PSD

Energy Code Technical Support Program

2023 Residential Stretch Code - Part 1

Overview

mass save®
Savings through energy efficiency

WE ARE MASS SAVE®:

BERKSHIRE GAS
An AVANGRID Company

Cape Light Compact

EVERSOURCE

Liberty

nationalgrid

Unitil

Who Is Mass Save®?

- Mass Save® is an initiative sponsored by Massachusetts' gas and electric Program Administrators and energy efficiency service providers, including
  - The Berkshire Gas Company
  - Cape Light Compact
  - Eversource Energy
  - Liberty Utilities
  - National Grid
  - Unitil

- 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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BERKSHIRE GAS
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Presented by:

PERFORMANCE
SYSTEMS
DEVELOPMENT

Continuing Education

Approved for (1) hour of CSL, AIA, CO continuing education units

2023 MASSACHUSETTS RESIDENTIAL ENERGY CODE

Agenda

- Introduction
- Prescriptive Option (Base code and Most Stretch additions/alterations)
- Stretch Code
- Requirements formerly-known as mandatory
- Appendix RB Solar Ready
- EV Ready
- Municipal Opt-in Specialized Stretch Code
- Summary

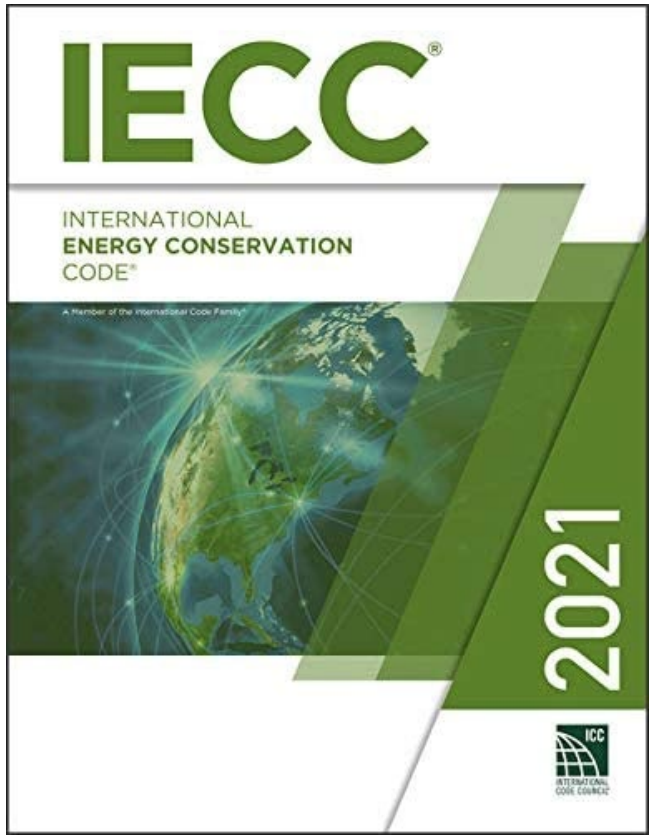
POLL QUESTION #1

Which of the following best describes your field of work?

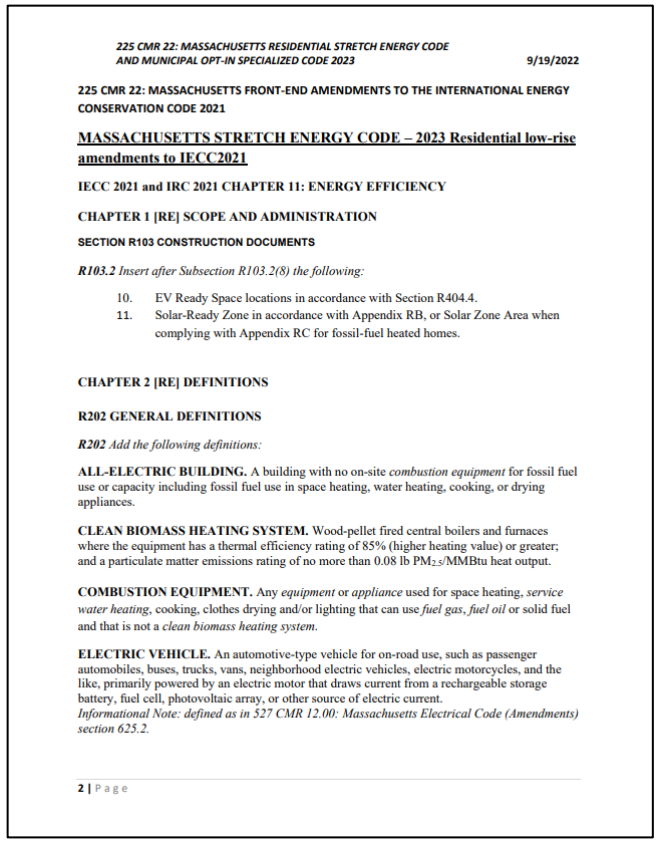
A. Builder
B. Architect
C. Code Official
D. HERS Rater
E. Passive House Consultant

The 2023 Massachusetts Energy Code

The 2021 IECC



Massachusetts Amendments



225 CMR 22: MASSACHUSETTS RESIDENTIAL STRETCH ENERGY CODE AND MUNICIPAL OPT-IN SPECIALIZED CODE 2023 9/19/2022

225 CMR 22: MASSACHUSETTS FRONT-END AMENDMENTS TO THE INTERNATIONAL ENERGY CONSERVATION CODE 2021

MASSACHUSETTS STRETCH ENERGY CODE – 2023 Residential low-rise amendments to IECC2021

IECC 2021 and IRC 2021 CHAPTER 11: ENERGY EFFICIENCY

CHAPTER 1 [RE] SCOPE AND ADMINISTRATION

SECTION R103 CONSTRUCTION DOCUMENTS

R103.2 *Insert after Subsection R103.2(8) the following:*

10. EV Ready Space locations in accordance with Section R404.4.
11. Solar-Ready Zone in accordance with Appendix RB, or Solar Zone Area when complying with Appendix RC for fossil-fuel heated homes.

CHAPTER 2 [RE] DEFINITIONS

R202 GENERAL DEFINITIONS

R202 *Add the following definitions:*

ALL-ELECTRIC BUILDING. A building with no on-site *combustion equipment* for fossil fuel use or capacity including fossil fuel use in space heating, water heating, cooking, or drying appliances.

CLEAN BIOMASS HEATING SYSTEM. Wood-pellet fired central boilers and furnaces where the equipment has a thermal efficiency rating of 85% (higher heating value) or greater; and a particulate matter emissions rating of no more than 0.08 lb $PM_{2.5}$/MMBtu heat output.

COMBUSTION EQUIPMENT. Any *equipment* or *appliance* used for space heating, *service water heating*, cooking, clothes drying and/or lighting that can use *fuel gas*, *fuel oil* or solid fuel and that is not a *clean biomass heating system*.

ELECTRIC VEHICLE. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles, and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array, or other source of electric current.
Informational Note: defined as in 527 CMR 12.00: Massachusetts Electrical Code (Amendments) section 625.2.

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The 2023 Massachusetts Energy Code

Municipal Opt-In Specialized Stretch Code

Stretch Code

Base Code

Overview of Changes

1 Jan. 2023

- Maximum HERS Index decrease from 55 to 52 ϟ
- Large additions and alterations must follow ERI path
- HRV/ERV required
- Specialized Stretch Code available for adoption

