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

HRV/Furnace ducting for Partially Dedicated System

* Ductwork layout may differ depending on model

Outside

Stale air coming from different areas of the house (e.g., bathroom, kitchen).

Air return

1 m (3') 2
min. recommend

Cold air return

* Unit airflow should be balanced while HRV is on "High" speed and furnace blower is running.

Forced Air Furnace
Stale air from return; fresh air to return

* Ductwork layout may differ depending on model.

* Unit air flow should be balanced while HRV is on "High" speed and furnace blower is running.

HRV/Furnace ducting for Simplified Installation - Option 1
Stale air from house; fresh air to supply

HRV/Furnace ducting for Simplified Installation - Option 2

- Ductwork layout may differ depending on model.

* Unit air flow should be balanced while HRV is on "High" speed and furnace blower is running.

Forced Air Furnace
Stale air from return; fresh to supply

HRV/Furnace ducting for Simplified Installation - Option 2

* Ductwork layout may differ depending on model.

Outside

Stale air coming from different areas of the house (i.e., bathroom, kitchen).

Air return

1 m (3’ 3”) min., recommended

Cold air return

Forced Air Furnace

* Unit air flow should be balanced while HRV is on “High” speed and furnace blower is running.
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
  o 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

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<th>Temp Mode</th>
<th>°C</th>
<th>°F</th>
<th>Net Airflow (L/s)</th>
<th>Net Airflow (cfm)</th>
<th>Power Consumed (Watts)</th>
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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
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!
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
HRVs and Central Air Handler Integration

- 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
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%
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:
  o Selecting the right HRV system
  o Injection into the HVAC system
  o Selecting the right air handler
  o 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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