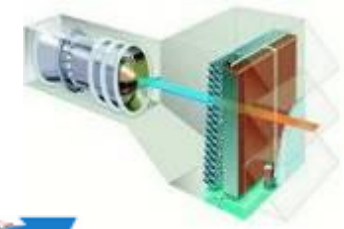
Manufacturing plants
Logistic & assembly hubs

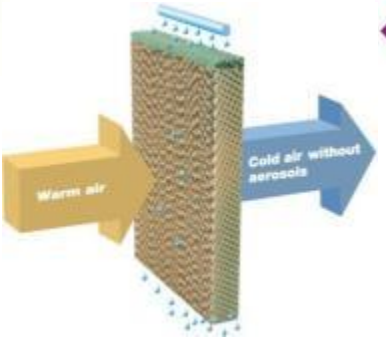
16 Manufacturing Plants
5 Logistic & Assembly Hubs
53 Sales & Service Centres

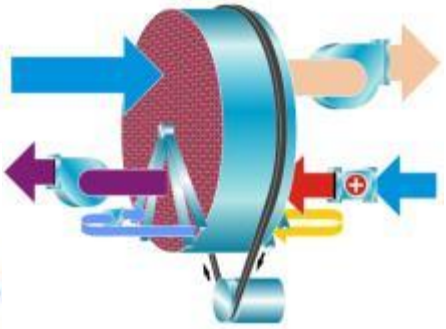
Munters Core Competencies

- Dehumidification
- Humidification
- Evaporative cooling
- Refrigeration
- Heating
- Energy recovery
- Mechanical separation liquid from gas









Pharma - Manufacturing of Tablets

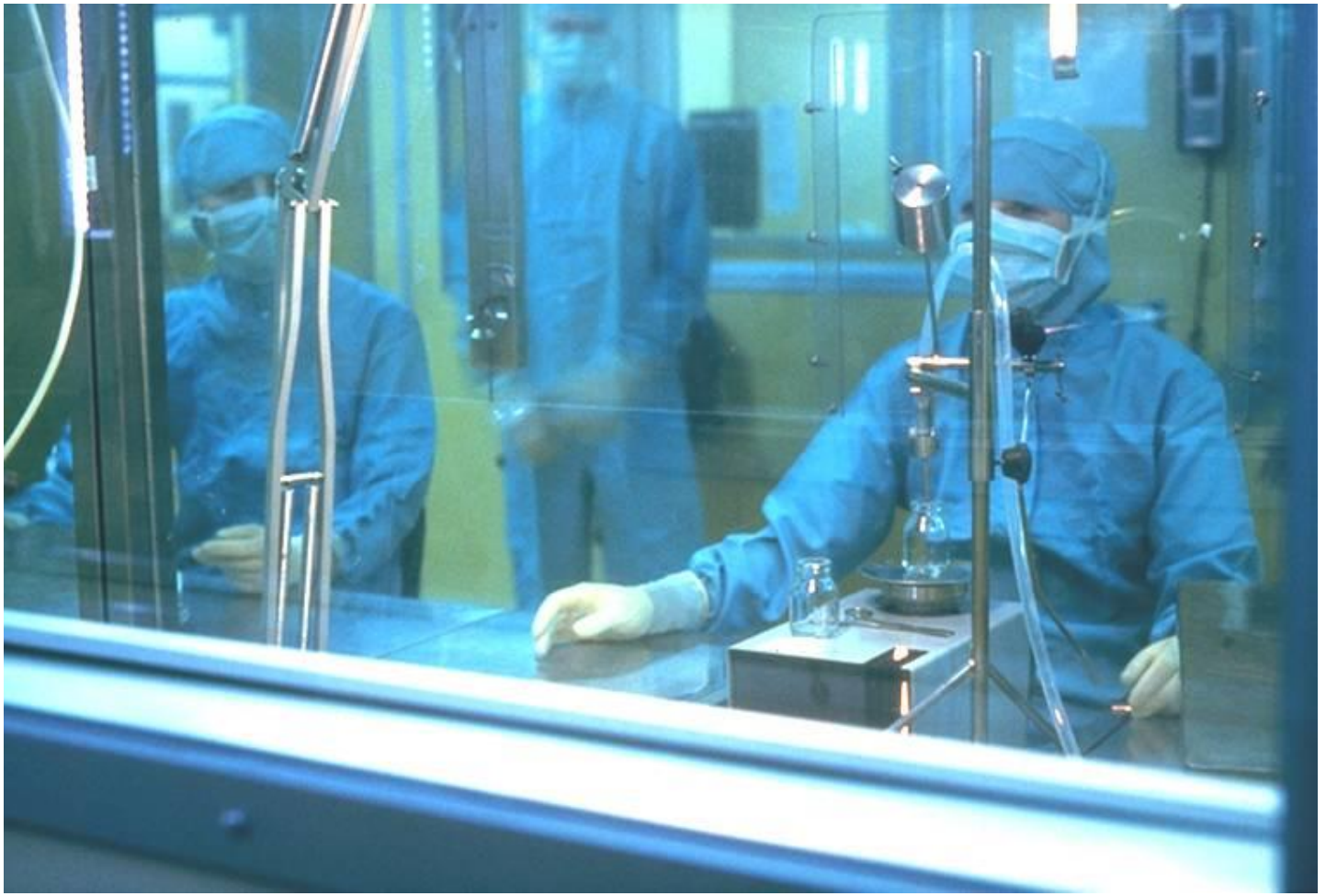
Pharma - Packaging of Effervescent Tablets

