



## **Integrating Dedicated Dehumidification Systems in Passive House Design: A Crucial Component for Optimal Indoor Air Quality**

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# Agenda

- What is a Dehumidifier?
- How does a Dehumidifier work?
- Should I, Could I, Would I?
- Quick Hitters

# Whole House Ventilating Dehumidifier

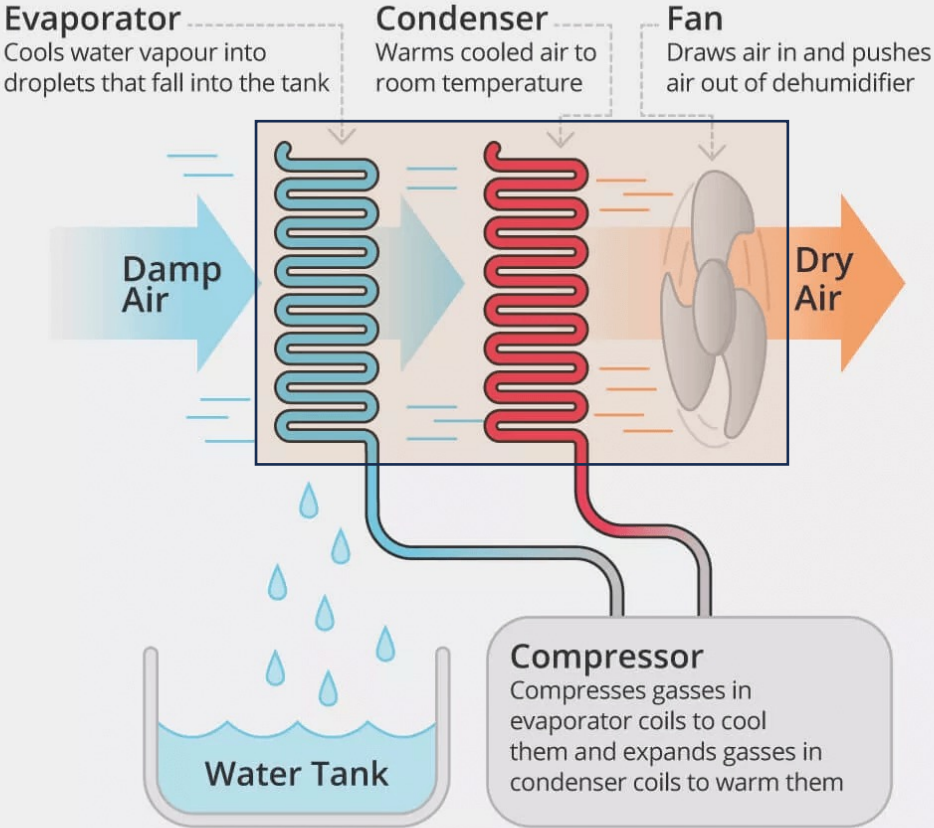
A whole house ventilating dehumidifier is designed to work with the home's HVAC system to:

- Bring in outdoor ventilation air
- Filter the air (MERV 13)
- Dehumidify the air in the entire home to maintain a set relative humidity (RH) level.



# Dehumidifier

## How a **Dehumidifier** works



Its an Air Conditioner in a box!



# Definitions and Terminology













**Sensible Load** is the temperature you feel on your body and measured with a thermometer. This is controlled with the HVAC thermostat.



**Latent Load** is the moisture in the air often referred to as relative humidity. This is more challenging to control with the HVAC thermostat.

# Passive Houses: Low-Sensible Load Homes

	Sensible Cooling Load	Latent Cooling Load
Continuous Insulation		
Air Tight Construction		
Optimized Windows/Shading		
Mechanical Ventilation		
Ducts in Conditioned Space		

Credit – Lisa White

# Other Factors That Can Lead to High Humidity

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Construction drying

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Lots of wood - other porous materials

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Seasonal Temperature Swings

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Daily Temperature Swings

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High SEER AC equipment with a high SHF

