



COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF
ENERGY AND ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENERGY RESOURCES
100 CAMBRIDGE ST., 9th FLOOR
BOSTON, MA 02114
Telephone: 617-626-7300

Maura T. Healey
Governor

Rebecca L. Tepper
Secretary

Kimberley Driscoll
Lt. Governor

Elizabeth Mahony
Commissioner

VIA EMAIL AND HAND DELIVERY

November 14, 2024

TO: Clerk of the House of Representatives
CC: Chairs of the Joint Committee on Telecommunications, Utilities, and Energy
RE: Submission of Stretch and Specialized Code Regulations (225 CMR 22.00 and 23.00)

Dear Clerk:

Pursuant to M.G.L. Chapter 25A, Section 12 (Section 12), please find enclosed:

- 225 CMR 22.00 – MASSACHUSETTS STRETCH CODE AND SPECIALIZED CODE FOR LOW-RISE RESIDENTIAL – 2024 RESIDENTIAL LOW-RISE AMENDMENTS TO IECC2021 AND IRC 2021 CHAPTER 11: ENERGY EFFICIENCY;
- 225 CMR 23.00 - MASSACHUSETTS STRETCH CODE AND SPECIALIZED CODE FOR COMMERCIAL, MULTI-FAMILY AND ALL OTHER CONSTRUCTION – 2024 AMENDMENTS TO IECC2021 AND ASHRAE STANDARD 90.1-2019;
- Summary of the proposed regulations in layman's terms.

In the development of amendments to 225 CMR 22.00 and 23.00, the pertinent provisions of Chapter 30A, except section five, have been complied with.

In addition to the requirements of Section 12, the Department of Energy Resources has made additional information available to the public regarding these proposed regulations. That information is accessible through the Department's website:

<https://www.mass.gov/info-details/stretch-energy-code-development>

Please direct questions and comments on these proposed regulations to:

Maliha Khan
Government Affairs Manager
Legislative Director 857-286-0690
maliha.khan@mass.gov

Sincerely,

A handwritten signature in black ink, reading "Elizabeth Mahony". The signature is written in a cursive style with a long, sweeping tail that extends to the right.

Elizabeth Mahony
Commissioner, Department of Energy Resources

Enclosures

Layman's Summary of Proposed 225 CMR 22.00 and 23.00

In December 2022, an updated Stretch Energy Code (Stretch Code) and a new Municipal Opt-in Specialized Code (Specialized Code) were published in 225 CMR 22.00 and 225 CMR 23.00. CMR 22.00 covers Residential low-rise construction and CMR 23.00 covers Commercial and all other construction (including most multi-family).

After a year and a half of working with these new regulations, DOER has received a significant volume of detailed and helpful feedback from regulated entities, building officials and the design and construction industry. To ensure a broad range of feedback DOER hosted a public listening session and public comment period in March and April, then again in September after the draft regulations were issued. The DOER has been taking feedback and questions on a rolling-basis through the StretchCode@mass.gov mailbox. Based on this collective input, DOER is proposing modest revisions to the Stretch and Specialized Codes. Some of the topics included in this revision include a passive house certification process, modification of the requirements for district energy systems, a number of technical edits requested by stakeholders, and the inclusion of additional context from the 2021 International Energy Conservation Code to improve the readability of the regulations.

HOUSE No. 5122

Communication from the Department of Energy Resources of the Executive Office of Energy and Environmental Affairs (under the provisions of section 12 of Chapter 25A of the General Laws) submitting proposed amendments to regulations 225 CMR 22.00 and 23.00 – governing the Stretch and Specialized Code Regulations. Telecommunications, Utilities and Energy.

The Commonwealth of Massachusetts

In the One Hundred and Ninety-Third General Court
(2023-2024)

1 **CMR 22.00: MASSACHUSETTS STRETCH CODE AND SPECIALIZED CODE**
2 **FOR LOW-RISE RESIDENTIAL – 2024 RESIDENTIAL LOW-**
3 **RISE AMENDMENTS TO IECC2021 AND IRC 2021 CHAPTER 11:**
4 **ENERGY EFFICIENCY**

5 (Note: please *see* 225 CMR 23.00 for Commercial, Multi-family and all other construction)
6
7

8 **Chapter 1: [RE] SCOPE AND ADMINISTRATION**
9

10 **SECTION R103 CONSTRUCTION DOCUMENTS**
11

12 *R103.2* *Revise Section R103.2 as follows:*

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

- 19 1. Energy compliance path.
- 20 2. Insulation materials and their *R*-values.
- 21 3. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
- 22 4. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
- 23 5. Mechanical system design criteria.
- 24 6. Mechanical and service water-heating systems and equipment types, sizes and
25 efficiencies.
- 26 7. Equipment and system controls.
- 27 8. Duct sealing, duct and pipe insulation and location.
- 28 9. Air sealing details.
- 29 10. *EV Ready Space* locations per R404.4.

30 11. *Solar-Ready Zone* in accordance with Appendix RB, or *Solar Zone Area* when
31 complying with Appendix RC for *mixed-fuel buildings*.

32
33 **Chapter 2: [RE] DEFINITIONS**

34
35 **SECTION R202 GENERAL DEFINITIONS**

36 *R202 Add the following definitions:*

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

40
41 **CLEAN BIOMASS HEATING SYSTEM.** Wood-pellet fired central boilers and furnaces
42 where the equipment has a thermal efficiency rating of 85% (higher heating value) or greater;
43 and a particulate matter emissions rating of no more than 0.08 lb. PM_{2.5}/MMBtu heat output.

44
45 **COMBUSTION EQUIPMENT.** Any *equipment* or *appliance* used for space heating, *service*
46 *water heating*, cooking, clothes drying and/or lighting that can use *fuel gas*, *fuel oil* or solid fuel
47 and that is not a *clean biomass heating system*.

48 **ELECTRIC VEHICLE.** An automotive-type vehicle for on-road use, such as passenger
49 automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles, and the
50 like, primarily powered by an electric motor that draws current from a rechargeable storage
51 battery, fuel cell, photovoltaic array, or other source of electric current.

52 *Informational Note: defined as in 527 CMR 12.00: Massachusetts Electrical Code*
53 *(Amendments) section 625.2.*

54
55 **ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).** The conductors, including the
56 ungrounded, grounded, and equipment grounding conductors, and the *Electric Vehicle*
57 connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed
58 specifically for the purpose of transferring energy between the premises wiring and the *Electric*
59 *Vehicle*.

60 *Informational Note: defined as in 527 CMR 12.00: Massachusetts Electrical Code*
61 *(Amendments) section 625.2.*

62
63 **ELECTRIC VEHICLE READY PARKING SPACE (“EV Ready Space”).** A designated
64 parking space which is provided with wiring and electrical service sufficient to provide AC level
65 II or equivalent EV charging, as defined by Standard SAE J1772 or SAE J3400 for *EVSE* servicing
66 light duty *Electric Vehicles*.

67
68 **ENTHALPY RECOVERY RATIO.** The ratio of change in enthalpy of the entering supply
69 airflow and the leaving supply airflow to the difference in enthalpy between the entering supply
70 airflow and the entering exhaust airflow, with no adjustment to account for that portion of the

71 psychrometric change in the leaving supply airflow that is the result of leakage of entering
72 exhaust airflow rather than exchange of heat or moisture between the airstreams.

73
74 **HIGH-EFFICACY LAMPS.** Light-emitting diode (LED) lamps with an efficacy of not less
75 than the following:

- 76 1. 60 lumens per watt for lamps over 40 watts.
- 77 2. 50 lumens per watt for lamps over 15 watts to 40 watts.
- 78 3. 45 lumens per watt for lamps 15 watts or less.

79
80 **MIXED-FUEL BUILDING.** A *building* that contains *combustion equipment* or includes piping
81 for such *equipment*.

82
83 **POTENTIAL SOLAR ZONE AREA.** The combined area of any low-sloped roofs and any
84 steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual
85 solar access is 70% or greater. Annual solar access is the ratio of “annual solar insolation with
86 shade” to the “annual solar insolation without shade”. Shading from obstructions located on the
87 roof or any other part of the building shall not be included in the determination of annual solar
88 access.

89 **SENSIBLE RECOVERY EFFICIENCY.** The net sensible energy recovered by the supply
90 airstream as adjusted by any supply fan energy, energy consumption of other equipment
91 transferring heat to/from the supply airstream, case heat loss or heat gain, air leakage, airflow
92 mass imbalance between the two airstreams, and the energy used for defrost, as a percent of the
93 sum of the potential sensible energy that could be recovered from ambient conditions, the
94 exhaust fan energy, and the energy consumption of any other equipment transferring heat
95 to/from the exhaust airstream.

96 **Chapter 3: [RE] GENERAL REQUIREMENTS**

97 98 **SECTION R301 CLIMATE ZONES**

99
100 **R301** Replace Section R301 as follows:

101
102 **R301.1 General.** Massachusetts is in *climate zone 5A*

103 104 **Chapter 4: [RE] RESIDENTIAL ENERGY EFFICIENCY**

105 106 **SECTION R401 GENERAL**

107
108 **R401** Revise Section R401 as follows:

109
110 **R401.1 Scope.** This chapter applies to *residential buildings*. Municipalities which have adopted
111 the Stretch Energy Code shall use the energy efficiency requirements of this chapter, or
112 Appendix AJ or Chapter 51 where applicable for existing buildings. Municipalities which have

113 adopted the Municipal Opt-in Specialized Stretch energy code shall comply with R401.2.4
114 including both the requirements of Appendix RC and this chapter.

115

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

121 **Exception:** Additions under 1,000 sf shall comply with the requirements of Sections R402,
122 R403, and R404. Level 1 and Level 2 alterations, and repairs to existing buildings, shall comply
123 with Chapter 5 [RE].

124 **R401.2.1 Prescriptive Compliance option.**

125 The Prescriptive Compliance option requires compliance with Sections R401.2.5 through R404
126 and R408.

127

128 **R401.2.2 Passive House Building Certification option.**

129 The Passive House Building Certification option requires compliance with Sections R405 and
130 R404.4.

131

132 **R401.2.3 Energy Rating Index option.**

133 The Energy Rating Index (ERI) option requires compliance with Sections R406, R403.6 and
134 R404.4.

135

136 **R401.2.4 Appendix RC.** Residential Buildings and dwelling units covered by this chapter may
137 elect to comply with the requirements of IECC Appendix RC and R404 as amended.

138

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

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

143 2. For buildings electing to be *all-electric buildings*, both R408.2.2 and R408.2.3
144 shall apply for primary space heating and domestic hot water supply.

145

146 **SECTION R402 BUILDING THERMAL ENVELOPE**

147

148 *Table R402.1.2 Modify Table R402.1.2 as follows:*

149

150 **TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS^a AND FENESTRATION**
 151 **REQUIREMENTS**

CLIMATE ZONE	FENESTRATION UFACTOR ^f	SKYLIGHT UFACTOR	GLAZED FENESTRATION SHGC ^{d, e}	CEILING UFACTOR	WOOD FRAME WALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOOR UFACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
5 and Marine 4	0.30	0.55	NR	0.026	0.045	0.082	0.033	0.050	0.055

152
 153 *Table R402.1.3 Modify Table R402.1.3 as follows:*
 154

155 **TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION**
 156 **REQUIREMENTS BY COMPONENT^a**

157

CLIMATE ZONE	FENESTRATION UFACTOR ^f	SKYLIGHT UFACTOR	GLAZED FENESTRATION SHGC ^{d, e}	CEILING UFACTOR	WOOD FRAME WALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOOR UFACTOR	BASEMENT WALL R-VALUE ^{c, g}	SLAB ^d R-VALUE & DEPTH	CRAWL SPACE WALL R-VALUE
5 and Marine 4	0.30 ⁱ	0.55	NR	49	20&5ci or 13&10ci or 0&20	13/17	30	15ci or 19 or 13+5ci	10ci, 4 ft	15ci or 19 or 13+5ci

158
 159
 160 *R402.1.5.1 Add Subsection R402.1.5.1 as follows:*

161 **R402.1.5.1 Approved software for Total UA alternative:** The following software is approved
 162 for demonstrating Total UA compliance: REScheck-Web for 2023 Massachusetts Stretch Energy
 163 Code available at <http://www.energycodes.gov/rescheck>

164
 165 *R402.4.1.1 Amend Table R402.4.1.1 as follows:*

TABLE R402.4.1.1 AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	All insulation shall be installed at Grade I quality in accordance with ANSI/ICC/RESNET 301. Air-permeable insulation shall not be used as a sealing material.

167

168 **SECTION R403 SYSTEMS**

169

170 *R403.3.5* Revise Section R403.3.5 as follows:

171

172 **R403.3.5 Duct testing.** Ducts shall be pressure tested in accordance with ANSI/RESNET/ICC
173 380 or ASTM E1554 to determine air leakage by one of the following methods:

174

- 175 1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25
176 Pa) across the system, including the manufacturer's air handler enclosure if installed at the
177 time of the test. Registers shall be taped or otherwise sealed during the test.
- 178 2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch
179 w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure.
180 Registers shall be taped or otherwise sealed during the test. Postconstruction or rough-in testing
181 and verification shall be done by a HERS Rater, HERS Rating Field Inspector, or an applicable
182 BPI Certified Professional. A written report of the results of the test shall be signed by the party
183 conducting the test and provided to the *code official*.

184

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

187

188 *R403.6* Revise Section R403.6 as follows:

189

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

192

193 Each dwelling unit of a residential building shall be provided with a continuously operating
194 mechanical balanced ventilation system that has been site verified to meet a minimum airflow
195 per one of the following:

196

- 197 1. RESNET HERS Index in accordance with ANSI/RESNET/ICC Standard 301
- 198 2. ASHRAE Standard 62.2-2019 or 62.2-2022

- 199 3. the following formula for one- and two-family dwellings and townhouses of
 200 three or less stories above grade plane:

201
 202
$$Q = .03 \times CFA + 7.5 \times (N_{br} + 1) - 0.052 \times Q_{50} \times S \times WSF$$

203
 204 Where: CFA is the conditioned floor area in sq ft

205 N_{br} is the number of bedrooms

206 Q_{50} is the verified blower door air leakage rate in cfm measured at
 207 50 Pascals

208 S is the building height factor determined by this table:

209

stories above grade plane	1	2	3
S	1.00	1.32	1.55

210
 211 WSF is the shielded weather factor as determined by this table:

212

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

213
 214 **R403.6.1** *Revise Section R403.6.1 and Subsections R403.6.1.1 and R403.6.1.2 as follows:*

215
 216 **R403.6.1 Heat or Energy Recovery Ventilation.** Heat or energy recovery balanced ventilation
 217 systems shall be provided for dwelling units as specified in either Section R403.6.1.1 or
 218 R403.6.1.2, as applicable.

219
 220 **R403.6.1.1 Large Systems.** Systems with a rated airflow exceeding 300 cfm shall have an
 221 *enthalpy recovery ratio* of not less than 50% at cooling design condition and not less than 60

222 percent at heating design condition, determined in accordance with AHRI 1060 at an airflow not
223 less than the design airflow. Compliance to the *enthalpy recovery ratio* shall be demonstrated by
224 ratings at design conditions and airflows by software or catalogs certified by AHRI.

225
226 **R403.6.1.2 Other Systems.** Systems with a rated airflow of 300 cfm or less shall have a *sensible*
227 *recovery efficiency* (SRE) of not less than 65% at 32°F (0°C) at an airflow not less than the
228 design airflow. SRE shall be determined in accordance with CAN/CSAC439 and compliance to
229 the requirement shall be demonstrated by a listing in Home Ventilating Institute's Certified
230 Product Directory. Linear interpolation of listed values for SRE shall be permitted.

231
232 *R403.6.3 Revise Subsection R403.6.3 as follows:*

233
234 **R403.6.3 Testing and Verification.** Installed performance of the mechanical ventilation system
235 shall be tested and verified by a HERS Rater, HERS Rating Field Inspector, or an applicable BPI
236 Certified Professional, and measured using a flow hood, flow grid, Residential IAQ Fault
237 Indicator Display certified to the California Energy Commission, or other airflow measuring
238 device in accordance with either RESNET Standard 380 or ACCA Standard 5.

239
240 *R403.6.4 Add Subsection R403.6.4 as follows:*

241
242 **R403.6.4 Air-moving equipment, selection and installation.** As referenced in ASHRAE
243 Standard 62.2, Section 7.1, ventilation devices and equipment shall be tested and certified in
244 accordance with HVI 920 (Home Ventilating Institute), or equivalent, and the certification label
245 shall be found on the product. Installation of systems or equipment shall be carried out in
246 accordance with manufacturers' design requirements and installation instructions. Where
247 multiple duct sizes and/or exterior hoods are standard options, the minimum size shall not be
248 used.

249
250 *R403.6.5 Add Subsection R403.6.5 as follows:*

251
252 **R403.6.5 Sound Rating.** Sound ratings for fans used for whole building ventilation shall be
253 rated at a maximum of 1.0 sone.

254
255 **Exception:** HVAC air handlers and remote-mounted fans need not meet sound requirements.
256 There must be at least 4ft. of ductwork between the remote-mounted fan and intake grille.

257
258 *R403.6.6 Add Subsection R403.6.6 as follows:*

259
260 **R403.6.6 Documentation.** The owner and the occupant of the dwelling unit shall be provided
261 with information on the ventilation design and systems installed, as well as instructions on the
262 proper operation and maintenance of the ventilation systems. Ventilation controls shall be
263 labeled with regard to their function, unless the function is obvious or unless the function is
264 communicated through a digital user interface provided with the control.

265

266 **R403.6.7** Add Subsection R403.6.7 as follows:

267
268 **R403.6.7 Air Inlets and Exhausts.** All ventilation air inlets shall be located a minimum of 10 ft.
269 from vent openings for plumbing drainage systems, appliance vent outlets, exhaust hood outlets,
270 vehicle exhaust, or other known contamination sources; and shall not be obstructed by snow,
271 plantings, or any other material. Outdoor forced air inlets shall be covered with rodent screens
272 having mesh openings not greater than ½ inch. A whole house mechanical ventilation system
273 shall not extract air from an unconditioned basement unless approved by a registered design
274 professional. Where wall inlet or exhaust vents are less than 7 ft. above finished grade in the area
275 of the venting including, but not limited to, decks and porches, a metal or plastic identification
276 plate shall be permanently mounted to the exterior of the building at a minimum height of 8 ft.
277 above grade directly in line with the vent terminal. The sign shall read, in print size no less than
278 one-half (1/2) inch in size, "MECH. VENT DIRECTLY BELOW. KEEP CLEAR OF ALL
279 OBSTRUCTIONS".

280

281 **Exceptions:**

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

288

289 **SECTION R404 ELECTRICAL POWER AND LIGHTING SYSTEMS**

290

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

292

293 **R404.4 Wiring for electric vehicle ready parking spaces (“EV ready spaces”).** *EV ready*
294 *spaces* shall be provided in accordance with Table R404.4. The dedicated branch circuit shall be
295 identified as “EV READY” in the service panel or subpanel directory, and the termination
296 location shall be marked as “EV READY”. The circuit shall terminate in a NEMA receptacle or

297 a Society of Automotive Engineers (SAE) Standard SAE J1772 or SAE J3400 electrical
 298 connector for *EVSE* servicing *Electric Vehicles*, located within 6 ft. (1828 mm) of each *EV ready*
 299 *space*. Conductors and outlets for *EVSE* shall be sized and installed in accordance with the MA
 300 electrical code.

301 **TABLE R404.4 EV READY PARKING 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 all installed spaces served with a 40-amp, 208/240-volt circuit with a minimum capacity of 9.6 kVA.

302 **Exceptions:**

- 303 1. In no case shall the number of required *EV Ready Spaces* be greater than the
 304 number of parking spaces installed.
- 305 2. This requirement will be considered met if all spaces which are not *EV Ready* are
 306 separated from the premises by a public right-of-way.
- 307 3. R-1, and R-2 multi-family properties may elect to comply with Commercial EV
 308 ready requirements in C405.13.
- 309 4. One or more SAE Level II spaces may be substituted with multiple SAE Level I
 310 spaces provided with wiring for a minimum 20amp 120 volt EVSE, with a ratio of at
 311 least 3 Level I spaces for each Level II space required.

312
 313 **SECTION R405 TOTAL BUILDING PERFORMANCE**

314
 315 *R405 Replace Section R405 in its entirety as follows:*

316
 317 **Section R405 Passive House Building Certification Option.**

318
 319 **R405.1 Compliance.** Projects may document compliance with either Phius certification in
 320 accordance with R405.2.1 or PHI certification in accordance with R405.2.2 or follow R405.3.
 321 Buildings shall be pre-certified as meeting the Phius CORE 2021 or Phius ZERO 2021 Passive
 322 Building Standard – North America, or newer, demonstrated using approved Passive House
 323 certification software and program criteria by PHIUS, where design-certification is demonstrated
 324 by Phius and a Certified Passive House Consultant (CPHC); or, Projects meeting the Certified
 325 Passive House standard using the approved Passive House certification software and program
 326 criteria by the Passive House Institute (PHI), where PHI certification is demonstrated by a
 327 PHIIaccredited Certifier.

328
 329 **R405.2 Documentation.** Compliance with Phius or PHI shall be in accordance with
 330 R405.2.1 or R405.2.2.

331 **R405.2.1 Phius Documentation.**

332

333 1. Prior to the issuance of a building permit, the following items must be provided to
334 the Building Official:

- 335 a. A Passive House Verification report with results from the approved Passive
336 House certification software which demonstrates project compliance with Phius CORE 2021 (or
337 newer), or Phius ZERO 2021 (or newer) performance requirements.
- 338 b. A statement from the CPHC that the verification report results accurately reflect
339 the plans submitted.
- 340 c. Evidence of project registration from Phius.