1 July 2024

- Maximum HERS Index decrease from 52 to 42 ϟ

ϟ All-electric homes qualify for a three-point increase in maximum HERS Index

THE BASE CODE PRESCRIPTIVE COMPLIANCE

MA Base Energy Code

The Base Energy Code is…

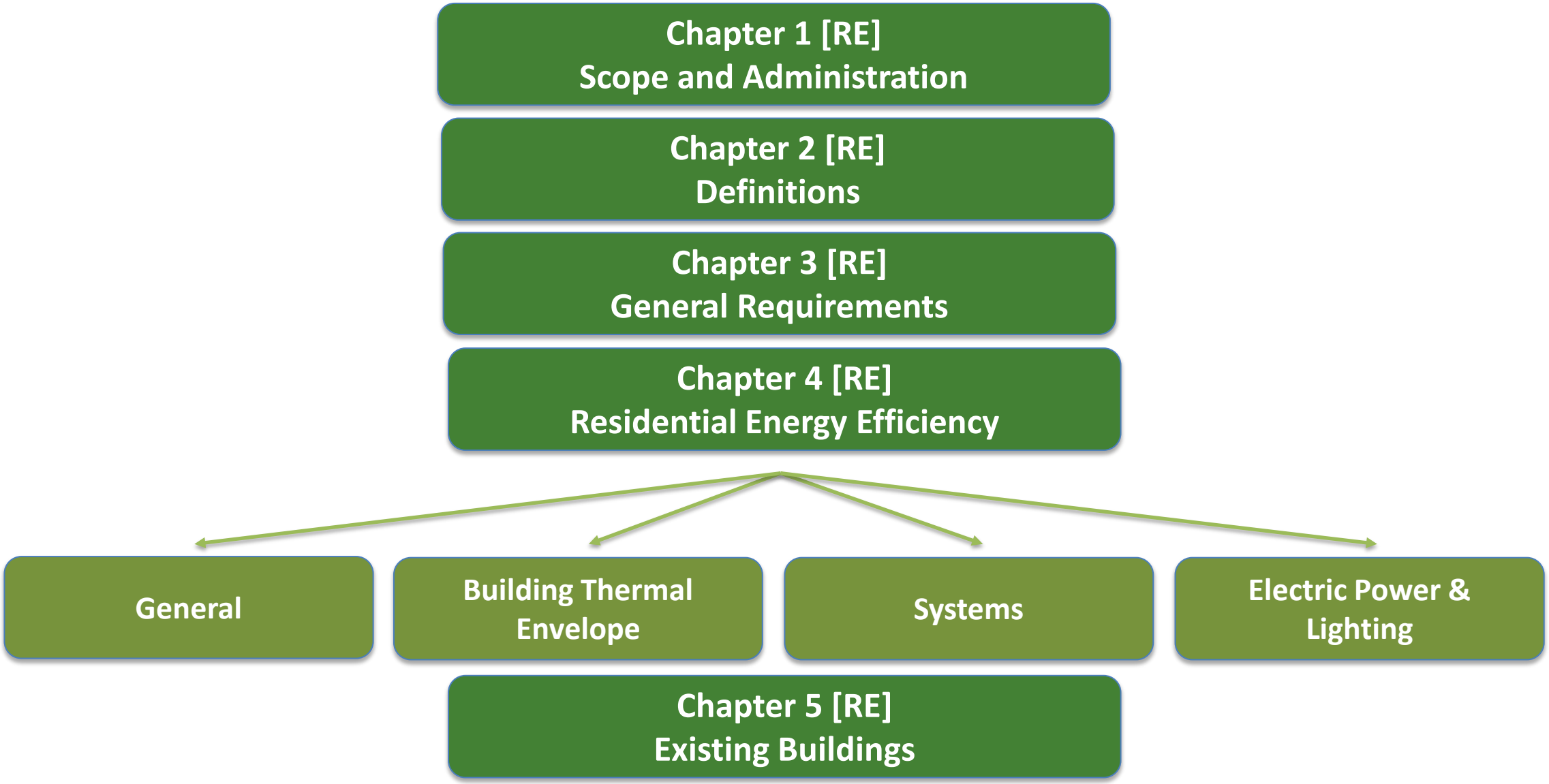
- The default statewide energy code
- Based on the 2021 IECC
- Provides a base level of energy savings

- Found in ***Chapter 11: Energy Efficiency Amendments*** of the MA State Building Code (CMR 780)

The Base Code and (Most) Stretch Code Additions and Alterations

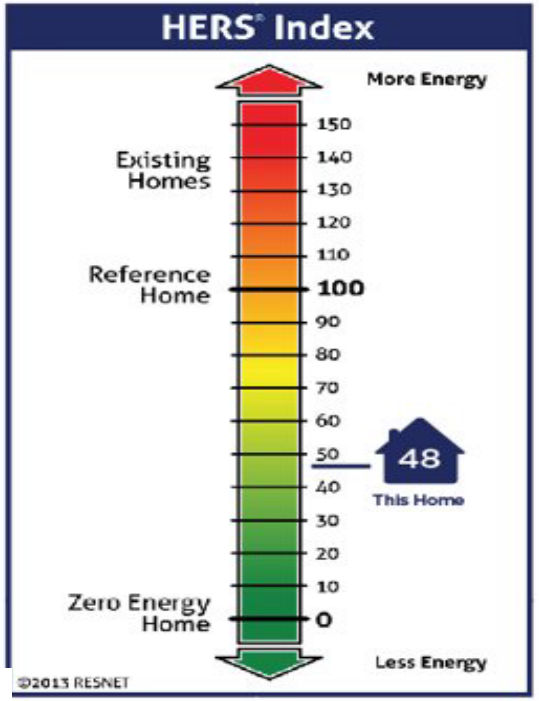
- The Prescriptive Path is only available for
  - Base Code projects
  - Stretch Code additions (except additions ≥ 1,000 sqft or ≥ 100% of existing building area)
  - Stretch Code alterations (except Level 3 alterations ≥ 1,000 sqft or ≥ 100% of existing building area)
- The provisions for these projects come from the 2021 IECC with Massachusetts amendments
- There are no changes to the available envelope compliance sub-paths: U-factor table, R-value table, and Total UA Alternative (i.e., RES*check*)
- Significant increases in R-values for above-grade walls and ceilings

The Base Code and (Most) Stretch Code Additions and Alterations



Other Compliance Options for Base Code

- Energy Rating Index Method



- PHIUS or PHI

PHIUS

Passive House Institute

NEW

ENERGY STAR Homes certification is no longer a compliance option

Changes to Prescriptive Values for Climate Zone 5

	2018 IECC	2021 IECC
FENESTRATION U-FACTOR	0.30	0.30
SKYLIGHT U-FACTOR	0.55	0.55
GLAZED FENESTRATION SHGC	NR	0.40
CEILING R-VALUE	49	60
WOOD FRAME WALL R-VALUE	20 or 13+5	20+5 or 13+10ci or 0+15
MASS WALL R-VALUE	13/17	13/17
FLOOR R-VALUE	30	30
BASEMENT WALL R-VALUE	15/19	15CI or 19 or 13+5ci
SLAB R-VALUE & DEPTH	10, 2ft.	10ci and 4’
CRAWL SPACE WALL R-VALUE	15/19	15ci or 19 or13+5ci

Note: These minimum R-values and maximum U-factors are NOT applicable to ERI or Passive House.

POLL QUESTION #2

The BBRS is responsible for the development of the Massachusetts base code True or False

A. True
B. False

2023 RESIDENTIAL STRETCH CODE OVERVIEW

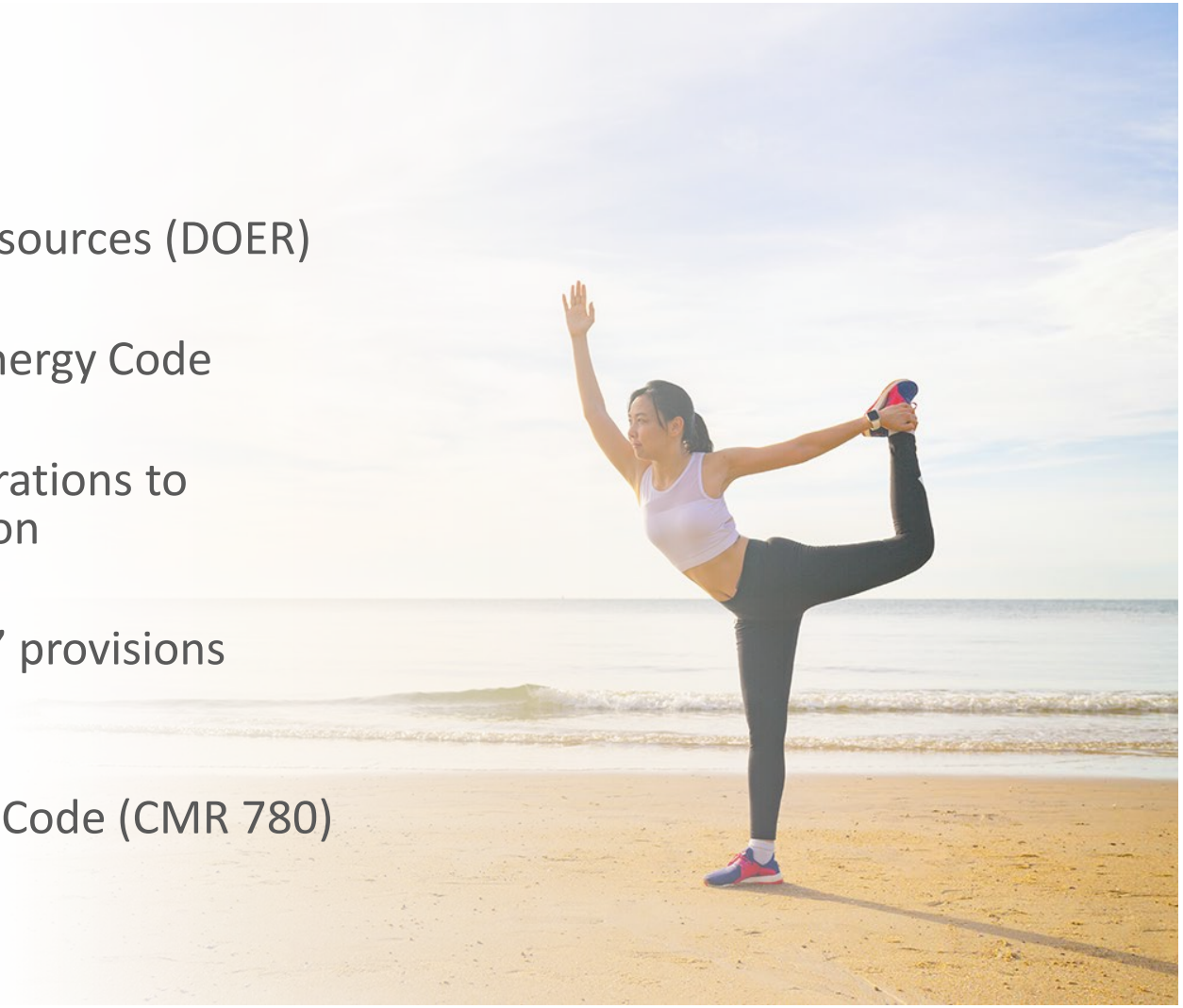
Green Communities Act

- Passed by the MA Legislature and signed into law in 2009
- Requires the Program Administrators to submit EE plans every 3 years – must be approved by the Dept. of Public Utilities
- ***Requires adoption of the International Energy Conservation Code and subsequent updating to the latest version within one year of its publication***
- Created the Energy Efficiency Advisory Council of DOER
- Created the Green Communities Program
  - Provides $10 million per year statewide in technical and financial help to municipalities to promote energy efficiency and the financing, siting and construction of renewable and alternative energy facilities.
  - ***Municipalities must adopt the Stretch Energy Code and meet a variety of other energy efficiency policies.***

