780 CMR 51.00: MASSACHUSETTS RESIDENTIAL CODE (Amendments to the 2021 International Residential Code)

CHAPTER R11: ENERGY EFFICIENCY

Add the following sections as follows:

[E] 1101.1.1 Criteria. Buildings shall be designed and constructed in accordance with the 2021 *International Energy Conservation Code* (IECC) with Massachusetts Amendments contained herein.

Exception.
1. Temporary structures, as regulated by Section 3103, do not need to comply with the building envelope requirements of Chapter 51.
2. Where a municipality has adopted the Stretch energy code or Specialized opt-in energy code then 225 CMR 22.00 shall apply.

CHAPTER 1 [RE] SCOPE AND ADMINISTRATION

SECTION R103
CONSTRUCTION DOCUMENTS

R103.2 Amend as follows:

R103.2 Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.
9. EV Ready Space locations per R404.2
10. Solar-Ready Zone in accordance with Appendix R~~A~~B

CHAPTER 2 [RE] DEFINITIONS

R202 GENERAL DEFINITIONS

Add the following definitions:

CLEAN BIOMASS HEATING SYSTEM. Wood-pellet fired central boilers and furnaces where the equipment has a thermal efficiency rating of 80% (higher heating value) or greater; and a particulate matter emissions rating of no more than 0.15 lb/MMBtu PM heat output.

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.*

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the *Electric Vehicle* connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the *Electric Vehicle*.
Informational Note: defined as in 527 CMR 12.00: Massachusetts Electrical Code (Amendments) section 625.2.

ELECTRIC VEHICLE CHARGING SPACE ("EV Ready Space"). A designated parking space which is provided with one dedicated 50-ampere branch circuit for EVSE servicing *Electric Vehicles*.

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R401 GENERAL

Revise and replace all portions of section R401 as follows:

R401.1 Scope. This chapter applies to *residential buildings*. Municipalities which have adopted the Stretch Energy Code or the Municipal Opt-in Specialized Stretch energy code, shall use the energy efficiency requirements of 225 CMR and chapter 51 or this chapter as applicable.

R401.2 Application. Residential buildings shall comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.

Exception: Additions, *alterations*, repairs and changes of occupancy to existing buildings complying with Chapter 5.

R401.2.1 Prescriptive Compliance Option.
The Prescriptive Compliance Option requires compliance with Sections R401 through R404.

R401.2.2 Passivehouse Building Certification Option.
The Passivehouse Building Certification Option requires compliance with Section R405.

R401.2.3 Energy Rating Index Option.
The Energy Rating Index (ERI) Option requires compliance with Section R406.
Qualifying approaches under R406 include the following:

a. Certified RESNET HERS rating with MA amendments.

R401.2.4 APPENDIX RC. Residential Buildings and dwelling units covered by this chapter may elect to comply with the requirements of IECC Appendix RC - ZERO ENERGY RESIDENTIAL BUILDING PROVISIONS

R401.2.5 MA Stretch energy code. Residential Buildings and dwelling units may elect to comply with the requirements of 225 CMR MASSACHUSETTS STRETCH ENERGY CODE, or, the MUNICIPAL OPT-IN SPECIALIZED STRETCH ENERGY CODE promulgated by the Massachusetts Department of Energy Resources.

R401.2.5 Additional energy efficiency. This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.

2. For buildings complying with the Energy Rating Index alternative Section R401.2.3, the Energy Rating Index value shall be less than or equal to the HERS index of 52 prior to credit for onsite renewable electric generation or as specified in Table R406.5.

The option selected for compliance shall be identified in the certificate required by Section R401.3.

R401.3 Certificate

R402.1.5.1 Add the section as follows:

R402.1.5.1 Approved software for Total UA alternative: The following software is approved for demonstrating Total UA compliance: REScheck-Web available at http://www.energycodes.gov/rescheck

R402.4.1.1 Amend Table R402.4.1.1 as follows:

TABLE R402.4.1.1

AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	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.

