

Appendix

Massachusetts has established legally-mandated goals for reducing carbon emissions by 50 percent compared to 1990 levels by 2030 and by a minimum of 85% by 2050 according to the Global Warming Solutions Act and the 2021 Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy. The Municipal Opt-In Specialized Energy Code (Specialized Code) is required to be designed to help achieve greenhouse gas emission limits and building sector sub-limits set every five years from 2025 to 2050. As a result, all compliance pathways under the Specialized Code are designed to ensure new construction that is consistent with a net-zero Massachusetts economy in 2050, primarily through building envelope energy efficiency, that in turn enables reduced heating loads and efficient electrification.

The largest greenhouse gas emissions impact for many buildings stems from the heating loads and choice of heating fuel for the building. Buildings reliant on combustion equipment have no clear pathway to zero emissions, while electrically heated buildings using heat pump technologies do due to the steady increase in renewable and clean energy sources on the NE-ISO electric grid, and opportunities for distributed solar and other on-site renewable energy generation.

The Specialized Code requires all new buildings to be designed with electric service and wiring sufficient for future electrification of space and water heating as well as any combustion equipment appliance loads.

There are three pathways to code compliance for both residential and commercial buildings, and the compliance pathway depends on the proposed fuel type and design. Homes or buildings can be zero energy, all electric, or mixed fuel.

For residential buildings, the following criteria must be achieved for each path:

RC103: Zero Energy: This pathway must either achieve a Passive House Institute United States (Phius) ZERO pre-certification or a Home Energy Rating System (HERS) Index of 42 (if mixed fuel) or 45 (if all electric) before factoring in on-site power production (OPP), typically via solar, and a HERS 0 after added OPP.

Note: A “Zero Energy Building” is; a building which through a combination of highly energy efficient design and onsite renewable energy generation (Solar PV or other) is designed to result in net zero energy consumption.

RC103: All Electric: This pathway requires full electrification of the home for water and space heating, clothes dryers, cooking equipment, and other features. Buildings that qualify for the all-electric pathway must achieve a HERS rating of 45 or pre-certification as meeting Phius CORE or Passive House International (PHI) requirements. This pathway must also comply with solar-ready provisions in Appendix RB of the Stretch Code and Stretch Code provisions for wiring for electric vehicle charging. Backup generators are still allowed, even when using the “all electric” pathway.

RC104: Mixed Fuel: This pathway requires electric readiness for future electrification of a home, meaning that homes should be wired to accommodate future electric use and outlets must be installed near fossil fuel equipment for future installation of electric equipment. This includes equipment for water and space heating, clothes dryers, and cooking appliances. In addition, a HERS Index of 42 or less

is required, or homes must meet Phius CORE or PHI requirements. In addition, a HERS Index of 42 or less is required for each dwelling unit, and each must have an electric vehicle ready space. This pathway must also adhere to Section RC105 which is guidance for a "Solar Ready Zone". If a new building is greater than 4,000 square feet of conditioned floor area, the option to follow this pathway is not available.

Multifamily residential buildings are technically covered by the Commercial Code. Multifamily buildings greater than 12,000 square feet will need to achieve Phius CORE or Passive House International (PHI) standards. These requirements are phased in. Buildings up to five stories must meet them as of July 1, 2023, and buildings higher than five stories must meet them as of January 1, 2024.

For commercial buildings, the following criteria must be achieved for each path:

CC103: Zero Energy: This is an optional pathway for buildings that are designed to result in net zero energy consumption for a year, where the onsite energy production must be greater than or equal to the building's energy use. R-Use buildings (a large category of buildings from motels to apartments) can follow RC102 (the residential Zero Energy Pathway) with PHIUS ZERO or HERS 0 certification.

CC104: All Electric: This pathway requires all energy services to be provided by electric power, with exception of external backup generation, a building following this pathway must meet the requirements of the Stretch Code for buildings of that type, size, and permit date.

CC105 and CC106: Mixed Fuel: This path is for buildings using fossil fuels for space heating, water heating, cooking, or clothes drying. In addition to otherwise applicable requirements of the Stretch Code, buildings following this option must all be electrification-ready, including pre-wiring for future electric conversion of any fossil fuel end uses. This means that buildings should be wired to accommodate future electric use and outlets must be installed near the fossil fuel equipment for future installation of electric equipment. In addition, this path requires on-site renewable energy production and additional minimum efficiency requirements for fossil fuel heating, ventilation, air conditioning, and water heating equipment.

Sources: Massachusetts Department of Energy Resources, MA Net Zero Buildings Coalition

225 CMR 22.00: MASSACHUSETTS STRETCH CODE AND SPECIALIZED CODE FOR LOW-RISE RESIDENTIAL – 2023 RESIDENTIAL LOW-RISE AMENDMENTS TO IECC2021 AND IRC 2021 CHAPTER 11: ENERGY EFFICIENCY
(Note: please see 225 CMR 23.00 for Commercial, Multi-family and all other construction)

Chapter 1: [RE] SCOPE AND ADMINISTRATION

SECTION R103 CONSTRUCTION DOCUMENTS

R103.2 Insert after Subsection R103.2(9) 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 *mixed-fuel buildings*.

Chapter 2: [RE] DEFINITIONS

SECTION 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.

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 READY PARKING SPACE ("EV Ready Space"). A designated parking space which is provided with wiring and electrical service sufficient to provide 240 volt AC level II or equivalent EV charging, as defined by Standard SAE J1772 for EVSE servicing light duty *Electric Vehicles*.

ENTHALPY RECOVERY RATIO. Change in the enthalpy of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air enthalpy, expressed as a percentage.

22.00: continued

HIGH-EFFICACY LAMPS. Light-emitting diode (LED) lamps with an efficacy of not less than the following:

1. 60 lumens per watt for lamps over 40 watts.
2. 50 lumens per watt for lamps over 15 watts to 40 watts.
3. 45 lumens per watt for lamps 15 watts or less.

MIXED-FUEL BUILDING. A *building* that contains *combustion equipment* or includes piping for such *equipment*.

POTENTIAL SOLAR ZONE AREA. The combined area of any flat roofs, or low-sloped roofs and any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual solar access is 70% or greater. Annual solar access is the ratio of “annual solar insolation with shade” to the “annual solar insolation without shade”. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

Chapter 3: [RE] GENERAL REQUIREMENTS

SECTION R301 CLIMATE ZONES

R301 Replace Section R301 as follows:

R301.1 General. Massachusetts is in *climate zone 5A*

Chapter 4: [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R401 GENERAL

R401 Replace Section R401.1 and R401.2 as follows:

R401.1 Scope. This chapter applies to *residential buildings*. Municipalities which have adopted the Stretch Energy Code shall use the energy efficiency requirements of this chapter, or Chapter 51 where applicable for existing buildings. Municipalities which have adopted the Municipal Opt-in Specialized Stretch energy code shall comply with R401.2.4 including both the requirements of Appendix RC and this chapter.

R401.2 Application. Residential buildings shall comply with Section R401.2.5 and either Sections R401.2.2, R401.2.3 or R401.2.4. R-use buildings without individually separate dwelling units (such as single-room occupancy buildings) may comply with Section R401.2.1. The option selected for compliance shall be identified in the certificate required by Section R401.3.

Exception: Additions under 1,000 sf, *level 1 and level 2 alterations*, and repairs to existing buildings complying with Chapter 5 [RE].

R401.2.1 Prescriptive Compliance Option. The Prescriptive Compliance Option requires compliance with Sections R401 through R404 and R408.

R401.2.2 Passivehouse Building Certification Option. The Passivehouse Building Certification Option requires compliance with Section R405 and R404.4.

R401.2.3 Energy Rating Index Option. The Energy Rating Index (ERI) Option requires compliance with Section R406, R403.6 and R404.4.

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 and R404 as amended.

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, two of the additional efficiency package options shall be installed according to Section R408.2.
2. For buildings electing to be *all-electric buildings*, both R408.2.2 and R408.2.3 shall apply for primary space heating and domestic hot water supply.

R402.1.5.1 Add Subsection R402.1.5.1 as follows:

R402.1.5.1 Approved Software for Total UA Alternative: The following software is approved for demonstrating Total UA compliance:

REScheck-Web for IECC2021 Massachusetts stretch code available at <http://www.energycodes.gov/rescheck>

R402.4.1.1 Modify Table R402.4.1.1 to amend the Insulation Installation Criteria 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. 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.

403.3.5 Insert the following to the end of Subsection R403.3.5:

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

R403.6 Replace Section R403.6 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 mechanical balanced ventilation system that has been site verified to meet a minimum airflow per either:

1. RESNET HERS Index in accordance with RESNET/ICC Standard 301, or
2. ASHRAE Standard 62.2-2019 or 62.2-2022, or
3. 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

R403.6.1 Replace Subsection R403.6.1 and Subsections R403.6.1.1 and R403.6.1.2 as follows:

R403.6.1 Heat or Energy Recovery Ventilation. Heat or energy recovery balanced ventilation systems shall be provided for dwelling units as specified in either Section R403.6.1.1 or R403.6.1.2, as applicable.

R403.6.1.1 Large Systems. Systems with a rated airflow exceeding 300 cfm shall have an enthalpy recovery ratio of not less than 50% at cooling design condition and not less than 60% at heating design condition, determined in accordance with AHRI 1060 at an airflow not less than the design airflow.

R403.6.1.2 Other Systems. Systems with a rated airflow of 300 cfm or less shall have a sensible recovery efficiency (SRE) of not less than 65% at 32°F (0°C) at an airflow not less than the design airflow. SRE shall be determined in accordance with CAN/CSA-C439 and shall be listed. Linear interpolation of listed values for SRE shall be permitted.

R403.6.3 Replace Subsection R403.6.3 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, Residential IAQ Fault Indicator Display certified to the California Energy Commission, or other airflow measuring device in accordance with either RESNET Standard 380 or ACCA Standard 5.

R403.6.4 – R403.6.7 Add Subsections R403.6.4 – R403.6.7 as follows:

R403.6.4 Air-moving equipment, selection and installation. As referenced in ASHRAE Standard 62.2, Section 7.1, ventilation devices and equipment shall be tested and certified in accordance with HVI 920 (Home Ventilating Institute), or equivalent, 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 four feet 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 or unless the function is communicated through a digital user interface provided with the control.

R403.6.7 Air Inlets and Exhausts. All ventilation air inlets shall be located a minimum of ten feet 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 1/2 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 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 feet above grade directly in line with the vent terminal. The sign shall read, in print size no less than 1/2 inch in size, "MECH. VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".

Exceptions:

1. Ventilation air inlets in the wall \geq three feet 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.

R404.4 Add Section R404.4 and Table R404.4 as follows:

R404.4 Wiring for Electric Vehicle Ready Parking 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 or a Society of Automotive Engineers (SAE) Standard SAE J1772 electrical connector for EVSE servicing *Electric Vehicles*, located within 6 feet (1828 mm) of each *EV ready space*. Conductors and outlets for EVSE shall be sized and installed in accordance with the MA electrical code.

TABLE R404.4 EV READY SPACE REQUIREMENTS

Type of Building	Number of Parking Spaces
1 & 2 family dwellings and town homes	At least one 50-amp branch circuit per dwelling unit to provide for AC Level II charging.
All other R-use buildings	At least 20% of spaces served with a 40-amp, 208/240-volt circuit with a minimum capacity of 9.6 kVA.

Exceptions:

1. In no case shall the number of required *EV Ready Spaces* be greater than the number of parking spaces installed.
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. R-2 multi-family properties may elect to comply with Commercial EV ready requirements in C405.13
4. One or more SAE Level II spaces may be substituted with multiple SAE Level I spaces provided with wiring for a minimum 20amp, 120 volt EVSE, with a ratio of at least 3 Level I spaces for each Level II space required.

R405. Replace Section R405 in its entirety as follows:

Section R405 Passivehouse Building Certification Option.

R405.1 Compliance. Projects may document compliance with either Phius certification in accordance with R405.2 or PHI certification in accordance with R405.3.

Projects pre-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 design-certification is demonstrated by Phius and a Certified Passive House Consultant (CPHC); or, Projects pre-certified as meeting the Certified Passive House standard using the current software and program criteria by the Passive House Institute (PHI), where PHI certification is demonstrated by a Certified Passive House Designer and a Certified Passive House Certifier.

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.