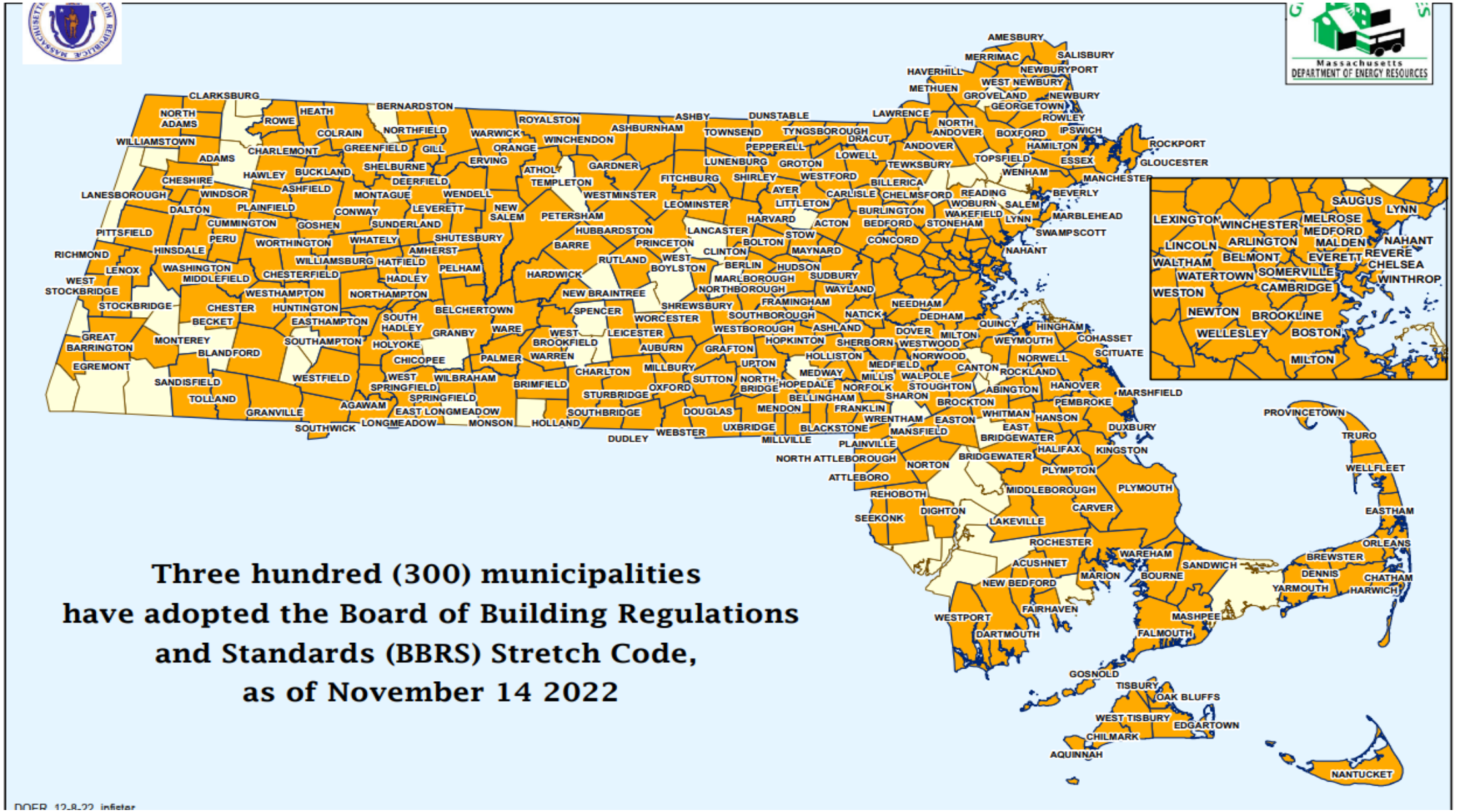
MA Stretch Energy Code

The residential Stretch Energy Code…

- Is developed by the MA Department of Energy Resources (DOER)
- Results in greater energy savings than the Base Energy Code
- Requires new homes and large additions and alterations to receive a HERS Rating or Passive House certification
- Requires compliance with 2021 IECC “mandatory” provisions (Passive House excluded)
- Is found in ***Appendix AA*** of the MA State Building Code (CMR 780)
- Is adopted at the level of the local jurisdiction



Stretch Code Communities



POLL QUESTION #3

DOER is responsible for the development of the Massachusetts stretch code True or False

A. True
B. False

STRETCH CODE UPDATES

Overview

1 Jan. 2023

Maximum HERS Index decrease from 55 to 52

Large additions and alterations must follow ERI path

HRV/ERV required

Specialized Stretch Code available for adoption

All-electric homes qualify for a three-point increase in maximum HERS Index

Maximum HERS Index decrease from 52 to 42

1 July 2024

The Stretch Code and Existing Buildings

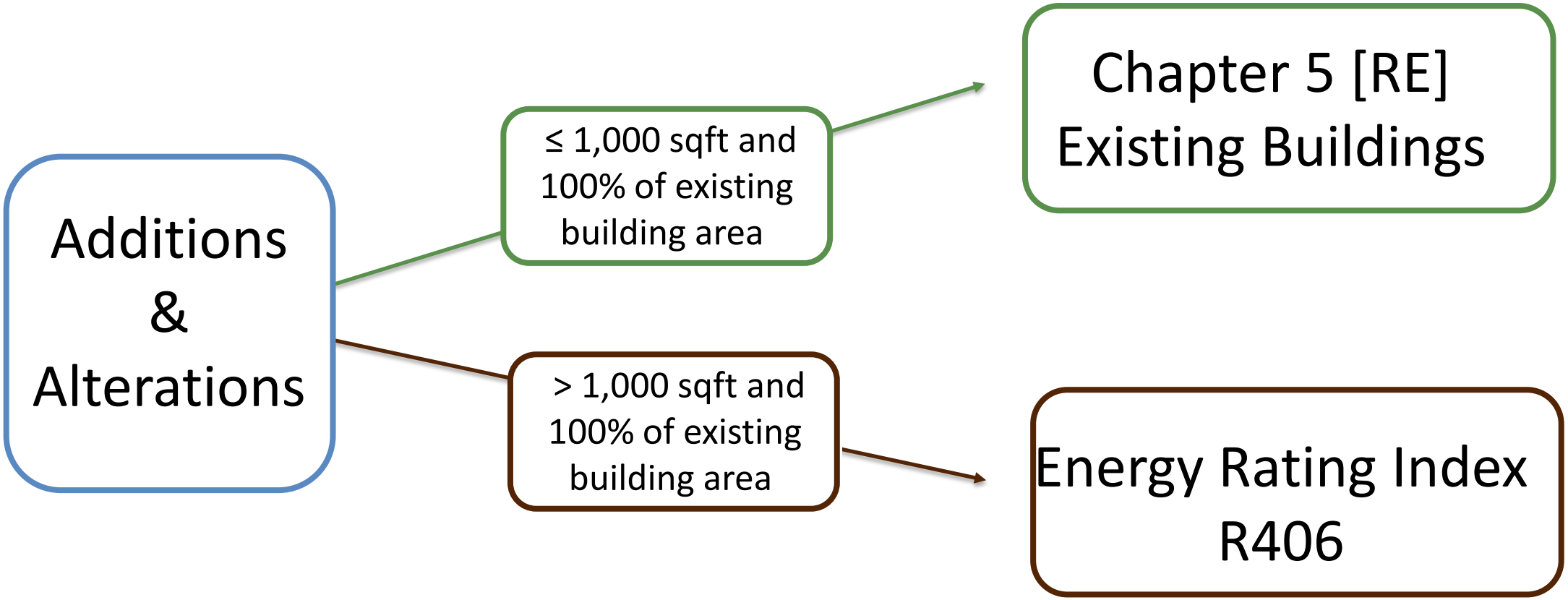


TABLE R406.5 MAXIMUM ENERGY RATING INDEX

Clean Energy Application	New Construction Starts January 1, 2023, until June 30, 2024	New Construction After July 1, 2024	Major Alterations, Additions, and Changes, of use Starts 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

*Solar Electric Generation = Solar photovoltaic array rated at 4kW or higher

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

Clean Energy Application	New Construction Starts January 1, 2023, until June 30, 2024	New Construction Permits IECC 2021	Major Alterations, Additions, and Changes. Starts January 1, 2023
HERS Rating	52	55	52
Solar Electric Generation*	55	42	55
All-Electric Building	55	45	55
Solar Electric* and All-Electric Building	58	45	58

*Solar Electric Generation = Solar photovoltaic array rated at 4kW or higher

R406.5.1 Trade-off for Clean energy systems.

