Code Changes to the 2024 International Energy Conservation Code (IECC) – Commercial Provisions

<table>
<tr><th>Mod Number</th><th>Summary - Text of Mod</th></tr>
<tr><td>CE#1</td><td>Clarifies how the commercial energy code applies.</td></tr>
<tr><td>Related mod:

CED1-2-22</td><td>C101.2 Scope. This code applies to ~~commercial buildings and the buildings' sites and associated systems and equipment.~~the design and construction of buildings not covered by the scope of the IECC—Residential Provisions.
<table>
<tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr>
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<tr><td>CE#2</td><td>A new clarification subsection states that appendices are not applicable unless adopted.</td></tr>
<tr><td>Related mod:

CED1-2-22</td><td>C101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted
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<tr><td>CE#3</td><td>Provides expanded clarification on the intent of this code.</td></tr>
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<table>
<tr><td>Related mod:

CED1-1-22</td><td>**C101.3 Intent.** ~~This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.~~The IECC—Commercial Provisions provide market-driven, enforceable requirements for the design and construction of *commercial buildings* , providing minimum efficiency requirements for buildings that result in the maximum level of energy efficiency that is safe, technologically feasible, and life cycle cost effective, considering economic feasibility, including potential costs and savings for consumers and building owners, and return on investment. Additionally, the code provides jurisdictions with supplemental requirements, including **ASHRAE 90.1**, and optional requirements that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030 and on additional timelines sought by governments, and achievement of additional policy goals as identified by the Energy and Carbon Advisory Council and approved by the Board of Directors. Requirements contained in the code will include, but not be limited to, prescriptive- and performance-based pathways. The code may include nonmandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the International Code Council and others. The code will aim to simplify code requirements to facilitate the code's use and compliance rate. The code is updated on a 3-year cycle with each subsequent edition providing increased energy savings over the prior edition. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this intent. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.
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<tr><td>**CE#4**</td><td>Renumbers sub-section C101.5.1 to C101.4.1. Creates new Section C102. Created by moving an existing Section.</td></tr>
<tr><td>Related Mod:

CED1-1-22</td><td>**~~C101.5~~C101.4 Compliance.** *Residential buildings* shall meet the provisions of IECC—Residential Provisions. *Commercial buildings* shall meet the provisions of IECC—Commercial Provisions.

~~C101.5.1~~C101.4.1 Compliance materials. The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code.
<table>
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<tr><td>**CE#5**</td><td>Moves and Renumbers Section C101.4. Renames C102.5 to Partial invalidity</td></tr>
</table>

Related Mod:	SECTION C102 APPLICABILITY ~~C101.4~~C102.1 **Applicability.** Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern. ~~C101.4.1~~C102.1.1 **Mixed residential and commercial buildings.** Where a *building* includes both *residential building* and *commercial building* portions, each portion shall be separately considered and meet the applicable provisions of IECC—Commercial Provisions or IECC—Residential Provisions. ~~C108.3~~C102.2 **Other laws.** The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law. ~~C108.2~~C102.3 **Applications of references.** References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code. ~~C108.1~~C102.4 **Referenced codes and standards.** The codes and standards referenced in this code shall be those listed in **Chapter 6**, and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and as further regulated in **Sections C102.4.1** and **C102.4.2**. ~~C108.1.1~~C102.4.1 **Conflicts.** Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply. ~~C108.1.2~~C102.4.2 **Provisions in referenced codes and standards.** Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard. ~~C107.1~~C102.5 ~~**General.**~~**Partial invalidity.** If a portion of this code is held to be illegal or void, such a decision shall not affect the validity of the remainder of this code. The original text of mod is not consistent with that of the 2023 FBC – EC.
CE#6	Created new Section C103. And New Sub sections C103.1 through C103.3

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

<table>
<tr><td>Related Mod:

CED1-3-22</td><td>

SECTION C103
CODE COMPLIANCE AGENCY

C103.1 Creation of enforcement agency. The **[INSERT NAME OF DEPARTMENT]** is hereby created and the official in charge thereof shall be known as the authority having jurisdiction (AHJ). The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

C103.2 Appointment. The AHJ shall be appointed by the chief appointing authority of the jurisdiction.

C103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the AHJ shall have the authority to appoint a deputy AHJ, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the AHJ.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

</td></tr>
<tr><td>CE#7</td><td>Renumbers Section C102. Renumbers C104.1.1.</td></tr>
</table>

Related Mod:

CED1-3-22

SECTION ~~C102~~C104

ALTERNATIVE MATERIALS, DESIGN AND METHODS OF CONSTRUCTION AND EQUIPMENT

~~102.1~~C104.1 General. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved* . The *code official* shall have the authority to approve an alternative material, design or method of construction upon the written application of the *owner* or the owner's authorized agent. The *code official* shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance* , durability, energy conservation and safety. The *code official* shall respond to the applicant, in writing, stating the reasons why the alternative was *approved* or was not *approved*.

~~C102.1.1~~C104.1.1 Above code programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program as exceeding the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered to be in compliance with this code. The requirements identified in ~~Table C407.2~~ **Table C407.2(1)** shall be met.

The original text of mod is not consistent with that of the 2023 FBC – EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#8

Renumbers C103

Related Mod:

CED1-2-22

SECTION ~~C103~~C105 CONSTRUCTION DOCUMENTS

~~C103.1~~C105.1 General. *Construction documents* and other supporting data shall be submitted in one or more sets, or in a digital format where allowed by the ~~building~~*code official*, with each application for a permit. The *construction documents* shall be prepared by a *registered design professional* where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the *code official* is authorized to require necessary *construction documents* to be prepared by a *registered design professional*.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#9

Renumbers sub-section C103.2. Added four new construction document requirement items to the existing lists:

- *Thermal bridges* as identified in Section C402.6.

- Location reserved for inverters, metering equipment, and energy storage systems (ESS), and a pathway reserved for routing raceways or conduits from the renewable energy system to the point of interconnection with the electrical service and the ESS.
- The location of pathways for routing raceways or cable from the on-site renewable energy system to the electrical distribution equipment.
- Location and layout of a designated area for ESS.
- Rated energy capacity and rated power capacity of the installed or panned ESS.

Related Mod:

CED1-2-22, CECP1-2-21, CEDP1-4-21, CEPI-7-21

~~C103.2~~C105.2 **Information on construction documents.** *Construction documents* shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official* . *Construction documents* shall be of sufficient clarity to

indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building* , systems and equipment as herein governed. Details shall include, but are not limited to, the following as applicable:

1. Energy compliance path.
2. Insulation materials and their *R*-values.
3. Fenestration *U-factors* and solar heat gain coefficients (SHGC).
4. Area-weighted *U-factor* and *solar heat gain coefficient* (SHGC) calculations.
5. *Air barrier* and air sealing details, including the location of the *air barrier* .
6. *Thermal bridges* as identified in **Section C402.6**.

~~5.~~7. Mechanical system design criteria.
~~6.~~8. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
~~7.~~9. Economizer description.
~~8.~~10. Equipment and system controls.
~~9.~~11. Fan motor horsepower (hp) and controls.
~~10.~~12. Duct sealing, *duct* and pipe insulation and location.
~~11.~~13. Lighting fixture schedule with wattage and control narrative.
~~12.~~14. Location of *daylight* zones on floor plans.
15. Location of pathways for routing of raceways or cable from the on-site renewable energy system to the electrical distribution equipment.
~~13.~~16. ~~Air barrier and air sealing details, including the location of the air barrier.~~Location reserved for inverters, metering equipment and energy storage systems (ESS), and a pathway reserved for routing of raceways or conduit from the renewable energy system to the point of interconnection with the electrical service and the ESS.
17. Location and layout of a designated area for ESS.
18. Rated energy capacity and rated power capacity of the installed or planned ESS.

~~C103.2.1~~C105.2.1 **Building thermal envelope depiction.** The *building thermal envelope* shall be represented on the construction drawings.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#10 **Renumbers C103.3 through C103.5**

<table>
<tr>
<td>Related Mod:</td>
<td>
~~C103.3~~C105.3 Examination of documents.
~~C103.3.1~~C105.3.1 Approval of construction documents
~~C103.3.2~~C105.3.2 Previous approvals.
~~C103.3.3~~C105.3.3 Phased approval
~~C103.4~~C105.4 Amended construction documents
~~C103.5~~C105.5 Retention of construction documents.
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<td>CE#11</td>
<td>
Renumbers Section C103.6 and sub-sections C103.6.1, C103.6.2, and C103.6.3.
Adds a new planning requirement for annual energy use data gathering and disclosure as specified per the energy monitoring section C405.13.
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<tr>
<td>Related Mod:

CE2D-29-23</td>
<td>
~~C103.6~~C105.6 Building documentation and closeout submittal requirements. The construction documents shall specify that the documents described in this section be provided to the building owner or owner's authorized agent within 90 days of the date of receipt of the certificate of occupancy.

~~C103.6.1~~C105.6.1 Record documents. Construction documents shall be updated to convey a record of the completed work. Such updates shall include mechanical, electrical and control drawings that indicate all changes to size, type and location of components, equipment and assemblies.

~~C103.6.2~~C105.6.2 Compliance documentation. Energy code compliance documentation and supporting calculations shall be delivered in one document to the building owner as part of the project record documents or manuals, or as a standalone document. This document shall include the specific energy code edition utilized for compliance determination for each system, documentation demonstrating compliance with Section C303.1.3 for each fenestration product installed, and the interior lighting power compliance path, building area or space-by-space, used to calculate the lighting power allowance.
For projects complying with Item 2 of Section C401.2, the documentation shall include:

1. The envelope insulation compliance path.
2. All compliance calculations including those required by Sections C402.1.4, C403.8.1, C405.3 and C405.5.
3. A plan for annual energy use data gathering and disclosure as specified in Section C405.13.

For projects complying with Section C407, the documentation shall include that required by Sections C407.3.1 and C407.3.2.

~~C103.6.3~~C105.6.3 Systems operation control.

The original text of mod is not consistent with that of the 2023 FBC – EC.
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CE#12	Renumbers Section C104. Renumbers C104.1-C104.5
Related Mod: CEPI-8-21-PI	SECTION ~~C104~~C106 FEES ~~**C104.1**~~**C106.1 Fees.** A permit shall not be ~~issued~~valid until the fees prescribed ~~in Section C106.2~~ by law have been paid~~, nor~~ . Nor shall an amendment to a permit be released until the additional fee, if any, has been paid. ~~**C104.2**~~**C106.2 Schedule of permit fees.** A fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority. **C106.3 Valuation of work.** The applicant for a permit shall provide an estimated value of the work for which the permit is being issued at the time of application. Such estimated valuations shall include the total value of the work, including materials and labor. Where, in the opinion of the *code official* , the valuation is underestimated, the permit shall be denied unless the applicant can show detailed estimates acceptable to the *code official* . The final valuation shall be *approved* by the *code official* . ~~**C104.3**~~**C106.4 Work commencing before permit issuance.** Any person who commences any work before obtaining the necessary permits shall be subject to ~~an additional~~a fee established by the *code official* that shall be in addition to the required permit fees. ~~**C104.4**~~**C106.5 Related fees.** The payment of the fee for the construction, *alteration* , removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law. ~~**C104.5**~~**C106.6 Refunds.** The *code official* is authorized to establish a refund policy. The original text of mod is not consistent with that of the 2023 FBC – EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#13	Renumbers C105. Renumbers C105.1, C105.2, C105.2.1 through C105.2.6.
Related Mod: CED1-5-22, CED1-87-22, CED1-92-22, CEPI-7-21	~~SECTION C107C112 VALIDITY~~ **SECTION ~~C105~~C107 INSPECTIONS** ~~**C105.1**~~**C107.1 General.** ~~**C105.2**~~**C107.2 Required inspections.** ~~**C105.2.1**~~**C107.2.1 Footing and foundation insulation.** Inspections shall verify the footing and foundation insulation *R-value* , location, thickness, depth of burial and protection of insulation as required by the code, *approved* plans and specifications.

~~C105.2.2~~C107.2.2 ~~Thermal~~Building thermal envelope. Inspections shall verify the ~~correct~~ type of insulation, *R*-values, location of insulation, *thermal bridge* mitigation, *fenestration* , *U-factor* , SHGC and VT, and that *air leakage* controls are ~~properly~~ installed, as required by the code, *approved* plans and specifications.

~~C105.2.3~~C107.2.3 Plumbing system. Inspections shall verify the type of insulation, *R*-values, protection required, controls and *heat traps* as required by the code, *approved* plans and specifications.

~~C105.2.4~~C107.2.4 Mechanical system. Inspections shall verify the installed HVAC equipment for the ~~correct~~ type and size, controls, insulation, *R*-values, system and damper *air leakage* , minimum fan efficiency, energy recovery and economizer as required by the code, *approved* plans and specifications.

~~C105.2.5~~C107.2.5 Electrical system. Inspections shall verify lighting system controls, components and meters as required by the code, *approved* plans and specifications. Where an ESS area is required, inspections shall verify space availability and pathways to electrical service.

~~C105.2.6~~C107.2.6 Final inspection. The final inspection shall include verification of the installation and proper operation of all required building controls, and documentation verifying activities associated with required *building commissioning* have been conducted in accordance with **Section C408**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

The original text of mod is not consistent with that of the 2023 FBC – EC.

CE#14 **Renumbers C105.3 through C105.6**

Related Mod:

CED1-5-22, CED1-87-22, CED1-92-22, CEPI-7-21

~~C105.3~~C107.3 Reinspection
~~C105.4~~C107.4 Approved inspection agencies.
~~C105.5~~C107.5 Inspection requests.
~~C105.6~~C107.6 Reinspection and testing.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

The original text of mod is not consistent with that of the 2023 FBC – EC.

CE#15 Deletes C108. Renumbers and renamed Section C106. Renumbers C108.1, C108.2

Related Mod:

~~SECTION C108~~C109 ~~REFERENCED STANDARDS~~

SECTION ~~C106~~C108 NOTICE OF APPROVAL

~~C106.1~~C108.1 Approval. After the prescribed tests and inspections indicate that the work complies in all respects with this code, a notice of approval shall be issued by the *code official* .

~~C106.2~~C108.2 Revocation.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

The original text of mod is not consistent with that of the 2023 FBC – EC.

CE#16

Renumbers and renamed Section C110. Adds new Section C109.4. The code official must take action per the board's decision.

Related Mod:

CED1-6-22, CEC2D-4-23 Part I,

SECTION ~~C110~~C109 ~~BOARD~~MEANS OF APPEALS

~~C110.1~~C109.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. ~~The *code official* shall be an ex officio member of said board but shall not have a vote on any matter before the board.~~ The board of appeals shall be appointed by the governing ~~body~~authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business, and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official* .

~~C110.2~~C109.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The board shall not have authority to waive requirements of this code.

~~C110.3~~C109.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training on matters pertaining to the provisions of this code and are not employees of the jurisdiction.

C109.4 Administration. The *code official* shall take action in accordance with the decisions of the board.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

The original text of mod is not consistent with that of the 2023 FBC – EC.

CE#17	Renumbers Section C109. Renumbers Sections C109.1 through C109.4.
Related Mod:	SECTION ~~C109~~C110 STOP WORK ORDER **~~C109.1~~C110.1 Authority.** Where the *code official* finds any work regulated by this code being performed in a manner contrary to the provisions of this code or in a dangerous or unsafe manner, the *code official* is authorized to issue a stop work order. **~~C109.2~~C110.2 Issuance.** The stop work order shall be in writing and shall be given to the *owner* of the property, the owner's authorized agent or the person performing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order and the conditions under which the cited work is authorized to resume. **~~C109.3~~C110.3 Emergencies.** Where an emergency exists, the *code official* shall not be required to give a written notice prior to stopping the work. **~~C109.4~~C110.4 Failure to comply.** Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to fines established by the AHJ. The original text of mod is not consistent with that of the 2023 FBC – EC.
CE#18	Renames "Air Curtain" and edits the definition.
Related Mod: CEPI-72-21	~~**AIR CURTAIN.** A device, installed at the *building entrance* , that generates and discharges a laminar air stream intended to prevent the infiltration of external, unconditioned air into the conditioned spaces, or the loss of interior, conditioned air to the outside.~~ **AIR CURTAIN UNIT.** A device installed at the building entrance that generates and discharges a laminar airstream intended to prevent the *infiltration* of external, unconditioned air into the conditioned spaces or the loss of interior, conditioned air to the outside.

CE#17:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#18:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#19	Adds new definition
Related Mod: CEPI-32-21	**AIR LEAKAGE.** The uncontrolled airflow through the *building thermal envelope* caused by pressure differences across the *building thermal envelope* . *Air leakage* can be inward (*infiltration*) or outward (exfiltration) through the *building thermal envelope* .
CE#20	Adds new definition
Related Mod: CEPI-225-21	**APPROVED SOURCE.** An independent person, firm or corporation *approved* by the code official, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.
CE#21	Adds new definition
Related Mod: CEPI-83-21	**BEST EFFICIENCY POINT (BEP).** The pump hydraulic power operating point (consisting of both flow and head conditions) that results in the maximum efficiency.
CE#22	Corrects error in text
Related Mod:	**BIOGAS.** A mixture of hydrocarbons that is a gas at 60°F (15.5°C) and 1 atmosphere of pressure that is produced through the anaerobic digestion of organic matter. The original text of mod is not consistent with that of the 2023 FBC – EC.

CE#19:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#20:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#21:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#22:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#23

Deletes Biomass. Adds new definition

Related Mod:

CEPI-12-21 Part I

~~**BIOMASS.** Nonfossilized and biodegradable organic material originating from plants, animals and/or microorganisms, including products, by-products, residues and waste from agriculture, forestry and related industries as well as the nonfossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of nonfossilized and biodegradable organic material.~~

BIOMASS WASTE. Organic nonfossil material of biological origin that is a byproduct or a discarded product. *Biomass waste* includes municipal solid waste from biogenic sources; landfill gas; sludge waste; agricultural crop byproducts; straw; and other biomass solids, liquids and biogases, but excludes wood and wood-derived fuels (including black liquor), biofuel feedstock, biodiesel and fuel ethanol.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

The original text of mod is not consistent with that of the 2023 FBC – EC.

CE#24

Adds new definition

Related Mod:

CECPI-4-21

CHI-FACTOR (χ-FACTOR). The heat loss factor for a single *thermal bridge* characterized as a point element of a *building thermal envelope* (Btu/h × °F) [W/k].

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#25

Adds new definition

Related Mod:

CEPI-83-21

CLEAN WATER PUMP. A device that is designed for use in pumping water with a maximum nonabsorbent free solid content of 0.016 lb/ft^3 (0.256 kg/m^3) and with a maximum dissolved solid content of 3.1 lb/ft^3 (49.66 kg/m^3), provided that the total gas content of the water does not exceed the saturation volume, and disregarding any additives necessary to prevent the water from freezing at a minimum of 14°F (-10°C).

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#26

Adds new definition

Related Mod:

RED1-360-22

COMMON AREAS. All conditioned spaces within *Group R* occupancy buildings that are not *dwelling units* or *sleeping units* .

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#27

Adds new definition

Related Mod:

CECPI-5-21, CECPI-2-21

COMMUNITY RENEWABLE ENERGY FACILITY. A facility that produces energy harvested from *renewable energy resources* and is qualified as a community energy facility under applicable jurisdictional statutes and rules.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#28

Adds new definition

Related Mod:

CEC2D-3-23

CONGREGATE LIVING FACILITIES. A *building* or part thereof that contains *sleeping units* where residents share bathroom or kitchen facilities, or both.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#29

Adds new definition

Related Mod:

CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit.

CEPI-225-21

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	X			

CE#30

Adds new definition

Related Mod:

CEPI-14-21

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

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#31

Adds new definition

Related Mod:

CEPI-84-21

DEHUMIDIFIER. A self-contained, electrically operated and mechanically encased product with the sole purpose of dehumidifying the space consisting of the following:

1. A refrigerated surface (evaporator) that condenses moisture from the atmosphere.
2. A refrigerating system, including an electric motor.
3. An air-circulating fan.
4. A means for collecting or disposing of the condensate.

A dehumidifier does not include a portable air conditioner, room air conditioner or packaged terminal air conditioner.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#32

Adds new definition

Related Mod:

CEPI-9-21

DEMAND CONTROL KITCHEN VENTILATION (DCKV). A system that provides *automatic* , continuous control over exhaust hood and makeup air fan speed in response to temperature, optical or infrared (IR) sensors that monitor cooking activity or through direct communication with cooking appliances.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	X			

CE#33	Adds new definition
Related Mod: CEPI-9-21	**DEMAND RESPONSE SIGNAL.** A signal that indicates a price or a request to modify electricity consumption for a limited time period. <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table>
CE#34	Adds new definition
Related Mod: CEPI-99-21	**DEMAND RESPONSIVE CONTROL.** A control capable of receiving and automatically responding to a *demand response signal* . <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td>X</td><td></td><td></td><td></td></tr></table>
CE#35	Adds new definition
Related Mod: CEPI-84-21	**DESSICANT DEHUMIDIFICATION SYSTEM.** A mechanical dehumidification technology that uses a solid or liquid material to remove moisture from the air. <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table>
CE#36	Adds new definition
Related Mod: CEPI-14-21	**DX-DEDICATED OUTDOOR AIR SYSTEM UNIT (DX-DOAS UNIT).** A type of air-cooled, water-cooled or water source factory-assembled product that dehumidifies 100 percent outdoor air to a low dew point and includes reheat that is capable of controlling the supply dry-bulb temperature of the dehumidified air to the designated supply air temperature. It may precondition outdoor air with an *energy recovery ventilation system* . <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td>x</td><td></td><td></td><td></td></tr></table>

CE#37	Adds new definition
Related Mod: CEPI-121-22	**EAST-ORIENTED.** Facing within 45 degrees of true east to the south and within less than 22.5 degrees of true east to the north in the northern hemisphere or facing within 45 degrees of true east to the north and within less than 22.5 degrees of true east to the south in the southern hemisphere.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#38	Modified an existing definition.
Related Mod: CE2D-4-23	**EMITTANCE.** The ratio of the radiant heat flux emitted by a specimen measured on a scale from 0 to 1, where a value of 1 indicates perfect release of thermal radiation.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#39	Adds new definition
Related Mod: CEPI-112-21	**ENERGY RECOVERY, SERIES.** A three-step process in which the first step is to remove energy from a single airstream without the use of mechanical cooling. In the second step, the airstream is mechanically cooled for the purpose of dehumidification. In the third step, the energy removed in the first step is reintroduced to the airstream.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#40	Adds new definition
Related Mod: CEPI-116-21	**ENERGY RECOVERY RATIO, SERIES (SERR).** The difference between the dry- bulb air temperatures leaving the *series energy recovery* unit and leaving the dehumidifying coil divided by the difference between 75°F (24°C) and the dry-bulb temperature of the air leaving the dehumidifying cooling coil.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#41	Adds new definition
Related Mod: CEPI-7-21	**ENERGY STORAGE SYSTEM (ESS).** One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time. Staff Classification: Correlates Directly X; Energy Standard Needed; Over lap Action: AS x; AS/IC; D; D/IC
CE#42	Adds new definition
Related Mod:	**ENERGY USE INTENSITY (EUI).** The metric indicating the total amount of energy consumed by a *building* in 1 year divided by the gross floor area of the *building* Staff Classification: Correlates Directly X; Energy Standard Needed; Over lap Action: AS x; AS/IC; D; D/IC
CE#43	Adds acronym to an existing definition of "Enthalpy Recovery Ratio" definition.
Related Mod: CEPI-119-21	~~ENTHALPY RECOVERY RATIO.~~ ENTHALPY RECOVERY RATIO (ERR). Change in the enthalpy of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air enthalpy, expressed as a percentage. Staff Classification: Correlates Directly; Energy Standard Needed; Over lap X Action: AS; AS/IC; D x; D/IC The original text of mod is not consistent with that of the 2023 FBC – EC.
CE#44	Adds new definition
Related Mod: CEPI-217-21	**EXTERIOR WALL ENVELOPE.** A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space from the detrimental effects of the exterior environment. Staff Classification: Correlates Directly X; Energy Standard Needed; Over lap Action: AS x; AS/IC; D; D/IC

CE#45	Adds new definition
Related Mod: CEPI-119-21	**FAN ELECTRICAL INPUT POWER.** The electrical input power in kilowatts required to operate an individual fan or *fan array* at design conditions. It includes the power consumption of motor controllers, where present.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#46	Adds new definition
Related Mod: CEPI-119-21	**FAN SYSTEM.** All the fans that contribute to the movement of air serving spaces that pass through a point of a common *duct* , plenum or cabinet.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#47	Adds new definition
Related Mod: CEPI-119-21	**FAN SYSTEM, COMPLEX.** A *fan system* that combines a *single-cabinet fan system* with other supply fans, exhaust fans or both.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#48	Adds new definition
Related Mod: CEPI-119-21	**FAN SYSTEM, EXHAUST OR RELIEF.** A *fan system* dedicated to the removal of air from interior spaces to the outdoors.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#49

Adds new definition

Related Mod:

CEPI-119-21

FAN SYSTEM, RETURN. A *fan system* dedicated to removing air from the interior where some or all the air is to be recirculated except during economizer operation

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			X	

CE#50

Adds new definition

Related Mod:

CEPI-119-21

FAN SYSTEM, SINGLE-CABINET. A fan system that supplies air to a space and recirculates the air, wherein a single cabinet houses a single fan, a single *fan array* , a single set of fans operating in parallel or fans or fan arrays in series.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	X			

CE#51

Adds new definition

Related Mod:

CEPI-119-21

FAN SYSTEM, TRANSFER. A *fan system* that exclusively moves air from one occupied space to another.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#52

Adds new definition

Related Mod:

CEPI-119-21

FAN SYSTEM AIRFLOW. The sum of the airflow of all fans with *fan electrical input power* greater than 1 kW at *fan system design conditions* , excluding the airflow that passes through downstream fans with *fan electrical input power* less than 1 kW.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#53	Modified an existing definition for clarity.
Related Mod: CECPI-4-21	***F-F* ACTOR.** The perimeter heat loss factor per unit perimeter length of ~~for~~ slab- on-grade floors (Btu/h × ft × °F) [W/(m × K)].

