



**HRV/ERV Code Primer**

**Background:** Requirements for DUV in multifamily dwelling units in the Code that lead to HRV/ERV installations are primarily established by two ICC codes – the IMC and IECC. A combination of both codes (IECC setting building envelope air tightness requirements, and IMC setting DUV requirements for tight dwelling units) is often needed for the code to require all homes and dwelling units to install a DUV system – a requirement that could be met by an HRV/ERV.

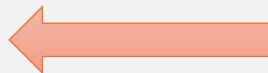
With this requirement established, the IMC provides specific requirements related to ventilation airflow, ducting, terminations, and components. The IECC provides specific requirements for energy recovery, fan efficacy, and air flow verification. This fact sheet provides guidance on how to find DUV system design and installation requirements that are relevant to HRVs/ERVs. Note that upon adoption, state and local jurisdictions may amend the code, or adopt different IMC and IECC code editions that will change the interaction between the codes on these issues.

**IMC**

**IECC (See Separate Fact Sheet)**

IMC Requirement for DUV for Tight Dwelling Units

IECC Building Envelope Air Tightness Requirements Drive DUV Requirements in IMC



Ventilation System Design



HRV/ERV Requirements (when applicable)



Ventilation System Air Flow  
Duct Design  
Components  
Exhaust and Intake Openings



Fan Efficacy Requirements (varies based on ventilation system)



Verification of Airflow

State and Local Code Amendments May Alter This Interaction



<b>HRV/ERV Allowed?</b>	<b>HRV/ERV Satisfies WHMV/DUV Requirements?</b>
<b>YES</b> No prohibition of HRV/ERV in IMC except as detailed in IMC 514.2	<b>YES</b> HRV/ERV satisfies requirements for DUV. Specific requirements that apply to HRV/ERV are detailed in this fact sheet.
<b>DUV Required?</b>	<b>HRV or ERV Required?</b>
<b>YES</b> IMC 401.2 – dwelling units meeting energy code air leakage requirements (IECC or ASHRAE 90.1) require DUV IMC 403.2 Requires Outdoor Air	<b>No</b> Allowed/Not Required IMC 403.1 HRV/ERV requirement achieved by additional code adoption <i>(note: there are some HRV/ERV requirements in commercial/residential IECC or ASHRAE 90.1, if adopted)</i>

### Specifying an HRV/ERV as DUV

<b>ASHRAE 62.2 Ventilation Rates Required?</b>	<b>DUV Allowed System Types Include One or More of the Following:</b>
<b>No</b> Generally, required CFM is lower in IMC. IMC also has less flexibility for advanced design considerations such as infiltration credits and particle filtration	<ul style="list-style-type: none"> <li>✓ Exhaust-only Ventilation System</li> <li>✓ Supply-only Ventilation System</li> <li>✓ Combination of Exhaust and Supply Fans</li> <li>✓ Does Not Prohibit Positive or Negative Pressure</li> </ul> <p><u>Includes, but Not Limited to HRV/ERV</u></p>

### IMC Flow Rate *(DUV Flow Rates = Continuous)*

<b>Mid/High-Rise:</b> Outdoor Air Required for Dwelling Units in Multifamily Buildings 4 Stories or More	<b>Low-Rise:</b> Outdoor Air Required for Dwelling Units in Multifamily Buildings 3 Stories or Less
Table 403.3.1.1: Outdoor Air Rate required for living space in dwelling units	IMC 403.3.2.1, Equation 4-9: $CFM = (0.01 \times Ft^2 \text{ of floor area}) + 7.5(\text{number of bedrooms} + 1)$
Determining Occupancy	Flow Rate
Based on # of bedrooms First bedroom = 2 people Additional bedrooms = 1 Person each	0.35 ACH, but not less than 15 CFM per person
<b>Example</b>	
1500 ft <sup>2</sup> apartment with 8 ft ceilings 2 bedrooms = 3 people	0.35 ACH = 70 CFM At least 15 CFM x 3 people = <u>45 CFM</u> minimum
<b>Balanced Ventilation Credit 403.3.2.1 Exception</b>	
<b>30% Outside Air Reduction</b>	
<ul style="list-style-type: none"> <li>✓ Balanced ventilation</li> <li>✓ Direct supply to kitchen, living room, and dining room</li> </ul>	
<i>Example: 75 CFM required unbalanced = 52.5 CFM required balanced</i>	

Note: low-rise multifamily dwelling units use the same equation for outdoor air flow rates as is used by the IRC for one and two family homes. Dwelling units in any multifamily building 4 stories or higher use Table 403.3.1.1 instead of an equation.  
Recommended Resource: while the IMC does not reference HVI listing, certified air flow rates can be found in the HVI CPD



**Other Outdoor Air Requirements**

Requirements that may apply to mid/high rise dwelling units depending on system design:

- ❖ Zone air flow adjustments IMC 403.3.1.1.1
- ❖ System airflow requirement IMC 403.3.1.1.2
- ❖ Exhaust contribution to required outdoor airflow IMC 403.3.1.2
- ❖ System operation via demand control IMC 403.3.1.3
- ❖ Variable air volume controls IMC 403.3.1.4

