

Up On the Roof

Recent advances in rooftop unit controls

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Cooling Efficiency Workshop



E Source

What's So Special About This RTU?

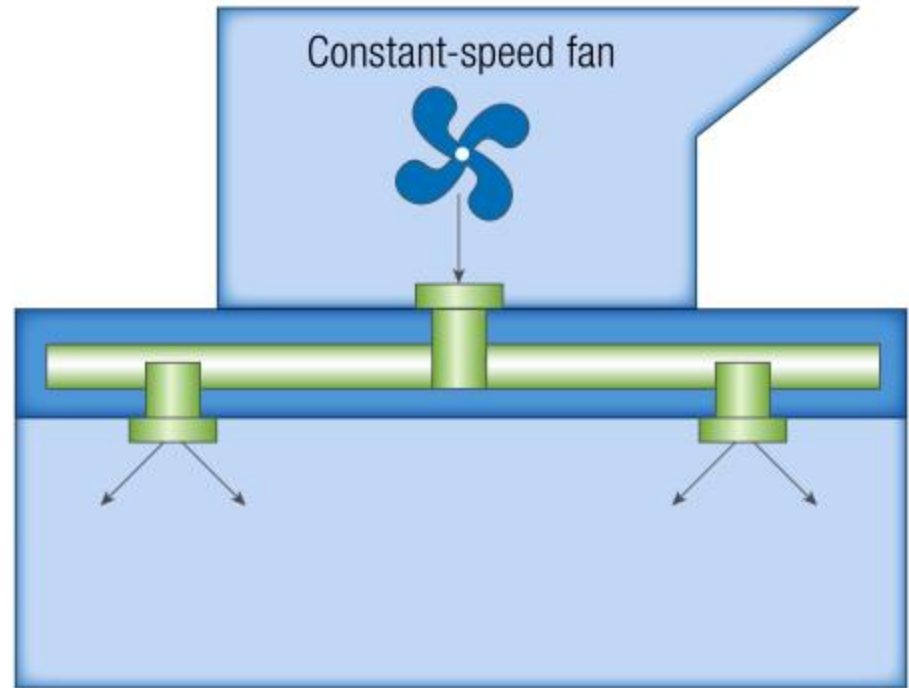


Source: Trane



Single-Zone Constant Volume (CV)

- One zone
- Fixed fan speed
- Fan either on or off

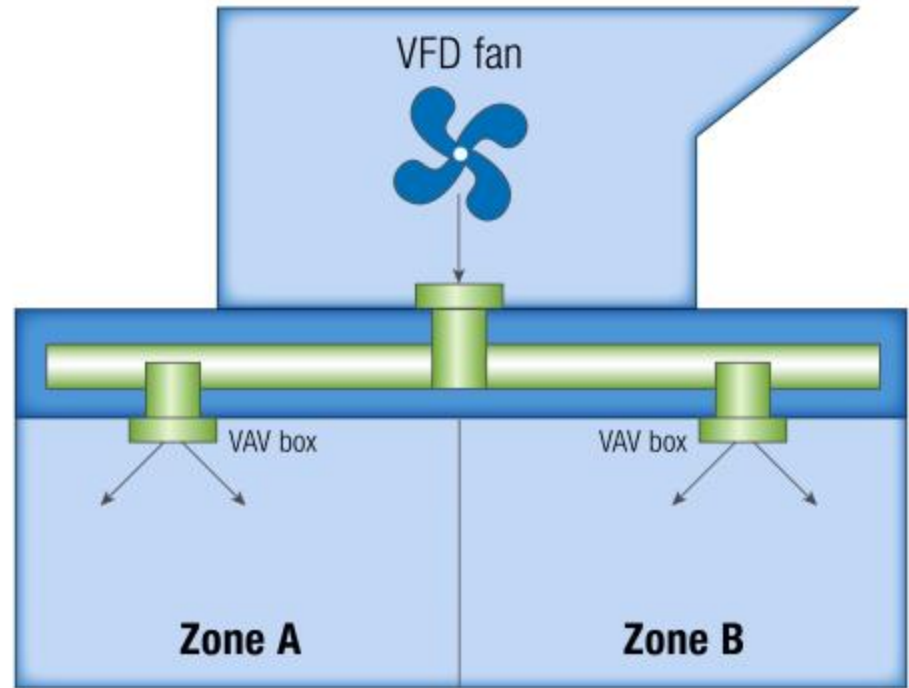


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Multizone Variable Air Volume (VAV)

