Part 2 – Mandatory and Additional Energy Efficiency Requirements

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# 2023 Residential Stretch Code

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  - The Berkshire Gas Company
  - Cape Light Compact
  - Eversource Energy
  - Liberty Utilities
  - National Grid
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- The Sponsors of Mass Save work closely with the Massachusetts Department of Energy Resources to provide a wide range of services, incentives, trainings, and information promoting energy efficiency that help residents and businesses manage energy use and related costs.


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## Continuing Education

**This webinar is approved for:**

- 1-hour CSL CEU
- 1 AIA LU | HSW
- 1 CO CEU
- 1 BPI CEU

*Everyone will receive a certificate of attendance via email*


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- Introduction
- Review Requirements Related to HERS Index
- Review Mandatory Requirements
- Apply Additional Efficiency Packages to Stretch Code Projects
- Municipal Opt-In Specialized Stretch Code
- Review Important New Requirements to the Stretch Code

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# Learning Outcomes

- Know how to apply HERS Rating Index to a residential project
- Be able to apply mandatory requirements for projects using the Prescriptive Compliance Approach
- Be able to apply mandatory requirements for projects using the ERI Compliance Alternative
- Be able to determine how application of Additional Energy Efficiency Packages affect the required HERS Index

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## Poll Question #1

Which of the following best describes your field of work?

A. Builder
B. Architect
C. Code Official
D. HERS Rater
E. Passive House Consultant

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# Mandatory Requirements

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## Compliance Options and Mandatory Requirements

| Compliance Options | Mandatory Requirements |
|---|---|
| Option 1:<br>Passive House Building Certification (R405) | ❑ Appendix RB: Solar Ready Provisions<br>❑ EV Ready Spaces |
| Option 2:<br>Energy Rating Index (R406) | ❑ Mandatory requirements per Table R406.2<br>❑ Maximum HERS Index per Table R406.5<br>❑ Appendix RB: Solar Ready Provisions<br>❑ EV Ready Spaces |
| Option 3:<br>MA Specialized Stretch Code (Appendix RC) | Includes all stretch code requirements and has ***additional*** requirements for mixed-fuel buildings |

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## Mandatory Requirements

- These requirements must be met, whether you are doing prescriptive work or stretch code
- Formerly known as "***mandatory***" and found throughout sections in Chapter 4
- These are now found in ***Table R406.2***

*Note: Meeting the items in Table R406.2 is not required for the Passive House Option*

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# Table 406.2 Requirements – Energy Rating Index

Requirements applicable to all compliance paths used to be labeled aside the individual section header as "(mandatory)".

Now all requirements applicable to the ERI path are summarized in Table R406.2.

**Table R406.2**
*Requirements for Energy Rating Index*

| | |
|---|---|
| **General** | |
| R401.3 | Certificate |
| **Building Thermal Envelope** | |
| R402.1.1 | Vapor retarder |
| R402.2.3 | Eave Baffle |
| R402.2.4.1 | Access hatches and doors |
| R402.2.10.1 | Crawl space wall insulation installation |
| R402.4.1.1 | Installation |
| R402.4.1.2 | Testing |
| **Mechanical** | |
| R403.1 | Controls |
| R403.3 | Ducts (except R403.3.2, R403.3.3, and R403.3.6) |
| R403.4 | Mechanical system piping insulation |
| R403.5.1 | Heated water circulation and temperature maintenance systems |
| R403.5.3 | Drain water heat recovery units |
| R403.6.1 | Heat or energy recovery ventilation (HRV/ERV) |
| R403.7 | Equipment sizing and efficiency rating |
| R403.8 | System serving multiple dwelling units |
| R403.9 | Snow and ice melt systems |
| R403.10 | Energy consumption of pools and spas |
| R403.11 | Portable spas |
| R403.12 | Residential pools and permanent residential spas |
| **Electrical Power and Lighting Systems** | |
| R404.1 | Lighting equipment |
| R404.2 | Interior lighting controls |
| R404.4 | Wiring for electric vehicle charging spaces |

