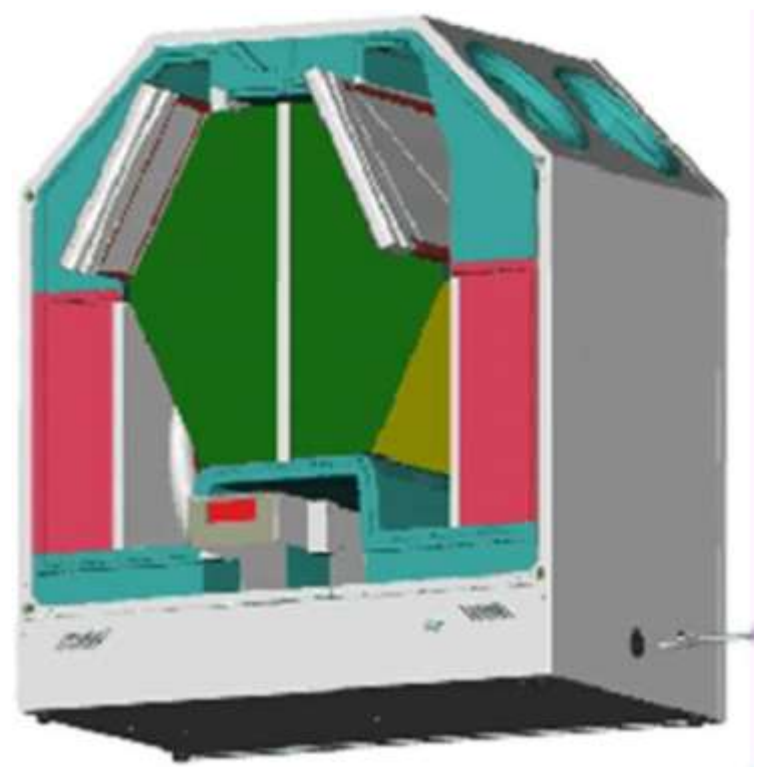
SELECTING AN HRV/ERV SYSTEM

Introduction

In this section, we take a look at what you need to know to be able to select an efficient HRV or ERV for your home.

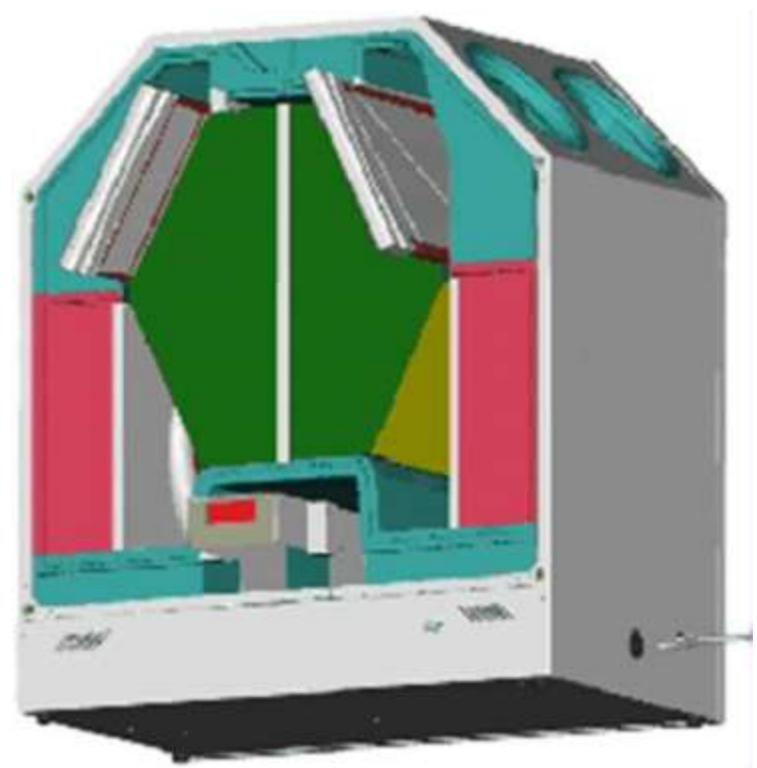


- HRV/ERV components
- Sizing the unit
- Efficiency testing
- Options (ground source pre-heater or pre-coolers)