341 OR

342 a. A Design Certification Letter from Phius.

343

344 2. Prior to the issuance of a final certificate of occupancy, the following items must
345 be provided to the building official:

- 346 a. Design Certification Letter from Phius.
- 347 b. An updated Passive House Verification Report with results from the approved
348 Passive House certification software which reflects “as-built” conditions and test
349 results (blower door and ventilation results) that demonstrate project compliance
350 with Phius performance requirements.
- 351 c. A statement from the CPHC that the envelope meets the Phius hygrothermal
352 requirements found in Appendix B of the Phius 2021 Certification guidebook.
- 353 d. A statement from the Phius project Verifier that the project test results meet the
354 model performance requirements, all the mandatory limits and any other
355 mandatory requirements.
- 356 e. A copy of the Phius workbook listing all testing results and as-built conditions.

357 OR

358 a. A Final Certification Letter, provided by Phius.

359 AND

360 f. Verification of compliance with R404.4 EV ready, and Appendix RB: Solar Ready Provisions.

361

362

363 **R405.2.2 Passive House Institute (PHI) Documentation.**

364 1. Prior to the issuance of a building permit, the following items must be provided to
365 the Building Official:

- 366 a. A PHPP (Passive House Planning Package) compliance report with results from
367 the approved Passive House certification software which demonstrates project
368 compliance with current PHI performance requirements;
- 369 b. A statement from the PHI-accredited Certifier that the approved Passive House
370 certification software results and compliance report accurately reflect the plans
371 submitted;
- 372 c. Evidence of project registration from a PHI-accredited Certifier.

373 OR

374 a. A Design State Conditional Assurance Letter from a PHI-accredited Certifier.

- 375 2. Prior to the issuance of a final certificate of occupancy, the following items must
376 be provided to the building official:
- 377 a. A Design State Conditional Assurance Letter from a PHI-accredited Certifier.
 - 378 b. An updated compliance report with results from the approved Passive House
379 certification software which reflects “as-built” conditions and test results (blower
380 door and ventilation results) that demonstrates project compliance with PHI
381 performance requirements;
 - 382 c. A copy of both the air leakage test results and report on the commission settings
383 and performance of the building’s ventilation system;
 - 384 d. A statement from the Certified Passive House Consultant or Certified Passive
385 House Designer that the project test results meet the model performance
386 requirements, all the mandatory limits and any other mandatory requirements.

387 OR

- 388 a. A Final Certification Letter from a PHI-accredited Certifier.

389 AND

- 390 e. Verification of compliance with R404.4 EV ready, and Appendix RB: Solar Read
391 Provisions.

392

393 **R405.3 Documentation of projects that pursued Phius or PHI certification that did not**
394 **achieve final certification.**

395 **R405.3.1 Compliance.** Buildings shall be pre-certified per Section R405.1. If, at construction
396 completion, final certification cannot be received from either Phius or PHI, this compliance
397 pathway may be followed to receive a certificate of occupancy based on compliance with
398 R405.3.2 Documentation. Compliance via R405.3.2 is not equivalent to either Phius or PHI
399 Certification and will not designate the project as a certified passive house.

400 **R405.3.2 Near Passive House Documentation.** The following materials are required:

- 401 **a.** Statement from the Phius certified consultant or PHI-accredited verifier
402 confirming project has completed all interim, final, and corrective testing and
403 modeling requirements, including a summary of deviations from certification
404 requirements.
- 405 **b.** Copy of executed contracts with Phius consultant or PHI rater/verifier
406 covering all required inspections and testing requirements for certification.
- 407 **c.** Design phase pre-certification/approval, in the form of a statement issued
408 from Phius or PHI-accredited verifier confirming design certification or pre-
409 certification was achieved.
- 410 **d.** Report from rater/verifier demonstrating as-built conditions, including
411 those that comply with Phius or PHI requirements, and those that do not.
 - 412 **i.** If the initial whole building blower door tests do not meet the
413 Phius or PHI airtightness requirement, a statement must be provided to
414 reflect evidence of a re-test. Statement shall include an explanation for

415 sources of leakage and attempted remediation efforts. Final test results
416 shall not exceed Phius or PHI airtightness thresholds by more than 30%.

417 **ii.** If the mechanical ventilation flow rates and balance do not meet
418 the requirements of Phius or PHI, report must show that installed
419 ventilation system demonstrates compliance with the mechanical code in
420 accordance with Section C403.

421 **e.** For projects with Phius design certification, provide final Energy Star and
422 Zero Energy Ready Homes certificates.

423 **f.** A letter from a licensed professional engineer that states that the potential
424 hygrothermal or moisture risk of the as-built assemblies, with the measured
425 blower door test result, is acceptably low.

426 SECTION 406 ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

427 **R406.2** *Revise TABLE R406.2 as follows:*

428 TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

429

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

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

432

433 **R406.3** *Reserve this section:*

434

435 **R406.3 Building thermal envelope.** *Reserved.*

436

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

438

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

443

444 **R406.5** *Revise Section R406.5 and Table R406.5 as follows:*

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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 a 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

	Maximum HERS Index score ^{a,b}			
	New construction permits after July 1, 2024	New Construction with R406.5.2 embodied carbon credit	Accessory Dwelling Units	Major alterations, additions, or change of use ^c
<i>Mixed-Fuel Building</i>	42	45	52	65
Solar Electric Generation	42	45	55	70
<i>All-Electric Building</i>	45	48	55	70
Solar Electric & <i>All-Electric Building</i>	45	48	58	75

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^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. ^c Alterations, Additions or Change of use covered by Section R502.1.1 or R503.1.5 are subject to this maximum HERS rating, except for *Historic Buildings* which may opt to follow R503.1.1 for *alterations*.

R406.5.1 Add Subsection R406.5.1 as follows:

R406.5.1 Trade-off for clean energy systems. Accessory dwelling units (ADUs) 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 4 kW or higher shall offset 3 HERS points for new ADUs, and 5 HERS points for alterations, change of use to Residential R-use occupancies or for fully attached additions.

469 2. *All-Electric Buildings* shall offset 3 HERS points for each dwelling unit in new
470 construction, including new ADUs, and 5 HERS points for alterations, change of use to
471 Residential R-use occupancies and fully attached additions.

472

473 **R406.5.2** Add Subsection R406.5.2 as follows:

474 **R406.5.2 Embodied carbon credit.** New construction following Section R406 may use either of
475 the following embodied carbon credits to increase the maximum allowable HERS rating for each
476 unit by 3 HERS points as shown in Table R406.5:

477 1. **Insulation embodied carbon credit:** new single *dwelling units* or R-use buildings
478 containing multiple *dwelling units* that demonstrate an average calculated insulation
479 Global Warming Potential (GWP) intensity (kg CO₂/m²) less than 0 across the whole
480 building envelope shall offset 3 HERS points for each applicable *dwelling unit* of new
481 construction. GWP intensity shall be based on the default values in Table R406.5.3, or
482 product specific EPDs or calculations in the approved tools: EC3 and BEAM, may be
483 used in place of default table values.

484

485 2. **Low GWP concrete mix credit:** new single *dwelling units* or R-use buildings containing
486 multiple *dwelling units* that demonstrate an average calculated concrete mix Global
487 Warming Potential (GWP) for at least 90% of all concrete mix used in the building of not
488 more than 100% of the 2022 NRMCA NorthEast Benchmark average values shown in
489 Table R406.5.4 shall offset 3 HERS points for each applicable *dwelling unit* of new
490 construction.

491 **R406.5.3** Add Subsection R406.5.3 as follows:

492 **R406.5.3 Documentation for insulation embodied carbon credit.** In order to apply the
493 insulation embodied carbon credit for a new *dwelling unit* or averaged across a multi-*dwelling*
494 *unit* building, the HERS rater of the unit or building must submit a complete calculation to
495 summarize estimated embodied carbon emissions from all insulation materials used in the
496 project. The output metric for this measure shall be Global Warming Potential (GWP) intensity,
497 capturing insulation GWP per conditioned square meter of project area. To complete the basic
498 calculation, project teams shall provide the following information for foundation, floor, wall, and
499 roof insulation materials:

- 500 1. Insulation material type
- 501 2. Product R-value
- 502 3. Total surface area (m²)
- 503 4. Default, industry-average GWP value, from Table R406.5.3 or GWP values
504 from Type III Product-specific Environmental Product Declaration (EPD)
- 505 5. Total project area (conditioned square feet)

506 Projects may substitute product-specific data for the default GWP value if the specified product
507 has a lower reported GWP than the default value. Substitution of default GWP values is only
508 allowed when type III product-specific EPDs are sourced and noted. Projects shall use GWP
509 values that include A1-A3 lifecycle stages, as documented in product-specific EPDs, with the

510 exception of SPF and XPS products. For these products, the A5 and B1 values shall be included
 511 in the documented GWP value to account for the on-site and off-gassing impact of blowing
 512 agents. Projects shall provide the EPDs declaration number in product-specific data substitution.

513 **TABLE R406.5.3** Add Table R406.5.3 as follows:

514 **TABLE R406.5.3 DEFAULT INSULATION GLOBAL WARMING POTENTIAL**
 515 **VALUES**

516 All values are from Building Emissions Accounting for Materials (BEAM)^a, unless noted.

Insulation Material	Default Global Warming Potential (GWP) in Kg CO₂e/ sq.m. RSI-1
Cellular glass – Aggregate	3.93 ^b
Cellulose – Densepack	-2.00
Cellulose – Blown/loosefill	-0.90
Cork – Board	-4.30
EPS/graphite – Board, unfaced, Type II – 15 psi	2.30
EPS/graphite – Board, unfaced, Type IX – 25 psi	3.10
EPS – Board, unfaced, Type I – 10 psi	2.50
EPS – Board, unfaced, Type II – 15 psi	3.40
EPS – Board, unfaced, Type IX – 25 psi	4.30
Fiberglass – Batt, unfaced	1.00
Fiberglass – Blown/loosefill	1.00
Fiberglass – Blown/spray	1.93 ^c
Hemp – Batt	-0.50
HempCrete	-4.10
Mineral wool – Batt, unfaced	1.50
Mineral wool – Blown loose fill	1.90
Mineral wool – Board, unfaced, “light” density	2.70 ^f
Mineral wool – Board, unfaced, “heavy” density	6.90 ^f
Phenolic foam – Board	1.54 ^d
Polyiso – Wall Board	4.10 ^e
Polyiso – Roof Board (GRF facer)	2.11 ^e
Polyiso – Roof Board (CGF facer)	2.95 ^e
SPF – Spray, open cell	1.40
SPF – Spray, closed cell HFO	3.50
SPF – Spray, high density HFO	4.00
SPF – Spray, closed cell HFC	13.10
SPF – Spray, high density HFC	17.00
Straw - Panel	-5.45

Vacuum Insulated Panel	7.40
Wood fiber – Board unfaced, European	-4.38
Wood fiber – Board unfaced, North America	-10.30
Wood fiber – Batt, unfaced	-1.60
Wool (Sheep) - Batt	0.20
Wool (Sheep) - Loosefill	0.80
XPS – Board, 25psi HFC	55.5
XPS – Board, 25psi “Low GWP” (HFO/HFC)	5.50

517 ^a<https://www.buildersforclimateaction.org/beam-estimator.html> ^bEPD

518 Declaration Number ^cEPD Declaration Number ^dEPD Declaration

519 Number EPD-KSI-20190072-IBC1-EN ^ePIMA published ISO-

520 compliant EPDs for polyiso products at:

521 <https://www.polyiso.org/page/EPDs>

522 ^fNAIMA value

523

524 **R406.5.4 Add Subsection R406.5.4 as follows:**

525 **R406.5.4 Documentation for low GWP concrete mix credit.** In order to apply the low GWP
526 concrete mix credit for one or more new dwelling units, the HERS rater of the unit must submit
527 specific EPDs for concrete used in the unit. Where multiple concrete mixes are used, a complete
528 calculation to summarize estimated embodied carbon emissions from at least 90% of all concrete
529 materials used in the project is required. The output metric for this measure shall be global
530 warming potential (GWP) per cubic meter as supplied, with the EPD verified by the concrete
531 ready-mix provider. The 3 HERS point credit shall be applied when the GWP per cubic meter is
532 demonstrated to be less than the Maximum GWP per cubic meter value shown in Table
533 R406.5.4. for at least 90% of all concrete used for that unit or building as appropriate.

534 **Table R406.5.4 Add Table R406.5.4 as follows:**

535 **TABLE R406.5.4 DEFAULT CONCRETE GLOBAL WARMING POTENTIAL**
536 **VALUES**

Maximum GWP (kg CO ₂ e) Limits for Concrete	
NORMAL WEIGHT CONCRETE	
Specified Compressive (f'c in psi)	Maximum GWP per cubic Strength meter ^a
0-2500	240
2501-3000	264
3001-4000	314
4001-5000	378
5001-6000	399
6001-8000	472

LIGHT WEIGHT CONCRETE	
Specified Compressive Strength (f'c in psi)	Maximum GWP per cubic meter ^a
0-3000	517
3001-4000	573
4001-5000	628
^a These numbers are 100% of the Eastern Region average GWP figures from the National Ready Mix Concrete Associations' "A Cradle-to-Gate Life Cycle Assessment of Ready-Mixed Concrete Manufactured by NRMCA Members, Version 3.2," (July 2022), pg. 65. NRMCA_LCAReportV3-2_20220224.pdf	

537

538 **R406.6** *Revise Section R406.6 as follows:*

539

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

544

545 **R407** *Reserve this Section:*

546

547 **SECTION R407 RESERVED**

548

549 **R408** *Revise Section R408 as follows:*

550

551 **SECTION R408 ADDITIONAL EFFICIENCY PACKAGE OPTIONS**

552

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

555

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

558

559 **R408.2.1 Enhanced envelope performance option.**

560 The total *building thermal envelope* UA, the sum of U-factor times assembly area, shall be less
 561 than or equal to 90% of the total UA resulting from multiplying the U -factors in Table R402.1.2
 562 by the same assembly area as in the proposed building. The UA calculation shall be performed in
 563 accordance with Section R402.1.5.

564

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

567

- 568 1. Greater than or equal to 8.1 HSPF2 and 15.2 SEER2 for ducted heat pumps and
569 8.5 HSPF2 and 16 SEER2 for ductless heat pumps.
570
571 2. Greater than or equal to 3.5 COP ground source heat pump.
572

573 For multiple cooling systems, all systems shall meet or exceed the minimum efficiency
574 requirements in this section and shall be sized to serve 100 percent of the cooling design
575 load. For multiple heating systems, all systems shall meet or exceed the minimum
576 efficiency requirements in this section and shall be sized to serve 100 percent of the
577 heating design load.
578

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

- 581 1. Greater than or equal to 2.0 UEF electric service water-heating system.
582 2. Greater than or equal to 0.4 solar fraction solar water-heating system.
583

584 **Chapter 5: [RE] EXISTING BUILDINGS**

585 **SECTION R501 GENERAL.**

586
587
588 *R501.2 Amend Section R501.2 to add an exception as follows:*
589

590 **R501.2 Compliance.** Additions, alterations, repairs or changes of occupancy to, or relocation of,
591 an existing building, building system or portion thereof shall comply with Section R502, R503,
592 R504 or R505, respectively, in this code. Changes where unconditioned space is changed to
593 conditioned space shall comply with Section R502
594

595 **Exception:** Projects that elect to follow Section R506 EnerPHit Standard.
596

597 **SECTION R502 ADDITIONS.**

598
599 *R502.1 Revise Section R502.1 as follows:*
600

601 **R502.1 General.** *Additions* to an existing *building*, *building* system or portion thereof shall
602 conform to the provisions of this code as those provisions relate to new construction without
603 requiring the unaltered portion of the existing *building* or *building* system to comply with this
604 code. *Additions* shall not create an unsafe or hazardous condition or overload existing *building*
605 systems. An *addition* shall be deemed to comply with this code where the *addition* alone
606 complies, where the existing *building* and *addition* comply with this code as a single building, or
607 where the *dwelling unit* with the *addition* achieves a certified HERS rating in accordance with
608 Table R406.5. *Additions* shall be in accordance with Section R502.1.1, R502.2 or R502.3.
609

610 *R502.1.1 Add Subsection R502.1.1 as follows:*
611

612 **R502.1.1 Large additions.** *Additions* to a *dwelling unit* exceeding 1,000 sq ft or exceeding
613 100% of the existing *conditioned floor area*, shall require the combined *dwelling unit* to comply
614 with the maximum HERS ratings for alterations, additions or change of use shown in Table
615 R406.5.

616

617 **Exception:** *Additions* that add existing basement or attic spaces to the *conditioned floor area* of
618 an existing *dwelling unit* due to changing the thermal boundary but not changing the building
619 footprint or roofline do not require a HERS rating.

620 **R502.2** *Revise Section R502.2 by deleting the Exceptions:*

621

622 **R502.2 Change in space conditioning.** Any unconditioned or low-energy space that is altered
623 to become *conditioned space* shall be required to be brought into full compliance with Chapter 5,
624 as appropriate.

625

626 **R502.3.1** *Revise the Exception in Subsection R502.3.1 as follows:*

627

628 **R502.3.1 Building envelope.** New *building envelope* assemblies that are part of the *addition*
629 shall comply with Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4.

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

632

633 SECTION R503 ALTERATIONS

634

635 **R503.1.1** *Revise Exception 2 as follows:*

636

637 Existing ceiling, wall or floor cavities exposed during construction provided that these cavities
638 are filled with insulation with a minimum of R-3.7 per inch for the depth of the cavity.

639

640 **R503.1.5** *Add new Subsection R503.1.5 as follows:*

641

642 **R503.1.5 Extensive Alterations and Level 3 Alterations.** Alterations that meet either of the
643 following criteria shall require the building or *dwelling unit* to comply with the maximum HERS
644 ratings for alterations, additions or change of use shown in Table R406.5:

645

646 1) Meet the IRC definition for *Extensive Alteration* and that exceeds 1000 sq ft or
647 100% of the existing conditioned floor area of the dwelling unit for one- and two-
648 family dwellings and multiple single-family dwellings(townhouses).

649

650 2) Meet the IEBC definition for *Level 3 Alteration* and that exceeds 1000 sq ft or
651 100% of the existing conditioned floor area of the building area for Group R-2, R-3,
652 and R4 buildings with three stories or less in height above grade plane, other than
653 one- and two-family dwellings and multiple single-family dwellings(townhouses).

654 **SECTION R505 CHANGE OF USE OR OCCUPANCY**

655

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

657

658 *R506 Add Section R506 as follows:*

659

660 **SECTION R506 ENERPHIT STANDARD COMPLIANCE PATHWAY**

661

662 **R506 EnerPHit Standard.** This option requires compliance with Sections R506.1 and R506.2.

663

664 **R506.1 Compliance.** Buildings shall be pre-certified as meeting the EnerPHit Retrofit Plan
665 standard using the approved Passive House certification software and program criteria by the
666 Passive House Institute (PHI), where PHI certification is demonstrated by a PHI-accredited
667 Certifier.

668

669 **R506.2 Documentation.**

670

671 1. Prior to the issuance of a building permit, the following items must be provided to
672 the Building Official:

673

674 a. A PHPP compliance report with results from the approved Passive House
675 certification software which demonstrates project compliance with current PHI
676 performance requirements;

677 b. A statement from the PHI-accredited Certifier that the approved Passive
678 House certification software results and compliance report accurately reflect the
679 plans submitted;

680 c. Evidence of project registration from a PHI-accredited Certifier.

681 OR

682 a. A Design State Conditional Assurance Letter from a PHI-accredited Certifier.

683

684 2. Prior to the issuance of a final certificate of occupancy, the following items must
685 be provided to the building official:

686

687 a. A Design State Conditional Assurance Letter from a PHI-accredited
688 Certifier.

689 b. An updated compliance report with results from the approved Passive
690 House

691 certification software which reflects “as-built” conditions and test results (blower door and
692 ventilation results) that demonstrates project compliance with PHI performance requirements;

693 c. A copy of both the air leakage test results and report on the commission
694 settings and performance of the building’s ventilation system;

695 d. A statement from the Certified Passive House Consultant or Certified
696 Passive House Designer that the project test results meet the model performance
697 requirements, all the mandatory limits and any other mandatory requirements.

698 OR

699 a. A Final Certification Letter from a PHI-accredited Certifier.

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712 *Appendix RB* revise the Appendix RB title as follows:

713 **Appendix RB: Solar-ready Provisions – Detached One- and Two-family Dwellings, Lowrise**
714 **Residential buildings and Townhouses** (Adopted as amended)

715

716 *RB101.1* Revise Section RB101.1 as follows:

717

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

720

721 **Exception:** Buildings and *dwelling units* complying with Appendix RC Sections RC102
722 or RC105.

723

724 *RB103.1* Replace Section RB103.1 as follows:

725

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

730

731 **Exceptions:**

732 1. New residential buildings with a permanently installed on-site renewable
733 energy system.

734 2. A building with a solar-ready zone that is shaded for more than 70% of
735 daylight hours annually.

736

737 *RB103.3* Replace Section RB103.3 as follows:

738

739 **RB103.3 Solar-ready zone area.** The total solar-ready zone area shall be not less than 300 sq.
740 ft.

741 (27.87 m²) exclusive of mandatory access or set back areas as required by the Massachusetts
742 Fire Code. New townhouses three stories or less in height above grade plane and with a total
743 floor area less than or equal to 2,000 sq. ft. (185.8 m²) per *dwelling unit* shall have a solar-ready
744 zone area of not less than 150 sq. ft. (13.94 m²). The solar-ready zone shall be composed of areas
745 not less than 5 ft. (1524 mm) in width and not less than 80 sq. ft. (7.44 m²) exclusive of access or
746 set back areas as required by the Massachusetts Fire Code.