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#54	Adds new definition
Related Mod: CECPI-2-21	**FINANCIAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT.** A financial arrangement between a renewable electricity generator and a purchaser wherein the purchaser pays or guarantees a price to the generator for the project's renewable generation. Also known as a "financial power purchase agreement" and "virtual power purchase agreement."

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#55	Adds new definition
Related Mod: CED1-208-22	**GREEN RETAIL TARIFF.** An electricity-rate structure qualified under applicable statutes or rules contracted by an electricity service provider to the building project *owner* to provide electricity generated with 100 percent *renewable energy resources* without the purchase of unbundled renewable energy certificates (RECs).

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#56	Modified an existing definition.
Related Mod: CEPI-185-21	**GREENHOUSE.** A structure or a thermally isolated area of a *building* that maintains a specialized sunlit environment with a skylight roof ratio of 50 percent or more above the growing area exclusively used for, and essential to, the cultivation, protection or maintenance of plants. *Greenhouses* are those that are erected for a period of 180 days or more

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#57	Adds new definition
Related Mod: CE2D-5-23	**HIGH-CAPACITY GAS-FIRED WATER HEATER.** Gas-fired instantaneous *water heaters* with a rated input greater than 200,000 Btu/h (58.6 kW) and not less than 4,000 Btu/h per gallon (310 W per liter) of stored water. Also, gas-fired storage *water heaters* with a rated input both greater than 105,000 Btu/h (30.8 kW) and less than 4,000 Btu/h per gallon (310 W per liter) of stored water.
CE#58	Adds new definition
Related Mod: CEPI-185-21	**HORTICULTURAL LIGHTING.** Electric lighting used for horticultural production, cultivation or maintenance
CE#59	Adds new definition
Related Mod: CEPI-102-21	**HUMIDISTATIC CONTROLS.** *Automatic* controls used to maintain humidity at a setpoint.
CE#60	Adds new definition

CE#57:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#58:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#59:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

<table>
<tr><td>Related Mod:

CEPI-76-21</td><td>HVAC TOTAL SYSTEM PERFORMANCE RATIO (HVAC TSPR). The ratio of the sum of a building’s annual heating and cooling load in thousands of Btu’s to the sum of annual site energy consumption of the building HVAC systems in Btu.

<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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</table></td></tr>
<tr><td>CE#61</td><td>Adds new definition</td></tr>
<tr><td>Related Mod:

CEPI-84-21</td><td>INDOOR GROW. A space, other than a greenhouse , used exclusively for and essential to horticultural production, cultivation or maintenance.

<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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</table></td></tr>
<tr><td>CE#62</td><td>Adds new definition</td></tr>
<tr><td>Related Mod:

CEPI-84-21</td><td>INTEGRATED HVAC SYSTEM. An HVAC system designed to handle both sensible and latent heat removal. Integrated HVAC systems include, but are not limited to, HVAC systems with a sensible heat ratio of 0.65 or less and the capability of providing cooling, dedicated outdoor air systems, single-package air conditioners with at least one refrigerant circuit providing hot gas reheat, and dehumidifiers modified to allow external heat rejection

<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
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</table></td></tr>
<tr><td>CE#63</td><td>Modified an existing definition.</td></tr>
<tr><td>Related Mod:

CEPI-124-21</td><td>LARGE-DIAMETER CEILING FAN. A ceiling fan that is greater than or equal to 84$^{1}/_{2}$ inches (2.15 m) ~~7 feet (2134 mm)~~ in diameter. These fans are sometimes referred to as High-Volume, Low-Speed (HVLS) fans.

This code change is already part of the 2023 FBC – EC.

<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
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</table></td></tr>
<tr><td>CE#64</td><td>Renamed an existing definition “Low-Sloped Roof.”</td></tr>
</table>

Related Mod: CECD1-11-22	~~LOW-SLOPED ROOF.~~**LOW SLOPE.** A ~~roof having a~~ slope less than 2 units vertical in 12 units horizontal (17 percent slope) as applied to roofs. This code change is already part of the 2023 FBC – EC. <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td></td><td></td><td>X</td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table>
CE#65	Adds new definition
Related Mod: CEPI-121-22	**NORTH-ORIENTED.** Facing within 67.5 degrees of true north in the northern hemisphere or facing within 67.5 degrees of true south in the southern hemisphere. <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td>x</td><td></td><td></td><td></td></tr></table>
CE#66	Adds new definition
Related Mod: CEPI-108-21	**OCCUPIED-STANDBY MODE.** Mode of operation when an HVAC *zone* is scheduled to be occupied and an occupant sensor indicates no occupants are within the *zone* . <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td>x</td><td></td><td></td><td></td></tr></table>
CE#67	Adds new definition
Related Mod:	**OWNER.** Any person, agent, operator, entity, firm or corporation having any legal or equitable interest in the property; or recorded in the official records of the state, county or municipality as holding an interest or title to the property; or otherwise having possession or control of the property, including the guardian of the estate of any such person, and the executor or administrator of the estate of such person if ordered to take possession of real property by a court. <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>X</td><td></td></tr></table>
CE#68	Adds new definition

Related Mod: CECD1-23-22	**PARKING AREA, EXTERIOR.** Parking spaces, drive aisles and ramps that are not located within a *building* , or that are located on a roof.
CE#69	Adds new definition
Related Mod: CECD1-23-22	**PARKING AREA, INTERIOR.** Parking spaces, drive aisles and ramps located within a *building* .
CE#70	Adds new definition
Related Mod: CECPI-6-21	**PARKING GARAGE SECTION.** A part of an enclosed parking garage that is separated from all other parts of the garage by full-height solid walls or operable openings that are intended to remain closed during normal operation and where vehicles cannot pass to other parts of the garage. A parking garage can have one or more *parking garage sections* , and *parking garage sections* can include multiple floors.
CE#71	Adds new definition
Related Mod: CEPI-185-21	**PHOTOSYNTHETIC PHOTON EFFICACY (PPE).** Photosynthetic photon flux emitted by a light source divided by its electrical input power in units of micromoles per second per watt, or micromoles per joule (μmol/J) between 400–700nm as defined by **ANSI/ASABE S640**
CE#72	Adds new definition

CE#69:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#70:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#71:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#72:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Related Mod: CECPI-2-21	PHYSICAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT. A contract for the purchase of renewable electricity from a specific renewable electricity generator to a purchaser of renewable electricity.	
CE#73	Adds new definition	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Related Mod: CEPI-97-21	**PROCESS APPLICATION.** A manufacturing, industrial or commercial procedure or activity where the primary purpose is other than conditioning spaces and maintaining comfort and amenities for the occupants of a *building* .	
CE#74	Adds new definition	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Related Mod: CECPI-4-21	**PSI-FACTOR (Ψ-FACTOR).** The heat loss factor per unit length of a *thermal bridge* characterized as a linear element of a *building thermal envelope* (Btu/h × ft × °F) [W/(m × K)].	
CE#75	Adds new definition	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Related Mod: CEPI-83-21	**PUMP ENERGY INDEX (PEI).** The ratio of a pump's energy rating divided by the energy rating of a minimally compliant pump. For pumps with the constant load operating mode, the relevant PEI is PEI_{CL}. For pumps with the variable load operating mode, the relevant PEI is PEI_{VL}.	
CE#76	Adds new definition	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

<table>
<tr><td>Related Mod:

CECD1-18-22</td><td>

PURCHASED ENERGY. Energy or power purchased for consumption and delivered to the *building site* .

<table>
<tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr>
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<tr><td>CE#77</td><td>Adds new definition</td></tr>
<tr><td>Related Mod:

CECPI-2-21</td><td>

RENEWABLE ENERGY CERTIFICATE (REC). A market-based instrument that represents and conveys the environmental, social and other nonpower attributes of 1 megawatt hour of renewable electricity generation and could be sold separately from the underlying physical electricity associated with *renewable energy resources* , also known as energy attribute and energy attribute certificate (EAC).

<table>
<tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr>
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<tr><td>CE#78</td><td>Adds new definition</td></tr>
<tr><td>Related Mod:

CECPI-5-21</td><td>

RENEWABLE ENERGY INVESTMENT FUND (REIF). A fund established by a jurisdiction to accept payment from building project owners to construct or acquire interests in qualifying renewable energy systems, together with their associated RECs, on the building project owners' behalf.

<table>
<tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr>
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</td></tr>
<tr><td>CE#79</td><td>Modifies an existing definition</td></tr>
<tr><td>Related Mod:</td><td>

RENEWABLE ENERGY RESOURCES. Energy derived from solar radiation, wind, waves, tides, ~~landfill gas, biogas,~~ *biomass* waste or extracted from hot fluid or steam heated within the earth.

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<tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr>
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CE#80	Modified an existing definition
Related Mod: CEPI-17-21 Part I	**ROOF REPLACEMENT.** ~~The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.~~An *alteration* that includes the removal of all existing layers of *roof assembly* materials down to the roof deck and the installation of replacement materials above the existing roof deck.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#81	Adds new definition
Related Mod: CEPI-193-21	**SENSIBLE ENERGY RECOVERY RATIO.** Change in the dry-bulb temperature of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air dry-bulb temperatures, expressed as a percentage.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#82	Adds new definition
Related Mod: CEPI-24-21 Part I	**SIMULATED BUILDING PERFORMANCE.** A process in which the proposed building design is compared to a *standard reference design* for the purposes of estimating relative energy use against a baseline to determine code compliance.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#83	Adds new definition
Related Mod: CEPI-121-22	**SOUTH-ORIENTED.** Facing within 45 degrees of true south in the northern hemisphere or facing within 45 degrees of true north in the southern hemisphere.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#84	Modified an existing definition
Related Mod: CEPI-24-21 Part I	**STANDARD REFERENCE DESIGN.** A version of the *proposed design* that meets the minimum requirements of this code and is used to determine the maximum annual energy use requirement for compliance based on total simulated building performance.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#85	Adds new definition
Related Mod: CE2D-2-23	**SUBSTANTIAL IMPROVEMENT.** Any *repair* , reconstruction, rehabilitation, *alteration* , *addition* or other improvement of a *building* or structure, the cost of which equals or is more than 50 percent of the market value of the structure before the improvement. Where the structure has sustained substantial damage, as defined in the ***International Building Code***, any *repairs* are considered *substantial improvement* regardless of the actual *repair* work performed. *Substantial improvement* does not include the following: 1. Improvement of a *building* ordered by the code official to correct health, sanitary or safety code violations. 2. *Alteration* of a historic building where the *alteration* will not affect the designation as a historic building.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#86	Adds new definition
Related Mod: CEPI-58-21	**TESTING UNIT ENCLOSURE AREA.** The area sum of all the boundary surfaces that define the *dwelling unit* , *sleeping unit* or ~~occupiable~~ *conditioned* *enclosed* *space,* including top/ceiling, bottom/floor and all side walls. This does not include interior partition walls within the *dwelling unit* , *sleeping unit* or ~~occupiable~~ *conditioned* *enclosed* *space*. Wall height shall be measured from the finished floor of the *conditioned space* to the finished floor or roof/ceiling *air barrier* above. Original text of mod is not consistent with that of the 2023 FBC-EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#87	Adds new definition
Related Mod: CED1-182-22	**THERMAL BLOCK.** A generic concept used in energy simulation. It can include one or more thermal zones. It represents a whole *building* or portion of a *building* with the same use type served by the same HVAC system type.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#88	Adds new definition
Related Mod: CECPI-4-21	**THERMAL BRIDGE.** An element or interface of elements that has higher thermal conductivity than the surrounding *building thermal envelope* , which creates a path of least resistance for heat transfer.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#89	Replaces “Time Switch Control” with “Time-Switch Control.”
Related Mod:	~~**TIME SWITCH CONTROL.**~~**TIME-SWITCH CONTROL.** An *automatic* control device or system that controls lighting or other loads, including switching off, based on time schedules. Original text of mod is not consistent with that of the 2023 FBC – EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#90	Modified an existing definition.
Related Mod: CED1-106-22	**WALL, ABOVE-GRADE.** A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the *building* or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, peripheral edges of floors, roof knee walls, dormer walls, gable end walls, walls enclosing a mansard roof, mechanical equipment penetrations and skylight shafts.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#91

Adds new definition

Related Mod:

CEPI-121-22

WEST-ORIENTED. Facing within 45 degrees of true west to the south and within less than 22.5 degrees of true west to the north in the northern hemisphere or facing within 45 degrees of true west to the north and within less than 22.5 degrees of true west to the south in the southern hemisphere.

\

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#92

Adds new definition

Related Mod:

CEPI-217-21

WORK AREA. That portion or portions of a *building* consisting of all reconfigured spaces as indicated on the *construction documents* . *Work area* excludes other portions of the *building* where incidental work entailed by the intended work must be performed and portions of the *building* where work not initially intended by the *owner* is specifically required by this code.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#93

Adds new exception. Roof insulation installed above the deck, the R-value must be labeled as specified by the material standards in Table 1508.2 of the IBC.

Related Mod:

CEPI-23-21, CEPI-24-21 Part I

C303.1.2 Insulation mark installation. Insulating materials shall be installed such that the manufacturer's *R-value* mark is readily observable upon inspection. For insulation materials that are installed without an observable manufacturer's *R-value* mark, such as blown or draped products, an insulation certificate complying with **Section C303.1.1** shall be left immediately after installation by the installer, in a conspicuous location within the *building* , to certify the installed *R-value* of the insulation material.

Exception: For roof insulation installed above the deck, the *R-value* shall be *labeled* as specified by the material standards in **Table 1508.2** of the *International Building Code*.

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#94

Adds Row "US STATES" to Table.

Related Mod:

TABLE C301.1

CLIMATE ZONES, MOISTURE REGIMES AND WARM HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY[a]

US STATES

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

Original text of mod is not consistent with that of the 2023 FBC -EC.

CE#95

Is this a mod?

Related Mod:

C301.3 Climate zone definitions. To determine the *climate zones* for locations not listed in this code, use the following information to determine *climate zone* numbers and letters in accordance with Items 1 through 5.

4.3. If between 30 and 70 percent of the precipitation, *P*, occurs during the high sun period, defined as April through September in the Northern Hemisphere and October through March in the Southern Hemisphere, then the dry/humid threshold is in accordance with **Equation 3-2**.

$$P < 0.44 \times (T - 19.5)$$
$$[P < 20.0 \times (T + 7) \text{ in SI units}]$$

$$P < 0.44 \times (T - 19.5)$$
Equation 3-2
$$\cancel{[P < 20.0 \times (T + 7) \text{ in SI units}]}$$

where:

P = Annual precipitation, inches (mm).

T = Annual mean temperature, °F (°C).

4.4. If 30 percent or less of the precipitation, *P*, occurs during the high sun period, defined as April through September in the Northern Hemisphere and October through March in the Southern Hemisphere, then the dry/humid threshold is in accordance with **Equation 3-3**.

$$P < 0.44 \times (T - 32)$$
$$[P < 20.0 \times T \text{ in SI units}]$$

$$P < 0.44 \times (T - 32)$$
Equation 3-3
$$\cancel{[P < 20.0 \times (T + 14) \text{ in SI units}]}$$

where:

P = Annual precipitation, inches (mm).

T = Annual mean temperature, °F (°C).

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

Original text of mod is not consistent with that of the 2023 FBC -EC.

CE#96

Revised the requirements of Section C303.1.3. U-factors, SHGC, and VT ratings of fenestration products must be determined in accordance with NFRC 100 and NRFC 200. And the manufacturer certificate label must fixed on the product or project.

Related Mod:

C303.1.3 Fenestration product rating. *U-factors* , *solar heat gain coefficient* (SHGC) and visible transmittance (VT) of fenestration products shall be determined as follows:

CED1-90-22

1. For windows, doors and skylights, *U-factor* , SHGC and VT ratings shall be determined in accordance with **NFRC 100** and **NFRC 200**.
2. Where required for garage doors and rolling doors, *U-factor* ratings shall be determined in accordance with either **NFRC 100** or **ANSI/DASMA 105**.

U-factors , SHGC and VT shall be determined by an accredited, independent laboratory, and *labeled* and certified by the manufacturer with a label affixed to the product or a label certificate specific to the products in the project.

Products lacking such a *labeled U-factor* shall be assigned a default *U-factor* from **Table C303.1.3(1)** or **Table C303.1.3(2)**. ~~The *solar heat gain coefficient* (SHGC) and *visible transmittance* (VT) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and *labeled* and certified by the manufacturer.~~ Products lacking such a *labeled* SHGC or VT shall be assigned a default SHGC or VT from **Table C303.1.3(3)**. For Tubular Daylighting Devices, VT_{annual} shall be measured and rated in accordance with **NFRC 203**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			X	

CE#97

Replaced Frame Type “Glazed block” with “Glass block.”

Related Mod:

CED1-91-22

TABLE C303.1.3(1) DEFUALT GLAZED WINDOW, GLASS DOOR AND SKYLIGHHT U-Factors

FRAME TYPE	WINDOW AND GLASS DOOR		SKYLIGHT	
	Single	Double	Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with thermal break	1.10	0.65	1.90	1.10
Nonmetal or metal clad	0.95	0.55	1.75	1.05
~~Glazed~~Glass block	0.60			

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

<table>
<tr><td></td><td></td></tr>
<tr><td>CE#98</td><td>Modified prescriptive compliance requirements for Dwelling Units and Sleeping Units. Dwelling and Sleeping Units in Group R-2 buildings that meet the requirements of Section R406 are considered to be in comply with this chapter.
In item #2, the phrase “Total Building Performance” was replaced with “Simulated Building Performance” per the new definition created for the latter.</td></tr>
<tr><td>Related Mod:

CEPI-23-21, CEPI-24-21 Part I</td><td>C401.2 Application. Commercial buildings shall comply with Section C401.2.1 or C401.2.2.

C401.2.1 International Energy Conservation Code. Commercial buildings shall comply with one of the following:
1. Prescriptive Compliance. The Prescriptive Compliance option requires compliance with Sections C402 through C406 and Section C408. Dwelling units and sleeping units in Group R-2 buildings ~~without systems serving multiple units~~ shall be deemed to be in compliance with this chapter, provided that they comply with Section R406.
2. ~~Total~~ Simulated Building Performance. The ~~Total~~ Simulated Building Performance option requires compliance with Section C407.

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

Original text of mod is not consistent with that of the 2023 FBC -EC.

<table>
<tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr>
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</table></td></tr>
<tr><td>CE#99</td><td>Renamed the section C401.3 title “Thermal envelope certificate.” Made similar editorial changes in the body of this sub-section for clarity.</td></tr>
<tr><td>Related Mod:</td><td>C401.3 Building thermal envelope certificate. A permanent building thermal envelope certificate shall be completed by an approved party. Such certificate shall be posted on a wall in the space where the space conditioning equipment is located, a utility</td></tr>
</table>

CED1-92-22, CED1-94-22, CED1-95-22	room or other *approved* location. If located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. A copy of the certificate shall also be included in the construction files for the project. The certificate shall include the following: 1. *R*-values of insulation installed in or on ceilings, roofs, walls, foundations and slabs, *basement walls*, *crawl space walls* and floors and *ducts* outside *conditioned spaces* . 2. *U-factors* and *solar heat gain coefficients* (SHGC) of fenestrations. 3. Results from any *building thermal envelope air leakage* testing performed on the *building* . Where there is more than one value for any component of the *building thermal envelope*, the certificate shall indicate the area-weighted average value where available. If the area-weighted average is not available, the certificate shall list each value that applies to 10 percent or more of the total component area. Original text of mod is not consistent with that of the 2023 FBC -EC. Staff Classification / Correlates Directly: — / Energy Standard Needed: — / Over lap: X Action: AS: — / AS/IC: — / D: x / D/IC: —
CE#100	Renames the Section C402 Building Envelope Requirements.
Related Mod: CED1-92-22, CED1-94-22, CED1-95-22	SECTION C402 **BUILDING THERMAL ENVELOPE REQUIREMENTS** Staff Classification / Correlates Directly: X / Energy Standard Needed: — / Over lap: — Action: AS: — / AS/IC: — / D: x / D/IC: —
CE#101	Revises the section for clarification and adds new requirements. Revises item #1. Edits requirements for clarity and adds new thermal envelope requirements per section C402.1.2.1.8 when mechanical equipment envelope penetration area exceeds 1%. Adds new item #2. Exterior wall solar reflectance and thermal emittance must comply with Section C402.3. Edits item #3 and adds new requirements. Fenestration in the building thermal envelope assemblies must comply with Section C402.5. Building and building thermal envelope must comply with Item 2 of Section C401.2.1, C401.2.2, or C402.1.4 if the vertical fenestration area or skylight exceeds Section C402.5 requirements. Edits item #4 or #5 for clarity (duplicate items).