Pharma - Manufacturing of Gelatine Capsules

- Drying of gelatine
- Production of capsule shape
- Capsule content
- Packaging

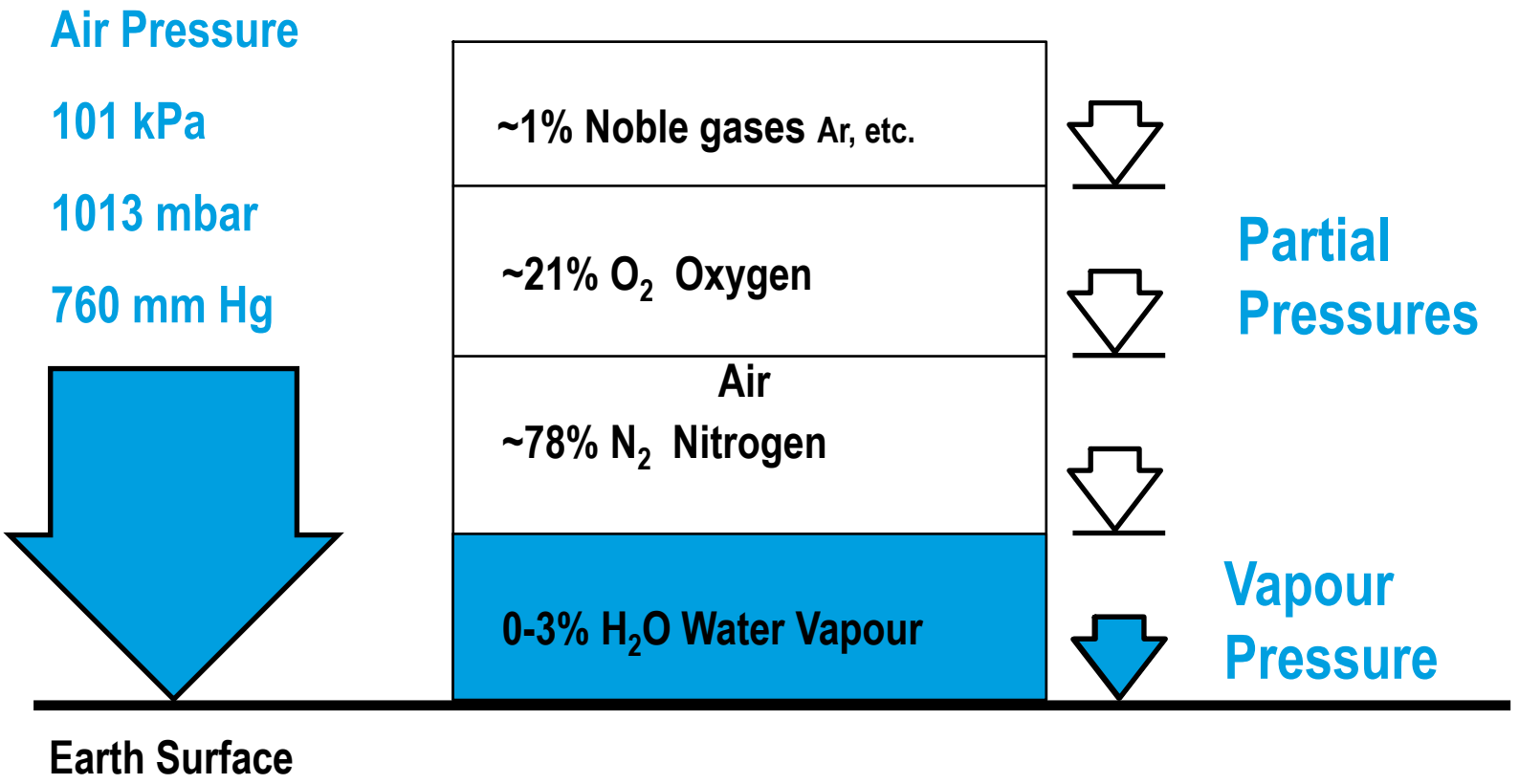
Pharma - After freeze-drying

Pharma - Cleanrooms



Humidity

The Composition Of Air



How To Quantify Humidity

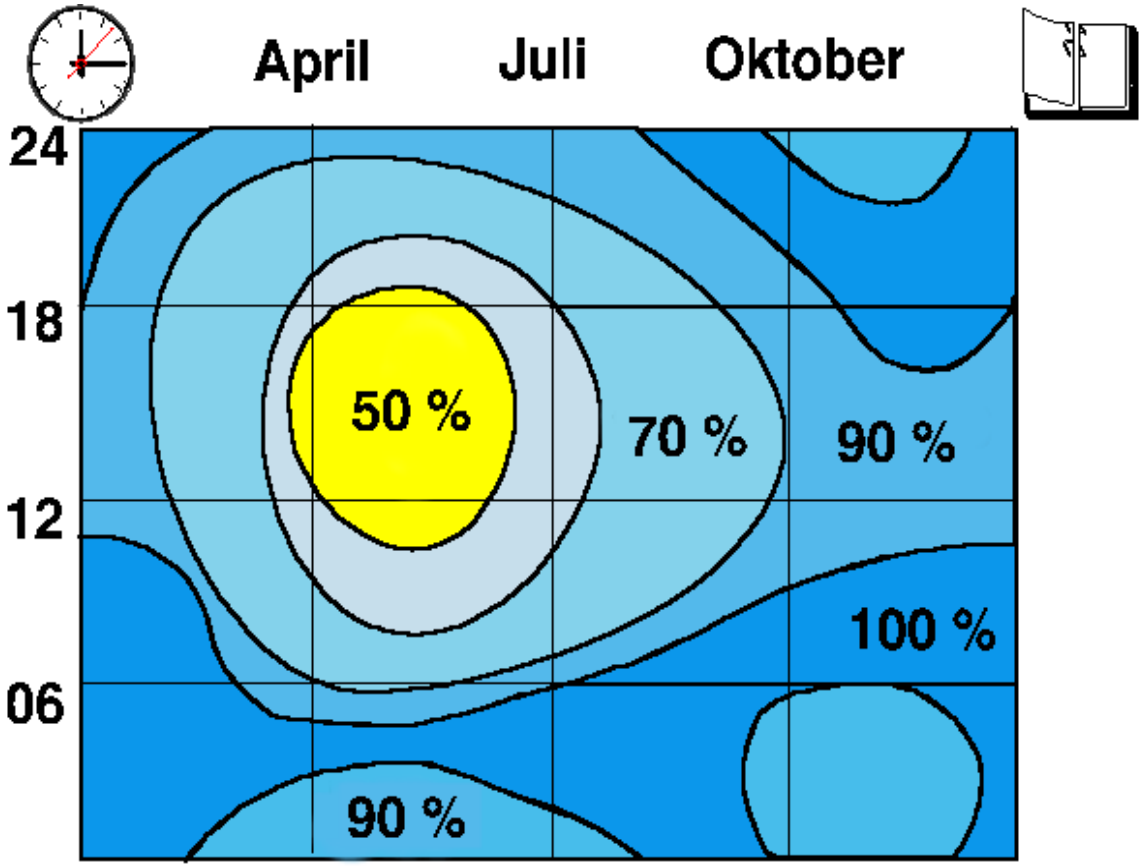
- Absolute Humidity (or “Humidity Ratio”)
  - The amount of (kilo)grams of water vapour per kilograms of (dry) air (g/kg)

- Relative Humidity
  - The ratio (in %) between the actual quantity of water vapour in the air and the maximum quantity of water vapour that the air can contain at a certain temperature

Humidity And Temperature

- Warm air can contain more water vapour than cold air
- Air at a certain temperature will have a corresponding maximum content of water vapour
- When too much water vapour is in the air (at a certain temperature), the air is “saturated” and the excess moisture will condense out
- This can happen when the temperature falls

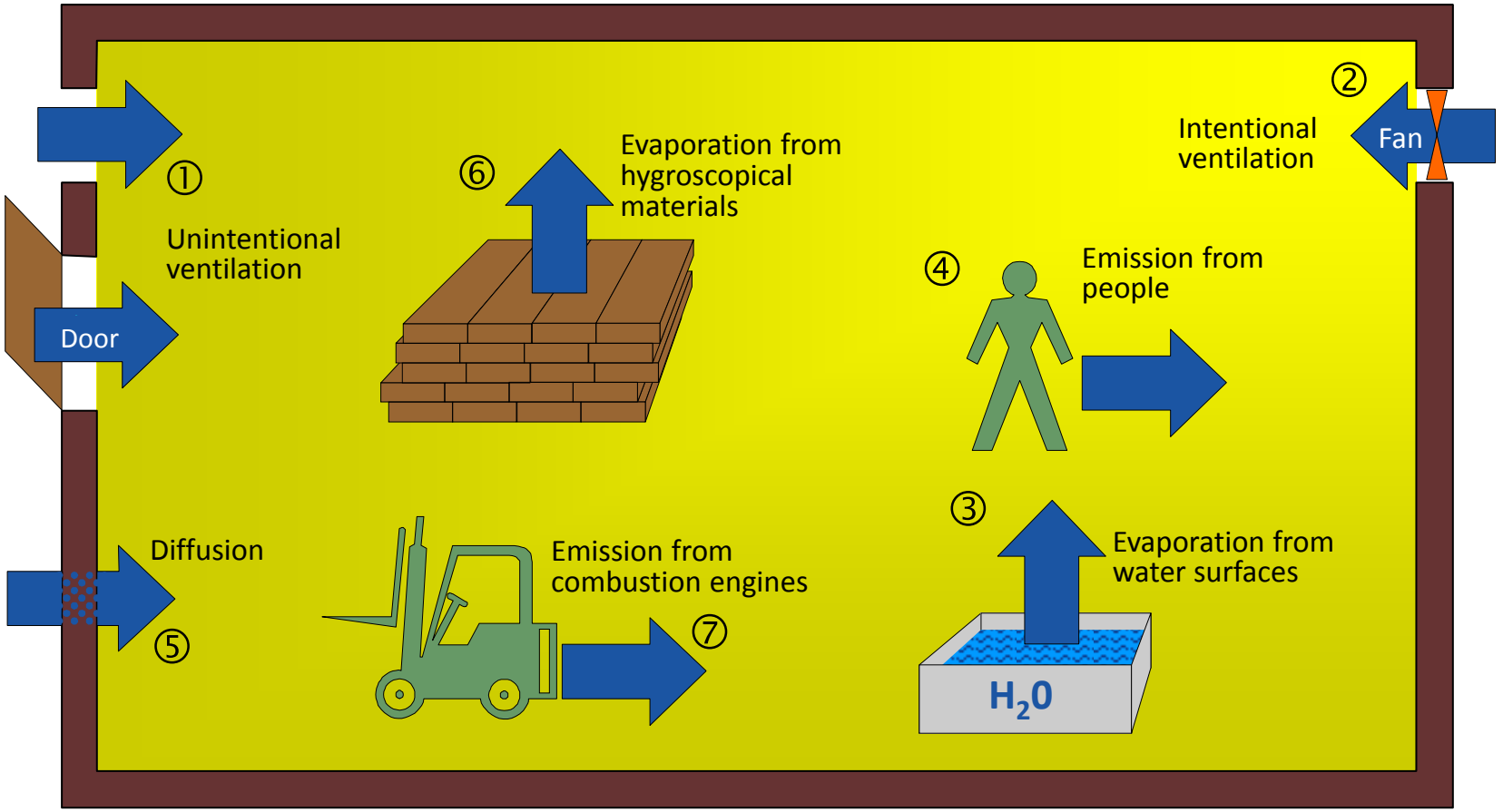
Outdoor Relative Humidity



Typical summer temperature and humidity conditions

	Dry temp	X-value g/kg
Stockholm	19,8	12,2
Riyadh	22,9	13,0
Sydney	24,8	16,4
New York	26,8	17,8
Tokyo	28,0	20,4
Rio de Janiero	30,1	21,5
Singapore	28,9	21,7
Shanghai	31,0	23,0
Caracas (We)	31,7	27,2
Raufahofn (Isl)	13,9	8,9

Sources Of Humidity In a “Closed” Environment

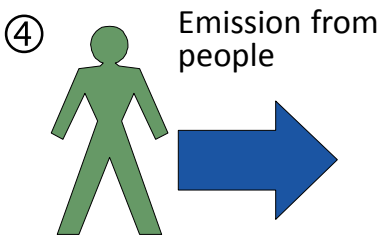


Sources Of Humidity In a “Closed” Environment

Humidity emitted depending on activity, clothing and room temperature

Average value at 20 - 25 °C and normal clothing:

- High activity 200 g/h
- Medium activity 125 g/h
- Low activity 40 g/h



Does Humidity Cause Problems?