747
748
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750

Appendix RC Revise the *Appendix RC* title and notes as follows:

751 **APPENDIX RC – MASSACHUSETTS MUNICIPAL OPT-IN SPECIALIZED STRETCH**
752 **CODE 2024 RESIDENTIAL LOW-RISE BUILDING PROVISIONS**

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

758
759
760

User Note:

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

764
765
766
767

SECTION RC101 COMPLIANCE

768 ***RC101** Replace Section RC101 as follows:*

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

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

776
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RC101.2 Application. New *dwelling units* over 4,000 sq.ft. 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.

780 R-use buildings with total *conditioned floor area* greater than 12,000 sq.ft. shall comply with the
781 provisions of Section R405 Passive House Building Certification Option, and any of the pathways
782 in Section RC101.1.

783 **Exception:** Residential *Group R-1* occupancies containing *sleeping units* where the
784 occupants are primarily *transient* in nature such as hotels (*transient*) and motels
785 (*transient*) may comply with R401.2.1 Prescriptive compliance option including R401.2.5
786 Additional Energy Efficiency.
787
788

789 **RC101.3 Definitions.**

790
791 **NET ZERO BUILDING.** A building which is consistent with achievement of MA 2050 net
792 zero emissions, through a combination of highly energy efficient design together with being
793 either a *Zero Energy Building*, or an *All-Electric Building*, or where fossil fuels are utilized, a
794 building fully pre-wired for future electrification and that generates solar power on-site from the
795 available *Potential Solar Zone Area*.

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

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

801 **SECTION RC102 ZERO ENERGY PATHWAY**

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

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

- 809 1. HERS value not including on-site power production (OPP) calculated in
810 accordance with ANSI/RESNET/ICC 301.
- 811 2. HERS value including on-site power production calculated in accordance
812 with RESNET/ICC 301 with the OPP in Equation 4.1.2 of ANSI/RESNET/ICC
813 301.
814

815 **TABLE RC102.2 MAXIMUM HERS RATING INDEX_a**

816

FUEL USAG E	HERS INDEX not including OPP	HERS INDEX not including OPP, with embodied carbon credit^b	Accessory Dwelling Unit HERS INDEX not including OPP	HERS INDEX including OPP
All Electric	45	48	55	0
Mixed-Fuel	42	45	52	0

- 817 a. The *dwelling unit* shall meet the mandatory requirements of Section
818 R406.2.
819 b. Embodied carbon credit in accordance with R406.5.2, and R406.5.3 or
820 R406.5.4.

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

822 **SECTION RC103 ALL ELECTRIC PATHWAY**

823

824 **RC103.1 General.** New *all electric buildings* shall comply with Section R401.2.5 and either
825 Section RC103.2 to demonstrate a certified final HERS rating for each *dwelling unit*, or Section
826 R405 and be pre-certified to the PHI or Phius CORE standard.

827

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

830

831 **RC103.2 All Electric HERS Rating Index score.** Compliance with this section requires that the
832 rated design for each *dwelling unit* be shown to have a certified HERS Index score less than or
833 equal to the values in Table RC103.2 when compared to the HERS reference design determined
834 in accordance with ANSI/RESNET/ICC 301:

835

836 **TABLE RC103.2 MAXIMUM HERS RATING INDEX^a**

837

FUEL USAGE	HERS INDEX not including OPP	HERS INDEX not including OPP, with embodied carbon credit^b	Accessory Dwelling Unit HERS INDEX not including OPP
All Electric	45	48	55

- 838 a. The *dwelling unit* shall meet the mandatory requirements of Section
839 R406.2.
840 b. Embodied carbon credit in accordance with R406.5.2, and R406.5.3 or
841 R406.5.4.

842 **RC104** Add Section RC104 and Table RC104.2 as follows:

843 **SECTION RC104 MIXED-FUEL PATHWAY**

844

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

849

850 1. HERS certification: Sections RC104.2 through RC104.5 and RC105

851 2. Passive House pre-certification: Section R405 and Section RC104.3

852

853

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

857

858 **RC104.2 HERS Rating Index score.** Compliance with this section requires that the rated design
859 be shown to have a HERS Index score less than or equal to the values in Table RC104.2 when
860 compared to the HERS reference design determined in accordance with ANSI/RESNET/ICC 301:

861

862 **TABLE RC104.2 MAXIMUM HERS RATING INDEX^a**

FUEL USAGE	HERS INDEX not including OPP	HERS INDEX not including OPP, with embodied carbon credit^b	Accessory Dwelling Unit HERS INDEX not including OPP
Mixed-Fuel building	42	45	52

863

a. The *dwelling unit* shall meet the mandatory requirements of Section R406.2.

864

b. Embodied carbon credit in accordance with R406.5.2, and R406.5.3 or R406.5.4.

865

866

867

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

873

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

876

1. Natural drainage for condensate from cooling equipment operation or a condensate drain located within 3 ft. (914 mm), and

877

878 2. A dedicated branch circuit in compliance with IRC Section
879 E3702.11 based on heat pump space heating equipment sized in
880 accordance with R403.7 and terminating within 3 ft. (914 mm) of the
881 location with no obstructions. Both ends of the branch circuit shall be
882 labeled “For Future Heat Pump Space Heater.”

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

886
887 **RC104.3.2 Household ranges and cooking appliances.** An individual branch circuit outlet with
888 a minimum rating of 250-volts, 40-amperes shall be installed within 3 ft. of each gas or propane
889 range or permanently installed cooking appliance.

890
891 **RC104.3.3 Household clothes dryers and water heaters.** An individual branch circuit outlet
892 with a minimum rating of 250-volts, 30-amperes shall be installed within 3 ft. of each gas or
893 propane household clothes dryer and water heater.

894
895 **RC104.3.4 Water heating space.** Any permanently installed domestic hot water heating
896 equipment shall be installed in an indoor space:

897 A) with a minimum volume of 700 cu. ft. (20,000 L) or the equivalent of one 16-inch
898 (406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203 mm) duct of
899 no more than 10 ft. (3048 mm) in length for cool exhaust air.

900 B) that is at least 3 ft. (914 mm) by 3 ft. (914 mm) by 7 ft. (2134 mm) high
901 surrounding or within 3 ft. (914 mm) of the installed water heater.

902 903 **RC104.4 On-site renewable energy**

904 New buildings shall comply with either RC104.4.1 or RC104.4.2. Buildings with *dwelling units*
905 following HERS certification shall comply with the requirements of RC105 solar-roof zone.
906 Buildings following the Passive House pre-certification shall comply with Appendix RB solar
907 ready provisions.

908
909 **RC104.4.1 One- and two- family dwellings and townhouses.** One- and two- family dwellings
910 and townhouses shall install an on-site renewable energy system with a nameplate DC power
911 rating measured under standard test conditions, of not less than 4kW per *dwelling unit*.

912 913 **Exception:**

914 1. A building or where the potential solar *zone area* is less than 300 sq.ft.

915
916 **RC104.4.2 Other group R occupancies.** Buildings in Group R-2, R-3 and R-4 shall install an
917 on-site renewable energy system with a rated capacity of not less than 0.75 W/ft² multiplied by
918 the gross conditioned floor area.

919 920 **Exceptions:**

- 921 1. A building with a permanently installed domestic solar water heating system
- 922 with a minimum solar savings fraction of 0.5.
- 923 2. A building where the *potential solar zone area* is less than 300 sq.ft.

924
925 **RC104.5 Electric vehicle readiness.** All buildings shall comply with Section R404.4 Wiring for
926 electric vehicle charging spaces.

927
928 **RC105 Add Section RC105 as follows:**

929 **SECTION RC105 SOLAR-ROOF ZONE**

930
931 **RC105.1 General.** New detached one- and two-family dwellings, and townhouses with not less
932 than 600 sq.ft. (55.74 m²) of roof area oriented between 110 degrees and 270 degrees of true north
933 shall comply with Sections RC105.2 through RC105.10.

934
935 **Exception:** A building where all areas of the roof that would otherwise meet the
936 requirements of Section RC105 are in full or partial shade for more than 70% of daylight
937 hours annually.

938
939 **RC105.2 Construction document requirements for solar zone.** Construction documents shall
940 indicate the solar zone.

941 **RC105.3 Solar zone area.** The total solar zone area shall be not less than 300 sq.ft. (27.87 m²)
942 exclusive of mandatory access or setback areas as required by the *MA Fire Code*. New townhouses
943 three stories or less in height above grade plane and with a total floor area less than or equal to
944 2,000 sq.ft. (185.8 m²) per *dwelling unit* shall have a solar zone area of not less than 150 sq.ft.
945 (13.94 m²). The solar zone shall be composed of areas not less than 5 feet (1524 mm) in width and
946 not less than 80 sq.ft. (7.44 m²) exclusive of access or setback areas as required by the *MA Fire*
947 *Code*.

948
949 **RC105.4 Obstructions.** Solar zones shall be free from obstructions, including but not limited to
950 vents, chimneys, and roof-mounted equipment.

951
952 **RC105.5 Shading.** The solar zone shall be set back from any existing or new
953 permanently affixed object on the building or site that is located south, east or west of
954 the solar zone a distance not less than two times the object's height above the nearest
955 point on the roof surface. Such objects include, but are not limited to, taller portions of
956 the building itself, parapets, chimneys, antennas, signage, rooftop equipment, trees and
957 roof plantings.

958
959 **RC105.6 Capped roof penetration sleeve.** A capped roof penetration sleeve shall be
960 provided adjacent to a solar zone located on a roof slope of not greater than 1 unit vertical
961 in 12 units horizontal (8% slope). The capped roof penetration sleeve shall be sized to
962 accommodate photovoltaic system conduit and shall have an inside diameter of not less
963 than 1¹/₄ inches (32 mm).

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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.

980 **CHAPTER 6 [RE] REFERENCED STANDARDS**

981

982 **REFERENCED STANDARDS** *Add the following Referenced Standards:*

983

984 **AHRI** Air-Conditioning, Heating & Refrigeration Institute

985 2311 Wilson Blvd., Suite 400,

986 Arlington, VA 22201

987 1060-2018. Performance Rating of Air-To-Air Exchangers for Energy Recovery

988 Ventilation Equipment.

989 **CSA** CSA Group

990 8501 East Pleasant Valley Road,

991 Cleveland, OH 44131-5516

992 CAN/CSA-C439-18. Laboratory methods of test for rating the performance of heat/energy
993 recovery ventilators.

994

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1001

1002 **REGULATORY AUTHORITY**

1003

1004

1005 M.G.L. c. 25A, §. 6; St. 2021, c. 8.

1006 **225 CMR 23.00: MASSACHUSETTS STRETCH CODE AND SPECIALIZED CODE**
1007 **FOR COMMERCIAL, MULTI-FAMILY AND ALL OTHER**
1008 **CONSTRUCTION – 2024 AMENDMENTS TO IECC2021 AND ASHRAE STANDARD**
1009 **90.1-2019 (Note: please see 225 CMR 22.00 for Residential Low-Rise construction)**
1010
1011

1012 **Chapter 1: [CE] SCOPE AND ADMINISTRATION**
1013

1014 **225 SECTION C103 CONSTRUCTION DOCUMENTS**
1015

1016 **C103.2** *Revise and insert into Section C103.2 as follows:*

1017 **C103.2 (2)** *Replace C103.2(2) as follows:*

1018 2. For projects greater than 20,000-sf, backstop compliance and thermal bridge derating
1019 calculations performed in accordance with latest edition of *Massachusetts Stretch Energy Code*
1020 *Technical Guidance, Attachment A, Envelope Performance and Thermal Bridge Derating.*

1021 For projects up to 20,000-sf, envelope information in COMcheck submittal per Section
1022 C103.2.2.

1023 **Exception:** Projects following either of the Certified Performance Standard Compliance
1024 pathways in Section C401.2.2 (Passive House or HERS Compliance).

1025 **C103.2** *Insert the following after Subsection C103.2(13):*

1026 14. Solar Ready roof zone in accordance with Appendix CB, or *Potential Solar Zone Area* in
1027 accordance with Appendix CC.

1028 15. EV Ready Spaces locations in accordance with C405.13

1029 16. For buildings using the Relative Performance Pathway (C407.2) because average
1030 ventilation at full occupancy is greater than 0.5 cfm/sf, submit mechanical equipment
1031 schedules for all new and/or existing air handling equipment designed to supply any quantity
1032 of outdoor air to the space, and an airflow riser diagram encompassing the complete project
1033 boundary. Mechanical equipment schedules shall clearly indicate the total design outdoor
1034 airflow for each unit. The air riser diagram shall include all supply, exhaust, and return air
1035 systems serving the space. The air riser diagram shall also include a summary of the total
1036 outdoor air supplied, the total gross square footage served by the ventilation system, and the
1037 overall flow rate per area in cfm/sf.

1038 17. For mixed fuel building following Appendix CC, construction documents showing
1039 electric HVAC retrofit design prepared by the HVAC engineer. The contract documents
1040 shall show future replacement of *combustion equipment* based HVAC system with an
1041 equivalent all electric system. Contract documents shall show *combustion equipment* to be
1042 replaced, future electric equipment, supporting electric, structural, and architectural
1043 infrastructure to be installed during building construction, and space allotments for future
1044 equipment.

1045 18. District Energy System Order of Conditions issued by the Department of Energy
1046 Resources (DOER), if applicable.

1047 *C103.2.2 Add the following Subsection:*

1048

1049 **C103.2.2 COMcheck Submittal and Simulation Guidelines.**

1050 1. For projects up to 20,000-sf, the construction documents submitted with the
1051 application for permit shall be accompanied by completed COMcheck Envelope,
1052 Lighting and Mechanical Compliance Certificates, and a Plan Review Inspection
1053 Checklist for the purposes of demonstrating compliance with the energy provisions of
1054 225 CMR 23.00: *Stretch Energy Code*.

1055 2. For projects greater than 20,000-sf, the construction documents submitted with
1056 the application for permit shall be accompanied by completed COMcheck Lighting and
1057 Mechanical Compliance Certificates, and a Plan Review Inspection Checklist.

1058 3. For projects greater than 20,000-sf which are following C401.2.1 Part 3, Relative
1059 Performance Compliance, the construction documents submitted with the application for
1060 permit shall be accompanied with completed calculations performed in accordance with
1061 latest edition of *Massachusetts Stretch Energy Code Technical Guidance, Attachment B,*
1062 *ASHRAE Appendix G Relative Performance Simulation Guidelines*.

1063 4. For projects greater than 20,000-sf which are following C401.2.1 Part 2, Targeted
1064 Performance Compliance, the construction documents submitted with the application for
1065 permit shall be accompanied with completed calculations performed in accordance with
1066 latest edition of *Massachusetts Stretch Energy Code Technical Guidance, Attachment C,*
1067 *Targeted Performance Simulation Guidelines*.

1068 **Exception:** Projects documenting compliance following either of the C401.2.2 Certified
1069 Performance Standard Compliance pathways (Passive House or HERS Compliance) shall follow
1070 applicable reporting requirements detailed Section C407.

1071

1072 **Chapter 2: [CE] DEFINITIONS**

1073

1074 **226 SECTION C202 GENERAL DEFINITIONS**

1075

1076 *C202 Add the following definitions:*

1077 **ALL-ELECTRIC BUILDING.** A building with no on-site *combustion equipment* for fossil fuel
1078 use or capacity for including fossil fuel use in space heating, water heating, cooking, or drying
1079 appliances.

1080

1081 **227 AUTOMATIC LOAD MANAGEMENT SYSTEMS (ALMS).** A control system that
1082 allows
1083 multiple connected *electric vehicle supply equipment (EVSE)* to share a circuit or panel and
1084 automatically manage power at each charger, reducing the total connected electrical capacity of
1085 all *EVSE*.

1086

1087 **CLASS 3 EXHAUST.** Exhaust meeting the definition of Class 3 air in ASHRAE/ASHE
1088 Standard 62.1-2019, including air with significant contaminant concentration, significant
1089 sensory-irritation intensity, or offensive odor. The Class 3 Exhaust system must be capable of
1090 reducing exhaust and makeup airflow rates to 50% of the zone design values or the minimum
1091 required to maintain pressurization relationship requirements.

1092
1093 **CLASS 4 EXHAUST.** Exhaust meeting the definition of Class 4 air in ASHRAE/ASHE
1094 Standard 62.1-2019, including laboratory fume hood exhaust, exhaust where energy recovery is
1095 not allowed by ASHRAE/ASHE Standard 170 for use in energy recovery systems with leakage
1096 potential, and systems exhausting toxic, flammable, paint or corrosive fumes or dust. The Class
1097 4 Exhaust system must be capable of reducing exhaust and makeup airflow rates to 50% of the
1098 zone design values or the minimum required to maintain pressurization relationship
1099 requirements. Excludes *exempt exhaust*.

1100
1101 **CLEAN BIOMASS HEATING SYSTEM.** Wood-pellet fired central boilers and furnaces with
1102 less than 3 million Btu/hour rated heat input, where the equipment has a thermal efficiency rating
1103 of 85% (higher heating value) or greater; and a particulate matter emissions rating of no more
1104 than 0.08 lb. PM_{2.5}/MMBtu heat output. Or wood chip fired central boilers and furnaces with less
1105 than 3 million Btu/hour rated heat input, where the equipment has a thermal efficiency rating of
1106 80% or greater and a particulate matter emissions rating of no more than 0.10 lb. PM_{2.5}/MMBtu
1107 heat output.

1108
1109 **COMBUSTION EQUIPMENT.** Any *equipment* or *appliance* used for space heating, *service*
1110 *water heating*, cooking, clothes drying and/or lighting that can use *fuel gas*, *fuel oil* or solid fuel
1111 and that is not a *clean biomass heating system*.

1112 **DEDICATED OUTSIDE AIR SYSTEM (DOAS).** A ventilation system that supplies 100%
1113 outdoor air primarily for the purpose of ventilation and that is a separate system from the zone
1114 space-conditioning system.

1115 **DISTRICT ENERGY SYSTEM.** A system for transferring heat energy from a centralized
1116 location to a distributed network of buildings through a system of pipes for the purposes of
1117 building space heating and/or space cooling and/or service water heating.

1118 **DISTRICT ENERGY SYSTEM, HEAT RECOVERY ENABLED.** A *district energy system*
1119 capable of recovering excess heat energy from buildings on the distributed network which are in
1120 cooling mode for useful space and/or service water heating in other buildings on the network.

1121 **228 DISTRICT ENERGY SYSTEM ORDER OF CONDITIONS.** A document issued by
1122 the Commonwealth of Massachusetts Department of Energy Resources which regulates the
1123 decarbonization and *efficient electrification* of all energy inputs of a *district energy system* for
1124 the purposes of building energy code compliance.

1125 **EFFICIENT ELECTRIFICATION.** Space heating using equipment having a system
1126 efficiency and a coefficient of performance greater than one (100%) at outdoor design

1127 temperature or water heating equipment with a system efficiency or Uniform Energy Factor
1128 (UEF) of greater than two (200%) at indoor operating temperature.

1129 **ELECTRIC VEHICLE.** An automotive-type vehicle for on-road use, such as passenger
1130 automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles, and
1131 the like, primarily powered by an electric motor that draws current from a rechargeable
1132 storage battery, fuel cell, photovoltaic array, or other source of electric current. *Informational*
1133 *note: defined as in 527 CMR 12 section 625.2.*

1134 **ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE):** The conductors, including the
1135 ungrounded, grounded, and equipment grounding conductors, and the *electric vehicle* connectors,
1136 attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically
1137 for the purpose of transferring energy between the premises wiring and the *electric vehicle*.
1138 *Informational note: defined as in 527 CMR 12 section 625.2.*

1139
1140 **229 ELECTRIC VEHICLE READY PARKING SPACE (“EV Ready Space”).** A
1141 designated
1142 parking space which is provided with wiring and electrical service sufficient to provide AC level
1143 II or equivalent EV charging, as defined by Standard SAE J1772 or SAE J3400 for *EVSE* servicing
1144 light duty *Electric Vehicles*.

1145
1146 **ENTHALPY RECOVERY RATIO.** The ratio of change in enthalpy of the entering supply
1147 airflow and the leaving supply airflow to the difference in enthalpy between the entering supply
1148 airflow and the entering exhaust airflow, with no adjustment to account for that portion of the
1149 psychrometric change in the leaving supply airflow that is the result of leakage of entering
1150 exhaust airflow rather than exchange of heat or moisture between the airstreams.

1151 **EXEMPT EXHAUST.** Exhaust for which energy recovery systems are prohibited by the
1152 applicable International Mechanical Code.

1153
1154 **EXHAUST SOURCE HEAT PUMP.** A type of electric heat pump that utilizes ventilation
1155 exhaust air as the thermal energy source.

1156 **FUEL GAS.** A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.
1157 *Informational note: Definition of fuel gas is mirrored from 2021 IMC to be useful in defining*
1158 *combustion equipment. It typically refers to natural gas and propane.*

1159 **FUEL OIL.** Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).
1160 *Informational note: Definition of fuel oil is mirrored from 2021 IMC to be useful in defining*
1161 *combustion equipment. It typically refers to heating oil products*

1162 **GLAZED WALL SYSTEM.** System consisting of any combination of both vision glass and/or
1163 *spandrel sections* to create an above-grade wall that is designed to separate the exterior and
1164 interior environments. These systems include, but are not limited to, curtain walls, window
1165 walls, and storefront windows.

1166 **MIXED-FUEL BUILDING.** A *building* that contains *combustion equipment* or includes piping
1167 for such *equipment*.

1168 **OTHER EXHAUST.** Any exhaust that does not fall under the categories of *Exempt Exhaust*,
1169 *Class 4 Exhaust*, or *Class 3 Exhaust*.