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High dew points outside

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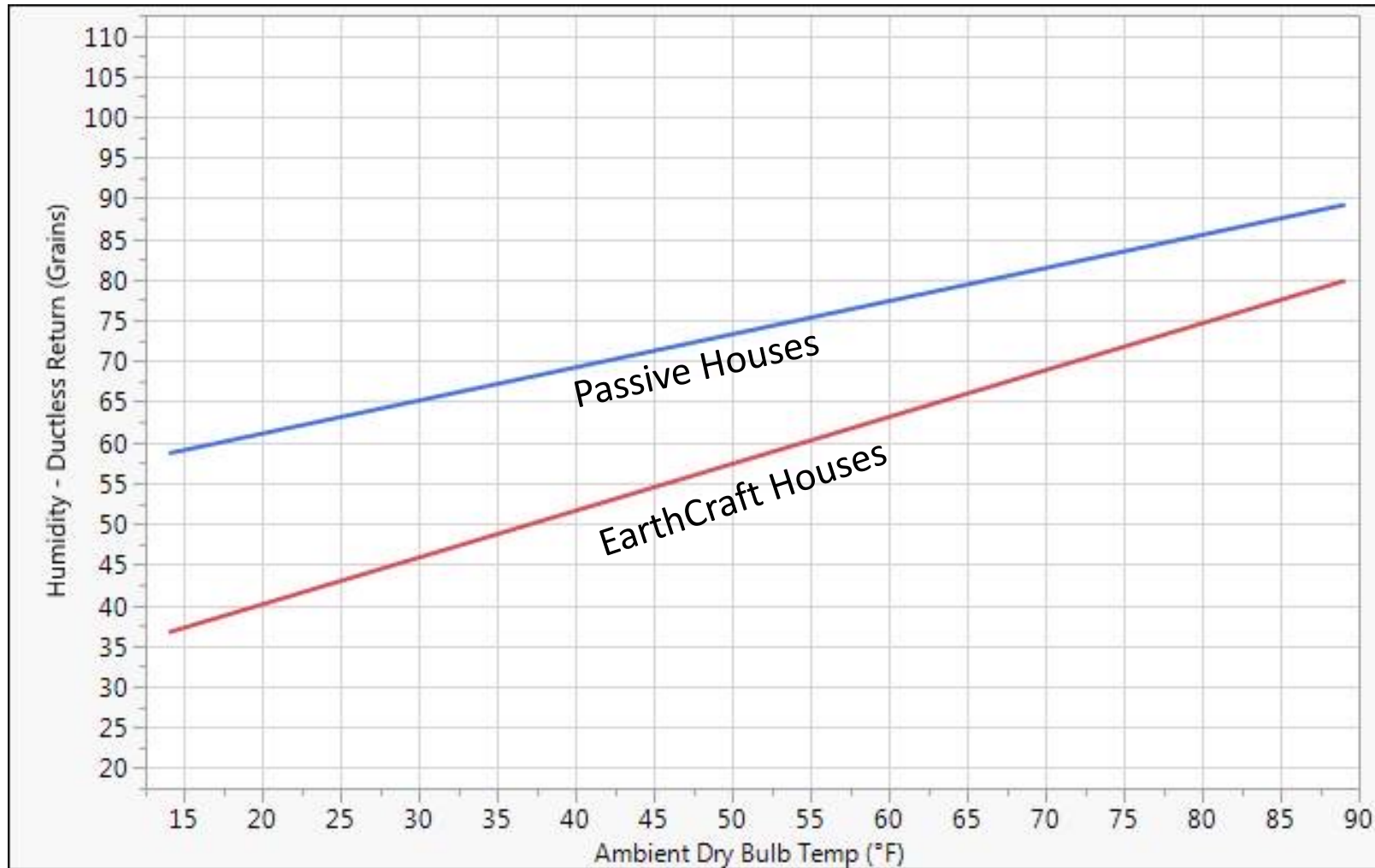
People generating moisture

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People operating the system and the house according to their lifestyle

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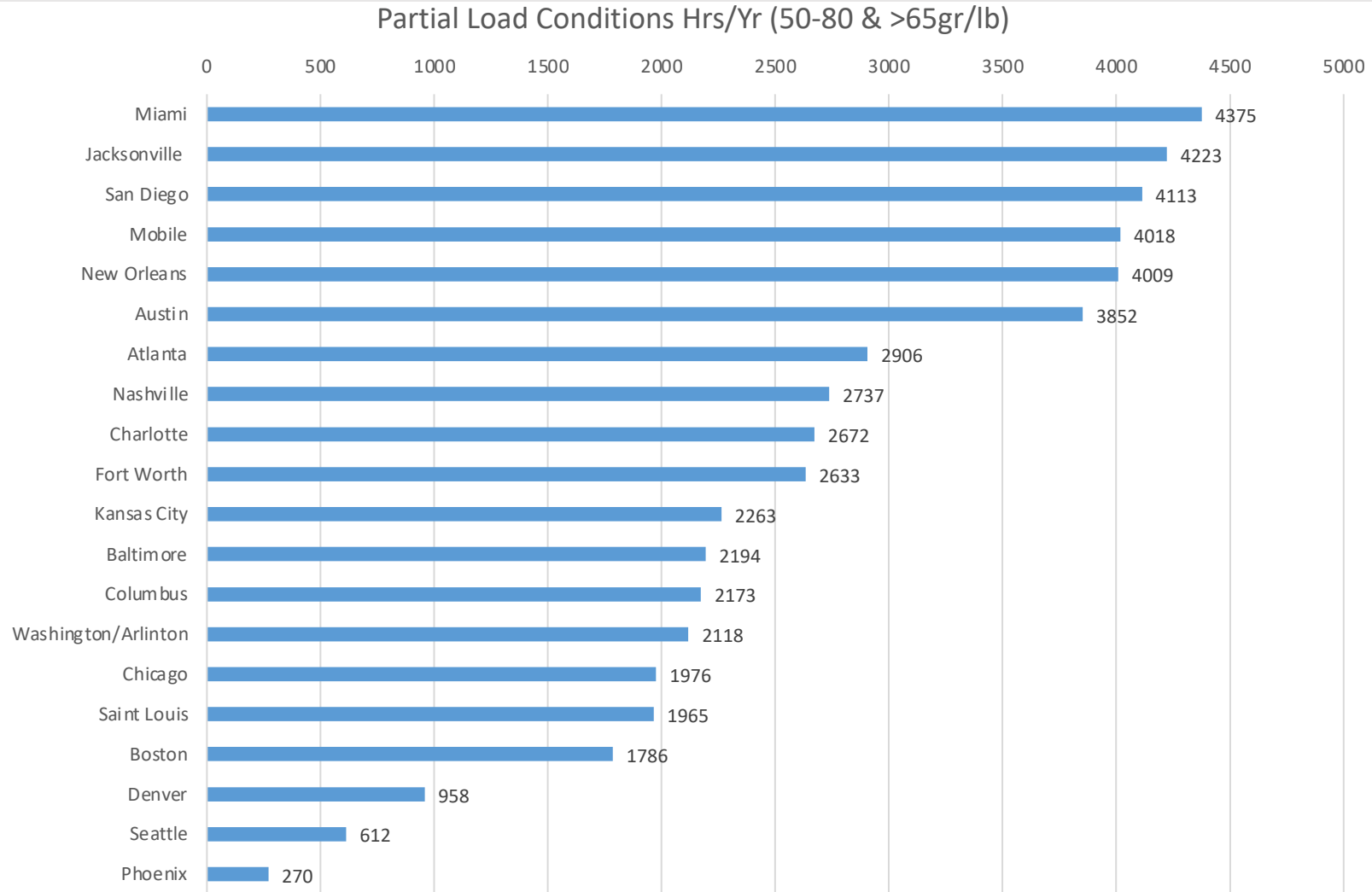
# Passive Houses Have More Internal Moisture