R406.2 Revise TABLE R406.2 as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION ^a	TITLE
R403.6.1	Heat or Energy Recovery Ventilation
	Electrical Power and Lighting Systems
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	Wiring for Electric Vehicle Charging Spaces

- a. Reference to a code section includes all of the relevant subsections except as indicated in the table.

R406.3 Reserve this section:

R406.3 Building Thermal Envelope. Reserved.

R406.4 Replace Section R406.4 with the following:

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.

R406.5 Replace Section R406.5 and Table R406.5 with the following:

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

Clean Energy Application	Maximum HERS Index score ^{a, b}		
	New construction until June 30, 2024	New construction permits after July 1, 2024	Major alterations, additions, or Change of use ^c
<i>Mixed-Fuel Building</i>	52	42	52
Solar Electric Generation	55	42	55
<i>All-Electric Building</i>	55	45	55
Solar Electric & All-Electric Building	58	45	58

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

^b The building shall meet the mandatory requirements of Section R406.2, 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 2015 International Energy Conservation Code.

^c Alterations, Additions or Change of use covered by Section R502.1.1 or R503.1.5 are subject to this maximum HERS rating.

R406.5.1 Add Subsection R406.5.1, as follows:

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 three 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 three HERS points for each dwelling unit in new construction, Level 3 alterations, change of use to Residential R-use categories and fully attached additions.

R406.6 Revise Section R406.6 by replacing the reference to Section R406.6 in the first sentence with reference to Section R406.5.

R407 Reserve this Section:

SECTION R407 RESERVED

R408.2.1 Revise the first sentence of Subsection R408.2.1 by replacing 95% with 90% to read as follows:

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 90% 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 Delete option 1. of Subsection R408.2.2 and renumber option 2. As option 1., and option 3 as option 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 10 HSPF/16 SEER air source heat pump.
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 Delete option 1. of Subsection R408.2.3 and renumber option 2. As option 1., and option 3 as option 2.

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

Chapter 5: [RE] EXISTING BUILDINGS

SECTION R502 ADDITIONS.

R502.1 Revise Subsection R502.1 by replacing the third and fourth sentence as follows:

An addition shall be deemed to comply with this code where the addition alone complies, where the existing building and addition comply with this code as a single building, or where the building with the addition achieves a certified HERS rating in accordance with Table R406.5. Additions shall be in accordance with Section R502.1.1, R502.2 or R502.3.

R502.1.1 Add Subsection R502.1.1 as follows:

R502.1.1 Large Additions. Additions to a dwelling unit exceeding 1,000 sq. ft. or exceeding 100% of the existing conditioned floor area, shall require the dwelling unit to comply with the maximum HERS ratings for alterations, additions or change of use shown in TABLE R406.5.

R502.2 Delete the Exceptions in Subsection R502.2.

R502.3.1 Replace the Exception in Subsection R502.3.1 as follows:

Exception: New envelope assemblies in additions of less than 1,000 sq. ft. are exempt from the requirements of Section R402.4.1.2.

R503.1.5 Add new subsection as follows:

R503.1.5 Level 3 Alterations or Change of Use. Alterations that meet the IEBC definition for *Level 3 Alteration* or the IRC definition for *Extensive Alteration*, exceeding 1,000 sq ft or exceeding 100% of the existing conditioned floor area, shall require the dwelling unit to comply with the maximum HERS ratings for alterations, additions or change of use shown in Table R406.5.

R505.1 Delete the Exception in Section R505.1.

Appendix RB revise the Appendix RB title as follows:

22.00: continued

Appendix RB: SOLAR-READY PROVISIONS – DETACHED ONE- AND TWO-FAMILY DWELLINGS, LOW-RISE RESIDENTIAL BUILDINGS AND TOWNHOUSES (Adopted as amended)

RB101.1 Replace Section RB101.1 as follows:

RB101.1 General. These provisions shall be applicable for new construction, except additions under 1,000 sq. ft.

Exception: Buildings and dwelling units complying with Appendix RC Sections RC102 or RC105

RB103.1 Replace Section RB103.1 as follows:

RB103.1 General. New R-use buildings including, but not limited to, detached one- and two-family dwellings, and townhouses with not less than 600 sq. ft. (55.74 m²) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Sections RB103.2 through RB103.8.

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.
2. A building with a solar-ready zone that is shaded for more than 70% of daylight hours annually.

RB103.3 Replace International Fire Code with Massachusetts Fire Code in Section RB103.3:

Appendix RC revise the Appendix RC title and notes as follows:

Appendix RC: MASSACHUSETTS MUNICIPAL OPT-IN SPECIALIZED STRETCH CODE 2023

RESIDENTIAL LOW-RISE BUILDING PROVISIONS

The provisions contained in this appendix together with referenced sections from the Stretch energy code constitute the Specialized opt-in code for residential low-rise buildings, and may be adopted by a city or town together with the Commercial Specialized code Appendix CC as their stretch energy code. When adopted by the local municipality, the provisions in this appendix are mandatory in combination with the IECC2021 with Massachusetts Stretch code amendments.

User Note:

About this appendix: This appendix provides requirements for residential buildings. Where adopted by ordinance as a requirement, Section RC101 language is intended to replace Section R401.2.

SECTION RC101 COMPLIANCE

RC101 Replace Section RC101 as follows:

RC101.1 Compliance. Existing residential buildings shall comply with Chapter 5 of the stretch energy code. New residential buildings shall be Net Zero Buildings and comply with Section R404.4 (EV wiring) and either Section R405 (Passivehouse) or Section R406 (HERS) in accordance with RC101.2, as well as one of the following Specialized code pathways:

1. Section RC102 Zero Energy pathway
2. Section RC103 All-Electric pathway
3. Sections RC104 and RC105 Mixed-Fuel pathway.

RC101.2 Application. New dwelling units over 4,000 square feet in conditioned floor area shall comply with either RC101.1 option 1. *Zero Energy Pathway* or option 2. *All-Electric Pathway*, and follow either Section RC102 or Section RC103.

R-use buildings with total conditioned floor area greater than 12,000 square feet shall comply with the provisions of Section R405 Passivehouse Building Certification Option, and any of the pathways in Section RC101.1.

RC101.3 Definitions.

NET ZERO BUILDING. A building which is consistent with achievement of MA 2050 net zero emissions, through a combination of highly energy efficient design together with being either a *Zero Energy Building*, or an *All-electric Building*, or where fossil fuels are utilized, a building fully pre-wired for future electrification and that generates solar power on-site from the available Potential Solar Zone Area.

ZERO ENERGY BUILDING. A building which through a combination of highly energy efficiency design and onsite renewable energy generation is designed to result in net zero energy consumption over the course of a year as measured in MMBtus or KWh_{eq}, on a site energy basis, excluding energy use for charging vehicles.

RC102 Replace Section RC102 and Table RC102.2 as follows:

SECTION RC102 ZERO ENERGY PATHWAY

RC102.1 General. New zero energy buildings shall comply with Section RC102.2 and demonstrate a certified HERS rating of 0 or less and comply with Section R406, or complete Design Certification to the Phius ZERO standard and comply with Section R405.

RC102.2 Energy Rating Index Zero Energy Score. Compliance with this section requires that the final HERS rated design be shown to have a score less than or equal to the values in Table RC102.2 when compared to the HERS reference design determined in accordance with RESNET/ICC 301 for both of the following:

1. HERS value not including on-site power production (OPP) calculated in accordance with RESNET/ICC 301.
2. HERS value including on-site power production calculated in accordance with RESNET/ICC 301 with the OPP in Equation 4.1.2 of RESNET/ICC 301.

TABLE RC102.2 MAXIMUM HERS RATING INDEX^a

FUEL USAGE	HERS RATING INDEX NOT INCLUDING OPP	HERS RATING INDEX INCLUDING OPP
All Electric	45	0
Mixed-Fuel	42	0

^a The building shall meet the requirements of Table R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or R402.1.3.

RC103 Add Section RC103 and Table RC103.2 as follows:

SECTION RC103 ALL ELECTRIC PATHWAY

RC103.1 General. New *all electric buildings* shall comply with Section R401.2.5 and either Section RC103.2 to demonstrate a certified final HERS rating of 45 or less, or Section R405 and be pre-certified to the PHI or Phius CORE standard.

All new buildings shall comply with Appendix RB solar ready provisions and Section R404.4 Wiring for Electric Vehicle Charging Spaces

RC103.2 All Electric HERS Rating Index Score. Compliance with this section requires that the rated design be shown to have a certified HERS Index score less than or equal to the values in Table RC103.2 when compared to the HERS reference design determined in accordance with RESNET/ICC 301 and the following:

1. HERS value not including on-site power production (OPP) calculated in accordance with RESNET/ICC 301.

TABLE RC103.2 MAXIMUM HERS RATING INDEX^a

FUEL USAGE	ENERGY RATING INDEX NOT INCLUDING OPP
All Electric	45

^a The building shall meet the requirements of Table R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or R402.1.3.

RC104 dd Section RC104 and Table RC104.2 as follows:

SECTION RC104 MIXED-FUEL PATHWAY

RC104.1 General. This section establishes requirements for new *residential mixed-fuel buildings* with any space heating systems, water heating systems or appliances capable of using fossil fuels such as natural gas, heating oil or propane fuel. All buildings shall comply with either:

1. HERS certification: Sections RC104.2 through RC104.5 and RC105
2. Passivehouse pre-certification: Section R405 and Section RC104.3

RC104.1.1 Biomass Heating. New *residential buildings* using *clean biomass heating systems* may comply with this section. Biomass heating that does not meet the performance standards of *clean biomass heating systems* shall not be permitted as a primary heating system.

RC104.2 HERS Rating Index Score. Compliance with this section requires that the rated design be shown to have a HERS Index score less than or equal to the values in Table RC103.2 when compared to the HERS reference design determined in accordance with RESNET/ICC 301 for both of the following:

1. HERS value not including on-site power production (OPP) calculated in accordance with RESNET/ICC 301.

TABLE RC104.2 MAXIMUM HERS RATING INDEX^a

FUEL USAGE	HERS RATING INDEX NOT INCLUDING OPP
Mixed-Fuel building	42

^aThe building shall meet the requirements of Table R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or R402.1.3.

C104.3 Electric Readiness. Any installed gas, fuel oil or propane furnaces, boilers, water heaters, dryers, or cooking equipment shall comply with the requirements of Sections RC104.3.1 through RC104.3.4. Capacity for the future electric circuits required in this section shall be included in the load calculations of the original installation of electric service to the building and each *dwelling unit*.

RC104.3.1 Space Heating. The building and each *dwelling unit* shall be provided with a designated exterior location(s) in accordance with the following:

1. Natural drainage for condensate from cooling equipment operation or a condensate drain located within three feet (914 mm), and
2. A dedicated branch circuit in compliance with IRC Section E3702.11 based on heat pump space heating equipment sized in accordance with R403.7 and terminating within three feet (914 mm) of the location with no obstructions. Both ends of the branch circuit shall be labeled "For Future Heat Pump Space Heater."

Exception: Where an electrical circuit in compliance with IRC Section E3702.11 exists for space cooling equipment based on heat pump space heating equipment sized in accordance with R403.7.

RC104.3.2 Household Ranges and Cooking Appliances. An individual branch circuit outlet with a minimum rating of 250-volts, 40-amperes shall be installed within three feet of each gas or propane range or permanently installed cooking appliance.

RC104.3.3 Household Clothes Dryers and Water Heaters. An individual branch circuit outlet with a minimum rating of 250-volts, 30-amperes shall be installed within three feet of each gas or propane household clothes dryer and water heater.

RC104.3.4 Water Heating Space. Any permanently installed domestic hot water heating equipment shall be installed in an indoor space:

- (A) with a minimum volume of 700 cubic feet (20,000 L) or the equivalent of one 16-inch (406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203 mm) duct of no more than 10 feet (3048 mm) in length for cool exhaust air.
- (B) that is at least 3 feet (914 mm) by 3 feet (914 mm) by 7 feet (2134 mm) high surrounding or within 3 feet (914 mm) of the installed water heater.

RC104.4 On-site Renewable Energy. New buildings shall comply with either RC104.4.1 or RC104.4.2. Buildings following HERS certification shall comply with the requirements of RC105 solar-roof zone. Buildings following the Passivehouse pre-certification shall comply with Appendix RB solar ready provisions.

RC104.4.1 One- and Two-family Dwellings and Townhouses. One- and two-family dwellings and townhouses shall install an on-site renewable energy system with a nameplate DC power rating measured under standard test conditions, of no less than 4kW per dwelling unit.