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# Requirements for ERI-MASS Amendments

**Table R406.2**
*Requirements for Energy Rating Index*

| | |
|---|---|
| **General** | |
| R401.3 | Certificate |
| **Building Thermal Envelope** | |
| R402.1.1 | Vapor retarder |
| R402.2.3 | Eave Baffle |
| R402.2.4.1 | Access hatches and doors |
| R402.2.10.1 | Crawl space wall insulation installation |
| R402.4.1.1 | Installation |
| R402.4.1.2 | Testing |
| **Mechanical** | |
| R403.1 | Controls |
| R403.3 | Ducts (except R403.3.2, R403.3.3, and R403.3.6) |
| R403.4 | Mechanical system piping insulation |
| R403.5.1 | Heated water circulation and temperature maintenance systems |
| R403.5.3 | Drain water heat recovery units |
| R403.6.1 | Heat or energy recovery ventilation (HRV/ERV) |
| R403.7 | Equipment sizing and efficiency rating |
| R403.8 | System serving multiple dwelling units |
| R403.9 | Snow and ice melt systems |
| R403.10 | Energy consumption of pools and spas |
| R403.11 | Portable spas |
| R403.12 | Residential pools and permanent residential spas |
| **Electrical Power and Lighting Systems** | |
| R404.1 | Lighting equipment |
| R404.2 | Interior lighting controls |
| R404.4 | Wiring for electric vehicle charging spaces |

## Massachusetts Amendments to Table R406.2

| SECTION | TITLE |
|---|---|
| R403.6.1 | Heat or energy recovery ventilation |
| R404.4 | Wiring for electric vehicle charging stations |
| ~~R406.3~~ | ~~Building Thermal Envelope~~ |

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## R401.3 Certificate

The 2021 IECC requires additional items to be listed on the certificate that is to be posted in the furnace or utility room including:

- Photovoltaic system information (if applicable)
- Energy Rating Index score with and without on-site generation) if applicable)
- The energy code edition and compliance path used

### Energy Code Certificate

Energy Code Edition _____ Compliance Path _____

**Building Thermal Envelope**
Ceiling R-value: _____
Roof R-value: _____
Wall R-value: _____
Slab R-value: _____
Bsmt wall R-value: _____
Crawl wall R-value: _____
Floor R-value: _____
Window U-factor: _____
Window SHGC: _____
Air infiltration rate: _____

Mechanical Systems
Duct R-value: _____
Duct leakage rate: _____
Heating equip eff: _____
Cooling equip eff: _____

Photovoltaic System
Capacity: _____
Inverter eff: _____
Panel tilt: _____
Panel orientation: _____

**Energy Rating Index**
With onsite power: _____ W/o onsite power: _____

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## Eave Baffles (R402.2.3)

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**Requires the eave baffles to be installed at the outer edge of the exterior wall top plate to provide maximum space for insulation above the top plate. Must be installed continuously even if soffit venting is not, to ensure air moves past.**

***NEW for 2021***

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## Access Hatches and Doors

**R402.2.4.1 Access hatches and door insulation installation and retention**

- Access hatches and doors are weather-stripped
- Access to equipment that prevents damaging or compressing the insulation
- Baffle to prevent loose-fill insulation from spilling
  - Into the living space
  - From higher to lower sections of the attic
  - From attics covering conditioned spaces to unconditioned spaces
- Baffle permanently maintains the installed R-value of loose-fill insulation

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## Poll Question #2

Eave baffles must be installed in every bay, whether using continuous soffit venting or individual soffit vents. True or false.