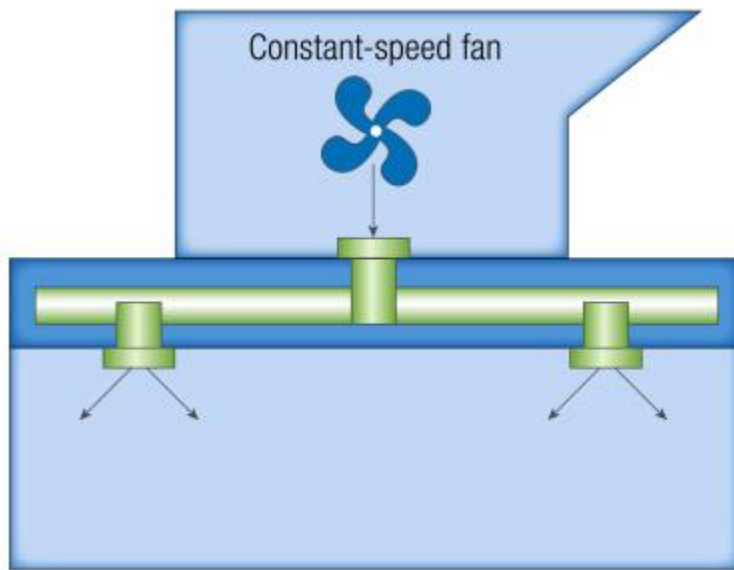
- Multiple zones
- Variable fan speed
- Fan speed based on duct pressure



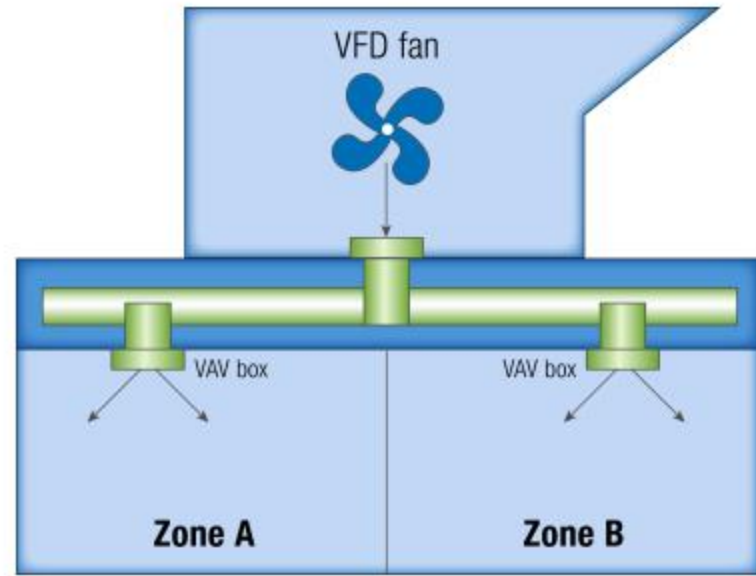
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Combine the Two ...



+



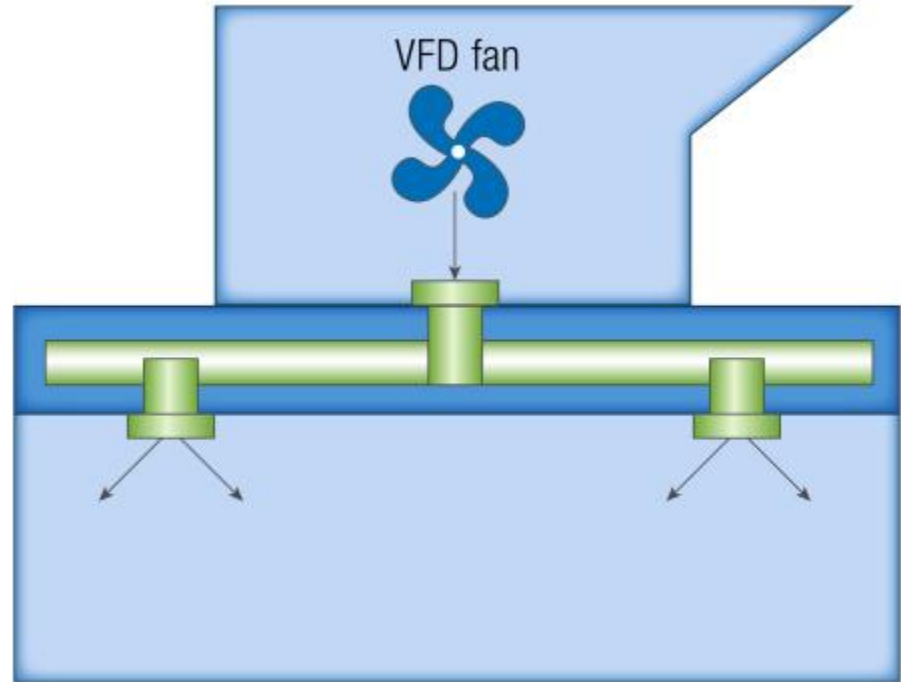
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Single-Zone Variable Air Volume (SZVAV)