Credit: Treleven, David. "Performance Monitoring of Mini-Splits in Mixed-Humid Low-Load Homes." 12<sup>th</sup> Annual North American Passive House Conference



# Humid Partial Load Annual Frequency



Credit: Kimberly Llewellyn

# Air Conditioning

Designed to reach a temperature set-point (sensible)



New units have dehumidification set-points – still cooling

**Typical residential HVAC systems**  
need 14 minutes of run time to begin effective dehumidification.

# SEER: Seasonal Energy Efficiency Ratio



*The SEER rating of a unit is the cooling output during a typical cooling season divided by the total electric energy input during the same period. The higher the unit's SEER rating, the more energy efficient it is.*

## High SEER AC



Larger coils that are very efficient at getting to a cool temp quickly means less run time. **Typical coil holds 1 pint of water per ton**



Coils do not get as cold as older AC systems. **Less water removed from air and going down the drain**



High efficiency A/C runs 1-3 minute fan delays at end of cycle to increase SEER rating. **Increases the SEER rating by .5**



**Can increase indoor RH by up to 10%**

# SHF: Sensible Heat Factor

The dehumidification effectiveness of air conditioning equipment

$$\text{SHF} = \frac{\text{Sensible Cooling Load}}{\text{Total Cooling Load}}$$

# SEER vs SHF

SEER  
&  
SHF



Water  
Removal



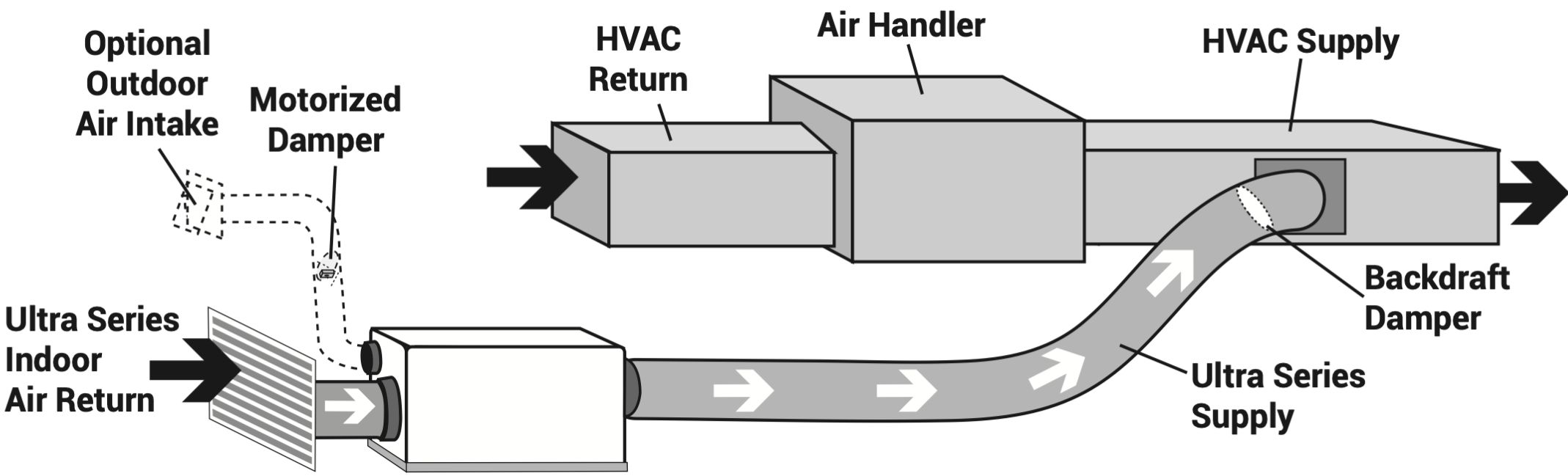
Rated Cooling Capacity (Btu/h) [95F]	SEER	Sensible Heat Factor
18000	20.5	0.87
22400	20.5	0.75
30600	14.5	0.64
33200	14.5	0.62
6000	33.1	0.96
6000	33.1	0.96
9000	30.5	0.92
9000	30.5	0.92
12000	26.1	0.83

