



# **Air-Side Economizers and Equipment Facilities –A Happy Marriage?**

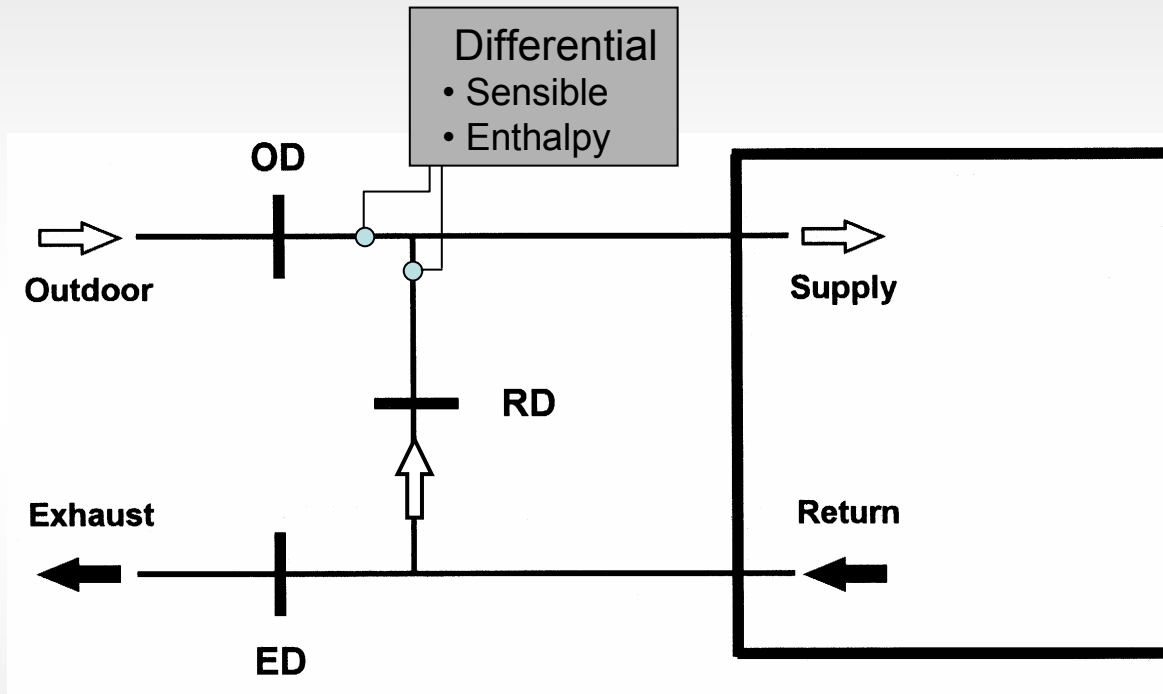
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# Objective

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- Air-Side Economizers
- Trend Study
  - Energy Savings
  - Additional Costs
  - Equipment Reliability
- Telecom Experiences

