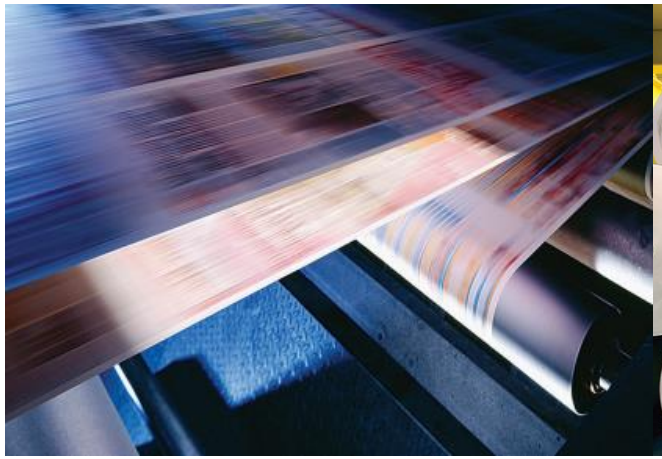
better together

Humidification for Paper and Corrugated industries



Nuno Silva, PhD - (Business Development)
Alvie Stephenson - (Sales manager)
William Truong - (Business Development)

condair

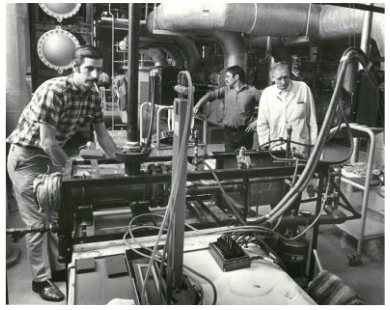
70 years of history

January 1975
Acquisition of
Defensor

Foundation
1948

1975

January 1982
Acquisition of
Nortec Ltd., CA&USA



1982

January **1982**
Acquisition of
Plascon AG, CH

1993

January **1993**
Acquisition of
Barth & Stöcklein GmbH, DE

January **2002**
Acquisition of
Draabe Industrie-technik GmbH, DE

October **2009**
Acquisition of
Eichler GmbH AT&HU

2011

February **2011**
Acquisition of
Anderberg Fugtstyring a/s, DK

May **2011**
Acquisition of
JS Humidifiers plc., UK

September **2011**
Acquisition of
ML System a/s, DK

January **2012**
Acquisition of
Hanseata S.A., ES

2017

January **2014**
Acquisition of
Geveke BV, NL&BE

July **2016**