Exception: A building where the potential solar zone area is less than 300 square feet.

RC104.4.2 Other Group R Occupancies. Buildings in Group R-2, R-3 and R-4 shall install an on-site renewable energy system with a rated capacity of not less than 0.75 W/ft² multiplied by the gross conditioned floor area.

Exceptions:

1. A building with a permanently installed domestic solar water heating system with a minimum solar savings fraction of 0.5.
2. A building where the potential solar zone area is less than 300 square feet.

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RC104.5 Electric Vehicle Readiness. All buildings shall comply with Section R404.4 *Wiring for Electric Vehicle Charging Spaces*.

RC105 Add Section RC105 as follows:

SECTION RC105 SOLAR-ROOF ZONE

RC105.1 General. New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m²) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Sections RC105.2 through RC105.10.

Exception: A building where all areas of the roof that would otherwise meet the requirements of Section RC105 are in full or partial shade for more than 70% of daylight hours annually.

RC105.2 Construction document requirements for solar- zone. Construction documents shall indicate the solar zone.

RC105.3 Solar Zone Area. The total solar zone area shall be not less than 300 square feet (27.87 m²) exclusive of mandatory access or setback 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 m²) per dwelling unit shall have a solar zone area of not less than 150 square feet (13.94 m²). The solar zone shall be composed of areas not less than five feet (1524 mm) in width and not less than 80 square feet (7.44 m²) exclusive of access or setback areas as required by the MA Fire Code.

RC105.4 Obstructions. Solar zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

RC105.5 Shading. The solar zone shall be set back from any existing or new permanently affixed object on the building or site that is located south, east or west of the solar zone a distance not less than two times the object's height above the nearest point on the roof surface. Such objects include, but are not limited to, taller portions of the building itself, parapets, chimneys, antennas, signage, rooftop equipment, trees and roof plantings.

RC105.6 Capped Roof Penetration Sleeve. A capped roof penetration sleeve shall be provided adjacent to a solar zone located on a roof slope of not greater than one unit vertical in 12 units horizontal (8% slope). The capped roof penetration sleeve shall be sized to accommodate photovoltaic system conduit and shall have an inside diameter of not less than 1¼ inches (32 mm).

RC105.7 Roof Load Documentation. The structural design loads for roof dead load and roof live load shall be clearly indicated on the construction documents.

RC105.8 Interconnection Pathway. Construction documents shall indicate pathways for routing of conduit or plumbing from the solar-ready zone to the electrical service panel or service hot water system.

RC105.9 Electrical Service Reserved Space. The main electrical service panel shall have space to allow installation of a dual pole circuit breaker for solar electric installation.

RC105.10 Construction Documentation Certificate. A permanent certificate, indicating the solar PV system size in AC and DC KW and or solar thermal size in KW equivalent 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.

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CHAPTER 6 [RE] REFERENCED STANDARDS

REFERENCED STANDARDS *Add the following Referenced Standards:*

AHRI	Air-Conditioning, Heating & Refrigeration Institute 2311 Wilson Blvd., Suite 400, Arlington, VA 22201
1060-2018.	Performance Rating of Air-To-Air Exchangers for Energy Recovery Ventilation Equipment.
CSA	CSA Group 8501 East Pleasant Valley Road, Cleveland, OH 44131-5516
CAN/CSA-C439-18.	Laboratory methods of test for rating the performance of heat/energy-recovery ventilators.

REGULATORY AUTHORITY

M.G.L. c. 25A, §. 6; St. 2021, c. 8.

225 CMR 23.00: MASSACHUSETTS FRONT-END AMENDMENTS TO THE INTERNATIONAL ENERGY CONSERVATION CODE 2021 MASSACHUSETTS STRETCH ENERGY CODE – 2023 COMMERCIAL AMENDMENTS TO IECC2021

Chapter 1: [CE] SCOPE AND ADMINISTRATION

SECTION C103 CONSTRUCTION DOCUMENTS

C103.2 Insert after Subsection C103.2(13) the following:

14. Solar Ready roof zone in accordance with Appendix CB, or *Potential Solar Zone Area* in accordance with Appendix CC.
15. EV Ready Spaces locations in accordance with Section C405.13
16. For buildings using the Relative Performance Pathway (C407.2) because average ventilation at full occupancy is greater than 0.5 cfm/sf, submit mechanical equipment schedules for all new and/or existing air handling equipment designed to supply any quantity of outdoor air to the space, and an airflow riser diagram encompassing the complete project boundary. Mechanical equipment schedules shall clearly indicate the total design outdoor airflow for each unit. The air riser diagram shall include all supply, exhaust, and return air systems serving the space. The air riser diagram shall also include a summary of the total outdoor air supplied, the total gross square footage served by the ventilation system, and the overall flow rate per area in cfm/sf.
17. For mixed fuel building following Appendix CC, construction documents showing electric HVAC retrofit design prepared by the HVAC engineer. The contract documents shall show future replacement of combustion equipment based HVAC system with an equivalent all electric system. Contract documents shall show combustion equipment to be replaced, future electric equipment, supporting electric, structural, and architectural infrastructure to be installed during building construction, and space allotments for future equipment.

C103.2.2 Add the following Subsection:

C103.2.2 COMcheck Submittal. The construction documents submitted with the application for permit shall be accompanied by completed COMcheck Envelope, Lighting and Mechanical Compliance Certificates, and a Plan Review Inspection Checklist for the purposes of demonstrating compliance with the energy provisions of 225 CMR 23.00: *Stretch Energy Code*.

Exception: Projects documenting compliance following Section C407.2 (ASHRAE 90.1 Appendix G) shall follow applicable reporting requirements.

Chapter 2: [CE] DEFINITIONS

SECTION C202 GENERAL DEFINITIONS

C202 Add the following definitions.

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

AUTOMATIC LOAD MANAGEMENT SYSTEMS (ALMS). A control system that allows multiple connected *electric vehicle supply equipment (EVSE)* to share a circuit or panel and automatically manage power at each charger, reducing the total connected electrical capacity of all *EVSE*.

CLASS 3 EXHAUST. Exhaust meeting the definition of Class 3 air in ASHRAE/ASHI Standard 62.1-2019, including air with significant contaminant concentration, significant sensory-irritation intensity, or offensive odor. The Class 3 Exhaust system must be capable of reducing exhaust and makeup airflow rates to 50% of the zone design values or the minimum required to maintain pressurization relationship requirements.

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CLASS 4 EXHAUST. Exhaust meeting the definition of Class 4 air in ASHRAE/ASHE Standard 62.1-2019, including laboratory fume hood exhaust, exhaust where energy recovery is not allowed by ASHRAE/ASHE Standard 170 for use in energy recovery systems with leakage potential, and systems exhausting toxic, flammable, paint or corrosive fumes or dust. The Class 4 Exhaust system must be capable of reducing exhaust and makeup airflow rates to 50% of the zone design values or the minimum required to maintain pressurization relationship requirements. Excludes *exempt exhaust*.

CLEAN BIOMASS HEATING SYSTEM. Wood-pellet fired central boilers and furnaces with less than 3 million Btu/hour rated heat input, 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, or wood chip fired central boilers and furnaces with less than three million Btu/hour rated heat input, where the equipment has a thermal efficiency rating of 80% or greater and a particulate matter emissions rating of no more than 0.10 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.

DEDICATED OUTSIDE AIR SYSTEM (DOAS). A ventilation system that supplies 100% outdoor air primarily for the purpose of ventilation and that is a separate system from the zone space-conditioning 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 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 section 625.2.*

ELECTRIC VEHICLE READY PARKING SPACE ("EV READY SPACE"). A designated parking space which is provided with wiring and electrical service sufficient to provide 240 volt AC Level 2 or equivalent EV charging, as defined by Standard SAE J1772 for EVSE servicing light duty electric vehicles.

ENTHALPY RECOVERY RATIO. The ratio of change in enthalpy of the entering supply airflow and the leaving supply airflow to the difference in enthalpy between the entering supply airflow and the entering exhaust airflow, with no adjustment to account for that portion of the psychrometric change in the leaving supply airflow that is the result of leakage of entering exhaust airflow rather than exchange of heat or moisture between the airstreams.

EXEMPT EXHAUST. Exhaust for which energy recovery systems are prohibited by the applicable International Mechanical Code.

EXHAUST SOURCE HEAT PUMP. A type of electric heat pump that utilizes ventilation exhaust air as the thermal energy source.

FUEL GAS. A natural gas, manufactured gas, liquified petroleum gas or a mixture of these. *Informational note: Definition of fuel gas is mirrored from 2021 IMC to be useful in defining combustion equipment. It typically refers to natural gas and propane.*

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C). *Informational note: Definition of fuel oil is mirrored from 2021 IMC to be useful in defining combustion equipment. It typically refers to heating oil products.*

23.00: continued

GLAZED WALL SYSTEM. System consisting of any combination of both vision glass and/or *spandrel sections* to create an above-grade wall that is designed to separate the exterior and interior environments. These systems include, but are not limited to, curtain walls, window walls, and storefront windows.

MIXED-FUEL BUILDING. A *building* that contains *combustion equipment* or includes piping for such *equipment*.

OTHER EXHAUST. Any exhaust that does not fall under the categories of *Exempt Exhaust*, *Class 4 Exhaust*, or *Class 3 Exhaust*.

SENSIBLE ENERGY RECOVERY RATIO. The change in the dry-bulb temperature of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air dry-bulb temperatures, expressed as a percentage.

SPANDREL SECTION. The opaque portion of a *glazed wall* system typically used to conceal or obscure features of the building structure or used for visual effect. A spandrel section may consist of, but is not limited to, an exterior exposed cladding layer (glazing or opaque material) with an interior insulated panel.

TENANT SPACE FIT OUT ZONE. Portion of a building in which only the envelope is completed, and the mechanical, lighting, and other interior systems are either incomplete or partially complete at the time of building permitting. Mechanical, lighting, and other interior systems may be completed under either the same building permit or a different building permit from the host building.

THERMAL BRIDGE: Part of the *building envelope* where otherwise uniform thermal resistance is changed by full or partial penetration of the thermal insulation by materials with higher thermal conductivities and/or where the interior and exterior areas of the envelope are different, such as, but not limited to, parapets and corners.

CLEAR FIELD: A *thermal bridge* that is uniformly distributed throughout an assembly such that accounting for the *thermal bridge* individually is impractical for whole-building calculations.

LINEAR: A *thermal bridge* that is continuous in one direction of the exterior envelope.

POINT A *thermal bridge* that is discrete and countable on an individual basis for whole-building calculations.

Chapter 3: [CE] GENERAL REQUIREMENTS

SECTION C301 CLIMATE ZONES

C301 Replace Section C301 as follows:

C301.1 GENERAL. Massachusetts is in *climate zone 5A*.

Chapter 4: [CE] COMMERCIAL ENERGY EFFICIENCY

SECTION C401 GENERAL

C401.2 Replace Section C401.2 as follows:

C401.2 Application. Commercial buildings shall comply with either Section C401.2.1 or C401.2.2. When constructed for the first time, all requirements imposed on the building housing a *tenant space fit out zone* shall also apply to the *tenant space fit out zone*. Commercial buildings containing multiple use type classifications (mixed-use buildings) shall comply with C401.2.4

23.00: continued

C401.2.1 Prescriptive and Performance Compliance. Commercial buildings shall comply with one of the following:

1. **Prescriptive Compliance:** This pathway may only be used for any nonresidential building, or portions thereof when following C401.2.4, up to 20,000-sf. The Prescriptive Compliance pathway requires compliance with Sections C401.3; C402 through C406, and Section C408.
2. **Targeted Performance Compliance:** This pathway shall be used for dormitory, fire station, library, office, school, police station, post office, and town hall buildings, or portions thereof when following C401.2.4, over 20,000-sf which have average ventilation at full occupancy of 0.5 cfm/sf or less. This pathway can also be used for any building of any size. After 1 July 2024, this pathway shall be used for residential buildings, or portions thereof when following C401.2.4, over 12,000-sf, or the building may comply with Section C401.2.2. The Targeted Performance Compliance pathway requires compliance with Section C401.3, Sections C402 through C406, Section C407.1, Section 408, and select sections of ANSI/ASHRAE/IESNA 90.1-2019 Appendix G as described in Section 407.1.
3. **Relative Performance Compliance:** This pathway may be used by buildings not required to use Option 2. The Relative Performance Compliance pathway requires that the Proposed building complies with Sections C401.3, C402.1.5, C402.2.8, C402.3, C402.4, C402.5, C402.6, C402.7, C403.5, C403.7, C405, C406, C407.2, C408, and ANSI/ASHRAE/IESNA 90.1-2019 using the Appendix G compliance pathway as modified in Section C407.2.