A. True

B. False

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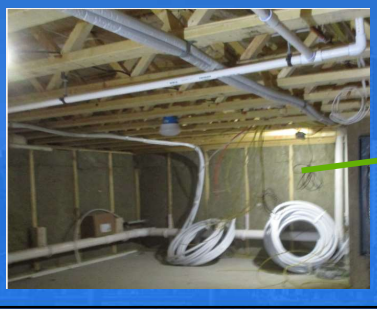
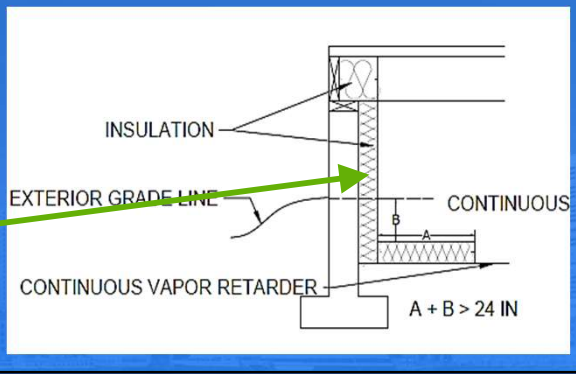
# R 402.2.10.1 Crawl Space Wall Insulation Installation

- Insulation is permanently fastened to the wall
- Extends downward from the floor to finished grade and then vertically or horizontally and additional 24 inches
- Exposed earth is covered with a continuous Class I vapor retarder
  - Lapped 6 inches
  - Extends up walls 6 inches



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# Air Barrier and Insulation Installation Criteria

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

| COMPONENT | AIR BARRIER CRITERIA | INSULATION INSTALLATION CRITERIA |
|---|---|---|
| General requirements | A continuous air barrier shall be installed in the building envelope.<br>Breaks or joints in the air barrier shall be sealed. | Air-permeable insulation shall not be used as a sealing material. |
| Ceiling/attic | The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed.<br>Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed. | The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. |
| Walls | The junction of the foundation and sill plate shall be sealed.<br>The junction of the top plate and the top of exterior walls shall be sealed.<br>Knee walls shall be sealed. | Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, *R*-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. |
| Windows, skylights and doors | The space between framing and skylights, and the jambs of windows and doors, shall be sealed. | — |
| Rim joists | Rim joists shall include an exterior air barrier.[b]<br>The junctions of the rim board to the sill plate and the rim board and the subfloor shall be air sealed. | Rim joists shall be insulated so that the insulation maintains permanent contact with the exterior rim board.[b] |
| Floors, including cantilevered floors and floors above garages | The air barrier shall be installed at any exposed edge of insulation. | Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extending from the bottom to the top of all perimeter floor framing members. |
| Basement crawl space and slab foundations | Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.10.<br>Penetrations through concrete foundation walls and slabs shall be air sealed.<br>Class 1 vapor retarders shall not be used as an air barrier on below-grade walls and shall be installed in accordance with Section R702.7 of the *International Residential Code*. | Crawl space insulation, where provided instead of floor insulation, shall be installed in accordance with Section R402.2.10.<br>Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.8.1.<br>Slab-on-grade floor insulation shall be installed in accordance with Section R402.2.10. |
| Shafts, penetrations | Duct and flue shafts to exterior or unconditioned space shall be sealed.<br>Utility penetrations of the air barrier shall be caulked, gasketed or otherwise sealed and shall allow for expansion, contraction of materials and mechanical vibration. | Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required *R*-value. |
| Narrow cavities | Narrow cavities of 1 inch or less that are not able to be insulated shall be air sealed. | Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space. |
| | | Insulated portions of the garage separation assembly shall |

No major changes from the 2018 IECC

- Building component
- Air barrier criteria
- Insulation installation criteria

## Massachusetts Amendment

TABLE R402.4.1.1 AIR BARRIER AND INSULATION INSTALLATION

| COMPONENT | INSULATION INSTALLATION CRITERIA |
|---|---|
| General requirements | All insulation shall be installed at Grade I quality in accordance with ICC/RESNET 301.<br>Air-permeable insulation shall not be used as a sealing material. |