- One zone
- Variable fan speed
- Fan speed based on ΔT between setting and actual room temperature
- Low speed when neither heating nor cooling is called for



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Advantages of SZVAV

Reduces energy consumption

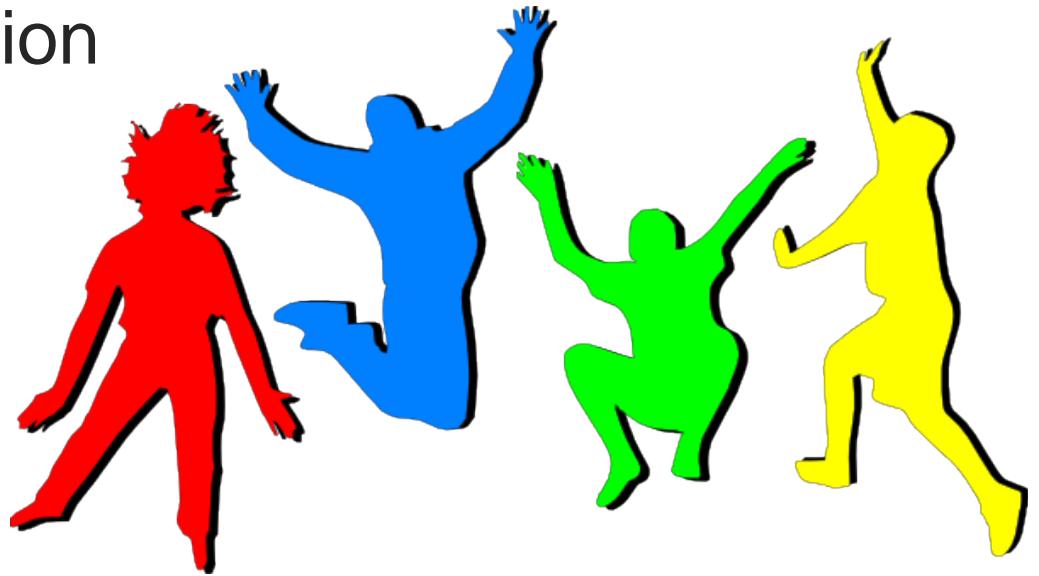
- SEER boost 2.5 points
- At least 20% energy savings

Helps compensate for oversizing

Improves dehumidification

Reduces fan noise

Reduces complexity



Courtesy: Clker.com



Additional Features

- Integrated economizer
- Demand-controlled ventilation
- Variable-speed compressor



Courtesy: Clker.com



Where Can You Get a SZVAV?

Aaon

Carrier

- Centurion

Daikin/McQuay

- Rebel

Lennox

- MSAV

Trane

- Precedent Plus

York



Courtesy: Daikin/McQuay



Source: Lennox



Size Matters

Where to use SZVAV:

Single zone units

7.5 tons or larger

- Occasionally cost-effective as low as 5 tons

Long run hours

- 24/7 the best
- Office hours (M-F, 9-5) are on the bubble

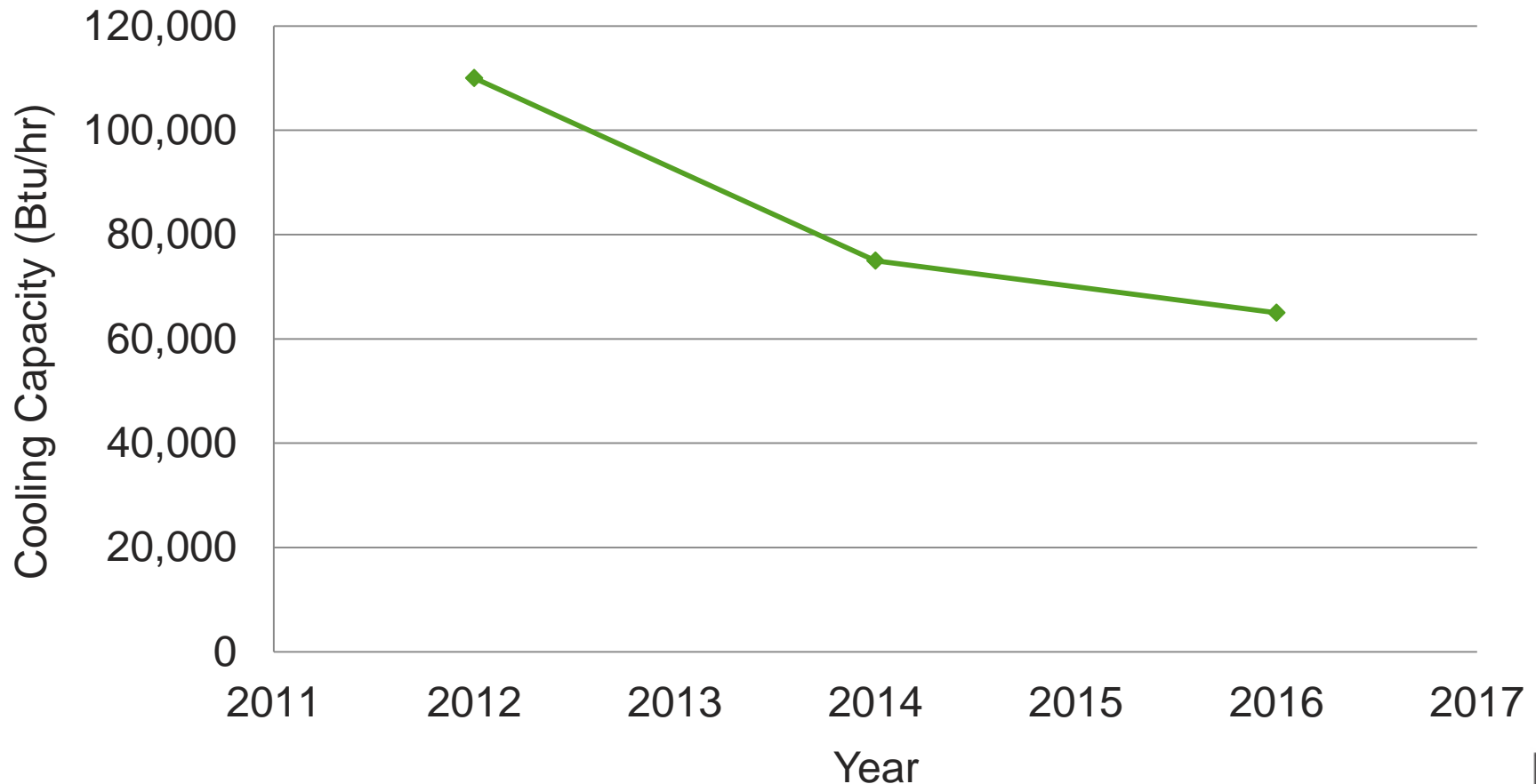
Oversized

- The more excess capacity, the greater the savings



Coming Soon to a Building Code Near You

Effective dates for SZVAV required by California Title 24
for DX cooling equipment



What About All Those Existing Units?



Source: Wikimedia Commons



RTU Variable-Frequency Drive Retrofit Devices

- Catalyst

[Transformative Wave Technologies](#)



Source: Transformative Wave Technologies

- Enerfit

[Enerfit LLC](#)



Source: Enerfit

- Digi-RTU Optimizer

[Bes-Tech](#) (DTL Controls)



Source: Bes-Tech



Different Strokes for Different Folks

Product	VFD evaporator fan	VFD compressor	VFD type	Damper for coil 2
Catalyst	✓		Indexed	
Enerfit	✓		Continuous	✓
Digi-RTU	✓	✓	Continuous	

Note: VFD = variable-frequency drive.