Exception: Additions, alterations, repairs and changes of occupancy to existing buildings complying with Chapter 5. This exception does not include *tenant space fit out zones* when constructed for the first time.

C401.2.2 Certified Performance Standard Compliance. Commercial buildings or portions thereof when following C401.2.4 shall comply with one of the following certified performance standard

1. **Passivehouse Compliance:** This pathway can be used for any building of any size. The Passive House Compliance pathway requires compliance with Sections C401.3, C402.3, C405, C407.3 and C408.
2. **HERS Compliance:** This pathway can be used for any Group R building with multiple individual *dwelling units*. The HERS pathway requires compliance with Section C401.3, C402.3, C405, C407.4 and C408.

C401.2.4 Add Section C401.2.4 Mixed Use Buildings

C401.2.4 Mixed Use Buildings. Where different building use types within a new building require different Section C401.2 Compliance Pathways, each use type shall separately and individually show compliance with C401.2.1 or C401.2.2 for that respective use type.

C401.4 Add Section C401.4 as follows:

C401.4 Building electrification. Building projects which utilize Section C407.2.1 shall conform with C401.4.1. Building projects which utilize Section C402.1.5.2 shall conform with C401.4.2 except for buildings using the Relative Performance pathway because average ventilation at full occupancy is greater than 0.5 cfm/sf which shall comply with C401.4.1 rather than C401.4.2. Building projects which utilize Section CC104.1, Part 1 shall conform with C401.4.3.

C401.4.1 Partial Space Heating Electrification. Electric air source, *exhaust source*, or ground source heat pump systems shall supply 25% of the building's peak space heating and ventilation air heating load at the ASHRAE 99.6% winter climatic design condition. Heat pumps used for space and ventilation air heating shall comply with C401.4.4.

C401.4.1.1 Heat Pump Primary Operation. Heat pump systems shall be controlled to prioritize their primary operation, prior to operation of supplemental fossil-fuel equipment, during non-emergency conditions.

23.00: continued

C401.4.2 Full Space Heating Electrification. Electric air source, *exhaust source*, or ground source heat pump systems shall supply 100% of the building's peak space heating and ventilation air heating load at the ASHRAE 99.6% winter climatic design condition. No fossil fuel heating equipment shall be used for space heating or ventilation air heating. Heat pumps used for space and ventilation air heating shall comply with C401.4.4.

C401.4.3 Full Space and Water Heating Electrification. Electric air source, *exhaust source*, or ground source heat pump systems shall supply 100% of the building's peak space heating and ventilation air heating load at the ASHRAE 99.6% winter climatic design condition. Electric air source, ground source, electric resistance, or solar thermal systems shall supply 100% of the building's service water.

No fossil fuel equipment shall be used for space heating, ventilation air heating, or service water heating. Heat pumps used for space and ventilation air heating shall comply with C401.4.4. Heat pump service water heating shall conform to the applicable efficiencies in Section C404.2. Solar thermal service water shall have a solar fraction of 0.4 or larger.

C401.4.4 Heat Pump Requirements. Heat pumps used for space heating and ventilation air heating shall comply with C401.4.4.1 through C401.4.4.3.

C401.4.4.1 Equipment Efficiencies. Heat pump equipment shall conform to the applicable efficiencies in Section C403.3.2.

C401.4.4.2 Multiple Systems. For buildings with multiple heat pump systems, compliance shall be based on the combined capacity of all heat pump systems serving the building. For purposes of this calculation, the heating capacity of a heat pump system shall not exceed the heating load of that system and the portion of the building served by that system.

C401.4.4.3 Exhaust Source Heat Pumps. For purposes of this calculation, the capacity of *exhaust source heat pumps* shall only include the heating capacity that exceeds the energy recovered by the minimum ventilation heat recovery required by C403.7.4. In addition, for purposes of this calculation, the capacity of the *exhaust source heat pumps* shall not exceed the heat pump capacity when the exhaust airflow is at 50% of design airflow.

C402.1.3 Delete Subsection C402.1.3 and Table C402.1.3 and mark as Reserved.

C402.1.3 Reserved.

C402.1.5 Replace Section C402.1.5 with the following:

C402.1.5 Component Performance Alternative. Above grade wall and fenestration values and areas determined in accordance with C402.1.5.1 or C402.1.5.2 shall be an alternative to compliance with the above grade wall U- factors in Tables C402.1.4 and vertical fenestration U- factors in Table C402.4 and the maximum allowable fenestration areas in Section C402.4.1. *Fenestration* shall meet the applicable SHGC requirements of Section C402.4.3. Buildings following ANSI/ASHRAE/IESNA 90.1-2019 Appendix G shall comply with this section. Roofs, below grade walls, floors, slab-on-grade floors, and opaque doors shall comply with the values in Table C402.1.4.

C402.1.5.1 Low Glazed Wall System Buildings. Buildings in which less than or equal to 50% of the total, above-grade wall area of the *building thermal envelope* is a *glazed wall system* shall comply with Equation 4-2a and vision glass used in the *glazed wall system* shall have a maximum whole assembly U factor of U-0.25.

Area-weighted U proposed ≤ 0.1285 (Equation 4-2a)

where:

Area-weighted U proposed = U value for each distinct assembly type of the above grade wall portion of the *building thermal envelope* weighted by vertical area for each distinct assembly type.

23.00: continued

C402.1.5.2 High Glazed Wall System Buildings. Buildings in which more than 50% of the total, above-grade wall area of the *building thermal envelope* is a *glazed wall system* shall comply with Equation 4-2b and vision glass used in the *glazed wall system* shall have a maximum whole assembly U factor of U-0.25 and the building complies with Section C401.4.2.

Area-weighted U proposed \leq 0.1600 (Equation 4-2b)

where:

Area-weighted U proposed = U value for each distinct assembly type of the above grade wall portion of the *building thermal envelope* weighted by vertical area for each distinct assembly type.

Exception: Buildings using the Relative Performance pathway because average ventilation at full occupancy is greater than 0.5 cfm/sf shall comply with C401.4.1 rather than C401.4.2.

C402.2.4.1 Delete the exception in Subsection C402.2.4.1:

C402.2.8 Add Subsection C402.2.8 as follows:

C402.2.8 Fireplaces. New combustion fireplaces shall have tight-fitting flue dampers or doors, and outdoor combustion air as required by the fireplace construction provisions of MA Construction Codes, as applicable. Where using tight-fitting doors on factory-built fireplaces listed and labeled in accordance with UL 127, the doors shall be tested and listed for the fireplace.

C402.3 Replace Section C402.3 with the following:

C402.3 Rooftop Solar Readiness (Mandatory). Follow Appendix CB: Solar-ready zone – Commercial.

C402.4 Modify Vertical fenestration U-factors in TABLE C402.4 as follows:

**CLIMATE ZONE 5 AND MARINE 4
Vertical fenestration U-factor**

Fixed fenestration	0.30
Operable fenestration	0.32

Add Subsection C402.4.6:

C402.4.6 Fenestration Documentation. In accordance with Section 303.1.3 fenestration performance shall be documented according to C402.4.6.1 or C402.4.6.2.

C402.4.6.1 Labeled Performance. The thermal transmittance of glazed fenestration products within the scope of NFRC shall be indicated by labels applied to the products at the manufacturing location or by a label certificate produced by an NFRC Approved Calculation Entity.

C402.4.6.2 Calculated Performance. Fenestration products outside the scope of NFRC may demonstrate compliance by submitting a thermal simulation report prepared by a registered design professional for each product as defined by NFRC 100. Thermal simulations shall be performed in accordance with the NFRC 100-2020 simulation procedures at the size and configuration defined in NFRC 100 Table 4-3.

C402.5 Replace Section C402.5 with the following:

C402.5 Air Leakage — Thermal Envelope. The *building thermal envelope* shall comply with Sections C402.5.1 through Section C402.5.10.1.

23.00: continued

C402.5.1 Replace Section C402.5.1 with the following and delete the exception:

C402.5.1 Air Barriers. A continuous *air barrier* shall be provided throughout the *building thermal envelope*. The continuous *air barrier* is permitted to be any combination of inside, outside, or within the *building thermal envelope*. The *air barrier* shall comply with Sections C402.5.1.1, and C402.5.1.2. The *air leakage* performance of the *air barrier* shall be verified in accordance with Section C402.5.2.

402.5.1.1 Replace Section C402.5.1.1 with the following:

C402.5.1.1 Air Barrier Design and Documentation Requirements. Design of the continuous *air barrier* shall be documented in the following manner:

1. Materials, assemblies, and systems comprising the continuous *air barrier* and their position within each *building thermal envelope* assembly shall be identified.
2. Joints, interconnections, and penetrations of the continuous *air barrier* materials, assemblies, and systems shall be detailed.
3. The continuity of the *air barrier* at building element assemblies that enclose conditioned space or provide a boundary between conditioned space and unconditioned space shall be identified.
4. Documentation of the continuous *air barrier* shall detail methods of sealing the *air barrier* such as wrapping, caulking, gasketing, taping or other *approved* methods at the following locations:
 - i. Joints around fenestration and door frames.
 - ii. Joints between walls and floors, between walls at building corners, between walls and roofs including parapets and copings, where above-grade walls meet foundations and similar intersections.
 - iii. Penetrations or attachments through the continuous *air barrier* in building envelope roofs, walls, and floors.
 - iv. Building assemblies used as ducts or plenums.
 - v. Changes in continuous *air barrier* materials and assemblies.
 - vi. Transition from one wall or roof assembly type to another such as, but not limited to, transition between opaque wall system and *glazed wall system*, and transition between a curtain wall glazed wall system and a storefront *glazed wall system*.
5. Identify where testing will or will not be performed in accordance with Section C402.5.2. Where testing will not be performed, a plan for field inspections required by C402.5.2.3 shall be provided that includes the following:
 - i. Schedule for periodic inspection(s),
 - ii. Continuous *air barrier* scope of work,
 - iii. List of critical inspection items,
 - iv. Inspection documentation requirements, and
 - v. Provisions for corrective actions where needed.

C402.5.1.2 Renumber Section C402.5.1.1 as Section C402.5.1.2 and make the following changes:

In Part 3, delete "Joints and seams associated with penetrations shall be sealed in the same manner or taped"

In Part 3, replace "from wind stack effect and mechanical ventilation" with "pressure".

In Part 4, replace "C402.5.10" with "C402.5.1.2.1".

C402.5.1.2.1 Add Section C402.5.1.2.1 as follows:

C402.5.1.2.1 Electrical and Communication Boxes. Electrical and communication boxes that penetrate the *air barrier* of the *building thermal envelope*, and that do not comply with C402.5.1.2.1.1, shall be caulked, taped, gasketed, or otherwise sealed to the *air barrier* element being penetrated. All openings on the concealed portion of the box shall be sealed. Where present, insulation shall rest against all concealed portions of the box.

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C402.5.1.2.1.1 Add Section C402.5.1.2.1.1 as follows:

C402.5.1.2.1.1 Air-sealed Boxes. Where air-sealed boxes are installed, they shall be marked in accordance with NEMA OS 4. Air-sealed boxes shall be installed in accordance with the manufacturer's instructions.

C402.5.1.3 Delete Section C402.5.1.3

C402.5.1.4 Delete Section C402.5.1.4

C402.5.1.5 Delete Section C402.5.1.5

C402.5.2 Replace Section C402.5.2 with the following:

C402.5.2 Air Leakage Compliance. *Air leakage* of the *building thermal envelope* shall be tested by an *approved* third party in accordance with C402.5.2.1. The measured *air leakage* shall not be greater than 0.35 cfm/ft² (1.8 L/s × m²) of the *building thermal envelope* area at a pressure differential of 0.3 inch water gauge (75 Pa) with the calculated *building thermal envelope* surface area being the sum of the above- and below-grade *building thermal envelope*.