- New construction following Section R406 or existing buildings and additions following IECC chapter 5[RE] may use clean energy trade-offs to increase the maximum allowable HERS rating for each unit separately served by any combination of the following:

- 1. Solar Electric Generation: Solar photovoltaic array rated at 4kW or higher shall offset 3 HERS points for Level 3 alterations, Change of use to Residential R-use categories or for fully attached additions.

- 2. All-Electric Buildings shall offset 3 HERS points for each dwelling unit in new construction, Level 3 alterations, change of use to Residential R-use categories and fully attached additions.

POLL QUESTION #4

When does the stretch code start for residential new construction and existing residential buildings?

A. June 30, 2023
B. July 1, 2024
C. January 1, 2023
D. July 1, 2023

STRETCH CODE COMPLIANCE PATHWAYS

R 401 Scope Compliance Options for Stretch Code

New Construction

R401.2.2 Passive House

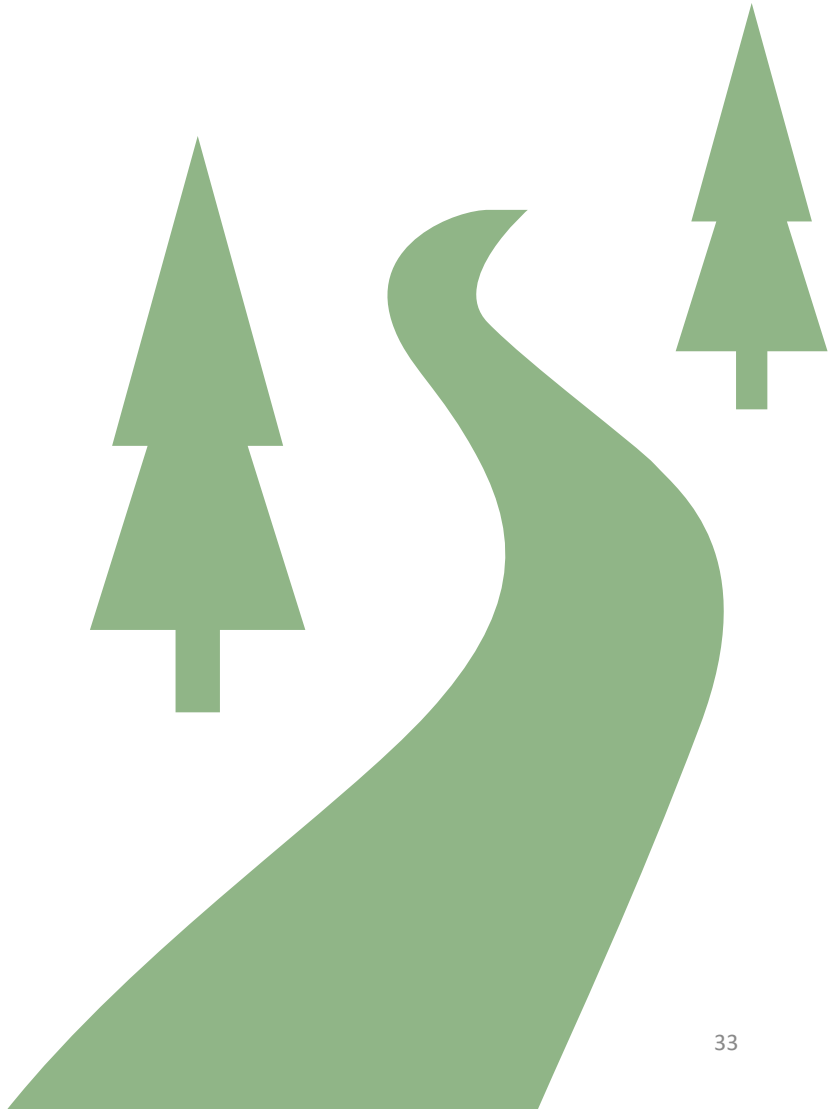
- The Passive House Building Certification Option requires compliance with Section R405 and R404.4.

R401.2.3 Energy Rating Index

- The Energy Rating Index (ERI) Option requires compliance with Section R406, R403.6 and R404.4.

R401.2.4 Appendix RC Opt-in Stretch Code

- Residential Buildings and dwelling units covered by this chapter may elect to comply with the requirements of IECC Appendix RC and R404 as amended.



ENERGY RATING INDEX/HERS

Table 406.2 Requirements - Energy Rating Index

Formerly Listed As Mandatory Requirements

Now in One Table

Section	Title
	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

PASSIVE HOUSE

Passive House Building Certification Option

- Projects may document compliance with either PHIUS certification or PHI certification.
- Must use the most recent version of the software for the Passive House approach

R405.2

PHIUS
Passive House Institute US

R405.3

Passive House Institute

PHIUS/ PHI
REQUIREMENTS FOR PERMIT APPLICATIONS

Documentation
WUFI Passive or other PHIUS approved software

PHIUS

- A PHIUS 2021 (or newer) Verification Report which demonstrates project compliance
- A CPHC verification report reflecting plans submitted.
- Project registration from PHIUS or Design certification letter .

Documentation
If using PHI Passive House software

PHI

- A PHPP compliance report which demonstrates project compliance with current PHI performance requirements
- Certified Passive House Consultant/Designer compliance report accurately reflect the plans submitted; are “based on plans”
- Evidence of project registration from PHI a Certified Passive House Certifier. OR
- A Design Certification Letter from a Certified Passive House Certifier.

2021 IECC MANDATORY REQUIREMENTS

Mandatory Requirements Overview

- Certificate (R401.3)
- Air Leakage (R402.4)
- Maximum fenestration U-factor and SHGC (R402.5)
- Controls (R403.1)
- Heat pump supplementary heat (R403.1.2)
- Duct sealing (R403.3.2)
- Duct testing (R403.3.3)
- Building cavities (R403.3.5)
- Mechanical system pipe insulation (R403.4)
- Heated water circulation and temperature maintenance system (R403.5.1)
- Hot water pipe insulation (R403.5.3)
- Mechanical ventilation (R403.6)
- Equipment sizing and efficiency rating (R403.7)
- System serving multiple dwelling units (R403.8)
- Snow melt and ice system controls (R403.9)
- Pools and permanent spas (R403.10)
- Portable spas (R403.11)
- Lighting equipment (404.1)

2021 IECC CHANGES FROM 2018 IECC BASE CODE

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. 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. 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. The junction of the top plate and the top of exterior walls shall be sealed. 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] 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. Penetrations through concrete foundation walls and slabs shall be air sealed. 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. Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.8.1. 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. 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.
	Air sealing shall be provided between the garage and	Insulated portions of the garage separation assembly shall