Components of HRV/ERV Devices

The following are the main components of HRV/ERV devices:

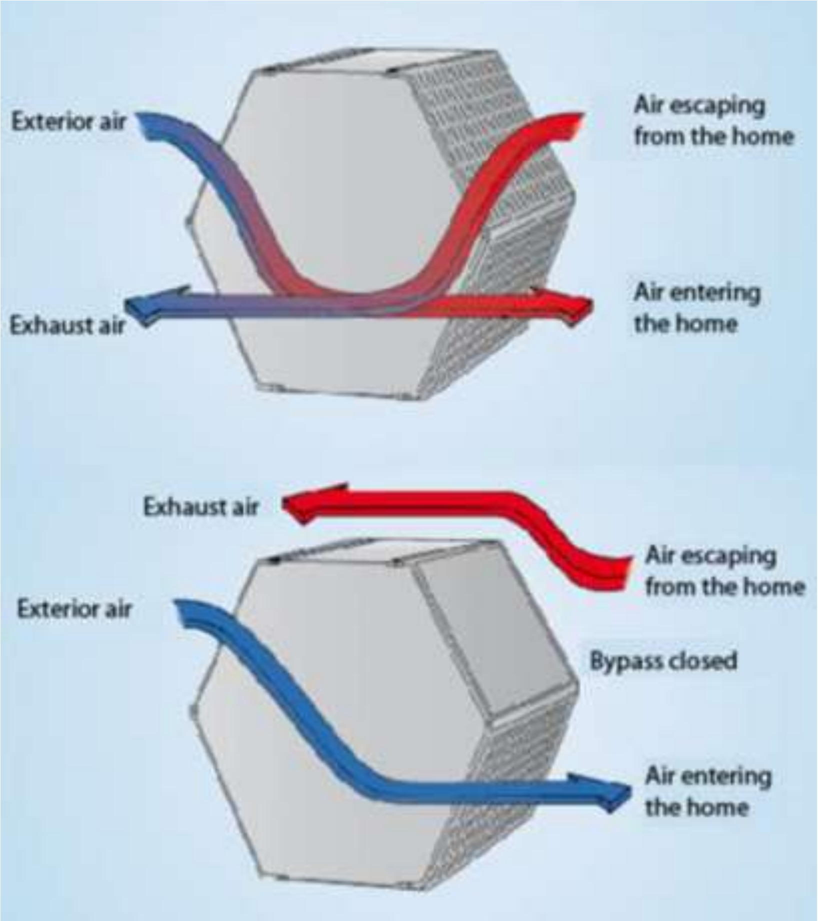
- heat exchanger (dark green core in the center)
- filters (gray parts at the upper right and left positions on the heat exchanger)
- intake and exhaust fans and motors (red boxes)
- controls (bottom center)



Components of Heat Recovery

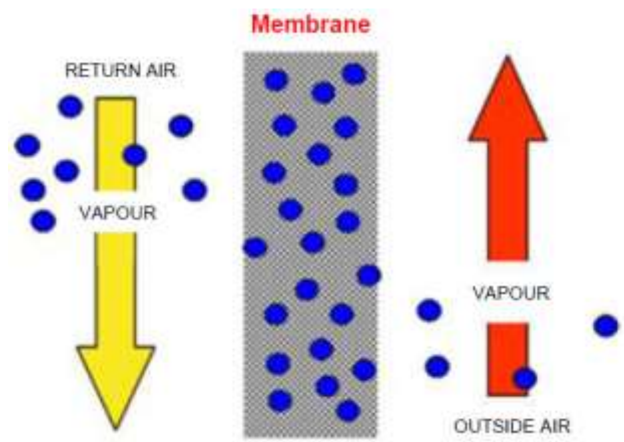
The top image shows the basic operation of an HRV/ERV. Below is an HRV/ERV operating with the summer bypass activated.

The summer bypass allows the cooler air to be brought directly into the dwelling when the inside temperature has increased above the set comfort temperature. This is accomplished with a damper that opens to re-route exhaust air around the heat transfer core, thus temporarily stopping heat recovery – similar to opening the windows but without the associated disadvantages.