Exceptions:

1. Where the measured *air leakage* rate is greater than 0.35 cfm/ft² (1.8 L/s × m²) but is not greater than 0.45 cfm/ft² (2.3 L/s × m²), the *approved* third party shall perform a diagnostic evaluation in accordance with ASTM E1186. All identified leaks shall be sealed where such sealing can be made without damaging existing building components. A report specifying the corrective actions taken to seal leaks shall be deemed to establish compliance with the requirements of this section where submitted to the code official and the building owner. Where the measured *air leakage rate* is greater than 0.45 cfm/ft² (2.3 L/s × m²), corrective actions must be made to the building and an additional test completed for which the results are 0.45 cfm/ft² (2.3 L/s × m²), or less.
2. As an alternative, buildings or portions of buildings, containing Group R and I occupancies, shall be permitted to be tested by an *approved* third party in accordance with C402.5.2.2. The reported *air leakage* of the *building thermal envelope* shall not be greater than 0.27 cfm/ft² (1.4 L/s × m²) of the *testing unit enclosure area* at a pressure differential of 0.2 inch water gauge (50 Pa).

C402.5.2.1 Add Section C402.5.2.1 as follows:

C402.5.2.1 Whole Building Test Method and Reporting. The *building thermal envelope* shall be tested for *air leakage* in accordance with ASTM E3158 or an equivalent *approved* method. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.

Exceptions:

1. For buildings less than 10,000 ft² (1000 m²), the entire *building thermal envelope* shall be permitted to be tested in accordance with ASTM E779, ASTM E3158 or ASTM E1827 or an equivalent *approved* method.
2. For buildings greater than 50,000 ft² (4645 m²), portions of the building shall be permitted to be tested and the measured *air leakage* shall be area-weighted by the surface areas of the *building thermal envelope* in each portion. The weighted average tested *air leakage* shall not be greater than the whole building leakage limit. The following portions of the building shall be tested:
 - i. The entire *building thermal envelope* area of stories that have any conditioned spaces directly under a roof.
 - ii. The entire *building thermal envelope* area of stories that have a building entrance, a floor over unconditioned space, a loading dock, or that are below grade.

23.00: continued

iii. Representative above-grade portions of the building totaling not less than 25% of the wall area enclosing the remaining conditioned space.

C402.5.2.2 Renumber Section C402.5.2 as new Section C402.5.2.2 and make the following changes:

Add "ASTM E3158," after "ASTM E1827"

Replace "Units shall be tested separately with an unguarded blower door test as follows:" with "Units shall be tested without simultaneously pressurizing adjacent units and shall be separately tested as follows".

In part 2, add "a middle floor unit" between "including a top floor unit" and "a ground floor unit"

In part 2, replace "two units shall be tested" with "three units shall be tested"

Add new Part 3 as follows: "Enclosed spaces with not less than one exterior wall in the building thermal envelope shall be tested in accordance with C402.5.3."

Add the following exception: "Exception: Corridors, stairwells, and enclosed spaces having a conditioned floor area not greater than 1,500 ft² shall be permitted to comply with Section C402.5.1.5 and either Section C402.5.1.3 or C402.5.1.4."

C402.5.2.3 Renumber Section C402.5.1.5 as Section C402.5.2.3 and make the following changes:

Add "In addition to the requirements of Sections C402.5.2.1 and C402.5.2.2" after "verification criteria" and before "the installation of the continuous air barrier".

In part 2, replace "components and assemblies" with "materials, assemblies, and systems"

In part 2, delete "while the air barrier is still accessible for inspection"

In part 2, replace "Sections C402.5.1.3 and C402.5.1.4" with "Sections C402.5.2.3.1 or C402.5.2.3.2" and add "The air barrier shall remain accessible for inspection and repair"

C402.5.2.3.1 Renumber Section C402.5.1.3 as new Section C402.5.2.3.1.

C402.5.2.3.2 Renumber Section C402.5.1.4 as new Section C402.5.2.3.2.

C402.5.3 Renumber Section C402.5.4 as Section C402.5.3 and make the following changes:

Replace "shall meet the provisions of Table C402.5.4" with "shall comply with Table C402.5.3".

Add "conducted by an accredited, independent testing laboratory" between "Testing shall be" and "in accordance with"

Replace "reference test standard in C402.5.4 by an accredited, independent testing laboratory" with "reference test standard in Table C402.5.3".

In Exception 1, replace "C402.5.1" with "C402.5.1.2"

In Exception 2, replace "comply with the testing alternative of Section C402.5," with "are tested for air leakage in accordance with Section C402.5.2"

In Exception 2, replace "Table C402.5.4" with "Table C402.5.3"

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Relabel "Table C402.5.4" to "Table C402.5.3"

C402.5.4 Renumber Section C402.5.5 as Section C402.5.4 and make the following changes:

In Part 2.1, delete "Table C402.1.3 or".

In Part 2.2, replace "Section C402.5.1.1" I "Section C402.5.1.2".

In Part 2.4, replace "Water lines" with "Piping serving as part of a heating or cooling system".

C402.5.5 Renumber Section C402.5.6 as Section C402.5.5 and make the following changes:

Replace "Section C402.5.4" with "Section C402.5.3".

C402.5.6 Renumber Section C402.5.7 as Section C402.5.6.

C402.5.7 Renumber Section C402.5.8 as C402.5.7 and make the following changes:

Replace "infiltration" with "air leakage".

C402.5.8 Renumber Section C402.5.9 as Section C402.5.8 and make the following changes:

C402.5.9 Renumber Section C402.5.10 as Section C402.5.9.

In part 2 replace "more" with "greater"

In part 2 replace "when" with "where"

C402.5.10 Renumber Section C402.5.11 as Section C402.5.10 and make the following changes:

Replace "and lower the heating setpoint to 55°F (13°C)" with "and lower the heating setpoint to 50°F (10°C)"

In Exception 1, add "operable openings into" before "separately-zoned areas"

In Exception 2, replace "warehouses" with "storage occupancies"

In Exception 3, revise to read: "Doors located in the exterior wall that are part of a vestibule system".

Add new Exception 4, "Operable openings used as part of a designed system for natural ventilation."

C402.5.10.1 Renumber Section C402.5.11.1 as Section C402.5.10.1

C402.6 Add Section C402.6 as follows:

C402.6 Approved Calculation Software Tools. The following software tools are sufficient to demonstrate compliance with Sections C401.2.1 Prescriptive Compliance and C402.7.

1. COMcheck-Web available at: <https://www.enegycodes.gov/comcheck>

C402.7 Add Section C402.7 and subsections as follows:

C402.7 Derating and Thermal Bridges

C402.7.1 General. In addition to pre-calculated assembly U-factors, C-factors, or F-factors outlined in Appendix A of ASHRAE 90.1 2019, vertical envelope performance shall also take into account the effect of *thermal bridges* according to both C402.7.2 and C402.7.3. In addition, the thermal resistance of *spandrel sections* within *glazed wall systems* shall be according to C402.7.4. Together with Appendix A of ASHRAE 90.1 2019, these derated values and *spandrel section* values shall be used when showing compliance with Section C402.1.4 or Section C402.1.5, as applicable.

23.00: continued

C402.7.2 Continuous Insulation for Vertical Walls. Installed vertical wall continuous insulation shall be derated using either C402.7.2.1, C402.7.2.2 or C402.7.2.3 to account for the effect of fasteners through the continuous insulation.

C402.7.2.1 Prescriptive Derating. Derate vertical wall continuous insulation using Equation C402.7.2.1 and a derating Factor from C402.7.2.1.1 for portions of wall having brick veneer systems and a derating factor from C402.7.2.1.2 or C402.7.2.1.3 for portions of wall having cladding systems.

(Equation C402.7.2.1)

$$R_{\text{derated}} = R_o \times \text{Derating Factor}$$

Where

R_{derated} : R value after derating, to be used when showing compliance R402.7.2
 R_o : R value of the continuous insulation prior to derating
 Derating Factor: Derating factor From C402.7.2.1.1, C402.7.2.1.2, or C402.7.2.1.3

C402.7.2.1.1 Brick Veneer Systems. Wall systems comprised of brick veneer anchored to the building with fasteners shall use a Derating Factor of 0.7 to account for the *clear field thermal bridge* derating effect of the fasteners. In addition, brick shelf angles shall be derated according to Section C402.7.3 to account for the *linear thermal bridge* derating effect of any brick shelf angles.

C402.7.2.1.2 Cladding Systems. Wall systems comprised of cladding systems shall use a derating factor per Table 402.7.2.1.2

Table 402.7.2.1.2 Cladding System Derating Factors

Thickness of R_o	Derating Factor
R_o is less than or equal to R-15	Derating Factor = $0.74 - 0.021 \times R_o$
R_o is greater than R-15	Derating Factor = $0.55 - 0.007 \times R_o$

C402.7.2.1.3 Cladding Systems with Qualifying Thermal Breaks. If plastic or fiberglass fasteners entirely comprised of material having thermal conductivity of 3 Btu-in/hr-ft²-F or less are used to support external cladding; or, if fasteners having thermal breaks which have a conductivity of 3 Btu-in/hr-ft²-F or less on both ends of the fastener are used to support external cladding, use Derating Factor of 0.8.

C402.7.2.2. Reference Derating. Use pre-solved, derated continuous insulation values contained in Building Envelope Thermal Bridging Guide, version 1.6 or higher, published by BC Hydro Power Smart at <https://www.bchydro.com>

C402.7.2.3. Modelled Derating. Use two or three-dimensional finite element analysis heat transfer model to calculate derated value. A three-dimensional model shall be used when there are *point thermal bridges* or thermal bridging in multiple planes.

C402.7.3. Linear Thermal Bridges. In addition to derating per Section C402.7.2, installed vertical wall insulation U values shall be further derated for *linear thermal bridges* where the vertical wall intersects the following: brick shelf angles, balconies, vertical interior walls, horizontal interior walls, windows, roof, other vertical walls on different plane, and grade using Equation C402.7.3.

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(Equation C402.7.3)

$$U_{derated} = \frac{PSI * Length}{A_{total}} + U_o$$

Where

- $U_{derated}$ Derated wall U value (Btu/hr-ft²-F)
- PSI Value from Section C402.7.3.1, C402.7.3.2, or C402.7.3.3 (Btu/hr-ft-F)
- Length Length of linear *thermal bridge* (ft)
- A_{total} Area of derated wall (ft²)
- U_o Wall or roof U value prior to *linear thermal bridge* derating

C402.7.3.1 Prescriptive PSI Values. Use PSI values from Table C402.7.3.1

Table C402.7.3.1 Linear Thermal Bridge Prescriptive PSI values.

Type of Linear Thermal Bridge	PSI-value (Btu/hr - ft - F)
Balcony to exterior vertical wall intersection	1.00
Intermediate floor to exterior vertical wall intersection	0.60
Interior vertical wall to exterior vertical wall intersection	0.50
Fenestration to exterior vertical wall intersection	0.32
Parapet (vertical wall to roof intersection)	0.60
Brick shelf angle	0.35
Vertical wall to grade intersection	0.52
Vertical wall plane transition (building corners and other changes in vertical wall plane)	0.25

C402.7.3.2 Reference PSI Values. Use pre-solved PSI values contained in Building Envelope Thermal Bridging Guide, version 1.6 or higher, published by BC Hydro Power Smart.

C402.7.3.3 Modelled PSI Values. Use a two or three-dimensional finite element analysis to calculate PSI values. A three-dimensional model shall be used when there are *point thermal bridges* or thermal bridging in multiple planes.

C402.7.4 Thermal Resistance of Spandrel Sections. R-factor of opaque *spandrel sections* within *curtain wall* systems shall be accordance with C402.7.4.1, C402.7.4.2, or C402.7.4.3.

C402.7.4.1 Prescriptive R Value. Opaque *spandrel sections* within *glazed wall systems* shall have at least R-12 insulation. For the purpose of calculating weighted U value in accordance with Section C402.1.5, *spandrel sections* shall use values in Table C402.7.4.1.

Table C402.7.4.1 Spandrel Section Default R values

Type	Default R-Value
Thermally broken	3.5
Non-thermally broken	2

C402.7.4.2 Reference R Values. Use pre-solved opaque *spandrel sections* R values contained in Building Envelope Thermal Bridging Guide, version 1.6 or higher, published by BC Hydro Power Smart.

23.00: continued

C402.7.4.3. Modelled R values. Use a two or three-dimensional finite element analysis to calculate R value of opaque *spandrel section*. A three-dimensional model shall be used when there are *point thermal bridges* or thermal bridging in multiple planes.

C403.5 Modify Section C403.5 as follows:

Add "Dedicated outside air systems" as Item 4 of the list of where air or water economizers shall be provided.

Delete exception 5 and renumber subsequent exceptions to reflect deletion

Table C403.5(1). Show only Climate Zone 5A.