Acquisition of
Lufta s.a.r.l., IT

June **2017**
JV 50/50
Condair S.A.P.I., MX

November **2017**
JV 50/50
Condair Nemlendirme A.S., TR

July **2018**
Acquisition of
Aireven Pty Ltd, AUS

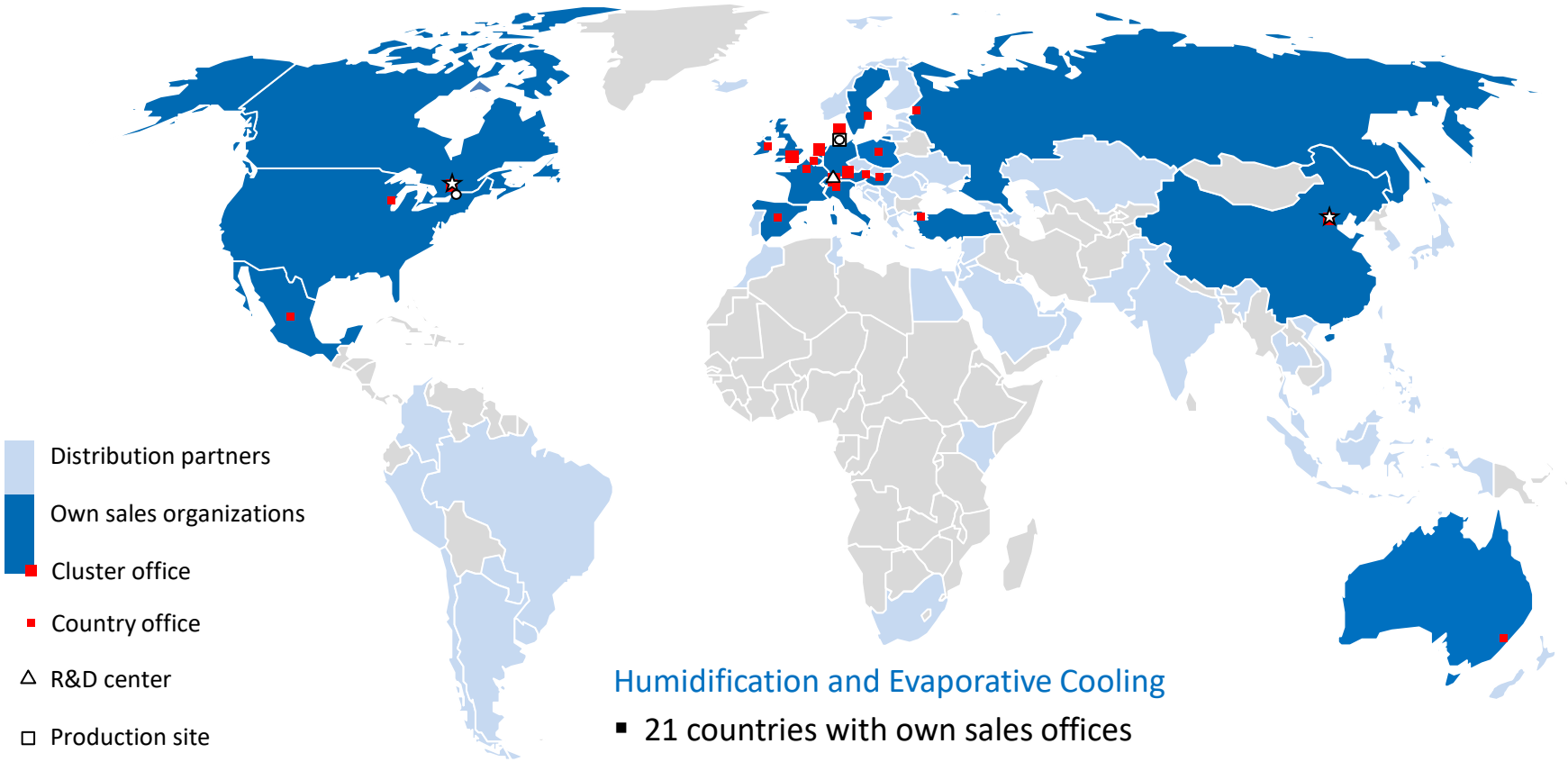
2019

January **2019**
Foundation of
Condair AB, SE

July **2019**
JV 50/50
Condair Polska Sp. z o.o., PL

The Condair Group, a world leader in humidification solutions, is the result of many acquisitions made over the last 50 years by Meier Capital (Walter Meier Group)

The Condair Group Organization
Sites and Markets



Humidification and Evaporative Cooling

- 21 countries with own sales offices
- Over 50 distribution partners worldwide and 120 agents covering North America
- Consolidating 6 R&D and 6 production sites to 3 each

What is Humidity and how do we measure it?

Humidity

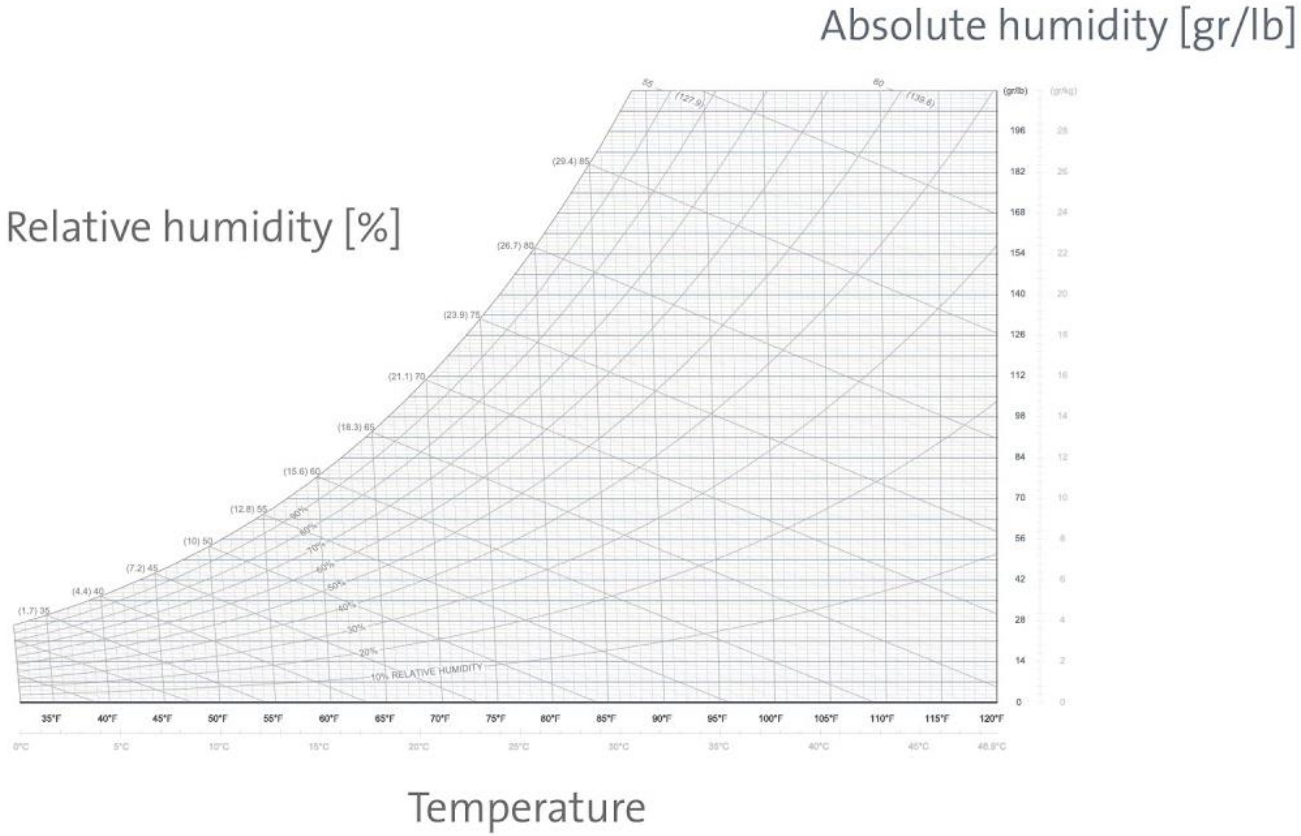
- The amount of water vapor in the air
- Measured in “Absolute” or “Relative” terms