1170
1171 **SENSIBLE ENERGY RECOVERY RATIO.** The change in the dry-bulb temperature of the
1172 outdoor air supply divided by the difference between the outdoor air and entering exhaust air
1173 dry-bulb temperatures, expressed as a percentage.

1174 **SENSIBLE RECOVERY EFFICIENCY.** The net sensible energy recovered by the supply
1175 airstream as adjusted by any supply fan energy, energy consumption of other equipment
1176 transferring heat to/from the supply airstream, case heat loss or heat gain, air leakage, airflow
1177 mass imbalance between the two airstreams, and the energy used for defrost, as a percent of the
1178 sum of the potential sensible energy that could be recovered from ambient conditions, the
1179 exhaust fan energy, and the energy consumption of any other equipment transferring heat to/from
1180 the exhaust airstream.

1181 **SPANDREL SECTION:** The opaque portion of a *glazed wall system* typically used to conceal
1182 or obscure features of the building structure or used for visual effect. A spandrel section may
1183 consist of, but is not limited to, an exterior exposed cladding layer (glazing or opaque material)
1184 with an interior insulated panel.

1185 **TENANT SPACE FIT OUT ZONE.** Portion of a building in which only the envelope is
1186 completed, and the mechanical, lighting, and other interior systems are either incomplete or
1187 partially complete at the time of building permitting. Mechanical, lighting, and other interior
1188 systems may be completed under either the same building permit or a different building permit
1189 from the host building.

1190 **THERMAL BRIDGE.** Part of the *building envelope* where otherwise uniform thermal
1191 resistance is changed by full or partial penetration of the thermal insulation by materials with
1192 higher thermal conductivities and/or where the interior and exterior areas of the envelope are
1193 different, such as, but not limited to, parapets and corners.

1194 **CLEAR FIELD:** A *thermal bridge* that is uniformly distributed throughout an assembly such
1195 that accounting for the *thermal bridge* individually is impractical for whole-building
1196 calculations.

1197 **LINEAR:** A *thermal bridge* that is continuous in one direction of the exterior envelope.

1198 **POINT:** A *thermal bridge* that is discrete and countable on an individual basis for
1199 wholebuilding calculations.

1200 **TOTAL RECOVERY EFFICIENCY:** The net total energy (sensible plus latent) recovered by
1201 the supply airstream as adjusted by supply fan energy, energy consumption of another equipment
1202 transferring heat to/from the supply airstream, case heat loss or heat gain, air leakage, airflow
1203 mass imbalance between the two airstreams, and the energy use for defrost as a percent of the
1204 sum of potential energy that could be recovered from the ambient conditions, the exhaust fan

1205 energy, and the energy consumption of any other equipment transferring heat to/from the exhaust
1206 airstream.

1207

1208 **Chapter 3: [CE] GENERAL REQUIREMENTS**

1209

1210 **230 SECTION C301 CLIMATE ZONES**

1211

1212 *C301 Abbreviate Section C301 as follows:*

1213 **C301.1 General.** Massachusetts is in *climate zone 5A*.

1214

1215 **Chapter 4: [CE] COMMERCIAL ENERGY EFFICIENCY**

1216

1217 **231 SECTION C401 GENERAL**

1218

1219 *C401.2 Replace Section C401.2 as follows:*

1220 **C401.2 Application.** Commercial buildings shall comply with either Section C401.2.1 or
1221 C401.2.2. When constructed for the first time, all requirements imposed on the building housing
1222 a *tenant space fit out zone* shall also apply to the *tenant space fit out zone*. Commercial buildings
1223 containing multiple use type classifications (mixed-use buildings) shall comply with C401.2.4.

1224

1225 **C401.2.1 Prescriptive and Performance Compliance.** Commercial buildings shall comply
1226 with one of the following:

1227

1228 1. **Prescriptive Compliance:** This pathway may only be used for any nonresidential
1229 building, or portions thereof when following C401.2.4, up to 20,000-sf. The
1230 Prescriptive Compliance pathway requires compliance with Sections C401.3,
1231 C402 through C406, and Section C408.

1232 2. **Targeted Performance Compliance:** This pathway shall be used for dormitory,
1233 fire station, library, office, school, police station, post office, and town hall buildings, or portions
1234 thereof when following C401.2.4, over 20,000-sf which have average ventilation at full
1235 occupancy of 0.5 cfm/sf or less. This pathway can also be used for any building of any size.

1236 After 1 July 2024, this pathway shall be used for residential buildings, or portions thereof when
1237 following C401.2.4, over 12,000-sf, or the building may comply with Section C401.2.2. The
1238 Targeted

1239 Performance Compliance pathway requires compliance with Section C401.3,
1240 Sections C402 through C406, Section C407.1, Section 408, and select sections of
1241 ANSI/ASHRAE/IESNA 90.1-2019 Appendix G as described in Section 407.1.

1242 3. **Relative Performance Compliance:** This pathway may be used by buildings not
1243 required to use Option 2. The Relative Performance Compliance pathway
1244 requires that the Proposed building complies with Sections C401.3, C402.1.5,
1245 C402.2.8, C402.3, C402.4, C402.5, C402.6, C402.7, C403.5, C403.7, C405.2.4,
1246 C405.13, C406, C407.2, C408, and ANSI/ASHRAE/IESNA 90.1-2019 using the

1247 Appendix G compliance pathway as modified in Section C407.2.

1248

1249 **Exception:** Additions, alterations, repairs and changes of occupancy to existing buildings
1250 complying with Chapter 5. This exception does not include *tenant space fit out zones* when
1251 constructed for the first time.

1252

1253 **C401.2.2 Certified Performance Standard Compliance.** Commercial buildings or portions
1254 thereof when following C401.2.4 shall comply with one of the following certified performance
1255 standards:

1256

1257 1. **Passive House Compliance:** This pathway can be used for any building of any
1258 size. This pathway requires compliance with Sections C401.3, C402.3, C405,
1259 C407.3 and C408.

1260

1261 2. **HERS Compliance:** This pathway can be used for any Group R occupancy
1262 building with multiple individual *dwelling units*. The HERS pathway requires
1263 compliance with Section C401.3, C402.3, C405, C407.4 and C408.

1264

1265 **C401.2.4 Add Section C401.2.4 as follows:**

1266 **C401.2.4 Mixed use buildings.** Where different building use types within a new building
1267 require different Section C401.2 Compliance Pathways, each use type shall separately and
1268 individually show compliance with C401.2.1 or C401.2.2 for that respective use type.

1269 **Exception:** Enclosed or unenclosed parking garages that are part of a larger building may follow
1270 the Prescriptive Compliance path even where they exceed 20,000-sf.

1271

1272 **C401.4 Add Section as follows:**

1273 **C401.4 Building electrification.** Building projects which utilize Section C407.2.1 shall
1274 conform with C401.4.1. Building projects which utilize Section C402.1.5.2 shall conform with
1275 C401.4.2 except for buildings using the Relative Performance pathway because average
1276 ventilation at full occupancy is greater than 0.5 cfm/sf which shall comply with C401.4.1 rather
1277 than C401.4.2. Building projects which utilize Section CC104.1, Part 1 shall conform with
1278 C401.4.3.

1279 **C401.4.1 Partial space heating electrification.** Electric air source, *exhaust source*, or ground
1280 source heat pump systems shall supply 25% of the building's peak space heating and ventilation
1281 air heating load at the ASHRAE 99.6% winter climatic design condition. Heat pumps used for
1282 space and ventilation air heating shall comply with C401.4.4.

1283 **C401.4.1.1 Heat pump primary operation.** The heat pumps shall be controlled to prioritize
1284 their primary operation, prior to operation of supplemental fossil-fuel equipment, during non-
1285 emergency conditions.

1286 **C401.4.2 Full space heating electrification.** Electric air source, *exhaust source*, or ground
1287 source heat pump systems shall supply 100% of the building's peak space heating and
1288 ventilation air heating load at the ASHRAE 99.6% winter climatic design condition.
1289 No fossil fuel heating equipment shall be used for space heating or ventilation air heating. Heat
1290 pumps used for space and ventilation air heating shall comply with C401.4.4.

1291 **C401.4.3 Full Space and Water Heating Electrification.** Electric air source, *exhaust source*,
1292 or ground source heat pump systems shall supply 100% of the building's peak space heating and
1293 ventilation air heating load at the ASHRAE 99.6% winter climatic design condition. Electric air
1294 source, ground source, electric resistance, or solar thermal systems shall supply 100% of the
1295 building's service water. No fossil fuel equipment shall be used for space heating, ventilation air
1296 heating, or service water heating. Heat pumps used for space and ventilation air heating shall
1297 comply with C401.4.4. Heat pump service water heating shall conform to the applicable
1298 efficiencies in Section C404.2. Solar thermal service water shall have solar fraction of 0.4 or
1299 larger.

1300
1301 **C401.4.4 Heat pump requirements.** Heat pumps used for space heating and ventilation air
1302 heating shall comply with C401.4.4.1 through C401.4.4.3.

1303 **C401.4.4.1 Equipment efficiencies.** Heat pump equipment shall conform to the applicable
1304 efficiencies in Section C403.3.2.

1305 **C401.4.4.2 Multiple systems.** For buildings with multiple heat pump systems, compliance shall
1306 be based on the combined capacity of all heat pump systems serving the building. For purposes
1307 of this calculation, the heating capacity of a heat pump system shall not exceed the heating load
1308 of that system and the portion of the building served by that system.

1309 **C401.4.4.3 Exhaust source heat pumps.** For purposes of this calculation, the capacity of
1310 *exhaust source heat pumps* shall only include the heating capacity that exceeds the energy
1311 recovered by the minimum ventilation heat recovery required by C403.7.4. In addition, for
1312 purposes of this calculation, the capacity of the *exhaust source heat pumps* shall not exceed the
1313 heat pump capacity when the exhaust airflow is at 50% of design airflow.

1314 **232 SECTION C402 BUILDING ENVELOPE REQUIREMENTS**

1315 **C402.1.3** *Delete Section C402.1.3 and Table C402.1.3 and mark as Reserved.*

1316 **C402.1.3 Reserved.**

1317

1318 **C402.1.4.1.1** *Revise as follows:*

1319 **C402.1.4.1.1 Tapered, above-deck insulation based on thickness.** Where used as a component
1320 of a maximum roof/ceiling assembly *U*-factor calculation, the sloped roof insulation *R*-value
1321 contribution to that calculation shall use the thickness at a point 1 inch thicker than the minimum
1322 along with the material *R*-value-per-inch (per-mm) solely for *U*-factor compliance as prescribed
1323 in Section C402.1.4.

1324 **C402.1.5** *Revise Section C402.1.5 as follows:*

1325 **C402.1.5 Component performance alternative.** Building envelope values and fenestration
1326 areas determined in accordance with C402.1.5.1 or C402.1.5.2 shall be an alternative to
1327 compliance with the U- factors in Tables C402.1.4 and C402.4 and the maximum allowable
1328 fenestration areas in Section C402.4.1. Buildings following ANSI/ASHRAE/IESNA 90.1-2019
1329 Appendix G shall comply with this section.

1330

1331 **C402.1.5.1 Low glazed wall system buildings.** Buildings in which less than or equal to 50% of
1332 the total, above-grade wall area of the *building thermal envelope* is a *glazed wall system* shall
1333 comply with Equation 4-2a and vision glass used in the *glazed wall system* shall have a
1334 maximum whole assembly U factor of U-0.25.

1335 Area-weighted U proposed ≤ 0.1285 (**Equation 4-2a**) where:

1336 Area-weighted U proposed = U value for each distinct assembly type of the above grade
1337 wall portion of the *building thermal envelope*, weighted by vertical area for each distinct
1338 assembly type.

1339

1340 **Exception:** Existing buildings following Section C505 (Change of Use) to create new R-use
1341 residential *dwelling units* with vision glass having a maximum whole assembly U factor of U-
1342 0.30 may comply by either: (1) each *dwelling unit* complies with Section C407.4 HERS Index
1343 for multi-family buildings, or (2) the building complies with Section C401.4.2 and the vertical
1344 envelope complies with Equation 4-2c.

1345 Area-weighted U proposed ≤ 0.1440 (**Equation 4-2c**)

1346

1347 **C402.1.5.2 High glazed wall system buildings.** Buildings in which more than 50% of the total,
1348 above-grade wall area of the *building thermal envelope* is a *glazed wall system* shall comply with
1349 Equation 4-2b, vision glass used in the *glazed wall system* shall have a maximum whole
1350 assembly U factor of U-0.25, the building shall comply with Section C401.4.2.

1351 Area-weighted U proposed ≤ 0.1600 (**Equation 4-2b**) where:

1352 Area-weighted U proposed = U value for each distinct assembly type of the above grade
1353 wall portion of the *building thermal envelope*, weighted by vertical area for each distinct
1354 assembly type.

1355

1356 **Exception:** Buildings using the Relative Performance pathway because average ventilation at
1357 full occupancy is greater than 0.5 cfm/sf shall comply with C401.4.1 rather than C401.4.2.

1358 **C402.2.1.2 Delete Section C402.2.1.2**

1359 **C402.2.4.1 Delete the exception in Section C402.2.4.1:**

1360 **C402.2.8 Add Subsection C402.2.8 as follows:**

1361 **C402.2.8 Fireplaces.** New combustion fireplaces shall have tight-fitting flue dampers or doors,
1362 and outdoor combustion air as required by the fireplace construction provisions of MA
1363 Construction Codes, as applicable. Where using tight-fitting doors on factory-built fireplaces

1364 listed and labeled in accordance with UL 127, the doors shall be tested and listed for the
1365 fireplace.

1366 **C402.3** Replace Section C402.3 with the following:

1367 **C402.3 Rooftop solar readiness (mandatory).** Follow Appendix CB: Solar-ready zone –
1368 Commercial.

1369
1370 **C402.4** Revise Section C402.4 as follows:

1371 **C402.4 Fenestration.** Fenestration shall comply with Sections C402.4.1 through C402.4.5 and
1372 Table C402.4. Daylight responsive controls shall comply with this section and Section C405.2.4.

1373 **Exception:** Revolving doors shall not be subject to the requirements of C402.1.4 and C402.4.
1374 Revolving doors may use representative U-factors contained in ASHRAE Handbook of
1375 Fundamentals, Chapter 15, Table 7 when showing compliance with C402.1.5.

1376 **Table C402.4** Modify Vertical fenestration U-factors in TABLE C402.4 as follows:

1377 **233 TABLE C402.4 BUILDING ENVELOPE FENESTRATION MAXIMUM U-**
1378 **FACTOR**

CLIMATE ZONE	5 AND MARINE 4
Vertical fenestration	
U-factor	
Fixed fenestration	0.30
Operable fenestration	0.32

1379

1380 **C402.4.6** Add Subsection C402.4.6:

1381 **C402.4.6 Fenestration documentation.** In accordance with Section 303.1.3 fenestration
1382 performance shall be documented according to C402.4.6.1 or C402.4.6.2.

1383 **C402.4.6.1 Labeled performance.** The thermal transmittance of glazed fenestration products
1384 within the scope of NFRC shall be indicated by labels applied to the products at the manufacturing
1385 location or by a label certificate produced by an NFRC Approved Calculation Entity.

1386 **C402.4.6.2 Calculated performance.** Fenestration products outside the scope of NFRC may
1387 demonstrate compliance by submitting a thermal simulation report prepared by a registered
1388 design professional for each product as defined by NFRC 100. Thermal simulations shall be
1389 performed in accordance with the NFRC 100-2020 simulation procedures. It is acceptable to
1390 area-weight the modeled fenestration U-value based on the relative proportions of fixed and
1391 operable windows and window sizes. It is also acceptable to simplify the calculations by
1392 assuming the worst case by using the highest window U-value for all fenestration specified on
1393 the project.

1394 **C402.5** Revise Section C402.5 as follows:

1395 **C402.5 Air leakage—thermal envelope.** The *building thermal envelope* shall comply with
1396 Sections C402.5.1 through Section C402.5.10.1.

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402.5.1.1 Replace Section with the following:

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 abovegrade 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.

1441 **C402.5.1.2** Replace Section C402.5.1.2 with the following:

1442

1443 **C402.5.1.2 Air barrier construction.** The *continuous air barrier* shall be constructed to comply
1444 with the following:

- 1445 1. The *air barrier* shall be continuous for all assemblies that comprise the
1446 *building thermal envelope* and across the joints and assemblies.
- 1447 2. Air barrier joints and seams shall be sealed, including sealing transitions in
1448 places and changes in materials. The joints and seals shall be securely
1449 installed in or on the joint for its entire length so as not to dislodge, loosen or
1450 otherwise impair its ability to resist positive and negative pressure
1451 differentials such as those from design wind load, stack effect and mechanical
1452 ventilation.
- 1453 3. Penetrations of the *air barrier* shall be caulked, gasketed or otherwise sealed
1454 in a manner compatible with the construction materials and location. Sealing
1455 shall allow for expansion, contraction and mechanical vibration. Sealing
1456 materials shall be securely installed around the penetration so as not to
1457 dislodge, loosen or otherwise impair the penetrations' ability to resist positive
1458 and negative pressure. Sealing of concealed fire sprinklers, where required,
1459 shall be in a manner that is recommended by the fire sprinkler manufacturer.
1460 Caulking or other adhesive sealants shall not be used to fill voids between fire
1461 sprinkler cover plates and walls or ceilings.
- 1462 4. Recessed lighting fixtures shall comply with C402.5.9. Where similar objects
1463 are installed that penetrate the *air barrier*, provisions shall be made to
1464 maintain the integrity of the *air barrier*.
- 1465 5. Electrical and communication boxes shall comply with C402.5.1.2.2
1466

1467 **C402.5.1.2.1** Add Section C402.5.1.2.1 as follows:

1468

1469 **C402.5.1.2.1 Electrical and communication boxes.** Electrical and communication boxes that
1470 penetrate the air barrier of the *building thermal envelope*, and that do not comply with
1471 C402.5.1.2.2.1, shall be caulked, taped, gasketed, or otherwise sealed to the air barrier element
1472 being penetrated. All openings on the concealed portion of the box shall be sealed. Where
1473 present, insulation shall rest against all concealed portions of the box.

1474

1475 **C402.5.1.2.1.1** Add Section C402.5.1.2.1.1 as follows:

1476

1477 **C402.5.1.2.1.1 Air-sealed boxes.** Where air-sealed boxes are installed, they shall be marked in
1478 accordance with NEMA OS 4. Air-sealed boxes shall be installed in accordance with the
1479 manufacturer's instructions.

1480

1481 **C402.5.1.3** Delete Section C402.5.1.3

1482

1483 **C402.5.1.4** Delete Section C402.5.1.4

1484

1485 **C402.5.1.5 Delete Section C402.5.1.5**

1486

1487 **C402.5.2 Replace Section C402.5.2 as follows:**

1488

1489 **C402.5.2 Air leakage compliance.** *Air leakage* of the *building thermal envelope* shall be tested
1490 by an *approved* third party in accordance with C402.5.2.1. The measured *air leakage* shall not be
1491 greater than 0.35 cfm/ft² (1.8 L/s × m²) of the *building thermal envelope* area at a pressure
1492 differential of 0.3 inch water gauge (75 Pa) with the calculated *building thermal envelope*
1493 surface area being the sum of the above- and below-grade *building thermal envelope*.

1494

1495 **Exceptions:**

1496 1. Where the measured *air leakage* rate is greater than 0.35 cfm/ft² (1.8 L/s ×
1497 m²) but is not greater than 0.45 cfm/ft² (2.3 L/s × m²), the *approved* third party
1498 shall perform a diagnostic evaluation in accordance with ASTM E1186. All
1499 identified leaks shall be sealed where such sealing can be made without damaging
1500 existing building components. A report specifying the corrective actions taken to
1501 seal leaks shall be deemed to establish compliance with the requirements of this
1502 section where submitted to the code official and the building owner. Where the
1503 measured *air leakage rate* is greater than 0.45 cfm/ft² (2.3 L/s × m²), corrective
1504 actions must be made to the building and an additional test completed for which
1505 the results are 0.45 cfm/ft² (2.3 L/s × m²), or less.

1506 2. As an alternative, buildings or portions of buildings, containing Group R
1507 and I occupancies, shall be permitted to be tested by an *approved* third party in
1508 accordance with C402.5.2.2. The reported *air leakage* of the *building thermal*
1509 *envelope* shall not be greater than 0.27 cfm/ft² (1.4 L/s × m²) of the *testing unit*
1510 *enclosure area* at a pressure differential of 0.2 inch water gauge (50 Pa).

1511

1512 **C402.5.2.1 Add Section C402.5.2.1 as follows:**

1513

1514 **C402.5.2.1 Whole building test method and reporting.** The *building thermal envelope* shall be
1515 tested for *air leakage* in accordance with ASTM E3158 or an equivalent *approved* method. A
1516 report that includes the tested surface area, floor area, air by volume, stories above grade, and
1517 leakage rates shall be submitted to the code official and the building owner.

1518 **Exceptions:**

1519 1. For buildings less than 10,000 ft² (1000 m²) the entire *building thermal*
1520 *envelope* shall be permitted to be tested in accordance with ASTM E779, ASTM
1521 E3158 or ASTM E1827 or an equivalent *approved* method.

1522 2. For buildings greater than 50,000 ft² (4645 m²), portions of the building
1523 shall be permitted to be tested and the measured *air leakage* shall be
1524 areawighted by the surface areas of the *building thermal envelope* in each
1525 portion. The weighted average tested *air leakage* shall not be greater than the
1526 whole building leakage limit. The following portions of the building shall be
1527 tested:

1528

1529 i. The entire *building thermal envelope* area of stories that have any
1530 conditioned spaces directly under a roof. ii. The entire *building thermal envelope* area of stories
1531 that have a building entrance, a floor over unconditioned space, a loading dock, or that are
1532 below grade. iii. Representative above-grade portions of the building totaling not less than 25%
1533 of the wall area enclosing the remaining conditioned space.