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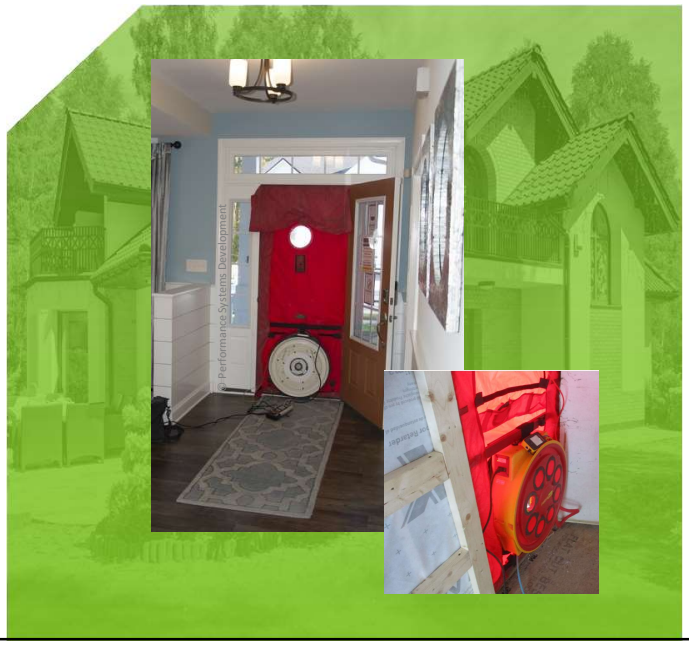
## R402.4.1.2 Testing

For the ERI Option, the 2021 IECC…

- Raises the maximum leakage rate from 3 ACH50 to 5 ACH50 or 0.28 cfm/sqft of enclosure area
- Adds an exception allowing up to 0.30 cfm/sqft for
  - Attached dwelling units
  - Dwelling units 1,500 sqft or smaller



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## Air Leakage Testing

**DWELLING UNIT ENCLOSURE AREA. The sum of the area of ceilings, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. Wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above.**

**In other words, the building thermal envelope and assemblies separating one unit from another.**

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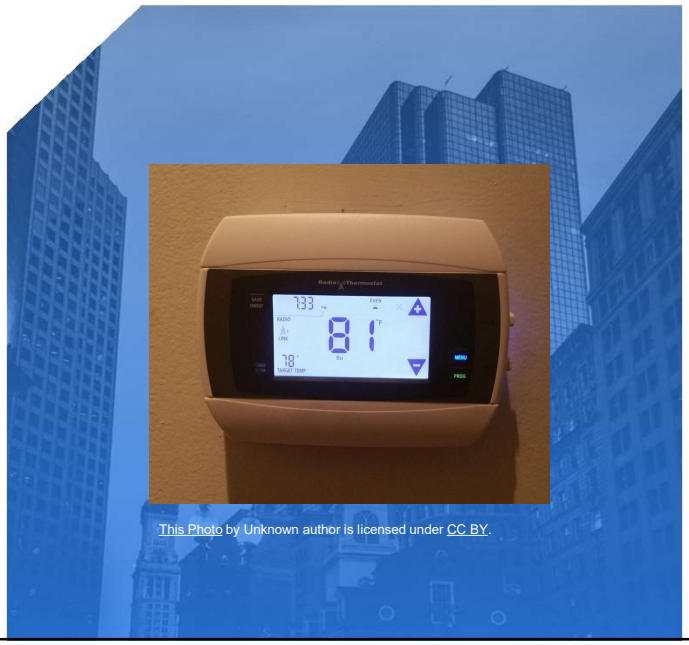
## Controls (R403.1)

- No changes from 2018 IECC
- The thermostat controlling the primary heating and cooling system of the dwelling shall:
  - Be capable of a daily schedule and maintain different temperature set points
  - Capable to set back or temporarily operate the system to maintain zone temperatures of not ≤ 55° not ≥ 85°
  - Initial manufacturing programming heating set point of not ≥ 70° and cooling setpoint of not ≤ 78°