Absolute Humidity

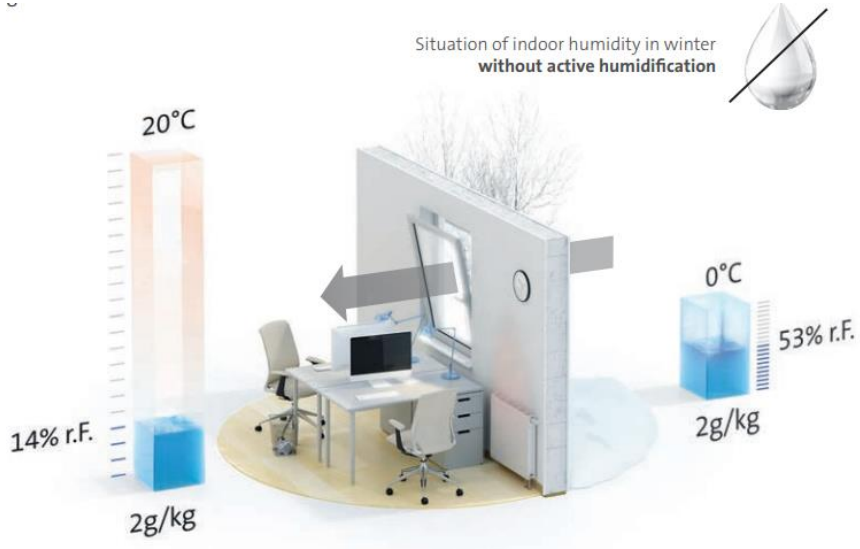
- Mass of water in particular volume of air
- Expressed as mass (grains/lb or g/kg)

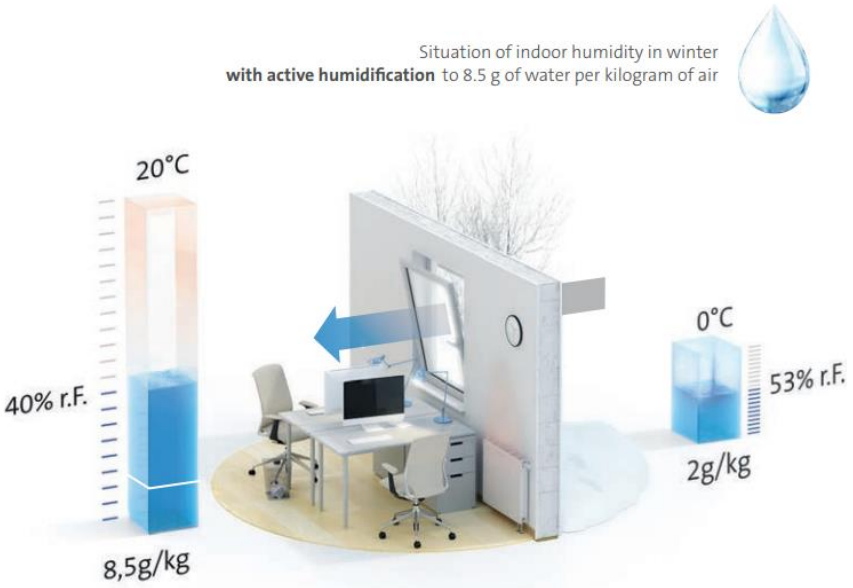
Relative Humidity

- Amount of water vapor in the air relative to how much it can hold at a given temperature (%)