1534

1535 **C402.5.2.2** Add Section C402.5.2.2 as follows:

1536

1537 **234 C402.5.2.2 Dwelling and sleeping unit enclosure test method and reporting.** The
1538 *building thermal envelope* shall be tested for *air leakage* in accordance with ASTM E779,
1539 ANSI/RESNET/ICC 380, ASTM E1827, ASTM E3158, or an equivalent *approved* method.
1540 Where multiple *dwelling units* or *sleeping units* or other occupiable conditioned spaces are
1541 contained within one *building thermal envelope*, each unit shall be considered an individual
1542 testing unit, and the building *air leakage* shall be the weighted average of all testing unit results,
1543 weighted by each testing unit enclosure area. Units shall be tested without simultaneously
1544 pressurizing adjacent units and shall be separately tested as follows:

1545 1. Where buildings have less than eight testing units, each testing unit shall
1546 be tested.

1547 2. Where buildings have eight or more testing units, the greater of seven
1548 units or 20 percent of the testing units in the building shall be tested, including a
1549 top floor unit, a middle floor unit, a ground floor unit and a unit with the largest
1550 testing unit enclosure area. For each tested unit that exceeds the maximum air
1551 leakage rate, an additional three units shall be tested, including a mixture of
1552 testing unit types and locations.

1553 3. *Enclosed spaces* with not less than one *exterior wall* in the *building*
1554 *thermal envelope* shall be tested in accordance with C402.5.3.

1555

1556 **Exception:** Corridors, stairwells, and *enclosed spaces* having a *conditioned floor area* not
1557 greater than 1,500 ft² shall be permitted to comply with Section C402.5.1.5 and either Section
1558 C402.5.1.3 or C402.5.1.4.

1559

1560 **C402.5.2.3** Replace Section C402.5.2.3 with the following:

1561

1562 **C402.5.2.3 Building envelope design and construction verification criteria.** In addition to the
1563 requirements of Sections C402.5.2.1 and C402.5.2.2, the installation of the continuous *air*
1564 *barrier* shall be verified by the *code official*, a *registered design professional* or *approved*
1565 *agency* in accordance with the following:

1566 1. A review of the construction documents and other supporting data shall be
1567 conducted to assess compliance with the requirements in Section C402.5.1.

1568 2. Inspection of continuous air barrier materials, assemblies, and systems
1569 shall be conducted during construction to verify compliance with the
1570 requirements of Sections C402.5.2.3.1 or C402.5.2.3.2. The air barrier shall
1571 remain accessible for inspection and repair.

1572 3. A final inspection report shall be provided for inspections completed by
1573 the *registered design professional* or *approved* agency. The inspection report
1574 shall be provided to the building owner or owner's authorized agent and the *code*
1575 *official*. The report shall identify deficiencies found during inspection and details
1576 of corrective measures taken.
1577

1578 **C402.5.2.3.1** Replace Section C402.5.2.3.1 with the following:
1579

1580 **C402.5.2.3.1 Materials.** Materials with an air permeability not greater than 0.004 cfm/ft² (0.02
1581 L/s × m²) under a pressure differential of 0.3 inch water gauge (75 Pa) where tested in
1582 accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16
1583 below shall be deemed to comply with this section, provided that joints are sealed and materials
1584 are installed as air barriers in accordance with the manufacturer's instructions.

- 1585 i. Plywood with a thickness of not less than 3/8 inch (10 mm).
- 1586 ii. Oriented strand board having a thickness of not less than 3/8 inch (10 mm).
- 1587 iii. Extruded polystyrene insulation board having a thickness of not less than 1/2
1588 inch (12.7 mm).
- 1589 iv. Foil-back polyisocyanurate insulation board having a thickness of not less
1590 than 1/2 inch (12.7 mm).
- 1591 v. Closed-cell spray foam having a minimum density of not less than 1.5 pcf
1592 (2.4 kg/m³) and having a thickness of not less than 1 1/2 inches (38 mm).
- 1593 vi. Open-cell spray foam with a density between greater than 0.4 and less than
1594 1.5 pcf (0.6 and 2.4 kg/m³) and having a thickness of not less than 4.5 inches
1595 (113 mm). vii. Exterior or interior gypsum board having a thickness of not
1596 less than 1/2 inch (12.7 mm).
- 1597 viii. Cement board having a thickness of not less than 1/2 inch (12.7 mm). ix. Built-up
1598 roofing membrane.
- 1599 x. Modified bituminous roof membrane.
- 1600 xi. Single-ply roof membrane.
- 1601 xii. A Portland cement/sand parge, or gypsum plaster having a thickness of not
1602 less than 5/8 inch (15.9 mm).
- 1603 xiii. Cast-in-place and precast concrete. xiv. Fully grouted concrete block
1604 masonry.
- 1605 xv. Sheet steel or aluminum.
- 1606 xvi. Solid or hollow masonry constructed of clay or shale masonry units.
1607

1608 **C402.5.2.3.2** Replace Section C402.5.2.3.2 with the following:
1609

1610 **C402.5.2.3.2 Assemblies.** Assemblies of materials and components with an average air leakage
1611 not greater than 0.04 cfm/ft² (0.2 L/s × m²) under a pressure differential of 0.3 inch of water
1612 gauge (75 Pa) where tested in accordance with ASTM E2357, ASTM E1677, ASTM D8052 or
1613 ASTM E283 shall comply with this section. Assemblies listed in Items 1 through 3 below shall
1614 be deemed to comply, provided that joints are sealed and the requirements of Section C402.5.1.1
1615 are met.

- 1616 1. Concrete masonry walls coated with either one application of
 1617 block filler or two applications of a paint or sealer coating.
 1618 2. Masonry walls constructed of clay or shale masonry units with a
 1619 nominal width greater than or equal to 4 inches (102 mm).
 1620 3. A Portland cement/sand parge, stucco or plaster not less than 1/2
 1621 inch (12.7 mm) in thickness.
 1622

1623 **C402.5.3** Replace Section C402.5.3 with the following:
 1624

1625 **C402.5.3 Air leakage of fenestration.** The air leakage of fenestration assemblies shall comply
 1626 with Table C402.5.3. Testing shall be conducted by an accredited, independent testing laboratory
 1627 in accordance with the applicable reference test standard in Table C402.5.3 and *labeled* by the
 1628 manufacturer.

1629 **Exceptions:**

- 1630 1. Field-fabricated fenestration assemblies that are sealed in accordance with
 1631 Section C402.5.1.2.
 1632 2. Fenestration in buildings that are tested for *air leakage* of in accordance with
 1633 Section C402.5.2 are not required to meet the air leakage requirements in Table
 1634 C402.5.3.
 1635

1636 **235 TABLE C402.5.3 MAXIMUM AIR LEAKAGE RATE FOR FENESTRATION**
 1637 **ASSEMBLIES**
 1638

FENNESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT ²)	TEST PROCEDURE
Windows	0.20 ^a	AAMA/WDMA/CSA101/I.S.2/A440 or NRFC 400
Sliding doors	0.20 ^a	
Swinging doors	0.20 ^a	
Skylights – with condensation weepage openings	0.30	
Skylights – all other	0.20 ^a	
<i>Curtain walls</i>	0.06	NRFC 400 or ASTM E283 at 1.57 psf (75 Pa)
Storefront glazing	0.06	
Commercial glazed swinging entrance doors	1.00	
Power-operated sliding doors and power operated folding doors	1.00	
Revolving doors	1.00	
Garage doors	0.40	ANSI/DASMA 105, NRFC 400, or ASTM E283 at 1.57 psf (75 Pa)
Rolling doors	1.00	
High-speed doors	1.30	

1639 For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m²
1640

1641 a. The maximum rate for windows, sliding and swinging doors, and skylights is permitted to be
1642 0.3 cfm per square foot of fenestration or door area when tested in accordance with
1643 AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa).

1644
1645 **C402.5.4** Replace Section C402.5.4 with the following:

1646 **C402.5.4 Rooms containing fuel-burning appliances.** In *Climate Zones* 3 through 8, where
1647 combustion air is supplied through openings in an exterior wall to a room or space containing a
1648 space-conditioning fuel-burning appliance, one of the following shall apply:

- 1649 1. The room or space containing the appliance shall be located
1650 outside of the *building thermal envelope*.
- 1651 2. The room or space containing the appliance shall be enclosed and
1652 isolated from conditioned spaces inside the *building thermal envelope*.

1653 Such rooms shall comply with all of the following:

- 1654 1. The walls, floors and ceilings that separate the enclosed room or space from conditioned
1655 spaces shall be insulated to be not less than equivalent to the insulation requirement of below-
1656 grade walls as specified in Table C402.1.4. 2. The walls, floors and ceilings that separate the
1657 enclosed room or space from conditioned spaces shall be sealed in accordance with Section
1658 C402.5.1.2.

- 1659 3. The doors into the enclosed room or space shall be fully gasketed.
- 1660 4. Piping serving as part of a heating or cooling system and ducts in
1661 the enclosed room or space shall be insulated in accordance with Section
1662 C403. Service water piping shall be insulated in accordance with Section
1663 C404.
- 1664 5. Where an air duct supplying combustion air to the enclosed room
1665 or space passes through *conditioned space*, the duct shall be insulated to
1666 an R-value of not less than R-8.

1667
1668 **Exception:** Fireplaces and stoves complying with Sections 901 through 905 of the *International*
1669 *Mechanical Code*, and Section 2111.14 of the *International Building Code*.

1670
1671 **C402.5.5** Replace Section C402.5.5 with the following:

1672
1673 **C402.5.5 Doors and access openings to shafts, chutes, stairways and elevator lobbies.** Doors
1674 and *access* openings from conditioned space to shafts, chutes stairways and elevator lobbies not
1675 within the scope of the fenestration assemblies covered by Section C402.5.3 shall be gasketed,
1676 weather-stripped or sealed.

1677
1678 **Exceptions:**

- 1679 1. Door openings required to comply with Section 716 of the *International Building*
1680 *Code*.
- 1681 2. Doors and door openings required by the *International Building Code* to comply with

1682 UL 1784.

1683

1684 **C402.5.6** Replace Section C402.5.6 with the following:

1685

1686 **C402.5.6 Air intakes, exhaust openings, stairways and shafts.** Stairway enclosures, elevator
1687 shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope
1688 shall be provided with dampers in accordance with Section C403.7.7.

1689

1690 **C402.5.7** Replace Section C402.5.7 with the following:

1691

1692 **C402.5.7 Loading dock weather seals.** Cargo door openings and loading door openings shall be
1693 equipped with weather seals that restrict *air leakage* and provide direct contact along the top and
1694 sides of vehicles that are parked in the doorway.

1695

1696 **C402.5.8** Replace Section C402.5.8 with the following:

1697

1698 **C402.5.8 Vestibules.** Building entrances shall be protected with an enclosed vestibule. Doors
1699 opening into and out of the vestibule shall be equipped with self-closing devices. Vestibules
1700 shall be designed so that in passing through the vestibule it is not necessary for the interior and
1701 exterior doors to open at the same time. The installation of one or more revolving doors in the
1702 *building entrance* shall not eliminate the requirement that a vestibule be provided on any doors
1703 adjacent to revolving doors.

1704 **Exceptions:** Vestibules are not required for the following:

1705

1. Doors not intended to be used by the public, such as doors to mechanical or
1706 electrical equipment rooms, or intended solely for employee use.

1707

2. Doors opening directly from a *sleeping unit* or dwelling unit.

1708

3. Doors that open directly from a space less than 3,000 sq. ft. (298 m²) in area.

1709

4. Revolving doors.

1710

5. Doors used primarily to facilitate vehicular movement or material handling and
1711 adjacent personnel doors.

1712

6. Doors that have an air curtain with a velocity of not less than 6.56 feet per second
1713 (2 m/s) at the floor that have been tested in accordance with ANSI/AMCA 220 and
1714 installed in accordance with the manufacturer's instructions. Manual or automatic
1715 controls shall be provided that will operate the air curtain with the opening and
1716 closing of the door. Air curtains and their controls shall comply with Section
1717 C408.2.3.

1718

1719 **C402.5.9** Replace Section C402.5.9 with the following:

1720

1721 **C402.5.9 Recessed lighting.** Recessed luminaires installed in the *building thermal envelope*
1722 shall be all of the following:

1723

1. IC-rated.

- 1724 2. Labeled as having an air leakage rate of not greater than 2.0 cfm (0.944
1725 L/s) where tested in accordance with ASTM E283 at a 1.57 psf (75 Pa) pressure
1726 differential.
1727 3. Sealed with a gasket or caulk between the housing and interior wall or
1728 ceiling covering.
1729

1730 **C402.5.10** *Replace Section C402.5.10 with the following:*
1731

1732 **C402.5.10 Operable openings interlocking.** Where occupancies have operable openings to the
1733 outdoors that are larger than 40 sq. ft. (3.7 m²) in area, such openings shall be interlocked with
1734 the heating and cooling system to raise the cooling setpoint to 90°F (32°C) and lower the heating
1735 setpoint to 50°F (10°C) whenever the operable opening is open. The change in heating and
1736 cooling setpoints shall occur when the operable opening has been open for a period not to exceed
1737 10 minutes.
1738

1739 **Exceptions:**

- 1740 1. Operable openings into separately-zoned areas associated with the
1741 preparation of food that contain appliances that contribute to the HVAC loads of a
1742 restaurant or similar type of occupancy.
1743 2. Storage occupancies that utilize overhead doors for the function of the
1744 occupancy, where approved by the code official.
1745 3. Doors located in the exterior wall that are part of a vestibule system.
1746 4. Operable openings used as part of a designed system for natural
1747 ventilation.
1748

1749 **C402.5.10.1** *Replace Section C402.5.10.1 with the following:*
1750

1751 **C402.5.10.1 Operable controls.** Controls shall comply with Section C403.13.
1752

1753 **C402.6** *Add Section C402.6 as follows:*

1754 **C402.6 Approved calculation software tools.** The following software tools are sufficient to
1755 demonstrate compliance with Sections C401.2.1 Prescriptive Compliance and C402.7 for projects
1756 up to 20,000 sq ft.

- 1757 1. COMcheck-Web available at: <https://www.energycodes.gov/comcheck>
1758

1759 For projects over 20,000-sf, COMcheck may not be used for envelope compliance. Per Section
1760 C103.2(2), backstop compliance and thermal bridge derating calculations performed in accordance
1761 with latest edition of *Massachusetts Stretch Energy Code Technical Guidance, Attachment A,*
1762 *Envelope Performance and Thermal Bridge Derating* shall be provided.

1763
1764 **C402.7** *Add Section C402.7 and subsections as follows:*

1765 **C402.7 Derating and Thermal Bridges.**

1766 **C402.7.1 General.** In addition to pre-calculated assembly U-factors, C-factors, or F factors
 1767 outlined in Appendix A of ASHRAE 90.1 2019, vertical envelope performance shall also take
 1768 into account the effect of *thermal bridges* according to both C402.7.2 and C402.7.3. In
 1769 addition, the thermal resistance of *spandrel sections* within *glazed wall systems* shall be
 1770 according to C402.7.4. Together with Appendix A of ASHRAE 90.1 2019, these derated
 1771 values and *spandrel section* values shall be used when showing compliance with Section
 1772 C402.1.4 or Section C402.1.5, as applicable.

1773 **C402.7.2 Continuous insulation for vertical walls.** Installed vertical wall continuous
 1774 insulation shall be derated using either C402.7.2.1, C402.7.2.2, or C402.7.2.3 to account for the
 1775 effect of fasteners through the continuous insulation.

1776 **C402.7.2.1 Prescriptive derating.** Derate vertical wall continuous insulation using Equation
 1777 C402.7.2.1 and derating Factor from C402.7.2.1.1 for portions of wall having brick veneer systems
 1778 and 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: From C402.7.2.1.1, C402.7.2.1.2, or C402.7.2.1.3

1785 **C402.7.2.1.1 Brick veneer systems.** Wall systems comprised of brick anchor fasteners
 1786 supporting brick veneer shall use a Derating Factor of 0.7 to account for the *clear field thermal*
 1787 *bridge* derating effect of the fasteners. In addition, brick shelf angles shall be derated according
 1788 to Section C402.7.3 to account for the *linear thermal bridge* derating effect of any brick shelf
 1789 angles.

1790 **C402.7.2.1.2 Cladding Systems.** Wall systems comprised of cladding systems shall use a
 1791 derating factor per Table 402.7.2.1.2

236 Table 402.7.2.1.2 Cladding system derating factors

Thickness of R_o	Derating Factor
R_o is less than or equal to R15	Derating Factor = $0.74 - 0.021 \times R_o$
R_o is greater than R-15	Derating Factor = $0.55 - 0.007 \times R_o$

1793

1794 **C402.7.2.1.3 Cladding systems with qualifying thermal breaks.** If plastic or fiberglass
 1795 fasteners entirely comprised of material having thermal conductivity of 3 Btu-in/hr-ft²-F or less
 1796 are used to support external cladding; or, if fasteners having thermal breaks which have a

1797 conductivity of 3 Btu-in/hr-ft²-F or less on both ends of the fastener are used to support external
 1798 cladding, use Derating Factor of 0.8.

1799 **C402.7.2.2 Reference derating.** Use pre-solved, derated continuous insulation values contained
 1800 in Building Envelope Thermal Bridging Guide, version 1.6 or higher, published by BC Hydro
 1801 Power Smart at <https://www.bchydro.com>

1802 **C402.7.2.3 Modeled derating.** Use two or three-dimensional finite element analysis heat
 1803 transfer model to calculate derated value. A three-dimensional model shall be used when there
 1804 are *point thermal bridges* or thermal bridging in multiple planes.

1805 **C402.7.3 Linear thermal bridges.** In addition to derating per Section C402.7.2, installed
 1806 vertical wall insulation U values shall be further derated for *linear thermal bridges* where the
 1807 vertical wall intersects the following: brick shelf angles, balconies, vertical interior walls,
 1808 horizontal interior walls, windows, roof, other vertical walls on different plane, and grade using
 1809 Equation C402.7.3.

1810 **237 (Equation C402.7.3)**

$$1811 \quad U_{\text{derated}} = \frac{\text{PSI} * \text{Length}}{A_{\text{total}}} + U_o$$

1814 Where

- 1815 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

1816 **C402.7.3.1 Prescriptive PSI values.** Use PSI values from Table C402.7.3.1

1817 **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
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1818

1819 **C402.7.3.2 Reference PSI values.** Use pre-solved PSI values contained in Building Envelope
 1820 Thermal Bridging Guide, version 1.6 or higher, published by BC Hydro Power Smart.

1821 **C402.7.3.3 Modelled PSI values.** Use a two or three-dimensional finite element analysis to
 1822 calculate PSI values. A three-dimensional model shall be used when there are *point thermal*
 1823 *bridges* or thermal bridging in multiple planes.

1824 **C402.7.4 Thermal Resistance of Spandrel Sections.** The R-factor of opaque *spandrel sections*
 1825 within *curtain wall* systems shall be accordance with C402.7.4.1, C402.7.4.2, or C402.7.4.3.

1826 **C402.7.4.1 Prescriptive R value.** Opaque *spandrel sections* within *glazed wall systems* shall
 1827 have at least R-12 insulation. For the purpose of calculating weighted U value in accordance
 1828 with Section C402.1.5, *spandrel sections* shall use the default R values in Table C402.7.4.1.

1829 **238 Table C402.7.4.1: Default R values for spandrel sections**

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

1830

1831 **C402.7.4.2 Reference R values.** Use pre-solved opaque *spandrel sections* R values contained in
 1832 Building Envelope Thermal Bridging Guide, version 1.6 or higher, published by BC Hydro
 1833 Power Smart.

1834 **C402.7.4.3 Modelled R values.** Use a two or three-dimensional finite element analysis to
 1835 calculate R value of opaque *spandrel section*. A three-dimensional model shall be used when
 1836 there are *point thermal bridges* or thermal bridging in multiple planes.

1837

1838 **239 SECTION C403 BUILDING MECHANICAL SYSTEMS**

1839 **C403.3.2** Replace tables as follows:

1840 *Replace 2021 IECC Table C403.3.2(8) with 2024 IECC Table CS403.3.2(8)*

1841 *Replace 2021 IECC Table C403.3.2(9) with 2024 IECC Table CS403.3.2(9)*

1842 **C403.5** Revise Section C403.5 as follows (*Sections C403.5.1 through C403.5.5 remain*
 1843 *unchanged*):

1844 **C403.5 Economizers.** Economizers shall comply with Sections C403.5.1 through C403.5.5. An
 1845 air or water economizer shall be provided for the following cooling systems:

- 1846 1. Chilled water systems with a total cooling capacity, less cooling capacity provided with air
 1847 economizers, as specified in Table C403.5(1).

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2. *Dedicated outside air systems*

3. Individual fan systems with cooling capacity greater than or equal to 54,000 Btu/h (15.8 kW) in buildings having other than a *Group R* occupancy, the total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 300,000 Btu/h (88 kW), whichever is greater.

4 Individual fan systems with cooling capacity greater than or equal to 270,000 Btu/h (79.1 kW) in buildings having a *Group R* occupancy. The total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 1,500,000 Btu/h (440 kW), whichever is greater.

Exceptions: Economizers are not required for the following systems.

1. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7°C) dew-point temperature to satisfy process needs.
2. Systems expected to operate less than 20 hours per week.
3. Systems serving supermarket areas with open refrigerated casework.
4. Systems that include a heat recovery system in accordance with Section C403.10.5.
5. VRF systems installed with a *dedicated outdoor air system*.