Table C403.5(2). Delete this table

C403.7.4 Replace Subsection C403.7.4 with the following:

C403.7.4 Energy Recovery Systems. Energy recovery ventilation systems shall be provided as specified in Section C403.7.4.1, as applicable and C403.7.4.2.

C403.7.4.1 *Modify Section C403.7.4.1 as follows:*

Replace "not less than 60 percent at heating design condition." with "not less than 75 percent at heating design condition. Outdoor air must be delivered directly to the dwelling unit. The building weighted average sensible energy recovery effectiveness must meet the requirements of C403.7.4.2."

Delete all the exceptions (exceptions 1 through 4).

C403.7.4.2 *Modify Section C403.7.4.2 as follows:*

Replace "The energy recovery system shall provide an enthalpy recovery ratio of not less than 50% at design conditions" with "The energy recovery system shall result in either 1 or 2, as applicable"

Add 1 and 2 as follows

1. A *sensible recovery ratio* of at least 50% at heating design conditions for systems that provide makeup for Class 3 or 4 *exhaust*. The requirement can be satisfied either for each fan system individually or based on a weighted average of the ventilation air flow for all applicable fan systems in the entire building per Equation C403.7.4.2(1).

Equation C403.7.4.2(1)

Weighted average *sensible energy recovery ratio* = [*sensible energy recovery ratio* for fan system 1 x outside air flow for system 1 + *sensible energy recovery ratio* for fan system 2 x outside air flow for system 2 + ...]/[outside air flow for system 1 + outside air flow for system 2 + ...]

2. An *enthalpy recovery ratio* of not less than 70% at heating and cooling design conditions for all other systems. The requirement can be satisfied either for each fan system individually or based on a weighted average of the ventilation air flow for all applicable fan systems in the entire building per Equation C403.7.4.2(2).

Equation C403.7.4.2(2)

23.00: continued

Weighted average *enthalpy energy recovery ratio* = [*enthalpy recovery ratio* for fan system 1 x outside air flow for system 1 + *enthalpy recovery ratio* for fan system 2 x outside air flow for system 2 + ...]/[outside air flow for system 1 + outside air flow for system 2 + ...]

Delete exceptions 2 (including 2.1 and 2.2), 4, 5, 6, 7, and 8

Renumber exception 3 as exception 2

Renumber exception 9 as exception 3 and change from "20 hours per week" to "10 hours per week"

Renumber exception 10 as exception 4

Renumber exception 11 as exception 5

Revise Tables C403.7.4.2(1) and C403.7.4.2(2) and show only Climate Zone 5A row, as follows:

Table C403.7.4.2(1) ENERGY RECOVERY REQUIREMENT (Ventilation systems operating less than 8,000 hours per year)

Climate Zone	PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
	>=10% and <20%	>=20% and <30%	>=30% and <40%	>=40% and <50%	>=50% and <60%	>=60% and <70%	>=70% and <80%	>=80%
	Design Supply Fan Airflow Rate (cfm)							
5A	10,000	8,000	2,750	0	0	0	0	0

Table C403.7.4.2(2) ENERGY RECOVERY REQUIREMENT (Ventilation systems operating note less than 8,000 hours per year)

Climate Zone	PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
	>=10% and <20%	>=20% and <30%	>=30% and <40%	>=40% and <50%	>=50% and <60%	>=60% and <70%	>=70% and <80%	>=80%
	Design Supply Fan Airflow Rate (cfm)							
5A	0	0	0	0	0	0	0	0

C405.2.4 Modify Section C405.2.4 as follows

In item 1, replace "150 watts" with "100 watts"

In item 3, replace "150 watts" with "100 watts"

C405.13 Add Section C405.13 as follows:

C405.13 Electric Vehicle Ready Parking Spaces ("EV Ready Spaces") (Mandatory). New parking spaces shall provide *EV Ready Spaces* in accordance with Table C405.13. Installed wiring suitable for 6.6kW or higher SAE J1772-2017 AC Level II EVSE shall be connected to the service panel and run to within 6 feet (1828mm) of any qualifying parking space. Conductors and outlets for *EVSE* shall be sized and installed in accordance with the MA electrical code.

23.00 : continued

TABLE C405.13 EV-READY SPACE REQUIREMENTS

Occupancy Classification	Minimum percentage of EV-Ready Spaces	EV Charging Performance Requirements
Group R and Group B	20%	40-amp dedicated branch circuit or larger branch circuit with ALMS in accordance with Table C405.13.1
All Other Occupancies	10%	40-amp dedicated branch circuit or larger branch circuit with ALMS in accordance with Table C405.13.1

Exceptions:

1. Parking spaces and garage spaces intended exclusively for storage of vehicles for retail sale or vehicle service are excluded from the EV-ready space percentage calculation.
2. Any parking facility with 4 or more spaces providing installed Direct Current fast charging EVSE with a minimum charging speed of 150 kW to each space.
3. One or more AC Level II spaces may be substituted with multiple AC Level I spaces provided with wiring for a minimum 20amp, 120-volt EVSE, with a ratio of at least 3 AC Level I spaces for each AC Level II space required.
4. Parking spaces specifically designated for medium or heavy-duty vehicles are excluded from the EV-ready space percentage calculation.

C405.13.1 Add Section C405.13.1 as follows:

C405.13.1 Minimum Charging Performance Requirements. *Automatic Load Management System (ALMS)* may be used to control *electric vehicle* loads for EV-Ready or EVSE-Installed Spaces with AC Level II or Level I charging, subject to the performance requirements in Table C405.13.1. The maximum number of parking spaces that may share a single branch circuit varies based on the percentage of all parking spaces to be provided with *EVSE*.

TABLE C405.13.1 EV-READY PERFORMANCE REQUIREMENTS

Circuit Breaker Amperage	Maximum Parking Spaces that May Share a Branch Circuit with 10%-60% EV Ready spaces	Maximum Parking Spaces that May Share a Branch Circuit with 61-100% EV Ready spaces
40A	1	2
50A	1	2
60A	2	4
70A	3	6
80A	4	8
90A	5	9
100A	6	10

C405.13.2 Add Section C405.13.2 as follows:

C405.13.2 Identification. *Construction documents* shall indicate the branch circuit termination point and proposed location of future EVSE. *Construction documents* shall also provide information on amperage of future EVSE, wiring schematics, *Automatic Load Management Systems*, and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required *EV ready spaces*.

C406.1 Modify Section C406.1 as follows:

Replace "shall achieve a total of 10 credits" with "shall achieve a total of 15 credits"

23.00: continued

Table C406.1(1) Modify Table C406.1(1) as follows:

Delete rows for C406.2.1: 5% heating efficiency improvement and C406.7.3: Efficient fossil fuel water heater

Replace row for option C406.2.3: 10% heating efficiency improvement with the following:

Section	Climate Zone 5A
C406.2.3 Renewable space heating	15

Add the following row for option C406.13:

Section	Climate Zone 5A
C406.13 Heavy Timber Construction	8

Table C406.1(2), Modify Table C406.1(2) as follows:

Delete rows for C406.2.1: 5% heating efficiency improvement and C406.7.3: Efficient fossil fuel water heater

Replace row for option C406.2.3: 10% heating efficiency improvement with the following:

Section	Climate Zone 5A
C406.2.3 Renewable space heating	15

Add the following row for option C406.13:

Section	Climate Zone 5A
C406.13 Heavy Timber Construction	8

Table C406.1(3) Modify Table C406.1(3) as follows:

Delete rows for C406.2.1: 5% heating efficiency improvement and C406.7.3: Efficient fossil fuel water heater

Replace row for option C406.2.3: 10% heating efficiency improvement with the following:

Section	Climate Zone 5A
C406.2.3 Renewable space heating	15

Add the following row for option C406.13:

Section	Climate Zone 5A
C406.13 Heavy Timber Construction	8

Table C406.1(4) Modify Table C406.1(4) as follows:

Delete rows for C406.2.1: 5% heating efficiency improvement and C406.7.3: Efficient fossil fuel water heater

Replace row for option C406.2.3: 10% heating efficiency improvement with the following:

Section	Climate Zone 5A
C406.2.3 Renewable space heating	15

Add the following row for option C406.13:

Section	Climate Zone 5A
C406.13 Heavy Timber Construction	8

23.00: continued

Table C406.1(5) Modify Table C406.1(5) as follows:

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Delete rows for C406.2.1: 5% heating efficiency improvement and C406.7.3: Efficient fossil fuel water heater

Replace row for option C406.2.3: 10% heating efficiency improvement with the following:

Section	Climate Zone 5A
C406.2.3 Renewable Space Heating	15

Add the following row for option C406.13:

Section	Climate Zone 5A
C406.12 Heavy Timber Construction	8

C406.1.1 Modify Section C406.1.1 as follows:

Replace "minimum number of 5 credits" with "minimum number of 10 credits"

C406.2.1 Delete this section

C406.2.3 Replace Section C406.2.3 with the following:

C406.2.3. Renewable space heating. All space heating shall be provided with cold-climate air source heat pumps having rated coefficient of performance (COP) of at least 1.75 at 5 degrees Fahrenheit source air, or ground source heat pumps.

C406.7.3 Delete this section

C406.9 Replace Section C406.9 with the following:

C406.9 Reduced air leakage. Air leakage of the building thermal envelope shall be tested by an approved third party in accordance with Section C402.5.2.1. The measured air leakage shall not exceed 0.20 cfm/ft² (1.1 L/s × m²) of the building thermal envelope at a pressure differential of 0.3 inches water gauge (75 Pa), with the calculated surface area being the sum of the above- and below-grade building thermal envelope.

C406.13 Add Section C406.13 as follows:

C406.13 Heavy Timber construction. For buildings with 4 stories or more of Type IV heavy timber construction either above grade, or above a podium.

C407 Replace Section C407 in its entirety with the following:

C407.1 Targeted Performance

This option requires compliance with Sections C407.1.1 through C407.1.2.

C407.1.1 Compliance. Buildings shall comply with Sections C407.1.1.1 through C407.1.1.6.

C407.1.1.1 Building performance modeling

Building performance modeling shall be used to show compliance with C407.1.1.5. The simulation program shall be a computer-based program for the analysis of energy consumption in buildings. The simulation shall include calculation methodologies for the building components being modeled and meet the requirements in ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Section G2.2.1(a)-(d) and Section G2.2.4.

23.00: continued

C407.1.1.2 Climatic Conditions

The simulation program shall perform the simulation using hourly values of climatic data using representative weather files prescribed by the Massachusetts Department of Energy Resources.

C407.1.1.3 Modeling Building Envelope Infiltration. The air leakage rate of the building envelope shall be modeled following ANSI/ASHRAE/IESNA 90.1-2019 Section G3.1.1.4.

C407.1.1.4 Internal loads, scheduling, and other modeling assumptions

Performance modeling shall use the internal load, scheduling, and other assumptions as prescribed by the Massachusetts Department of Energy Resources.

C407.1.1.5 Thermal energy demand intensity (TEDI) limits

Performance modeling shall show that the building's heating thermal energy demand intensity and cooling thermal energy demand intensity are less than or equal to the values in Table C407.1.1.5

Table C407.1.1.5 Thermal Energy Demand Intensity (TEDI) Limits

Use Type	Heating TEDI (kBtu/sf-yr)	Cooling TEDI (kBtu/sf-yr)
Office, fire station, library, police station, post office, town hall $\geq 125,000$ -sf	1.5	23
Office, fire station, library, police station, post office, town hall between 75,000 and 125,000-sf	4 - 0.00002 * Area (sf)	18 + 0.00004 * Area (sf)
Office, fire station, library, police station, post office, town hall $\leq 75,000$ -sf	2.5	21
K-12 School $\geq 125,000$ -sf	2.2	12
K-12 School between 75,000 and 125,000-sf	2.7 - 0.000004 * Area (sf)	32 - 0.00016 * Area (sf)
K-12 School $\leq 75,000$ -sf	2.4	20
Residential multifamily and dormitory $\geq 125,000$ -sf	2.8	22
Residential multifamily and dormitory between 75,000 and 125,000-sf	3.8 - 0.000008 * Area (sf)	4.5 + 0.00014 * Area (sf)
Residential multifamily and dormitory $\leq 75,000$ -sf	3.2	15
All other $\geq 125,000$ -sf	1.5	23
All other between 75,000 and 125,000-sf	4 - 0.00002 * Area (sf)	18 + 0.00004 * Area (sf)
All other $\leq 75,000$ -sf	2.5	21

C407.1.1.6 Mixed use buildings

For buildings having more than one use type where any use type is more than 10% of the total space conditioned area, each separate use type having more than 10% of the total space conditioned area shall separately and individually show compliance with C407.1.1.5 for that respective use type. Use types having less than or equal to 10% of the total space conditioned area do not have to show separate, individual compliance with C407.1.1.5 but can be incorporated into and treated as the majority use type.