© E Source



Source: Wikimedia Commons



Source: Enerfit



All Provide Additional Features

- Demand-controlled ventilation
- Integrated economizer control
- Web control and monitoring
- Fault detection and diagnostics



They're Not Modest

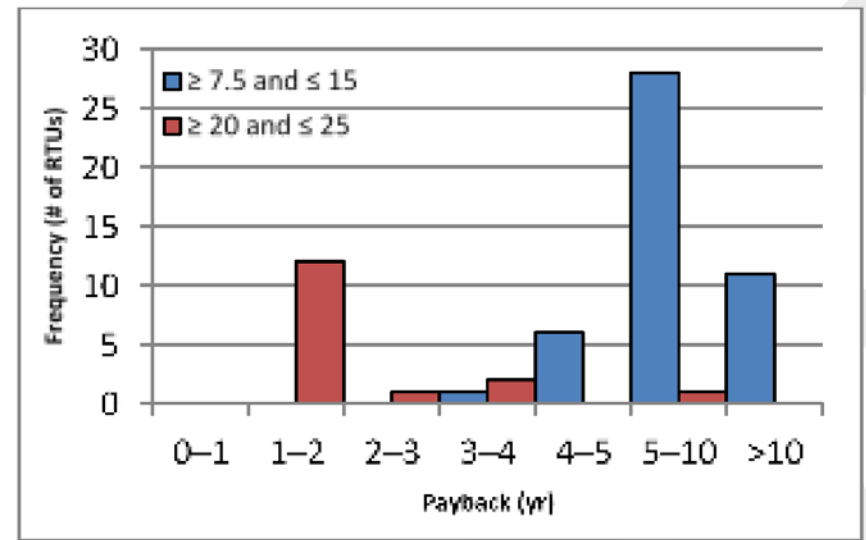
Product	Annual HVAC energy savings	Simple payback period	Cost
Catalyst	25–40%	2 years	\$4,000 (15-ton)
Enerfit	50–70%	1–3 years	\$4,700 (20-ton)
Digi-RTU	50%	1–4 years	\$600 per ton \$12,000 (20-ton)

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Finally, from PNNL, a Definitive Study

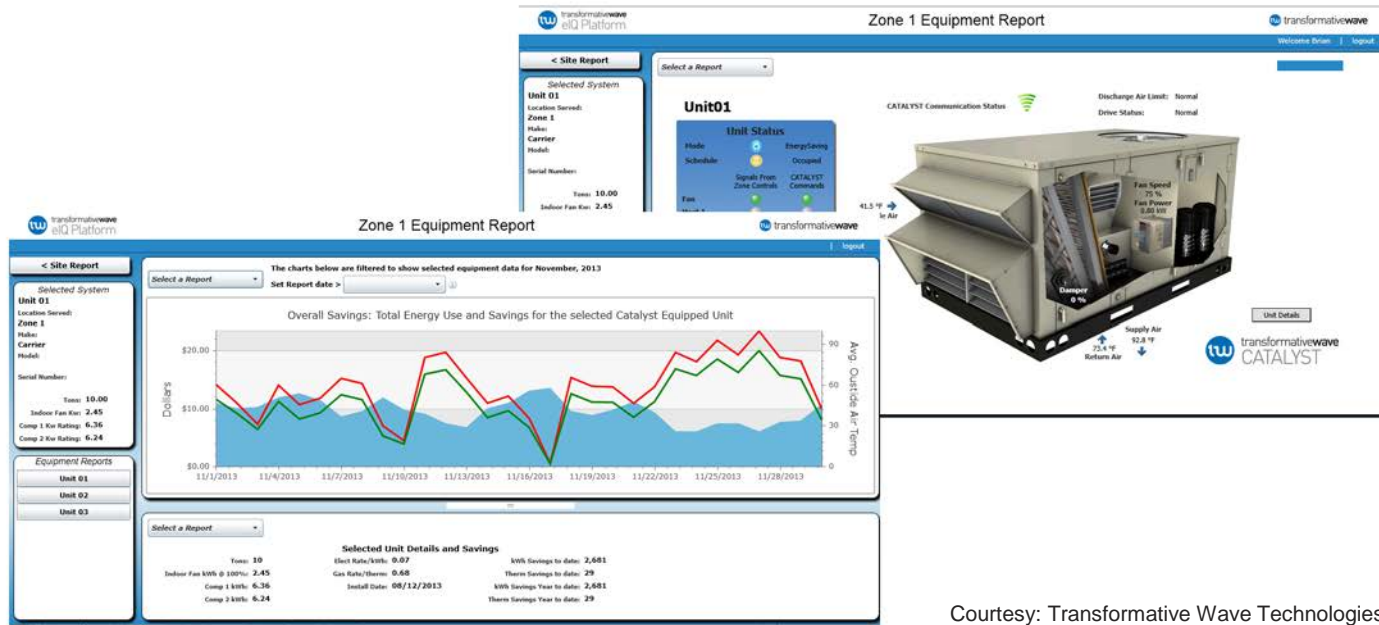
- Number of rooftop units tested: 66
- Building types: mercantile, office, food sales, healthcare
- Savings varied widely: 22% to 90%
- Average savings: 55%
- Average simple payback period: 3 years