	#4/#5. Air leakage of the building thermal envelope must comply with Section C402.6. Created new bullet items #6 and #7 from the existing code language. #6. Thermal bridges in above-grade walls must comply with Section C402.7. #7. Walk-in coolers, walk-in freezers, refrigerated warehouse coolers, and refrigerated warehouse freezers must comply with Section C403.12. Some of the changes may increase the code stringency but are cost-effective.
Related Mod: CEPI-29-21, CEPI-28-21, CECPI-4-21, CEPI-27-21, CEPI-32-21, CEPI-31-21, CED1-92-22, CED1-94-22	**Section C401.2.1** shall comply with the following: 1. The opaque portions of the *building thermal envelope* shall comply with the specific insulation requirements of **Section C402.2** and the thermal requirements of **Section C402.1.2**, ~~the *R*-value-based method of~~ **C402.1.3**; ~~the *U*-, *C*- and *F*-factor-based method of Section C402.1.2;~~ or ~~the component performance alternative of~~ **C402.1.4**. Where the total area of through penetrations of mechanical equipment is greater than 1 percent of the opaque *above-grade wall* area, the *building thermal envelope* shall comply with **Section C402.1.2.1.8**. 2. Wall solar reflectance and thermal *emittance* shall comply with **Section C402.3**. ~~2.~~ 3. Roof solar reflectance and thermal *emittance* shall comply with **Section C402.4**. ~~3.~~ 4. *Fenestration* in the *building thermal envelope* ~~assemblies~~shall comply with **Section C402.5**. Where *buildings* have a vertical fenestration area or skylight area greater than that allowed in **Section C402.5**, the *building* and *building thermal envelope* shall comply with Item 2 of **Section C401.2.1**, **C401.2.2** or **C402.1.4**. ~~4.~~ *Air leakage* of building thermal envelope ~~assemblies~~ shall comply with **Section C402.6**. ~~5.~~ *Air leakage* of the building thermal envelope shall comply with **Section C402.6**. ~~6.~~ *Thermal bridges* in *above-grade walls* shall comply with **Section C402.7**. ~~7.~~ *Walk-in coolers* , *walk-in freezers* , *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with **Section C403.12**. ~~Alternatively, where buildings have a vertical fenestration area or skylight area exceeding that allowed in Section C402.5, the building and *building thermal envelope* shall comply with Item 2 of Section C401.2.1 or Section C401.2.2.~~ ~~Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.12.~~ Original text of mod is not consistent with that of the 2023 FBC -EC.
CE#102	Moves the two requirements to a new sub-section C402.1.1.1 to create the low energy building specifications. Adds new sub-section C402.1.1.1. Renumbers an existing section and made editorial changes. Renumbers Section C402.1.2, made editorial changes, and increased the heating capacity threshold to 20 kBth from 17 kBtuh.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

Related Mod:

CEPI-34-21, CED1-92-22, CEPI-34-21, CED1-99-22

C402.1.1 Low-energy buildings and greenhouses. The following low-energy buildings, or portions thereof separated from the remainder of the *building* by *building thermal envelope* assemblies complying with this section, shall be exempt from the *building thermal envelope* provisions of **Section C402**.

~~1. Those with a peak design rate of energy usage less than 3.4 Btu/h × ft^2 (10.7 W/m^2) or 1.0 watt per square foot (10.7 W/m^2) of floor area for space conditioning purposes.~~

~~2. Those that do not contain *conditioned space* .~~

C402.1.1.1 Low-energy buildings. *Buildings* that comply with either of the following:

1. Those with a peak design rate of energy usage less than 3.4 Btu/h × ft^2 (10.7 W/m^2) or 1.0 watt per square foot (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space* .

~~**C402.1.1.1**~~ **C402.1.1.2 Greenhouses.** *Greenhouse* structures or areas that are mechanically heated or cooled and that comply with all of the following shall be exempt from the *building thermal envelope* requirements of this code:

1. Exterior opaque envelope assemblies comply with **Sections C402.2** and C402.5.5.

   Exception: Low energy greenhouses that comply with **Section C402.1.1**.

2. Interior partition *building thermal envelope* assemblies that separate the *greenhouse* from *conditioned space* comply with **Sections C402.2**, **C402.5.3** and **C402.5.5**.
3. Fenestration assemblies that comply with the *building thermal envelope* requirements in **Table C402.1.1.2**. The *U-factor* for a roof shall be for the *roof assembly* or a roof that includes the assembly and an *internal curtain system* .

   Exception: Unconditioned greenhouses.

~~**C402.1.2**~~ **C402.1.1.3 Equipment buildings.** *Buildings* that comply with the following shall be exempt from the *building thermal envelope* provisions of this code:

1. Are separate *buildings* with floor area not more than 1,200 square feet (111 m^2).
2. Are intended to house electric equipment with installed equipment power totaling not less than 7 watts per square foot (75 W/m^2) and not intended for human occupancy.
3. Have a heating system capacity not greater than ~~(17~~ 20,000 Btu/h) (~~5~~6 kW) ~~a~~nd a heating *thermostat* setpoint that is restricted to not more than 50°F (10°C).
4. Have an average wall and roof *U-factor* less than 0.20~~0~~ in Climate Zones 1 through 5 and less than 0.12~~0~~ in Climate Zones 6 through 8.
5. Comply with the roof solar reflectance and thermal *emittance* provisions for Climate Zone 1.

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<td>FSEC – Anticipated energy impact on FBC-EC – Decrease
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<tr>
<td>CE#103</td>
<td>Renumbers an existing table C402.1.1.1 and renamed the table header.</td>
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<tr>
<td>Related Mod:

CEPI-34-21</td>
<td>~~TABLE C402.1.1.1~~ TABLE C402.1.1.2
FENESTRATION BUILDING THERMAL ENVELOPE MAXIMUM REQUIREMENTS
<table>
<tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr>
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<tr>
<td>CE#104</td>
<td>Renumbers section C402.1.4 and made editorial changes for clarity.</td>
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<tr>
<td>Related Mod:

CEPI-27-21, CEPI-28-21, CED1-94-22</td>
<td>~~C402.1.4~~ C402.1.2 Assembly U-factor, C-factor or F-factor-based method. ~~Building thermal envelope opaque assemblies shall meet the requirements of Sections C402.2 and C402.5 based on the climate zone specified in Chapter 3.~~ Building thermal envelope opaque assemblies ~~intended to comply on an assembly U-, C- or F-factor basis~~ shall have a U-, C- or F-factor not greater than that specified in Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the U-, C- or F-factor from the "Group R" column of Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the U-, C- or F-factor from the "All other" column of Table C402.1.2
<table>
<tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr>
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<tr>
<td>CE#105</td>
<td>Renumbers Table C402.1.4. Deleted footnote text "ci = Continuous Insulation, NR = No Requirement, LS = Liner System."</td>
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<tr>
<td>CEPI-28-21,CED1-92-22, CED1-100-22</td>
<td>~~TABLE C402.1.4~~ TABLE C402.1.2 OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD[a, b]
For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³. ~~ci = Continuous Insulation, NR = No Requirement, LS = Liner System.~~</td>
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Staff Classification	Correlates Directly	Energy Standard Needed	Over lap	
	X			

Action	AS	AS/IC	D	D/IC
	x			

CE#106

Renumbers Section C402.1.4.1, renamed the section title and revised the opaque assembly provisions.

This is a re-organized new section.

U-factors, C-factors, and F-factors of assemblies and calculation procedures from ASHRAE 90.1 Appendix A can be a compliance alternative, provided they meet the criteria of table C402.1.2.

U-factors of opaque assemblies determined by testing in accordance with ASTM C1363 can be a The R-value of continuous insulation must be permitted to be added to or subtracted from the original tested design, and airspaces used for assembly evaluations must comply with Section C402.2.7.

Related Mod:

CEPI-27-21, CEPI-41-21, CED1-103-22

~~C402.1.4.1~~ C402.1.2.1 ~~Roof/ceiling assembly.~~ Methods of determining *U*-, *C*- and *F*-factors. ~~The maximum roof/ceiling assembly *U*-factor shall not exceed that specified in Table C402.1.2 based on construction materials used in the roof/ceiling assembly.~~ Where assembly *U-factors* , *C*-factors and *F*-factors and calculation procedures are established in **ANSI/ASHRAE/IES 90.1** Appendix A for opaque assemblies, such opaque assemblies shall be a compliance alternative provided they meet the criteria of **Table C402.1.2** and the construction, excluding cladding system on walls, complies with the applicable construction details from **ANSI/ASHRAE/IES 90.1** Appendix A. Where *U-factors* have been established by testing in accordance with **ASTM C1363**, such opaque assemblies shall be a compliance alternative provided they meet the criteria of **Table C402.1.4**. The *R-value* of *continuous insulation* shall be permitted to be added to or subtracted from the original tested design. Airspaces used for assembly evaluations shall comply with **Section C402.2.7**.

~~C402.1.4.1.1~~ C402.1.2.1.1 Tapered, above-deck insulation based on thickness. ~~Where used as a component of a maximum roof/ceiling assembly *U-factor* calculation, the sloped roof insulation *R-value* contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value-per-inch (per-mm) solely for *U*-factor compliance as prescribed in Section C402.1.2.~~ For tapered, above-deck roof insulation, area-weighted *U-factors* of non-uniform insulation thickness shall be determined by an *approved* method.

Exception: The area-weighted *U*-factor shall be permitted to be determined by using the inverse of the average *R*-value determined in accordance with the exception to **Section C402.1.3.2**.

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap	
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Action	AS	AS/IC	D	D/IC
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CE#107	Renumbers Section C402.1.4.1.2. Adds new subsection C402.1.2.1.3. In determining compliance with Table C402.1.2, the U-factor of concrete masonry units with integral insulation shall be permitted to be used. Adds new subsection C402.1.2.1.4. Assembly complying with Section C402.1.3.4 must be permitted to comply with the required maximum U-factors for mass walls and mass floors in accordance with Table C402.1.2.
Related Mods: CEPI-41-21, CED1-103-22, CEPI-27-21, CED1-100-21	~~C402.1.4.1.2~~ C402.1.2.1.2 **Suspended ceilings.** Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly *U-factor* of the roof/ceiling construction. **C402.1.2.1.3 Concrete masonry units, integral insulation.** In determining compliance with **Table C402.1.2**, the *U-factor* of concrete masonry units with integral insulation shall be permitted to be used. **C402.1.2.1.4 Mass walls and floors.** Compliance with required maximum *U-factors* for mass walls and mass floors in accordance with **Table C402.1.2** shall be permitted for assemblies complying with **Section C402.1.3.4**. Original text of mod is not consistent with that of the 2023 FBC -EC. <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td></td><td></td><td>X</td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table>
CE#108	Adds new subsection C402.1.2.1.5. Where above-grade walls include more than one assembly type or penetration of the opaque wall area, an approved method can determine the area-weighted U-factor of the above-grade wall.
Related Mods: CED1-107-22	**C402.1.2.1.5 Area-weighted averaging of above-grade wall *U*-factors.** Where *above-grade walls* include more than one assembly type or a penetration of the opaque wall area, the area-weighted *U-factor* of the *above-grade wall* is permitted to be determined by an *approved* method. <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table>

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CE#109

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Renumbers Section C402.1.4.2, renames title and revises the provision of how it is applied depending on cavity insulation, frame spacing, and shape of frames

+

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Related Mods:

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~~**C402.1.4.2**~~ **C402.1.2.1.6** ~~**Thermal resistance of cold-formed steel walls.**~~ **Cold- formed steel assemblies.** ~~*U-factors* of walls with cold-formed steel studs shall be permitted to be determined in accordance with Equation 4-1.~~

~~(Equation 4-1)~~

~~where:~~

~~R_s = The cumulative *R*-value of the wall components along the path of heat transfer, excluding the *cavity insulation* and steel studs.~~

~~*ER* = The effective *R*-value of the *cavity insulation* with steel studs as specified in Table C402.1.2.1.6.~~

U-factors for building thermal envelopes containing cold-formed steel-framed ceilings and walls shall be permitted to be determined in accordance with **AISI S250** as modified herein.

1. Where the steel-framed wall contains no *cavity insulation*, and uses *continuous insulation* to satisfy the *U-factor* maximum, the steel-framed wall member spacing is permitted to be installed at any on-center spacing.
2. Where the steel-framed wall contains framing at 24 inches (610 mm) on center with a 23 percent framing factor or framing at 16 inches (406 mm) on center with a 25 percent framing factor, the next lower framing member spacing input values shall be used when calculating using **AISI S250**.
3. Where the steel-framed wall contains less than 23 percent framing factors, the

   AISI S250 shall be used without any modifications.
4. Where the steel-framed wall contains other than standard C-shape framing members, the **AISI S250** calculation option for other than standard C- shape framing is permitted to be used.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
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CE#110

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Adds new subsection C402.1.2.1.7.
This section clarifies and improves the consistency of thermal performance specification for spandrel panels. No change in code stringency.

Adds new subsection C402.1.2.1.8. The changes requires to use an approved u-factor for the equipment or a default u-factor of 0.5 for the envelope impacted. This change increases the code stringency but is a cost-effective measure.

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</table>

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<tr>
<td>Related Mods:

CEPI-44-21</td>
<td>
C402.1.2.1.7 Spandrel panels. U-factors of opaque assemblies within fenestration framing systems shall be determined in accordance with the default values in Table C402.1.2.1.7, ASTM C1363 or ANSI/NFRC 100.
<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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<tr>
<td>CE#111</td>
<td>Adds new subsection C402.1.2.1.8. The changes requires to use an approved u-factor for the equipment or a default u-factor of 0.5 for the envelope impacted. This change increases the code stringency but is a cost-effective measure.</td>
</tr>
<tr>
<td>Related Mods:

CEPI-29-21, CED1-106-22, CED1-108-22</td>
<td>
C402.1.2.1.8 Mechanical equipment penetrations. Where the total area of through penetrations of mechanical equipment is greater than 1 percent of the opaque above- grade wall area, such area shall be calculated as a separate wall assembly, in accordance with either Section C402.1.2.1.5 or Section C402.1.4 using a published and approved U-factor for that equipment or a default U-factor of 0.5.
<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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FSEC – Anticipated energy impact on FBC-EC – Decrease
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<tr>
<td>CE#112</td>
<td>Adds new table C402.1.2.1.7.</td>
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</table>

Related Mod: CEPI-44-21, CED1-110-22	

TABLE C402.1.2.1.7
EFFECTIVE U-FACTORS FOR SPANDREL PANELS[a]

RATED *R*-VALUE OF INSULATION BETWEEN FRAMING MEMBERS		R-4	R-7	R-10	R-15	R-20	R-25	R-30
Frame Type	**Spandrel Panel**	**Default *U*-Factor**						
Aluminum without thermal break[b]	Single glass pane, stone, or metal panel	0.285	0.259	0.247	0.236	0.230	0.226	0.224
	Double glazing with no low-e coatings	0.273	0.254	0.244	0.234	0.229	0.226	0.223
	Triple glazing or double glazing with low-e glass	0.263	0.249	0.241	0.233	0.228	0.225	0.223
Aluminum with thermal break[c]	Single glass pane, stone, or metal panel	0.243	0.212	0.197	0.184	0.176	0.172	0.169
	Double glazing with no low-e coatings	0.228	0.205	0.193	0.182	0.175	0.171	0.168
	Triple glazing or double glazing with low-e glass	0.217	0.199	0.189	0.180	0.174	0.170	0.167
Structural glazing[d]	Single glass pane, stone, or metal panel	0.217	0.180	0.161	0.145	0.136	0.130	0.126
	Double glazing with no low-e coatings	0.199	0.172	0.157	0.143	0.135	0.129	0.126
	Triple glazing or double glazing with low-e glass	0.186	0.165	0.152	0.140	0.133	0.128	0.125
No framing or insulation is continuous[e]	Single glass pane, stone, or metal panel	0.160	0.108	0.082	0.058	0.045	0.037	0.031
	Double glazing with no low-e coatings	0.147	0.102	0.078	0.056	0.044	0.036	0.030
	Triple glazing or double glazing with low-e glass	0.139	0.098	0.076	0.055	0.043	0.035	0.030

a. Extrapolation outside of the table shall not be permitted. Assemblies with distance between framing less than 30 inches, or not included in the default table, shall have a *U*-factor determined by testing in compliance with **ASTM C1363** or modeling in compliance with **ANSI/NFRC 100**. Spandrel panel assemblies in the table do not include metal backpans. For designs with metal backpans, multiply the *U*-factor by 1.2.

b. This frame type shall be used for systems that do not contain a nonmetallic element separating the metal exposed to the exterior from the metal exposed to the interior condition.
c. This frame type shall be used for systems where a nonmetallic element separates the metal exposed to the exterior from the metal that is exposed to the interior condition.
d. This frame type shall be used for systems that have no exposed mullion on the exterior.
e. This frame type shall be used for systems where there is no framing or the insulation is continuous and uninterrupted between framing.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
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Action	AS	AS/IC	D	D/IC
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CE#113

Revised the provision of Section C402.1.3 for clarity.

Related Mod:

CEPI-27-21, CEPI-28-21, CEPI-35-21, CEPI-36-21, CEPI-37-21, CEPI-38-21, CED1-92-22, CED1-94-22, CED1-100-22, CED1-111-22, CED1-112-22, CE2D-7-23

C402.1.3 Insulation component *R*-value-based method. ~~*Building thermal envelope*~~ opaque ~~assemblies shall comply with the requirements of Sections C402.2 and C402.5 based on the *climate zone* specified in Chapter 3.~~ For opaque portions of the *building thermal envelope* ~~intended to comply on an insulation component *R*-value basis,~~ the *R*-values for *cavity insulation* and *continuous insulation* shall be not less than that specified in **Table C402.1.3**. ~~Where cavity insulation is installed in multiple layers, the cavity insulation *R*-values shall be summed to determine compliance with the cavity insulation *R*-value requirements. Where continuous insulation is installed in multiple layers, the continuous insulation *R*-values shall be summed to determine compliance with the continuous insulation *R*-value requirements. Cavity insulation *R*-values shall not be used to determine compliance with the continuous insulation *R*-value requirements in Table C402.1.3. Commercial~~ *Group R* occupancy buildings or portions of *commercial buildings* enclosing *Group R* occupancies shall use the *R*-values from the "*Group R*" column of **Table C402.1.3**. *Commercial buildings* or portions of *commercial buildings* enclosing occupancies other than *Group R* shall use the *R*-values from the "All other" column of **Table C402.1.3**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
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Action	AS	AS/IC	D	D/IC
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CE#114

Provides an alternative combination of cavity and continuous minimum insulation requirements for Metal and Wood Frames above grade walls. Also, make editorial changes to the footnotes. No change to the code stringency.

Related Mod:

CEPI-27-21, CE2D-7-23

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, *R*-VALUE METHOD[a]

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-25 + R-11 + R-11 LS	R-25 + R-11 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-60	R-60	R-60	R-60

Walls, above grade																
Mass[f]	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13 + R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-17ci	R-13 + R-19.5ci	R-13 + R-19.5ci	R-13 + R-19.5ci
Metal framed[h, i]	R-13 + R-5ci R-0 + R-10ci or R-13 + R-5ci or R-20 + R-3.8ci	R-13 + R-5ci R-0 + R-10ci or R-13 + R-5ci or R-20 + R-3.8ci	R-13 + R-5ci R-0 + R-10ci or R-13 + R-5ci or R-20 + R-3.8ci	R-13 + R-7.5ci R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	R-13 + R-7.5ci R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	R-13 + R-7.5ci R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	R-13 + R-7.5ci R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	R-13 + R-7.5ci R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	R-13 + R-10ci R-0 + R-15.2ci or R-13 + R-10ci or R-20 + R-9ci	R-13 + R-10ci R-0 + R-15.2ci or R-13 + R-10ci or R-20 + R-9ci	R-13 + R-12.5ci R-0 + R-17.3ci or R-13 + R-12.5ci or R-20 + R-11ci	R-13 + R-12.5ci R-0 + R-17.3ci or R-13 + R-12.5ci or R-20 + R-11ci	R-13 + R-12.5ci R-0 + R-17.3ci or R-13 + R-12.5ci or R-20 + R-11ci	R-13 + R-15.6ci R-0 + R-21ci or R-13 + R-15.6ci or R-20 + R-14.3ci	R-13 + R-18.8ci R-0 + R-24ci or R-13 + R-18.8ci or R-20 + R-17.5ci	R-13 + R-18.8ci R-0 + R-24ci or R-13 + R-18.8ci or R-20 + R-17.5ci
Wood framed and other[h, i]	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 +R-16ci or R-13 + R-7.5ci or R20 + R3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 + R-27.5ci or R-13 + R-18.8ci or R-20 + R-14ci	R-0 + R-27.5ci or R-13 + R-18.8ci or R-20 + R-14ci
Walls, below grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-10ci	R-7.5ci	R-10ci	R-10ci	R-15ci	R-15ci	R-15ci	R-15ci	R-15ci
Floors																
Mass[e]	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-14.6ci	R-16.7ci	R-14.6ci	R-16.7ci	R-16.7ci	R-16.7ci	R-20.9ci	R-20.9ci	R-23ci	R-23ci
Joist/ framing	R-13	R-13	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38
Slab-on-grade floors																
Unheated slabs	NR	NR	NR	NR	NR	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-20 for 24″ below	R-20 for 24″ below	R-20 for 48″ below	R-20 for 24″ below	R-20 for 48″ below	R-20 for 48″ below	R-25 for 48″ below
Heated slabs[g]	R-7.5 for 12″ below + R-5 full slab	R-7.5 for 12″ below + R-5 full slab	R-7.5 for 12″ below + R-5 full slab	R-7.5 for 12″ below + R-5 full slab	R-10 for 24″ below + R-5 full slab	R-10 for 24″ below + R-5 full slab	R-15 for 24″ below + R-5 full slab	R-15 for 24″ below + R-5 full slab	R-15 for 36″ below + R-5 full slab	R-15 for 36″ below + R-5 full slab	R-15 for 36″ below + R-5 full slab	R-20 for 48″ below + R-5 full slab	R-20 for 48″ below + R-5 full slab	R-20 for 48″ below + R-5 full slab	R-20 for 48″ below + R-5 full slab	R-20 for 48″ below + R-5 full slab

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3. ci = Continuous Insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in **ANSI/ASHRAE/IES 90.1** Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in **Table C402.1.2**.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with **ASTM C90**, ungrouted or partially grouted at not less than 32 inches or less on center vertically and not less than 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft^2°F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation *R*-value requirements for heated slabs. above-grade mass walls.
e. “Mass floors” shall be in accordance with **Section C402.1.3.4**.
f. “Mass walls” shall be in accordance with **Section C402.1.3.4**.
g. The first value is for perimeter insulation and the second value is for full, under-slab insulation. Perimeter insulation and full-slab insulation components shall be installed in accordance with **Section C402.2.4**. is not required to extend below the bottom of the slab.

<table>
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h. The first value is cavity insulation; the second value is continuous insulation. Therefore, “R-0 + R-12ci” means R-12 continuous insulation and no cavity insulation; “R-13 + R-3.8ci” means R-13 cavity insulation and R-3.8 continuous insulation; “R-20” means R-20 cavity insulation and no continuous insulation R-13, R-20 and R-27 cavity insulation, as used in this table, apply to a nominal 4-inch, 6-inch and 8-inch-deep wood or cold-formed steel stud cavities, respectively.
i. Where the required R-value in Table C402.1.3 is met by using continuous insulation such that cavity insulation is not required, the R-value is applicable to any wall framing spacing.

Original text of mod is not consistent with that of the 2023 FBC -EC.

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<tr><td>CE#115</td><td>Adds new Section C402.1.3.1. Adds new Section C402.1.3.2.</td></tr>
<tr><td>Related Mod:</td><td>
C402.1.3.1 R-value of multi-layered insulation components. Where cavity insulation is installed in multiple layers, the cavity insulation R-values shall be summed to determine compliance with the cavity insulation R-value requirements. Where continuous insulation is installed in multiple layers, the continuous insulation R-values shall be summed to determine compliance with the continuous insulation R-value requirements. Cavity insulation R-values shall not be used to determine compliance with the continuous insulation R-value requirements in Table C402.1.3.