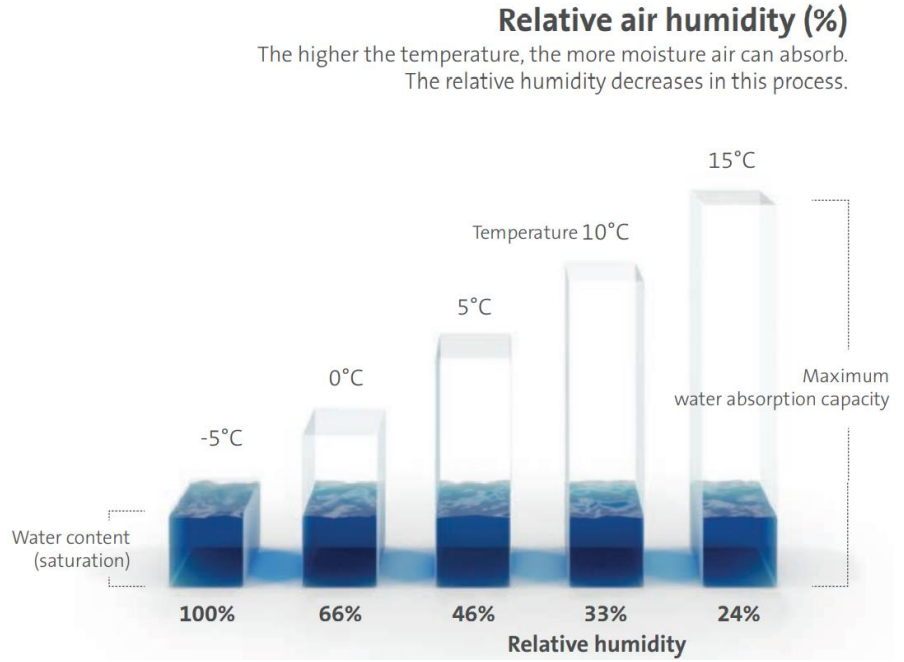


What Causes Dryness?





20 °C = 68 °F
0 °C = 32 °F



Outdoor RH%	Indoor RH% (after heating ventilation air to 70°F)										
100	2	4	5	6	7	9	12	17	19	23	29
60	1	2	3	3	4	5	7	9	11	14	17
50	1	1	3	3	4	4	6	8	9	12	14
45	1	1	2	3	3	4	6	7	8	11	13
40	1	1	2	3	3	4	5	7	7	10	12
30	0	1	2	1	2	3	4	5	5	7	9
20	0	1	1	1	2	2	3	3	3	5	5
	-20	-10	-5	0	5	10	15	20	25	30	35

Outdoor Temperature (°F)

Printing – Humidity?

Requirements

- Optimum humidity 50 – 60% RH

Applications

- Printing halls
- Paper stock
- CTP (Computer-to-plate)
- Further processing

Benefits

- No paper distortion
- No static
- Machine efficiency
  - No web breaks
  - No paper sticking
  - No registered off sets
- Constant level of quality
- Reduced waste
- Longer life-cycle cylinder/plates
- No lime deposits
- Constant ink transfer
- Fast drying
- Optimized color-water-balance
- Increased printing plates lifetime

Ambient Air Humidity Effect On Paper

<u>Ambient air humidity too high</u>
Absorbs moisture = Wavy edges

Paper is Hygroscopic

<u>Ambient air humidity too low</u>
Releases moisture = Tight edges

With the right relative humidity:

- Dimensional accuracy of the paper is assured
- Eliminates jamming due to electrostatic

Packaging

Requirements

- 45 – 55% relative humidity

Benefits

- Machine efficiency
- Constant level of quality
- Less waste
- Less downtime
- Reduce score cracking
- Dimensional stability
- Adhesive properties

Methods of air humidification

Isothermal

- Gas Steam
- Electric Steam
- Resistive Steam
- Live Steam

Steam

Adiabatic

- Evap Media
- Nozzles
- High Pressure
- Ultrasonic

Evaporation

Steam: Energy comes from electricity, gas, or heat exchange process

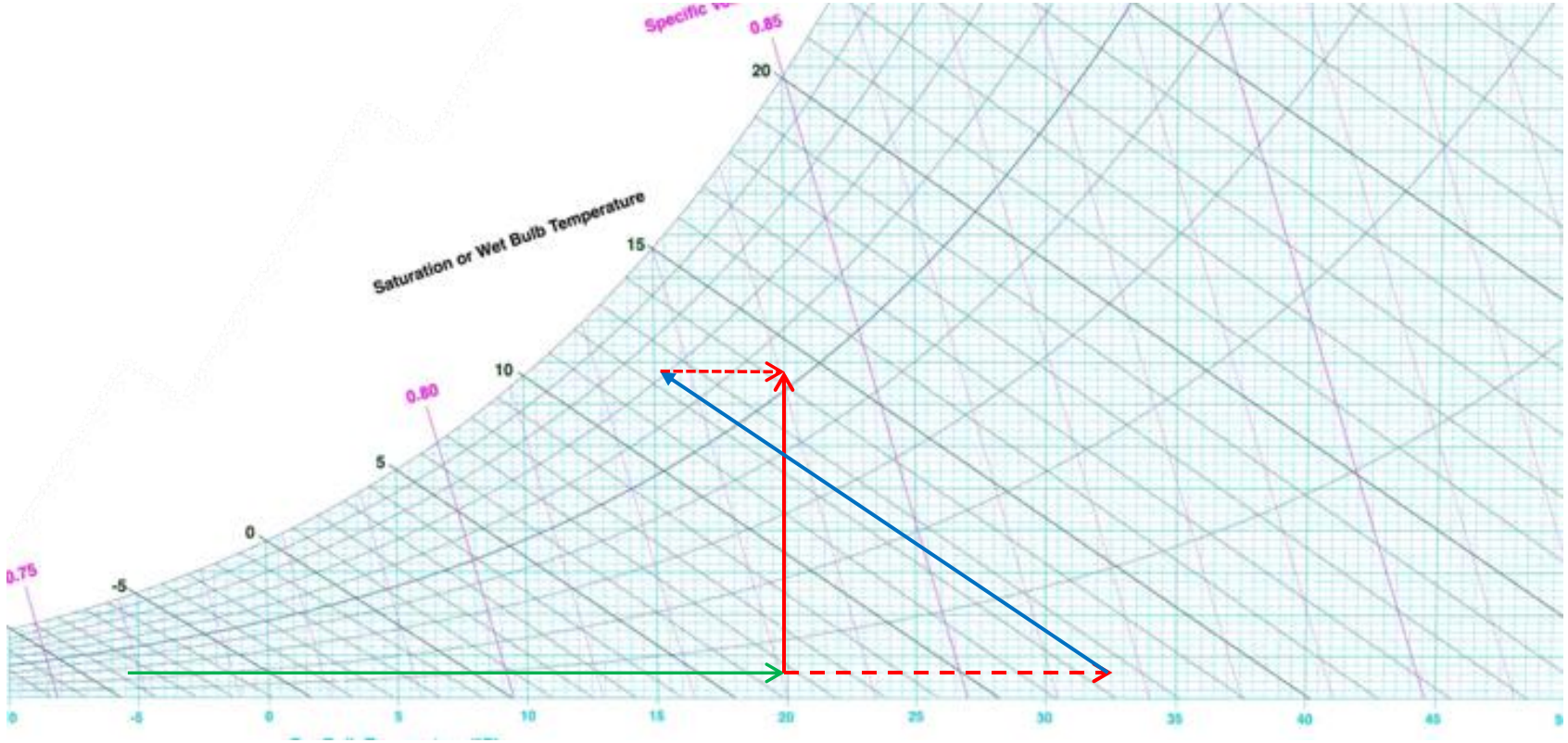
Adiabatic (Spray / Evaporative): Energy comes from the air