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

240 TABLE C403.5(1) MINIMUM CHILLED-WATER SYSTEM COOLING CAPACITY FOR DETERMINING ECONOMIZER COOLING REQUIREMENTS

TOTAL CHILLED-WATER SYSTEM CAPACITY LESS CAPACITY OF COOLING UNITS WITH AIR ECONOMIZERS (Climate Zone 5A)	
Local water-cooled chilled-water systems	Air-cooled chilled- water systems or district chilledwater systems
1,320,000 Btu/h	1,720,000 Btu/h

For SI: 1 British thermal unit per hour = 0.2931 W.

Table C403.5(2). *Delete Table C403.5(2).*

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.

1879 **C403.7.4.1** *Revise Section C403.7.4.1 as follows:*

1880

1881 **C403.7.4.1 Nontransient dwelling units.** Nontransient dwelling units shall be provided with
1882 outdoor air energy recovery ventilation systems. Outdoor air must be delivered directly to the
1883 dwelling unit. The energy recovery system shall result in either 1 or 2, as applicable.

1884

1885 1. The system shall have an *enthalpy recovery ratio* of not less than 60% at cooling
1886 design condition and a *sensible energy recovery ratio* of not less than 75% at heating
1887 design condition. Outdoor air must be delivered directly to the dwelling unit. Compliance
1888 to the *sensible energy recovery ratio* and *enthalpy recovery ratio* shall be demonstrated
1889 by ratings generated at design conditions and airflows by software or catalogs certified
1890 by AHRI.

1891

1892 2. The system, at or above the design outdoor airflow, shall have a *sensible recovery*
1893 *efficiency* (SRE) that is not less than 72% at 32°F (0°C). The system shall have a *total*
1894 *recovery efficiency* (TRE) rating that is not less than 50% at 95°F (35°C). SRE and TRE
1895 shall be determined in accordance with CAN/CSA-C439 and compliance to the
1896 requirement shall be demonstrated by a listing in Home Ventilating Institute's Certified
1897 Product Directory. Linear interpolation of listed values for SRE shall be permitted.

1898

1899 **C403.7.4.2** *Revise Section C403.7.4.2 as follows:*

1900

1901 **C403.7.4.2 Spaces other than nontransient dwelling units.** Where the supply airflow rate of a
1902 fan system serving a space other than a nontransient dwelling unit exceeds the values specified
1903 in Tables C403.7.4.2(1) and C403.7.4.2(2), the system shall include an energy recovery system.
1904 The energy recovery system shall result in either 1 or 2, as applicable. Where an air economizer
1905 is required, the energy recovery system shall include a bypass or controls that permit operation
1906 of the economizer as required by Section C403.5. Compliance to the *sensible energy recovery*
1907 *ratio* and *enthalpy recovery ratio* requirements shall be demonstrated by ratings generated at
1908 design conditions and airflows by software or catalogs certified by AHRI.

1909 1. A *sensible energy recovery ratio* of at least 50% at heating design
1910 conditions for systems that provide makeup for *Class 3 or 4 exhaust*. Compliance
1911 to this limit shall be demonstrated by ratings at design conditions and airflows by
1912 software or catalog certified by AHRI. The requirement can be satisfied either for
1913 each fan system individually or based on a weighted average of the ventilation air
1914 flow for all applicable fan systems in the entire building per Equation
1915 C403.7.4.2(1).

1916 **Equation C403.7.4.2(1)**

1917 Weighted average *sensible energy recovery ratio* = [*sensible energy recovery ratio* for fan
1918 system 1 x outside air flow for system 1 + *sensible energy recovery ratio* for fan system 2 x
1919 outside air flow for system 2 + ...]/[outside air flow for system 1 + outside air flow for system 2
1920 + ...]

1921 2. For all other systems a *sensible energy recovery ratio* of not less than 70%
 1922 at heating design conditions and airflows, and *enthalpy recovery ratio* of not less
 1923 than 60% at heating and cooling design conditions and airflows. The requirement
 1924 can be satisfied either for each fan system individually or based on a weighted average of the
 1925 ventilation air flow for all applicable fan systems in the entire building per Equation
 1926 C403.7.4.2.(1) for *sensible energy recovery ratio* and Equation C403.7.4.2(2) for *enthalpy*
 1927 *recovery ratio*.

1928 **Equation C403.7.4.2(2)**

1929 Weighted average *enthalpy recovery ratio* = [*enthalpy recovery ratio* for fan system 1 x outside
 1930 air flow for system 1 + *enthalpy recovery ratio* for fan system 2 x outside air flow for system 2 +
 1931 ...]/[outside air flow for system 1 + outside air flow for system 2 + ...]

1932 **Exception:** An energy recovery ventilation system shall not be required in any of the following
 1933 conditions:

- 1934 1. Where energy recovery systems are prohibited by the
 1935 *International Mechanical Code*.
- 1936 2. Systems serving spaces that are heated to less than 40°F
 1937 (10°C) and that are not cooled.
- 1938 3. Systems expected to operate less than 10 hours per week at
 1939 the *outdoor air* percent- age covered by Table C403.7.4.2(1).
- 1940 4. Systems exhausting toxic, flammable, paint or corrosive
 1941 fumes or dust.
- 1942 5. Commercial kitchen hoods used for collecting and
 1943 removing grease vapors and smoke.

1945 *Revise Tables C403.7.4.2(1) and C403.7.4.2(2) and show only Climate Zone 5A row, as follows:*
 1946

1947 **241 Table C403.7.4.2(1) ENERGY RECOVERY REQUIREMENT (Ventilation systems**
 1948 **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
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1950
1951
1952

242 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

1953
1954
1955

C403.7.5 Revise Section C403.7.5 as follows:

C403.7.5 Kitchen exhaust systems. Replacement air introduced directly into the exhaust hood cavity shall not be greater than 10% of the hood exhaust airflow rate. Conditioned supply air delivered to any space shall not exceed the greater of the following:

1. The ventilation rate required to meet the space heating or cooling load.
2. The hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered to be that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.

Where total kitchen hood exhaust airflow rate is greater than 5,000 cfm (2360 L/s), each hood shall be a factory-built commercial exhaust hood listed by a nationally recognized testing laboratory in compliance with UL 710. Each hood shall have a maximum exhaust rate as specified in Table C403.7.5 and shall comply with one of the following:

1. Not less than 50% of all replacement air shall be transfer air that would otherwise be exhausted.
2. Demand ventilation systems on not less than 75% of the exhaust air that are configured to provide not less than a 50% reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle.

1974

1975 3. Listed energy recovery devices with a sensible heat recovery effectiveness of not
 1976 less than 40% on not less than 50% of the total exhaust airflow.

1977 Where a single hood, or hood section, is installed over appliances with different duty ratings, the
 1978 maximum allowable flow rate for the hood or hood section shall be based on the requirements
 1979 for the highest appliance duty rating under the hood or hood section.

1980 **Exception:** Where not less than 75% of all the replacement air is transfer air that would
 1981 otherwise be exhausted.

1982 **243 TABLE C403.7.5 MAXIMUM NET EXHAUST FLOW RATE CFM PER LINEAR**
 1983 **FOOT OF HOOD LENGTH**

TYPE OF HOOD	LIGHT-DUTY EQUIPMENT	MEDIUM-DUTY EQUIPMENT	HEAVY-DUTY EQUIPMENT	EXTRAHEAVY-DUTY EQUIPMENT
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	NA	NA
Backshelf/Passover	210	210	280	NA

1984 For SI: 1 cfm = 0.4719 L/s; 1 foot = 304.8 mm.

1985 NA = Not Allowed.

1986 **244 SECTION C405 ELECTRICAL POWER AND LIGHTING SYSTEMS**

1987

1988 **C405.2.4** *Revise Section C405.2.4 as follows:*

1989 **C405.2.4 Daylight-responsive controls.** *Daylight responsive controls* complying with Section
 1990 C405.2.4.1 shall be provided to control the general lighting within *daylight zones* in the
 1991 following spaces:

- 1992 1. Spaces with a total of more than 100 watts of *general lighting* within primary
 1993 sidelit daylight zones complying with Section C405.2.4.2.
- 1994 2. Spaces with a total of more than 300 watts of *general lighting* within sidelit
 1995 daylight zones complying with Section C405.2.4.2.
- 1996 3. Spaces with a total of more than 100 watts of *general lighting* within toplit
 1997 daylight zones complying with Section C405.2.4.3.

1998

1999 **C405.13** *Add Section C405.13 as follows:*

2000 **C405.13 Electric vehicle ready parking spaces (“EV Ready Spaces”) (Mandatory).** New
 2001 parking spaces shall provide *EV Ready Spaces* in accordance with Table C405.13. Installed
 2002 wiring suitable for 6.6kW or higher SAE J3400 or SAE J1772-2017 AC Level II EVSE shall be
 2003 connected to the service panel and run to within 6 feet (1828mm) of any qualifying parking
 2004 space. Conductors and outlets for *EVSE* shall be sized and installed in accordance with the MA
 2005 electrical code.

2006 **245 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

2007 **Exceptions:**

- 2008 1. Parking spaces and garage spaces intended exclusively for storage of vehicles
 2009 for retail sale or vehicle service are excluded from the EV-ready space
 2010 percentage calculation.
- 2011 2. Any parking facility with 4 or more spaces providing installed Direct Current
 2012 fast charging EVSE with a minimum charging speed of 150 kW to each space.
- 2013 3. One or more AC Level II spaces may be substituted with multiple AC Level I
 2014 spaces provided with wiring for a minimum 20amp, 120volt EVSE, with a
 2015 ratio of at least 3 AC Level I spaces for each AC Level II space required.
- 2016 4. Parking spaces specifically designated for medium or heavy-duty vehicles are
 2017 excluded from the EV-ready space percentage calculation.

2018
 2019 **C405.13.1** *Modify Table C405.13.1 as follows:*

2020 **246 C405.13.1 Minimum Charging Performance Requirements.** *Automatic Load*
 2021 *Management*

2022 *System (ALMS)* may be used to control *electric vehicle* loads for EV-Ready or EVSE-Installed
 2023 Spaces with AC Level II or Level I charging, subject to the performance requirements in Table
 2024 C405.13.1.

2025 **247 TABLE C405.13.1 EV-READY PERFORMANCE REQUIREMENTS**

Circuit Breaker Amperage	Maximum Parking Spaces that May Share a Branch Circuit with 10% or more EV Ready spaces
40A	2
50A	2
60A	4

70A	6
80A	8
90A	9
100A	10

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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*.

248 SECTION C406 ADDITIONAL EFFICIENCY REQUIREMENTS

C406.1 *Revise Section C406.1 as follows:*

C406.1 Additional energy efficiency credit requirements. New buildings shall achieve a total of 15 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of Section C406. Where a building contains multiple-use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Where not required by Section C405.12, include an energy monitoring system in accordance with Section C406.10.
10. Where not required by Section C403.2.3, include a fault detection and diagnostics (FDD) system in accordance with Section C406.11.
11. Efficient kitchen equipment in accordance with Section C406.12.
12. Heavy Timber Construction in accordance with Section C406.13
13. Low GWP concrete mix in accordance with Section C406.14
14. Net zero GWP insulation in accordance with Section C406.15

C406.1.1 *Add Subsection C406.1.1 as follows:*

2065 **C406.1.1 Tenant Spaces.** Tenant spaces shall comply with sufficient options from Tables
2066 C406.1(1) through C406.1(5) to achieve a minimum number of 10 credits, where credits are
2067 selected from Section C406.2, C406.3, C406.4, C406.6, C406.7 or C406.10. Where the entire
2068 building complies using credits from C406.5, C406.8, or C406.9, tenant spaces shall be deemed
2069 to comply with this section.
2070

2071 Exception: Previously occupied tenant spaces that comply with this code in accordance with
2072 Section C501.
2073

2074 **Table C406.1(1) through Table C406.1(5)** In Table C406.1(1) through Table C406.1(5), delete
2075 rows for C406.2.1;
2076

2077 **Table C406.1(1) through Table C406.1(5)** In Table C406.1(1) through Table C406.1(5), replace
2078 row for option C406.2.3 with the following:
2079

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

2080
2081 **Table C406.1(1) through Table C406.1(5)** In Table C406.1(1) through Table C406.1(5), delete
2082 rows for C406.7.3;
2083

2084 **Tables C406.1(1) through Table C406.1(5)** add the following row for options C406.13, C406.14
2085 and C406.15:
2086

Section	Climate Zone 5A
C406.13 Heavy Timber Construction	8
C406.14 Low GWP concrete mix	8
C406.15 Net zero GWP insulation	8

2087
2088 **C406.2.3** Replace Section C406.2.3 as follows:
2089

2090 **C406.2.3. Renewable space heating.** All space heating shall be provided with cold-climate air
2091 source heat pumps having rated coefficient of performance (COP) of at least 1.75 at 5 degrees
2092 Fahrenheit outside source air; or, ground source heat pumps. Electric resistance shall not be
2093 used except for defrost function.

2094 **C406.7.3** Delete and Reserve Section C406.7.3.
2095

2096 **C406.7.3** Reserved.
2097

2098 **C406.9** Replace Section C406.9 with the following:
2099

2099 **C406.9 Reduced air leakage.** Air leakage of the building thermal envelope shall be tested by an
2100 approved third party in accordance with Section C402.5.2.1. The measured air leakage shall not

2101 exceed 0.20 cfm/ft² (1.1 L/s × m²) of the *building thermal envelope* at a pressure differential of
 2102 0.3 inch water gauge (75 Pa), with the calculated surface area being the sum of the above- and
 2103 below-grade *building thermal envelope*.

2104

2105 **C406.13** Add Section C406.13 as follows:

2106 **C406.13 Heavy Timber construction.** In buildings with 4 stories or more of Type IV heavy
 2107 timber construction either above grade, or above a podium.

2108 **C406.14** Add Section C406.14 and Table C406.14 as follows:

2109 **C406.14 Low GWP concrete mix.** In new buildings where EPDs are provided with
 2110 construction documentation that demonstrate an average calculated concrete mix Global
 2111 Warming Potential (GWP) for at least 90% of all concrete mix used in the building of not more
 2112 than 100% of the 2022 NRMCA NorthEast Benchmark average values shown in Table C406.14.

2113 **C406.14.1 Documentation for low GWP concrete mix credit.** In order to apply the low GWP
 2114 concrete mix credits, the architect or engineer of record must submit specific EPDs for concrete
 2115 used in the project. Where multiple concrete mixes are used, a complete calculation to
 2116 summarize estimated embodied carbon emissions from at least 90% of all concrete materials
 2117 used in the project is required. The output metric for this measure shall be global warming
 2118 potential (GWP) per cubic meter as supplied, with the EPD verified by the concrete ready-mix
 2119 provider. The C406.14 credits shall be applied when the GWP per cubic meter is demonstrated
 2120 to be less than the Maximum GWP per cubic meter value shown in Table C406.14. for at least
 2121 90% of all concrete used for the project.

2122 **249 TABLE C406.14 DEFAULT CONCRETE GLOBAL WARMING POTENTIAL**
 2123 **VALUES**

Maximum GWP (kg CO₂e) Limits for Concrete	
NORMAL WEIGHT CONCRETE	
Specified Compressive Strength (f_c in psi)	Maximum GWP per cubic meter^a
0-2500	240
2501-3000	264
3001-4000	314
4001-5000	378
5001-6000	399
6001-8000	472

LIGHT WEIGHT CONCRETE	
Specified Compressive Strength (f'c in psi)	Maximum GWP per cubic meter ^a
0-3000	517
3001-4000	573
4001-5000	628
^a These numbers are 100% of the Eastern Region average GWP figures from the National Ready Mix Concrete Associations' "A Cradle-to-Gate Life Cycle Assessment of Ready-Mixed Concrete Manufactured by NRMCA Members, Version 3.2," (July 2022), pg. 65. NRMCA_LCARreportV3-2_20220224.pdf	

2124

2125 **C406.15** Add Section C406.15 as follows:

2126 **C406.15 Net zero GWP insulation.** In new buildings that demonstrate an average calculated
 2127 insulation Global Warming Potential (GWP) intensity (kg CO₂e/m²) less than 0 across the whole
 2128 building envelope. GWP intensity shall be based on the default values in Table C406.15. or
 2129 product specific EPDs or calculations in the approved tools: EC3 and BEAM, may be used in
 2130 place of default table C406.15 values.

2131 **C406.15.1 Documentation for insulation embodied carbon credit.** In order to apply the
 2132 insulation embodied carbon credits for a building, the architect or engineer of record for the
 2133 building must submit a complete calculation to summarize estimated embodied carbon emissions
 2134 from all insulation materials used in the building project. The output metric for this measure
 2135 shall be Global Warming Potential (GWP) intensity, capturing insulation GWP per conditioned
 2136 square meter of project area. To complete the basic calculation, project teams shall provide the
 2137 following information for foundation, floor, wall, and roof insulation materials:

- 2138 1. Insulation material type
- 2139 2. Product R-value
- 2140 3. Total surface area (m²)
- 2141 4. Default, industry-average GWP value, from Table C406.15 or GWP values from Type
- 2142 III Product-specific Environmental Product Declaration (EPD)
- 2143 5. Total project area (conditioned square feet)

2144 Projects may substitute product-specific data for the default GWP value if the specified product
 2145 has a lower reported GWP than the default value. Substitution of default GWP values is only
 2146 allowed when type III product-specific EPDs are sourced and noted. Projects shall use GWP
 2147 values that include A1-A3 lifecycle stages, as documented in product-specific EPDs, with the
 2148 exception of SPF and XPS products. For these products, the A5 and B1 values shall be included
 2149 in the documented GWP value to account for the on-site and off-gassing impact of blowing
 2150 agents. Projects shall provide the EPDs declaration number in product-specific data substitution.

2151 **TABLE C406.15** Add Table C406.15 as follows:

2152 **250 TABLE C406.15 DEFAULT INSULATION GLOBAL WARMING POTENTIAL**
 2153 **VALUES**

2154 All values are from Building Emissions Accounting for Materials (BEAM)^a, unless noted.

Insulation Material	Default Global Warming Potential (GWP) in Kg CO₂e/sq.m. RSI-1
Cellular glass – Aggregate	3.93 ^b
Cellulose – Densepack	-2.00
Cellulose – Blown/loosefill	-0.90
Cork – Board	-4.30
EPS/graphite – Board, unfaced, Type II – 15 psi	2.30
EPS/graphite – Board, unfaced, Type IX – 25 psi	3.10
EPS – Board, unfaced, Type I – 10 psi	2.50
EPS – Board, unfaced, Type II – 15 psi	3.40
EPS – Board, unfaced, Type IX – 25 psi	4.30
Fiberglass – Batt, unfaced	1.00
Fiberglass – Blown/loosefill	1.00
Fiberglass – Blown/spray	1.93 ^c
Hemp – Batt	-0.50
HempCrete	-4.10
Mineral wool – Batt, unfaced	1.50
Mineral wool – Blown loose fill	1.90

Mineral wool – Board, unfaced, “light” density	2.70 ^f
Mineral wool – Board, unfaced, “heavy” density	6.90 ^f
Phenolic foam – Board	1.54 ^d
Polyiso – Wall Board	4.10 ^e
Polyiso – Roof Board (GRF facer)	2.11 ^e
Polyiso – Roof Board (CGF facer)	2.95 ^e
SPF – Spray, open cell	1.40
SPF – Spray, closed cell HFO	3.50
SPF – Spray, high density HFO	4.00
SPF – Spray, closed cell HFC	13.10
SPF – Spray, high density HFC	17.00
Straw - Panel	-5.45
Vacuum Insulated Panel	7.40
Wood fiber – Board unfaced, European	-4.38
Wood fiber – Board unfaced, North America	-10.30
Wood fiber – Batt, unfaced	-1.60
Wool (Sheep) - Batt	0.20
Wool (Sheep) - Loosefill	0.80
XPS – Board, 25psi HFC	55.5
XPS – Board, 25psi “Low GWP” (HFO/HFC)	5.50

2155 ^a<https://www.buildersforclimateaction.org/beam->

2156 estimator.html ^bEPD Declaration Number ^cEPD Declaration

2157 Number

2158 ^dEPD Declaration Number EPD-KSI-20190072-IBC1-EN

2159 ^ePIMA published ISO-compliant EPDs for polyiso products at:

2160 <https://www.polyiso.org/page/EPDs>

2161 ^fNAIMA value

2162

2163 **SECTION C407 TOTAL BUILDING PERFORMANCE CERTIFICATION METHODS**

2164 *C407 Replace Section C407 in its entirety as follows:*

2165

2166 **251 C407.1 Targeted Performance**

2167 This option requires compliance with Section C407.1.1 through C407.1.2.

2168

2169 **C407.1.1 Compliance.** Building shall comply with Section C407.1.1.1 through
2170 C407.1.1.6

2171

2172 **252 C407.1.1.1 Building performance modeling**

2173 Building performance modeling shall be used to show compliance with C407.1.1.5. The
2174 simulation program shall be a computer-based program for the analysis of energy consumption
2175 in buildings. The simulation shall include calculation methodologies for the building
2176 components being modeled and meet the requirements in
2177 ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Section G2.2.1(a)-(d) and G2.2.4.

2178

2179 **C407.1.1.2 Climatic conditions.** The simulation program shall perform the simulation using
2180 hourly values of climatic data using representative weather files prescribed by the
2181 Massachusetts Department of Energy Resources.

2182

2183 **C407.1.1.3 Modeling building envelope infiltration.** The air leakage rate of the building
2184 envelope shall be modeled following ANSI/ASHRAE/IESNA 90.1-2019 Section
2185 G3.1.1.4.

2186

2187 **C407.1.1.4 Internal loads, scheduling, and other modeling assumptions.** Performance
2188 modeling shall use the internal load, scheduling, and other assumptions as prescribed by
2189 the Massachusetts Department of Energy Resources.

2190

2191 **C407.1.1.5 Thermal energy demand intensity (TEDI) limits.** Performance modeling shall
2192 show that the building's heating thermal energy demand intensity and cooling thermal
2193 energy demand intensity are less than or equal to the values in Table C407.1.1.5.

