



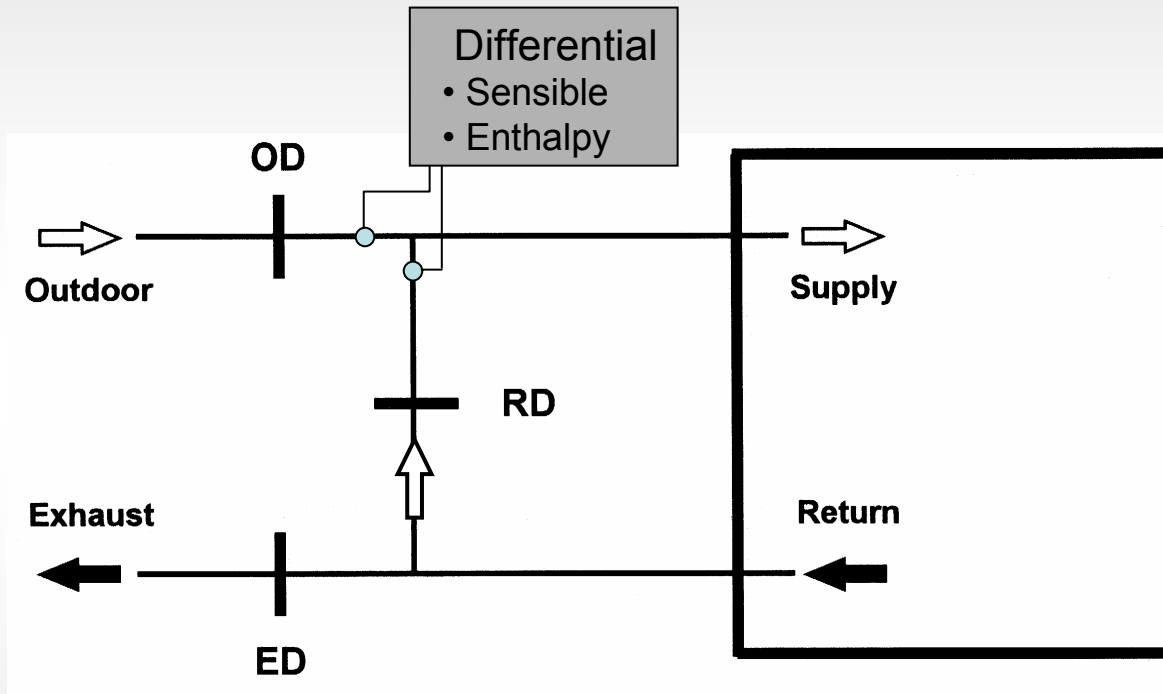
Air-Side Economizers and Equipment Facilities –A Happy Marriage?