We will quickly walk through a list of humidity related processes that cause damages, quality loss and/or cost increases.

- Condensation (water) and frost formation (ice – i.e. condensation below 0°C)
- Corrosion of metals
- Influence of moisture on resistance values (electronic malfunctions)
- Mould affecting hygiene in ducts, systems, buildings and manufacturing processes
- Property and quality change of materials and substances
  - Storage and production processes that require a stable, optimal climate
  - Product drying (deliberate moisture reduction, avoiding too high temperatures)
- Chemical reactions with moisture in the air
- Special cases of humidity impact
  - Comfort impact
  - Energy impact

Visible Humidity - Condensation on cold surfaces or in cold air

Visible Humidity - Condensation on cold surfaces or in cold air

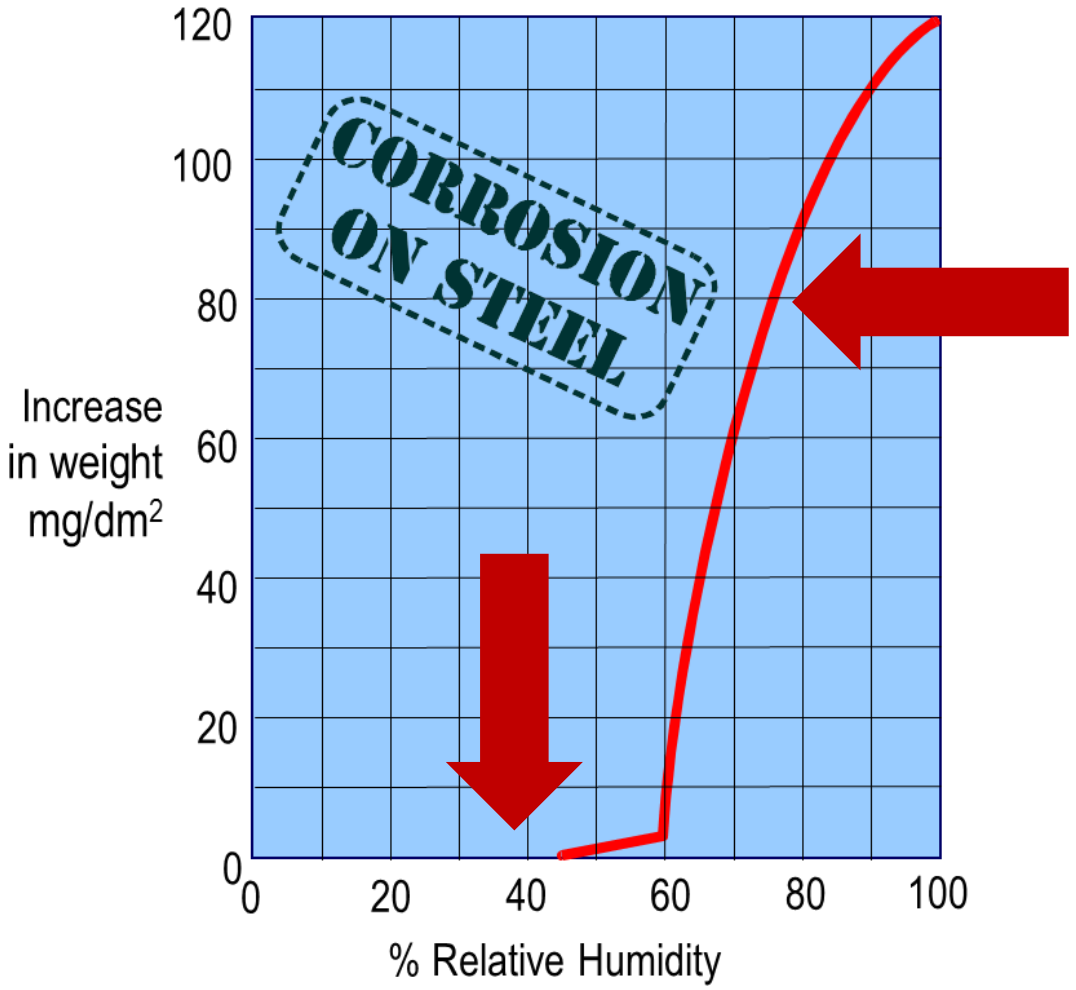
Source: www.myallergo.de

Source: www.teachingengineering.org

Source: www.bontott-tetoablak.hu

Source: www.szelloztetes.hu

High Humidity Causes Corrosion

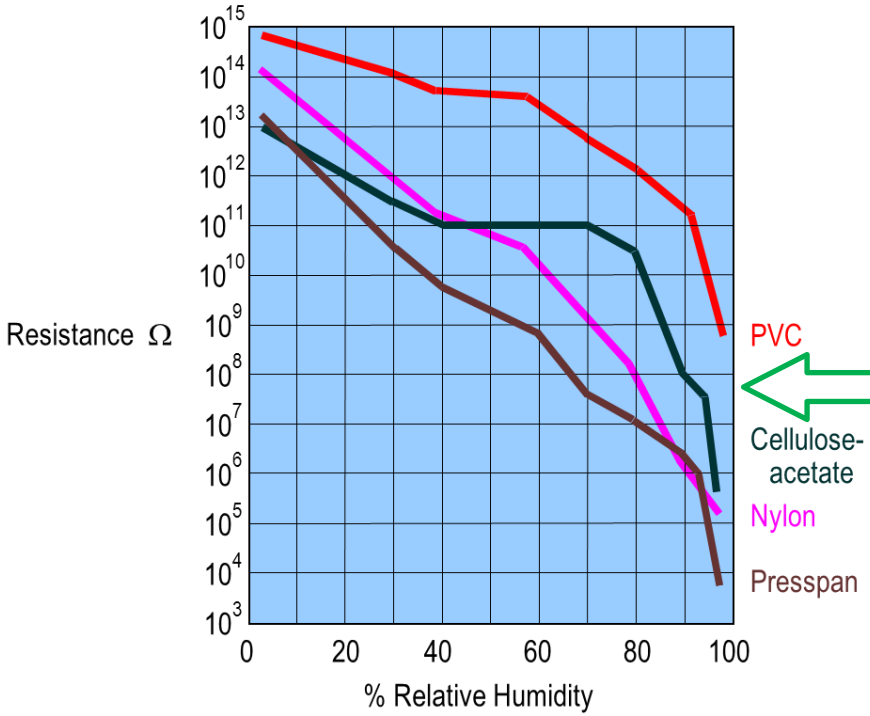


Above 60% Relative Humidity (RH) the speed of corrosion on steel rises exponentially

Below 45% RH corrosion development on steel is virtually ZERO

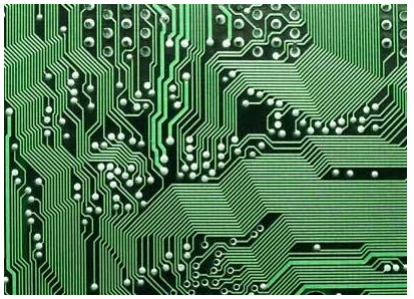
Humidity control can be used to stop or slow down corrosion

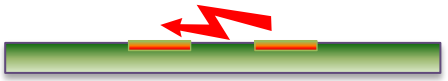
Influence of Moisture on Resistance Values



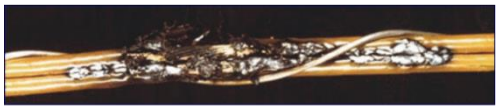
Electric conductivity increases in moist environments

