BetterBuiltNW

Making Friends and Influencing Physics: HRVs and Central Air Handler Integration

Spring Trade Ally Forum

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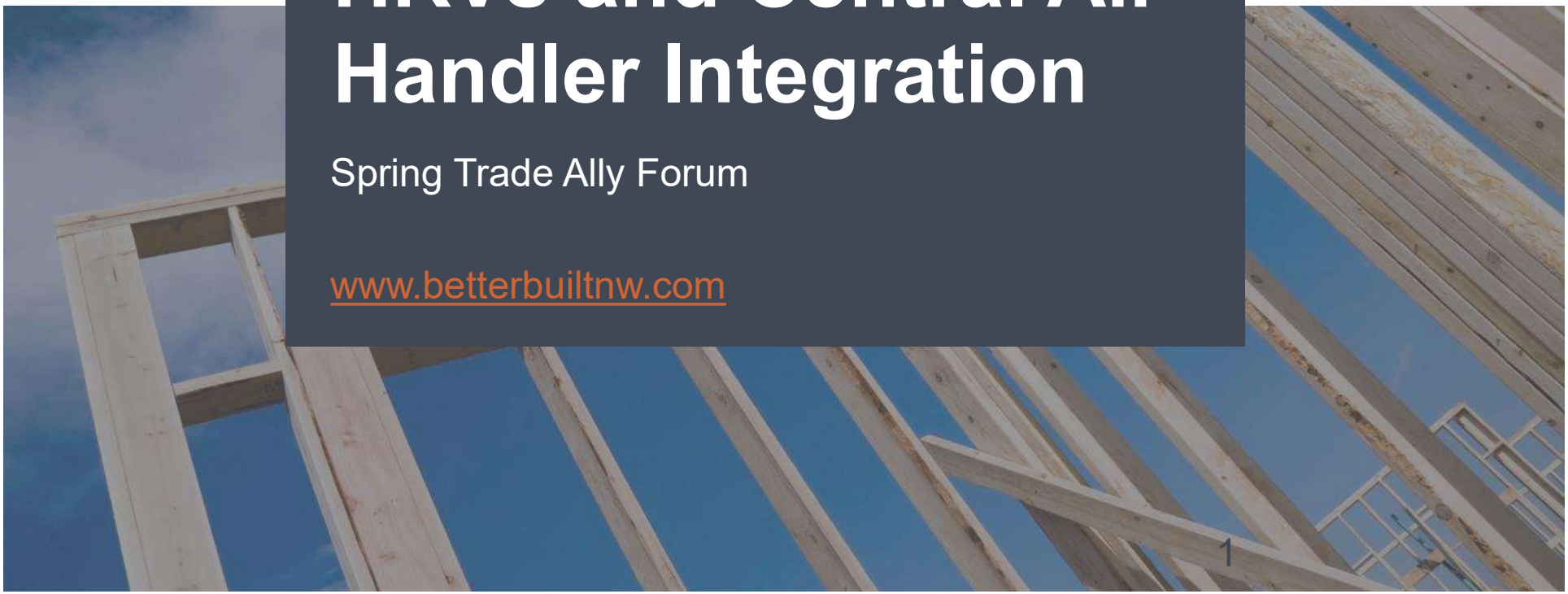
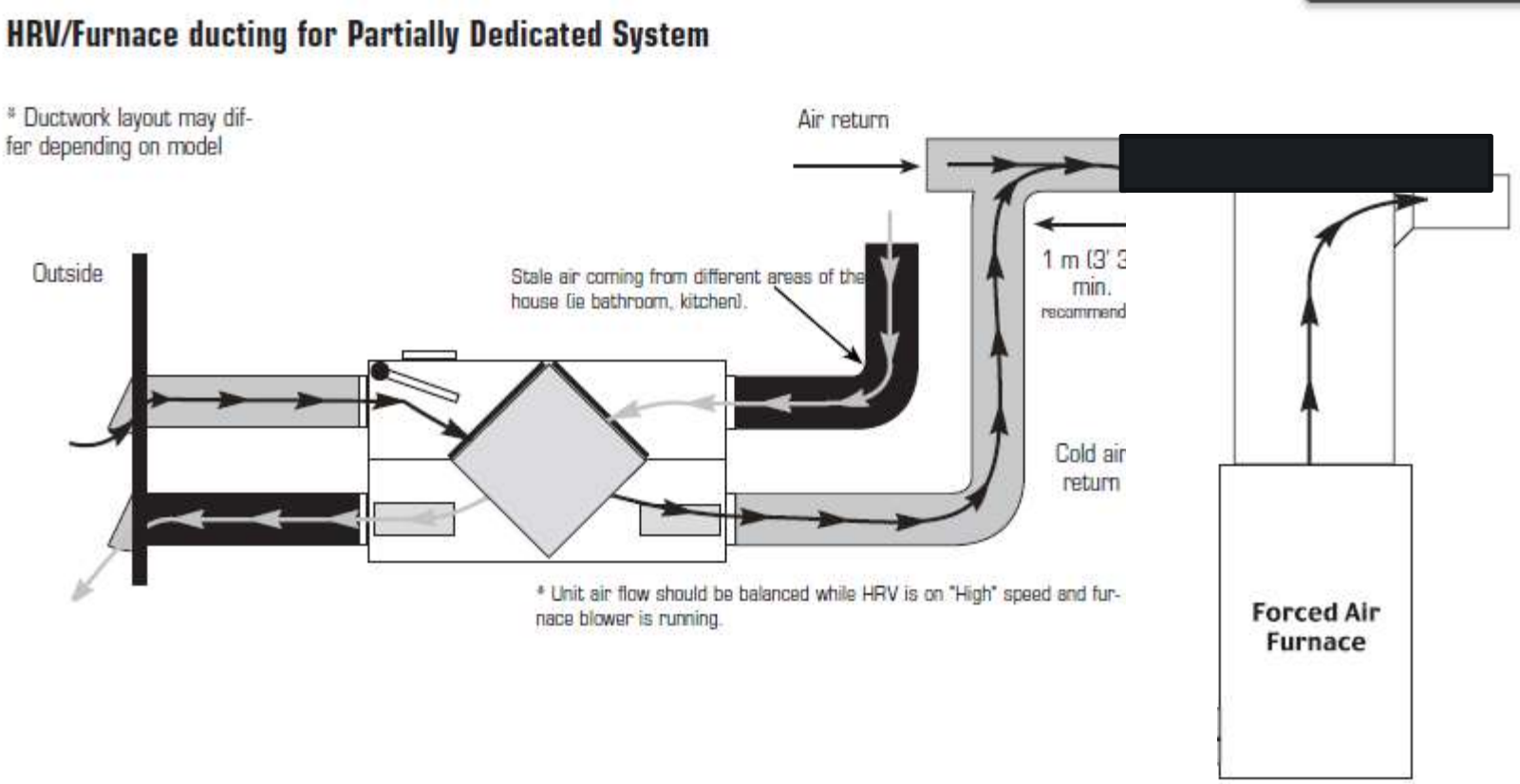