C407.1.2 Documentation. Simulated performance shall be documented, and documentation shall be submitted to the rating authority. Documentation shall include all the assumptions used in the performance modeling such that the documentation can be used as a specification checklist for implementation during design and construction. The information shall be submitted in a report and shall include the items described in ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Section G1.3.2 Parts b, g, h, i, j, k, l, n, o, and q, and Section G1.3.3.

C407.2 Relative Performance. This option requires compliance with Section C407.2.1 and C407.2.2

23.00: continued

C407.2.1 Electrification and Documentation of Highly Ventilated Buildings. Buildings using the Relative Performance Pathway (C407.2) because average ventilation at full occupancy is greater than 0.5 cfm/sf shall have space heating electrified in accordance with Section C401.4.1 and shall submit design documents showing ventilation system design and air flow rates as required by Section C103.2 part 16.

C407.2.2 Compliance. Building shall comply with ANSI/ASHRAE/IESNA 90.1-2019 Section 4.2 using the Appendix G pathway as modified by C407.2.2.1 and C407.2.2.2.

C407.2.2.1 Modification to ANSI/ASHRAE/IESNA 90.1-2019 Section 4.2.

ANSI/ASHRAE/IESNA 90.1-2019 Section 4.2 Replace 4.2.1.1 with the following:

New buildings shall comply with 4.2.2 through 4.2.5 and normative Appendix G. When using Normative Appendix G, the Performance Energy Index (PEI) of new buildings, additions to existing buildings, and alterations to existing buildings shall be less than or equal to the Performance Energy Index Target (PEI_t) when calculated in accordance with the following:

$$PEI_t = [BBUE + (BPF \times BBRE)]/BBSE$$

- PEI = Performance Energy Index calculated in accordance with Section G1.2
- BBUE = Baseline building unregulated site energy
- BBRE = Baseline building regulated site energy
- BPF = Building performance factor from Table 4.2.1.1 For building area types not listed in Table 4.2.1.1 use "All others". Where a building has multiple area types, the required BPF shall be equal to the area-weighted average of the building area types.
- BBSE = Baseline building site energy (sum of BBUE and BBRE)

ANSI/ASHRAE/IESNA 90.1-2019 Section 4.2 Revise Table 4.2.1.1 to show only Climate Zone 5A; remove multifamily, office, and school; and adjust the BPFs as follows:

TABLE 4.2.1.1 BUILDING PERFORMANCE FACTOR (BPF)

Building Area Type	Climate Zone 5A
Health care/hospital	0.59
Hotel/motel	0.57
Restaurant	0.62
Retail	0.47
Warehouse	0.41
All others	0.51

C407.2.2.2 Modification to ANSI/ASHRAE/IESNA 90.1-2019 Appendix G

ANSI/ASHRAE/IESNA 90.1-2019 Appendix G In all Sections of Appendix G, replace references to "baseline building performance" with "baseline building site energy", replace "proposed building performance" with "proposed building site energy", replace "energy cost savings" with "site energy savings"

ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Replace G1.2.2 with following, keeping the exception unchanged:

23.00: continued

The site energy of the proposed design is calculated in accordance with the provisions of this appendix using the following

g formula:

Performance energy index (PEI) = Proposed building site energy / baseline building site energy (BBSE)

Both the proposed building site energy and the baseline building site energy shall include all end use load components within and associated with the building when calculating the performance energy index.

ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Delete G1.3.2 Part m and Part p

ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Delete G2.1 Part c

ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Revise G2.4.1 as follows

Site recovered energy shall be subtracted from the proposed building site energy when calculating performance. Energy used to recharge vehicles that are used for on-road and off-site transportation purposes, or energy losses from use of behind-the-meter energy storage, should not be included when calculating performance. On-site renewable energy shall not be subtracted from the proposed building site energy when calculating performance.

ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Delete G2.4.2

ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Add the following row to Section G Table G3.1.1-1.

**TABLE G3.1.1-1 BASELINE BUILDING VERTICAL FENESTRATION
PERCENTAGE OF GROSS ABOVE-GRADE-WALL AREA**

Building Area Types	Baseline Building Gross Above-Grade-Wall Area
Multifamily	24%

Section C407.3 Add Section C407.3 as follows:

C407.3 Passive House. This option requires compliance with Section C407.3.1 and C407.3.2.

C407.3.1 Compliance. Buildings shall be pre-certified as meeting the Phius CORE 2021 or Phius ZERO 2021 Passive Building Standard - North America, or newer, demonstrated using Phius approved software, where Phius Design-Certification is demonstrated by Phius and a Certified Passive House Consultant (CPHC); or, Projects pre-certified as meeting the Certified Passive House standard using the current software and program criteria by the Passive House Institute (PHI), where PHI certification is demonstrated by a Certified Passive House Designer and a Certified Passive House Certifier.

C407.3.2 Documentation. Compliance with Phius or PHI shall be in accordance with C407.3.3.1 or C407.3.3.2

C407.3.2.1 Phius Documentation. When using WUFI Passive or other Phius-approved software:

1. Prior to the issuance of a building permit, the following item(s) 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.

23.00: continued

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 C405.13: EV ready, and Appendix CB: Solar Ready Provisions.

C407.3.2.2 Passive House International (PHI) Documentation.

1. If using PHI Passive House software, prior to the issuance of a building permit, the following item(s) 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 items 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 demonstrates project compliance with PHI performance requirements;
- c. A copy of the Passive House Verifier's or Rater's test results;
- d. A statement from the CPHD that the project test results meet the model performance requirements, all the mandatory limits and any other mandatory requirements.

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 C405.13: EV ready, and Appendix CB: Solar Ready Provisions.

Section C407.4 Add Section C407.4 as follows:

C407.4 HERS Index (HERS) for multi-family buildings. This option requires compliance with Section C407.4.1, C407.4.2, C407.4.3

C407.4.1 Compliance. Each dwelling unit shall have a certified HERS Index (HERS) rating less than or equal to the appropriate value indicated in Table C407.4 when compared to the *HERS index reference design* for each dwelling unit prior to credit for onsite renewable electric generation. Buildings shall meet or exceed ENERGY STAR Multifamily New Construction (MFNC) program requirements. The Home Energy Rating Index (HERS) shall be determined in accordance with RESNET/ICC Standard 301-2019. Software tools used for determining HERS Index shall be Approved Software Rating Tools in accordance with RESNET/ICC 301. Where calculations require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from RESNET/ ICC 301.

23.00: continued

TABLE C407.4 MAXIMUM ENERGY RATING INDEX

Building Energy Sources	Maximum HERS Index score ^a		
	New construction permits until June 30, 2024	New construction permits after July 1, 2024	Major alterations, additions, or Change of use ^b
Mixed-fuel building	52	42	52
Solar Electric Generation	55	42	55
All-Electric building	55	45	55
Solar Electric & All-Electric building	58	45	58

^a Maximum HERS rating prior to onsite renewable electric generation in accordance with Section C407.4

^b Alterations, Additions or Change of use covered by Section R503.1.5 are subject to this maximum HERS rating.

C407.4.2 Documentation. Documentation verifying that the methods and accuracy of compliance software tools conform to the provisions of this section shall be provided to the building official in accordance with C407.4.3.1 and C407.4.3.2:

C407.4.2.1 Prior to issuance of building permit. Prior to the issuance of a building permit, the following items must be provided to the Building Official:

1. Building street address, or other building site identification.
2. Declare the HERS Index on title page and building plans.
3. The name of the individual performing the analysis and generating the compliance report.
4. The name and version of the compliance software tool.
5. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
6. A certificate indicating that the proposed design has a HERS Index less than or equal to the appropriate score indicated in Table C407.4 when compared to the BRI reference design. The certificate shall document the building component energy specifications that are included in the calculation, including: component level insulation R-values or U-factors; assumed duct system and building envelope air leakage testing results; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
7. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

C407.4.2.2 Prior to issuance of certificate of occupancy. Prior to the issuance of a certificate of occupancy, the following items must be provided to the Building Official:

1. Building street address or other *building site* identification.
2. Declaration of the Final HERS Index on title page and on building plans.
3. The name of the individual performing the analysis and generating the report.
4. The name and version of the compliance software tool.
5. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
6. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections C407.4. The certificate shall report the energy features that were confirmed to be in the home, including: component-level insulation R-values or U-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed.
7. Documentation that each unit meets or exceeds ENERGY STAR Multifamily New Construction (MFNC) program requirements.
8. Where on-site renewable energy systems have been installed on or in the home, the certificate shall report the type and production size of the installed system.
9. Compliance with C405.13, and either Appendix CB or Appendix CC as applicable

23.00: continued

C407.4.3 Verification by approved agency. Verification of compliance shall be completed by a certified HERS rater.

CHAPTER 5 [CE] EXISTING BUILDINGS

C501.2 *Delete the exception*

C502.1 *Revise Section C502.1 as follows:*

Add the following first sentence "Additions to an existing building where the addition is up to 100% of the size of the existing building and less than 20,000-sf shall comply with Sections C401.3, C402 through C406, and Section C408. Additions which exceed either of these limits shall comply with the applicable pathway for new construction in C401.2."

C502.2 *Revise Section C502.2 as follows:*

Remove both exceptions

C503.1 *Revise Section C503.1 as follows:*

Replace "the requirements of Section C503" with "the requirements of Sections C503, C402, C403, C404, and C405"

Replace Exception 3 with "Where the component performance alternative in Section 402.1.5 is used to comply with this section, the proposed UA shall not be greater than 110 percent of the target UA."

C505.1 *Revise Section C505.1 as follows:*

Replace "this code" with "Sections C401.3, C402 through C406, and Section C408"

Appendix CB Adopt unamended

Appendix CB: Solar-ready Zone - Commercial.

APPENDIX CC - MASSACHUSETTS MUNICIPAL OPT-IN SPECIALIZED ENERGY CODE 2023

COMMERCIAL BUILDING PROVISIONS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance. The provisions contained in this appendix together with referenced sections from the Stretch energy code constitute the Specialized opt-in code for commercial buildings, and may be adopted by a city or town together with the Residential Specialized code Appendix RC as their stretch energy code. When adopted by the local municipality, the provisions in this appendix are mandatory in combination with the IECC2021 with Massachusetts Stretch code amendments.

SECTION CC101 GENERAL

CC101.1 *Replace Section CC101 as follows:*

CC101.1 Purpose. The purpose of this appendix is to form the commercial building provisions of the Massachusetts Municipal Opt-in Specialized Code to supplement the Massachusetts Stretch Energy Code and to provide a compliance pathway for buildings that require renewable energy systems of adequate capacity to achieve net zero carbon.

CC101.2 *Replace Section CC101.2 as follows:*

23.00: continued

CC101.2 Scope. This appendix applies to new buildings that are addressed by the Municipal Opt-in Specialized Code. The Specialized Code maintains the energy efficiency requirements of the Stretch Code for all building types except multi-family. CC103 lays out the additional clean energy requirements for all building types.

Residential buildings and *dwelling units* within mixed use buildings shall comply as follows:

- (1) New *dwelling units* over 4,000 square feet in conditioned floor area in *Mixed Fuel Buildings* shall comply with the Zero Energy pathway and Section CC103 or with residential code Section RC102.
- (2) New R-use buildings over 12,000 square feet in conditioned floor area shall comply in accordance with Table CC101.2.
- (3) New R-use buildings less than or equal to 12,000 square feet in conditioned floor area shall comply with Residential Appendix RC.

TABLE CC101.2 MULTI-FAMILY AND R-USE COMPLIANCE

R-Use buildings over 12,000 sf, or R-Use portions over 12,000 sf in mixed-use buildings	Compliance Path options by permit submittal date		
	C407.3 Passive house	C407.1 Targeted Performance	C407.4 HERS Index
Up to 5 stories	Required from Jan 1, 2023		
6 stories and higher	Required from Jan 1, 2024	Optional until Jan 1, 2024	Optional until Jan 1, 2024

Exceptions:

1. Detached one- and two-family dwellings and townhouses as well as Group R-2 buildings three stories or less in height above grade plane, manufactured homes (mobile dwellings), and manufactured houses (modular dwellings). These buildings and dwelling units shall comply with Residential Appendix RC under the Specialized energy code.
2. Buildings that use neither electricity nor fossil fuel.