Over insulation material



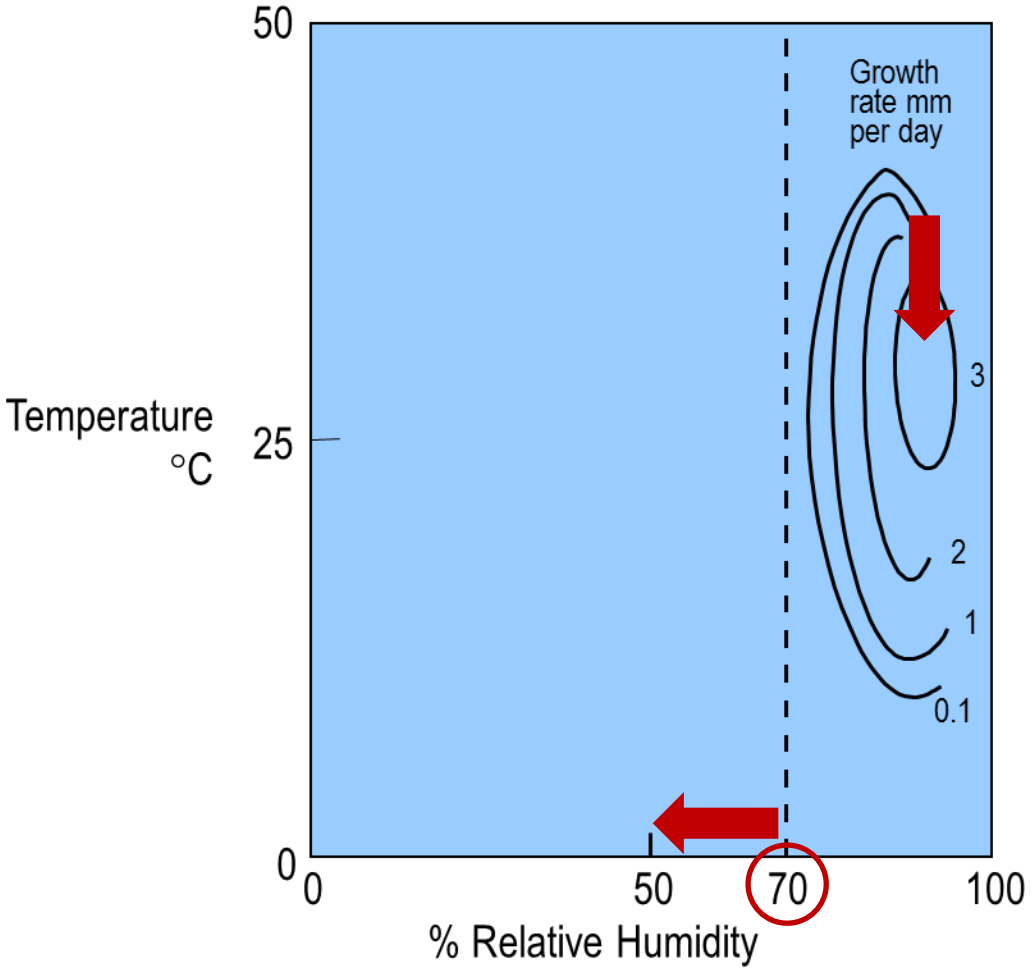


But also through air…..



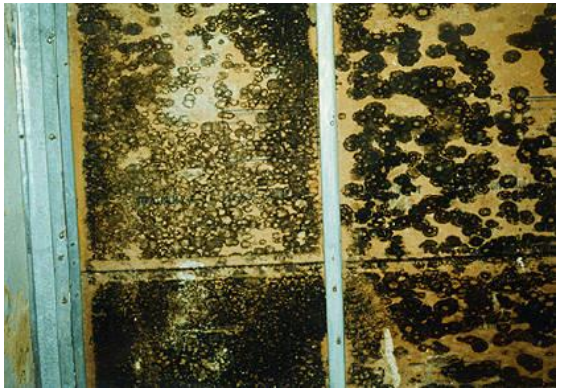
Simulated Arcing Event

High Humidity Speeds Up Mould Growth



Mould has high growth rates at higher temperatures (25-30°C) and high humidities

Below 70% Relative Humidity mould growth is virtually ZERO



High Humidity Speeds Up Mould Growth – Hanoi Example

Hanoi, Hoàn Kiếm, Hanoi, Vietnam
Wednesday 8:00 AM
Mostly Cloudy

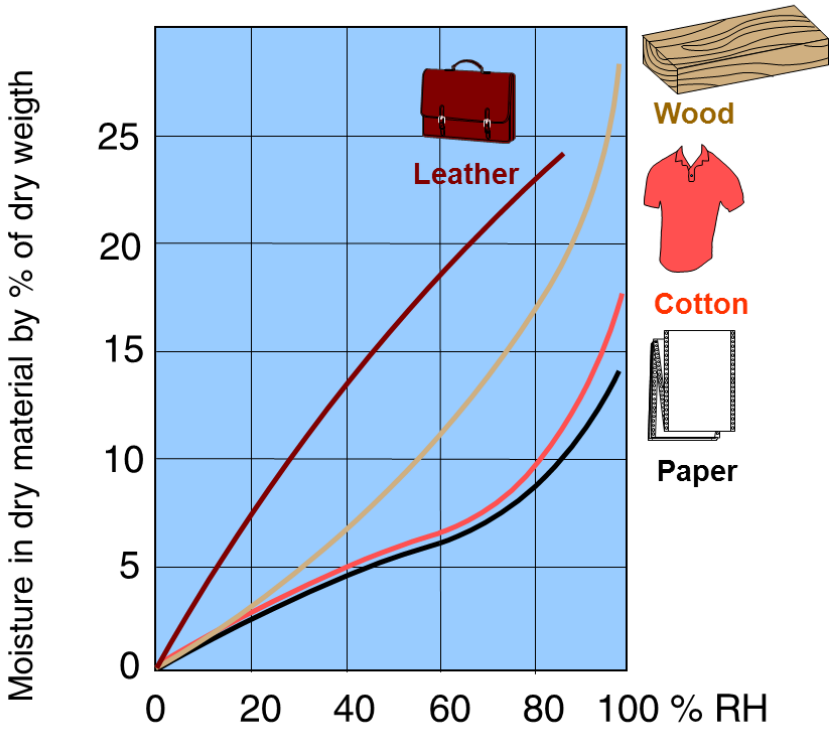
25 °F | °C

Precipitation: 8%
Humidity: 74%
Wind: 16 km/h

Relative Humidity by month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
68	70	76	75	69	71	72	75	73	69	68	67	71.1

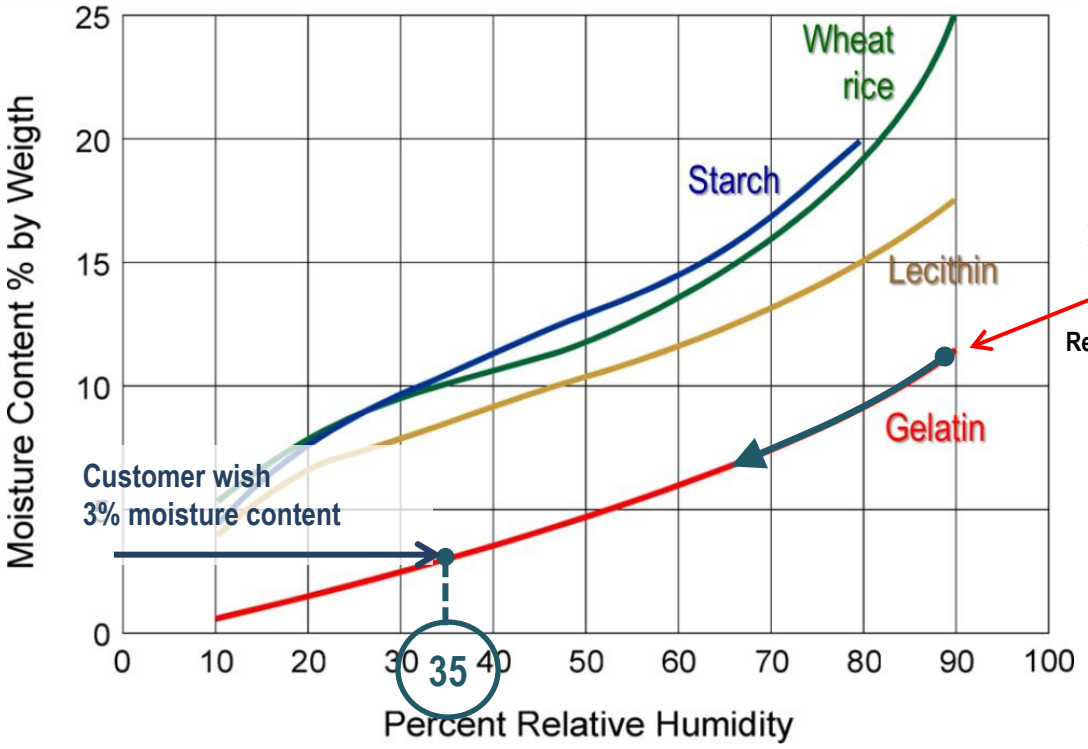
Property and Quality Change of Materials and Substances

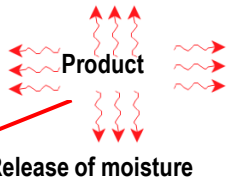


Materials and substances will have changing properties at different humidities

Storage and production in the right, constant climate will optimise quality of the product and the production process and reduce cost