# Should I? Could I? Would I?

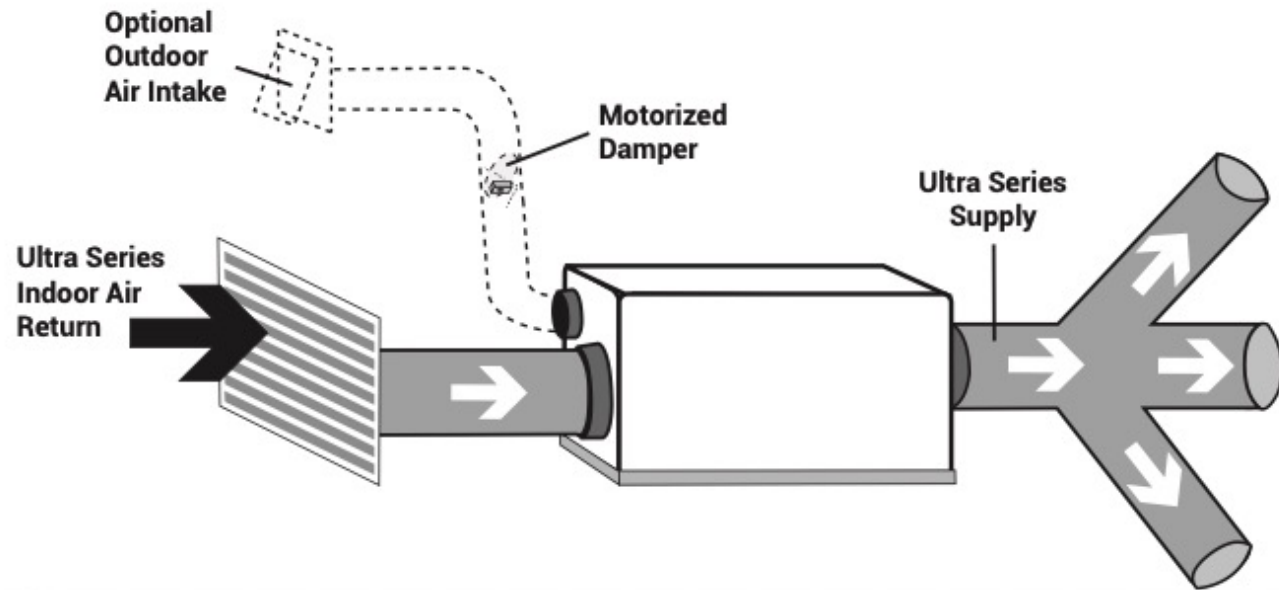
1. Could I use a dehu if I don't have forced air or ERV ductwork systems?
2. Should I Connect an ERV and Dehumidifier?
3. Could I install a Dehumidifier on the return side?
4. Should I install a Dehumidifier on the supply side?



# Install Matters!



# No Forced Air or ERV Ductwork



# Connect ERV and Dehumidifier

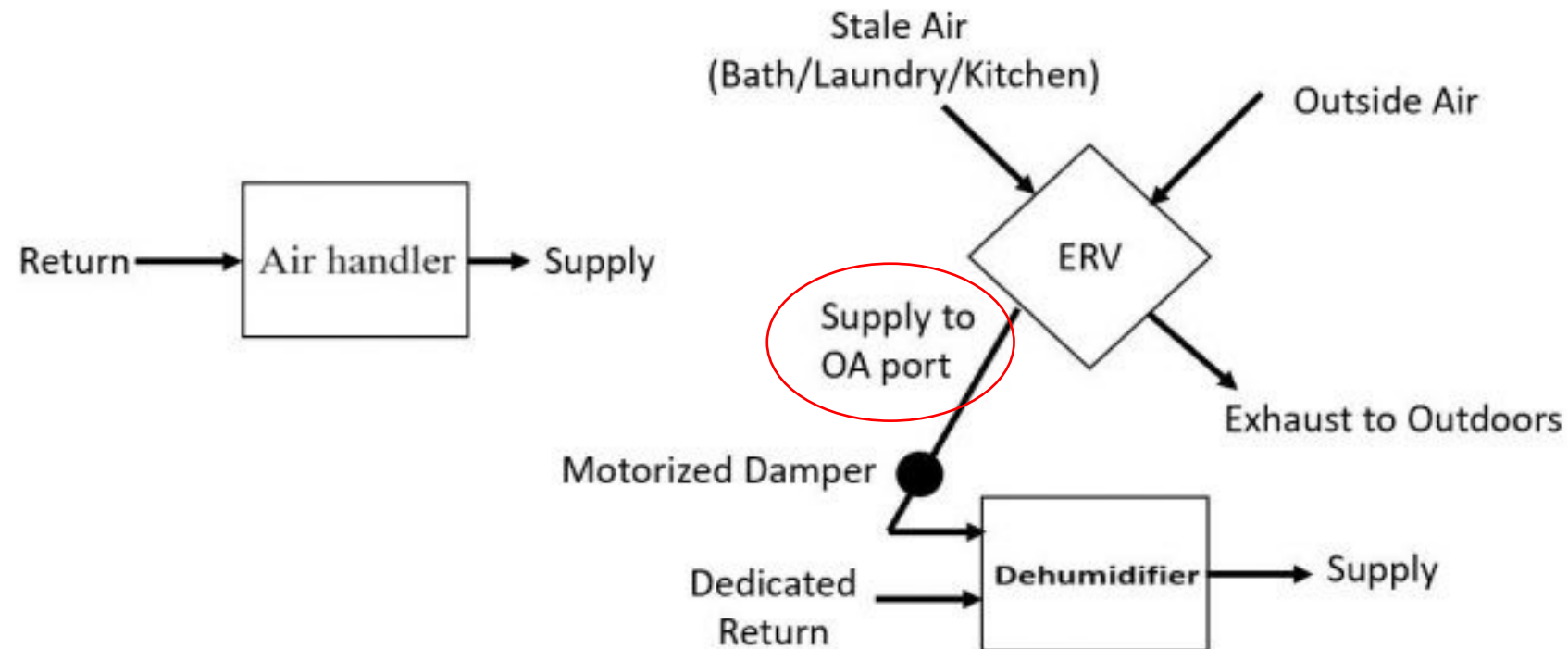
Don't have traditional forced air systems?