R403.3.5 Amend as follows:

R403.3.5 Duct testing. Ducts shall be pressure tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Postconstruction or rough-in testing and verification shall be done by a HERS Rater, HERS Rating Field Inspector, or an applicable BPI Certified Professional. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

Exception: A duct air-leakage test shall not be required for ducts serving heating, cooling or ventilation systems that are not integrated with ducts serving heating or cooling systems.

R403.6 Revise the section as follows:

R403.6 Mechanical ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the *ventilation* system is not operating.

Each dwelling unit of a residential building shall be provided with continuously operating exhaust, supply or balanced mechanical ventilation that has been site verified to meet a minimum airflow per one of the following methods:

1. Table R403.6.1

TABLE R403.6.1 MINIMUM REQUIRED AIRFLOW IN CFM BASED ON SIZE OF HOUSE AND NUMBER OF BEDROOMS

SIZE OF HOUSE	0-1 BEDROOMS	2-3 BEDROOMS	4-5 BEDROOMS	6-7 BEDROOMS	>7 BEDROOMS
Up to 1500 sq ft	30	45	60	75	90
1501 – 3000 sq ft	45	60	75	90	105
3001 – 4500 sq ft	60	75	90	105	120
4501 – 6000 sq ft	75	90	105	120	135
6001 – 7500 sq ft	90	105	120	135	150
> 7500 sq ft	105	120	135	150	165

2. RESNET HERS Index
3. ASHRAE 62.2 - 2019 or
4. the following formula for one- and two-family dwellings and townhouses of three or less stories above grade plane:

$$Q = .03 \times CFA + 7.5 \times (N_{br} + 1) - 0.052 \times Q_{50} \times S \times WSF$$

Where: CFA is the conditioned floor area in sq ft
N_{br} is the number of bedrooms
Q_{50} is the verified blower door air leakage rate in cfm measured at 50 Pascals
S is the building height factor determined by this table:

stories above grade plane	1	2	3
S	1.00	1.32	1.55

WSF is the shielded weather factor as determined by this table:

County	**WSF**
Barnstable	0.60

Berkshire	0.52
Bristol	0.54
Dukes	0.59
Essex	0.58
Franklin	0.52
Hampden	0.49
Hampshire	0.59
Middlesex	0.55
Nantucket	0.61
Norfolk	0.52
Plymouth	0.53
Suffolk	0.66
Worcester	0.59

Revise and Replace R403.6.3 and add sections R403.6.4 through R403.6.7 as follows:

R403.6.3 Testing and Verification. Installed performance of the mechanical ventilation system shall be tested and verified by a HERS Rater, HERS Rating Field Inspector, or an applicable BPI Certified Professional, and measured using a flow hood, flow grid, or other airflow measuring device in accordance with either RESNET Standard Chapter 8 or ACCA Standard 5.

R403.6.4 Air-moving equipment, selection and installation. As referenced in ASHRAE Standard 62.2-2013, Section 7.1, ventilation devices and equipment shall be tested and certified by AMCA (Air Movement and Control Association) or HVI (Home Ventilating Institute) and the certification label shall be found on the product. Installation of systems or equipment shall be carried out in accordance with manufacturers' design requirements and installation instructions. Where multiple duct sizes and/or exterior hoods are standard options, the minimum size shall not be used.

R403.6.5 Sound Rating. Sound ratings for fans used for whole building ventilation shall be rated at a maximum of 1.0 sone.

> **Exception:** HVAC air handlers and remote-mounted fans need not meet sound requirements. There must be at least 4ft of ductwork between the remote-mounted fan and intake grille.

R403.6.6 Documentation. The owner and the occupant of the dwelling unit shall be provided with information on the ventilation design and systems installed, as well as instructions on the proper operation and maintenance of the ventilation systems. Ventilation controls shall be labeled with regard to their function, unless the function is obvious.