Stale air from house; fresh air to return



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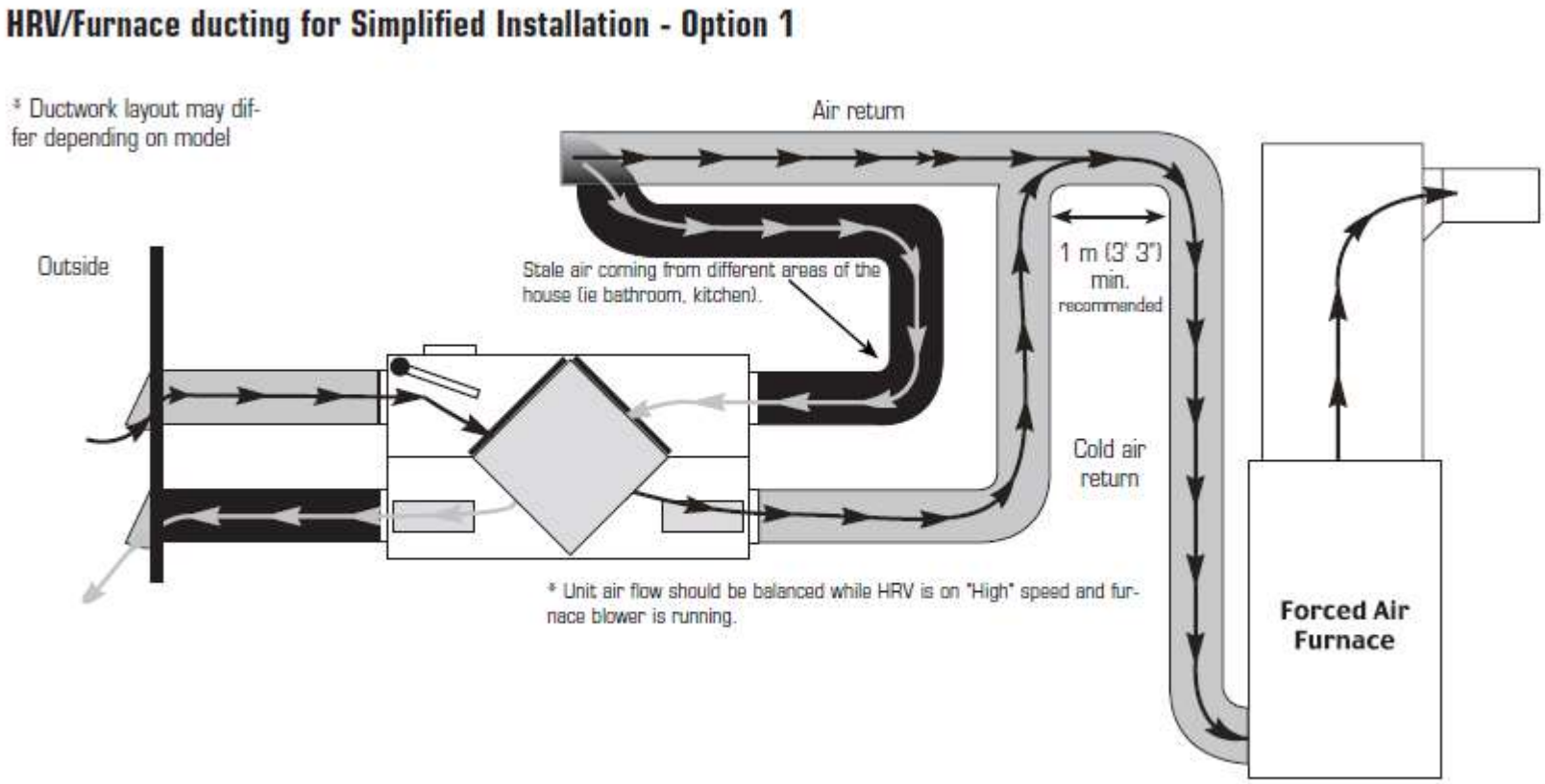
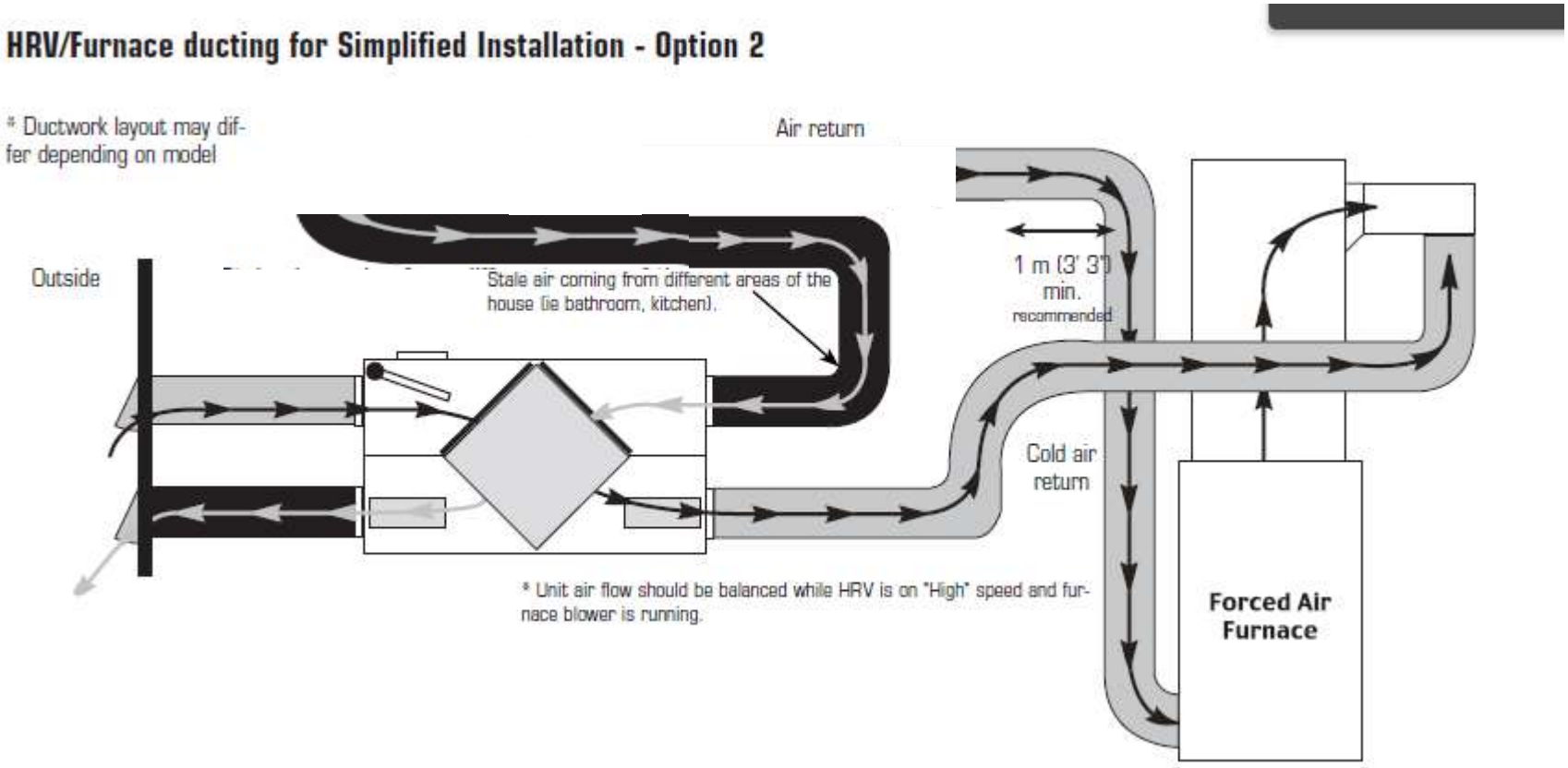
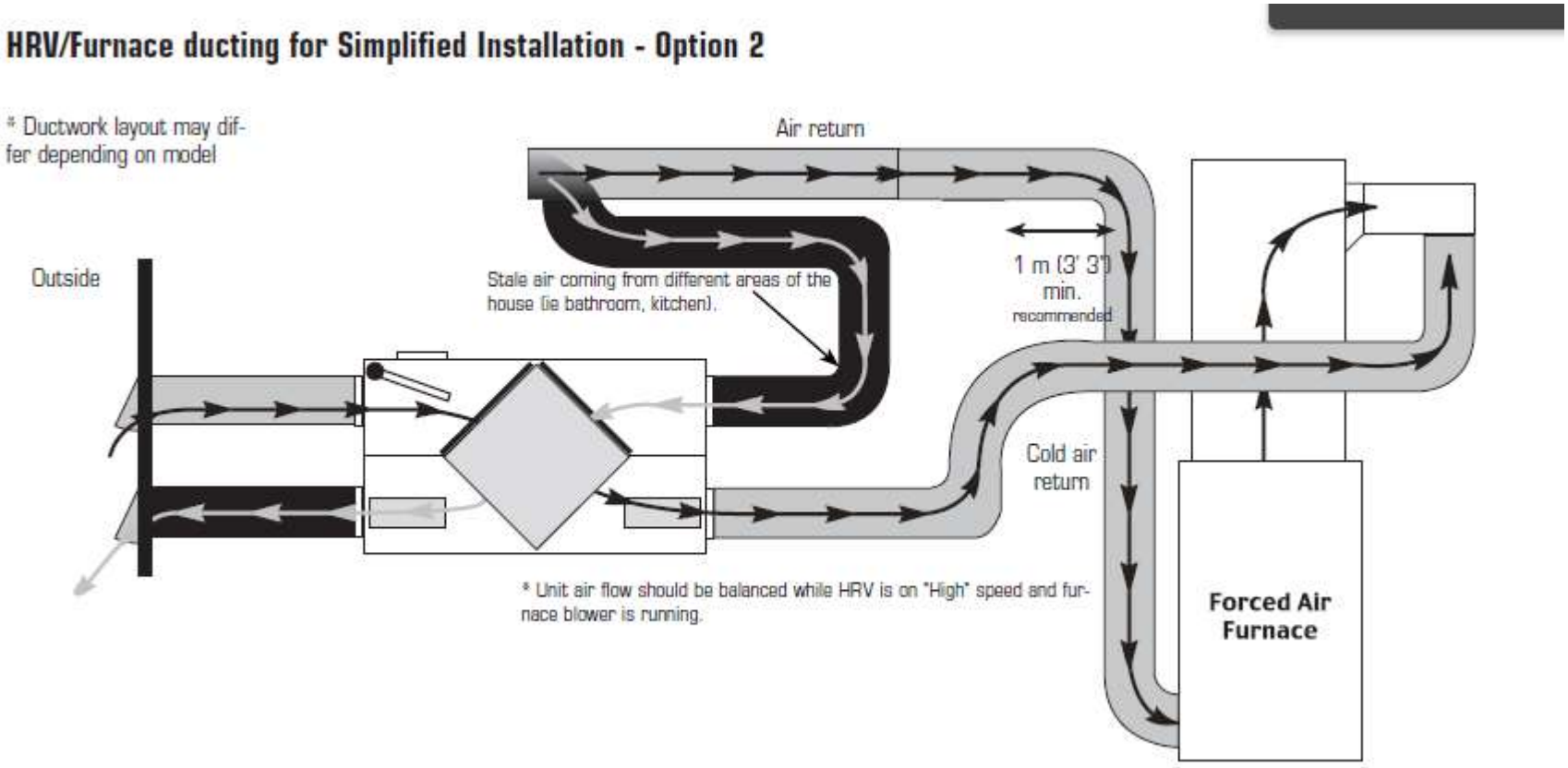