C402.1.3.2 Area-weighted averaging of R-values. Area-weighted averaging shall not be permitted for R-value compliance.

Exception: For tapered above-deck roof insulation, compliance with the R-values required in Table C402.1.3 shall be permitted to be demonstrated by multiplying the rated R-value per inch of the insulation material by the average thickness of the roof insulation. The average thickness of the roof insulation shall equal the total volume of the roof insulation divided by the area of the roof.

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<tr><td>CE#116</td><td>Renumbers Section C402.2.1.3.</td></tr>
<tr><td>Related Mod:

CEPI-41-21</td><td>
<s>C402.2.1.3</s> C402.1.3.3 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the minimum thermal resistance (R-value) of roof insulation in roof/ceiling construction.

Original text of mod is not consistent with that of the 2023 FBC -EC.

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<table>
<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
<tr><td></td><td></td><td></td><td>x</td><td></td></tr>
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CE#117 Adds new Section C402.1.3.4. Section C402.1.2.1.4 references this section.

Related Mod:

CEPI-27-21, CED1-100-21

C402.1.3.4 Mass walls and mass floors. Compliance with required maximum *U-factors* for mass walls and mass floors in accordance with **Table C402.1.2** and minimum *R*-values for insulation components applied to mass walls and mass floors in accordance with **Table C402.1.3** shall be permitted for assemblies complying with the following:

1. Where used as a component of the *building thermal envelope* , mass walls shall comply with one of the following:
   1.1. Weigh not less that 35 pounds per square foot (171 kg/m^2) of wall surface area.
   1.2. Weigh not less than 25 pounds per square foot (122 kg/m^2) of wall surface area where the material weight is not more than 120 pounds per cubic foot (pcf) (1922 kg/m^3).
   1.3. Have a heat capacity exceeding 7 Btu/ft^2 × °F (144 kJ/m^2 × K).
   1.4. Have a heat capacity exceeding 5 Btu/ft^2 × °F (103 kJ/m^2 × K) where the material weight is not more than 120 pcf (1922 kg/m^3).
2. Where used as a component of the *building thermal envelope* , the minimum weight of mass floors shall comply with one of the following:
   2.1. Thirty-five pounds per square foot (171 kg/m^2) of floor surface area.
   2.2. Twenty-five pounds per square foot (122 kg/m^2) of floor surface area where the material weight is not more than 120 pcf (1922 kg/m^3).

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#118 Renumbers Section C402.1.5, renames the section title, updates the referenced sections, and updates the compliance equation to account for thermal bridges.

Related Mod:

CECPI-4-21, CED1-92-22, CED1-94-22

~~**C402.1.5**~~ **C402.1.4 Component performance** ~~**alternative**~~**method.** Building thermal envelope values and fenestration areas determined in accordance with ~~Equation 4-2~~ **Equation 4-1** shall be an alternative to compliance with the *U*-, *F*-, psi-, chi-, and *C*-factors in **Tables C402.1.2**, **C402.1.2.1.7**, **C402.1.4** and **C402.5** and the maximum allowable fenestration areas in **Section C402.5.1**. *Fenestration* shall meet the applicable SHGC requirements of **Section C402.5.3**.

~~where~~ ~~**(Equation 4-2)**~~

~~A = Sum of the (UA Dif) values for each distinct assembly type of the *building thermal envelope* , other than slabs on grade and below-grade walls.~~

~~UA Dif = UA Proposed – UA Table.~~

~~UA Proposed = Proposed *U*-value × Area.~~

~~UA Table = (*U*-factor from **Table C402.1.3**, **C402.1.2** or **C402.5**) × Area.~~

~~B = Sum of the (FL Dif) values for each distinct slab-on-grade perimeter condition of the *building thermal envelope*.~~

~~FL Dif = FL Proposed – FL Table.~~

~~FL Proposed = Proposed *F*-value × Perimeter length.~~

~~FL Table = (*F*-factor specified in **Table C402.1.2**) × Perimeter length.~~

~~C = Sum of the (CA Dif) values for each distinct *below-grade wall* assembly type of the *building thermal envelope*.~~

~~CA Dif = CA Proposed – CA Table.~~

~~CA Proposed = Proposed *C*-value × Area.~~

~~CA Table = (Maximum allowable *C*-factor specified in **Table C402.1.2**) × Area.~~

~~Where the proposed vertical glazing area is less than or equal to the maximum vertical glazing area allowed by **Section C402.5.1**, the value of D (Excess Vertical Glazing Value) shall be zero. Otherwise:~~

~~D = (DA × UV) – (DA × U Wall), but not less than zero. DA = (Proposed Vertical Glazing Area) – (Vertical Glazing Area allowed by **Section C402.5.1**). UA Wall = Sum of the (UA Proposed) values for each opaque assembly of the exterior wall.~~

~~U Wall = Area-weighted average *U*-value of all above-grade wall assemblies. UAV = Sum of the (UA Proposed) values for each vertical glazing assembly. UV = UAV/total vertical glazing area.~~

~~Where the proposed skylight area is less than or equal to the skylight area allowed by **Section C402.5.1**, the value of E (Excess Skylight Value) shall be zero. Otherwise: E = (EA × US) – (EA × U Roof), but not less than zero.~~

~~EA = (Proposed Skylight Area) – (Allowable Skylight Area as specified in **Section C402.5.1**). U Roof = Area-weighted average *U*-value of all roof assemblies.~~

~~UAS = Sum of the (UA Proposed) values for each skylight assembly. US = UAS/total skylight area.~~

$$A_P + B_P + C_P + T_P \le A_T + B_T + C_T + T_T - T_T - V_F - V_S$$ Equation 4-1

where:

A_P = Sum of the (area × *U*-factor) for each proposed building thermal envelope assembly, other than slab-on-grade or below-grade wall assemblies.

B_P = Sum of the (length × *F*-factor) for each proposed slab-on-grade edge condition.

C_P = Sum of the (area × *C*-factor) for each proposed below-grade wall assembly.

T_P = Sum of the (ψLP) and (χNP) values for each type of thermal bridge condition of the building thermal envelope as identified in **Section C402.7** in the proposed building. For the purposes of this section, the (ψLP) and (χNP) values for thermal bridges caused by materials with a thermal conductivity less than or equal to 3.0 Btu × in/h × ft^2 × °F shall be assigned as zero. For buildings or structures located in Climate Zones 0 through 3, the value of T_P shall be assigned as zero.

ψLP= Psi-factor × length of the thermal bridge elements in the proposed building thermal envelope.

χNP = Chi-factor × number of the thermal bridge point elements other than fasteners, ties or brackets in the proposed building thermal envelope.

A_T = Sum of the (area × *U*-factor permitted by **Tables C402.1.2** and **C402.5**) for each proposed building thermal envelope assembly, other than slab-on-grade or below-grade wall assemblies.

B_T = Sum of the (length × *F*-factor permitted by **Table C402.1.2** for each proposed slab-on- grade edge condition.

C_T = Sum of the (area × *C*-factor permitted by **Table C402.1.2**) for each proposed below-grade wall assembly.

T_T = Sum of the (ψLT) and (χNT) values for each type of thermal bridge condition in the proposed building thermal envelope as identified in **Section C402.7** with values specified as "compliant" in **Table C402.1.4**. For the purposes of this section, the (ψLT) and (χNT) values for thermal bridges caused by materials with a thermal conductivity less than or equal to 3.0 Btu × in/h × ft^2 × °F shall be assigned as zero. For buildings or structures located in Climate Zones 0 through 3, the value of T_T shall be assigned as zero.

ψLT= (Psi-factor specified as "compliant" in **Table C402.1.4**) × length of the thermal bridge elements in the proposed building thermal envelope.

χNT = (Chi-factor specified as "compliant" in **Table C402.1.4**) × number of the thermal bridge point elements other than fasteners, ties or brackets in the proposed building thermal envelope.

P_F = Maximum vertical fenestration area allowable by **Section C402.5.1**, **C402.5.1.1** or C402.5.1.2.

Q_F = Proposed vertical fenestration area.

$R_F = Q_F – P_F$, but not less than zero (excess vertical fenestration area).

S_F = Area-weighted average *U*-factor permitted by **Table C402.5** of all vertical fenestration assemblies.

T_F = Area-weighted average *U*-factor permitted by **Table C402.1.2** of all exterior opaque wall assemblies.

$U_F = S_F – T_F$ (excess *U*-factor for excess vertical fenestration area). $V_F = R_F × U_F$ (excess *U* × *A* due to excess vertical fenestration area). P_S = Maximum skylight area allowable by **Section C402.1.2**.

Q_S = Actual skylight area.

$R_S = Q_S – P_S$, but not less than zero (excess skylight area).

S_S = Area-weighted average *U*-factor permitted by **Table C402.5** of all skylights.

T_S = Area-weighted average *U*-factor permitted by **Table C402.1.2** of all opaque roof assemblies.

$U_S = S_S – T_S$ (excess *U*-factor for excess skylight area).

$V_S = R_S × U_S$ (excess *U* × *A* due to excess skylight area).

A proposed psi- or *chi-factor* for each thermal bridge shall comply with one of the following, as applicable:

1. Where the proposed mitigation of a thermal bridge is compliant with the requirements of **Section C402.7**, the "compliant" values in **Table C402.1.4** shall be used for the proposed psi- or chi-factors.
2. Where a thermal bridge is not mitigated in a manner at least equivalent to **Section C402.7**, the "noncompliant" values in **Table C402.1.4** shall be used for the proposed psi- or chi-factors.
3. Where the proposed mitigation of a thermal bridge provides a psi- or chi-factor less than the "compliant" values in **Table C402.1.4**, the proposed psi- or chi-factor shall be determined by thermal analysis, testing or other approved sources.

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#119

Adds new table C402.1.4. This change is consistent with the thermal performance of products currently in the market.

Related Mod:

TABLE C402.1.4

PSI- and CHI-FACTORS TO DETERMINE THERMAL BRIDGES FOR THE COMPONENT PERFORMANCE METHOD

CECPI-4-21, CED1-138-22

THERMAL BRIDGE PER SECTION C402.7	THERMAL BRIDGE COMPLIANT WITH SECTION C402.7		THERMAL BRIDGE NONCOMPLIANT WITH SECTION C402.7	
	Psi-Factor (Btu/h × ft × °F)	Chi-Factor (Btu/h × °F)	Psi-Factor (Btu/h × ft × °F)	Chi-Factor (Btu/h × °F)
C402.7.1 Balconies and floor decks	0.2	N/A	0.5	N/A
C402.7.2 Cladding supports	0.2	N/A	0.3	N/A
C402.7.3 Structural beams and columns	N/A	1.0 carbon steel 0.3 concrete	N/A	2.0 carbon steel 1.0 concrete
C402.7.4 Vertical fenestration	0.15	N/A	0.3	N/A
C402.7.5 Parapets	0.2	N/A	0.4	N/A

For SI: 1 W/m × K = 0.578 Btu/h × ft × °F, 1 W/K = 1.9 Btu/h × °F.

N/A = Not Applicable.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#120 Renumbers Section C402.5.5. Made editorial changes.

Related Mod:

CECPI-3-21

~~C402.5.5~~ C402.1.5 **Rooms containing fuel-burning appliances.** In Climate Zones 3 through 8, where combustion air is supplied through openings in an *exterior wall* to a room or space containing a space-conditioning fuel-burning appliance, one of the following shall apply:

1. The room or space containing the appliance shall be located outside of the *building thermal envelope*.
2. The room or space containing the appliance shall be enclosed and isolated from *conditioned spaces* inside the *building thermal envelope*. Such rooms shall comply with all of the following:
    2.1. The walls, floors and ceilings that separate the enclosed room or space from *conditioned spaces* shall be insulated to be not less than equivalent to the insulation requirement of *below-grade walls* as specified in **Table C402.1.3** or **Table C402.1.2**.
    2.2. The walls, floors and ceilings that separate the enclosed room or space from *conditioned spaces* shall be sealed in accordance with **Section C402.6.1.2**.
    2.3. The doors into the enclosed room or space shall be fully gasketed.

2.4. Piping serving as part of a heating or cooling system ~~Water lines~~and *ducts* in the enclosed room or space shall be insulated in accordance with **Section C403**. Service water piping shall be insulated in accordance with **Section C404**.

2.5. Where an air *duct* supplying combustion air to the enclosed room or space passes through *conditioned space* , the *duct* shall be insulated to an *R-value* of not less than R-8.

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

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#121

Renames Section C402.2 title, makes editorial change and updates the referenced sections.
Deletes Section C402.2.1.1.
Renumbers Section C402.2.1.4 and edits the provision.
Adds new Section C402.2.1.3. This new section clarifies the minimum thickness requirements of tapered insulation.

Related Mod:

CEPI-27-21

C402.2 Specific ~~*building thermal envelope*~~ insulation and installation requirements. Insulation in *building thermal envelope* opaque assemblies shall be installed in accordance ~~comply~~with **Section C303.2** and **Sections C402.2.1** through **C402.2.7**, or an approved design ~~and Table C402.1.3~~.

C402.2.1 Roof-ceiling construction~~assembly~~. ~~The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on construction materials used in the roof assembly.~~ Insulation materials in the roof-ceiling construction shall be installed between the roof or ceiling framing, continuously below the ceiling framing, continuously above, below, or within the roof deck or in any *approved* combination thereof. Insulation installed above the roof deck shall comply with **Sections C402.2.1.1** through **C402.2.1.3**.

~~**C402.2.1.1 Tapered, above-deck insulation based on thickness.** Where used as a component of a roof/ceiling assembly *R*-value calculation, the sloped roof insulation *R*-value contribution to that calculation shall use the average thickness in inches (mm) along with the material *R*-value-per-inch (per-mm) solely for *R*-value compliance as prescribed in **Section 402.1.3**.~~

~~C402.2.1.4~~ C402.2.1.1 Joints staggered. Continuous , above-deck insulation board located above the roof deck shall be installed in not less than two layers and the edge joints between each layer of insulation shall be staggered, except where insulation tapers to the roof deck at a gutter edge, roof drain or scupper.

~~**C402.2.1.2 Minimum thickness, lowest point.** The minimum thickness of above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be not less than 1 inch (25 mm).~~

	~~C402.2.1.5~~ C402.2.1.2 **Skylight curbs.** Skylight curbs shall be insulated to the level of ~~roofs with~~ the above-deck roof insulation ~~entirely above the deck~~ or R-5, whichever is less. **Exception:** Unit skylight curbs included as a component of a skylight *listed* and *labeled* in accordance with **NFRC 100** shall not be required to be insulated. **C402.2.1.3 Minimum thickness of tapered insulation.** The thickness of tapered above- deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be not less than 1 inch (25 mm). Original text of mod is not consistent with that of the 2023 FBC -EC.
CE#122	Revises the provision to include insulation installation requirements and removes the reference to the minimum efficiency level requirement tables.
Related Mod: C402.2.2 Above-grade walls	**C402.2.2 Above-grade walls.** ~~The minimum thermal resistance (*R*-value) of materials installed between floor framing, be integral to the floor assembly, in the wall cavity between framing members and continuously on the walls shall be as specified in **Table C402.1.3**, based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units shall not be used in determining compliance with **Table C402.1.3** except as otherwise noted in the table. In determining compliance with **Table C402.1.2**, the use of the *U*-factor of concrete masonry units with integral insulation shall be permitted.~~ ~~"Mass walls" where used as a component in the thermal envelope of a building shall comply with one of the following:~~ ~~1. Weigh not less than 35 pounds per square foot (171 kg/m^2) of wall surface area.~~ ~~2. Weigh not less than 25 pounds per square foot (122 kg/m^2) of wall surface area where the material weight is not more than 120 pcf (1900 kg/m^3).~~ ~~3. Have a heat capacity exceeding 7 Btu/ft^2 × °F (144 kJ/m^2 × K).~~ ~~4. Have a heat capacity exceeding 5 Btu/ft^2× °F (103 kJ/m^2× K), where the material weight is not more than 120 pcf (1900 kg/m^3).~~ *Above-grade wall* insulation materials shall be installed between the wall framing, be integral to the wall assembly, be continuous on the wall assembly, or be any combination of these insulation methods. Where *continuous insulation* is layered on the exterior side of a wall assembly, the joints shall be staggered. Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#123

Renames the section title, revises the provision, and removes the minimum requirement table references.

Related Mod:

CEPI-27-21

C402.2.3 Floors over outdoor air or unconditioned space. ~~The thermal properties~~ (component ~~*R*-values or assembly *U*-, *C*- or *F*-factors) of floor assemblies over outdoor air~~ ~~or unconditioned space shall be as specified in Table C402.1.3 or C402.1.2 based on the construction materials used in the floor assembly. Floor framing *cavity insulation* or structural slab insulation shall be installed to maintain permanent contact with the underside of the subfloor decking or structural slabs.~~

~~"Mass floors" where used as a component of the thermal envelope of a building shall provide one of the following weights:~~ Floor insulation shall be installed between floor framing, be integral to the floor assembly, be continuous on the floor assembly, or be any combination of these insulation methods. Where *continuous insulation* is layered on the exterior side of a floor assembly, the joints shall be staggered. Floor framing *cavity insulation* or structural slab insulation shall be installed to maintain permanent contact with the underside of the subfloor decking or structural slabs.

1. ~~35 pounds per square foot (171 kg/m²) of floor surface area.~~
2. ~~25 pounds per square foot (122 kg/m2) of floor surface area where the material weight is not more than 120 pounds per cubic foot (1923 kg/m3).~~

Exceptions:

1. The floor framing *cavity insulation* or structural slab insulation shall be permitted to be installed in contact with the top side of sheathing or *continuous insulation* installed on the bottom side of floor assemblies. ~~where combined with insulation that meets or exceeds the minimum *R*-value in Table C402.1.3 for "Metal framed" or "Wood framed and other" values for "Walls, above grade" and extends from the bottom to the top of all perimeter floor framing or floor assembly members.~~ Floor framing or structural slab members at the perimeter of the floor assembly shall be insulated vertically for their full depth with insulation equivalent to that required for the above-grade wall construction.
2. Insulation applied to the underside of concrete floor slabs shall be permitted an airspace of not more than 1 inch (25 mm) where it turns up and is in contact with the underside of the floor under walls associated with the *building thermal envelope* .

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

Original text of mod is not consistent with that of the 2023 FBC -EC.

CE#124

Revises the provision and combines the subsection C402.2.4.1.

Related Mod:

C402.2.4 Slabs-on-grade. ~~The minimum thermal resistance (*R*-value) of the insulation for unheated or *heated slab* -on-grade floors designed in accordance with the *R*-value method of Section C402.1.3 shall be as specified in Table C402.1.3.~~ Where

CEPI-27-21	installed, the perimeter insulation for slab-on-grade shall be placed on the outside of the foundation or on the inside of the foundation wall. For installations complying with **Table C402.1.3**, the perimeter insulation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Where installed, full slab insulation shall be continuous under the entire area of the slab-on- grade floor, except at structural column locations and service penetrations. Insulation required at the *heated slab* perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation. **Exception:** Where the slab-on-grade floor is greater than 24 inches (610 mm) below the finished exterior grade, perimeter insulation is not required. ~~**402.2.4.1 Insulation installation.** Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insu lation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.~~ ~~**Exception:** Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.~~
CE#125	Revises the provision of section C402.2.5.
Related Mod: CEPI-27-21	**C402.2.5 Below-grade walls.** ~~The *C*-factor for the below-grade exterior walls shall be in accordance with Table C402.1.2. The *R*-value of the insulating material installed continuously within or on the below-grade exterior walls of the building envelope shall be in accordance with Table C402.1.3. The *C*-factor or *R*-value required~~ Below-grade wall insulation shall be installed between framing members, be integral to the wall assembly, be continuous on the wall assembly, or be any combination of these insulation methods. For installations complying with **Section C401.2.1**, insulation shall extend to a depth of not less than 10 feet (3048 mm) below the outside finished ground level or to the level of the lowest floor of the conditioned space enclosed by the below-grade wall, whichever is less. Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#126 Deletes an exception.

Related Mod:

CEPI-27-21

C402.2.6 Insulation of radiant heating systems. *Radiant heating system* panels, and their associated components that are installed in interior or exterior assemblies, shall be insulated to an *R*-value of not less than R-3.5 on all surfaces not facing the space being heated. *Radiant heating system* panels that are installed in the *building thermal envelope* shall be separated from the exterior of the building or unconditioned or exempt spaces by not less than the *R* -value of insulation installed in the opaque assembly in which they are installed or the assembly shall comply with **Section C402.1.2**.

~~**Exception:** *Heated slabs* on grade insulated in accordance with **Section C402.2.4**.~~

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#127 Revises the provision. The changes enforce best practices that minimize airflow into enclosed air spaces and improve their thermal performance.

Related Mod:

CEPI-48-21

C402.2.7 Airspaces. Where the *R-value* of an airspace is used for compliance in accordance with **Section C402.1**, the airspace shall be enclosed in ~~an unventilated~~ a cavity ~~constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where the enclosed airspace is located on the interior side of the continuous *air barrier* and~~ is bounded on all sides by building components ~~.~~ and constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where one of the following conditions occur:

1. The enclosed airspace is unventilated.
2. The enclosed airspace is bounded on at least one side by an anchored masonry veneer, constructed in accordance with **Chapter 14** of the *International Building Code* and vented by veneer weep holes located only at the bottom of the airspace and spaced not less than 15 inches (381 mm) on center with top of the cavity airspace closed.

Exception: ~~The thermal resistance of airspaces located on the~~ For ventilated cavities, the effect of the *ventilation* of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with **ASTM C1363** modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#128

Adds new section C402.3. Requires minimum solar reflectance of 0.3 for above grade walls. Current products in the market meet this requirement but may slightly increase the stringency.

Related Mod:

CEPI-31-21, CED1-121-22

C402.3 Above-grade wall solar reflectance. For Climate Zone 0, above-grade *east-oriented* , *south-oriented* and west-oriented walls shall comply with either of the following:

1. Not less than 75 percent of the opaque *above-grade wall* area shall have an area-weighted initial solar reflectance of not less than 0.30 where tested in accordance with **ASTM C1549** with AM1.5GV output or **ASTM E903** with AM1.5GV output, or determined in accordance with an *approved source* . This *above-grade wall* area shall have an *emittance* or emissivity of not less than 0.75 where tested in accordance with **ASTM C835**, **ASTM C1371**, **ASTM E408** or determined in accordance with an *approved source* . For the portion of the *above- grade wall* that is glass spandrel area, a solar reflectance of not less than 0.29, as determined in accordance with **NFRC 300** or **ISO 9050**, shall be permitted. Area-weighted averaging is permitted using only south-, east- and *west-oriented* walls enclosing the same occupancy classification.
2. Not less than 30 percent of the opaque *above-grade wall* area shall be shaded by manmade structures, existing buildings, hillsides, permanent building projections, on-site renewable energy systems or a combination of these. Shade coverage shall be calculated by projecting the shading surface downward on the *above-grade wall* at an angle of 45 degrees.

Exception: *Above-grade walls* of low-energy buildings complying with **Section C402.1.1.1**, greenhouses complying with **Section C402.1.1.2** and equipment buildings complying with **Section C402.1.1.3**.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#129

Renumbers Section C402.3 and replaced the text "Sloped" with "Slope."

Related Mod:

CEPI-31-21, CED1-121-22

~~C402.3~~ C402.4 **Roof solar reflectance and thermal emittance.** ~~Low-sloped~~ *Low slope* roofs directly above cooled *conditioned spaces* in Climate Zones 0 through 3 shall comply with one or more of the options in **Table C402.4**.

Exceptions: The following roofs and portions of roofs are exempt from the requirements of Table C402.4:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#130

Renumbers table C402.3.