Enthalpy Recovery Systems

In an ERV that utilizes an enthalpy exchanger (shown on the right), the channels of the heat recovery core are made of a membrane that allows moisture, as well as heat, to transfer to the incoming or outgoing air stream. High-humidity air is prevented from entering a house in a hot, humid environment, or alternatively, humidity is retained in a house in a cold, dry climate.



Humidity exchange by semi-permeable membrane

- Efficiency for heat recovery: 80%
- Efficiency for humidity recovery: 65%

Heat Exchanger vs. Energy Exchanger

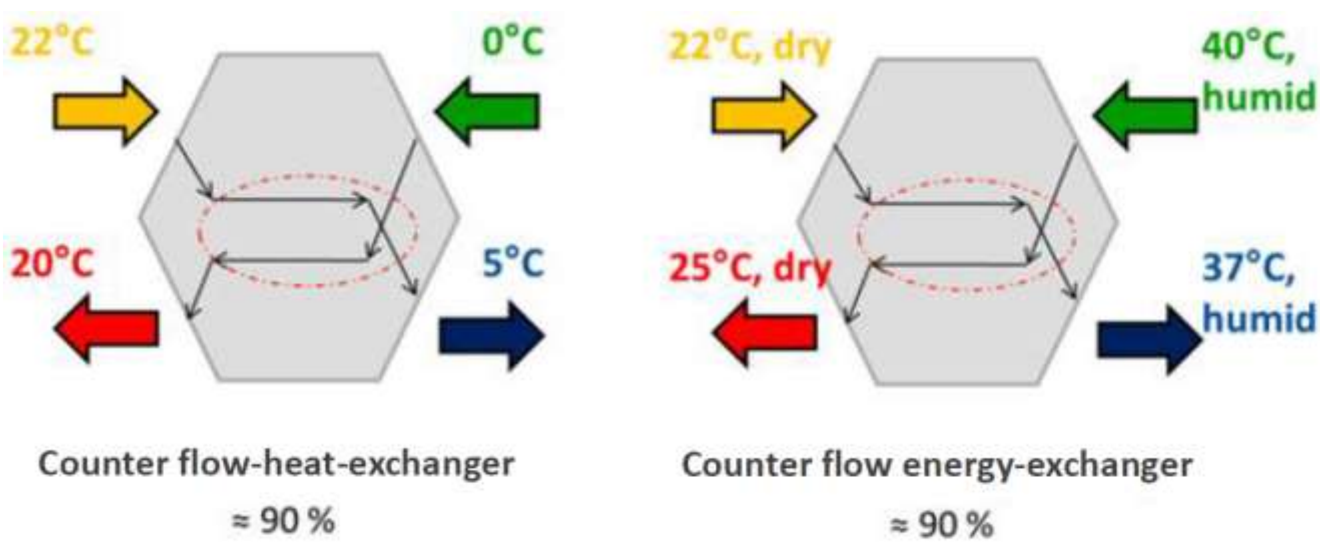
In many climates, there is not a definitive answer to the question of whether to use an HRV which transfers heat only, or an ERV that also transfers moisture. However, there are a few guidelines to consider, depending on the geographic location of the building.

- Locations in the hot, humid South will usually use an ERV.
- Locations west of the Rocky Mountains predominantly install an HRV.

Heat Exchanger vs. Energy Exchanger

For all other locations, it is important to remember that an HRV has a slightly higher heat recovery efficiency, while ERV can retain humidity in winter in cold climates, and reject humidity in warm climates.

Counterflow-heat-exchanger **Counterflow-heat-exchanger**



HRV in a cool climate and ERV in a warm, humid climate

Sizing

A good rule of thumb with respect to installing the right size device to meet the desired air changes for a specific application is to plan for a continuous ventilation rate of a maximum of 60% of the HRV/ERV device capacity.

This allows for a low setting to accommodate a low occupancy in the dwelling and higher settings to boost ventilation for bathrooms or kitchen as required.

HRV/ERV Testing: North America

When selecting an HRV/ERV for your home, look for those with third-party testing showing, at a minimum, energy performance of the unit.