2194

2195 **253 Table C407.1.1.5 Thermal Energy Demand Intensity (TEDI) Limits**

2196

Use Type	Heating TEDI (kBtu/sf-yr)	Cooling TEDI (kBtu/sf-yr)
Office, fire station, library, police station, post office, town hall >= 125,000-sf	1.5	23

Office, fire station, library, police station, post office, town hall between 75,000 and 125,000-sf	$4 - 0.00002 * \text{Area (sf)}$	$18 + 0.00004 * \text{Area (sf)}$
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 125,000sf	$2.7 - 0.000004 * \text{Area (sf)}$	$32 - 0.00016 * \text{Area (sf)}$
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	$3.8 - 0.000008 * \text{Area (sf)}$	$4.5 + 0.00014 * \text{Area (sf)}$
Residential multifamily and dormitory $< 75,000$ -sf	3.2	15
All other $\geq 125,000$ -sf	1.5	23
All other between 75,000 and 125,0000-sf	$4 - 0.00002 * \text{Area (sf)}$	$18 + 0.00004 * \text{Area (sf)}$
All other $\leq 75,000$ -sf	2.5	21

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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 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.

2211
2212 **C407.2 Relative Performance.** This option requires compliance with Section C407.2.1 and
2213 C407.2.2.

2214
2215 **C407.2.1** *Add exception to Section C407.2.1 as follows:*

2216 **C407.2.1 Electrification and documentation for highly ventilated buildings.** Buildings using
2217 the Relative Performance Pathway (C407.2) because average ventilation at full occupancy is
2218 greater than 0.5 cfm/sf shall have space heating electrified in accordance with Section C401.4.1
2219 and shall submit design documents showing ventilation system design and air flow rates as
2220 required by Section C103.2 part 16.

2221
2222 **Exception:** Space heating uses provided by a *district energy system* which is transitioning to a
2223 *heat recovery enabled district energy system* and subject to a
2224 *district energy system order of conditions* in good standing from the Commonwealth of
2225 Massachusetts Department of Energy Resources.

2226
2227 **C407.2.2 Compliance.** Building shall comply with ANSI/ASHRAE/IESNA 90.1-2019 Section
2228 4.2 using the Appendix G pathway as modified by C407.2.2.1 and C407.2.2.2.

2229
2230 **C407.2.2.1 Modification to ANSI/ASHRAE/IESNA 90.1-2019 Section 4.2.**

2231
2232 **ANSI/ASHRAE/IESNA 90.1-2019 Section 4.2** *Replace Section 4.2.1.1 with following:*

2233
2234 New buildings shall comply with 4.2.2 through 4.2.5 and normative Appendix G. When using
2235 Normative Appendix G, the Performance Energy Index (PEI) of new buildings, additions to
2236 existing buildings, and alterations to existing buildings shall be less than or equal to the
2237 Performance Energy Index Target (PEI_t) when calculated in accordance with the following:

2238
2239
$$PEI_t = [BBUE + (BPF \times BBRE)]/BBSE \qquad \text{(Equation C407.2.2.1)}$$

Where:

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)

2240
2241 **ANSI/ASHRAE/IESNA 90.1-2019 Section 4.2** *Revise Table 4.2.1.1 to show only Climate Zone*
2242 *5A; remove multifamily, office, and school; and adjust the BPFs as follows:*

2243

2244

254 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

2245

2246

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

2247

2248

ANSI/ASHRAE/IESNA 90.1-2019 Appendix G In all Sections of Appendix G, replace

2249

references to “baseline building performance” with “baseline building site energy”, replace

2250

“proposed building performance” with “proposed building site energy”, replace “energy cost

2251

savings” with “site energy savings”

2252

2253

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

2254

exception unchanged:

2255

2256

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

2257

appendix using the following formula:

2258

2259

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

2260

(BBSE)

2261

2262

Both the proposed building site energy and the baseline building site energy shall include all end

2263

use load components within and associated with the building when calculating the performance

2264

energy index.

2265

2266

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

2267

2268

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

2269

2270

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

2271

2272

Site recovered energy shall be subtracted from the proposed building site energy when

2273

calculating performance. Energy used to recharge vehicles that are used for on-road and off-site

2274

transportation purposes, or energy losses from use of behind-the-meter energy storage, should

2275

not be included when calculating performance. On-site renewable energy shall not be subtracted

2276

from the proposed building site energy when calculating performance.

2277

2278

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

2279

2280 *ANSI/ASHRAE/IESNA 90.1-2019 Appendix G Add the following row to Section G Table*
2281 *G3.1.1-*
2282 *1.*

2283
2284 **256 TABLE G3.1.1-1 BASELINE BUILDING VERTICAL FENESTRATION**
2285 **PERCENTAGE OF GROSS ABOVE-GRADE-WALL AREA**

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

2286
2287 **C407.3** Add Section C407.3 as follows:

2288 **C407.3 Passive House.** This option requires compliance with Section C407.3.1 and C407.3.2.

2289 **C407.3.1 Compliance.** Projects may document compliance with either Phius certification in
2290 accordance with C407.3.2.1 or PHI certification in accordance with C407.3.2.1 or follow
2291 C407.3.2.3. Buildings shall be pre-certified as meeting the Phius CORE 2021 or Phius ZERO
2292 2021 Passive Building Standard – North America, or newer, demonstrated using approved Passive
2293 House certification software and program criteria by PHIUS, where design-certification is
2294 demonstrated by Phius and a Certified Passive House Consultant (CPHC); or, Projects meeting
2295 the Certified Passive House standard using the approved Passive House certification software and
2296 program criteria by the Passive House Institute (PHI), where PHI certification is demonstrated by
2297 a PHI-accredited Certifier.

2298
2299 **C407.3.2 Documentation.** Compliance with Phius or PHI shall be in accordance with
2300 C407.3.2.1 or C407.3.2.2

2301 **C407.3.2.1 Phius Documentation.**

- 2302 1. Prior to the issuance of a building permit, the following items must be provided to
2303 the Building Official:
- 2304 a. A Passive House Verification report with results from the
2305 approved Passive House certification software which demonstrates
2306 project compliance with Phius CORE 2021 (or newer), or Phius ZERO
2307 2021 (or newer) performance requirements.
 - 2308 b. A statement from the CPHC that the verification report results
2309 accurately reflect the plans submitted.
 - 2310 c. Evidence of project registration from Phius.

2311 OR

- 2312 a. A Design Certification Letter from Phius.
- 2313
- 2314 2. Prior to the issuance of a final certificate of occupancy, the following items
2315 must be provided to the building official:
- 2316 a. Design Certification Letter from Phius.
 - 2317 b. An updated Passive House Verification Report with results from
2318 the

2319 approved Passive House certification software which reflects “as-built” conditions and
2320 test results (blower door and ventilation results) that demonstrate project compliance with
2321 Phius performance requirements.

2322 c. A statement from the CPHC that the envelope meets the Phius
2323 hygrothermal requirements found in Appendix B of the Phius 2021
2324 Certification guidebook

2325 d. A statement from the Phius project Verifier that the project test
2326 results meet the model performance requirements, all the mandatory
2327 limits and any other mandatory requirements.

2328 e. A copy of the Phius workbook listing all testing results and as-
2329 built conditions.

2330 OR

2331 a. A Final Certification Letter, provided by Phius.

2332 AND

2333 f. Verification of compliance with C405.13: EV ready, and Appendix CB: Solar Ready
2334 Provisions.

2335

2336

2337 **C407.3.2.2 Passive House Institute (PHI) Documentation.**

2338 1. Prior to the issuance of a building permit, the following items must be provided to
2339 the Building Official:

2340 a. A PHPP (Passive House Planning Package) compliance report with results
2341 from the approved Passive House certification software which demonstrates
2342 project compliance with current PHI performance requirements;

2343 b. A statement from the PHI-accredited Certifier that the approved Passive
2344 House certification software results and compliance report accurately reflect the
2345 plans submitted;

2346 c. Evidence of project registration from a PHI-accredited Certifier.

2347 OR

2348 a. A Design State Conditional Assurance Letter from a PHI-accredited Certifier.

2349

2350 2. Prior to the issuance of a final certificate of occupancy, the following items must
2351 be provided to the building official:

2352 a. A Design State Conditional Assurance Letter from a PHI-accredited Certifier.

2353 b. An updated compliance report with results from the approved Passive House
2354 certification software which reflects “as-built” conditions and test results
2355 (blower door and ventilation results) that demonstrates project compliance
2356 with PHI performance requirements;

2357 c. A copy of both the air leakage test results and report on the commission
2358 settings and performance of the building’s ventilation system;

2359 d. A statement from the Certified Passive House Consultant or Certified Passive
2360 House Designer that the project test results meet the model performance
2361 requirements, all the mandatory limits and any other mandatory requirements.

2362 OR

2363 a. A Final Certification Letter from a PHI-accredited Certifier.

2364 AND

2365 e. Verification of compliance with C405.13: EV ready, and Appendix CB: Solar Ready
2366 Provisions.

2367

2368 **C407.3.2.3 Documentation for design certified Passive House projects that fail final**
2369 **certification.**

2370 **C407.3.2.3.1 Compliance.** Buildings shall be pre-certified per Section C407.3.1.

2371 If, at construction completion, final certification cannot be received from either Phius
2372 or PHI, this compliance pathway may be followed to receive a certificate of occupancy
2373 based on compliance with C407.3.2.3.2 Documentation. Compliance via C407.3.2.3.2 is not
2374 equivalent to either Phius or PHI Certification and will not designate the project as a
2375 certified passive house.

2376 **C407.3.2.3.2 Near Passive House Documentation.** The following materials are required:

- 2377 **a.** Statement from the Phius certified consultant or PHI-accredited verifier
2378 confirming project has completed all interim, final, and corrective testing and
2379 modeling requirements, including a summary of deviations from certification
2380 requirements.
- 2381 **b.** Copy of executed contracts with Phius consultant or PHI rater/verifier
2382 covering all required inspections and testing requirements for certification.
- 2383 **c.** Design phase pre-certification/approval, in the form of a statement issued
2384 from Phius or PHI-accredited verifier confirming design certification or pre-
2385 certification was achieved.
- 2386 **d.** Report from rater/verifier demonstrating as-built conditions, including
2387 those that comply with Phius or PHI requirements, and those that do not.
- 2388 **i.** If the initial whole building blower door tests do not meet the
2389 Phius or PHI airtightness requirement, a statement must be provided to
2390 reflect evidence of a re-test. Statement shall include an explanation for
2391 sources of leakage and attempted remediation efforts. Final test results
2392 shall not exceed Phius or PHI airtightness thresholds by more than 30%.
- 2393 **ii.** If the mechanical ventilation flow rates and balance do not meet
2394 the requirements of Phius or PHI, report must show that installed
2395 ventilation system demonstrates compliance with the mechanical code in
2396 accordance with Section C403.
- 2397 **e.** For projects with Phius design certification, provide final Energy Star and
2398 Zero Energy Ready Homes certificates.
- 2399 **f.** A letter from a licensed professional engineer that states that the potential
2400 hygrothermal or moisture risk of the as-built assemblies, with the measured
2401 blower door test result, is acceptably low.

2402

2403 **C407.4 Add Section C407.4 as follows:**

2404 **C407.4 HERS Index for multi-family buildings.** This option requires compliance with Section
 2405 C407.4.1, C407.4.2, C407.4.3

2406
 2407 **C407.4.1 Compliance.** Each *dwelling unit* shall have a certified HERS Index (HERS) rating less
 2408 than or equal to the appropriate value indicated in Table C407.4 when compared to the *HERS*
 2409 *index reference design* for each *dwelling unit* prior to credit for onsite renewable electric
 2410 generation. Buildings shall meet or exceed ENERGY STAR Multifamily New Construction
 2411 (MFNC) program requirements. The Home Energy Rating Index (HERS) shall be determined in
 2412 accordance with ANSI/RESNET/ICC Standard 301. Software tools used for determining HERS
 2413 Index shall be Approved Software Rating Tools in accordance with ANSI/RESNET/ICC 301.
 2414 Where calculations require input values not specified in Section C407.4, those input values shall
 2415 be taken from ANSI/RESNET/ ICC 301.

2416 **257 TABLE C407.4 MAXIMUM ENERGY RATING INDEX**

	New construction permits after July 1, 2024	New Construction with R406.5.2 embodied carbon credit ^c	Major alterations, additions, or Change of use ^b
<i>Mixed-Fuel Building</i>	42	45	55
Solar Electric Generation	42	45	58
<i>All-Electric Building</i>	45	48	58
Solar Electric & <i>All-Electric Building</i>	45	48	61

2417
 2418 ^a Maximum HERS rating prior to onsite renewable electric generation in accordance with
 2419 Section C407.4

2420 ^b Alterations, Additions or Change of use covered by Sections C502, C503 or C505 are
 2421 subject to this maximum HERS rating, except for Historic buildings which may opt to follow the
 2422 prescriptive compliance pathway in C401 as applicable. ^cNew multi-family and mixed-use
 2423 buildings may follow Sections R406.5.2 – R406.5.4 from 225 CMR 22 (Residential Stretch
 2424 code) to demonstrate eligibility where applicable.

2425

2426 **C407.4.2 Documentation.** Documentation verifying that the methods and accuracy of compliance
2427 software tools conform to the provisions of this section shall be provided to the *building official*
2428 in accordance with C407.4.3.1 and C407.4.3.2.:

2429 **C407.4.2.1 Prior to issuance of building permit.** Prior to the issuance of a building permit,
2430 the following items must be provided to the Building Official:

- 2431 1. Building street address, or other *building site* identification.
- 2432 2. Declare the HERS Index on title page and building plans.
- 2433 3. The name of the individual performing the analysis and generating the
2434 compliance report.
- 2435 4. The name and version of the compliance software tool.
- 2436 5. Documentation of all inputs entered into the software used to produce the results
2437 for the reference design and/or the rated home.
- 2438 6. A certificate indicating that the proposed design has a HERS Index less than or
2439 equal to the appropriate score indicated in Table C407.4 when compared to the ERI
2440 reference design. The certificate shall document the building component energy
2441 specifications that are included in the calculation, including: component level insulation
2442 R-values or Ufactors; assumed duct system and building envelope air leakage testing
2443 results; and the type and rated efficiencies of proposed heating, cooling, mechanical
2444 ventilation, and service water-heating equipment to be installed. If on-site renewable
2445 energy systems will be installed, the certificate shall report the type and production size
2446 of the proposed system.
- 2447 7. When a site-specific report is not generated, the proposed design shall be based
2448 on the worst-case orientation and configuration of the rated home.

2449

2450

2451 **C407.4.2.2 Prior to issuance of certificate of occupancy.** Prior to the issuance of a
2452 certificate of occupancy, the following items must be provided to the Building Official:

- 2453 1. Building street address or other *building site* identification.
- 2454 2. Declaration of the Final HERS Index on title page and on building plans.
- 2455 3. The name of the individual performing the analysis and generating the report.
- 2456 4. The name and version of the compliance software tool.
- 2457 5. Documentation of all inputs entered into the software used to produce the results for
2458 the reference design and/or the rated home.
- 2459 6. A final confirmed certificate indicating that the confirmed rated design of the built
2460 home complies with Sections C407.4. The certificate shall report the energy features
2461 that were confirmed to be in the home, including: component-level insulation Rvalues
2462 or U-factors; results from any required duct system and building envelope air leakage
2463 testing; and the type and rated efficiencies of the heating, cooling, mechanical
2464 ventilation, and service water-heating equipment installed.
- 2465 7. Documentation that each unit meets or exceeds ENERGY STAR Multifamily New
2466 Construction (MFNC) program requirements.

- 2467 8. Where on-site renewable energy systems have been installed on or in the home, the
2468 certificate shall report the type and production size of the installed system.
2469 9. Compliance with C405.13, and either Appendix CB or Appendix CC as applicable.
2470 10. Optional compliance with R406.5.2 Embodied carbon credit as documented in
2471 accordance with R406.5.3 or R406.5.4 as applicable.
2472

2473 **C407.4.3 Verification by approved agency.** Verification of compliance shall be completed by
2474 a certified HERS rater.

2475 **258 CHAPTER 5: [CE] EXISTING BUILDINGS SECTION C501 GENERAL**

2476 *C501.2 Revise Section C501.2 and replace the exception to Section C501.2 as follows:*

2477 **C501.2 Compliance.** *Additions, alterations, repairs,* and changes of occupancy to, or relocation
2478 of, existing buildings and structures shall comply with Sections C502, C503, C504 and C505 of
2479 this code, as applicable, and with the provisions for *alterations, repairs, additions* and changes
2480 of occupancy or relocation, respectively, in the International Building Code, International
2481 Existing Building Code, Massachusetts Fire Code, International Mechanical Code,
2482 Massachusetts Plumbing Code, and NFPA 70. Changes where unconditioned space is changed to
2483 conditioned space shall comply with Section C502.

2484 **Exception:** *Additions, alterations, repairs* or changes of occupancy complying with Section
2485 C506 EnerPHit standard compliance pathway.

2486 **259 SECTION C502 ADDITIONS**

2487 *C502.1 Revise Section C502.1 as follows:*

2488

2489 **C502.1 General.** Additions to an existing building where the addition is up to 100% of the size
2490 of the existing building and less than 20,000 sq. ft. shall comply with Sections C401.3, C402
2491 through C406, and Section C408. Additions which exceed either of these limits shall comply
2492 with the applicable pathway for new construction in C401.2. Additions shall not create an
2493 unsafe or hazardous condition or overload existing building systems. An addition shall be
2494 deemed to comply with this code if the addition alone complies or if the existing building and
2495 addition comply with this code as a single building.

2496

2497 *C502.2 Remove both exceptions to Section C502.2:*

2498

2499 *C502.3.7 Add Section C502.3.7 as follows:*

2500 **C502.3.7 Air Infiltration Testing.** Additions shall be required to comply with air infiltration
2501 testing requirements in accordance with Section C402.5 for the addition only.

2502 **260 SECTION C503 ALTERATIONS**

2503 *C503.1 Revise Section C503.1 as follows:*

2504

2505 **C503.1 General.** *Alterations* to any *building* or structure shall comply with the requirements of
2506 Section C503, and Sections C402, C403, C404, C405 of the code for new construction.

2507 *Alterations* shall be such that the existing *building* or structure is not less conforming to the
2508 provisions of this code than the *existing building* or structure was prior to the *alteration*.

2509 *Alterations* to an existing *building*, *building* system or portion thereof shall conform to the
2510 provisions of this code as those provisions relate to new construction without requiring the
2511 unaltered portions of the existing *building* or *building* system to comply with this code.

2512 *Alterations* shall not create an unsafe or hazardous condition or overload existing *building*
2513 systems.

2514 **Exceptions:** The following *alterations* need not comply with the requirements for new
2515 construction, provided that the energy use of the building is not increased:

- 2516 1. Storm windows installed over existing *fenestration*.
- 2517 2. Surface-applied window film installed on existing single-pane *fenestration*
2518 assemblies reducing solar heat gain, provided that the code does not require the
2519 glazing or *fenestration* to be replaced.
- 2520 3. Where the component performance alternative in Section 402.1.5 is used
2521 to comply with this section, the proposed UA shall not be greater than 110% of
2522 the target UA.
- 2523 4. Construction where the existing roof, wall or floor cavity is not exposed.
- 2524 5. *Roof recover*.
- 2525 6. *Air barriers* shall not be required for *roof recover* and roof replacement
2526 where the *alterations* or renovations to the building do not include *alterations*,
2527 renovations or *repairs* to the remainder of the building envelope.
- 2528 7. Wall cavities that are exposed during construction shall comply with
2529 Section C402.1.4. Localized removal of interior finishes up to 10 ft² does not
2530 require upgrading the wall assembly to show compliance with Section C402.1.4.
2531 Localized exposed cavities shall be filled with insulation not less than R-4 / inch.

2532 **C503.2** *Revise Section C503.2 as follows:*

2533 **C503.2 Building envelope.** New building envelope assemblies that are part of the alteration
2534 shall comply with Section C402.

2535 **C503.2.4** *Add Section C503.2.4 as follows:*

2536 **C503.2.4 Derating and Thermal Bridges.** Existing linear thermal bridges inherent to the
2537 building structure and/or components that are not part of the alteration shall not be accounted for
2538 per C402.7.3. Construction documents shall include the following documentation in tabular
2539 format for these linear thermal bridges that may be excluded from vertical envelope
2540 performance:

- 2541 1. Linear thermal bridge type.
- 2542 2. Aggregate length of each type of linear thermal bridge.

2543 3. Relevant detail in the construction documents showing a cross-
2544 section through the thermal bridge.

2545 **261 SECTION C505 CHANGE OF OCCUPANCY OR USE**

2546 *C505.1 Revise Section C505.1 as follows:*

2547
2548 **C505.1 General.** Spaces undergoing a change in occupancy that would result in an increase in
2549 either total modeled annual fossil fuel use or total modeled annual energy use shall comply with
2550 Sections C401.3, C402 through C406, and Section C408. Where the use in a space changes from
2551 one use in Table C405.3.2(1) or C405.3.2(2) to another use in Table C405.3.2(1) or C405.3.2(2),
2552 the installed lighting wattage shall comply with Section C405.3. Where the space undergoing a
2553 change in occupancy or use in a building with a fenestration area that exceeds the limits of
2554 Section C402.4.1, the space is exempt from Section C402.4.1 provided that there is not an
2555 increase in fenestration area.