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## Heat Pump Supplementary Heat (R403.1.2)

- No changes from 2018 IECC
- Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

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# Ducts in Floors and Exterior Walls

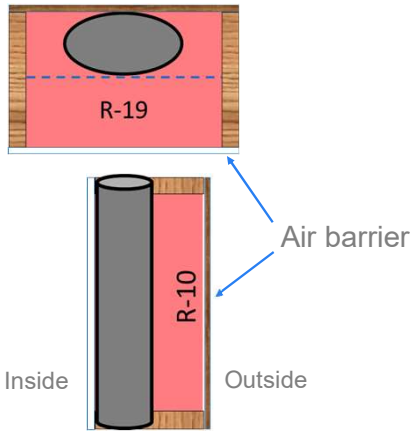
Ducts, floors, and exterior walls that are a part of the thermal envelope **can be considered in conditioned space** when certain criteria are met. *This section does NOT apply to the ERI path.*

**Ducts in floors over unconditioned space**

1. A continuous air barrier is installed between the unconditioned space and the duct
2. Floor insulation is installed per R402.2.7 found under Specific Insulation Requirements
3. At least R-19 insulation installed separating the duct from the unconditioned space for the full cavity width

**Ducts in exterior walls**

1. A continuous air barrier is installed between the unconditioned space and the duct
2. Minimum R-10 insulation separating the duct from the outside for the full cavity width
3. The remainder of the cavity is filled with insulation

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# Duct Leakage Testing

Duct leakage testing is required ***regardless*** of duct and air handler location

- No exceptions for systems entirely within the thermal envelope

Testing standards added

- ANSI/RESNET/ICC 380 or
- ASTM E1554

Prescriptive leakage limits (not applicable to stretch code)

- 4 cfm/100 sf with air handler installed
- 3 cfm/100 sf without air handler installed
- 8 cfm/100 sf when entire system is inside

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## Building Cavities (R403.3.7)

**No change from 2018 IECC**

**Building framing cavities shall not be used as ducts or plenums.**

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## Heated Water Circulation

Hot water boiler temperature reset are required, and the controls must now be manufacturer installed.


Source : Supply house

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## Mechanical System Pipe Insulation (R403.3)

**No change from 2018 IECC**

**Mechanical system piping capable of carrying fluids greater than 105° or less than 55° shall be insulated to an R-value of not less than R-3**


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## Mechanical Ventilation (R403.6)

**Requirements of Section 403.6**

- Dampers required on all terminations
- Whole-house ventilation
  - Minimum ventilation rates
  - HRV or ERV required
  - Minimum fan efficacies
- Testing and verification
- HVI 920 certified equipment installed per manufacturer's instructions
- Sound rating

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## R403.5.3 Hot Water Pipe Insulation

| IECC 2021 Hot Water Pipe Insulation of R-3 Required for |
|---|
| 1) Hot water piping ¾ inch nominal diameter and larger |
| 2) Piping serving more than one dwelling unit |
| 3) Piping located outside conditioned space |
| 4) Piping from water heater to distribution manifold |
| 5) Piping located under a floor slab |
| 6) Buried piping |
| 7) Supply and Return piping in recirculation systems other than demand recirculation systems |