- Ductless mini-split
- Heating and Cooling with high static duct systems
- Radiant cooling systems

# Option 1: In Tandem

1. Dehumidifier fan must run with ERV is ON
2. Motorized damper is required to prevent dehumidifier from drawing air when ERV is off
3. Higher operating cost

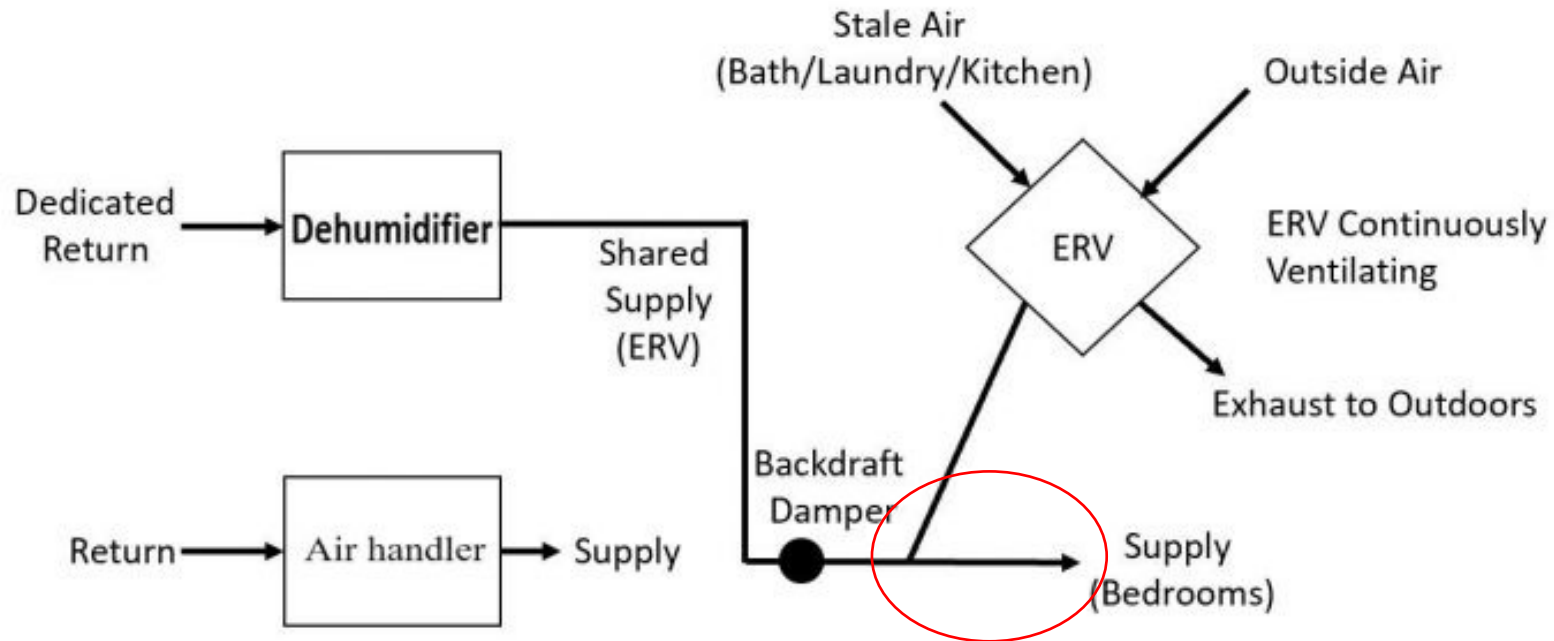
Dehumidifier and ERV Tandem



# Option 2: Share Supply Ducts

1. Backdraft damper required to prevent ERV supply from entering dehu return
2. Commissioning: Ductwork static pressure changes if commissioned with dehu on or off
  - May affect flow rate
  - May create slight positive or negative pressure on the house when dehu runs