Heat of Evaporation:
970 – 1075 BTU/lb
2257 - 2500 kJ/kg

Isothermal Vs. Adiabatic

- Vapor pressure differential governs evaporation rate
- Evaporation slows as it approaches saturation
- Constant Enthalpy process

- Arid = Rapid Evaporation
- Damp = Slow Evaporation



Benefits of Adiabatic Systems

- Energy efficient
- Free cooling
- Typical larger capacities for single units (up to 2800 lbs/hr)
- Minimal maintenance

Humidification - Steam Generation

Steam Generation

Same IC & Touch Display

Electrode

EL Series

Resistive

RS Series

Gas

GS Series

Small Electrode

RH Series

Central Steam

Livesteam

LS Series

Steam-to-steam

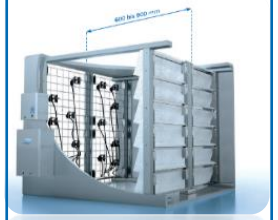
SE Series

Adiabatic Portfolio – Modular Solutions

Atomization/Evaporation

Same IC & Touch Display

HVAC (duct application)

- Evaporators
  
  ME Series
- High pressure nozzle systems
  
  HP Series
- Hybrid (low pressure & evaporation)
  
  DL Series

Direct Systems (direct room application)

- High pressure nozzle systems
  
  Draabe ML System
- Compressed air nozzle systems
  
  JetSpray
- Rotary disk atomizers
  
  ABS
- Ultrasonic nebulizers
  
  US Series
- Mobile evaporators
  
  B500
- Ceiling humidifier
  
  TE

Water Treatment Systems (reverse osmosis)

RO-A



ML System


Draabe box (rental)