- No major changes
- Still required for all compliance options

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: _____

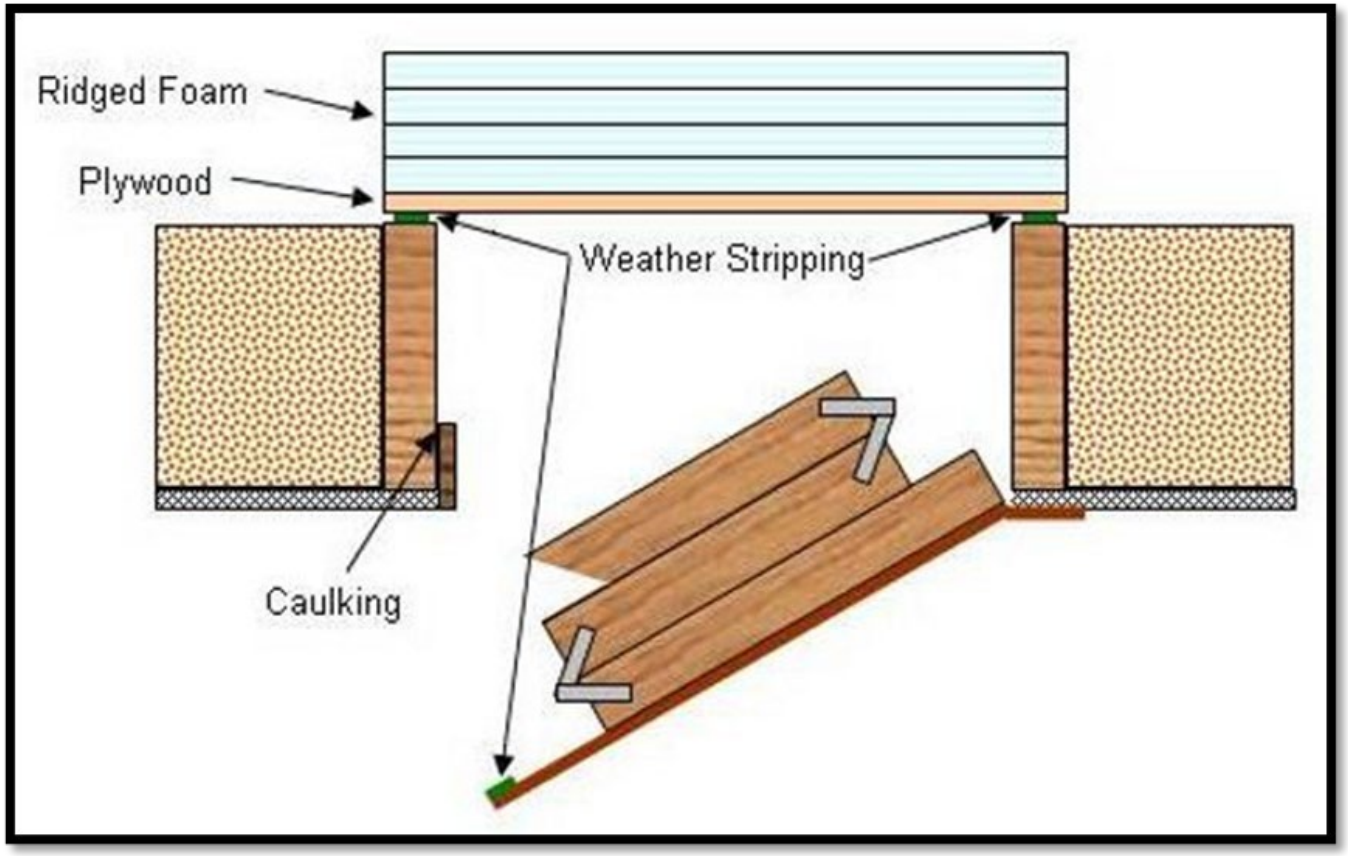
Photovoltaic System

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

Energy Rating Index

With onsite power: _____ W/o onsite power: _____

R402.2.4 - Attic Hatches and Doors



Pull-down Attic Stairs can be custom built, or kits can be installed

AIR LEAKAGE TESTING

- Max ACH50 for Prescriptive Option
  - CZs 3-8 = 3.0
- Total Building Performance Option
  - Max ACH50 for all CZs = 5.0
  - Reference home uses prescriptive maximum
- Energy Rating Index (ERI) Option
  - Max ACH50 for all CZs = 5.0

AIR LEAKAGE TESTING

- Air leakage **per square foot of enclosure area** may be used in lieu of ACH50 for:
  - ***Attached*** single- and multiple-family building dwelling units
  - Buildings or dwelling units ≤ 1,500 square feet

Maximum leakage rate = **0.30 cfm per sf**

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.

DUCTS IN FLOORS AND EXTERIOR WALLS

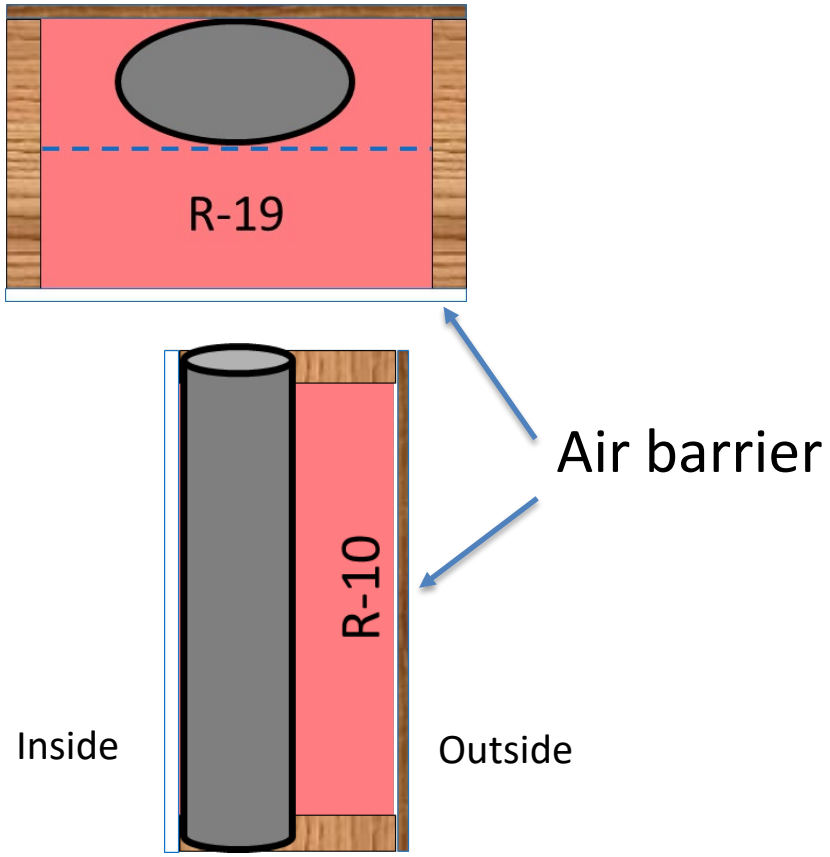
- Ducts, floors, and exterior walls that are a part of the thermal envelope **can be considered in conditioned space** when certain criteria are met. This section does NOT apply to the Total Building Performance or ERI paths.

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

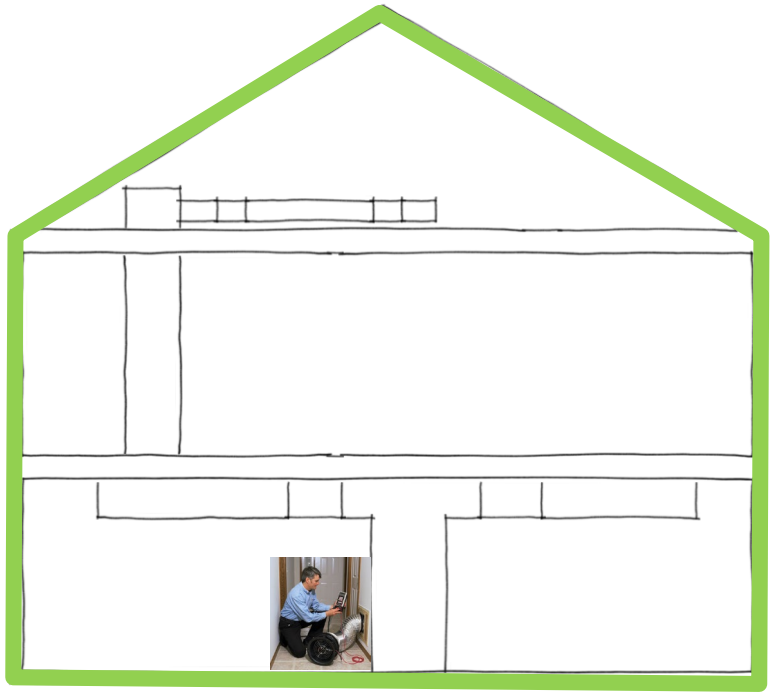
1. A continuous air barrier is installed between the unconditioned space and the duct
2. Minimum R-10 insulation separating the duct from the outside for the full cavity width
3. The remainder of the cavity is filled with insulation



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
  - 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

- Limits do not apply to Total Building Performance or ERI paths



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.

Side note: HRV or ERV required in CZs 5

2021 IECC Changes

Electrical Power and Lighting Systems R404.1

- 100% High Efficacy lighting is required in all sockets

EXTERIOR LIGHTING POWER

Exterior lighting for multifamily buildings must comply with the commercial provisions of the IECC (Lighting Power Allowance).