***Piping located outside conditioned space should be insulated even if the nominal diameter is less than ¾ in.***

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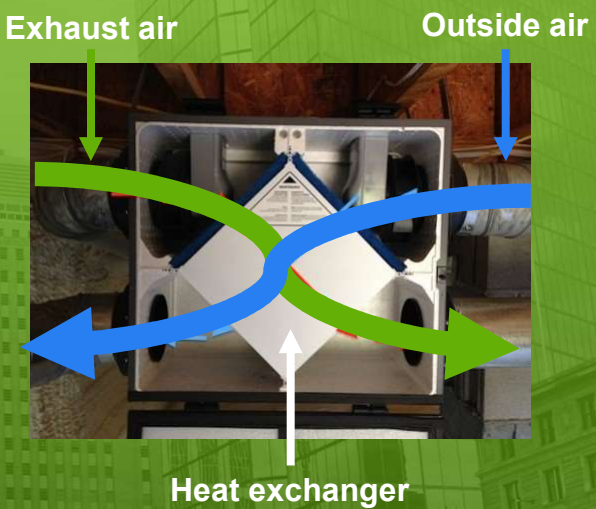
## Mechanical Ventilation: What is a HRV vs ERV?

- **HRV = Heat Recovery Ventilation**
  - **Transfers only sensible heat**
- **ERV = Energy (or Enthalpy) Recovery Ventilation**
  - **Transfers sensible and latent heat**

**HRVs/ERVs can have a wide range of recovery efficiencies (a few are even 90%+)**

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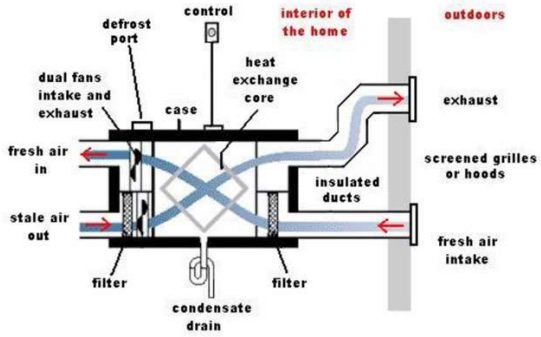
## Mechanical Ventilation Systems (HRV/ERV)

Mechanical ventilation systems must be either an HRV or ERV. No supply or exhaust systems in stretch code towns. Balanced systems only, no more supply or exhaust only.




Interior workings of an HRV

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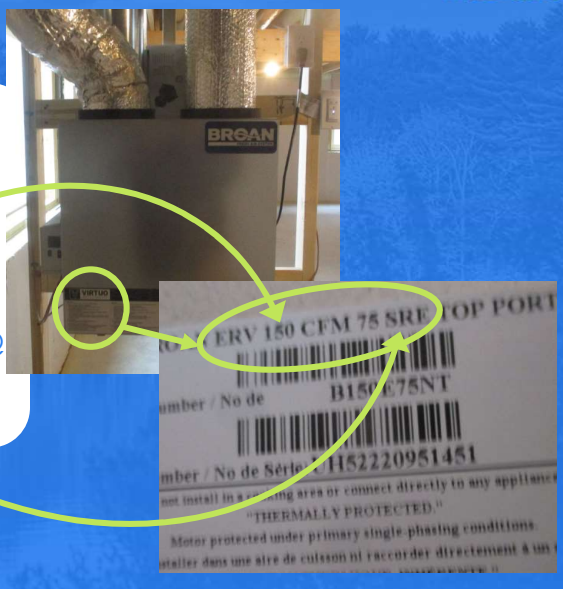
## Mechanical Ventilation Systems (HRV/ERV)

- ✓ Large Systems (>300CFM)
  - ✓ ≥50% Enthalpy Recovery Ratio – Cooling Design Condition
  - ✓ ≥60% Enthalpy Recovery Ratio Heating Design Condition
- ✓ Other Systems (≤300 CFM)
  - ✓ ≥65% Sensible Recovery Ratio (SRE) @ 32°F at an airflow not less than the design airflow

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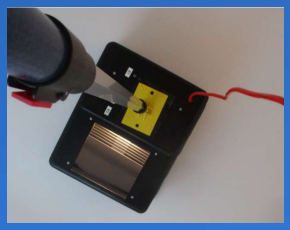
## Mechanical Ventilation System Testing

Mechanical ventilation systems must be tested and verified to achieve minimum required ventilation rate

- This includes whole-house and local ventilation systems
- Exception: Kitchen range hoods ducted to the outside with 6-inch or larger duct and not more than one 90-degree elbow or equivalent.