R403.6.7 Air Inlets and Exhausts. All ventilation air inlets shall be located a minimum of 10ft from vent openings for plumbing drainage systems, appliance vent outlets, exhaust hood outlets, vehicle exhaust, or other known contamination sources; and shall not be obstructed by snow, plantings, or any other material. Outdoor forced air inlets shall be covered with rodent screens having mesh openings not greater than ½ inch. A whole house mechanical ventilation system shall not extract air from an unconditioned basement unless approved by a registered design professional. Where wall inlet or exhaust vents are less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, a metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the vent terminal. The sign shall read, in print size no less than one-half (1/2) inch in size, "MECH. VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".

Exceptions:

1. Ventilation air inlets in the wall ≥ 3 ft. from dryer exhausts and contamination sources exiting through the roof.
2. No minimum separation distance shall be required between local exhaust outlets in kitchens/bathrooms and windows.
3. Vent terminations that meet the requirements of the National Fuel Gas Code (NFPA 54/ ANSI Z223 .1) or equivalent.

Add section R404.4 as follows:

R404.4 Wiring for Electric Vehicle Charging Spaces ("EV Ready Spaces"). *EV Ready Spaces* shall be provided in accordance with Table R404.4. The 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 or a Society of Automotive Engineers (SAE) standard J1772 electrical connector.

TABLE R404.4 EV READY SPACE REQUIREMENTS

Type of Building	Number of parking spaces
1 & 2 family dwellings and town houses	At least 1 per unit
Multi-family	At least 10%

Exceptions:

1. In no case shall the number of required *EV Ready Spaces* be greater than the number of parking spaces otherwise required by local ordinance.
2. This requirement will be considered met if all spaces which are not *EV Ready* are separated from the premises by a public right-of-way.
3. Any 50-ampere branch circuit may be replaced by 3 or more "EV READY" labelled 20-ampere branch circuits and terminations where sufficient spaces are available.
4. Residential structures of 1-4 dwelling units may use a 40-ampere dedicated circuit, or if necessary a 110 volt 20-ampere dedicated circuit, if a 50-ampere dedicated circuit would require the dwelling unit to upgrade the size of the electrical service beyond what would be required per the MA Electrical Code (527 CMR) for the unit if a dedicated circuit was not reserved for EVSE.

   Construction documents shall identify the total service load required to serve the residential unit. If the reservation of a 50-ampere branch circuit will require an upgrade to a larger electrical service, the exception shall apply.

R405. Delete subsection and replace as follows:

R405 Passivehouse Building Certification Option.
R405.1 Scope. Projects certified as meeting the PHIUS CORE 2021 or PHIUS ZERO 2021 Passive Building Standard – North America, or newer, demonstrated using approved software by PHIUS, where PHIUS certification is demonstrated by a Certified Passive House Consultant; or,
Projects certified as meeting the Certified Passive House standard using software by the Passive House Institute (PHI), where PHI certification is demonstrated by a Certified Passive House Designer.

R405.2 Phius Documentation. When using WUFI Passive or other Phius approved software:
1. Prior to the issuance of a building permit, the following items must be provided to the Building Official:

a. A Phius 2021 (or newer) Verification Report which demonstrates project compliance with Phius 2021 (or newer) performance requirements.
b. A statement from the CPHC that the verification report results accurately reflect the plans submitted.
c. Evidence of project registration from Phius.
OR
a. A Design Certification Letter from Phius.

2. Prior to the issuance of a certificate of occupancy, the following items must be provided to the building official:
a. Design Certification Letter from Phius.
b. An updated Verification Report by the CPHC which reflects "as-built" conditions and test results that demonstrate project compliance with Phius (blower door and ventilation results).
c. A statement from the CPHC that the envelope meets the Phius hygrothermal requirements found in Appendix B of the Phius 2021 Certification guidebook
d. A statement from the Phius Certified Verifier or Rater that the project test results and other Phius verification requirements are met.
e. A copy of the Phius workbook listing all testing results and as-built conditions.