Property and Quality Change of Materials and Substances

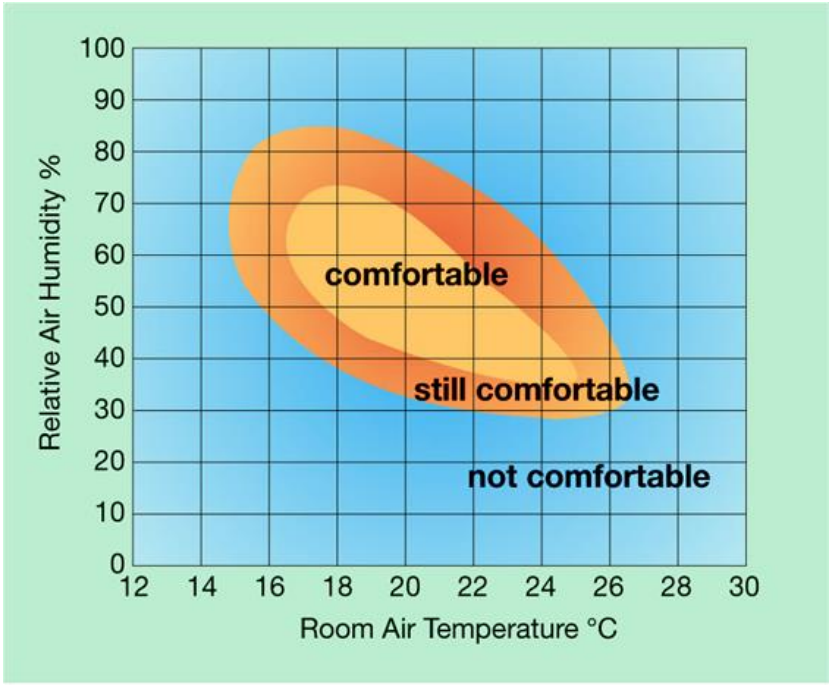




Some manufacturing and curing processes require a product to be dried

Product drying is a delicate process, especially if heat is a concern

Relative Humidity and Comfort Feeling



Human comfort feeling depends on a combination of room temperature, air speed, wall temperature and RELATIVE HUMIDITY

At lower RH less cooling is required to maintain a comfortable climate

Other benefits are no condensation and mould growth is the duct system…. much healthier!

Humidity Control and Energy

Moisture Removal Cost Comparison

Typical Energy Cost to Remove 120 Pounds of Water Per Hour

Dehumidifier	$1.00
Air Conditioner	$7.86
Produce/Dairy Cases	$9.13
Meat/Deli Cases	$10.62
Frozen Food Cases	$14.83
Ice Cream Cases	$16.72

Source: Tyler Refrigeration Advance Development

Desiccant dehumidification can save a lot of energy

Depending on the temperature and initial humidity level, moisture removal through condensation can be costly and ineffective

If applied properly, it is much more cost effective to dehumidify than to heat objects and buildings

Dehumidification can be combined with cooling to reach the desired climate at optimal energy efficiency

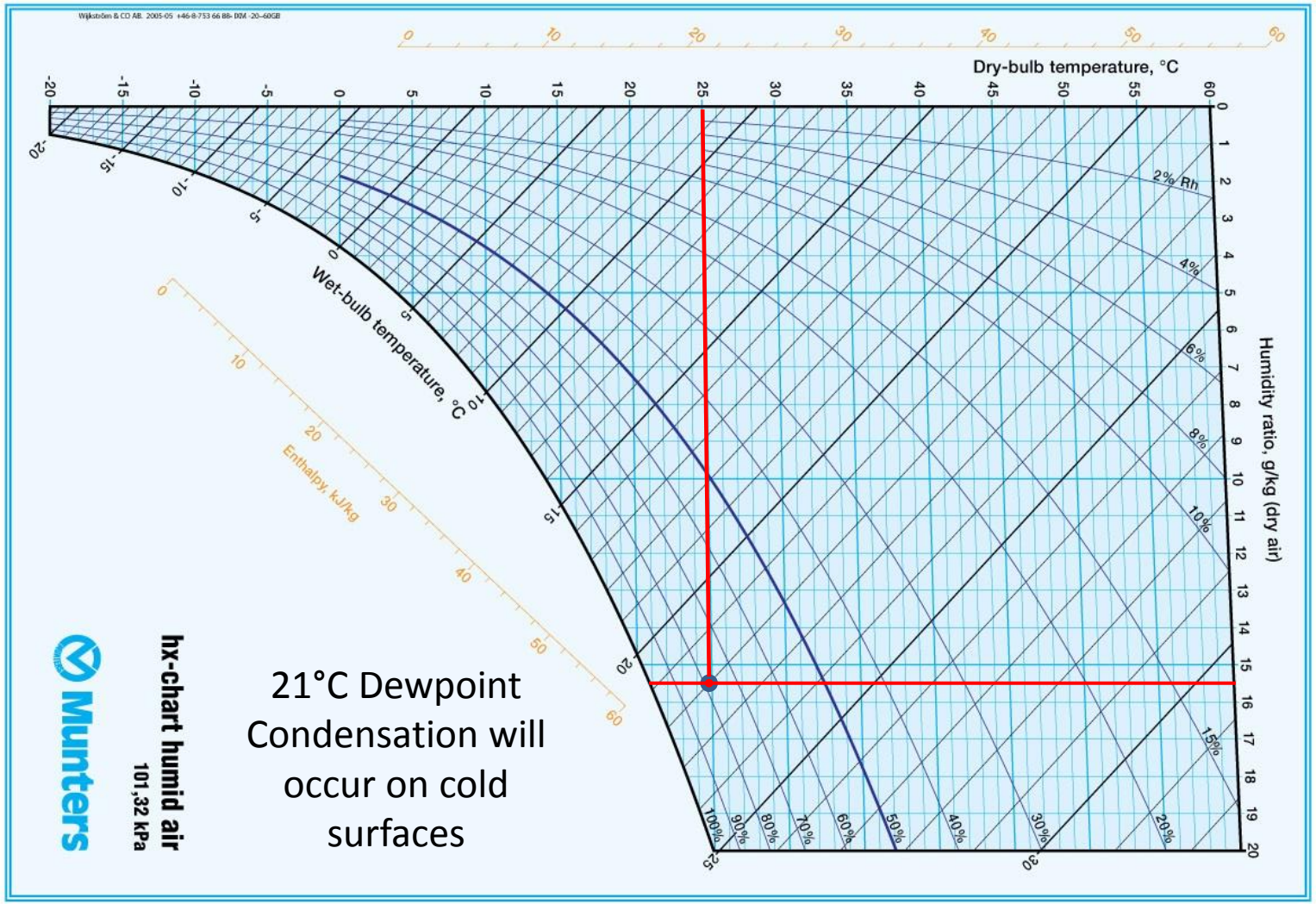
Humidity Control

The Benefits of Humidity Control

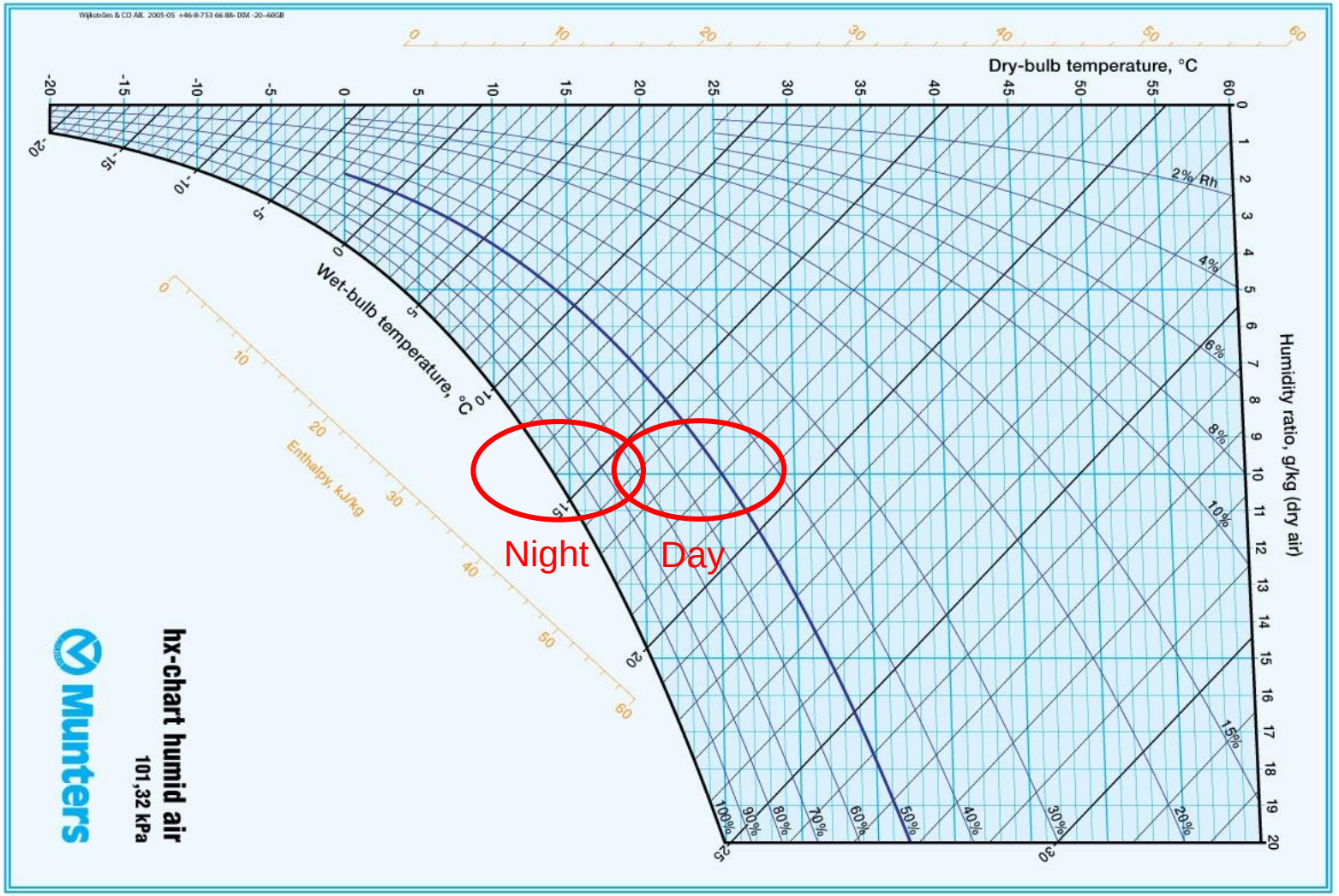
- Condensation prevention
- Corrosion prevention
- Electrical resistance optimisation
- Mould prevention
- Property change optimisation, incl. drying
- Chemical reaction prevention
- Comfort optimisation
- Energy optimisation
- Other reasons (damping, ionisation prevention, etc.)