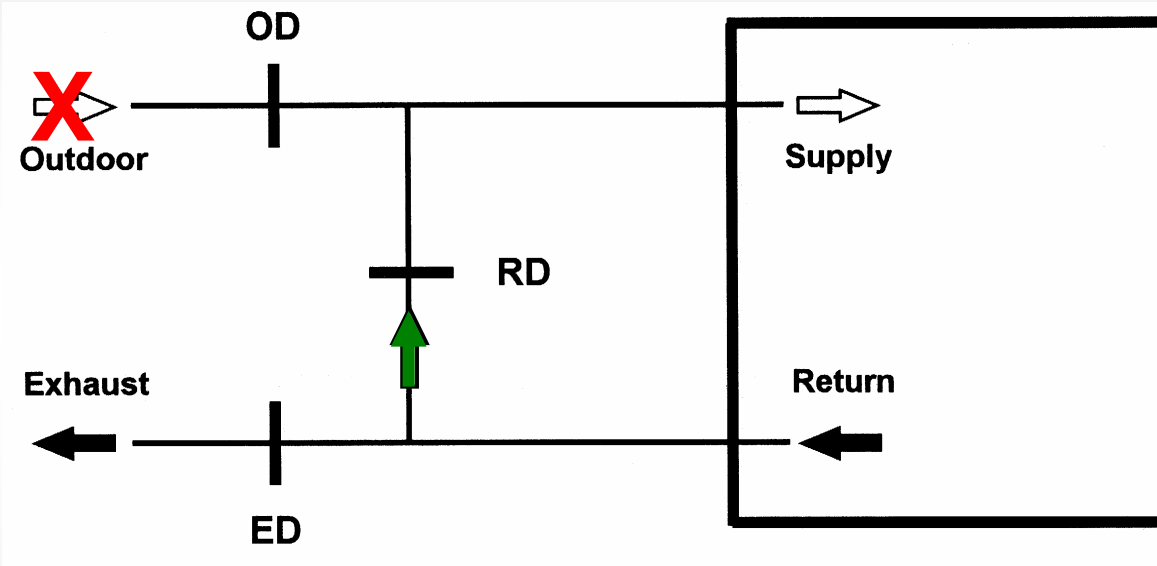
# Air-Side Economizers



- + Over-Ride Controls (extreme outdoor conditions)
- + Lock-Out Controls (no cooling needed)

# Damper Position 1

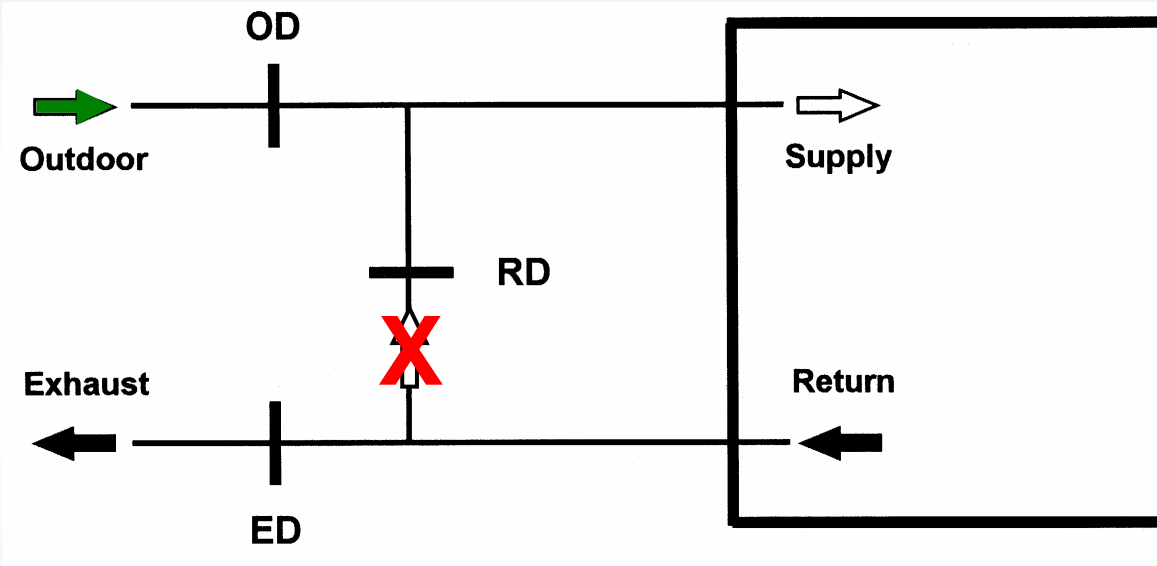
OAT > RAT



No Free Cooling  
(minimum OA)