Requirements that apply to low-rise dwelling units:

- ❖ IMC 403.3.2.2 Corridors and common spaces flow rate = 0.06 CFM per ft<sup>2</sup> of floor area (may be relevant depending on common space ventilation system)
- ❖ IMC 403.3.2.4 When provided in dwelling unit, controls include text or symbol indicating systems function
- ❖ IMC 403.3.2.5 Exhaust or outdoor air equipment listed and labeled: ANSI/AMCA 210-ANSI/ASHRAE 51

Note: HVI 916 also references ANSI/AMCA 210-ANSI/ASHRAE 51

**Dwelling Units in Mid/High-Rise Multifamily Buildings: Local Exhaust Flow Rates Table 403.3.1.1**

Local Exhaust Rates	Bathroom	Kitchen
Continuous	25 CFM	50 CFM
Intermittent	50 CFM	100 CFM

Note: may be relevant to HRV/ERV tied to local exhaust

**Dwelling Units in Low-rise: Local Exhaust Flow Rates Table 403.3.2.3**

Local Exhaust Rates	Bathroom	Kitchen
Continuous	20 CFM	25 CFM
Intermittent	50 CFM	100 CFM

Note: may be relevant to HRV/ERV tied to local exhaust

Recommended Resource: See HVI CPD for certified air flow ratings

**Mechanical Inspections IMC 112.2**

Rough-in inspection

- After roof, framing, fire blocking and bracing are in place
- Prior to installation of wall or ceiling membranes
- All ducting and other components to be concealed are complete

Final inspection

- Upon completion of mechanical system

**Maintenance of Mechanical Systems IMC 102.3**

Mechanical systems shall be maintained

- Proper operating condition
- In accordance with original design
- Safe and sanitary condition
- Maintained in accordance with requirements of code edition under which system was installed.
- Owner is responsible
- Building department can require reinspection
- Maintenance inspection in accordance with ASHRAE/ACCA/ANSI Standard 180

**Requirements Specific to Energy Recovery located in section 514 for exhaust systems:**

**IMC 514.1** General ERV (and HRV) Requirements






















- Where required for energy conservation, ERVs shall meet requirements of IECC
- Ducted HRVs listed and labeled in accordance with UL 1812
- Nonducted HRVs listed and labeled in accordance with UL 1815

**IMC 514.2** ERV (and HRV) Prohibited Applications (*except ERVs that recover sensible heat only using coil-type heat exchanger*)

- Hazardous waste exhaust systems (per IMC 510)
- Dust, stock, and refuse systems that convey explosive or flammable vapors, fumes, or dust
- Smoke control systems (per IMC 513)
- Type I hood commercial kitchen exhaust
- Clothes dryer systems (per IMC 504)

Note: these are not common HRV/ERV applications in residential dwelling units

## Requirements for Ventilation System Components, Installation, and Design that Apply to HRV/ERV in Addition to Other Ventilation Systems

Exhaust Openings and Terminations IMC 501.3, 501.3.1		Intake Openings (mechanical and gravity) IMC 401.4		Recirculation of Air IMC 403.2.1, IMC 514.4	
Where discharge will cause a public nuisance		<10 ft from lot lines or buildings on the same lot line		Recirculation to meet required air flow rates	
Where discharge can readily be drawn in again by a ventilation system		< 10 ft horizontally from any hazardous or noxious contaminant		Recirculated from one dwelling to another	
< 3 ft from property line		<i>Examples: vents, streets, alleys, parking lots, loading docks</i>		Recirculation to dissimilar occupancies	
Exhausted into an attic, crawl space, or directed onto walkways				Recirculation of air from kitchens to other spaces	
< 3 ft from operable openings		< 10 ft horizontal separation from streets, alleys, parking lots, loading docks AND $\geq$ 25 ft vertical separation		Air conveyed by ERV/HRV cross leakage between air streams	
< 10 ft from mechanical air intakes					< 10% of airflow design capacity is not considered recirculated
In flood hazard area, location at or above required elevation in IBC 1612		In flood hazard area, location at or above required elevation in IBC 1612		Recirculation of air from garages common for multiple dwelling units to other spaces	
Approved, factory-built intake/exhaust combination termination fitting separates air streams in accordance with manufacturer's instructions		Approved, factory-built intake/exhaust combination termination fitting separates air streams in accordance with manufacturer's instructions		Transfer air from occupiable space may serve as makeup air for required exhaust systems (kitchens, baths, toilets) if transfer and exhaust air is sufficient to meet required flow rate (except when recirculation from a specific space is prohibited) (IMC 403.2.2)	
Kitchen exhaust openings meet requirements of IMC 506.3.13, 506.4, or 506.5 depending on system type		Intake openings < 10 ft of contaminant source $\geq$ 3 ft below contaminant source			