- Exceptions
  - Detached two-family dwellings
  - Townhouses
  - Solar-powered lamps not connected to any electrical service
  - Luminaires controlled by a motion sensor
  - Lamps and luminaires that comply with Section R404.1 (high-efficacy light sources)

High-efficacy light sources:

- Lamps with at least 65 lumens per watt
- Luminaires with at least 45 lumens per watt

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

INTERIOR LIGHTING CONTROLS

- Dimmers, occupant sensors, or controls built into the fixture

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

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

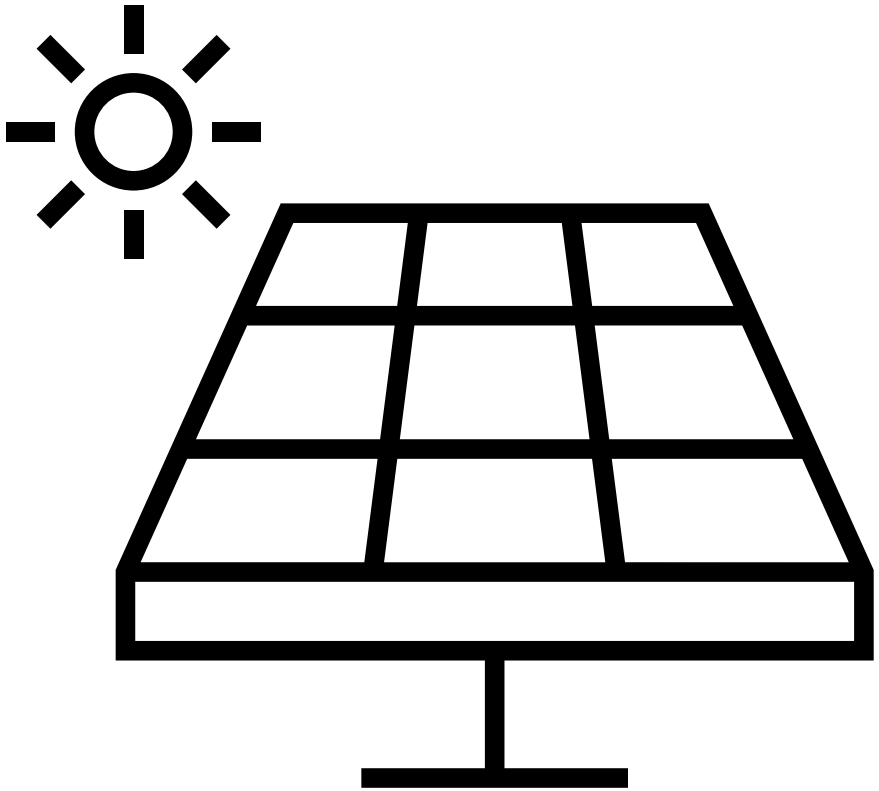
1. Enhanced envelope performance option (R408.2.1)
2. More efficient HVAC equipment performance option (R408.2.2)
3. Reduced energy use in service water-heating option (R408.2.3)
4. More efficient duct thermal distribution system option (R408.2.4)
5. Improved air sealing and efficient ventilation system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

APPENDIX RB: SOLAR-READY PROVISIONS

RB 101 SCOPE

- RB101.1 General
  - These provisions shall be applicable for all **R-use buildings** new construction, except additions 1,000 sqft and under.
- Exceptions
  - Buildings and dwelling units complying with Appendix RC: Sections RC102, Zero energy pathway or RC105, more than 70 of roof shaded

SECTION RB102



GENERAL DEFINITION SOLAR-READY ZONE.

- A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

APPENDIX RB: SOLAR-READY PROVISIONS

New in 2021:

Applies to all R-use Buildings 3 stories and below

Shading

- The solar-ready zone shall be set back from any permanently affixed object, such as a chimney on the building that is located south, east, or west of the solar-ready zone
- Setback must be at least 2X the object's height
- Objects may include taller portions of the building, parapets, chimneys, antennas, signage, rooftop equipment, trees and roof plantings

Capped roof penetration sleeve

- A capped roof penetration sleeve shall be provided adjacent to a solar-ready zone located on a roof slope of not greater than 1 in 12.
- Sleeve shall be sized to accommodate the future photovoltaic system conduit, but not less than 1.25” in diameter

EV READY

R404.4 Wiring for Electric Vehicle Charging Spaces ("EV Ready Spaces")

- EV Ready Spaces shall be provided in accordance with Table R404.4
  - The dedicated branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY".
    - The circuit shall terminate in a NEMA receptacle, outlet or a Society of Automotive Engineers (SAE) standard J1772 electrical connector.

EV Ready Spaces

TABLE R404.4 EV READY SPACE REQUIREMENTS

Type of Building	Number of spaces	Wiring Requirement
1 & 2 Family Dwellings and Townhomes	At least one EV Ready Space per dwelling unit	50 Amp circuit provided
All other R-use Buildings	At least 20% of spaces	40-amp, 208/240-volt circuit with a minimum capacity of 9.6 kVA

APPENDIX RC – MASSACHUSETTS MUNICIPAL OPT-IN SPECIALIZED STRETCH CODE 2023

Municipal Specialized Opt-in Code

The Specialized Stretch Code…

- Includes net-zero building performance standards
- Is designed to achieve MA GHG emissions limits
- Requires compliance with the Stretch Code
- Requires pre-wiring for future electrification of space and water heating for homes with fossil fuels
- Is adopted at the local level but is NOT required for participation in Green Communities

Specialized Code Pathways

Meet the Stretch Code

+

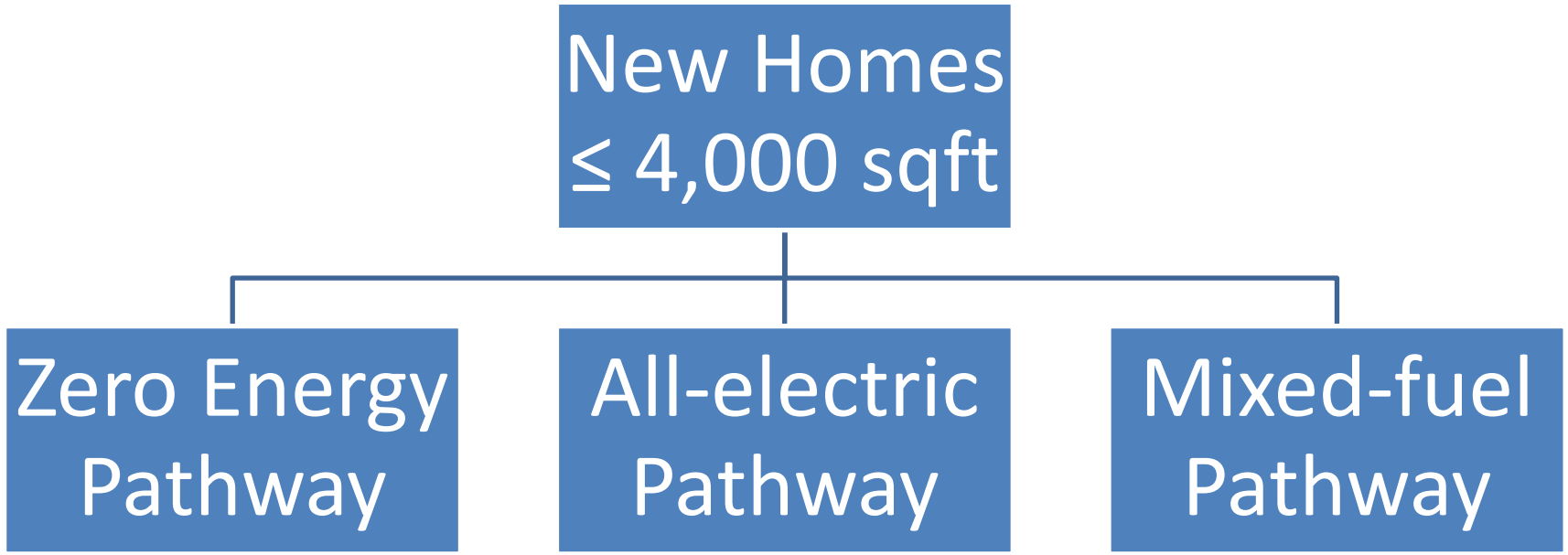
Follow One Specialized Code Pathway

Zero Energy Pathway RC201	All-electric Pathway RC 103	Mixed-fuel Pathway RC104 and RC105
• HERS 0 or Phius ZERO	• HERS 45 • No requirements beyond the Stretch Code	• HERS 42 • Pre-wiring for electrification • Onsite renewable energy

Specialized Code Pathways

Allowable pathways depend on:

- Dwelling unit or building floor area
- Presence or absence of fossil fuels or fossil fuel piping



Specialized Code Requirement Summary

TABLE 2: Residential Specialized code requirements summary by building/dwelling unit size

Building Size	Fuel Type	Minimum Efficiency	Electrification	Min. EV wiring	Renewable Generation
Dwelling units up to 4,000 sf	All Electric	HERS 45 or Phius CORE or PHI	Full	1 parking space	Optional
Dwelling units up to 4,000 sf	Mixed-fuel	HERS 42 or Phius CORE or PHI	Pre-wiring	1 parking space	Solar PV (except shaded sites)
Dwelling units > 4,000 sf	All Electric	HERS 45 or Phius CORE or PHI	Full	1 parking space	Optional
Dwelling units > 4,000 sf	Mixed-fuel	HERS 0 or Phius ZERO	Pre-wiring	1 parking space	Solar PV or other renewables
Multi-family >12,000 sf	All Electric	Phius CORE or PHI	Full	20% of spaces	Optional
Multi-family >12,000 sf	Mixed-fuel	Phius CORE or PHI	Pre-wiring	20% of spaces	Optional

Questions about the energy code?

Energy Code Support Hotline:

855-757-9717

Energy Code Support Email:

energycodesma@psdconsulting.com

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

Residential New Construction

- **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
- **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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2023 Residential Stretch Code – Part 2

Mandatory and Additional Energy Efficiency Requirements

mass save®
Savings through energy efficiency

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Who Is Mass Save®?