Mostly, the benefits are found in a combination of above reasons

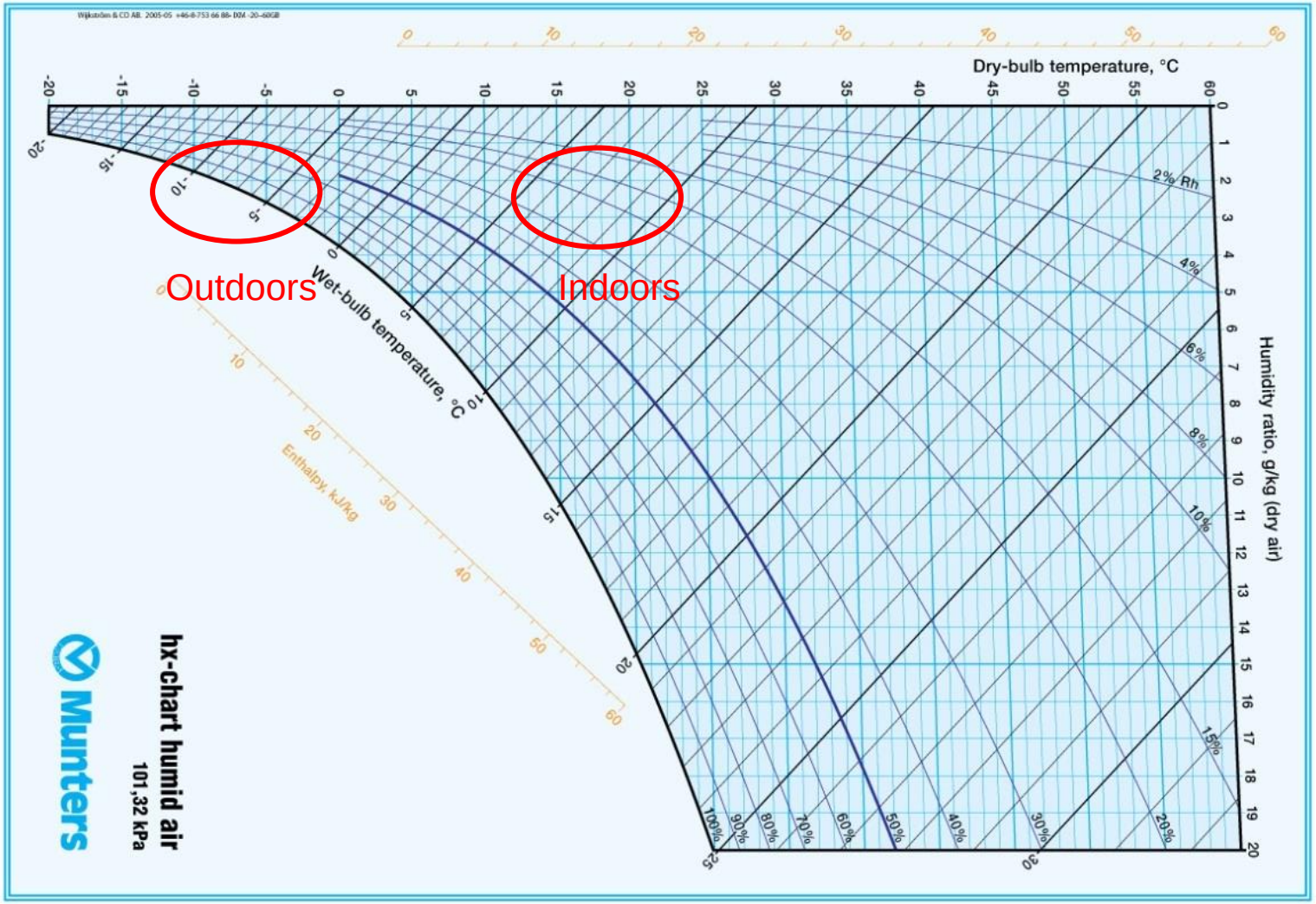
How to determine Relative Humidity and Dew Point