ML Series - Benefits of Direct Room Humidifiers

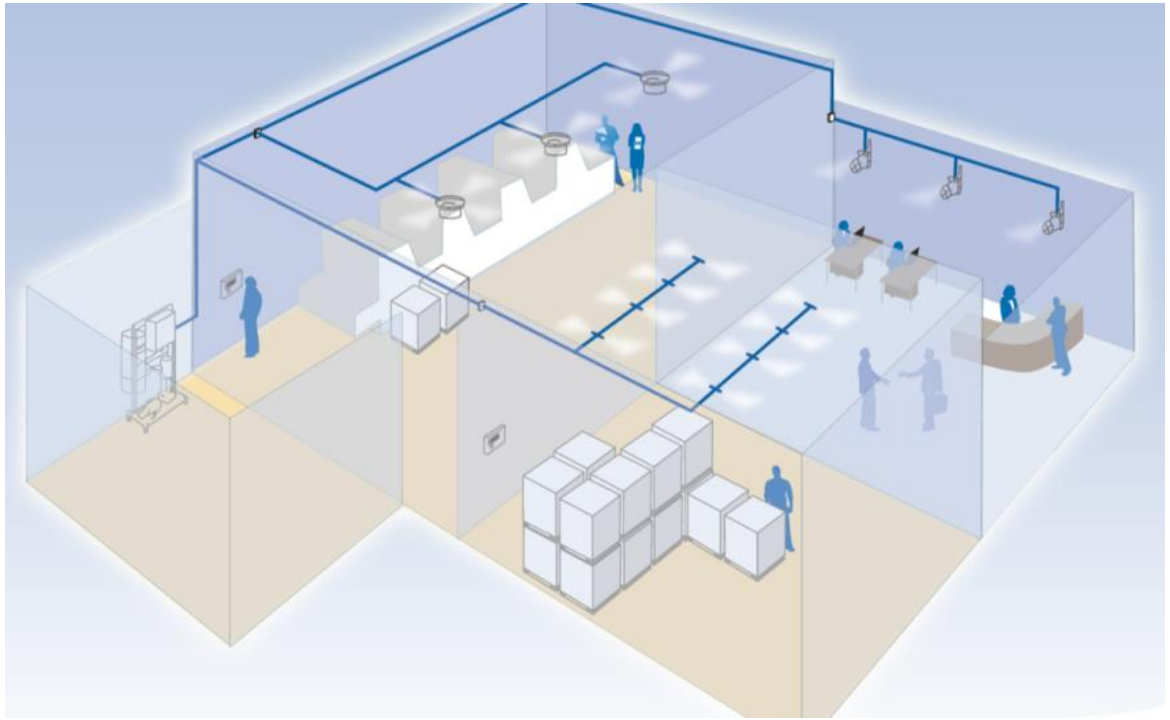
ML Series Flex Humidifier

ML Series Princess Humidifier

ML Series Solo Humidifier

- Instant output of humidity directly where it is needed when there is a demand
- Systems can be tailored for each individual site
- Fan assisted mist dispersion decreases absorption times and needed clearances
- Wall or ceiling mounting options including low ceilings
- Low energy consumption

Why adiabatic In-Space for Paper and corrugated



- Multiple Head and Nozzles serving multiple zones
- Low Ceiling Applications
- Clean Room Applications
- ESD or Dust Suppression
- Adiabatic cooling where needed
- No or limited duct work – Great for RETROFITS
- Capacities of tens of lbs/hr. to several **thousands** of lbs/hr.
- Improved ESG

EL & RS Series Benefits of Electric Humidifiers

EL Series Electrode Steam Humidifier

RS Series Resistive Steam Humidifier

- Pure, clean, sterile steam humidification
- Quick and easy maintenance
- Humidifier fits into tight spots with zero-side clearance
- Water consumption is minimized
- Standard drain water cooling to 140°F (60°C) - no external equipment required for DWC
- Outdoor model can be installed in locations down to -40°F (-40°C)

Energy

Energy Use

- ~1000 BTU/lb to change phase from liquid to gas
- Steam humidifiers use electricity or gas
- Adiabatic humidifiers draw energy from air

Better ESG with adiabatic DRS

- Low energy consumption – Cooling effect – High energy saving rebates
- 100% evaporation efficiency 100% hygienic and BQ testing on-site
- Guaranteed service and parts for 10 years after model phase-out
- Downsize mechanical cooling loads
- Boost energy footprint with 1-stop solution upgrades: from load sizing through system design, installation and maintenance
- Reduce your building energy intensity and greenhouse emissions
- **Condair new hourly simulation tool**

Better ESG with adiabatic DRS

Cost Anal AB

condair

Product Comparison

Resistive Steam

RS

Innovative scale management for easy servicing, accurate humidity control and no disposable boiling cylinders.

Ultrasonic

US

Generates an ultra-fine mist that cools and humidifies a space directly.

Design Conditions

Peak Load: 160 lbs/hr

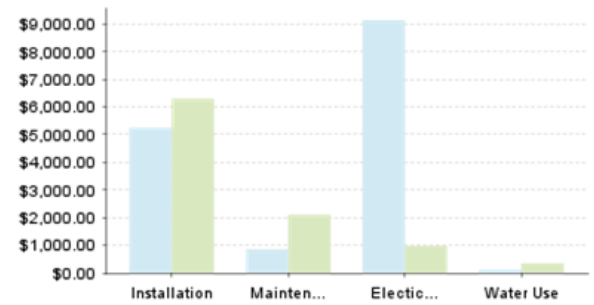
Annual

Humidifier Hrs.: 2,400 hrs
Fan Hrs.: 3,000 hrs

Adiabatic Design Selection / Setup

Beneficial Cooling

Cost Summary



Summary

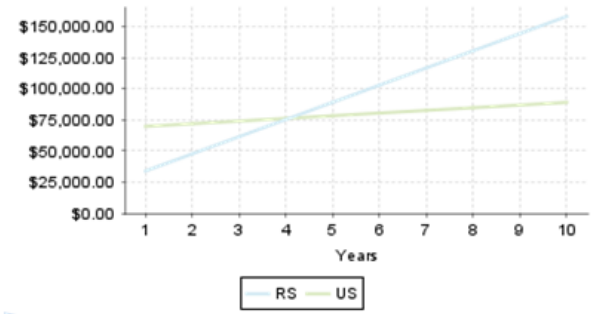
RS: RS

First Year	$33,853
Maintenance	$850
Energy	$12,795
Water	$159
Total	**$158,084**
(10 years)	