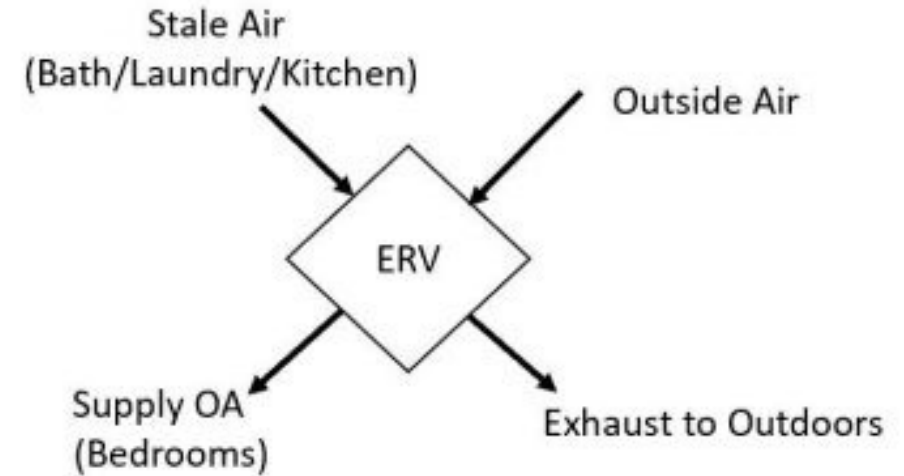
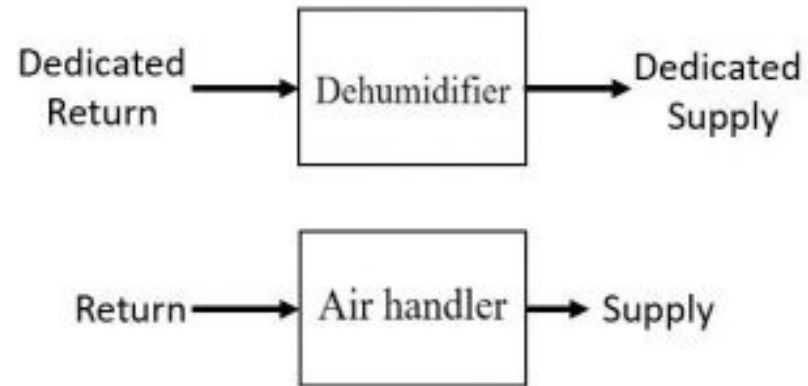
Dehumidifier and ERV Shared Supply