Stale air from house; fresh air to supply



Stale air from return; fresh to supply




Assumption:
You already appreciate the value of an HRV
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Ventilation Systems
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Mechanical Ventilation

An ideal ventilation system

- Homeowners understand it
- Homeowners use it
  - They don't turn it off because it makes the home uncomfortable
- Doesn't use too much energy

Ventilation System Types

1. Exhaust Only
2. Supply Only
3. Balanced – Stand Alone
4. Balanced – Furnace Integrated

A leaky house is not a ventilation system

Why Don't People Install HRVs?

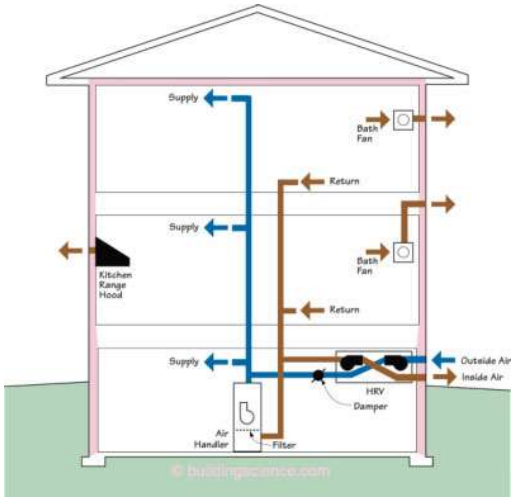
- We mistake ventilation as an energy thing, not an indoor air quality (IAQ) thing
- Little or no benefit in REM/Rate*, no benefit at all in HES
- Too expensive
- Not the best choice for all homes

* unless you really understand how to model all of the features individually

Balanced – Integrated HRV

Advantages

- Balanced ventilation
- Best air distribution
- Potentially saves energy (with good fan)
- Pull EXHAUST air from bathrooms and other high moisture or pollutant areas



Disadvantages

- Costs more than code minimum requires
- Requires running ducting independent of other systems into rooms
- Fresh air must be delivered into main body rooms and bedrooms
- System must be commissioned and balanced

Best Application

- Airtight homes with central air handlers

Integrated HRV: (Perfect) Definition

- A heat recovery ventilation system that makes use of an existing whole-house air handler for distribution of fresh supply air (typically through your furnace or heat pump).
- Must pull air directly from bathrooms and high moisture areas
- Takes advantage of both independent and central H/AC controls

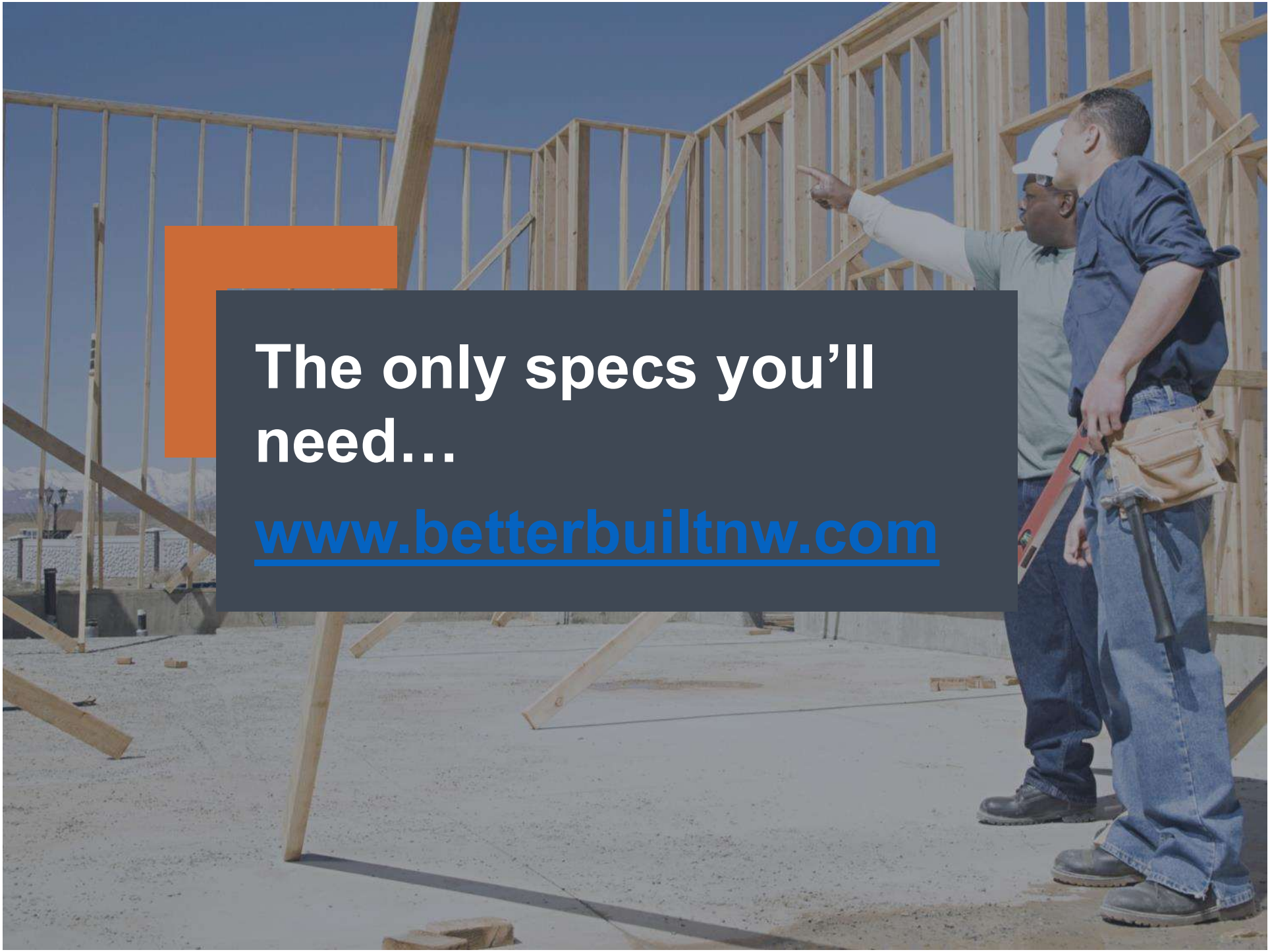
HE or High Efficiency HRV models are defined as:

- SRE 80% or higher
- Efficacy 1.25 CFM/watt (.8 watts/cfm)

Integrated HRV: Builder/Contractor Benefits

An integrated system using existing HVAC ductwork…

- Requires the least amount of additional ductwork to be installed
- Saves cost
- Reaches all the rooms you want supplied with fresh air
- Actually brings the V back into an HVAC total system


The only specs you'll need…
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HRV Specification

1. Air Handler and HRV must use one of these control modes:
    - **Mode A** - HRV runs continuously and system cycles AH with a smart controller (or AH runs continuously as well)
    - **Mode B** - Use an HRV with built in dampers that close when not supplying air; no restrictions on AH use
    - **Mode C** - Interlock the HRV controls to the AH fan so that the AH cannot run without the HRV
2. HRV exhaust pulls from places where contaminants are common
3. Injection port design
4. Ventilation system sized to meet program requirements at the middle of the flow range
5. SRE >80% and high fan efficacy (1.25 cfm/watt)
    - Numbers at lowest tested net supply airflow

HRV Specification

HVI Products Listing

Energy Ratings

Full Report | More — 3 Energy data points

Temp Mode	°C	°F	Net Airflow (L/s)	Net Airflow (cfm)	Power Consumed (Watts)	Sensible Recovery Efficiency
HEATING	0	32	31	65	34	86
HEATING	0	32	41	87	44	86
HEATING	0	32	51	108	60	86

Operating Mode A

Intermittent/continuous central H/AC fan operation with continuous HRV

- Ventilation cycles (not heating and cooling cycles) set to run close to minimum fan speed, is <40 watts (16 pin designed ECM air handler meets this)

Why?

- Meets distribution requirement by minimizing fan energy use/noise
- Mitigates delivery air temperatures during off duty run cycles

Operating Mode B

Intermittent central H/AC fan operation with intermittent HRV

- Ventilation cycles (not heating and cooling cycles) set to run close to minimum fan speed, is <40 watts (16 pin designed ECM air handler meets this)
- Either HRV comes with built in backflow dampers, or additional dampers are installed to prevent backflow from when AH is on and when HRV is off.

Why?

- Saves energy when compared to continuous
- Meets distribution goal while minimizing fan energy use and noise
- Prevents the reverse flow through the supply half of the HRV when AH is on and HRV is off

Operating Mode C

Interlock the HRV controls to the AH fan, so that the AH cannot run without the HRV

- Controls must be set properly to operate both systems such that HRV runs when calls for heating and cooling, as well as calls for AH to run during partial load days when system calls for ventilation.

Why?

- Prevents energy costs for unnecessary run times
- Maximizes distribution with every call for ventilation, while ensuring that all heating and cooling runs integrate ventilation.

Calculators Are Available

Math is hard!

But it doesn't have to be!

RED Calc Free Tools

Getting Started
Tool Descriptions
Preferences
Ventilation
New
ASHRAE 62.2-2016
ASHRAE 62.2-2013
ASHRAE 62.2-2010
ASHRAE 62.2 CA
Electrical Usage
Depressurization
Pitot Tube Airflow
Box Airflow
Moisture
Moisture Metrics
Wood Moisture
Air Leakage
Air Leakage Metrics
ZPD
Design Infiltration
Advanced Infiltration
Insulation
Dense Pack
Loose Fill
Heat Transfer
Infrared R-Value
Parallel Path R-Value
Domestic Hot Water
Systems Comparison
Average Daily Usage
First Hour Rating
Instantaneous Sizing
Volume per Use
Water Flow Rate
Weather Data
Weather Station Data

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RED ASHRAE 62.2-2010 Ventilation

Reset Print

New or existing construction [Existing]
Use infiltration credit [Yes]

Closest weather station [-- Select a Country --]
Weather factor [1/hr] =

Floor area [ft2]
Number of occupants
Building height [ft]
Measured leakage @ 50Pa [CFM]

Use Advanced Blower Door Inputs

Use Local Ventilation Alternative Compliance

Whole-Bldg Ventilation Results

$N\text{-factor}_{2010}$ =
Natural airflow [CFM] =
Total required ventilation rate [CFM] =
Infiltration credit [CFM] =
Required mechanical ventilation rate [CFM] =

Whole-Bldg Ventilation Run-Time Tool

Fan capacity [CFM]
Fan run-time per hour [min] =

Version 2016-07-06 01:30 © 2016 Residential Energy Dynamics, LLC

HRV Specification Requirement 2

HRV exhaust pulls from places where contaminants are common (not connected to central return duct)

Why?