OR

a. A Project Certificate demonstrating final certification awarded by Phius.

AND

f. A statement from the Phius Verifier or Rater of compliance with R404.4: EV ready, and Appendix RB: Solar Ready Provisions.

R405.3 Passive House International (PHI) Documentation.

1. If using PHI Passive House software, prior to the issuance of a building permit, the following items must be provided to the Building Official:
a. A PHPP compliance report which demonstrates project compliance with current PHI performance requirements;
b. A statement from the Certified Passive House Consultant/Designer (CPHC/D) that the PHPP results and compliance report accurately reflect the plans submitted;
c. Evidence of project registration from a Certified Passive House Certifier.

OR

a. A Design Certification Letter from a Certified Passive House Certifier.

2. Prior to the issuance of a certificate of occupancy, the following item(s) must be provided to the building official:
a. A Design Certification Letter from a Certified Passive House Certifier.
b. An updated PHPP compliance report which reflects "as-built" conditions and test results (blower door and ventilation results) that demonstrate project compliance with PHI performance requirements;
c. A statement from the CPHD that the project test results meet the model performance requirements, all the mandatory limits and any other mandatory requirements.
d. A copy of the Passive House Verifier's or Rater's test results;

OR

a. A Final Certification Letter from a Certified Passive House Certifier

AND

e. A statement from the Passive House Verifier or Rater of compliance with R404.4: EV ready, and Appendix RB: Solar Ready Provisions.

R406.1 - Revise and add subsection as follows:

R406.1 Scope. This section establishes criteria for compliance using an Energy Rating Index (ERI) analysis, or approved alternative energy performance rating methods.

R406.1.1 Approved alternative energy performance methods. The following rating threshold criteria are sufficient to demonstrate energy code compliance under section R406 without calculation of a standard reference design. The mandatory provisions listed in R406.2 also apply:
Any other software approved by the Board of Building Regulations and Standards.

R406.3 Reserved.

Revise and Replace section R406.4 as follows:

R406.4 Energy Rating Index. The Energy Rating Index (ERI) shall be the RESNET certified HERS index determined in accordance with RESNET/ICC 301.
Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

Revise and Replace section R406.5 and Table T406.5 as follows:

R406.5 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have an HERS index rating less than or equal to the appropriate value indicated in Table R406.5 when compared to the *HERS index reference design* for each dwelling unit prior to credit for onsite renewable electric generation.

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

On-site Renewable Energy Application	Maximum HERS Index score[a, b]	
	New construction	Whole house renovations; additions
None	52	65
Solar Electric Generation	55	70
Clean Space Heating	55	70
Solar Electric & Clean Space Heating	58	75

[a] Maximum HERS rating prior to onsite renewable electric generation in accordance with Section R406.5

[b] Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of SectionR406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2021 International Energy Conservation Code.

Add subsection R406.5.1 as follows:

R406.5.1 Trade-off for onsite renewable energy systems. New construction following R406.3 or existing buildings and additions following IECC chapter 5[RE] may use renewable 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 new construction, or 5 HERS points for renovations and fully attached additions.
2. Clean Space Heating: Clean Biomass Heating System, solar thermal array, cold climate air source heat pump having rated coefficient of performance (COP) of at least 1.75 at 5 degrees Fahrenheit, or geothermal heat pump, or a combination of these systems, operating as the primary heating system shall offset 3 HERS points for new construction, or 5 HERS points for renovations and fully attached additions.

Revise and replace section R406.6 as follows:

R406.6 Verification by approved agency. Verification of compliance with Section R406 as outlined in Sections R406.4 and R406.5 shall be completed by an *approved* third party. Verification of compliance with Section R406.2 shall be completed by the authority having jurisdiction or an *approved* third-party inspection agency in accordance with Section R105.4.

Delete section R406.7.3.