Related Mod:

~~TABLE C402.3~~ TABLE C402.4

MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CEPI-31-21, CED1-121-22	

CE#131

Renumbers Section C402.3.1.

Related Mod:

CEPI-31-21, CED1-121-22

~~C402.3.1~~ C402.4.1 **Aged roof solar reflectance.** Where an aged solar reflectance required by **Section C402.4** is not available, it shall be determined in accordance with **Equation 4-2**.

$$R_{aged} = [0.2 + 0.7(R_{initial} - 0.2)] \qquad \text{Equation 4-2}$$

where:

R_{aged} = The aged solar reflectance.

$R_{initial}$ = The initial solar reflectance determined in accordance with **CRRC-S100**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#132

Renumbers Section C402.4.

Related Mod:

CEPI-31-21, CED1-121-22

~~C402.4~~ C402.5 **Fenestration.** *Fenestration* shall comply with **Sections C402.5.1** through **C402.5.5** and **Table C402.5**. Daylight responsive controls shall comply with this section and **Section C405.2.4**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#133

Renumbers Table C402.4 and decreased the U-factor of fixed fenestration for climate zones 3, 4, 5, 7, and 8.

Related Mod:

CED1-126-22

~~TABLE C402.4~~ TABLE C402.5

BUILDING ENVELOPE FENESTRATION MAXIMUM *U*-FACTOR AND SHGC REQUIREMENTS

CLIMATE ZONE	0 AND 1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Fixed fenestration	0.50	0.45	~~0.42~~ 0.38	~~0.36~~ 0.34	~~0.36~~ 0.34	0.34	~~0.29~~ 0.28	~~0.26~~ 0.25
Operable fenestration	0.62	0.60	0.54	0.45	0.45	0.42	0.36	0.32
Entrance doors	0.83	0.77	0.68	0.63	0.63	0.63	0.63	0.63

	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable

PF < 0.2	0.23	0.21	0.25	0.23	0.25	0.23	0.36	0.33	0.38	0.33	0.38	0.34	0.40	0.36	0.40	0.36
0.2 ≤ PF < 0.5	0.28	0.25	0.30	0.28	0.30	0.28	0.43	0.40	0.46	0.40	0.46	0.41	0.48	0.43	0.48	0.43
PF ≥ 0.5	0.37	0.34	0.40	0.37	0.40	0.37	0.58	0.53	0.61	0.53	0.61	0.54	0.64	0.58	0.64	0.58

U-factor	0.70	0.65	0.55	0.50	0.50	0.50	0.44	0.41
SHGC	0.30	0.30	0.30	0.40	0.40	0.40	NR	NR

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#134

Renumbers Section C402.4.1.
Renumbers Section C402.4.1.1 and edits the code language to clarify its applicability is to primary sidelit or toplit daylight zones.
Renumbers Section C402.4.1.2 and makes editorial changes.

Related Mod:

CEPI-167-21

~~C402.4.1~~ C402.5.1 Maximum area. The vertical *fenestration* area, not including *opaque doors* and opaque spandrel panels, shall be not greater than 30 percent of the gross *above- grade wall* area. The skylight area shall be not greater than 3 percent of the gross roof area.

~~C402.4.1.1~~ C402.5.1.1 Increased vertical fenestration area with daylight responsive controls. In Climate Zones 0 through 6, not more than 40 percent of the gross *above- grade wall* area shall be vertical *fenestration* , provided that all of the following requirements are met:

1. In buildings not greater than two stories above grade, not less than 50 percent of the *net floor area* is within a primary sidelit daylight zone or a toplit daylight zone.
2. In buildings three or more stories above grade, not less than 25 percent of the *net floor area* is within a primary sidelit daylight zone or a toplit daylight zone.
3. *Daylight responsive controls* are installed in *daylight zones*.
4. *Visible transmittance* (VT) of vertical *fenestration* is not less than 1.1 times *solar heat gain coefficient* (SHGC).

Exception: *Fenestration* that is outside the scope of **NFRC 200** is not required to comply with Item 4.

~~C402.4.1.2~~ C402.5.1.2 Increased skylight area with daylight responsive controls. The skylight area shall be not more than 6 percent of the roof area provided that *daylight responsive controls* are installed in *toplit daylight zones*.

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#135

Renumbers Section C402.4.2.

Renumbers Section C402.4.2.1.
Renumbers Section C402.4.2.2.

Related Mod:

CEPI-167-21

~~C402.4.2~~ C402.5.2 **Minimum skylight fenestration area.** Skylights shall be provided in *enclosed spaces* greater than 2,500 square feet (232 m^2) in floor area, directly under a roof with not less than 75 percent of the ceiling area with a ceiling height greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/ exercise center, convention center, automotive service area, space where manufacturing occurs, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation depot or workshop. The total *toplit daylight zone* shall be not less than half the floor area and shall comply with one of the following:

1. A minimum skylight area to *toplit daylight zone* of not less than 3 percent where all skylights have a VT of notless than 0.40, or VT_{annual} of not less than 0.26, as determined in accordance with **Section C303.1.3**.
2. A minimum skylight effective aperture, determined in accordance with **Equation 4-3**, of:
   2.1. Not less than 1 percent using a skylight's VT rating; or
   2.2. Not less than 0.66 percent using a Tubular Daylight Device's VT_{annual} rating.

$$\text{Skylight Effective Aperture} = \frac{0.85 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}}{\text{Toplit Zone}}$$

Equation 4-3

~~C402.4.2.1~~ C402.5.2.1 **Lighting controls in toplit daylight zones.** *Daylight responsive controls* shall be provided in toplit daylight zones.

~~C402.4.2.2~~ C402.5.2.2 **Haze factor.**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#136

Renumbers Section C402.4.3 and Renumbers the equation. Renumbers Section C402.4.3.1. Renumbers Section C402.4.3.2. Renumbers Section C402.4.3.3. Renumbers Section C402.4.3.4.

Related Mod:

CEPI-167-21

~~C402.4.3~~ C402.5.3 **Maximum *U*-factor and SHGC.** The maximum *U-factor* and *solar heat gain coefficient* (SHGC) for *fenestration* shall be as specified in **Table C402.5**.

The window projection factor shall be determined in accordance with ~~Equation 4-5~~ **Equation 4-4**.

$$PF = A/B$$

Equation 4-4

Where different windows or glass doors have different *PF* values, they shall each be evaluated separately.

	~~C402.4.3.1~~ C402.5.3.1 **Increased skylight SHGC.** In Climate Zones 0 through 6, skylights shall be permitted a maximum SHGC of 0.60 where located above *daylight zones* provided with *daylight responsive controls*. ~~C402.4.3.2~~ C402.5.3.2 **Increased skylight *U*-factor.** Where skylights are installed above *daylight zones* provided with *daylight responsive controls* , a maximum *U-factor* of 0.9 shall be permitted in Climate Zones 0 through 3 and a maximum *U-factor* of 0.75 shall be permitted in *Climate Zones* 4 through 8. ~~C402.4.3.3~~ C402.5.3.3 **Dynamic glazing.** ~~C402.4.3.4~~ C402.5.3.4 **Area-weighted *U*-factor.** An area-weighted average shall be permitted to satisfy the *U-factor* requirements for each fenestration product category listed in **Table C402.5**. Individual fenestration products from different fenestration product categories listed in **Table C402.5** shall not be combined in calculating area-weighted average *U-factor*
CE#137	Renumbers Section C402.4.4. Renumbers Section C402.4.5. Renumbers subsection C402.4.5.1. Renumbers subsection C402.4.5.2.
Related Mod: CEPI-167-21	~~C402.4.4~~ C402.5.4 **Daylight zones.** Daylight zones referenced in **Sections C402.5.1.1** through **C402.5.3.2** shall comply with **Sections C405.2.4.2** and **C405.2.4.3**, as applicable. Daylight zones shall include *toplit daylight zones* and sidelit *daylight* zones. ~~C402.4.5~~ C402.5.5 **Doors.** Opaque swinging doors shall comply with **Table C402.1.2**. Opaque nonswinging doors shall comply with **Table C402.1.2**. *Opaque doors* shall be considered as part of the gross area of *above-grade walls* that are part of the *building thermal envelope* . *Opaque doors* shall comply with **Section C402.5.5.1** or **C402.5.5.2**. Other doors shall comply with the provisions of **Section C402.5.3** for vertical *fenestration* . ~~C402.4.5.1~~ C402.5.5.1 **Opaque swinging doors.** Opaque swinging doors shall comply with **Table C402.1.2**. ~~C402.4.5.2~~ C402.5.5.2 **Nonswinging doors.** Opaque nonswinging doors that are horizontally hinged sectional doors with a single row of *fenestration* shall have an assembly *U-factor* less than or equal to 0.440 in Climate Zones 0 through 6 and less than or equal to 0.360 in Climate Zones 7 and 8, provided that the fenestration area is not less than 14 percent and not more than 25 percent of the total door area. **Exception:** Other doors shall comply with the provisions of **Section C402.5.3** for vertical *fenestration* . Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#138	Renumbers Section C402.5 renames the title and revises the provision. Renumbers Section C402.5.1 and revises the provision. This requires air leakage performance of the air barrier must be verified per Section C402.6.2.

Related Mod:

CECPI-3-21,CEPI-58-21,CEPI-32-21,CED1-92-22

~~**C402.5**~~ **C402.6 Air leakage—building thermal envelope.** The *building thermal envelope* shall comply with **Sections C402.6.1** through **C402.6.7**. ~~Section C402.6.11.1, or the building *thermal envelope* shall be tested in accordance with Section C402.6.2.2 or C402.6.2.1. Where compliance is based on such testing, the building shall also comply with Sections C402.6.5, C402.6.7 and C402.6.6.~~

~~**C402.5.1**~~ **C402.6.1 Air barriers.** A continuous *air barrier* shall be provided throughout the *building thermal envelope* . The ~~continuous *air barriers* shall~~ *air barrier* is permitted to be located at any combination of ~~on the~~ inside, ~~or~~ outside or within ~~of~~ the *building thermal envelope* . ~~, located within the assemblies composing the building thermal envelope, or any combination thereof.~~ The *air barrier* shall comply with **Sections C402.6.1.1** and **C402.6.1.2**. The *air leakage* performance of the *air barrier* shall be verified in accordance with **Section C402.6.2**.

Exception: Air barriers are not required in buildings located in *Climate Zone* 2B

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#139	Adds new Section C402.6.1.1. New section was creating by re-organizing an existing section for clarity.

Related Mod:

CECPI-3-21,CED1-92-22,CED1-128-22

C402.6.1.1 Air barrier design and documentation requirements. Design of the continuous *air barrier* shall be documented as follows:

1. Components 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* components shall be detailed.
3. The continuity of the *air barrier* 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:
   - 4.1. Joints around *fenestration* and door frames.
   - 4.2. Joints between walls and floors; between walls at building corners; between walls and roofs, including parapets and copings; where *above-grade walls* meet foundations; and at similar intersections.
   - 4.3. Penetrations or attachments through the continuous *air barrier* .
   - 4.4. Building assemblies used as *ducts* or plenums.
   - 4.5. Changes in continuous *air barrier* materials and assemblies.
5. Identify where testing will or will not be performed in accordance with **Section C402.6.2**. Where testing will not be performed, a plan for field inspections required by **Section C402.6.2.3** shall be provided that includes the following:
   - 5.1. A schedule for periodic inspection.
   - 5.2. The continuous *air barrier* scope of work.
   - 5.3. A list of critical inspection items.
   - 5.4. Inspection documentation requirements.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

	5.5. Provisions for corrective actions where needed.
CE#140	Renumbers Section C402.5.1.1 and revises the provision. Adds new requirements for the electrical and communication boxes to comply with a new sub-section C402.6.1.2.2.
Related Mod: CECPI-3-21,CEPI-60-21,CEPI-32-21,CED1-130-22	~~**C402.5.1.1**~~ **C402.6.1.2 Air barrier construction.** The *continuous air barrier* shall be constructed to comply with the following: 1. The *air barrier* shall be continuous for all assemblies that ~~are~~compromise the *building thermal envelope* ~~*of the building*~~ and across the joints and assemblies. 2. *Air barrier* joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. 3. Penetrations of the *air barrier* shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. ~~Joints and seams associated with penetrations shall be sealed in the same manner or taped.~~ Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure~~from wind, stack effect and mechanical ventilation~~. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the fire sprinkler manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings. 4. Recessed lighting fixtures shall comply with **Section C402.6.1.2.1**. Where similar objects are installed that penetrate the *air barrier*, provisions shall be made to maintain the integrity of the *air barrier* . 5. Electrical and communication boxes shall comply with **Section C402.6.1.2.2.** <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td>x</td><td></td><td></td><td></td></tr></table>
CE#141	Renumbers Section C402.5.10 and makes editorial changes. Adds new Section C402.6.1.2.2. This new subsection was created due to section re-arrangement. Adds new Section C402.6.1.2.2.1.This new subsection was created due to section re-arrangement.
Related Mod: CECPI-3-21, CEPI-60-21, CECPI-3-21, CECPI-3-21	~~**C402.5.10**~~ **C402.6.1.2.1 Recessed lighting.** Recessed luminaires installed in the *building thermal envelope* shall be all of the following: 1. IC-rated. 2. *Labeled* as having an *air leakage* rate of ~~not more~~ not greater than 2.0 cfm (0.944 L/s) when tested in accordance with **ASTM E283** at a 1.57 psf (75 Pa) pressure differential. 3. Sealed with a gasket or caulk between the housing and interior wall or ceiling covering. **C402.6.1.2.2 Electrical and communication boxes.** Electrical and communication boxes that penetrate the *air barrier* of the *building thermal envelope* , and that do not comply with **Section C402.6.1.2.2.1**, shall be caulked, taped, gasketed

	or otherwise sealed to the *air barrier* element being penetrated. All openings on the concealed portion of the box shall be sealed. Where present, insulation shall rest against all concealed portions of the box. **C402.6.1.2.2.1 Air-sealed boxes.** Where air-sealed boxes are installed, they shall be marked in accordance with **NEMA OS 4**. Air-sealed boxes shall be installed in accordance with the manufacturer's instructions. Staff Classification: Correlates Directly: X; Energy Standard Needed: ; Over lap: Action: AS: ; AS/IC: ; D: x; D/IC:
CE#142	Renumbers and renames the title of Section C402.5.1.2, revises the testing requirements, re-arranges the provisions, and modifies the exceptions. Reduces the measured air leakage threshold to 0.35 cfm/ft2 from 0.40 cfm/ft2 due to advances in air leakage control technology. Also, the measured air leakage upper limit was reduced to 0.45 cfm/ft2 from 0.60 cfm/ft2 for the exception. Exempts buildings larger than 25,000 ft2 floor area from the testing requirement in climate zones 0 through 4. Allows alternative testing method and maximum air-leakage rate for dwelling and sleeping units per Section C402.6.2.2. It increases the code stringency, but it is a cost-effective change and is equivalent to the ASHRAE 90.1-2022 requirement.
Related Mod: CECPI-3-21,CEPI-58-21,CEPI-32-21,CEPI-61-21,CED1-131-22,CED1-132-22,CE2D-9-23, CEPI-71-21	~~**C402.5.1.2**~~ **C402.6.2 Air** ~~**barrier**~~ **leakage compliance.** ~~A continuous *air barrier* for the opaque building envelope shall comply with the following:~~ ~~1. Buildings or portions of buildings, including *Group R* and I occupancies, shall meet the provisions of **Section C402.6.2.2**.~~ ~~**Exception:** Buildings in Climate Zones 2B, 3C and 5C.~~ ~~2. Buildings or portions of buildings other than *Group R* and I occupancies shall meet the provisions of **Section C402.6.2.1**.~~ ~~Exceptions:~~ ~~1. Buildings in Climate Zones 2B, 3B, 3C and 5C.~~ ~~2. Buildings larger than 5,000 square feet (464.5 m^2) floor area in Climate Zones 0B, 1, 2A, 4B and 4C.~~ ~~3. Buildings between 5,000 square feet (464.5 m^2) and 50,000 square feet (4645 m^{-2}) floor area in Climate Zones 0A, 3A and 5B.~~ ~~3. Buildings or portions of buildings that do not complete air barrier testing shall meet the provisions of **Section C402.6.2.3.1** or **C402.6.2.3.2** in addition to **Section C402.6.2.3**.~~ Air leakage of the *building thermal envelope* shall be tested by an approved third party in accordance with **Section C402.6.2.1**. The measured air leakage shall not be greater than 0.35 cubic feet per minute per square foot (1.8 L/s x m^2) of the *building thermal envelope* area at a pressure differential of 0.3 inch water gauge (75 Pa) with the calculated *building thermal envelope* surface area being the sum of the above- and below-grade *building thermal envelope*.

Exceptions:

1. Where the measured *air leakage* rate is greater than 0.35 cfm/ft^2 (1.8 L/s × m^2) but is not greater than 0.45 cfm/ft^2 (2.3 L/s × m^2), the *approved* third party shall perform a diagnostic evaluation using a smoke tracer or infrared imaging. The evaluation shall be conducted while the building is pressurized or depressurized along with a visual inspection of the air barrier in accordance with **ASTM E1186**. All identified leaks shall be sealed where such sealing can be made without damaging existing building components. A report specifying the corrective actions taken to seal leaks shall be deemed to establish compliance with the requirements of this section where submitted to the *code official* and the *building* owner. Where the measured *air leakage* rate is greater than 0.45 cfm/ft^2 (2.3 L/s × m^2), corrective actions must be made to the *building* and an additional test completed for which the results are 0.45 cfm/ft^2 (2.3 L/s × m^2) or less.
2. Buildings in Climate Zone 2B.
3. Buildings larger than 25,000 square feet (2323 m^2) floor area in Climate Zones 0 through 4, other than *Group I and R* occupancies, that comply with **Section C402.6.2.3**.

3. As an alternative, *buildings* or portions of *buildings* containing Group I-1 and R-2 occupancies shall be permitted to be tested by an *approved* third party in accordance with **Section C402.6.2.2**. The reported *air leakage* of the *building thermal envelope* shall not be greater than 0.27 cfm/ft^2 (1.4 L/s × m^2) of the *testing unit enclosure area* at a pressure differential of 0.2 inch water gauge (50 Pa).

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#143

Renumbers and renames the title of Section C402.5.3, re-arranges the provision, moves part of the requirements, and updates referenced sections.

The modified exception permits air leakage testing of the entire building's thermal envelope for buildings with less than 10,000 ft2 of floor area and of a portion of the building's thermal envelope for buildings with greater than 50,000 ft2 of floor area.

Related Mod:

CECPI-3-21, CE2D-9-23

~~**C402.5.3**~~ **C402.6.2.1** ~~**Building thermal envelope testing**~~**. Whole building test method and reporting.** The *building thermal envelope* shall be tested by an *approved* third party in accordance with ~~ASTM E779, ANSI/RESNET/ICC 380,~~ **ASTM E3158** ~~or ASTM E1827~~ or an equivalent *approved* method ~~*approved* by the *code official*~~ . ~~The measured *air leakage* shall not exceed 0.40 cfm/ft ^{2} (2.0 L/s × m^2) of the *building thermal envelope* area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the *building* shall be tested and the measured air leakages shall be area weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole *building* leakage~~

	~~limit. In the alternative approach, the following portions of the building shall be tested:~~ A report that includes the tested surface area, floor area, air by volume, stories above grade, and air leakage rates shall be submitted to the *code official* and the building *owner*. ~~1. The entire envelope area of all stories that have any spaces directly under a roof.~~ ~~2. The entire envelope area of all stories that have a *building* entrance, exposed floor, or loading dock, or are below grade.~~ ~~3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining *conditioned space*.~~ Exceptions: 1. ~~Where the measured *air leakage* rate exceeds 0.40 cfm/ft^2 (2.0 L/s × m^2) but does not exceed 0.60 cfm/ft^2 (3.0 L/s × m^2), a diagnostic evaluation using smoke tracer or infrared imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the *building* owner, and shall be deemed to comply with the requirements of this section~~ For *buildings* less than 10,000 square feet (929 m^2), the entire *building thermal envelope* shall be permitted to be tested in accordance with **ASTM E779**, **ASTM E3158**, **ASTM E1827** or an equivalent approved method. 2. For *buildings* greater than 50,000 square feet (4645 m^2), portions of the *building* shall be permitted to be tested and the measured *air leakage* shall be area weighted by the surface areas of the *building thermal envelope* in each portion. The weighted-average tested *air leakage* shall not be greater than the whole building air leakage limit. The following portions of the *building* shall be tested: 2.1. The entire *building thermal envelope* area of stories that have any *conditioned spaces* directly under a roof. 2.2. The entire *building thermal envelope* area of stories that have a building entrance, have a floor over unconditioned space, have a loading dock or that are below grade. 2.3. Representative above-grade portions of the building totaling not less than 25 percent of the wall area enclosing the remaining *conditioned space*. <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td>x</td><td></td><td></td><td></td></tr></table>
CE#144	Renumbers and renames Section C402.5.2 and revises the provision to clarify the testing method and requirements. No change in the stringency.
Related Mod: CECPI-3-21,	**~~C402.5.2~~ C402.6.2.2 Dwelling and sleeping unit enclosure ~~testing.~~ method and reporting.** The *building thermal envelope* shall be tested for *air leakage* in accordance with **ASTM E779**, **ANSI/RESNET/ICC 380**, **ASTM E1827** or an equivalent *approved* method ~~approved by the *code official*~~. ~~The measured *air leakage* shall not~~ exceed 0.30 cfm/ft ^{2} (1.5 ~~L/s m^2) of the *testing unit enclosure area* at a pressure differential of 0.2 inch water gauge (50 Pa).~~ Where multiple *dwelling units* or *sleeping units* or other ~~occupiable conditioned~~ spaces are contained within one *building thermal envelope*, each ~~unit~~ shall be

CE2D-9-23

considered an individual testing unit, and the *building air leakage* shall be the weighted average of all ~~testing~~tested unit results, weighted by each *testing ~~unit's~~unit enclosure area*. Units shall be tested ~~separately with an unguarded blower door test as follows:~~ without simultaneously testing adjacent units and shall be separately tested as follows:

1. Where buildings have ~~fewer~~ less than eight total ~~testing~~ dwelling or sleeping units, each testing unit shall be tested.
2. Where ~~For~~ buildings ~~with~~ have eight or more ~~testing~~ dwelling or sleeping units, the greater of seven units or 20 percent of the ~~testing~~ units in the building shall be tested, including a top floor unit, a middle floor unit, a ground floor unit and a unit with the largest *testing unit enclosure area* . For each tested unit that exceeds the maximum air leakage rate, an additional ~~two~~ three units shall be tested, including a mixture of testing unit types and locations.
3. *Enclosed spaces* with not less than one *exterior wall* in the *building thermal envelope* shall be tested in accordance with **Section C402.6.2.1**.

   Exception: Corridors, stairwells, and *enclosed spaces* having a *conditioned floor area* not greater than 1,500 square feet (139 m^2) shall be permitted to comply with **Section C402.6.2.3** and either **Section C402.6.2.3.1** or **Section C402.6.2.3.2**.

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#145 Renumbers and renames Section C402.5.1.5 and makes editorial changes to clarify the code.