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Objective

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

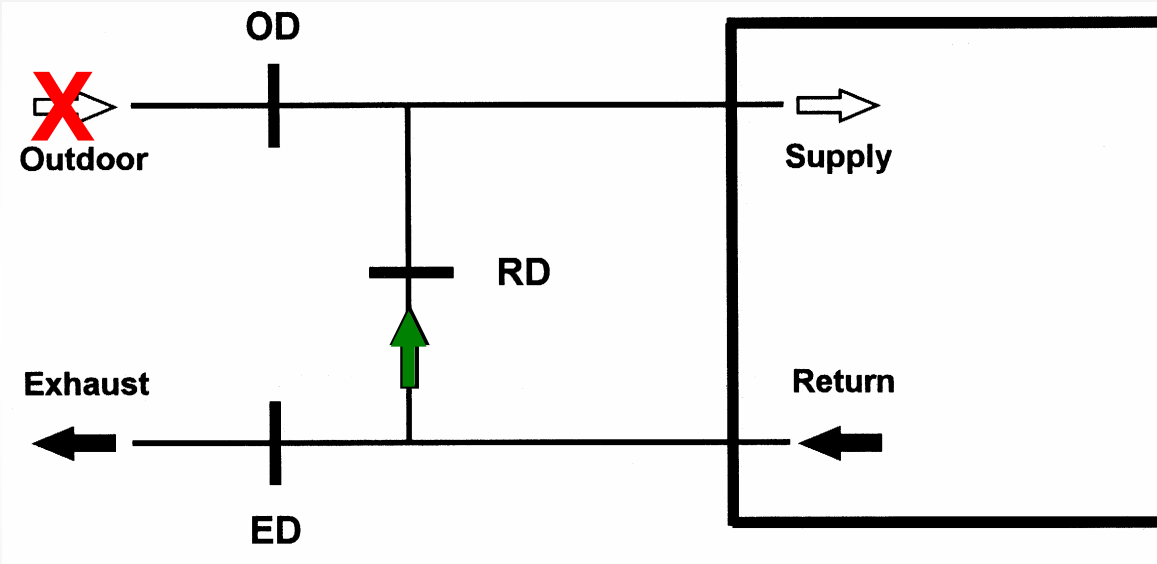
Air-Side Economizers



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

Damper Position 1

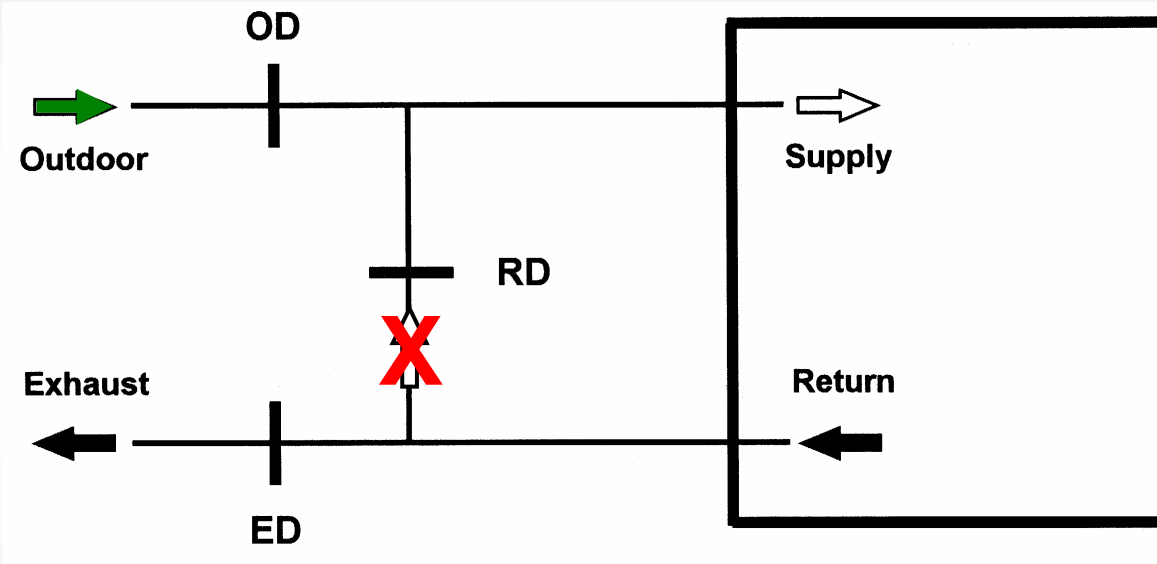
OAT > RAT



No Free Cooling
(minimum OA)

Damper Position 2

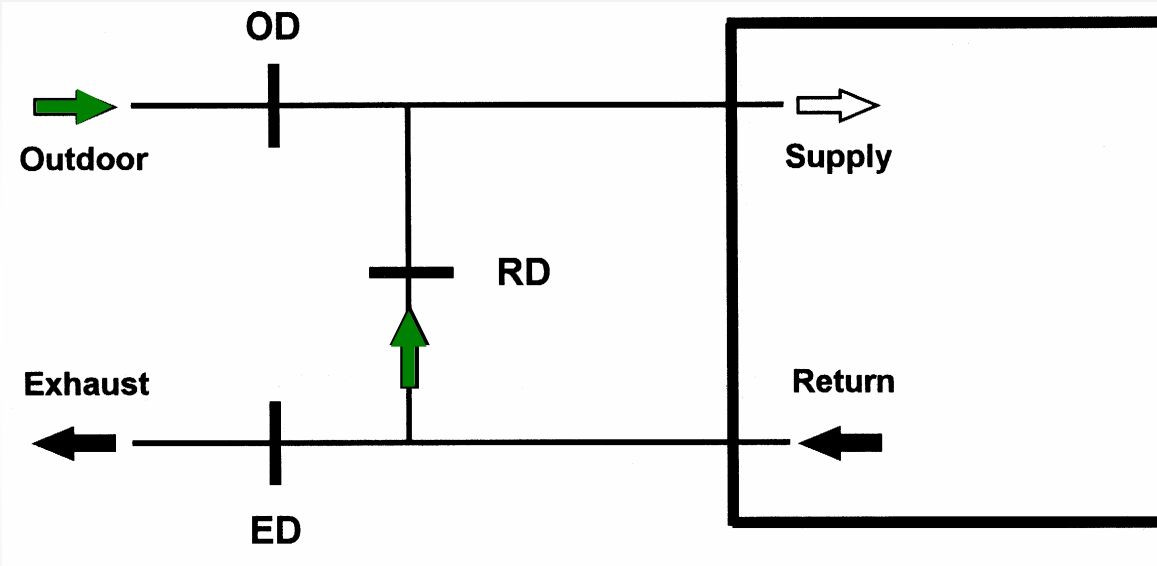
OAT < RAT



Partial Free Cooling
(100% OA)

Damper Position 3

$OAT < SAT$



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

Trend: Energy Savings

	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

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

Indoor Climate

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

Trend: Percentage of Outdoor Air

	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”)

	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

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

- 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

- 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

- 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