CC101.3 Add Section CC101.3 as follows:

CC101.3 Compliance. New buildings shall demonstrate compliance with Sections CC101.4, CC101.5 and one of the following pathways:

1. **Zero Energy Pathway:** Buildings shall comply with Section CC103 and demonstrate that they are *Zero Energy Buildings* in accordance with Equation CC-1. *Mixed Fuel Buildings* with any capacity for on-site fossil fuel use shall be pre-wired for future electrification of all fuel uses in accordance with Section CC105.
2. **All-Electric Pathway:** Buildings shall comply with Section CC104.
3. **Mixed Fuel Pathway:** *Mixed Fuel Buildings* other than *Zero Energy Buildings* with any capacity for on-site fossil fuel use shall comply with CC105 and CC106. The following uses shall be excluded when determining whether new buildings will have on-site fossil fuel use:
 - a. On-site back-up generators using fossil fuels
 - b. On-site refuelling of vehicles or outdoor equipment using fossil fuels

CC101.4 Add Section CC101.4 as follows:

CC101.4 Minimum Building Energy Efficiency. New buildings shall comply with Section C401.2.1 or C401.2.2, as prescribed in Section C401. Existing buildings shall comply with Chapter 5 as amended.

CC101.5 Add Section CC101.5 as follows:

CC101.5 Minimum Electric Vehicle Ready Parking Requirements. New parking spaces shall provide *electric vehicle ready spaces* in accordance with Section C405.13 and Table C405.13.

SECTION CC102 DEFINITIONS

CC102 Add the following definitions:

23.00: continued

NET ZERO EMISSIONS BUILDING. A building which is consistent with achievement of MA 2050 net zero emissions, through a combination of highly energy efficient design together with being either a *Zero Energy Building*, or an *All-Electric Building*, or where fossil fuels are utilized, the building is fully pre-wired for future electrification and generates solar power on-site from the available *Potential Solar Zone Area*.

POTENTIAL SOLAR ZONE AREA. The combined area of any flat roofs, or low-sloped roofs and any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual solar access is 70 percent or greater. Annual solar access is the ratio of "annual solar insolation with shade" to the "annual solar insolation without shade". Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

ZERO ENERGY BUILDING. A building which through a combination of highly energy efficient design and onsite renewable energy generation is designed to result in net zero energy consumption over the course of a year as measured in MMBtus or KWheq, on a site energy basis, excluding energy use for charging vehicles.

CC102 Delete the definitions for: Adjusted off-site renewable energy, zero energy performance index (ZEPI PB/EE).

SECTION CC103 ZERO ENERGY PATHWAY MINIMUM RENEWABLE ENERGY

CC103.1 Modify Section CC103.1 as follows (keeping Table CC103.1 unchanged):

Delete "or off-site renewable energy shall be procured"

Equation CC-1 Replace Equation CC-1 with the following:

$$RE_{\text{onsite}} \geq E_{\text{building}} \text{ (Equation CC-1)}$$

where:

RE_{onsite} = Annual site energy production from on-site renewable energy systems (Section CC103.2).

23.00: continued

Ebuilding = Building energy use without consideration of renewable energy systems, on-site energy storage, on-site back-up generators, or on-site refuelling of vehicles or outdoor equipment.

When Section C401.2.1(1) is used for compliance with the Section CC101.4, building energy shall be determined by multiplying the gross *conditioned floor area* plus the gross semi-heated floor area of the proposed building by an EUI selected from Table CC103.1. Use a weighted average for mixed-use buildings.

When any compliance pathway other than Section C401.2.1 Part 1 is used for compliance with CC101.4, building site energy use shall be determined from energy simulations.

CC103.2 *Modify Section CC103.2 as follows:*

After “approved by the code official” add “Commercial R-use buildings may comply using the Zero Energy Buildings pathways in Appendix RC by certifying that all units meet HERS 0 or lower with on-site renewable generation or by following the on-site renewable energy calculation used in the Plius ZERO certification standard when following the Passive house compliance pathway.”

CC103.3 *Delete this section*

CC104 *Add Section CC104 as follows:*

SECTION CC104 ALL ELECTRIC PATHWAY

CC104.1 General. *New all-electric buildings shall comply with Sections CC101.4, CC101.5 and with one of the following:*

1. Section C401.2.1 and Section C401.4.3
2. Section C407.3 Passive house
3. Exclusively R-use buildings permitted prior to January 2024 may comply with Section C407.4 when all dwelling units have a HERS rating of 45 or less.

CC105 *Add Section CC105 as follows:*

SECTION CC105 MIXED-FUEL BUILDING PATHWAY

CC105.1 General. This section together with Section CC106 establishes additional minimum requirements for new *mixed-fuel buildings*.

CC105.1.1 Biomass Heating. *New buildings using clean biomass heating systems may comply with this section without meeting CC105.3.1 and CC105.3.2. Buildings with any combustion equipment using biomass that does not meet the performance standards of clean biomass heating systems shall be deemed mixed-fuel buildings and shall comply with this section in full.*

CC105.2 On-site Renewable Energy. *New mixed-fuel buildings shall have equipment installed for on-site renewable energy with a rated capacity of not less than 1.5 W/ft² (16.1 W/m²) multiplied by the sum of the gross conditioned floor area of the three largest floors.*

Exception: *Where the building site cannot meet the requirement in full with an on-site renewable energy system, the building site shall install a partial system sized to not less than 75% of the Potential Solar Zone Area.*

CC105.3 Additional efficiency requirements. *Additional efficiency requirements for compliance with this Section are set forth in Sections RC105.3.1 through RC105.3.3*

CC105.3.1 More efficient HVAC equipment performance. *Primary heating and cooling equipment shall meet the following efficiencies as applicable:*

23.00: continued

CC105.3.1 More Efficient HVAC Equipment Performance. Primary heating and cooling equipment shall meet the following efficiencies as applicable:

1. Space heating *combustion equipment* shall be rated at greater than or equal to 95 AFUE.
2. All refrigerant-based air conditioning equipment shall be a heat pump with greater than or equal to 10 HSPF rated heating performance and greater than or equal to 16 SEER rated cooling performance.
3. Ground source heat pump systems shall be rated at greater than or equal to 3.5 COP at design temperature.

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

Exception: *Clean biomass heating systems* used as the primary heating system.

CC105.3.2 Reduced Energy Use in Service Water-heating . The hot water system shall meet one of the following efficiencies:

1. than or equal to 82 EF *combustion equipment* service\water-heating system.
2. Greater than or equal to 2.0 UEF electric service water-heating system.
3. Greater than or equal to 0.4 solar fraction solar water-heating system.
4. *Clean biomass heating system* supplied water-heating system.

CC106 Add Section CC106 as follows:

SECTION CC106 WIRING FOR FUTURE ELECTRIFICATION

CC106.1 Additional Electric Infrastructure. All *combustion equipment* and end-uses shall be installed in accordance with this section. Capacity for the future electric circuits required in this section shall be included in the load calculations of the original installation of electric service to the building, and each *dwelling unit* for R-use buildings or portions thereof.

CC106.1.1 Electric Infrastructure for Dwelling and Sleeping Units. *Combustion equipment* and end-uses serving individual *dwelling units* or *sleeping units* shall comply with Section RC104.4.3 Electric Readiness.

CC106.1.2 Combustion Water Heating Equipment. Gas-fired or oil-fired water heaters with a capacity less than 300,000 Btu/h (88 kW) shall be installed in accordance with the following:

1. A dedicated 208/240-volt branch circuit with a minimum capacity of 30 amps shall terminate within three feet (914 mm) from the water heater and be accessible to the water heater with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Heat Pump Water Heater" and be electrically isolated,
2. A condensate drain that is no more than two inches (51 mm) higher than the base of the installed water heater and allows natural draining without pump assistance shall be installed within three feet (914 mm) of the water heater,
3. The water heater shall be installed in a space with minimum dimensions of three feet (914 mm) by three feet (914 mm) by seven feet (2134 mm) high, and
4. The water heater shall be installed in a space with a minimum volume of 700 cubic feet (20,000 L) or the equivalent of one 16-inch (406 mm) by 24-inch (610 mm) grill to a heated space and one eight-inch (203 mm) duct of no more than ten feet (3048 mm) in length for cool exhaust air.

CC106.1.3 Cooking Ranges, Ovens and Cooktops. An individual branch circuit outlet with a minimum rating of 250-volts, 40-amperes shall be installed within three feet of each gas or propane range or any permanently installed *combustion equipment* oven or cooktop.

Exception: Commercial kitchens for cafeteria, restaurant or commercial catering business use .

23.00: continued

CC106.1.5 Other combustion equipment. *Combustion equipment* not covered by Sections CC106.1.1 and CC106.1.4 and within buildings having average ventilation at full occupancy of 0.5 cfm/sf or less shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the *appliance or equipment* and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric appliance, equipment or end use with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, "For future electric equipment".

CC106.1.6 Other combustion equipment, highly ventilated buildings. *Combustion equipment* not covered by Sections CC106.1.1 and CC106.1.4 and within buildings having average ventilation at full occupancy of greater than 0.5 cfm/sf shall comply with Section CC106.1.6.1 through CC106.1.6.5.

CC106.1.6.1 HVAC Design and Installed Associated Electric Service. An all-electric HVAC retrofit design shall be prepared by the HVAC engineer for approval by the authority having jurisdiction. The electric service installed with the building shall be sufficient to accommodate the all-electric HVAC retrofit design. The contract documents shall show future replacement of *combustion equipment* based HVAC system with an equivalent all-electric system. Contract documents shall show *combustion equipment* to be replaced, future electric equipment, supporting electric, structural, and architectural infrastructure to be installed during building construction, and space allotments for future equipment.

CC106.1.6.2 Heating, Ventilation, and Air Conditioning (HVAC) Compatibility. HVAC design shall ensure that air, water, or other systems serviced by *combustion equipment* can also be serviced by future electric retrofit equipment without having to upgrade, alter, or update such systems.

CC106.1.6.3 Equipment Efficiencies. Electric retrofit equipment used for space and water heating shall conform to Section C401.4.3.

CC106.1.6.4 Installed Infrastructure. Infrastructure shall be installed as part of building construction to accommodate future electric retrofit in order to minimize cost and disruption during retrofit. Infrastructure to be installed as part of building construction shall include, but is not limited to, power infrastructure to the building to accommodate future electric retrofit system, electric service to future distributed equipment within the building, conduits to accommodate controls to future distributed equipment within the building, and structural and architectural elements to accommodate future retrofit equipment.

CC106.1.6.5 Space for Future Retrofit Equipment. Interior and exterior space shall be allotted to accommodate all future electric retrofit equipment. Where interior or exterior allotted space exceeds the space used for *combustion equipment* to be replaced, and/or does not correspond to the *combustion equipment* locations to be replaced, such space shall be set aside and may not be used for any other purpose. Signage, labels, and borders shall be used to prominently display areas and limits set aside for future equipment to prevent encroachment.

REGULATORY AUTHORITY:

M.G.L. Ch. 25A, §. 6; St. 2021, c. 8.

Chapter 122

BUILDING CONSTRUCTION

ARTICLE I
Stretch Energy Code

§ 122-2.
§ 122-3.

Applicability.
Stretch Code.

§ 122-1. Purpose.

[HISTORY: Adopted by the Town Meeting of the Town of Dedham as indicated in article histories. Amendments noted where applicable.]

ARTICLE I
Stretch Energy Code
[Adopted 5-17-2010 ATM by Art. 39]

§ 122-1. Purpose.

The purpose of the Stretch Code is to provide a more energy efficient alternative to the base energy code applicable to the relevant sections of the building code for both new construction and existing buildings.

§ 122-2. Applicability.

The Stretch Code applies to residential and commercial buildings. Buildings not included in this scope shall comply with 780 CMR 13, 34, 61, or 93, as applicable.

§ 122-3. Stretch Code.

The Stretch Code, as codified by the Board of Building Regulations and Standards as 780 CMR Appendix 115.AA, including any future editions, amendments or modifications, is herein incorporated by reference into the Town of Dedham General Bylaws.

The Stretch Code shall be enforced by the building commissioner or any assistant inspector of buildings.