- Mass Save® is an initiative sponsored by Massachusetts' gas and electric utilities and energy efficiency service providers, including
  - The Berkshire Gas Company
  - Cape Light Compact
  - Eversource Energy
  - Liberty Utilities
  - National Grid
  - Unitil

- 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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Presented by:

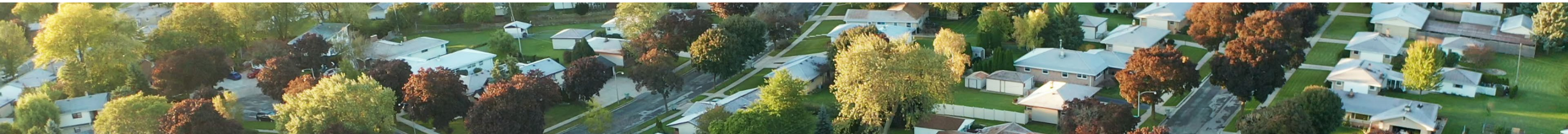
PERFORMANCE
SYSTEMS
DEVELOPMENT

Continuing Education

Approved for (1) hour of CSL, AIA, CO continuing education units

Agenda

- Review requirements that apply in addition to the maximum HERS Index ("mandatory" requirements)
- Indicate what is new in the 2021 IECC and what has stayed the same
- 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
  - Interior and exterior lighting controls
  - Electric vehicle readiness
- How Additional Efficiency Packages apply to stretch code projects



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

MANDATORY REQUIREMENTS

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

Compliance Options and Mandatory Requirements

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

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

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~~

MA Amendments

R403.6.1 Heat or Energy Recovery Ventilation.

- R403.6.1.1: Large Systems
  - Systems exceeding 300 CFM must have a
    - Cooling enthalpy recovery ratio ≥ 50%
    - Heating enthalpy recovery ratio ≥ 60%
- R403.6.1.2 Other Systems
  - Systems 300 CFM or below must have a
    - Sensible recovery ratio (SRE) ≥ 65% at 32 ^{o}F

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: _____

Eave Baffles (R402.2.3)

- 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

© Performance Systems Development

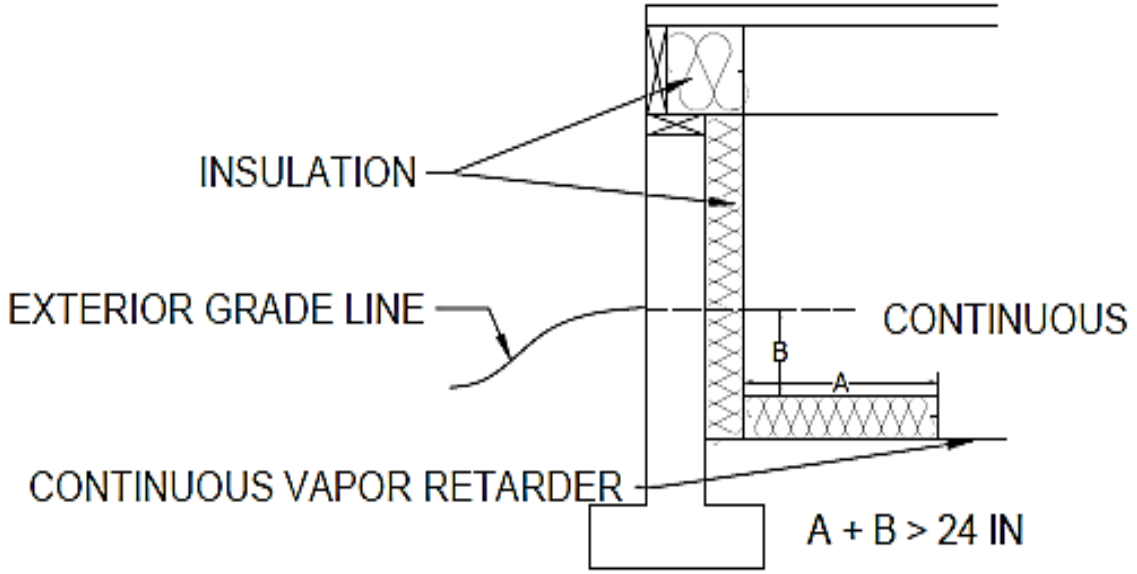
Access Hatches and Doors

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

R402.2.10.1 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



Air Barrier and Insulation Installation Criteria

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION*

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. 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. 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. The junction of the top plate and the top of exterior walls shall be sealed. 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] 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. Penetrations through concrete foundation walls and slabs shall be air sealed. 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. Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.8.1. 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. 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.
	Air sealing shall be provided between the garage and	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. Air-permeable insulation shall not be used as a sealing material.

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

Air Leakage Testing

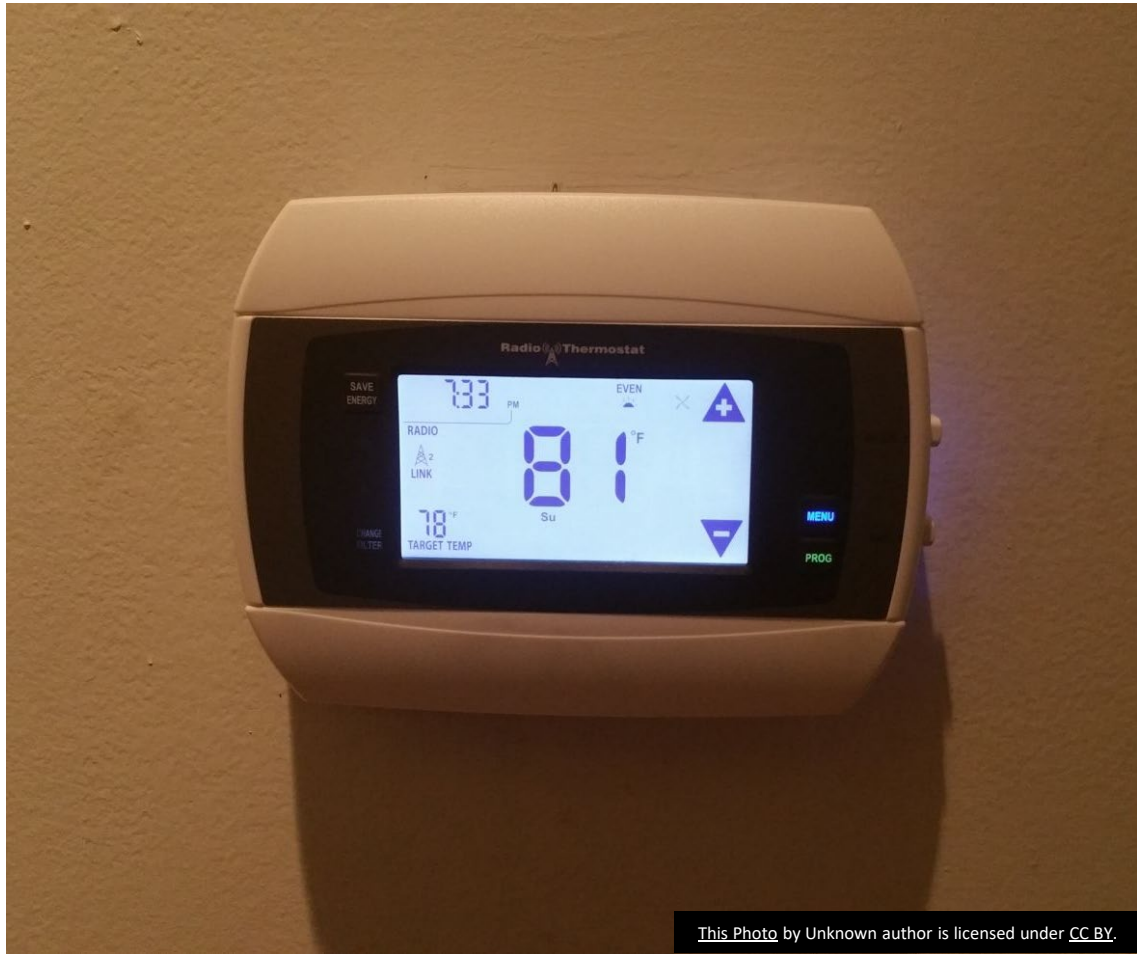
DWELLING UNIT ENCLOSURE AREA. The sum of the area of ceilings, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. Wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor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

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

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°



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 .

Ducts in Floors and Exterior Walls

This section does NOT apply to the ERI path (i.e., it applies to "small" additions and alterations only).