### Protection for exhaust and intake openings terminating outdoors IMC 401.5, 501.3.2

- Corrosion-resistant screens, louvres or grilles
- $1/4"$  (6mm)  $\leq$  screen/louvre/grille openings  $\leq 1/2"$  (13mm)
- Protected against local weather conditions
- Louvres protecting openings in hurricane-prone regions (defined in IBC) comply with AMCA 550
- Meet protective requirements of IBC for exterior wall openings

Note: requirements for exhaust openings and terminations as well as intake openings are applicable to HRV/ERV exhaust and supply components. Bathroom, toilet room and kitchen exhaust information is included for situations in which HRV/ERV may be integrated with these ventilation systems

Note: Intake/exhaust combination termination fittings allowed here have potential enabling HRV/ERV design flexibility for multifamily projects constrained by space

Recommended Resource: see HVI CPD for information on certified duct termination fittings, fresh air inlets, and static vents

**Duct Requirements for Ventilation Systems:**

- Air Movement in egress IMC (601.2)
  - Makeup air in corridor for exhaust systems permitted only if outdoor air provided to corridor > makeup air taken
  - Corridors within dwelling units not prohibited as makeup air
- Ductwork for exit enclosure ventilation must meet applicable requirements of IMC 601.3
  - Note: exit enclosure is typically a common exit with fire separation from other spaces and intended as part of egress.
- Exhaust ducts under positive pressure may not pass through ducts or plenums (IMC 601.4)
- Return air openings (IMC 601.5)
  - Openings located  $\geq 10$  ft from open combustion chamber or draft hood of another appliance in same room
  - Not taken from hazardous or insanitary location or refrigeration room (as defined by IMC)
  - Return air taken from any room  $\leq$  outside air flow rate supplied
  - Return/transfer openings sized in accordance with manufacturer's installation instructions, ACCA Manual D or registered design professional
  - Not discharged from one dwelling into another
  - No direct connection to return air of forced air furnace from crawl space
  - Not taken from closet, bathroom, toilet room, kitchen, garage, boiler room, furnace room or unconditioned attic
  - Not taken from indoor swimming pool enclosures and associated deck areas
  - Return air may be taken from kitchen where return air serves the kitchen and opening  $\geq 10$ ft from cooking appliances
  - Return air may be taken from kitchen in a dwelling unit where kitchen and living space is in a single room, cooking appliance is electric and cooking appliance  $\geq 5$  ft from return opening
- Ventilation plenums meet location requirements of IMC 602.1
- Static fire/radiation dampers only installed if HVAC system automatically shuts down in event of fire (IMC 607.2.3)
- Dynamic ceiling radiation dampers designed to be used in a fire labeled for use in dynamic systems (IMC 607.6.2.1.1)
- Balancing (IMC 608.1)
  - Provided with means to adjust system to achieve desired air flow rates
  - Distribution balanced by an approved method and verified that system capable of providing supply and exhaust air flow rates as required by IMC Chapter 4

Note: duct requirements above are also applicable to heating and cooling ducts. Some requirements are designed for heating and cooling ducts but may apply to ventilation ducts depending on the situation. Many of these requirements will not be relevant to HRV/ERV serving single dwelling units.



*Note on Important Change in 2021 IMC: The 2021 IMC implemented a major change to the trigger for when dwelling units are required to have DUV. Prior editions tied the requirement to a specific building air tightness test result. The IECC did not mandate testing of units for buildings above 3 stories. The result could be interpreted as not needing DUV if no testing occurred. This situation also created the misperception that if a unit was leakier than 5 ACH50, it did not require DUV to achieve good indoor air quality. IMC 401.2 was amended in the 2021 IMC to require any dwelling built to the air-tightness requirements of the IECC or (ASHRAE 90.1) to include DUV – eliminating possible gaps in DUV coverage for dwellings.*

### Fact Sheet Acronyms

ACCA = Air Conditioning Contractors of America  
 ACH = Air Changes per Hour  
 AHJ = Authority Having Jurisdiction  
 ANSI = American National Standards Institute  
 AMCA = Air Movement and Control Association  
 ASHRAE = American Society of Heating, Refrigerating, and Air-Conditioning Engineers  
 CFM = Cubic Feet per Minute  
 CPD = Certified Products Directory  
 DUV = Dwelling Unit Ventilation  
 ERV = Energy Recovery Ventilator  
 Ft = Feet  
 HRV = Heat Recovery Ventilator  
 HVI = Home Ventilating Institute  
 IBC = International Building Code  
 ICC = International Code Council  
 IECC = International Energy Conservation Code  
 IMC = International Mechanical Code  
 IRC = International Residential Code  
 UL = Underwriters Laboratories

### Important Resources

- ❖ HVI CPD <https://www.hvi.org/hvi-certified-products-directory/>
- ❖ ASHRAE Read-Only Standards <https://www.ashrae.org/technical-resources/standards-and-guidelines/read-only-versions-of-ashrae-standards>
- ❖ ICC Codes <https://codes.iccsafe.org/> for actual code text and other codes referenced throughout IMC
- ❖ State and/or Local Code Adoption Information – check with your state and/or local building department for adopted code edition and any amendments. Depending on the AHJ, requirements may be significantly amended from ICC published code