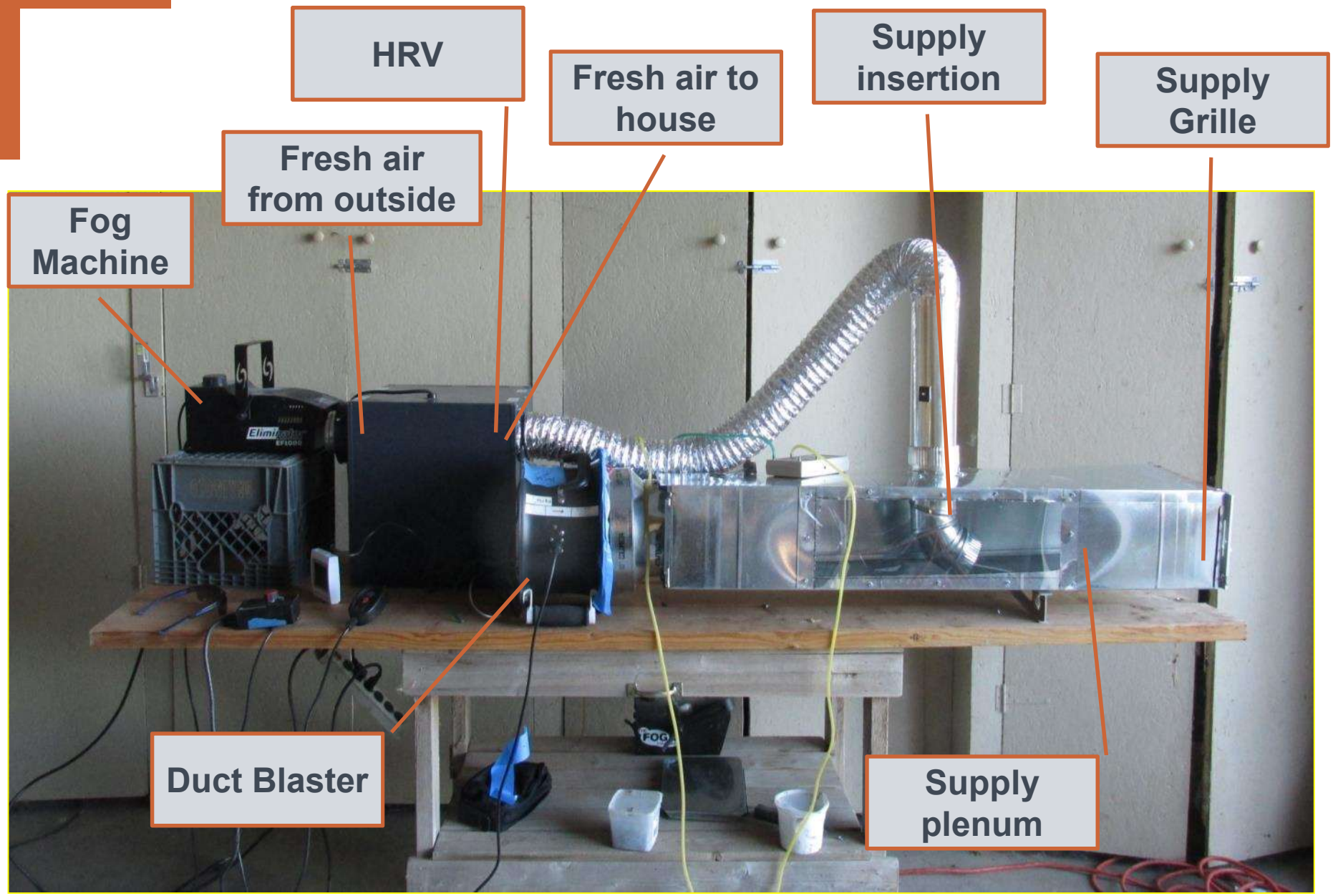
- Prevents pressures of the central fan duct system from overpowering HRV exhaust during on duty cycles (Return suckage sucks!)
- Heat recovery opportunities from bathroom
- Offsets HRV costs by eliminating laundry or ½ bath fans
- Opportunities to pull air from high contaminant locations (for example all bathrooms)

HRV Specification Requirement 3

Injection Port Design: HRV supply into supply central duct system

Why?

- Ensures fresh air into all rooms of the house
- Reduces pressure blocks in the supply ducts (which may lead to imbalanced HRV supply vs return flows)
- No need to build a separate supply system