2556 Exceptions:

- 2557 1. Where the component performance alternative in Section C402.1.5 is used to comply
2558 with this section, the proposed UA shall not be greater than 100% of the target UA.
2559
- 2560 2. Projects complying with C401.2 (New construction pathways)
2561
- 2562 3. Projects complying with C506 (EnerPHit standard).
2563
- 2564 4. Interior tenant fit outs having an area of 20% or less of the total building area and which
2565 do not include changes to the adjacent existing exterior wall and/or *glazed wall system*
2566 shall be considered Alterations per Section C503. Changes to existing punched window
2567 fenestration, when brought into compliance with Section C402.4.3 and which derate
2568 window U-value due to the fenestration to exterior wall intersection linear thermal
2569 bridge, shall not disqualify the interior fit out from this exception. Derating of the
2570 window U value shall be determined in accordance with Equation C402.7.3 where the U
2571 values shown in the equation is the U value of the window and the A_{total} value shown in
2572 the equation is the area of the window.
2573

2574 *C506 Add Section C506 as follows:*

2575
2576 **262 SECTION C506 ENERPHIT STANDARD COMPLIANCE PATHWAY**

2577 **C506 EnerPHit Standard.** This option requires compliance with Section C506.1 and C506.2.

2578 **C506.1 Compliance.** Buildings shall be pre-certified as meeting the EnerPHit Retrofit Plan
2579 standard using the approved Passive House certification software and program criteria by the
2580 Passive House Institute (PHI), where PHI certification is demonstrated by a PHI-accredited
2581 Certifier.

2582 **C506.2 Documentation.** Compliance with EnerPHit standard shall be documented in
2583 accordance with the following:

2584 1. Prior to the issuance of a building permit, the following items must be provided to the
2585 Building Official:

2586 a. A compliance report with results from the approved Passive House certification
2587 software which demonstrates project compliance with current PHI performance
2588 requirements;

2589 b. A statement from the PHI-accredited Certifier that the approved Passive House
2590 certification software results and compliance report accurately reflect the plans
2591 submitted;

2592

2593 c. Evidence of project registration from a PHI-accredited Certifier.

2594 OR

2595 a. A Design Certification Letter/ Design State Conditional Assurance Letter from a PHI-
2596 accredited Certifier.

2597

2598 2. Prior to the issuance of a final certificate of occupancy, the following items must be
2599 provided to the building official:

2600 a. A Design Certification Letter from a PHI-accredited Certifier.

2601 b. An updated compliance report with results from the approved Passive House
2602 certification software which reflects “as-built” conditions and test results (blower
2603 door and ventilation results) that demonstrates project compliance with PHI
2604 performance requirements;

2605 c. A copy of both the air leakage test results and report on the commission settings
2606 and performance of the building’s ventilation system;

2607 d. A statement from the Certified Passive House Consultant or Certified Passive
2608 House Designer that the project test results meet the model performance
2609 requirements, all the mandatory limits and any other mandatory requirements.

2610 OR

2611 a. A Final Certification Letter from a PHI-accredited Certifier.

2612

2613

2614

2615 *Appendix CB Adopt unamended*

2616

2617 **APPENDIX CB: Solar-Ready Zone—Commercial.**

2618

2619 **263 APPENDIX CC - MASSACHUSETTS MUNICIPAL OPT-IN SPECIALIZED**
 2620 **ENERGY CODE 2023 COMMERCIAL BUILDING PROVISIONS**

2621 *The provisions contained in this appendix are not mandatory unless specifically referenced in*
 2622 *the adopting ordinance. The provisions contained in this appendix together with referenced*
 2623 *sections from the Stretch energy code constitute the Specialized opt-in code for commercial*
 2624 *buildings, and may be adopted by a city or town together with the Residential Specialized code*
 2625 *Appendix RC as their stretch energy code. When adopted by the local municipality, the*
 2626 *provisions in this appendix are mandatory in combination with the IECC2021 with*
 2627 *Massachusetts Stretch code amendments.*

2628
 2629 **264 SECTION CC101 GENERAL**

2630
 2631 *CC101.1 Replace Section CC101 as follows:*

2632
 2633 **CC101.1 Purpose.** The purpose of this appendix is to form the commercial building provisions
 2634 of the Massachusetts Municipal Opt-in Specialized Code to supplement the Massachusetts
 2635 Stretch Energy Code and to provide a compliance pathway for buildings that require renewable
 2636 energy systems of adequate capacity to achieve net zero carbon.

2637
 2638 *CC101.2 Replace Section CC101.2 as follows:*

2639 **CC101.2 Scope.** This appendix applies to new buildings that are addressed by the Municipal
 2640 Opt-in Specialized Code. Residential buildings or *dwelling units* within mixed use buildings
 2641 shall comply as follows:

- 2642 1) New *dwelling units* over 4,000 sq. ft. in conditioned floor area in *Mixed Fuel*
 2643 *Buildings* shall comply with the Zero Energy pathway and Section CC103 or with residential
 2644 code Section RC102.
 2645 2) New R-use buildings over 12,000 sq. ft. in conditioned floor area shall comply in
 2646 accordance with Table CC101.2.
 2647 3) New R-use buildings less than or equal to 12,000 square feet in conditioned floor area
 2648 shall comply with Residential Appendix RC.

2649
 2650 **265 TABLE CC101.2 MULTI-FAMILY AND R-USE COMPLIANCE**

R-Use buildings over 12,000 sf, or RUse portions over 12,000 sf in mixeduse buildings	Compliance Path options	
	C407.3 Passive house	C401.2.1 Prescriptive and Performance Compliance
R-2 Multi-family	Required	N/A

R-1 Occupancies (e.g. transient occupancy Hotels/Motels)	Optional	Options 1,2 or 3
---	----------	------------------

2651 **Exceptions:**

- 2652 1. Detached one- and two-family dwellings and townhouses as well as Group R-2
2653 buildings three stories or less in height above grade plane, manufactured homes
2654 (mobile dwellings), and manufactured houses (modular dwellings). These buildings
2655 and dwelling units shall comply with Residential Appendix RC under the Specialized
2656 energy code.
2657 2. Buildings that use neither electricity nor fossil fuel.
2658

2659 *CC101.3 Add Section CC101.3 as follows:*

2660 **CC101.3 Compliance.** New buildings shall demonstrate compliance with Sections CC101.4,
2661 CC101.5 and one of the following pathways:

- 2662 1. **Zero Energy pathway:** Buildings shall comply with Section CC103 and demonstrate
2663 that they are *Zero Energy Buildings* in accordance with Equation CC-1. *Mixed Fuel*
2664 *Buildings* with any capacity for on-site fossil fuel use shall be pre-wired for future
2665 electrification of all fuel uses in accordance with Section CC105.
2666 2. **All-Electric pathway:** Buildings shall comply with Section CC104.
2667 3. **Mixed Fuel pathway:** *Mixed Fuel Buildings* other than *Zero Energy Buildings* with any
2668 capacity for on-site fossil fuel use shall comply with CC105 and CC106.
2669

2670 The following uses shall be excluded when determining whether new buildings will have
2671 on site fossil fuel use:

- 2672 a. On-site back up power generators using fossil fuel
2673 b. On-site refuelling of vehicles or outdoor equipment using fossil fuels.
2674

2675 *CC101.4 Add Section CC101.4 as follows:*

2676 **CC101.4 Minimum building energy efficiency.** New buildings shall comply with Section
2677 C401.2.1 or C401.2.2. as prescribed in Section C401. Existing buildings shall comply with
2678 Chapter 5 as amended.

2679 *CC101.5 Add Section CC101.5 as follows:*

2680 **CC101.5 Minimum electric vehicle ready parking requirements.** New parking spaces shall
2681 provide *electric vehicle ready spaces* in accordance with Section C405.13 and Table C405.13.
2682

2683 **266 SECTION CC102 DEFINITIONS**

2684
2685 *CC102 Revise Section CC102 as follows:*
2686

2687 **CC102.1 Definitions.** The definitions contained in this section supplement or modify the
2688 definitions in the MA amended *International Energy Conservation Code*, in Section C202.

2689
2690 **BUILDING ENERGY.** All energy consumed at the *building site* as measured at the site
2691 boundary. Contributions from onsite or off-site renewable energy systems shall not be
2692 considered when determining the building energy.

2693
2694 **ENERGY UTILIZATION INTENSITY (EUI).** The site energy for either the baseline building
2695 or the proposed building divided by the gross *conditioned floor area* plus any semiheated floor
2696 area of the building. For the baseline building, the EUI can be divided between regulated energy
2697 use and unregulated energy use.

2698
2699 **NET ZERO EMISSIONS BUILDING.** A building which is consistent with achievement of
2700 MA 2050 net zero emissions, through a combination of highly energy efficient design together
2701 with being either a *Zero Energy Building*, or an *All-Electric Building*, or where fossil fuels are
2702 utilized, the building is fully pre-wired for future electrification and generates solar power on-
2703 site from the available *Potential Solar Zone Area*.

2704
2705 **OFF-SITE RENEWABLE ENERGY SYSTEM.** Renewable energy system not located on the
2706 building project.

2707
2708 **ON-SITE RENEWABLE ENERGY SYSTEM.** Renewable energy systems on the building
2709 project.

2710
2711 **POTENTIAL SOLAR ZONE AREA.** The combined area of any low-sloped roofs and any
2712 steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual
2713 solar access is 70 percent or greater. Annual solar access is the ratio of “annual solar insolation
2714 with shade” to the “annual solar insolation without shade”. Shading from obstructions located on
2715 the roof or any other part of the building shall not be included in the determination of annual
2716 solar access.

2717
2718 **RENEWABLE ENERGY SYSTEM.** Photovoltaic, solar thermal, geothermal energy and wind
2719 systems used to generate energy.

2720
2721 **SEMIHEATED SPACE.** An enclosed space within a building that is heated by a heating
2722 system whose output capacity is greater than or equal to 3.4 Btu/h × ft² of floor area but is not a
2723 conditioned space.

2724
2725 **ZERO ENERGY BUILDING.** A building which through a combination of highly energy
2726 efficiency design and onsite renewable energy generation is designed to result in net zero energy
2727 consumption over the course of a year as measured in MMBtus or KWh_{eq}, on a site energy basis,
2728 excluding energy use for charging vehicles.

2729

2730 **267 SECTION CC103 ZERO ENERGY PATHWAY MINIMUM RENEWABLE**
2731 **ENERGY**

2732
2733 *CC103.1* Revise Section CC103.1 as follows (keeping Table CC103.1 for climate zone 5A
2734 unchanged):

2735 **CC103.1 Renewable energy.** On-site renewable energy systems shall be installed to offset the
2736 building energy as calculated in Equation CC-1.

2737
2738 $RE_{onsite} \geq E_{building}$ (Equation CC-1)

2739
2740 **where:**

2741
2742 RE_{onsite} = Annual site energy production from on-site renewable energy systems (see Section
2743 CC103.2).

2744 $E_{building}$ = Building energy use without consideration of renewable energy systems, on-site
2745 energy storage, on-site back-up generators, or on-site refuelling of vehicles or outdoor
2746 equipment.

2747 When Section C401.2.1(1) is used for compliance with Section CC101.4, building energy shall
2748 be determined by multiplying the gross *conditioned floor area* plus the gross semi-heated floor
2749 area of the proposed building by an EUI selected from Table CC103.1. Use a weighted average
2750 for mixed-use buildings.

2751
2752 When any compliance pathway other than Section C401.2.1 Part 1 is used for compliance with
2753 CC101.4, building site energy use shall be determined from energy simulations.

2754 *CC103.2* Revise Section CC103.2 as follows:
2755

2756 **CC103.2 Calculation of on-site renewable energy.** The annual energy production from on-site
2757 renewable energy systems shall be determined using the PVWatts software or other software
2758 approved by the code official. Commercial R-use buildings may comply using the Zero Energy
2759 Buildings pathways in Appendix RC by certifying that all units meet HERS 0 or lower with
2760 onsite renewable generation or by following the on-site renewable energy calculation used in the
2761 Phius ZERO certification standard when following the Passive house compliance pathway.

2762
2763 *CC103.3* Delete Section CC103.3:

2764
2765 *CC104* Add Section CC104 as follows:
2766

2767 **268 SECTION CC104 ALL ELECTRIC PATHWAY**

2768 **CC104.1 General.** New *all-electric buildings* shall comply with Sections CC101.4, CC101.5
2769 and with one of the following:

- 2770 1) Section C401.2.1 and Section C401.4.3
2771 2) Section C407.3 Passive house

2772

2773 **CC105** Add Section CC105 as follows:

2774

2775 **269 SECTION CC105 MIXED-FUEL BUILDING PATHWAY**

2776 **CC105.1 General.** This section together with Section CC106 establishes additional minimum
2777 requirements for new *mixed-fuel buildings*.

2778

2779 **CC105.1.1 Biomass heating.** New buildings using *clean biomass heating systems* may comply
2780 with this section without meeting CC105.3.1 and CC105.3.2. Buildings with any *combustion*
2781 *equipment* using biomass that does not meet the performance standards of *clean biomass heating*
2782 *systems* shall be deemed *mixed-fuel buildings* and shall comply with this section in full.

2783

2784 **CC105.2** Revise Section CC105.2 as follows:

2785 **CC105.2 On-site renewable energy.** New mixed-fuel buildings shall have equipment installed
2786 for on-site renewable energy with a rated capacity of not less than 1.5 W/ft² (16.1 W/m²)
2787 multiplied by the sum of the gross conditioned floor area of the three largest floors.

2788 **Exceptions:**

2789

2790 1. Where the building site cannot meet the requirement in full with an on-site renewable energy
2791 system, the building site shall install a partial system designed to utilize not less than 75% of
2792 the *Potential Solar Zone Area*.

2793 2. Buildings having average ventilation at full occupancy of greater than 0.5 cfm/sf,
2794 *Hospitals*, and *Psychiatric Hospitals*, shall have equipment installed for on-site
2795 renewable energy with a rated capacity of not less than 0.5 W/ ft² (5.4 W/m²) multiplied
2796 by the sum of the gross conditioned floor area of the three largest floors.

2797 3. Buildings interconnected to a downtown spot network portion of the electric grid,
2798 provided that the electric utility provides a statement that on-site renewable energy can
2799 not be safely interconnected.

2800

2801 **CC105.3.** Revise CC105.3 as follows:

2802 **CC105.3 Additional efficiency requirements.** Additional efficiency requirements for
2803 compliance with this Section are set forth in Sections CC105.3.1 and CC105.3.2.

2804

2805 **CC105.3.1 More efficient HVAC equipment performance.** Primary heating and cooling
2806 *equipment* shall meet the following efficiencies as applicable:

2807 1. Space heating *combustion equipment* shall be rated at greater than or equal to 95
2808 AFUE.

2809 2. All refrigerant-based air conditioning equipment shall be a heat pump with
2810 greater than or equal to 8.1 HSPF2 rated heating performance and greater than or equal to
2811 15.2 SEER2 rated cooling performance for ducted systems, and greater than or equal to
2812 8.5

2813 HSPF2 rated heating performance and greater than or equal to 16 SEER2 rated cooling
2814 performance for ductless systems.

2815 3. Ground source heat pump systems shall be rated at greater than or equal to 3.5
2816 COP at design temperature.

2817
2818 For multiple cooling systems, all systems shall meet or exceed the minimum efficiency
2819 requirements in this section and collectively shall be sized to serve 100% of the cooling design
2820 load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency
2821 requirements in this section and collectively shall be sized to serve 100% of the heating design
2822 load.

2823 **Exception:** *Clean biomass heating systems* used as the primary heating system.

2824
2825 **CC105.3.2 Reduced energy use in service water-heating option.** The hot water system shall
2826 meet one of the following efficiencies:

- 2827 1. Greater than or equal to 82 EF *combustion equipment* service\water-heating system.
2828 2. Greater than or equal to 2.0 UEF electric service water-heating system.
2829 3. Greater than or equal to 0.4 solar fraction solar water-heating system.
2830 4. *Clean biomass heating system* supplied water-heating system.

2831
2832 **Exception:** Space and *service water heating* uses provided by a *district energy system* subject to
2833 a *district energy system order of conditions* in good standing from the Commonwealth of
2834 Massachusetts Department of Energy Resources.

2835
2836 **CC106** Add new Section CC106 as follows:

2837
2838 **270 SECTION CC106 WIRING FOR FUTURE ELECTRIFICATION**

2839
2840 **CC106.1 Additional electric infrastructure.** All *combustion equipment* and end-uses shall be
2841 installed in accordance with this section. Capacity for the future electric circuits required in this
2842 section shall be included in the load calculations of the original installation of electric service to
2843 the building, and each *dwelling unit* for R-use buildings or portions thereof.

2844 **Exception:** Space and *service water heating* uses provided by a *district energy system* subject to
2845 a *district energy system order of conditions* in good standing from the Commonwealth of
2846 Massachusetts Department of Energy Resources.

2847 **CC106.1.1 Electric infrastructure for dwelling and sleeping units.** *Combustion equipment*
2848 and end-uses serving individual *dwelling units* or *sleeping units* shall comply with Section
2849 RC104.3 Electric Readiness.

2850 **CC106.1.2 Combustion water heating equipment.** Gas-fired or oil-fired water heaters with a
2851 capacity less than 300,000 Btu/h (88 kW) shall be installed in accordance with the following:

- 2852 1. A dedicated 208/240-volt branch circuit with a minimum capacity of 30
2853 amps shall terminate within 3 ft. (914 mm) from the water heater and be
2854 accessible to the water heater with no obstructions. Both ends of the

- 2855 branch circuit shall be labeled with the words "For Future Heat Pump
2856 Water Heater" and be electrically isolated,
- 2857 2. A condensate drain that is no more than 2 inches (51 mm) higher than the
2858 base of the installed water heater and allows natural draining without
2859 pump assistance shall be installed within 3 ft. (914 mm) of the water
2860 heater,
 - 2861 3. The water heater shall be installed in a space with minimum dimensions of
2862 3 ft. (914 mm) by 3 ft. (914 mm) by 7 ft. (2134 mm) high, and
 - 2863 4. The water heater shall be installed in a space with a minimum volume of
2864 700 cu. ft. (20,000 L) or the equivalent of one 16-inch (406 mm) by
2865 24inch (610 mm) grill to a heated space and one 8 inch (203 mm) duct of
2866 no more than 10 ft. (3048 mm) in length for cool exhaust air.

2867
2868 **CC106.1.3 Cooking ranges, ovens and cooktops.** An individual branch circuit outlet with a
2869 minimum rating of 250-volts, 40-amperes shall be installed within 3 ft. of each gas or propane
2870 range or any permanently installed *combustion equipment* oven or cooktop.

2871
2872 **Exception:** Commercial kitchens for cafeteria, restaurant or commercial catering business use.

2873
2874 **CC106.1.4 Clothes Dryers.** An individual branch circuit outlet with a minimum rating of 250-
2875 volts, 30-amperes shall be installed within 3 ft. of each gas or propane clothes dryer.

2876
2877 **Exception:** commercial drying equipment used for manufacturing and process loads

2878
2879 **CC106.1.5 Other combustion equipment.** *Combustion equipment* not covered by Sections
2880 CC106.1.1 and CC106.1.4 and within buildings having average ventilation at full occupancy of
2881 0.5 cfm/sf or less shall be provided with conduit that is continuous between a junction box
2882 located within 3 ft. (914 mm) of the *appliance* or *equipment* and an electrical panel. The junction
2883 box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch
2884 circuit with sufficient capacity for an equivalent electric appliance, equipment or end use with an
2885 equivalent equipment capacity. The electrical junction box and electrical panel shall have labels
2886 stating, "For future electric equipment".

2887 **CC106.1.6 Other combustion equipment, highly ventilated buildings.** *Combustion equipment*
2888 not covered by Sections CC106.1.1 and CC106.1.4 and within buildings having average
2889 ventilation at full occupancy of greater than 0.5 cfm/sf shall comply with Section CC106.1.6.1
2890 through CC106.1.6.5.

2891 **CC106.1.6.1 HVAC Design and Installed Associated Electric Service.** An allelectric HVAC
2892 retrofit design shall be prepared by the HVAC engineer for approval by the authority having
2893 jurisdiction. The electric service installed with the building shall be sufficient to accommodate
2894 the all-electric HVAC retrofit design. The contract documents shall show future replacement of
2895 *combustion equipment* based HVAC system with an equivalent all-electric system. Contract
2896 documents shall show *combustion equipment* to be replaced, future electric equipment,
2897 supporting electric, structural, and architectural infrastructure to be installed during building
2898 construction, and space allotments for future equipment.

2899 **CC106.1.6.2 Heating, Ventilation, and Air Conditioning (HVAC) Compatibility.** HVAC
2900 design shall ensure that air, water, or other systems serviced by *combustion equipment* can also
2901 be serviced by future electric retrofit equipment without having to upgrade, alter, or update such
2902 systems.

2903 **CC106.1.6.3 Equipment Efficiencies.** Electric retrofit equipment used for space and water
2904 heating shall conform to Section C401.4.3.

2905 **CC106.1.6.4 Installed Infrastructure.** Infrastructure shall be installed as part of building
2906 construction to accommodate future electric retrofit in order to minimize cost and disruption
2907 during retrofit. Infrastructure to be installed as part of building construction shall include, but is
2908 not limited to, power infrastructure to the building to accommodate future electric retrofit
2909 system, electric service to future distributed equipment within the building, conduits to
2910 accommodate controls to future distributed equipment within the building, and structural and
2911 architectural elements to accommodate future retrofit equipment.

2912 **CC106.1.6.5 Space for Future Retrofit Equipment.** Interior and exterior space shall be
2913 allotted to accommodate all future electric retrofit equipment. Where interior or exterior allotted
2914 space exceeds the space used for *combustion equipment* to be replaced, and/or does not
2915 correspond to the *combustion equipment* locations to be replaced, such space shall be set aside
2916 and may not be used for any other purpose. Signage, labels, and borders shall be used to
2917 prominently display areas and limits set aside for future equipment to prevent encroachment.