Here is an HRV being tested at the accredited HVI testing center in Toronto, Ontario, Canada

HRV Testing: Passive House Institute, Germany

The Passive House Institute (PHI) in Germany test and certifies HRVs and ERVs somewhat differently to the guidelines followed in North America.

The PHI tests a unit for both heat recovery efficiency and energy use, as well as cross-flow leakage and noise levels.

Presently, North American architects designers and engineers predominantly use the HVI reports, whereas the Passive House movement relies more on the PHI certification.

PHI certification numbers can be applied directly to the PHPP (Passive House Planning Package) for determining the total efficiency of a dwelling.

Example: ERV Listing

This is a sample ERV listing from the HVI (Home Ventilating Institute)

Model: • Options Installed: None
Electrical Requirements: Volts: 120 Amps: 1.5
Exhaust Air Transfer Ratio: 0.03 @100 Pa/0.4 in. wg 0.03 @ 50 Pa / 0.2 in. wg
Low Temp. Vent Reduction Factor: 27.9% Supply 30.2% Exhaust • Low Temp. Imbalance Factor: 1.13

ENERGY PERFORMANCE

SUPPLY TEMP °C	°F	NET AIR FLOW L/S	CFM	POWER CONSUMED WATTS	SENSIBLE RECOVERY EFFICIENCY	APPARENT SENSIBLE EFFECTIVENESS	LATENT MOISTURE TRANSFER
0	+32	13	28	73	69	94	0.68
0	+32	45	96	137	62	74	0.48
-25	-13	25	54	102	54	83	0.58

VENTILATION PERFORMANCE

EXT. STATIC PRESSURE Pa	in wg	NET SUPPLY AIR FLOW L/s	cfm	GROSS AIR FLOW SUPPLY L/s	cfm	EXHAUST L/s	cfm
25	0.1	55	116	56	119	59	125
50	0.2	53	113	55	116	57	121
75	0.3	50	107	52	111	54	115
100	0.4	49	104	50	107	53	112
125	0.5	46	98	48	101	50	105
150	0.6	44	94	46	97	47	100
175	0.7	42	88	43	91	45	95
200	0.8	39	82	40	84	42	90
225	0.9	37	78	38	81	40	84
250	1.0	34	72	35	75	37	78

Notice that although the ASE (apparent sensible effectiveness – gross recovery number, shown as a percentage) seems good at 94% at 28 cfm, the SRE (sensible recovery efficiency) is significantly lower. The SRE is a corrected number that takes into account the motor energy or heat, cross-flow leakage (leakage of air between the incoming and outgoing air streams), and case leakage (heat transferred from the outside unit to the air passing through the unit). This unit uses 73 watts of power for 28 cfm – a lot of power, which is a factor in warming the incoming air, reduces the real energy efficiency of this ERV.

Example: HRV Listing

This sample HRV listing shows a more efficient unit, which uses less than 1/3 (one-third) watt of power per cfm and has a high ASE and SRE. The ASE is important for comfort, as it indicates how close to the ambient temperature the incoming air will be, while the SRE is a better overall indicator of total energy efficiency. Operating parameters can be manipulated to increase the ASE, but the SRE is corrected for these factors.

Model: Options Installed: None
Electrical Requirements: Volts: 230 Amps: 1.77
haust Air Transfer Ratio:0.004 @100 Pa /0.4 in. Wg 0.003 @ 50 Pa / 0.3 in. Wg
Low Temp. Vent Reduction Factor: 0% Supply 0% Exhaust • Low Temp.
Imbalance Factor: 1.07

ENERGY PERFORMANCE

SUPPLY TEMP °C	°F	NET AIR FLOW L/S	CFM	POWER CONSUMED WATTS	SENSIBLE RECOVERY EFFICIENCY	APPARENT SENSIBLE EFFECTIVENESS	LATENT MOISTURE TRANSFER
0	+32	31	65	20	88	93	0.01
0	+32	47	99	32	87	93	0.00
0	+32	61	129	50	85	91	0.00
-25	-13	34	71	832	49	99	0.01