Related Mod:

CECPI-3-21, CED1-92-22, CE2D-10-23

~~C402.5.1.5~~ C402.6.2.3 Building thermal envelope ~~performance~~ design and construction verification criteria. Where **Section C402.6.2.1** and **C402.6.2.2** are not applicable the~~The~~ installation of the continuous *air barrier* shall be verified by the *code official* , a *registered design professional* or *approved*agency in accordance with the following:

1. A review of the *construction documents* and other supporting data shall be conducted to assess compliance with the requirements in Section **C402.6.1**.
2. Inspection of continuous *air barrier* components and assemblies shall be conducted during construction ~~while the *air barrier* is still accessible for inspection and *repair*~~ to verify compliance with the requirements of **Sections C402.6.2.3.1** and **C402.6.2.3.2**. The air barrier shall be provided with access for inspection and repair.
3. A final ~~commissioning~~ inspection report shall be provided for inspections completed by the *registered design professional* or *approved*agency. The ~~commissioning~~ inspection report shall be provided to the building *owner* or owner's authorized agent and the *code official* . The report shall identify deficiencies found during ~~the review of the construction documents and~~ inspection and details of corrective measures taken.

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#146 Renumbers Section C402.5.1.3. Renumbers Section C402.5.1.3 and makes editorial changes.

Related Mod:

CECPI-3-21

~~C402.5.1.3~~ C402.6.2.3.1 **Materials.** Materials with an air permeability not greater than 0.004 cfm/ft^2(0.02 L/s × m ^{2}) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with **ASTM E2178** shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as *air barriers* in accordance with the manufacturer's instructions.

~~C402.5.1.4~~ C402.6.2.3.2 **Assemblies.** Assemblies of materials and components with an average *air leakage* not greater than 0.04 cfm/ft^2 (0.2 L/s × m^2) under a pressure differential of 0.3 inch of water gauge ~~(w.g.)~~(75 Pa) ~~when~~where tested in accordance with **ASTM E2357**, **ASTM E1677**, **ASTM D8052** or **ASTM E283** shall comply with this section. Assemblies listed in Items 1 through 3 below shall be deemed to comply, provided that joints are sealed and the requirements of **SectionC402.6.1.2** are met.

1. Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.
2. Masonry walls constructed of clay or shale masonry units with a nominal width ~~of~~ greater than or equal to 4 inches (102 mm)~~or more~~.
3. A Portland cement/sand parge, stucco or plaster not less than $^1/_2$ inch (12.7 mm) in thickness.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#147 Renumbers Section C402.5.4, renames the title, and makes editorial changes.

Related Mod:

CECPI-3-21,CEPI-16-21 Part I

~~C402.5.4~~ C402.6.3 **Air leakage of fenestration and opaque doors.** The *air leakage* of *fenestration* and opaque door assemblies shall comply with ~~meet the provisions of~~ **Table C402.6.3**. Testing shall be ~~in accordance with the~~ conducted by an accredited, independent testing laboratory in accordance with applicable reference test standards in **Table C402.6.3** ~~by an accredited, independent testing laboratory~~ and *labeled* by the manufacturer.

Exceptions:

1. Field-fabricated fenestration assemblies that are sealed in accordance with Section C402.6.1.
2. *Fenestration* in *buildings* that ~~comply with the testing alternative of Section C402.6~~ is tested in accordance with **Section C402.6.2** is ~~are~~ not required to meet the *air leakage* requirements in **Table C402.6.3**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#148 Renumbers table C402.5.2.

Related Mod:

CECPI-3-21

~~TABLE C402.5.4~~ TABLE C402.6.3 **MAXIMUM AIR LEAKAGE RATE FOR FENESTREATION ASSEMBLIES**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#149

Renumbers Section C402.5.6 and makes editorial changes. Renumbers Section C402.5.7 and replaces the text "envelope" with "thermal envelope." Renumbers Section C402.5.9, makes editorial changes, and revises the exception.

Related Mod:

CECPI-3-21, CECPI-3-21, CED1-92-22, CECPI-3-21

~~C402.5.6~~ C402.6.4 Doors and access openings to shafts, chutes, stairways and elevator lobbies. Doors and *access* openings from *conditioned space* to shafts, chutes, stairways and elevator lobbies not within the scope of the fenestration assemblies covered by **Section C402.6.3** shall be gasketed, weather-stripped or sealed.

Exceptions:

1. Door openings required to comply with **Section 716** of the *International Building Code*.
2. Doors and door openings required ~~to comply with~~ by the ***International Building Code*** to comply with **UL 1784** ~~by the *International Building Code*~~ .

~~C402.5.7~~ C402.6.5 Air intakes, exhaust openings, stairways and shafts. Stairway enclosures, elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building thermal envelope shall be provided with dampers in accordance with **Section C403.7.7**.

~~C402.5.9~~ C402.6.6 Vestibules. *Building entrances* shall be protected with an enclosed vestibule ~~, with all doors~~. Doors opening into and out of the vestibule equipped with self- closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the *building entrance* shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.

Exceptions: Vestibules are not required for the following:

1. Buildings in Climate Zones 0 through 2.
2. Doors not intended to be used by the public, such as doors to mechanical or electrical *equipment rooms* , or intended solely for employee use.
3. Doors opening directly from a *sleeping unit* or *dwelling unit*.
4. Doors that open directly from a space less than 3,000 square feet (298 m^2) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
7. Doors that have an air curtain unit with a velocity of not less than 6.56 feet per second (2 m/s) at 6 inches (152 mm) above ~~at~~ the floor that ~~have~~ has been tested in accordance with **ANSI/AMCA 220** or **ISO 27327-1** and installed in accordance with the manufacturer's instructions. *Manual* or *automatic* controls shall be provided that will operate the *air curtain unit* with the opening and closing of the door and comply with **Section C403.4.1.5**. *Air ~~curtains~~ curtain units* and their controls shall comply with **Section C408.2.3**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#150

Renumbers Section C402.5.8 and replaces the text "infiltration" with "air leakage."

Related Mod:

CECPI-3-21,CEPI-32-21

~~C402.5.8~~ C402.6.7 **Loading dock weather seals.** Cargo door openings and loading door openings shall be equipped with weather seals that restrict ~~infiltration~~ *air leakage* and provide direct contact along the top and sides of vehicles that are parked in the doorway.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#151

Adds a new section C402.7. Adds a provision for treatment of thermal bridges in above grade walls. Exempts climate zones 0 through 3 only. This increases the stringency for climate zones 4 through 8. Adds a new subsection C402.7.1. Adds a new subsection C402.7.2. Adds a new subsection C402.7.3. Adds a new subsection C402.7.4. Adds a new subsection C402.7.5.

Related Mod:

CECPI-4-21, CED1-107-22, CED1-138-22 CED1-139-22, CED1-110-22

C402.7 Thermal bridges in above-grade walls. *Thermal bridges* in *above-grade walls* shall comply with this section or an *approved* design.

Exceptions:

1. *Buildings* and structures located in Climate Zones 0 through 3.
2. Any *thermal bridge* with a material thermal conductivity not greater than 3.0 Btu/h × ft × °F (5.19 W/m × K).
3. Blocking, coping, flashing and other similar materials for attachment of roof coverings.
4. *Thermal bridges* accounted for in the *U-factor* or *C-factor* for a *building thermal envelope*.

C402.7.1 Balconies and floor decks. Balconies and concrete floor decks shall not penetrate the *building thermal envelope*. Such assemblies shall be separately supported or shall be supported by structural attachments or elements that minimize thermal bridging through the *building thermal envelope*.

Exceptions: Balconies and concrete floor decks shall be permitted to penetrate the *building thermal envelope* where one of the following applies:

1. An area-weighted *U-factor* is used for *above-grade wall* compliance that includes a *U-factor* of 0.8 Btu/h × °F × ft^2 (1.38 W/m × K) for the area of the *above-grade wall* penetrated by the concrete floor deck in accordance with **Section C402.1.2.1.5**.
2. An *approved* thermal break device with not less than R-10 insulation material is installed in accordance with the manufacturer's instructions.
3. An *approved* design where the *above-grade wall U-factor* used for compliance accounts for all balcony and concrete floor deck *thermal bridges*.

C402.7.2 Cladding supports. Linear elements supporting opaque cladding shall be offset from the structure with attachments that allow the *continuous insulation* , where present, to pass behind the cladding support element except at the point of attachment.

Exceptions:

1. An *approved* design where the *above-grade wall U-factor* used for compliance accounts for the cladding support element *thermal bridge* .
2. Anchoring for *curtain wall* and window wall systems where *curtain wall* and window wall systems comply with **Section C402.7.4**.

C402.7.3 Structural beams and columns. Structural steel and concrete beams and columns that project through the *building thermal envelope* shall be covered with not less than R-5 insulation for not less than 2 feet (610 mm) beyond the interior or exterior surface of an insulation component within the *building thermal envelope* .

Exceptions:

1. Where an *approved* thermal break device is installed in accordance with the manufacturer's instructions.
2. An *approved* design where the *above-grade wall U-factor* used to demonstrate compliance accounts for the beam or column *thermal bridge* .

C402.7.4 Vertical fenestration. Vertical *fenestration* intersections with *above-grade walls* shall comply with one or more of the following:

1. Where *above-grade walls* include *continuous insulation* , the plane of the exterior glazing layer or, for metal frame *fenestration* , a nonmetal thermal break in the frame shall be positioned within 2 inches (610 mm) of the interior or exterior surface of the *continuous insulation*.
2. Where *above-grade walls* do not include *continuous insulation* , the plane of the exterior glazing layer or, for metal frame *fenestration* , a nonmetal thermal break in the frame shall be positioned within the thickness of the integral or *cavity insulation* .
3. The surface of the rough opening, not covered by the fenestration frame, shall be insulated with insulation of not less than R-3 material or covered with a wood buck that is not less than 1.5 inches (38 mm) thick.
4. For the intersection between vertical *fenestration* and opaque spandrel in a shared framing system, manufacturer's data for the spandrel *U-factor* shall account for *thermal bridges*.

Exceptions:

1. Where an *approved* design for the *above-grade wall U-factor* used for compliance accounts for *thermal bridges* at the intersection with the vertical *fenestration* .
2. Doors.

C402.7.5 Parapets. Parapets shall comply with one or more of the following as applicable:

1. Where *continuous insulation* is installed on the exterior side of the *above-grade wall* and the roof is insulated with insulation entirely above deck, the *continuous insulation* shall extend up both sides of the parapet not less than 2 feet (610

mm) above the roof covering or to the top of the parapet, whichever is less. Parapets that are an integral part of a fire-resistance rated wall, and the exterior *continuous insulation* applied to the parapet, shall comply with the fire-resistance ratings of the building code.

2. Where *continuous insulation* is installed on the exterior side of the *above-grade wall* and the roof insulation is below the roof deck, the *continuous insulation* shall extend up the exterior side of the parapet to not less than the height of the top surface of the *roof assembly*.
3. Where *continuous insulation* is not installed on the exterior side of the *above-grade wall* and the roof is insulated with insulation entirely above deck, the wall cavity or integral insulation shall extend into the parapet up to the exterior face of the roof insulation or equivalent *R-value* insulation shall be installed not less than 2 feet (610 mm) horizontally inward on the underside of the roof deck.
4. Where *continuous insulation* is not installed on the exterior side of the *above-grade wall* and the roof insulation is below the roof deck, the wall and roof insulation components shall be adjacent to each other at the roof-ceiling-wall intersection.
5. Where a thermal break device with not less than R-10 insulation material aligned with the *above-grade wall* and roof insulation is installed in accordance with the manufacturer's instructions.

Exception: An *approved* design where the *above-grade wall U*-factor used for compliance accounts for the parapet *thermal bridge* .

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#152 Revises the section to clarify the compliance requirements of mechanical systems and data center systems.

Related Mod:

CEPI-76-21, CED1-198-22

SECTION C403 BUILDING MECHANICAL SYSTEMS

C403.1 General. Mechanical systems and equipment serving the building heating, cooling, ventilating or refrigerating needs shall comply with one of the following: ~~this section.~~

1. **Section C403.1.1** and **Sections C403.2** through **C403.17.**
2. *Data Centers* shall comply with **Section C403.1.1**, **Section C403.1.2** and **Sections C403.6** through **C403.17.**

4. Section C409

~~**Exception:** *Data center systems* are exempt from the requirements of Sections C403.4 and C403.5.~~

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#153 Revises the provision that data centers must comply with Sections 6 and 8 of ASHRAE 90.4.

Related Mod:

CEPI-75-21

C403.1.2 Data centers. *Data center systems* shall comply with Sections 6 and 8 of **ASHRAE 90.4.** ~~with the following changes:~~

~~1. Replace design mechanical load component (MLC) values specified in Table 6.2.1.1 of the ASHRAE 90.4 with the values in Table C403.1.2(1) as applicable in each *climate zone*.~~

~~2. Replace annualized MLC values specified in Table 6.2.1.2 of the ASHRAE 90.4 with the values in Table C403.1.2(2) as applicable in each *climate zone*.~~

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

Original text of mod is not consistent with that of the 2023 FBC -EC.

CE#154

Deletes Table C403.1.2(1). Now the section directly references ASHRAE 90.4. Deletes Table C403.1.2(2). Now the section directly references ASHRAE 90.4.

Related Mod:

CEPI-75-21

~~TABLE C403.1.2(1)~~

~~CLIMATE ZONE~~	~~DESIGN MLC AT 100% AND AT 50% ITE LOAD~~
~~0A~~	~~0.24~~
~~OB~~	~~0.26~~
~~1A~~	~~0.23~~
~~2A~~	~~0.24~~
~~3A~~	~~0.23~~
~~4A~~	~~0.23~~
~~5A~~	~~0.22~~
~~6A~~	~~0.22~~
~~1B~~	~~0.28~~
~~2B~~	~~0.27~~
~~3B~~	~~0.26~~
~~4B~~	~~0.23~~
~~5B~~	~~0.23~~
~~6B~~	~~0.21~~
~~3C~~	~~0.19~~

~~4C~~	~~0.21~~
~~5C~~	~~0.19~~
~~7~~	~~0.20~~
~~8~~	~~0.19~~

~~TABLE C403.1.2(2)~~

~~MAXIMUM ANNUALIZED MECHANICAL LOAD COMPONENT (ANNUALIZED MLC)~~

~~CLIMATE ZONE~~	~~HVAC MAXIMUM ANNUALIZED MLC AT 100% AND AT 50% ITE LOAD~~
~~0A~~	~~0.19~~
~~0B~~	~~0.20~~
~~1A~~	~~0.18~~
~~2A~~	~~0.19~~
~~3A~~	~~0.18~~
~~4A~~	~~0.17~~
~~5A~~	~~0.17~~
~~6A~~	~~0.17~~
~~1B~~	~~0.16~~
~~2B~~	~~0.18~~
~~3B~~	~~0.18~~
~~4B~~	~~0.18~~
~~5B~~	~~0.16~~
~~6B~~	~~0.17~~
~~3C~~	~~0.16~~
~~4C~~	~~0.16~~

~~5C~~	~~0.16~~
~~7~~	~~0.16~~
~~8~~	~~0.16~~

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#155 Editorial changes for clarification.

Related Mod:

CEPI-86-21

C403.2.3 Fault detection and diagnostics. ~~New buildings~~ Buildings with ~~an HVAC system serving~~ a gross *conditioned floor area* of not less than 100,000 square feet (9290 m^2) served by one or more HVAC systems that are controlled by a *direct digital control* (DDC) system ~~or larger~~ shall include a fault detection and diagnostics (FDD) system to monitor the HVAC system's performance and automatically identify faults. The *FDD system* shall:

1. Include permanently installed sensors and devices to monitor ~~the~~ HVAC system~~'s~~ performance.
2. Sample ~~the~~ HVAC system~~'s~~ performance at least once every 15 minutes.
3. Automatically identify and report HVAC system faults.
4. Automatically notify authorized personnel of identified HVAC system faults.
5. Automatically provide prioritized recommendations for *repair* of identified faults based on analysis of data collected from the sampling of HVAC system performance.
6. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

Exception: R-1 and R-2 occupancies.

Original text of mod is not consistent with that of the 2023 FBC -EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#156 Editorial changes for clarification and removes minimum efficiency values of before 1/1/2023.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap

Action	AS	AS/IC	D	D/IC
			x	

CE#157 Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1. Removes minimum efficiency values of before 1/1/2023.

Related Mod: CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22	~~TABLE C403.3.2(1)~~ **~~ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING~~ UNITS—MINIMUM EFFICIENCY REQUIREMENTS** [c, d]

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~HEADING SECTION TYPE~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~ [a]
~~Air conditioners, air cooled~~	~~< 65,000~~ Btu/h [b]	~~All~~	~~Split system, three phase and applications outside~~ US single phase [b]	~~13.0 SEER before 1/1/ 2023~~ ~~13.4 SEER2 after 1/1/ 2023~~	**~~AHRI 210/ 240—2017~~** ~~before 1/1/ 2023~~ **~~AHRI 210/ 240—2023~~** ~~after 1/1/2023~~
			~~Single-package, three phase and applications~~ outside US single phase [b]	~~14.0 SEER before 1/1/ 2023~~ ~~13.4 SEER2 after 1/1/ 2023~~	
~~Space constrained, air cooled~~	~~≤ 30,000~~ Btu/h [b]	~~All~~	~~Split system, three phase and applications outside~~ US single phase [b]	~~12.0 SEER before 1/1/ 2023~~ ~~11.7 SEER2 after 1/1/ 2023~~	**~~AHRI 210/ 240—2017~~** ~~before 1/1/ 2023~~ **~~AHRI 210/ 240—2023~~** ~~after 1/1/2023~~
			~~Single package, three phase and applications~~ outside US single phase [b]	~~12.0 SEER before 1/1/ 2023~~ ~~11.7 SEER2 after 1/1/ 2023~~	
Small duct, ~~high velocity, air cooled~~	~~< 65,000~~ Btu/h [b]	~~All~~	~~Split system, three phase~~ and applications outside ~~US single phase~~ [b]	~~12.0 SEER before 1/1/ 2023~~ ~~12.1 SEER2 after 1/1/ 2023~~	**~~AHRI 210/ 240—2017~~** ~~before 1/1/ 2023~~ **~~AHRI 210/ 240—2023~~** ~~after 1/1/2023~~

		~~Air conditioners, air cooled~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric resistance (or none)~~	~~Split systemand single package~~	~~11.2 EER~~ ~~12.9 IEER before 1/1/2023~~ ~~14.8 IEER after 1/1/2023~~	**~~AHRI 340/360~~**
				~~All other~~		~~11.0 EER~~ ~~12.7 IEER before 1/1/2023~~ ~~14.6 IEER after 1/1/2023~~	
			~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~Electric resistance (or none)~~		~~11.0 EER~~ ~~12.4 IEER before 1/1/2023~~ ~~14.2 IEER after 1/1/2023~~	
				~~All other~~		~~10.8 EER~~ ~~12.2 IEER before 1/1/2023~~ ~~14.0 IEER after 1/1/2023~~	
			~~≥ 240,000 Btu/h and < 760,000 Btu/h~~	~~Electric resistance (or none)~~		~~10.0 EER~~ ~~11.6 IEER before 1/1/2023~~ ~~13.2 IEER after 1/1/2023~~	
						~~9.8 EER~~ ~~11.4 IEER~~	

				~~All other~~	~~Split system and single package~~	~~before 1/1/2023 13.0 IEER after 1/1/2023~~	~~**AHRI 340/360**~~
			~~≥ 760,000 Btu/h~~	~~Electric resistance (or none)~~		~~9.7 EER 11.2 IEERbefore 1/1/2023 12.5 IEERafter 1/1/2023~~	
				~~All other~~		~~9.5 EER 11.0 IEER before 1/1/2023 12.3 IEER after 1/1/2023~~	
		~~Air conditioners, water cooled~~	~~< 65,000 Btu/h~~	~~All~~	~~Split systemand single package~~	~~12.1 EER 12.3 IEER~~	~~**AHRI 210/240**~~
			~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric resistance (or none)~~		~~12.1 EER 13.9 IEER~~	~~**AHRI 340/360**~~
				~~All other~~		~~11.9 EER 13.7 IEER~~	
			~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~Electric resistance (or none)~~		~~12.5 EER 13.9 IEER~~	
				~~All other~~		~~12.3 EER 13.7 IEER~~	
			~~≥ 240,000 Btu/h and < 760,000 Btu/h~~	~~Electric resistance (or none)~~		~~12.4 EER 13.6 IEER~~	
				~~All other~~		~~12.2 EER 13.4 IEER~~	

			~~≥ 760,000 Btu/h~~	~~Electric resistance (or none)~~		~~12.2 EER~~ ~~13.5 IEER~~	
				~~All other~~		~~12.0 EER~~ ~~13.3 IEER~~	
		~~Air conditioners, evaporatively cooled~~	~~< 65,000~~ Btu/h [b]	~~All~~	~~Split systemand single package~~	~~12.1 EER~~ ~~12.3 IEER~~	~~**AHRI 210/240**~~
			~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric resistance (or none)~~		~~12.1 EER~~ ~~12.3 IEER~~	~~**AHRI 340/360**~~
				~~All other~~		~~11.9 EER~~ ~~12.1 IEER~~	
			≥ 135,000 ~~Btu/h and < 240,000 Btu/h~~	~~Electric resistance (or none)~~		~~12.0 EER~~ ~~12.2 IEER~~	
				~~All other~~		~~11.8 EER~~ ~~12.0 IEER~~	
			~~≥ 240,000 Btu/h and < 760,000 Btu/h~~	~~Electric resistance (or none)~~		~~11.9 EER~~ ~~12.1 IEER~~	
				~~All other~~		~~11.7 EER~~ ~~11.9 IEER~~	
			~~≥ 760,000 Btu/h~~	~~Electric resistance (or none)~~		~~11.7 EER~~ ~~11.9 IEER~~	
				~~All other~~		~~11.5 EER~~ ~~11.7 IEER~~	
		~~Condensing units, air cooled~~	~~≥ 135,000 Btu/h~~	—	—	~~10.5 EER~~ ~~11.8 IEER~~	~~**AHRI 365**~~
		~~Condensing units, water cooled~~	~~≥ 135,000 Btu/h~~	—	—	~~13.5 EER~~ ~~14.0 IEER~~	~~**AHRI 365**~~

~~Condensing units, evaporatively cooled~~	~~≥ 135,000 Btu/h~~	—	—	~~13.5 EER 14.0 IEER~~	~~**AHRI 365**~~

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

a. ~~**Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

b. ~~Single-phase, US air-cooled air conditioners less than 65,000 Btu/h are regulated as consumer products by the US Department of Energy Code of Federal Regulations **DOE 10 CFR 430**. SEER and SEER2 values for single-phase products are set by the US Department of Energy.~~

c. ~~**DOE 10 CFR 430** Subpart B Appendix M1 includes the test procedure updates effective 1/ 1/2023 that will be incorporated in **AHRI 210/240—2023**.~~

d. ~~This table is a replica of **ASHRAE 90.1** Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements.~~

TABLE C403.3.2(1)

ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS—MINIMUM EFFICIENCY REQUIREMENTS[c]

EQUIPMENT TYPE	SIZE CATEGORY	HEADING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Air conditioners, air cooled	< 65,000 Btu/h[b]	All	Split system, three phase and applications outside US single phase[b]	13.4 SEER2	**AHRI 210/ 240—2023**
			Single-package, three phase and applications outside US single phase[b]	13.4 SEER2	
Space constrained, air cooled	≤ 30,000 Btu/h[b]	All	Split system, three phase and applications outside US single phase[b]	11.7 SEER2	**AHRI 210/ 240—2023**
			Single package, three phase and applications outside US single phase[b]	11.7 SEER2	

Small duct, high velocity, air cooled	< 65,000 Btu/h[b]	All	Split system, three phase and applications outside US single phase[b]	12. 0 SEER2	**AHRI 210/ 240—2023**
Air conditioners, air cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	Split system and single package	14.8 IEER	**AHRI 340/360**
		All other		14.6 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)		14.2 IEER	
		All other		14.0 IEER	
	≥ 240,000 Btu/h and < 760,000 Btu/h	Electric resistance (or none)	Split system and single package	13.2 IEER	**AHRI 340/360**
		All other		13.0 IEER	
	≥ 760,000 Btu/h	Electric resistance (or none)		12.5 IEER	
		All other		12.3 IEER	
Air conditioners, water cooled	< 65,000 Btu/h	All	Split system and single package	12.1 EER 12.3 IEER	**AHRI 210/240**
	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)		12.1 EER 13.9 IEER	**AHRI 340/360**
		All other		11.9 EER 13.7 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)		12.5 EER 13.9 IEER	
		All other		12.3 EER 13.7 IEER	
	≥ 240,000 Btu/h and <	Electric resistance (or none)		12.4 EER 13.6 IEER	

			760,000 Btu/h	All other		12.2 EER 13.4 IEER	
			≥ 760,000 Btu/h	Electric resistance (or none)		12.2 EER 13.5 IEER	
				All other		12.0 EER 13.3 IEER	
		Air conditioners, evaporatively cooled	< 65,000 Btu/h[b]	All	Split systemand single package	12.1 EER 12.3 IEER	**AHRI 210/240**
			≥ 65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)		12.1 EER 12.3 IEER	**AHRI 340/360**
				All other		11.9 EER 12.1 IEER	
			≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)		12.0 EER 12.2 IEER	
				All other		11.8 EER 12.0 IEER	
			≥ 240,000 Btu/h and < 760,000 Btu/h	Electric resistance (or none)		11.9 EER 12.1 IEER	
				All other		11.7 EER 11.9 IEER	
			≥ 760,000 Btu/h	Electric resistance (or none)		11.7 EER 11.9 IEER	
				All other		11.5 EER 11.7 IEER	
		Condensing units, air cooled	≥ 135,000 Btu/h	—	—	10.5 EER 11.8 IEER	**AHRI 365**
		Condensing units, water cooled	≥ 135,000 Btu/h	—	—	13.5 EER 14.0 IEER	**AHRI 365**

Condensing units, evaporatively cooled	≥ 135,000 Btu/h	—	—	13.5 EER 14.0 IEER	**AHRI 365**

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

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

b. Single-phase, US air-cooled air conditioners less than 65,000 Btu/h are regulated as consumer products by the US Department of Energy Code of Federal Regulations **DOE 10 CFR 430**. SEER and SEER2 values for single-phase products are set by the US Department of Energy.

c. **DOE 10 CFR 430** Subpart B Appendix M1 includes the test procedure updates effective January 1, 2023, documented in **AHRI 210/240—2023**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#158 Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1. Removes minimum efficiency values of before 1/1/2023.