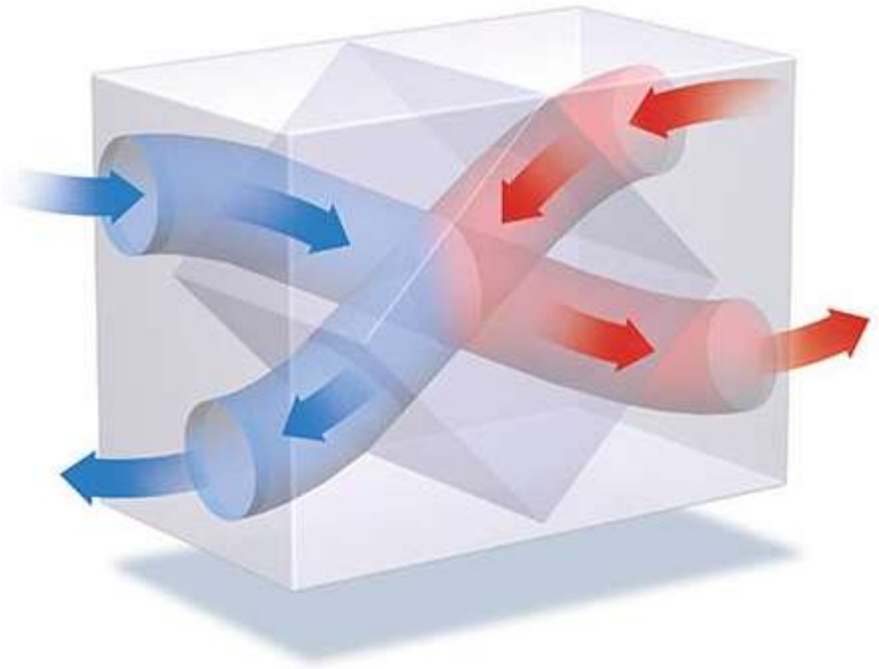

HRV
Fresh air to house
Supply insertion
Supply Grille
Fresh air from outside
Fog Machine
Duct Blaster
Supply plenum

The Fog Machine Test

Pushing Air Into the Return Side is BAD

Return side can result in…

- Very large imbalances
- Over ventilation
- Outside air sucked into the HRV at higher rates than designed

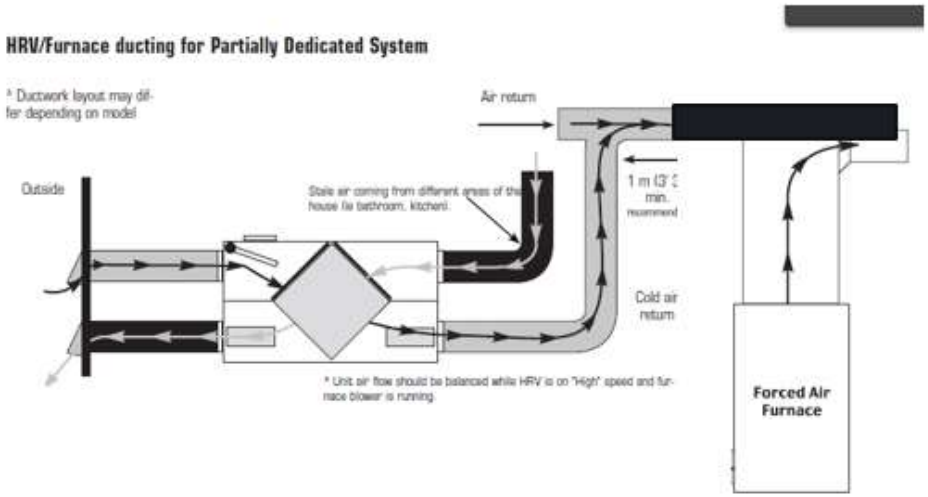


Sometimes though, we don't have the room, choice, or ability to inject into the supply…

Consider these practices

- Don't install filter grills
- Constant air regulators can be your friend
- Oversize the return duct

Stale air from house; fresh air to return



HRV Specification Requirement 4

System sized to meet program standards at the middle of the HRV flow range

- ASHRAE 62.2 most often meets this

Why?

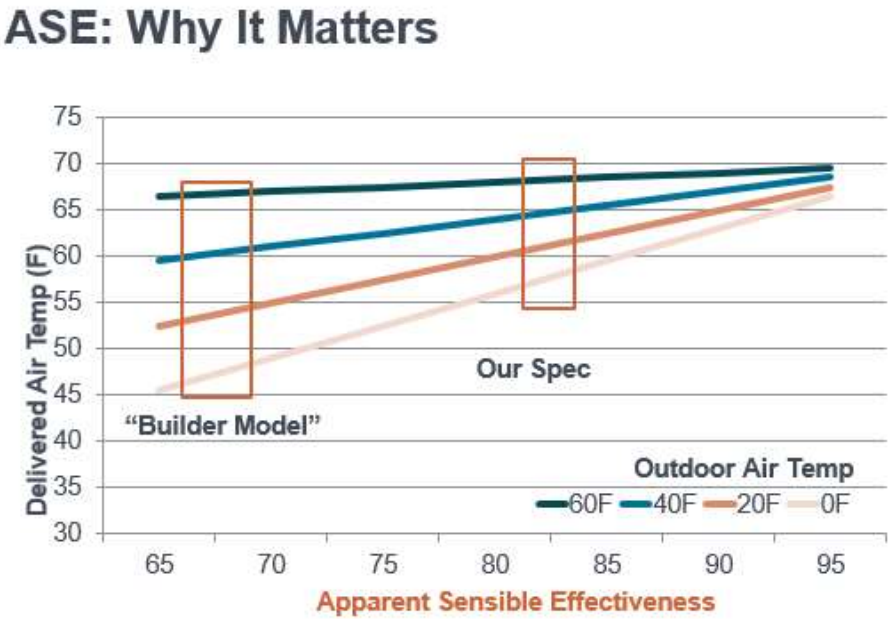
- It meets code
- Program standards are designed to meet the minimum requirements to deliver fresh air into living spaces
- Programs and certain standards are regularly being updated to reward smart design
- Prevents wasting money on an additional ducting and labor

HRV Specification Requirement 5

SRE >80%, Efficacy >1.25cfm/watt

Why?