US: US

First Year	$69,717
Maintenance	$2,100
Energy	($421)
Water	$462
Total	**$88,986**
(10 years)	

Life Cycle Cost



Equipment Setup

General Setup

Humidifier Peak Load	160	lbs/hr
Average Usage	70	%
Corrected Humidifier Load	112	lbs/hr
RO System Efficiency	70	%
Yearly Operation	2,400	hrs

Utility Rate Information

Electricity Demand Charge	0.10	USD/kWh
Electricity Service Charge	8.00	USD/kW per month
Natural Gas	10.00	USD/kWh
Central Steam	10.31	USD/1000 kg
District Heating	0.05	USD/kWh
Water	2.50	USD/m^3
Reverse Osmosis Water	8.00	USD/m^3
Sewer	4.00	USD/m^3

Adiabatic Setup

Air Volume	6,000	CFM
Fan Efficiency	70	%
Yearly Fan Operation	3,000	hrs
Adiabatic Mode	Include Cooling Savings	

Coefficient of Performance COP (if applicable)

Equivalent Cooling System	6	
Preheat System	2	District

Data Outputs

Utility Usage

	Water Type	Water Usage	RO Waste	Sewer Billed	Sewer Actual	Electricity Demand	Cooling (saved)	Pre-heat (spent)
RS	Potable	44,289 gal $111		44,289 gal $177	11,958 gal $48	91,392 kWh $9,139/year		
US	RO	43,108 gal $345	18,475 gal $46	61,583 gal $246	29,252 gal $117	9,677 kWh $968/year	13,920 kWh/year	41,455 kWh/year

Adiabatic Data

	RS	US
Pressure Loss (Off-Season)		
Pressure Loss (Humidifying)		
Additional Fan Energy		
Additional Fan Energy Cost		

Total Costs

		RS	US
Totals	**First Year**	**$33,853**	**$69,717**
	Subsequent	**$13,803**	**$2,141**

Cummulative Life Cost

	RS	US
Initial	$20,050	$67,576
2020	$33,853	$69,717
2021	$47,657	$71,858
2022	$61,460	$73,999
2023	$75,264	$76,140
2024	$89,067	$78,281
2025	$102,871	$80,422
2026	$116,674	$82,563
2027	$130,477	$84,704
2028	$144,281	$86,845
2029	$158,084	$88,986

Applications

MEADWESTVACO PACKAGING

Condair ML High Pressure Humidifier
Food Processing & Manufacturing

MeadWestvaco –

MeadWestvaco is a producer of packaging, specialty papers, consumer and office products and specialty chemicals. The company's paperboard, package and paper brands include Carrier Kote, Custom Kote, Printkote, Tango, Amaray, Dosepak and Vision.

Condair ML Series
High Pressure Humidifier

SEDA NORTH AMERICA INC.

Condair MLP100PLC / MLRO1500 Humidifier
Packaging Industry

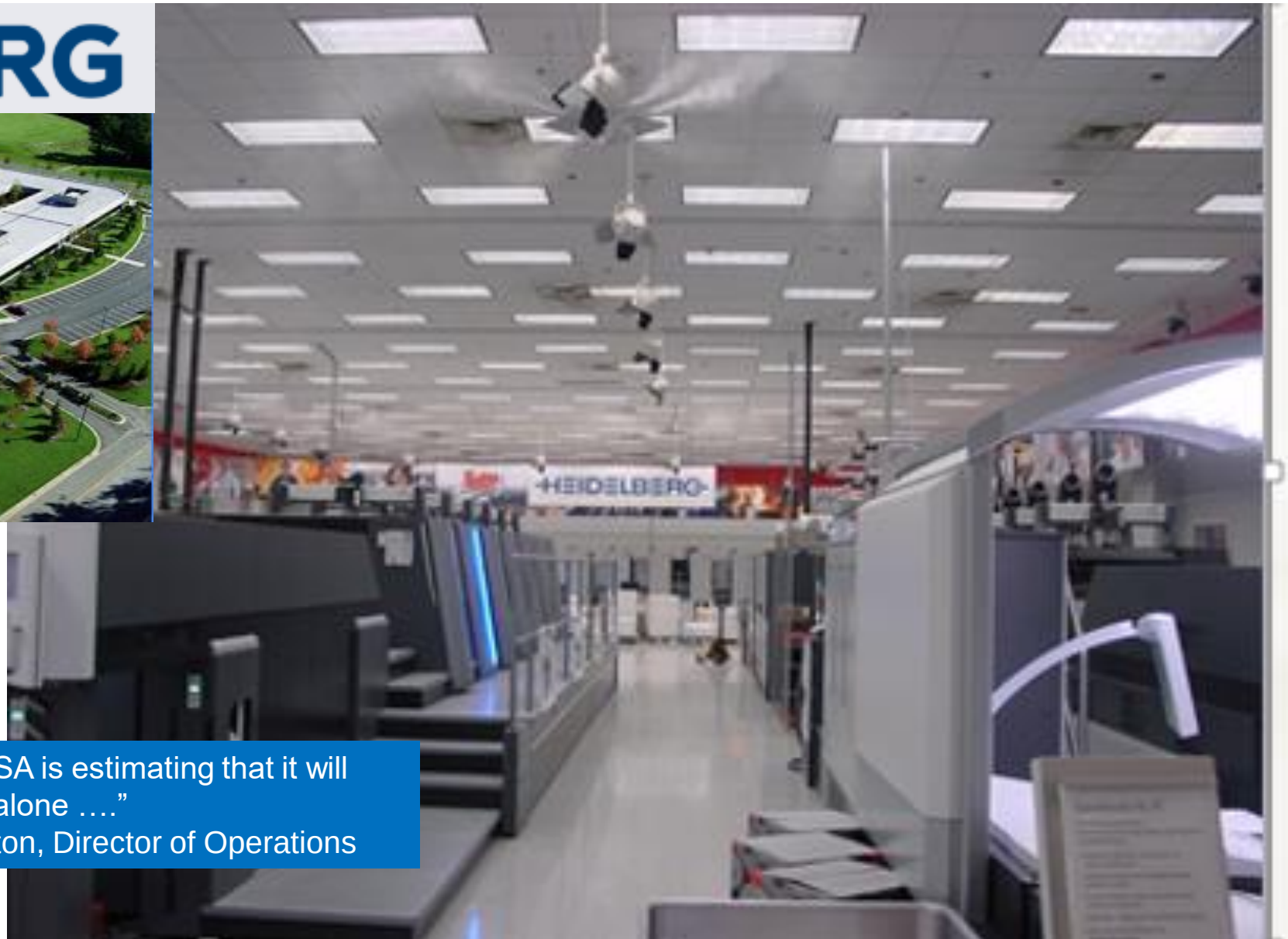
Seda North America Inc. – Mount Pleasant, WI