# The Standard

1. Best performance
2. Highest cost

## Separate Duct Systems



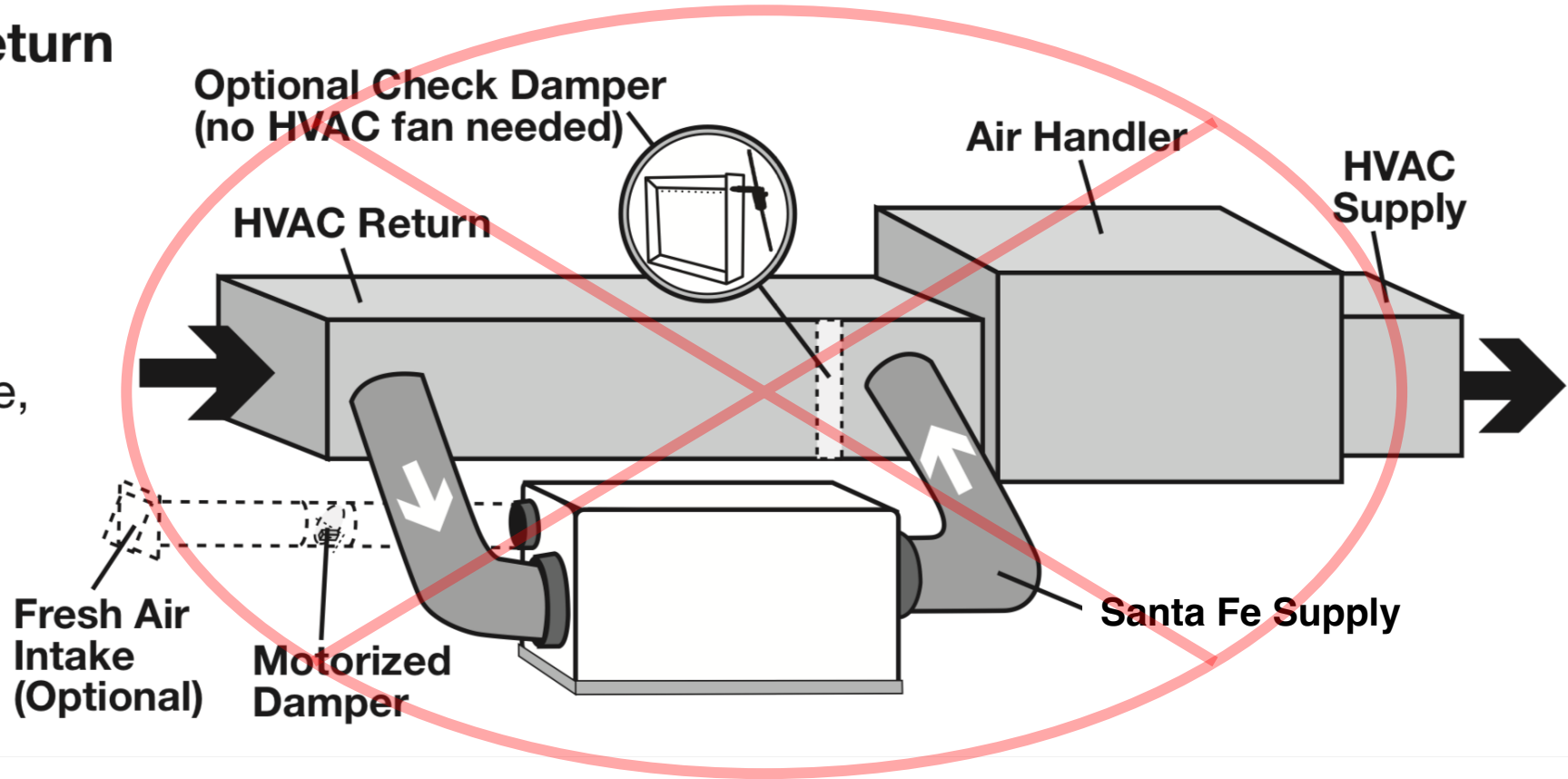


# Return-To-Return

## HVAC Return to HVAC Return

Check Damper should be in place between the Return and Supply connections of the dehumidifier.

If Check Damper is not in place, the HVAC fan must turn on when the dehumidifier is in operation.



# FSEC Report

**FLORIDA SOLAR ENERGY CENTER®**

**Final Report**

**Investigation of Energy Impacts of Ducted  
Dehumidifier Duct Configurations and Location**

DBPR Project #B21551  
UCF/FSEC #2012-7106

FSEC-CR-2038-18


**June 1, 2018**

*Submitted to:*

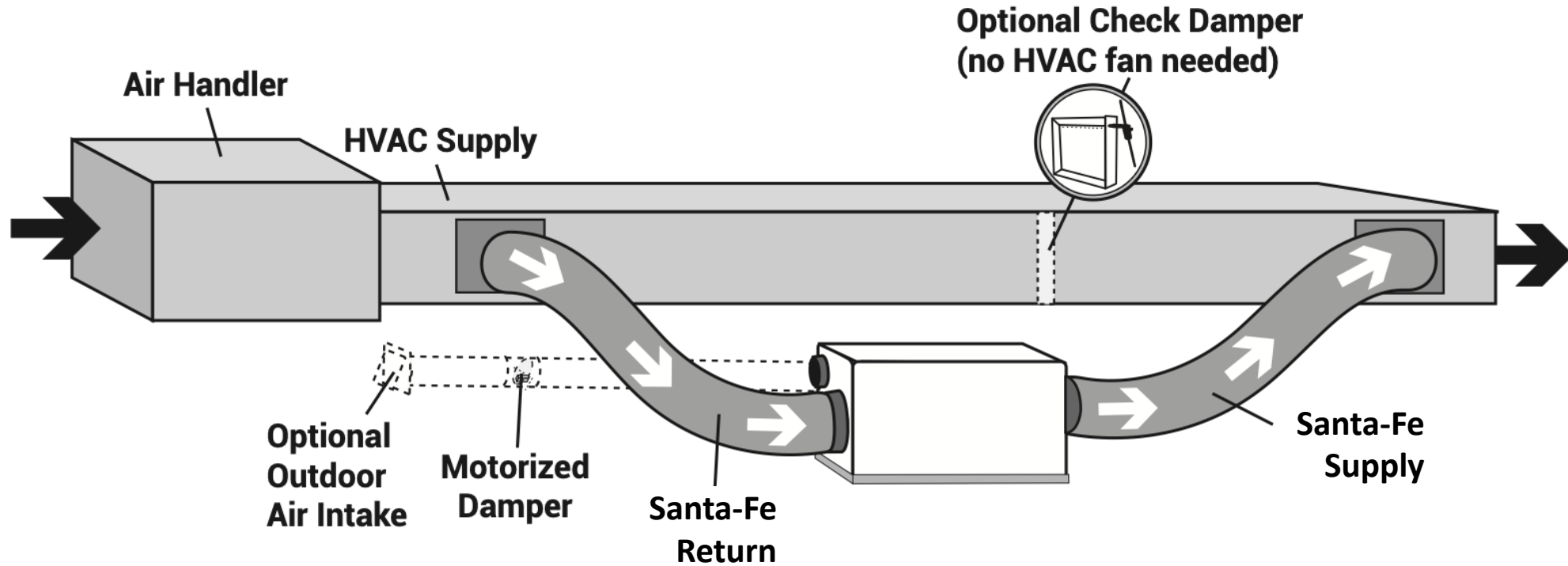
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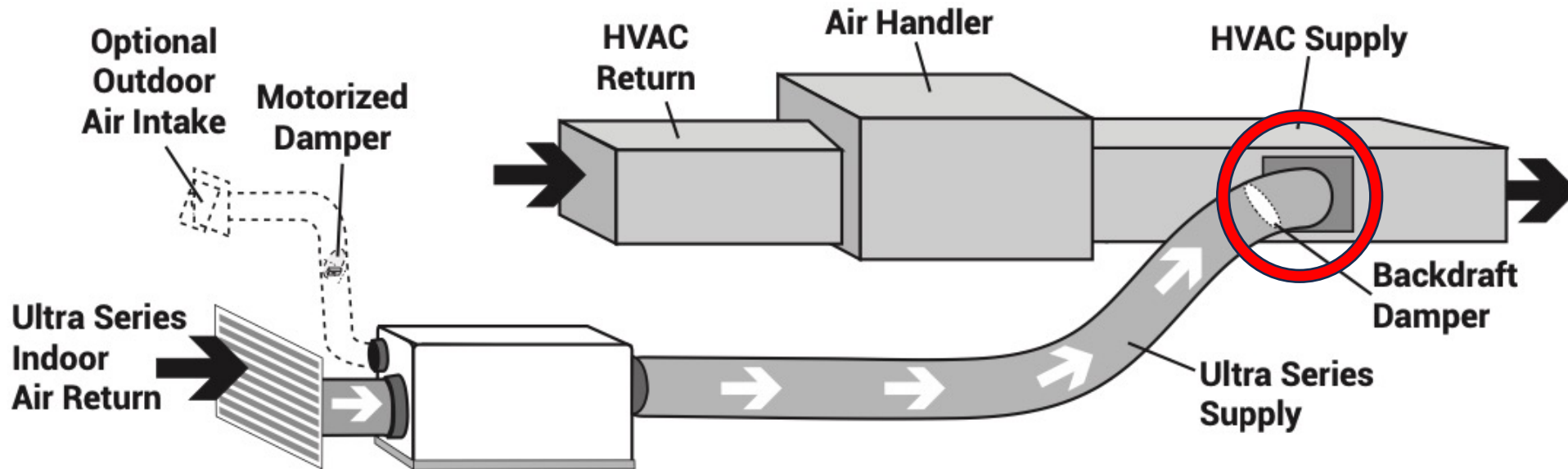
# Supply-To-Supply