# Damper Position 2

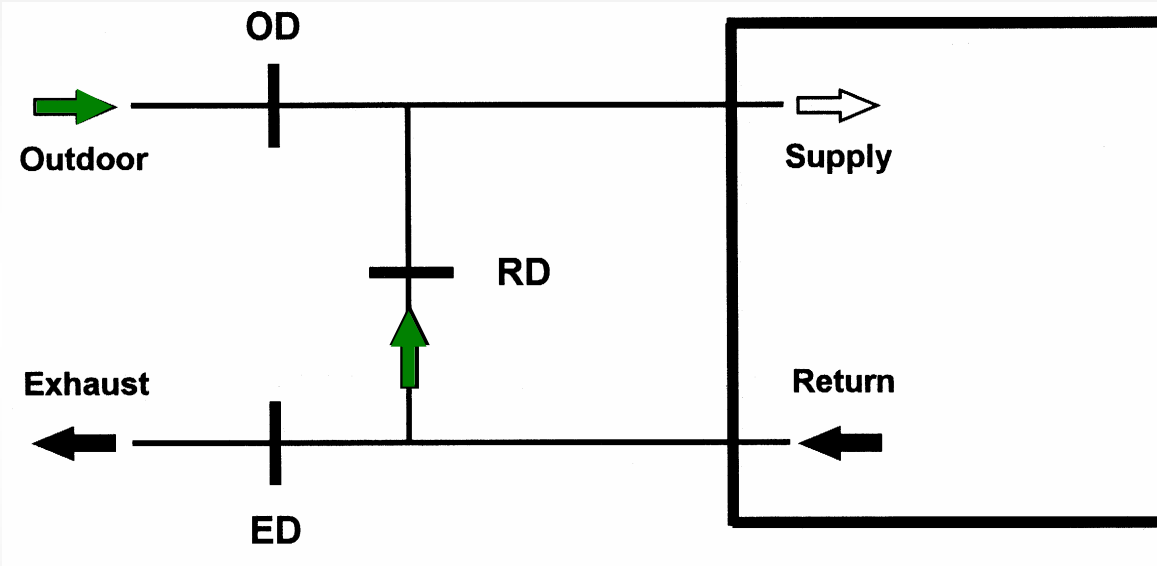
OAT < RAT



Partial Free Cooling  
(100% OA)

# Damper Position 3

$OAT < SAT$



**100% Free Cooling  
( $<100\%$  OA)**

# Trend: Energy Savings

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	Sensible %	Enthalpy %
Seattle	55	57
Los Angeles	45	49
Chicago	26	36
Washington	18	33
Miami	-28	8

Operation can be Augmented with Evaporative Pre-Cooling

Indoor and Outdoor Climate Dependency

# Outdoor Climate

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	<b>DB °F</b>	<b>Below DB % of Year</b>
<b>Los Angeles</b>	75	98
	69	86
	63	59
	57	32
	51	6
<b>San Francisco</b>	75	99
	69	96
	63	86
	57	69
	51	30

# Indoor Climate

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Guideline	Temp °C	Hum %
Telecom (GR-3028)	18–27	Max 55
Data Center (ASHRAE)	20–25	40–55

# Trend: Percentage of Outdoor Air

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	Sensible %	Enthalpy %
Los Angeles	78	72
Seattle	56	56
Chicago	50	41
Washington	54	38
Miami	65	25

**Humidified Spaces May Not Benefit From Economizers**

**The More Outdoor Air, the More Fine Particles, and...  
the More Equipment Soiling**

# Trend: Fine Particles (“Dust”)

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	Particles [ $\mu\text{g}/\text{m}^3$ ]		
	Outdoor	None	Enthalpy
Los Angeles	23	0.36	2.2
Seattle	19	0.34	1.4
Chicago	20	0.34	1.1
Washington	14	0.25	0.8
Miami	17	0.28	0.6

Fine Particles + Humidity = #@!#

# Equipment Robustness

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Guideline	Temp °C	Hum %
NEBS ("operating")	5–40	5–85
CLASS 1 ("allowable")	15–32	20–80

**+ Equipment Turn-Over Differ Significantly**

# Service Provider 1: 2000 COs

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- Most Central Offices use air-side economizers
- Both sensible and enthalpy economizers are used
- Little problems; occasional indoor humidity swings due to rapid weather changes.
- Overall good success. Sometimes disconnected in humid and/or hot locations.
- NEBS robust equipment

# Service Provider 2: 1200 COs

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- Most Central Offices use air-side economizers
- Enthalpy economizer is most common
- No equipment failures. Dust storms in desert areas can wipe out a filter bank completely.
- All new HVAC designs are required to include air-side economizers
- Purging capabilities

# Summary

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- Energy Savings (+)
- Additional Costs (–)
- Equipment Reliability (–)
  - Indoor Operating Protocols
  - Outdoor Climate (location)
  - Economizer Type
  - Over-Ride & Lock-Out Controls
  - Filter Efficiency
  - Sensor and Filter Maintenance
  - Equipment Robustness
  - Equipment Turn-Over