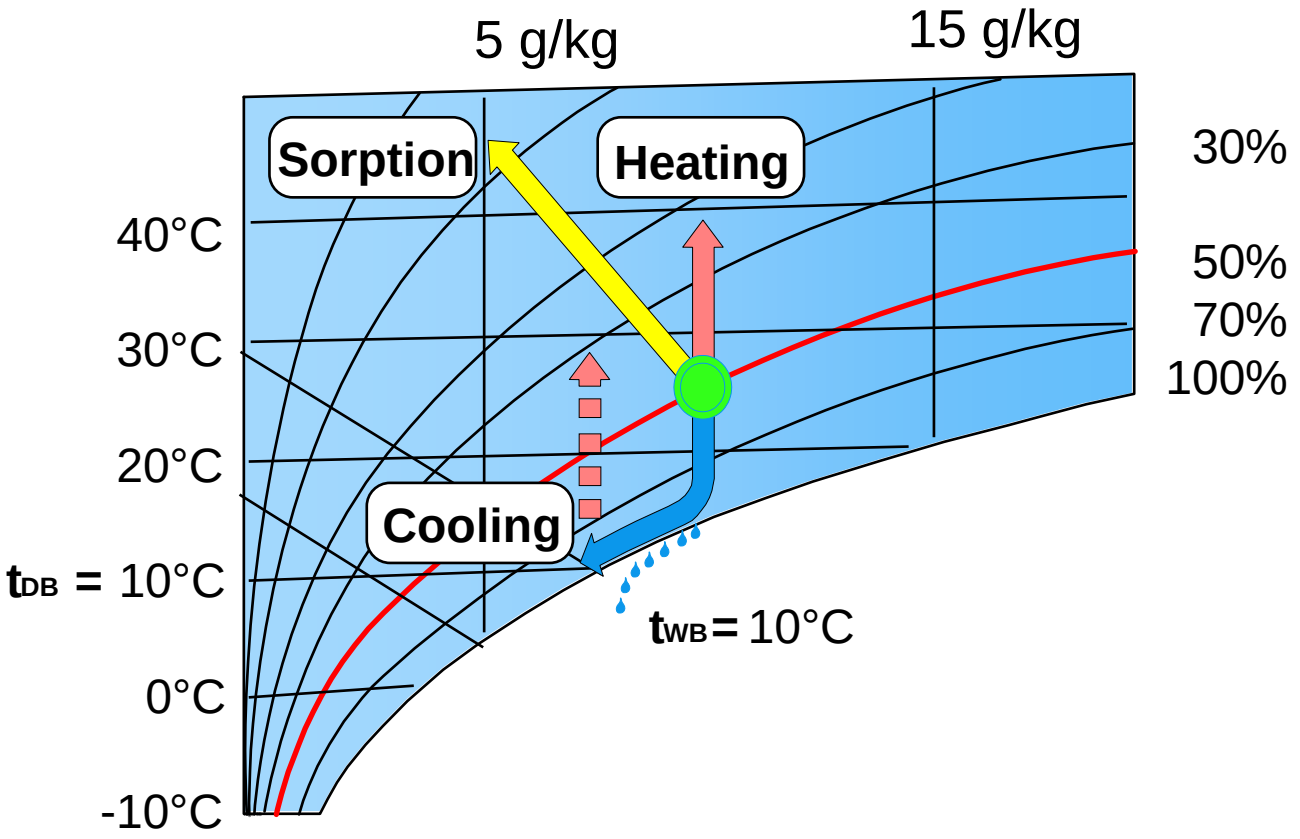
Relative Humidity Cycle During 24 Hours



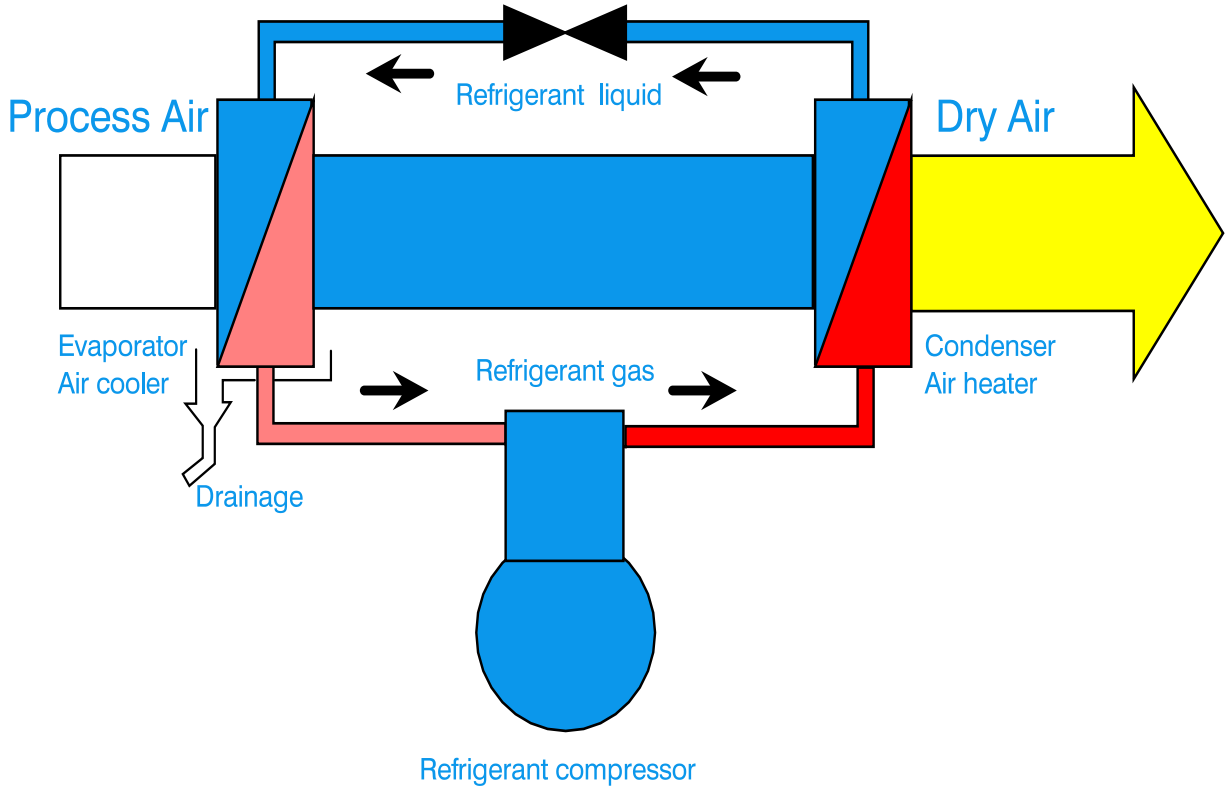
Relative Humidity in Winter – Outdoors versus Indoors