Related Mod:

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22

~~TABLE C403.3.2(2) ELECTRICALLY OPERATED AIR COOOLED UNITARY HEAT PUMPS – MINIMUM EFFECIENCY REQUIREMENTS[c,d]~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~HEADING SECTION TYPE~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~ [a]
~~Air cooled (cooling mode)~~	~~< 66,000 Btu/h~~	~~All~~	~~Split system, three phase and applications outside~~ US single phase [b]	~~14.0 SEER before 1/1/2023 14.3 SEER2 after 1/1/ 2023~~	~~**AHRI 210/ 240—2017** before 1/1/ 2023 **AHRI 210/ 240—2023** after 1/1/2023~~
			~~Single package, three phase and applications outside~~ US single phase [b]	~~14.0 SEER before 1/1/2023 13.4 SEER2 after 1/1/ 2023~~	
~~Space constrained, air~~	~~≤ 30,000~~		~~Split system, three phase and applications outside~~ US single phase [b]	~~12.0 SEER before 1/1/2023 11.7 SEER2 after 1/1/ 2023~~	~~**AHRI 210/ 240—2017** before 1/1/~~

		~~cooled (cooling mode)~~	~~Btu/h~~	~~All~~	~~Single package, three phase and applications outside~~ US single phase [b]	~~12.0 SEER before 1/1/2023 11.7 SEER2 after 1/1/2023~~	2023 ~~**AHRI 210/ 240—2023**~~ ~~after 1/1/2023~~
		~~Single duct, high velocity, air cooled (cooling mode)~~	~~< 65,000~~	~~All~~	~~Split system, three phase and applications outside~~ US single phase [b]	~~12.0 SEER before 1/1/2023 12.0 SEER2 after 1/1/2023~~	~~**AHRI 210/ 240—2017**~~ ~~before 1/1/~~ 2023 ~~**AHRI 210/ 240—2023**~~ ~~after 1/1/2023~~
		~~Air cooled (cooling mode)~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric resistance (or none)~~	~~Split system and single package~~	~~11.0 EER 12.2 IEER before 1/1/2023 14.1 IEER after 1/1/2023~~	~~**AHRI 340/360**~~
				~~All other~~		~~10.8 EER 12.0 IEER before 1/1/2023 13.9 IEER after 1/1/2023~~	
			~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~Electric resistance (or none)~~		~~10.6 EER 11.6 IEER before 1/1/2023 13.5 IEER after 1/1/2023~~	
				~~All other~~		~~10.4 EER 11.4 IEER before 1/1/2023 13.3 IEER after 1/1/2023~~	
			~~≥ 240,000 Btu/h~~	~~Electric resistance (or none)~~		~~9.5 EER 10.6 IEER before 1/1/2023 12.5 IEER after 1/1/2023~~	
				~~All other~~		~~9.3 EER 10.4 IEER before 1/1/2023 12.3 IEER after 1/1/2023~~	

		~~Air cooled (heating mode)~~	~~< 65,000 Btu/h~~	~~All~~	~~Split system, three phase and applications outside~~ US single phase [b]	~~8.2 HSPF before 1/1/2023 7.5 HSPF2 after 1/1/2023~~	**~~AHRI 210/ 240—2017~~** ~~before 1/1/2023~~ **~~AHRI 210/ 240—2023~~** ~~after 1/1/2023~~	
					~~Single package, three phase and applications outside~~ US single phase [b]	~~8.0 HSPF before 1/1/2023 6.7 HSPF2 after 1/1/2023~~		
		~~Space constrained, air cooled (heating mode)~~	~~≤ 30,000 Btu/h~~	~~All~~	~~Split system, three phase and applications outside~~ US single phase [b]	~~7.4 HSPF before 1/1/2023 6.3 HSPF2 after 1/1/2023~~	**~~AHRI 210/ 240—2017~~** ~~before 1/1/2023~~ **~~AHRI 210/ 240—2023~~** ~~after 1/1/2023~~	
					~~Single package, three phase and applications outside~~ US single phase [b]	~~7.4 HSPF before 1/1/2023 6.3 HSPF2 after 1/1/2023~~		
		~~Small duct, high velocity, air cooled (heating mode)~~	~~< 65,000 Btu/h~~	~~All~~	~~Split system, three phase and applications outside~~ US single phase [b]	~~7.2 HSPF before 1/1/2023 6.1 HSPF2 after 1/1/2023~~	**~~AHRI 210/ 240—2017~~** ~~before 1/1/2023~~ **~~AHRI 210/ 240—2023~~** ~~after 1/1/2023~~	
		~~Air cooled (heating mode)~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)~~	~~All~~	~~47°F db/43°F wb outdoor air~~	~~3.30 COP~~ $_H$ ~~before 1/1/2023 3.40 COP~~ $_H$ ~~after 1/1/2023~~	**~~AHRI 340/360~~**	
					~~17°F db/15°F wb outdoor air~~	~~2.25 COP~~ $_H$		
			~~≥ 135,000 Btu/h and < 240,000 Btu/h (cooling capacity)~~		~~47°F db/43°F wb outdoor air~~	~~3.20 COP~~ $_H$ ~~before 1/1/2023 3.30 SOP~~ $_H$ ~~after 1/1/2023~~		
					~~17°F db/15°F wb outdoor air~~	~~2.05 COP~~ $_H$		

	~~≥ 240,000 Btu/h (cooling capacity)~~		~~47°F db/43°F wb outdoor air~~	~~3.20 COP_H~~	
			~~17°F db/15°F wb outdoor air~~	~~2.05 COP_H~~	

~~For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) – 32]/1.8, wb = wet bulb, db = dry bulb.~~

a. ~~**Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~
b. ~~Single-phase, US air-cooled heat pumps less than 65,000 Btu/h are regulated as consumer products by the US Department of Energy Code of Federal Regulations **DOE 10 CFR 430**. SEER, SEER2 and HSPF values for single-phase products are set by the US Department of Energy.~~
c. ~~**DOE 10 CFR 430** Subpart B Appendix M1 includes the test procedure updates effective 1/ 1/2023 that will be incorporated in **AHRI 210/240—2023**.~~
d. ~~This table is a replica of **ASHRAE 90.1** Table 6.8.1-2 Electrically Operated Air-Cooled Unitary Heat Pumps—Minimum Efficiency Requirements.~~

TABLE C403.3.2(2)

ELECTRICALLY OPERATED AIR-COOLED UNITARY HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS[c]

EQUIPMENT TYPE	SIZE CATEGORY	HEADING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Air cooled (cooling mode)	< 65,000 Btu/h	All	Split system, three phase and applications outside US single phase[b]	14.3 SEER2	**AHRI 210/ 240—2023**
			Single package, three phase and applications outside US single phase[b]	13.4 SEER2	
Space constrained, air			Split system, three phase and applications outside US single phase[b]	11.7 SEER2	**AHRI 210/**

		cooled (cooling mode)	≤ 30,000 Btu/h	All	Single package, three phase and applications outside US single phase[b]	11.7 SEER2	**240—2023**
		Small duct, high velocity, air cooled (cooling mode)	< 65,000 Btu/h	All	Split system, three phase and applications outside US single phase[b]	12.0 SEER2	**AHRI 210/ 240—2023**
		Air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	Split system and single package	14.1 IEER	**AHRI 340/360**
				All other		13.9 IEER	
			≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)		13.5 IEER	
				All other		13.3 IEER	
			≥ 240,000 Btu/h	Electric resistance (or none)		12.5 IEER	
				All other		12.3 IEER	
		Air cooled (heating mode)	< 65,000 Btu/h (cooling capacity)	—	Split system, three phase and applications outside US single phase[b]	7.5 HSPF2	**AHRI 210/ 240—2023**
					Single package, three phase and applications outside US single phase[b]	6.7 HSPF2	
		Space constrained, air cooled (heating mode)	≤ 30,000 Btu/h (cooling capacity)	—	Split system, three phase and applications outside US single phase[b]	6.3 HSPF2	**AHRI 210/ 240—2023**
					Single package, three phase and applications outside US single phase[b]	6.3 HSPF2	

Small duct high velocity, air cooled (heating mode)	< 65,000 Btu/h	—	Split system, three phase and applications outside US single phase[b]	6.1 HSPF2	**AHRI 210/ 240—2023**
Air cooled (heating mode)	≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)	—	47°F db/43°F wb outdoor air	3.40 COP_H	**AHRI 340/360**
			17°F db/15°F wb outdoor air	2.25 COP_H	
	≥ 135,000 Btu/h and < 240,000 Btu/h (cooling capacity)		47°F db/43°F wb outdoor air	3.30 SOP_H	
			17°F db/15°F wb outdoor air	2.05 COP_H	
	≥ 240,000 Btu/h (cooling capacity)		47°F db/43°F wb outdoor air	3.20 COP_H	
			17°F db/15°F wb outdoor air	2.05 COP_H	

For SI: 1 British thermal unit per hour = 0.2931 W, °C = (°F – 32)/1.8, wb = wet bulb, db = dry bulb.

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.
b. Single-phase, US air-cooled heat pumps less than 65,000 Btu/h are regulated as consumer products by the US Department of Energy Code of Federal Regulations **DOE 10 CFR 430**. SEER, SEER2 and HSPF values for single-phase products are set by the US Department of Energy.
c. **DOE 10 CFR 430** Subpart B Appendix M1 includes the test procedure updates effective January 1, 2023, documented in **AHRI 210/240—2023**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#159 Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1. Removes minimum efficiency values of before 1/1/2023.

Related Mods:

~~TABLE C403.3.2(3)~~

~~**WATER-CHILLING PACKAGES—MINIMUM EFFICIENCY REQUIREMENTS [a, b, e, f]**~~

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	UNITS	PATH A	PATH B	~~TEST PROCEDURE~~ ~~c~~
~~Air cooled chillers~~	~~< 150 tons~~	~~EER (Btu/Wh)~~	~~≥ 10.100 FL~~	~~≥ 9.700 FL~~	**~~AHRI 550/590~~**
			~~≥ 13.700 IPLV.IP~~	~~≥ 15.800 IPLV.IP~~	
	~~≥ 150 tons~~		~~≥ 10.100 FL~~	~~≥ 9.700FL~~	
			~~≥ 14.000 IPLV.IP~~	~~≥ 16.100 IPLV.IP~~	
~~Air cooled without condenser, electrically operated~~	~~All capacities~~	~~EER (Btu/Wh)~~	~~Air-cooled chillers without condenser must be rated with matching condensers and comply with air-cooled chiller efficiency requirements~~		**~~AHRI 550/590~~**
~~Water cooled, electrically operated positive displacement~~	~~< 75 tons~~	~~kW/ton~~	~~≤ 0.750 FL~~	~~≤ 0.780 FL~~	**~~AHRI 550/590~~**
			~~≤ 0.600 IPLV.IP~~	~~≤ 0.500 IPLV.IP~~	
	~~≥ 75 tons and < 150 tons~~		~~≤ 0.720 FL~~	~~≤ 0.750 FL~~	
			~~≤ 0.560 IPLV.IP~~	~~≤ 0.490 IPLV.IP~~	
	~~≥ 150 tons and < 300 tons~~		~~≤ 0.660 FL~~	~~≤ 0.680 FL~~	
			~~≤ 0.540 IPLV.IP~~	~~≤ 0.440 IPLV.IP~~	
	~~≥ 300 tons and < 600 tons~~		~~≤ 0.610 FL~~	~~≤ 0.625 FL~~	
			~~≤ 0.520 IPLV.IP~~	~~≤ 0.410 IPLV.IP~~	
	~~≥ 600 tons~~		~~≤ 0.560 FL~~	~~≤ 0.585 FL~~	
			~~≤ 0.500 IPLV.IP~~	~~≤ 0.380 IPLV.IP~~	
~~Water cooled, electrically operated centrifugal~~	~~< 150 tons~~	~~kW/ton~~	~~≤ 0.610 FL~~	~~≤ 0.695 FL~~	**~~AHRI 550/590~~**
			~~≤ 0.550 IPLV.IP~~	~~≤ 0.440 IPLV.IP~~	
			~~≤ 0.610 FL~~	~~≤ 0.635 FL~~	
			~~≤ 0.550 IPLV.IP~~	~~≤ 0.400 IPLV.IP~~	
	~~≥ 300 tons and < 400 tons~~		~~≤ 0.560 FL~~	~~≤ 0.595 FL~~	
			~~≤ 0.520 IPLV.IP~~	~~≤ 0.390 IPLV.IP~~	
	~~≥ 400 tons~~		~~≤ 0.560 FL~~	~~≤ 0.585 FL~~	

	~~and < 600 tons~~		~~≤ 0.500 IPLV.IP~~	~~≤ 0.380 IPLV.IP~~	
	~~≥ 600 tons~~		~~≤ 0.560 FL~~	~~≤ 0.585 FL~~	
			~~≤ 0.500 IPLV.IP~~	~~≤ 0.380 IPLV.IP~~	
~~Air cooled absorption, single effect~~	~~All capacities~~	~~COP (W/W)~~	~~≥ 0.600 FL~~	~~NA~~ [d]	~~**AHRI 560**~~
~~Water cooled absorption, single effect~~	~~All capacities~~	~~COP (W/W)~~	~~≥ 0.700 FL~~	~~NA~~ [d]	~~**AHRI 560**~~
~~Absorption double effect, indirect fired~~	~~All capacities~~	~~COP (W/W)~~	~~≥ 1.000 FL~~	~~NA~~ [d]	~~**AHRI 560**~~
			~~≥ 0.150 IPLV.IP~~		
~~Absorption double effect, direct fired~~	~~All capacities~~	~~COP (W/W)~~	~~≥ 1.000 FL~~	~~NA~~ [d]	~~**AHRI 560**~~
			~~≥ 1.000 IPLV~~		

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. The requirements for centrifugal chillers shall be adjusted for nonstandard rating conditions per **Section C403.3.2.1** and are applicable only for the range of conditions listed there. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.~~

~~c. Both the full-load and IPLV.IP requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.~~

~~d. NA means the requirements are not applicable for Path B, and only Path A can be used for compliance.~~

~~e. FL is the full-load performance requirements, and IPLV.IP is for the part-load performance requirements.~~

~~f. This table is a replica of **ASHRAE 90.1** Table 6.8.1-3 Water-Chilling Packages—Minimum Efficiency Requirements.~~

TABLE C403.3.2(3)
LIQUID-CHILLING PACKAGES—MINIMUM EFFICIENCY REQUIREMENTS [a, b, e]

EQUIPMENT TYPE	SIZE CATEGORY	UNITS	PATH A	PATH B	TEST PROCEDURE [c]
	< 150 tons	EER	≥ 10.100 FL	≥ 9.700 FL	
			≥ 13.700 IPLV.IP	≥ 15.800 IPLV.IP	

		Air cooled	≥ 150 tons	(Btu/ Wh)	≥ 10.100 FL	≥ 9.700FL	**AHRI 550/590**
					≥ 14.000 IPLV.IP	≥ 16.100 IPLV.IP	
		Air cooled without condenser, electrically operated	All capacities	EER (Btu/ Wh)	Air-cooled without condenser must be rated with matching condensers and comply with air-cooled chiller efficiency requirements		**AHRI 550/590**
		Liquid-cooled, electrically operated positive displacement	< 75 tons	kW/ ton	≤ 0.750 FL	≤ 0.780 FL	**AHRI 550/590**
					≤ 0.600 IPLV.IP	≤ 0.500 IPLV.IP	
			≥ 75 tons and < 150 tons		≤ 0.720 FL	≤ 0.750 FL	
					≤ 0.560 IPLV.IP	≤ 0.490 IPLV.IP	
			≥ 150 tons and < 300 tons		≤ 0.660 FL	≤ 0.680 FL	
					≤ 0.540 IPLV.IP	≤ 0.440 IPLV.IP	
			≥ 300 tons and < 600 tons		≤ 0.610 FL	≤ 0.625 FL	
					≤ 0.520 IPLV.IP	≤ 0.410 IPLV.IP	
			≥ 600 tons		≤ 0.560 FL	≤ 0.585 FL	
					≤ 0.500 IPLV.IP	≤ 0.380 IPLV.IP	
		Liquid-cooled, electrically operated centrifugal	< 150 tons	kW/ ton	≤ 0.610 FL	≤ 0.695 FL	**AHRI 550/590**
					≤ 0.550 IPLV.IP	≤ 0.440 IPLV.IP	
			≥150 tons and <300 tons		≤ 0.610 FL	≤ 0.635 FL	
					≤ 0.550 IPLV.IP	≤ 0.400 IPLV.IP	
			≥ 300 tons and < 400 tons		≤ 0.560 FL	≤ 0.595 FL	
					≤ 0.520 IPLV.IP	≤ 0.390 IPLV.IP	
			≥ 400 tons and < 600 tons		≤ 0.560 FL	≤ 0.585 FL	
					≤ 0.500 IPLV.IP	≤ 0.380 IPLV.IP	
			≥ 600 tons		≤ 0.560 FL	≤ 0.585 FL	
					≤ 0.500 IPLV.IP	≤ 0.380 IPLV.IP	

Air cooled absorption, single effect	All capacities	COP (W/W)	≥ 0.600 FL	NA[d]	**AHRI 560**
Liquid-cooled absorption, single effect	All capacities	COP (W/W)	≥ 0.700 FL	NA[d]	**AHRI 560**
Absorption double effect, indirect fired	All capacities	COP (W/W)	≥ 1.000 FL ≥ 0.150 IPLV.IP	NA[d]	**AHRI 560**
Absorption double effect, direct fired	All capacities	COP (W/W)	≥ 1.000 FL ≥ 1.000 IPLV	NA[d]	**AHRI 560**

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

b. The requirements for centrifugal chillers shall be adjusted for nonstandard rating conditions per **Section C403.3.2.1** and are applicable only for the range of conditions listed there. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.

c. Both the full-load and IPLV.IP requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.

d. NA means the requirements are not applicable for Path B, and only Path A can be used for compliance.

e. FL is the full-load performance requirements, and IPLV.IP is for the part-load performance requirements.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#160	Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mods: CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22	

~~TABLE C403.3.2(4)~~

~~ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE- PACKAGE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS AND ROOM AIR-~~ CONDITIONER ~~HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS~~ ~~[e]~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY (INPUT)~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~ [d]	~~TEST PROCEDURE~~ [a]
~~PTAC(cooling mode) standard size~~	~~< 7,000 Btu/h~~	~~95°F db/75°Fwb~~ outdoor air [c]	~~11.9 EER~~	~~AHRI 310/380~~
	~~≥ 7,000 Btu/h and ≤ 15,000 Btu/h~~		~~14.0 – (0.300 × Cap/1,000)~~ EER [d]	
	~~> 15,000 Btu/h~~		~~9.5 EER~~	
~~PTAC(cooling mode)~~ nonstandard size [a]	~~< 7,000 Btu/h~~	~~95°F db/75°F wb~~ outdoor air [c]	~~9.4 EER~~	~~AHRI 310/380~~
	~~≥ 7,000 Btu/h and ≤ 15,000 Btu/h~~		~~10.9 – (0.213 × Cap/1,000)~~ EER [d]	
	~~> 15,000 Btu/h~~		~~7.7 EER~~	
~~PTHP (cooling mode) standard size~~	~~< 7,000 Btu/h~~	~~95°F db/75°Fwb~~ outdoor air [c]	~~11.9 EER~~	~~AHRI 310/380~~
	~~≥ 7,000 Btu/h and ≤ 15,000 Btu/h~~		~~14.0 – (0.300 × Cap/1,000)~~ EER [d]	
	~~> 15,000 Btu/h~~		~~9.5 EER~~	
	~~< 7,000 Btu/h~~		~~9.3 EER~~	

~~PTHP (coolingmode)~~ nonstandard size [b]	~~≥ 7,000 Btu/h and ≤ 15,000 Btu/h~~	~~95°F db/75°Fwb~~ outdoor air [c]	~~10.8 – (0.213 × Cap/1,000)~~ EER [d]	~~**AHRI 310/380**~~
	~~> 15,000 Btu/h~~		~~7.6 EER~~	
~~PTHP (heating mode) standard size~~	~~< 7,000 Btu/h~~	~~47°F db/43°F wb outdoor air~~	~~3.3 COP~~ $_{\underline{H}}$	~~**AHRI 310/380**~~
	~~≥ 7,000 Btu/h and ≤ 15,000 Btu/h~~		~~3.7 – (0.052 × Cap/1,000)~~ COP $_{\underline{H}}$ [d]	
	~~> 15,000 Btu/h~~		~~2.90 COP~~ $_{\underline{H}}$	
~~PTHP (heating mode)~~ nonstandard size [b]	~~< 7,000 Btu/h~~	~~47°F db/43°F wb outdoor air~~	~~2.7 COP~~ $_{\underline{H}}$	~~**AHRI 310/380**~~
	~~≥ 7,000 Btu/h and ≤ 15,000 Btu/h~~		~~2.9 – (0.026 × Cap/1000)~~ COP $_{\underline{H}}$ [d]	
	~~> 15,000 Btu/h~~		~~2.5 COP~~ $_{\underline{H}}$	
SPVAC(cooling mode) ~~single and three phase~~	~~< 65,000 Btu/h~~	95°F db/75°Fwb ~~outdoor air~~ [c]	~~11.0 EER~~	~~**AHRI 390**~~
	~~≥ 65,000 Btu/h and ≤ 135,000 Btu/h~~		~~10.0 EER~~	
	~~≥ 135,000 Btu/h and ≤ 240,000 Btu/h~~		~~10.0 EER~~	
	~~< 65,000 Btu/h~~		~~11.0 EER~~	