VENTILATION PERFORMANCE

EXT. STATIC PRESSURE Pa	in wg	NET SUPPLY AIR FLOW L/s	cfm	GROSS AIR FLOW SUPPLY L/s	cfm	EXHAUST L/s	cfm
25	0.1	123	260	123	261	126	266
50	0.2	119	251	119	252	124	262
75	0.3	115	243	115	244	121	255
00	0.4	111	236	112	237	117	247
125	0.5	108	229	109	230	113	239
150	0.6	105	223	105	223	109	230
175	0.7	102	216	102	217	105	223
200	0.8	99	210	99	210	102	217
225	0.9	96	203	96	204	100	212
250	1.0	94	198	94	199	98	208

Ground Source Pre-heater or Pre-cooler

An option for use with an HRV is a ground source pre-heater or pre-cooler. This image shows a ground loop of glycol and a small circulating pump to pre-heat or pre-cool and dehumidify incoming air with a hydronic coil.

When called for, either for pre-warming to prevent frost and to increase efficiency, or for pre-cooling to increase efficiency and possible provide some tempering of hot or warm air, a pump in the unit circulates ground temperature glycol through a coil, and incoming air is run across it to temper it. At a very small cost for powering the pump, significant reductions in energy use and increases in comfort can be achieved.

The ground source pre-heater or pre-cooler is the beige rectangular unit shown on the right of the HRV

Ground Source Pre-heater or Pre-cooler

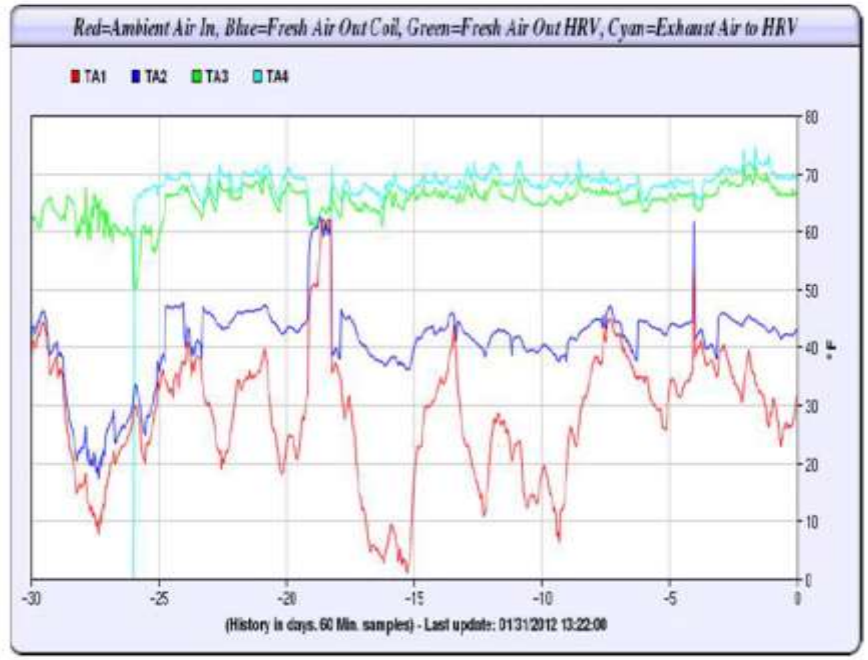
Here is a closer view of the ground source pre-heater or pre-cooler. The ground source loop is shown connected by copper pipes – the incoming air is run over the coil inside the unit, after passing through the filter box.

Ground Source Pre-heater or Pre-cooler

The lines on this graph represent the following air temperatures:

- Outside (red)
- Between the ground source pre-heater or pre-cooler and HRV (blue)
- Coming out of the HRV (green)
- Room (light blue)

As shown, the lowest outside air temperature (near 0°F) was tempered to nearly 40°F by the ground source pre-heater or pre-cooler. This air was then introduced to the interior room within a couple of degrees of the inside temperature.



Source:

Peter Schneider, Energy Consultant, Vermont Energy Investment Corporation, Burlington, VT

Ground Source Pre-heater or Pre-cooler

In the system shown here, the incoming air is delivered straight into the ground source pre-heater or pre-cooler, then into the HRV, and then distributed through small ducts to and from the rooms in the house.

For more info, call

888.778.6701

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