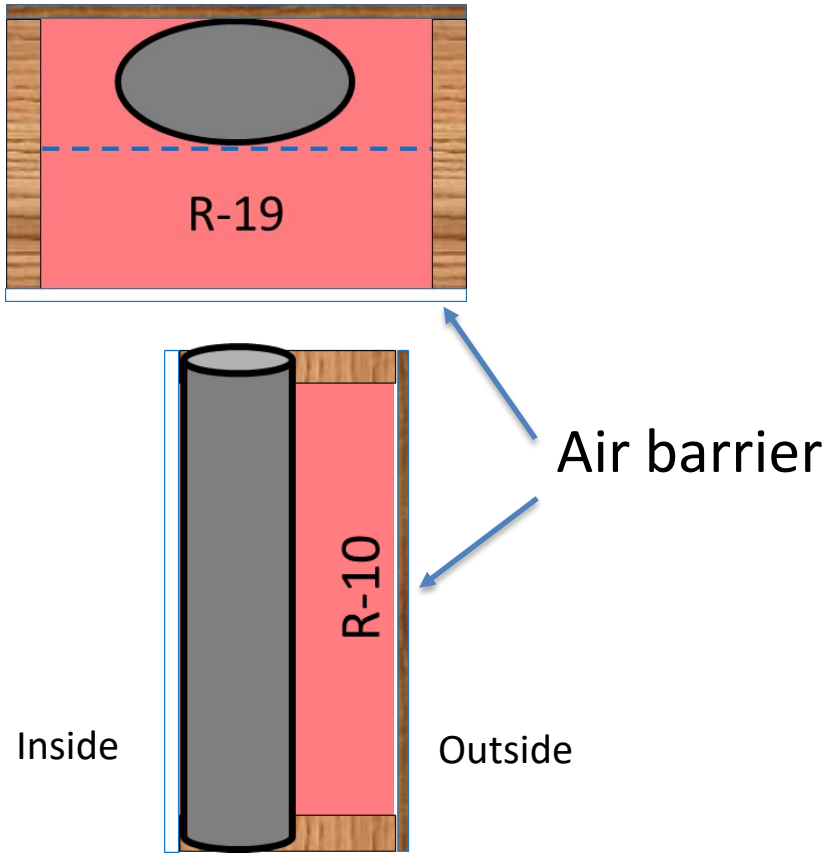
- Ducts, floors, and exterior walls that are a part of the thermal envelope **can be considered in conditioned space** when certain criteria are met.

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

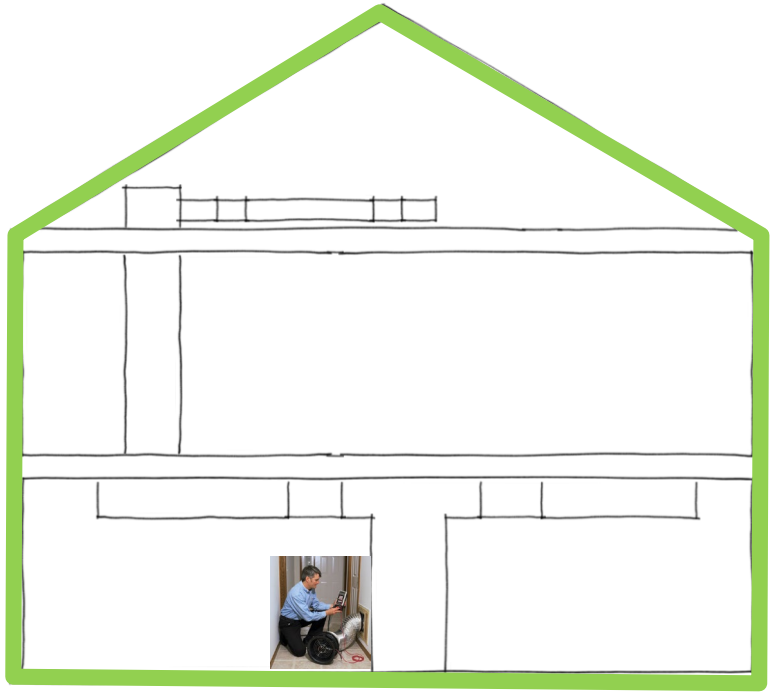
Ducts in exterior walls

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



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



Building Cavities (R403.3.7)

- No Change from 2018 IECC

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

Mechanical System Pipe Insulation (R403.4)

- 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

Heated Water Circulation

- Hot water boiler temperature reset are required, manufacturer installed.

Source : Supply house

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.

Mechanical Ventilation (R403.6)

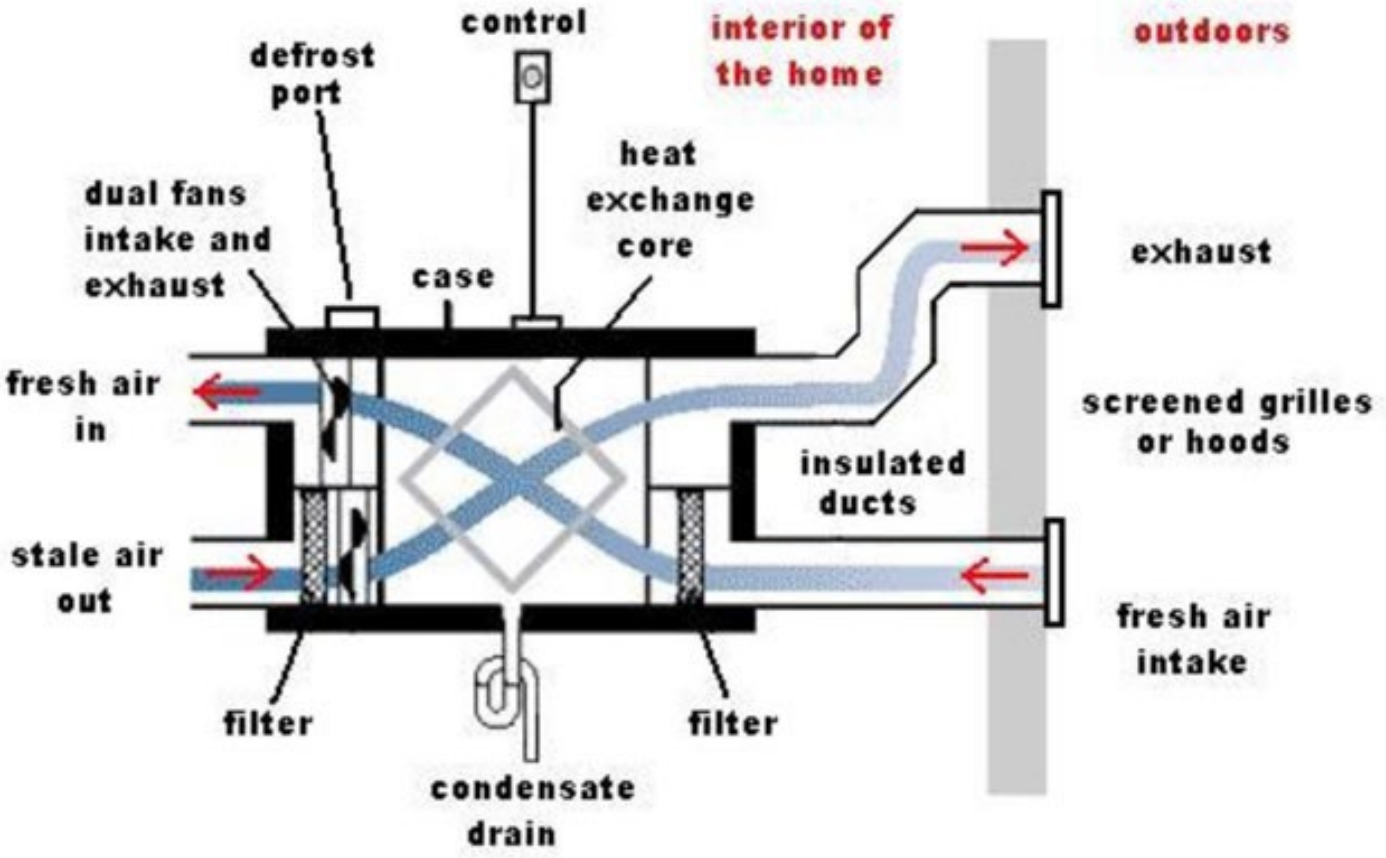
Zehnder Heat Recovery Ventilation System

Requirements of Section 403.6

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

Mechanical Ventilation System

- 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

Poll Question #2

What is the main difference between a HRV and ERV

A. HRV removes sensible heat only
B. ERV removes sensible heat only
C. HRV removes both sensile and latent heat
D. ERV removes both sensible and latent heat

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.

Snow Melt and Ice Systems Controls (R403.9)

- 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.

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

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.

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

Interior Lighting Controls

- Dimmers, occupant sensors, or controls built into the fixture

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

Poll Question #3

Mandatory Requirements can be found in Table 406.2?

A. True
B. False

Additional Efficiency Packages

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)

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 Alterations, 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

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
  - 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

Energy Code Support

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Savings through energy efficiency
Energy Code Technical Support Program

Questions about the energy code?

Energy Code Support Hotline:

855-757-9717

Energy Code Support Email:

energycodesma@psdconsulting.com

Residential New Construction

- **Five incentive paths** that cover new construction and renovation projects with multiple fuel types, multiple Program Administrator Sponsors, 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.
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Residential New Construction

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  - 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
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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
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nationalgrid
Unitil