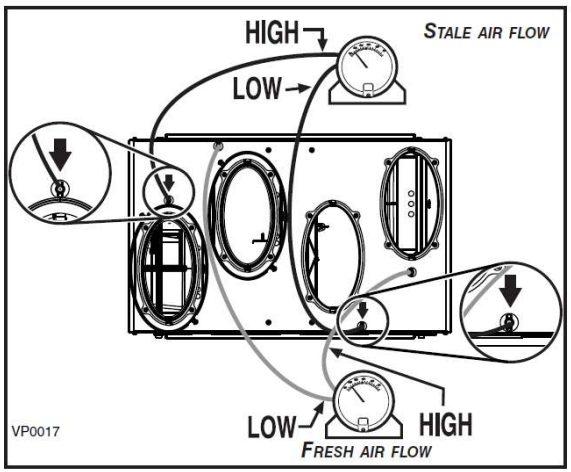
- A **high SRE** ensures efficiency and **energy transfer** in HRV
- A **high ASE**—a result of high SRE—ensures effectiveness and **temperature transfer** in HRV
    - This ensures delivered air temperature meets occupant comfort standards during off duty cycles (it pre-conditions the air avoiding cold air onto occupants)
- **High efficacy** ensures low **fan energy** required to operate HRV



HRV COMMISSIONING

Balance the supply and exhaust airstream volumes

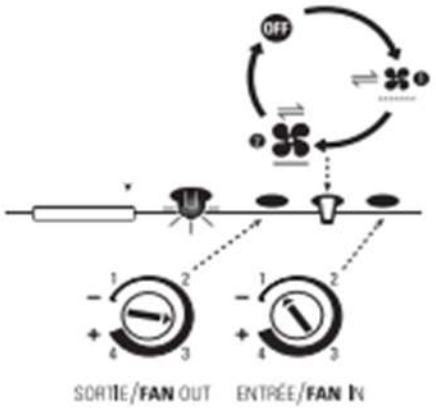
- Use balancing pressure taps if provided
- Alternatively, measure the flow at each diffuser grille and compare the total supply to the total exhaust flow
- Adjust balancing dampers to get total supply and exhaust within 10%

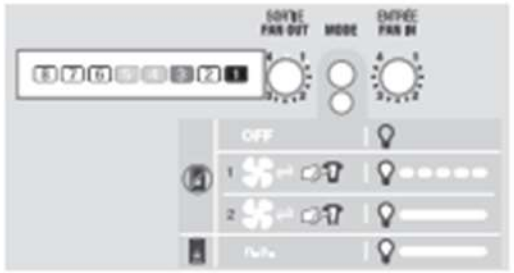


Aldes E80 HRG

POTENTIOMETER style interface

For this series, the speed of the blower is adjusted with two potentiometers; one for the SUPPLY (FAN IN) and one for the EXHAUST (FAN OUT) (see figure below). The installation must balance air flow brought in from the outside and the exhaust air flow so that the difference between the two is less than 10% of the maximum air flow. This air balance is especially important in homes using a combustion device or in those located in areas where the ground emits radon.

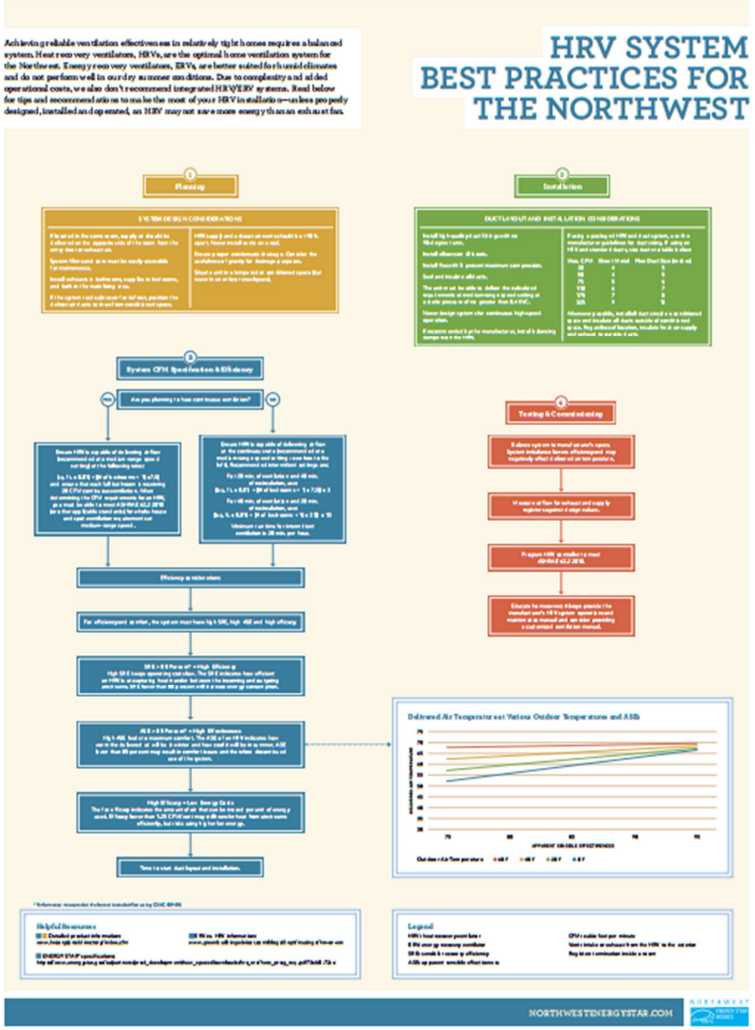




Resources

- Manufacturer's website
- HVI Product Directory
- ENERGY STAR
- HRV System Best Practices Poster
- Building Science Corporation
- Building Science Translator
- Building America Solution Center
- Canadian Guide to HRVs

- www.betterbuiltnw.com



Overview

- Choose to install an integrated HRV
- Use available resources
- Get assistance with:
  - Selecting the right HRV system
  - Injection into the HVAC system
  - Selecting the right air handler
  - Placement of HRV
- Sell fresh, clean air

Integrated HRV: Rules for Success

The golden rules (in a perfect world)

1. Integrated fresh air into the supply
    - No tying into returns
2. Uses injection design
    - Use turns, not Ts
3. Energy Efficient
    - HRV has SRE 80% or higher
    - Fan that moves at least 1.25 CFM/watt (.8 watt/CFM)
    - Central air handler can operate very efficiently at low fan speed (16 pin ECM)
4. Pull exhaust air from bathrooms

THANK YOU

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