Source: Pacific Northwest National Laboratory



In Addition to Energy Efficiency
















Courtesy: Transformative Wave Technologies



Fault Detection and Diagnostics

Unit03 Health Status

Drive Communication	
Drive Fault	
Fan Run	
Fan Belt	
Heating Fail	
Cooling Fail	
Damper Fail	
Space Sensor	
Supply Sensor	
Return Sensor	
OSA Sensor	
CO2 Sensor	
Service Off	

Courtesy: Transformative Wave Technologies



System Monitoring



Scottsdale
7111 E. Mayo Blvd.



Unit Name	Serves	Comm	Mode	Health	Occ	Fan Call	Comfort Status	Space Temp	Actual Heat	Actual S/P	Actual Cool S/P	Fan Status	Fan Speed	Fan Power	Cooling 1	Cooling 2	Heating 1	Heating 2	Supply	Return	OSA	CO2	OSA Volume
Unit01	Sales Seafood							71.6 °F	70 °F	73 °F			40 %	0.34 kW					80.3 °F	77.5 °F	87.9 °F	446 ppm	-
Unit02	Main Sales Cntr							72.3 °F	70 °F	73 °F			40 %	0.33 kW					80.7 °F	77.8 °F	88.7 °F	450 ppm	-
Unit03	Sales Tapas							72.8 °F	70 °F	73 °F			40 %	0.36 kW					79.7 °F	76.7 °F	88.0 °F	473 ppm	-
Unit04	Loading Dock							70.3 °F	68 °F	71 °F			90 %	1.80 kW					53.0 °F	72.1 °F	84.2 °F	412 ppm	-
Unit05	Food Prep							71.0 °F	68 °F	71 °F			40 %	0.13 kW					82.7 °F	77.8 °F	82.7 °F	392 ppm	-
Unit06	Checkstands							70.6 °F	68 °F	73 °F			40 %	0.14 kW					82.8 °F	78.1 °F	80.3 °F	442 ppm	-
Unit07	Bakery							71.5 °F	68 °F	71 °F			40 %	0.14 kW					81.4 °F	77.6 °F	80.6 °F	472 ppm	-
Unit08	Vestibule							74.0 °F	68 °F	71 °F			90 %	0.84 kW					45.2 °F	74.0 °F	82.4 °F	-	-
Unit09	Produce							72.3 °F	68 °F	71 °F			90 %	0.46 kW					46.3 °F	76.8 °F	47.6 °F	443 ppm	-

Site Data	Space Humidity		Space Humidity Setpoint		Dehumidification Cool Reheat		Dehumidification Su		Dehumidification Fan Speed Setpoint		Space Dewpoint	
	Unit	%RH	%RH	%RH	Cool	Reheat	Dehumidification Su	Dehumidification Su	Fan Speed	Fan Speed	°F	°F
OSA Humidity 20.5 %RH	Unit01	31.3 %RH	50.0 %	50.0 %					80.0 %	80.0 %	39.7 °F	
	Unit02	28.8 %RH	50.0 %	50.0 %			-	-	80.0 %	80.0 %	38.1 °F	
	Unit03	35.7 %RH	50.0 %	50.0 %			-	-	80.0 %	80.0 %	44.7 °F	
OSA Dewpoint 39.4 °F	Unit04	-	-	-	-	-	-	-	-	-	-	-
	Unit05	-	-	-	-	-	-	-	-	-	-	-
Space Static 0.02 in/wc	Unit06	34.4 %RH	50.0 %	50.0 %			55.0 °F	55.0 °F	75.0 %	75.0 %	41.3 °F	
	Unit07	34.9 %RH	50.0 %	50.0 %			55.0 °F	55.0 °F	75.0 %	75.0 %	42.5 °F	
	Unit08	-	-	-	-	-	-	-	-	-	-	-
	Unit09	32.7 %RH	50.0 %	50.0 %			55.0 °F	55.0 °F	75.0 %	75.0 %	41.4 °F	

Courtesy: Transformative Wave Technologies



For More Information

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Have a question? Ask our experts: www.esource.com/question