ADD sections R408 ADDITIONAL EFFICIENCY PACKAGE OPTIONS through R408.2.4 as follows:

R408 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

R408.1 Scope. This section establishes additional efficiency package options to achieve additional energy efficiency in accordance with Section R401.2.5.

R408.2 Additional efficiency package options. Additional efficiency package options for compliance with Section R401.2.1 are set forth in Sections R408.2.1 through R408.2.5.

R408.2.1 Enhanced envelope performance option.
The total *building thermal envelope* UA, the sum of *U*-factor times assembly area, shall be less than or equal to 95 percent of the total UA resulting from multiplying the *U*-factors in Table R402.1.2 by the same assembly area as in the proposed building. The UA calculation shall be performed in accordance with Section R402.1.5. The area-weighted average SHGC of all glazed fenestration shall be less than or equal to 95 percent of the maximum glazed fenestration SHGC in Table R402.1.2.

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies:

1. Greater than or equal to 8.5 HSPF2 and 16 SEER2 for ductless heat pumps and 8.5 HSPF2 and 15.2 SEER2 for ducted heat pumps..
2. Greater than or equal to 3.5 COP ground source heat pump.

For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

R408.2.3 Reduced energy use in service water-heating option. The hot water system shall meet one of the following efficiencies:

1. Greater than or equal to 2.0 EF electric service water-heating system.
2. Greater than or equal to 0.4 solar fraction solar water-heating system.

R408.2.4 More efficient duct thermal distribution system option. The thermal distribution system shall meet one of the following efficiencies:

1. 100 percent of ducts and air handlers located entirely within the *building thermal envelope*.
2. 100 percent of ductless thermal distribution system or hydronic thermal distribution system located completely inside the *building thermal envelope*.

CHAPTER 5 [RE] EXISTING BUILDINGS

R502 ADDITIONS.

Revise and replace section R502.1.2 Revise as follows:

R502.1.2 Existing plus addition compliance (Simulated Performance Alternative).
The *addition* and any *alterations* that are part of the project shall comply with Section R406 and shall achieve a maximum HERS index using Table R406.4.~~1.~~

Delete the Exception to section R503.2.

Appendix RB: Solar-ready Provisions – Detached One- and Two-family Dwellings, Low-rise Residential Buildings and Townhouses

SECTION RB101 SCOPE

Revise and replace section RB101.1 General as follows:

RB101.1 General. These provisions shall be applicable for new construction, except additions.

SECTION RB102 GENERAL DEFINITION

Add the following 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.

SECTION RB103 SOLAR-READY ZONE

Add Exception #3 to RB103.1 General. As follows:

3. Buildings and structures as designed and shown in construction documents that do not meet the conditions for a solar-ready zone area.

Revise and replace section RB103.2 Construction document requirements for solar ready zone as follows:

RB103.2 Construction document requirements for solar ready zone. Construction documents shall indicate the solar ready zone where applicable.

Revise and replace section RB103.3 Solar-ready zone area as follows:

RB103.3 Solar-ready zone area. The total solar-ready zone area shall consist of an area not less than 300 square feet (27.87 m2) exclusive of mandatory access or set back areas as required by the MA Fire Code. New townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet (185.8 m^2) per dwelling shall have a solar-ready zone area of not less than 150 square feet (13.94 m^2). The solar-ready zone shall be composed of areas not less than 5 feet (1524 mm) in width and not less than 80 square feet (7.44 m^2) exclusive of access or set back areas as required by the MA Fire Code.

Revise and replace section RB103.4 Obstructions as follows:

RB103.4 Obstructions. Solar-ready zones shall consist of an area free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.
NOTE: Nothing in RA103.4 shall require any construction documents to be redesigned or reconfigured so as to create a solar-ready zone area.

Delete RB103.7 Electrical service reserved space and Renumber section RB103.8 as RB103.7, as shown below:

RB103.7 Construction documentation certificate. A permanent certificate, indicating the solar-ready zone and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.