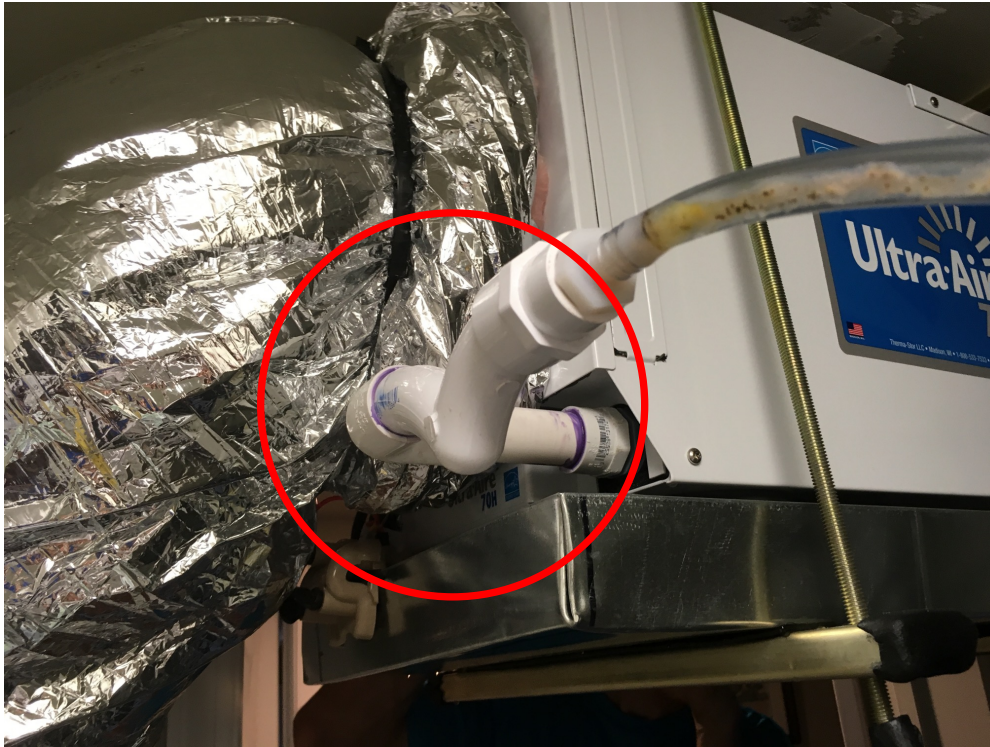
# Quick Hitters!!

- Don't install dehumidifiers over a bedroom
- Don't install thermostat/humidistat in pathway of supply air
- Install it close to a crawl door for easier maintenance
- Two forced air systems and one dehumidifier

# Don't forget the backdraft damper



# Sufficient P-Trap





# Why Homes Need Dedicated Dehumidification

- Comfort, Health & Property Protection
- Partial & No-Load Times of the Year
- Can't Control Human Behavior
- Only Way to Ensure 50% RH

# Thank you!

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