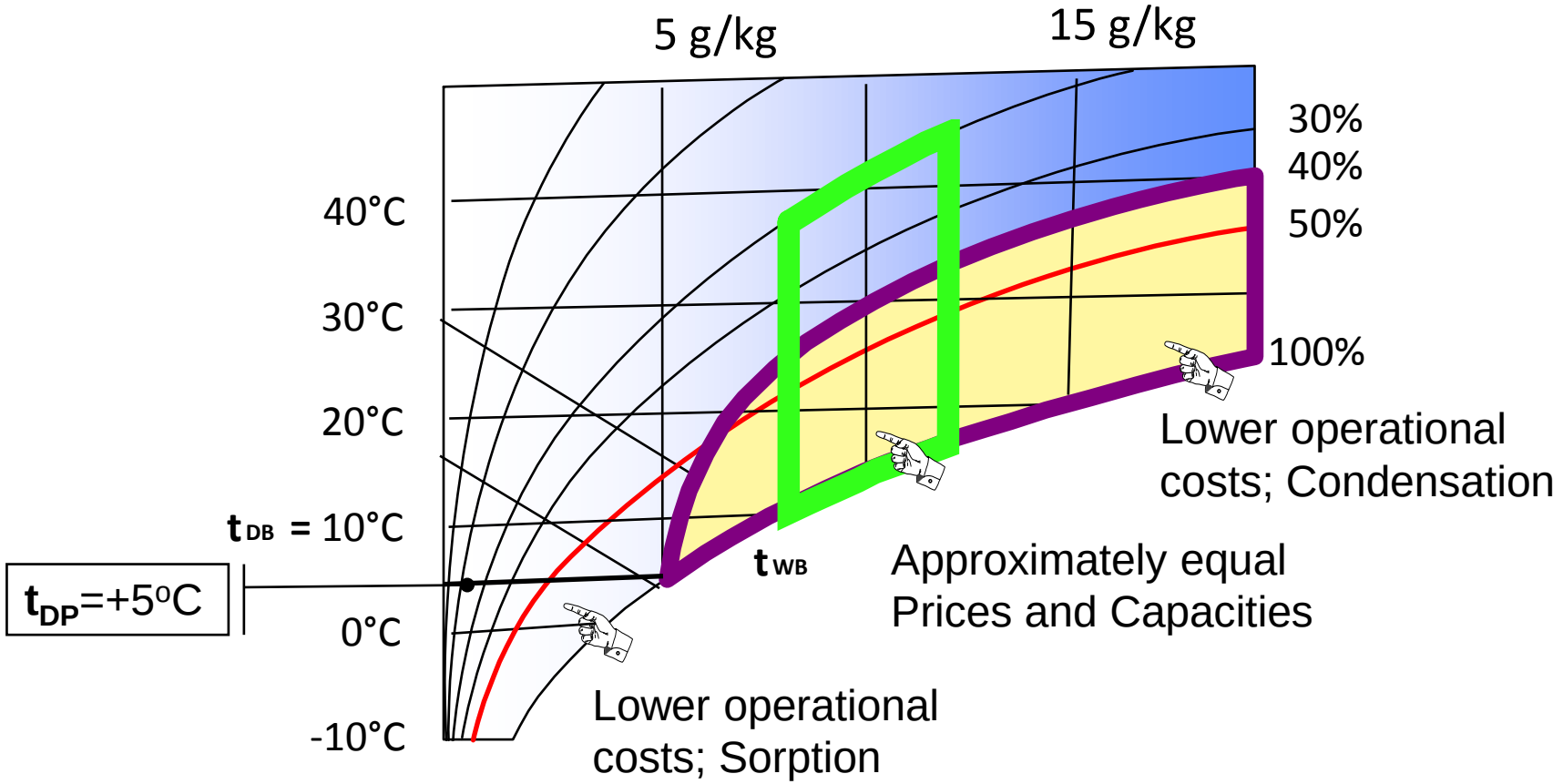
Changing Environment - Methods



Cooling Dehumidifier



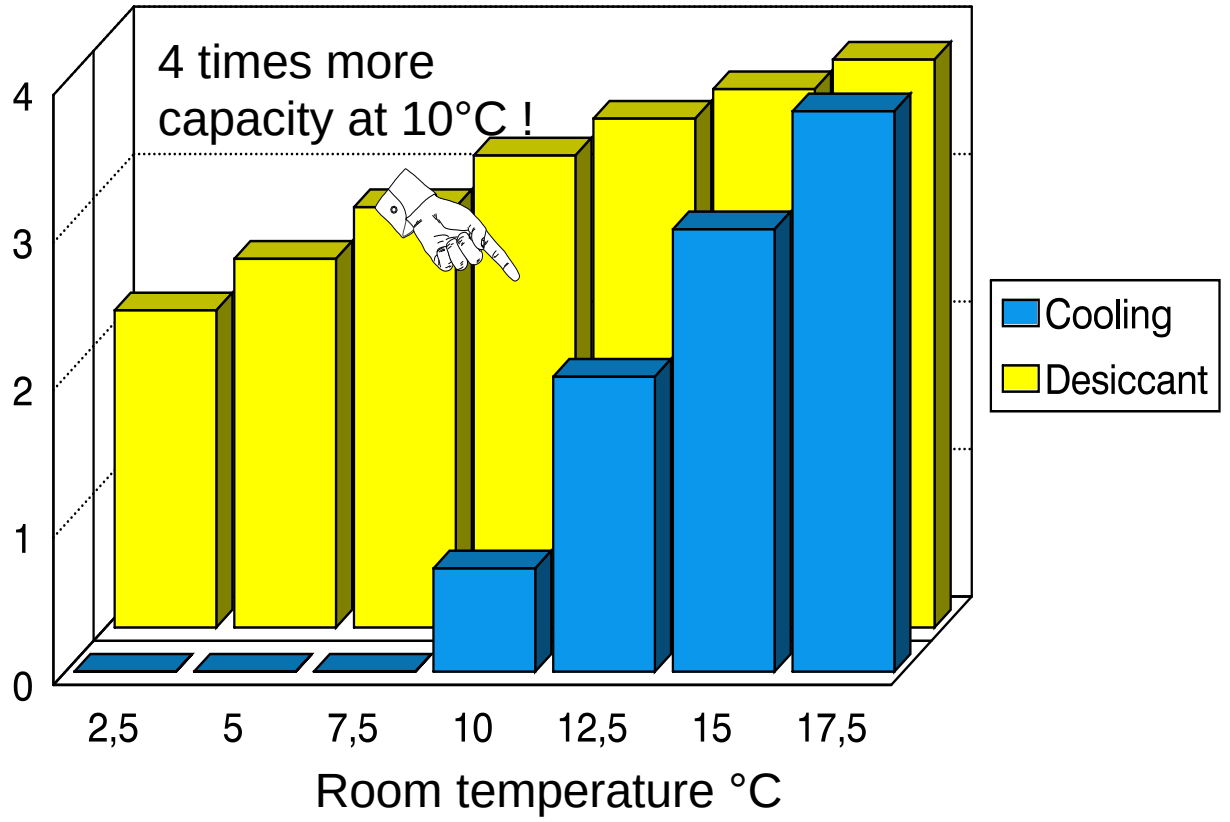
Costs Comparison - Condensation vs Sorption



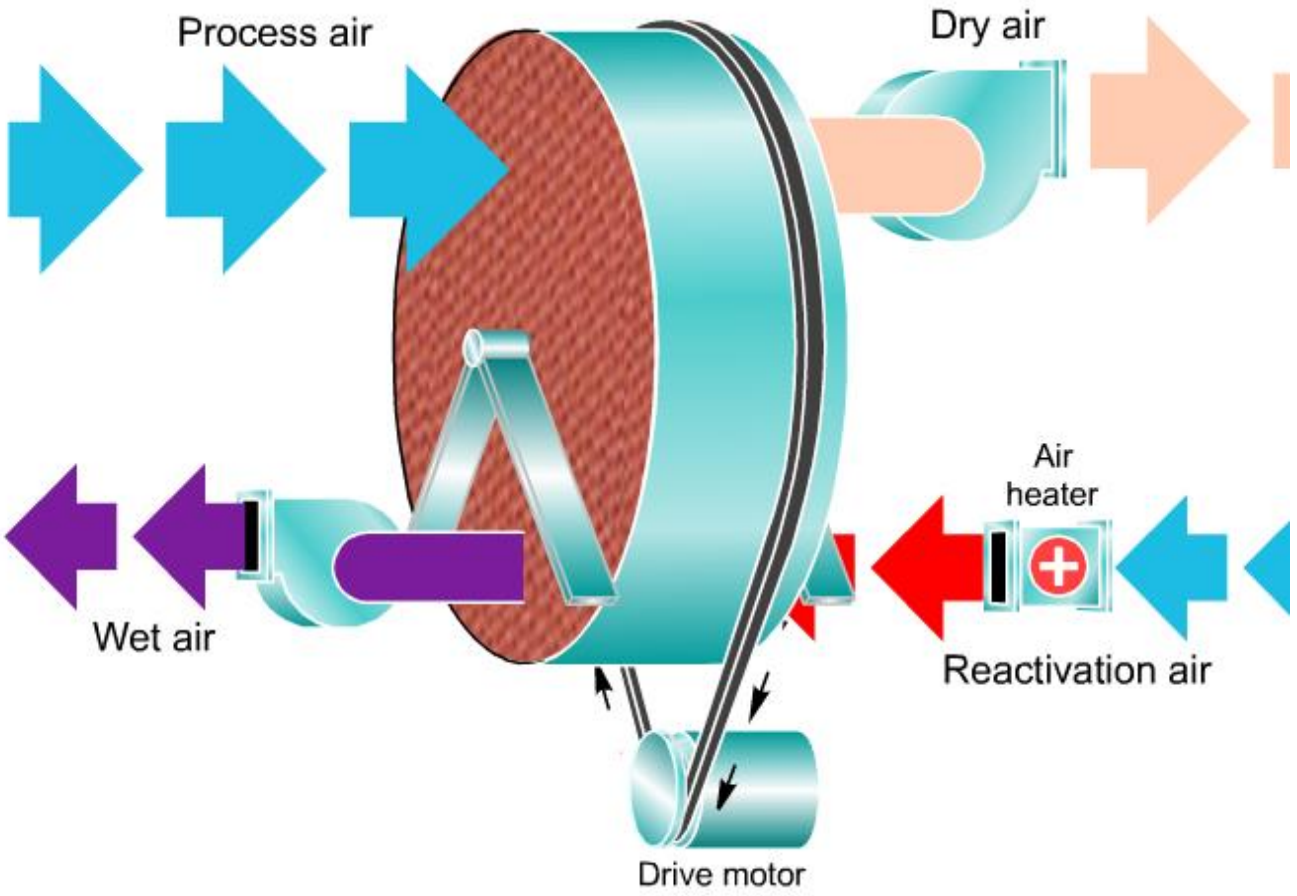
Costs Comparison - Condensation vs Sorption

- Example of real Munters customers
  - Sample size: 52 Pharmaceutical clean room applications
  - Average Dew Point: -5°C
  - Highest Dew Point: 7°C
  - Lowest Dew Point: -27°C
- 51 of these applications are below 5°C DP
- 36 of these applications are below 0°C DP
- In almost all cases condensation type dehumidification (DX / refrigeration / chillers) would not be suitable

Desiccant vs Cooling - D/H Capacities at 50% RH

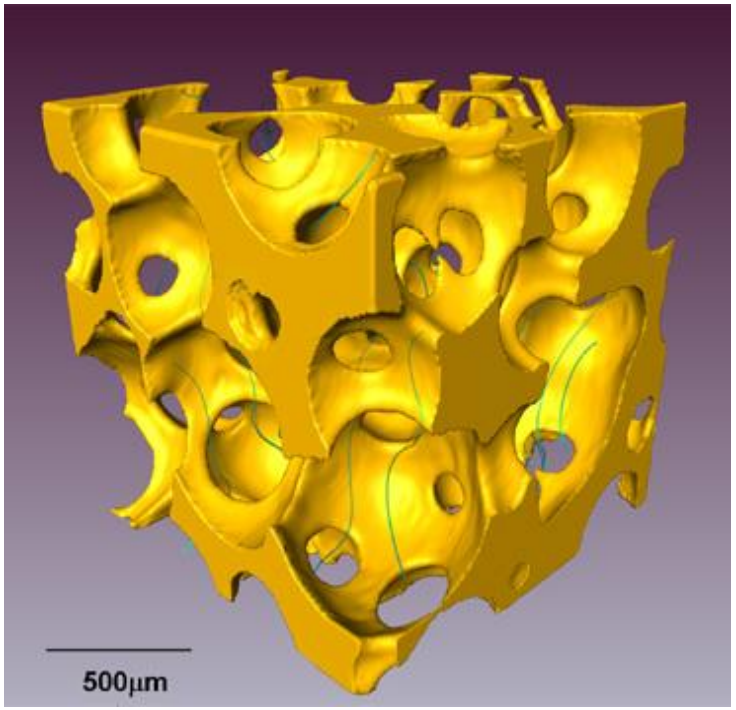


Sorption Dehumidifier - Munters Rotor Principle



Silica Gel

- A non-crystalline (amorph) silicon dioxide based material which has water molecules in its composition. Adsorption takes place in cavities and pores.



In closing

Humidity is present in all environments

Dehumidification can deliver the following benefits

- Eliminate Condensation (water) and frost formation (ice – i.e. condensation below 0°C)
- Prevent corrosion of metals
- Prevent influence of moisture on resistance values (electronic malfunctions)
- Stop mould formation and improve hygiene
- Prevent property and quality change of materials and substances

Thank you for your attention

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www.munters.com