Seda North America is part of a privately owned multinational packaging group. Seda is a global leader in developing effective solutions for a broad range of packaging applications. By combining innovative manufacturing processes with state-of-the-art printing and converting technologies, they create packaging solutions to drive the market and promote the world's best-known brands.

Condair ML Series
High Pressure Humidifier

condair

HEIDELBERG



"Since installing the system, Heidelberg USA is estimating that it will save more than $17,000 a year in energy alone …."

Russ Barton, Director of Operations

Label Printing - Syracuse

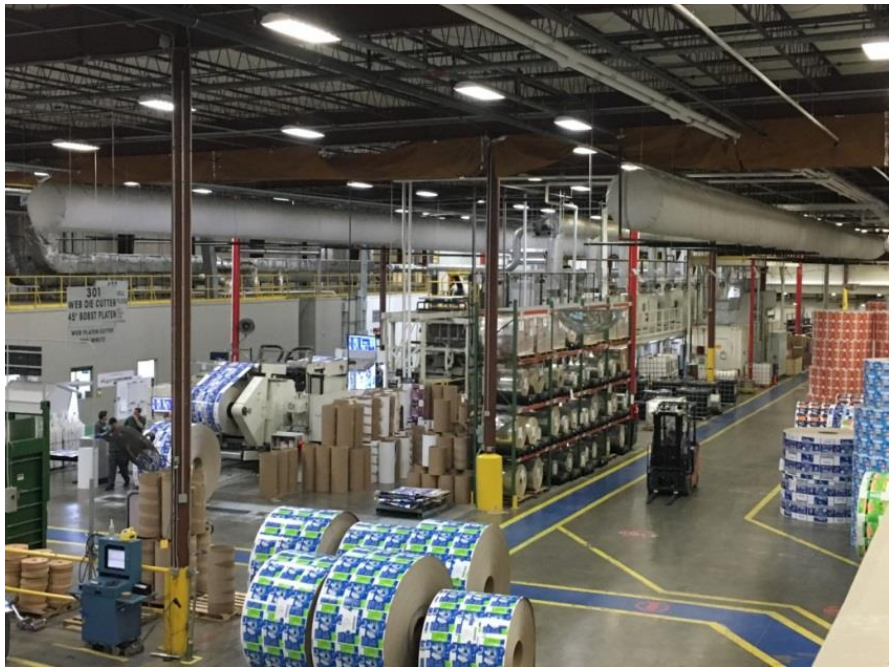
- 50,000 sq ft New Construction
- 1,100 lb/hr
- NYSERDA incentive approved for $74,462

New York State Energy Research and Development Authority

- NYSERDA's mandate is to reduce the need for additional electrical generation through usage (KWH) and demand (KW) reduction
- Incentive monies are made available for pre-approved high-efficiency equipment as well as process or equipment modifications that reduce energy use

Specialized Packaging, Baldwinsville, NY

- 1050 lb/hr FLEX nozzles
- 60,000 cfm outdoor make-up air fabric duct system to pressurize Gallus press zone
- $90,000 NYSERDA Incentive
- Packaging manufacturer for consumer products



Around the world

- Strong name recognition in printing and packaging, industries

Summary

Condair experts – Application Support

- 70 years of experience

Contact:

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- William.Truong@Condair.com
- Alvie.Stephenson@Condair.com

Thank you

Questions?