Testing in accordance with the manufacturer's instructions, flow hood or box, flow grid or other airflow measuring device.

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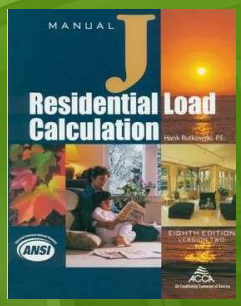
## Equipment Sizing and Efficiency Rating (R403.7)

- No change from 2018 IECC
- Heating and cooling equipment shall be sized in accordance with:
  - ACCA manual S and ACCA manual J (or other approved methodologies)
- New or replacement heating and cooling equipment shall meet efficiency ratings required by federal law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## Poll Question #3

What is the main difference between a HRV and ERV?

A. HRV removes moisture only

B. ERV removes sensible heat only

C. HRV removes both sensible and latent heat

D. ERV removes both sensible and latent heat

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## Portable Spas (R403.11)

- No change from 2018 IECC
- The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP-14 or the American National Standard for Portable Electric Spa Energy Efficiency.

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## Exterior Lighting Controls

Where total exterior lighting is > 30 W

- Manual on/off switch that is auto-off capable
  - Exception for lighting serving multiple dwelling units
- Lighting automatically shuts off when daylight is present and satisfies the lighting needs
- Override allowed, but must return to automatic within 24 hours

Microsoft stock image

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## Interior Lighting Controls

Dimmers, occupant sensors, or controls built into the fixture

Exceptions:

- Bathrooms
- Hallways
- Exterior lighting fixtures
- Lighting designed for safety or security

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## Snow Melt and Ice Systems Controls (R 403.9)

- No change from 2018 IECC
- Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is greater than 50°F and precipitation is not falling, and an automatic or manual control that will allow shutoff when the outdoor temperature is greater than 40°F.

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## Pools and Permanent Spas (R403.10)

- No change from 2018 IECC
- On-Off Switch / mounted on outside of heater with ready access or within 3 ft of heater.
- Switch will not change setting of thermostat
- No continuous burning pilot lights
- Time switches turn off heaters and pumps unless they are built in.
  - Except/ public health requires 24 hr operation.
  - Except/ pumps that operate solar- waste heat recovery systems
- Covers on outdoor heated pools and spas
  - With exceptions

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## Poll Question #4

Mandatory Requirements can be found in Table 406.2. True or False.

A. True

B. False

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# Additional Efficiency Packages

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## R401.2.5 Additional Energy Efficiency

**R401.2.5**

1. Buildings complying with the Prescriptive Compliance Option ***must choose two*** packages from R408.2. (Not applicable to stretch code)
2. Buildings electing to be *all-electric* must meet the HVAC and DHW efficiencies of R408.2.2 and R408.2.3.

**R408.2**

1. Enhanced envelope performance option (R408.2.1)
2. More efficient HVAC equipment performance option (R408.2.2)
3. Reduced energy use in service water-heating option (R408.2.3)
4. More efficient duct thermal distribution system option (R408.2.4)
5. Improved air sealing and efficient ventilation system option (R408.2.5)

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## Poll Question #5

How many additional efficiency packages must you choose?

A. One

B. Three

C. Two

D. None

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# R401.2.5 Additional Energy Efficiency

**To be able to utilize the increased maximum HERS Indexes for all-electric buildings, homes must meet the efficiency requirements of R408.2.2 and R408.2.**

| Clean Energy Application | New Construction | | Major Alternations, Additions, and Changes of Use |
|---|---|---|---|
| | January 1, 2023, through June 30, 2024 | Starting July 1, 2024 | Starting January 1, 2023 |
| Mixed-Fuel Building | 52 | 42 | 52 |
| Solar Electric Generation* | 55 | 42 | 55 |
| All-Electric Building | 55 | 45 | 55 |
| Solar Electric* and All-Electric Building | 58 | 45 | 58 |

**R408.2.2 More Efficient HVAC Equipment Performance**

- **≥ 10 HSPF air source heat pump**
- **≥ 3.5 COP ground source**

**R408.2.3 Reduced Energy Use in Service Water-Heating**

- **≥ 2.0 EF electric service water-heating system**
- **≥ 0.4 solar fraction solar water-heating system**

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## Summary

- Requirements formerly known as “mandatory” are found in [MA] Table R406.2
- These requirements are found in the 2021 IECC and MA Amendments
- Important new requirements
  - Retainers to prevent loose-fill insulation from spilling from one attic level to another
  - Total leakage test required for all new duct systems
  - HRV/ERV required for all new homes
  - Mechanical ventilation flow rate to be tested
  - Interior and exterior lighting controls
  - Electric vehicle readiness
- To be eligible for HERS Index credits all-electric homes, high-efficiency electric HVAC and DHW equipment must be specified

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## Poll Question #6

What is the HERS Index for mixed fuel on July 1, 2024?

A. 45

B. 52

C. 42

D. 55

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## Mass Save Incentive Programs

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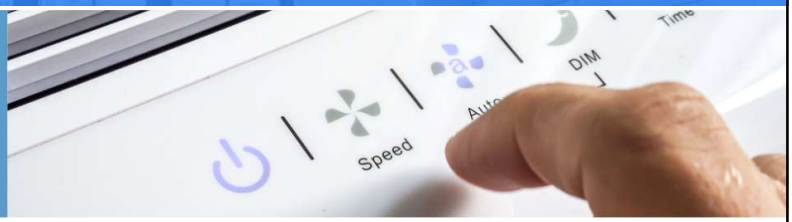
**Residential Rebates and Incentives**

Rebates for appliances, heating systems and more.




**www.masssave.com/en/residential/rebates-and-incentives**

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# Residential New Construction

***Five incentive paths*** that cover new construction and renovation projects with multiple fuel types, multiple Program Administrators and both commercial and residential meters

Incentives are ***performance-based*** for incorporating high-performance upgrades that go beyond minimum building code requirements

Program also features a ***Passive House & All-Electric Homes workforce training initiative*** to promote workforce development and market transformation in the energy efficiency and residential building construction industry.

ICF serves as single point of contact Lead Vendor for all statewide Sponsors

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# Residential New Construction

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**Low Rise New Construction**

- 1-4 unit homes and 5+ unit multi-family ≤ 3 Stories and residential-metered heat
- Enrollment via program-approved HERS rater

**All-Electric Homes**

- Single Family and 2-4 unit new construction homes
- All-Electric heating, cooling, water heating and cooking
- Enrollment via program-approved HERS rater

**Renovations & Additions**

- 1-4 unit homes and 5+ unit multi-family ≤ 3 Stories and residential-metered heat
- Major renovations & large additions
- Enrollment via program-approved HERS rater

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## Residential New Construction

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**High Rise New Construction**

- 4+ stories and 5+ units with residential-metered heat [or] all multi-family buildings with master-metered heat
- Enrollment via program Account Manager

**Passive House**

- New Construction multi-family buildings of 5+ units pursuing Passive House Certification (PHI or PHIUS)
- Enrollment via program Account Manager

**Passive House & All-Electric Homes Training**

- Enrollment online via Energy Efficiency Learning Center
- 50% cost reimbursement upon completion of Passive House professional accreditations (PHI or PHIUS)

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## Energy Code Support

### Questions about the energy code?

**Energy Code Support Hotline:**

855-757-9717

**Energy Code Support Email:**

energycodesma@psdconsulting.com

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Thanks!
Massachusetts Energy Code Technical Support Program
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