		~~SPVHP (cooling mode)~~	~~≥ 65,000 Btu/h and ≤ 135,000 Btu/h~~	95°F db/75°Fwb ~~outdoor air~~ [c]	~~10.0 EER~~	**~~AHRI 390~~**
			~~≥ 135,000 Btu/h and ≤ 240,000 Btu/h~~		~~10.1 EER~~	
		~~SPVHP (heating mode)~~	~~< 65,000 Btu/h~~	~~47°F db/43°F wb outdoor air~~	~~3.3 COP~~ $_H$	**~~AHRI 390~~**
			~~≥ 65,000 Btu/h and ≤ 135,000 Btu/h~~		~~3.0 COP~~ $_H$	
			~~≥ 135,000 Btu/h and ≤ 240,000 Btu/h~~		~~3.0 COP~~ $_H$	
		~~Room air conditionerswithout reverse cycle with louvered sides for applications outside US~~	~~< 6,000 Btu/h~~	—	~~11.0 CEER~~	**~~ANSI/AHAM RAC-1~~**
			~~≥ 6,000 Btu/h and < 8,000 Btu/h~~	—	~~11.0 CEER~~	
			~~≥ 8,000 Btu/h and < 14,000 Btu/h~~	—	~~10.9 CEER~~	
			~~≥ 14,000 Btu/h and < 20,000 Btu/h~~	—	~~10.7 CEER~~	
			~~≥ 20,000 Btu/h and < 28,000 Btu/h~~	—	~~9.4 CEER~~	

	~~≥ 28,000 Btu/h~~	—	~~9.0 CEER~~	
~~Room air conditioners without louvered sides~~	~~< 6,000 Btu/h~~	—	~~10.0 CEER~~	**~~ANSI/AHAM RAC-1~~**
	~~≥ 6,000 Btu/h and < 8,000 Btu/h~~	—	~~10.0 CEER~~	
	~~≥ 8,000 Btu/h and < 11,000 Btu/h~~	—	~~9.6 CEER~~	
	~~≥ 11,000 Btu/h and < 14,000 Btu/h~~	—	~~9.5 CEER~~	
	~~≥ 14,000 Btu/h and < 20,000 Btu/h~~	—	~~9.3 CEER~~	
	~~≥ 20,000 Btu/h~~	—	~~9.4 CEER~~	
~~Room air conditioners with reverse cycle, with louvered sides for applications outside US~~	~~< 20,000 Btu/h~~	—	~~9.8 CEER~~	**~~ANSI/AHAM RAC-1~~**
	~~≥ 20,000 Btu/h~~	—	~~9.3 CEER~~	
~~Room air conditioners with reverse cycle without louvered sides for applications outside US~~	~~< 14,000 Btu/h~~	—	~~9.3 CEER~~	**~~ANSI/AHAM RAC-1~~**
	~~≥ 14,000 Btu/h~~	—	~~8.7 CEER~~	
~~Room air conditioners, casement only for applications outside US~~	~~All~~	—	~~9.5 CEER~~	**~~ANSI/AHAM RAC-1~~**
~~Room air conditioners, casement slider for applications outside US~~	~~All~~	—	~~10.4 CEER~~	**~~ANSI/AHAM RAC-1~~**

~~For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) – 32]/1.8, wb = wet bulb, db = dry bulb.~~

~~"Cap" = The rated cooling capacity of the project in Btu/h. Where the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. Where the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculations.~~

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~
~~b. Nonstandard size units must be factory labeled as follows: "MANUFACTURED FOR NONSTANDARD SIZE APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW STANDARD PROJECTS." Nonstandard size efficiencies apply only to units being installed in existing sleeves having an external wall opening of less than 16 inches (406 mm) high or less than 42 inches (1067 mm) wide and having a cross-sectional area less than 670 square inches (0.43 m^2).~~
~~c. The cooling-mode wet bulb temperature requirement only applies for units that reject condensate to the condenser coil.~~
~~d. "Cap" in EER and COPH equations for PTACs and PTHPs means cooling capacity in Btu/h at 95°F outdoor dry-bulb temperature.~~
~~e. This table is a replica of **ASHRAE 90.1** Table 6.8.1-4 Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air- Conditioner Heat Pumps—Minimum Efficiency Requirements.~~

TABLE C403.3.2(4)

ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE- PACKAGE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS AND ROOM AIR-CONDITIONER HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS[e]

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[d]	TEST PROCEDURE[a]
PTAC (cooling mode) standard size	< 7,000 Btu/h	95°F db/75°F wb outdoor air[c]	11.9 EER	AHRI 310/380
	≥ 7,000 Btu/h and ≤ 15,000 Btu/h		14.0 – (0.300 × Cap/1,000) EER[d]	
	> 15,000 Btu/h		9.5 EER	
PTAC (cooling mode) nonstandard size[a]	< 7,000 Btu/h	95°F db/75°F wb outdoor air[c]	9.4 EER	AHRI 310/380
	≥ 7,000 Btu/h and ≤ 15,000 Btu/h		10.9 – (0.213 × Cap/1,000) EER[d]	
	> 15,000 Btu/h		7.7 EER	

PTHP (cooling mode) standard size	< 7,000 Btu/h	95°F db/75°F wb outdoor air[c]	11.9 EER	**AHRI 310/380**
	≥ 7,000 Btu/h and ≤ 15,000 Btu/h		14.0 – (0.300 × Cap/1,000) EER[d]	
	> 15,000 Btu/h		9.5 EER	
PTHP (cooling mode) nonstandard size[b]	< 7,000 Btu/h	95°F db/75°F wb outdoor air[c]	9.3 EER	**AHRI 310/380**
	≥ 7,000 Btu/h and ≤ 15,000 Btu/h		10.8 – (0.213 × Cap/1,000) EER[d]	
	> 15,000 Btu/h		7.6 EER	
PTHP (heating mode) standard size	< 7,000 Btu/h	47°F db/43°F wb outdoor air	3.3 COP_H	**AHRI 310/380**
	≥ 7,000 Btu/h and ≤ 15,000 Btu/h		3.7 – (0.052 × Cap/1,000) COP_H[d]	
	> 15,000 Btu/h		2.90 COP_H	
PTHP (heating mode) nonstandard size[b]	< 7,000 Btu/h	47°F db/43°F wb outdoor air	2.7 COP_H	**AHRI 310/380**
	≥ 7,000 Btu/h and ≤ 15,000 Btu/h		2.9 – (0.026 × Cap/1000) COP_H[d]	
	> 15,000 Btu/h		2.5 COP_H	
SPVAC (cooling mode) single and three phase	< 65,000 Btu/h	95°F db/75°F wb outdoor air[c]	11.0 EER	**AHRI 390**
	≥ 65,000 Btu/h and ≤ 135,000 Btu/h		10.0 EER	

	≥ 135,000 Btu/h and ≤ 240,000 Btu/h		10.0 EER	
SPVHP (cooling mode)	< 65,000 Btu/h	95°F db/75°F wb outdoor air[c]	11.0 EER	**AHRI 390**
	≥ 65,000 Btu/h and ≤ 135,000 Btu/h		10.0 EER	
	≥ 135,000 Btu/h and ≤ 240,000 Btu/h		10. 0 EER	
SPVHP (heating mode)	< 65,000 Btu/h	47°F db/43°F wb outdoor air	3.3 COP_H	**AHRI 390**
	≥ 65,000 Btu/h and ≤ 135,000 Btu/h		3.0 COP_H	
	≥ 135,000 Btu/h and ≤ 240,000 Btu/h		3.0 COP_H	
Room air conditioners without reverse cycle with louvered sides for applications outside US[d]	< 6,000 Btu/h	—	11.0 CEER	**ANSI/AHAM RAC-1**
	≥ 6,000 Btu/h and < 8,000 Btu/h	—	11.0 CEER	
	≥ 8,000 Btu/h and < 14,000 Btu/h	—	10.9 CEER	

		≥ 14,000 Btu/h and < 20,000 Btu/h	—	10.7 CEER		
		≥ 20,000 Btu/h and < 28,000 Btu/h	—	9.4 CEER		
		≥ 28,000 Btu/h	—	9.0 CEER		
	Room air conditioners without louvered sides	< 6,000 Btu/h	—	10.0 CEER	**ANSI/AHAM RAC-1**	
		≥ 6,000 Btu/h and < 8,000 Btu/h	—	10.0 CEER		
		≥ 8,000 Btu/h and < 11,000 Btu/h	—	9.6 CEER		
		≥ 11,000 Btu/h and < 14,000 Btu/h	—	9.5 CEER		
			—	9.3 CEER		
		≥ 20,000 Btu/h	—	9.4 CEER		
	Room air conditioners with reverse cycle, with louvered sides for applications outside US[d]	< 20,000 Btu/h	—	9.8 CEER	**ANSI/AHAM RAC-1**	
		≥ 20,000 Btu/h	—	9.3 CEER		
	Room air conditioners with reverse cycle without louvered sides for applications outside US[d]	< 14,000 Btu/h	—	9.3 CEER	**ANSI/AHAM RAC-1**	
		≥ 14,000 Btu/h	—	8.7 CEER		
	Room air conditioners, casement only for applications outside US[d]	All	—	9.5 CEER	**ANSI/AHAM RAC-1**	
	Room air conditioners, casement slider for applications outside US[d]	All	—	10.4 CEER	**ANSI/AHAM RAC-1**	

For SI: 1 British thermal unit per hour = 0.2931 W, °C = (°F – 32)/1.8, wb = wet bulb, db = dry bulb.

"Cap" = The rated cooling capacity of the project in Btu/h. Where the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. Where the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculations.

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

b. Nonstandard size units must be factory labeled as follows: "MANUFACTURED FOR NONSTANDARD SIZE APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW STANDARD PROJECTS." Nonstandard size efficiencies apply only to units being installed in existing sleeves having an external wall opening of less than 16 inches high or less than 42 inches wide and having a cross-sectional area less than 670 square inches.

c. The cooling-mode wet bulb temperature requirement only applies for units that reject condensate to the condenser coil.

d. Room air conditioners are regulated as consumer products by **10 CFR 430**. For US applications of room air conditioners, refer to Informative Appendix F, Table F-3, for the US DOE minimum efficiency requirements for US applications.

e. "Cap" in EER and COP_H equations for PTACs and PTHPs means cooling capacity in Btu/h at 95°F outdoor dry-bulb temperature.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#161

Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1. Removes minimum efficiency values of before 1/1/2023.

Related Mods:

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22

~~TABLE C403.3.2(5)~~

~~**WARM-AIR FURNACES AND COMBINATION WARM-AIR FURNACES/AIR-CONDITIONING UNITS, WARM-AIR DUCT FURNACES AND UNIT HEATERS—MINIMUM EFFICIENCY REQUIREMENTS**~~ [g]

~~**EQUIPMENT TYPE**~~	~~**SIZE CATEGORY (INPUT)**~~	~~**SUBCATEGORY OR RATING CONDITION**~~	~~**MINIMUM EFFICIENCY**~~	~~**TEST**~~ **PROCEDURE** [a]
~~Warm-air furnace, gas fired for application outside the US~~	~~< 225,000 Btu/h~~	~~Maximum capacity~~ [c]	~~80% AFUE (nonweatherized) or 81% AFUE (weatherized) or~~ 80% E_t [b, d]	~~**DOE 10 CFR 430** Appendix N or Section 2.39, Thermal Efficiency,~~ ~~**ANSI Z21.47**~~

~~Warm-air furnace, gas fired~~	~~< 225,000 Btu/h~~	~~Maximum capacity~~ [c]	80% E_t [b, d] ~~before 1/1/2023~~ 81% E_t [d] ~~after 1/1/2023~~	~~Section 2.39, Thermal Efficiency,~~ ~~**ANSI Z21.47**~~
~~Warm-air furnace, oil fired for application outside the US~~	< 225,000 ~~Btu/h~~	~~Maximum capacity~~ [c]	~~83% AFUE (nonweatherized) or 78% AFUE (weatherized) or~~ 80% E_t [b, d]	~~**DOE 10 CFR 430** Appendix N or Section 42, Combustion,~~ ~~**UL 727**~~
~~Warm-air furnace, oil fired~~	< 225,000 ~~Btu/h~~	Maximum capacity [c]	~~80% E_t before 1/1/2023~~ 82% E_t [d] after 1/ ~~1/2023~~	~~Section 42, Combustion,~~ ~~**UL 727**~~
~~Electric furnaces for applications outside the US~~	~~< 225,000 Btu/h~~	~~All~~	~~96% AFUE~~	~~**DOE 10 CFR 430** Appendix N~~
~~Warm-air duct furnaces, gas fired~~	~~All capacities~~	~~Maximum capacity~~ [c]	80% E_c [e]	~~Section 2.10, Efficiency,~~ ~~**ANSI Z83.8**~~
~~Warm-air unit heaters, gas fired~~	~~All capacities~~	~~Maximum capacity~~ [c]	80% E_c [e, f]	~~Section 2.10, Efficiency,~~ ~~**ANSI Z83.8**~~
~~Warm-air unit heaters, oil fired~~	~~All capacities~~	~~Maximum capacity~~ [c]	80% E_c [e, f]	~~Section 40, Combustion,~~ ~~**UL 731**~~

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

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. Combination units (i.e., furnaces contained within the same cabinet as an air conditioner) not covered by **DOE 10 CFR 430** (i.e., three-phase power or with cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating. All other units greater than 225,000 Btu/h sold in the US must meet the AFUE standards for consumer products and test using USDOE's AFUE test procedure at **DOE 10 CFR 430**, Subpart B, Appendix N.~~

~~c. Compliance of multiple firing rate units shall be at the maximum firing rate.~~

~~d. E_t = thermal efficiency. Units must also include an interrupted or intermittent ignition device (IID), have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.~~

~~e. E_c = combustion efficiency (100 percent less flue losses). See test procedure for detailed discussion.~~

~~f. Units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an automatic flue damper.~~

~~g. This table is a replica of **ASHRAE 90.1** Table 6.8.1-5 Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements.~~

TABLE C403.3.2(5)
WARM-AIR FURNACES AND COMBINATION WARM-AIR FURNACES/AIR-CONDITIONING UNITS, WARM-AIR DUCT FURNACES AND UNIT HEATERS—MINIMUM EFFICIENCY REQUIREMENTS[g]

DESCRIPTION	FUEL	ELECTRIC POWER PHASE	APPLICATION LOCATION	HEATING CAPACITY (INPUT), Btu/h[b]	COMBO-UNIT COOLING CAPACITY, Btu/h	SUBTYPE	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Warm-air furnace	Gas	1	Inside US	< 225,000	< 65,000	See Informative Appendix F, Table F-4[f]		
Warm-air furnace	Gas	1	Inside US	< 225,000	≥ 65,000	Nonweatherized	80% AFUE	Appendix N[g]
						Weatherized	81% AFUE or 80% E_t[c]	Appendix N[g]
								ANSI Z21.47
Warm-air furnace	Gas	1	Outside US	< 225,000	All	Nonweatherized	80% AFUE	Appendix N[g]
						Weatherized	81% AFUE or 80% E_t[c]	Appendix N[g]
								ANSI Z21.47
Warm-air furnace	Gas	3	All	< 225,000	All	Nonweatherized	80% AFUE	Appendix N[g]
						Weatherized	81% AFUE or 80% E_t[c]	Appendix N[g]
								ANSI Z21.47
Warm-air furnace	Gas	All	All	≥ 225,000 and ≤ 400,000	All	All	81% E_t[c]	**ANSI Z21.47**
Warm-air furnace	Gas	All	Inside US	> 400,000	All	All	80%E_t[c] before 1/1/2023 81% E_t[c] after 1/1/2023	**ANSI Z21.47**
Warm-air furnace	Gas	All	Outside US	> 400,000	All	All	80%Etc before 1/1/2023 81% Etc after 1/1/2023	**ANSI Z21.47** or **ANSI Z83.8**
Warm-air furnace	Oil	1	Inside US	< 225,000	< 65,000	See Informative Appendix F, Table F-4[f]		

Warm-air furnace	Oil	1	Inside US	< 225,000	≥ 65,000	Nonweatherized	83% AFUE	Appendix N[g]
						Weatherized	78% AFUE or 80% E_t[d]	Appendix N[g] Section 42 **UL 727**
Warm-air furnace	Oil	1	Outside US	< 225,000	All	Nonweatherized	83% AFUE	Appendix N[g]
						Weatherized	78% AFUE or 80% E_t[d]	Appendix N[g] Section 42 **UL 727**
Warm-air furnace	Oil	3	All	<225,000	All	Nonweatherized	83% AFUE	Appendix N[g]
						Weatherized	78% AFUE or 80%E_t[d]	Appendix N[g] Section 42 **UL 727**
Warm-air furnace	Oil	All	All	≥ 225,000	All	All	82% E_t[d]	Section 42 **UL 727**
Warm-air furnace	Electric	1	Inside US	< 225,000	< 65,000	See Informative Appendix F, Table F-4[f]		
Warm-air furnace	Electric	1	Inside US	< 225,000	≥ 65,000	All	96% AFUE	Appendix N[g]
Warm-air furnace	Electric	1	Outside US	< 225,000	All	All	96% AFUE	Appendix N[g]
Warm-air furnace	Electric	3	All	< 225,000	All	All	96% AFUE	Appendix N[g]
Warm-air duct furnaces	Gas	All	All	All	All	All	80% E_c[d]	**ANSI Z83.8**
Warm-air unit heaters	Gas	All	All	All	All	All	80% E_c[d, e]	**ANSI Z83.8**
Warm-air unit heaters	Oil	All	All	All	All	All	80% E_c[d, e]	Section 40 **UL 731**

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

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure. For this table, the following applies:
- Appendix N = 10 CFR 430 Appendix N
- **ANSI Z21.47** = Section 2.39, Thermal Efficiency, **ANSI Z21.47**
- **ANSI Z83.3** = Section 2.10, Efficiency, **ANSI Z83.3**
- **UL 727** = Section 42, Combustion, **UL 727**
- **UL 731** = Section 40, Combustion, **UL 731**

b. Compliance of multiple firing rate units shall be at the maximum firingrate.

c. E_t = thermal efficiency. Units must also include an interrupted or intermittent ignition device (IID), have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

d. E_c = combustion efficiency (100 percent less flue losses). See test procedure for detailed discussion.

e. Units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an *automatic* flue damper.

f. Includes combination units with cooling capacity < 65,000 Btu/h. For US applications of federally covered < 225,000 Btu/h products, see Informative Appendix F, Table F-4.

g. **10 CFR 430** is limited to-single phase equipment that is not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 65,000 Btu/h but for the test and rating procedures are not impacted for three-phase and can be used for AFUE ratings for **ASHRAE/IES Standard 90.1** three-phase products and single-phase products with a cooling capacity greater than 65,000 Btu/h.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#162 Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mods:

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22

~~TABLE C403.3.2(6)~~

~~GAS- AND OIL-FIRED BOILERS—MINIMUM EFFICIENCY REQUIREMENTS~~ [i]

~~EQUIPMENT TYPE~~ [b]	~~SUBCATEGORY OR RATING CONDITION~~	~~SIZE CATEGORY (INPUT)~~	~~MINIMUM EFFICIENCY~~	~~EFFICIENCY AS OF 3/2/2022~~	~~TEST PROCEDURE~~ [a]
~~Boilers, hot water~~	~~Gas fired~~	~~< 300,000 Btu/h~~ [g, h] ~~for applications outside US~~	~~82% AFUE~~	~~82% AFUE~~	~~**DOE 10 CFR 430** Appendix N~~
		~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h~~ [e]	~~80% E_t~~ [d]	~~80% E_t~~ [d]	~~DOE 10 CFR 431.86~~
		~~> 2,500,000 Btu/h~~ [b]	~~82% E_c~~ [c]	~~82% E_c~~ [c]	
	~~Oil fired~~ [f]	~~< 300,000 Btu/h~~ [g,h] ~~for applications outside US~~	~~84% AFUE~~	~~84% AFUE~~	~~**DOE 10 CFR 430** Appendix N~~
		~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h~~ [e]	~~82% E_t~~ [d]	~~82% E_t~~ [d]	~~DOE 10 CFR 431.86~~

		~~> 2,500,000 Btu/h~~ ~~b~~	~~84% E_c~~ ~~c~~	~~84% E_c~~ ~~c~~	
~~Boilers, steam~~	~~Gas fired~~	~~< 300,000 Btu/h~~[g] ~~for applications outside US~~	~~80% AFUE~~	~~80% AFUE~~	~~**DOE 10 CFR**~~ **430** ~~Appendix N~~
	~~Gas fired—all, except natural draft~~	~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h~~ ~~e~~	~~79% E_t~~ ~~d~~	~~79% E_t~~ ~~d~~	~~DOE 10 CFR 431.86~~
		~~> 2,500,000 Btu/h~~ ~~b~~	~~79% E_t~~ ~~d~~	~~79% E_t~~ ~~d~~	
	~~Gas fired—natural draft~~	~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h~~ ~~e~~	~~77% E_t~~ ~~d~~	~~79% E_t~~ ~~d~~	
		~~> 2,500,000 Btu/h~~ ~~b~~	~~77% E_t~~ ~~d~~	~~79% E_t~~ ~~d~~	
	~~Oil fired f~~	~~< 300,000~~ Btu/h[g]for ~~applications outside US~~	~~82% AFUE~~	~~82% AFUE~~	~~**DOE 10 CFR**~~ **430** ~~Appendix N~~
		~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h~~ e	81% E_t d	81% E_t d	~~DOE 10 CFR 431.86~~
		~~> 2,500,000 Btu/h~~ b	81% E_t d	81% E_t d	

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

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

b. ~~These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.~~
c. ~~E_c = Combustion efficiency (100 percent less flue losses).~~
d. ~~E_t = Thermal efficiency.~~
e. ~~Maximum capacity—minimum and maximum ratings as provided for and allowed by the unit's controls.~~
f. ~~Includes oil-fired (residual).~~
g. ~~Boilers shall not be equipped with a constant burning pilot light.~~
h. ~~A boiler not equipped with a tankless domestic water-heating coil shall be equipped with an automatic means for adjusting the temperature of the water such that an incremental change in inferred heat load produces a corresponding incremental change in the temperature of the water supplied.~~
i. ~~This table is a replica of **ASHRAE 90.1** Table 6.8.1-6 Gas- and Oil-Fired Boilers—Minimum Efficiency Requirements.~~

TABLE C403.3.2(6)

GAS- AND OIL-FIRED BOILERS—MINIMUM EFFICIENCY REQUIREMENTS[i]

EQUIPMENT TYPE[b]	SUBCATEGORY OR RATING CONDITION	SIZE CATEGORY (INPUT)	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Boilers, hot water	Gas fired	< 300,000 Btu/h[g, h] for applications outside US	84% AFUE	**DOE 10 CFR 430** Appendix N
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	84% E_t[d]	**DOE 10 CFR 431.86**
		> 2,500,000 Btu/h[b] and ≤ 10,000,000 Btu/h[b]	82% E_c[c]	
		> 10,000,000 Btu/h[b]	82% E_c[c]	
	Oil fired[f]	< 300,000 Btu/h[g, h] for applications outside US	86% AFUE	**DOE 10 CFR 430** Appendix N
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	82% E_t[d]	**DOE 10 CFR 431.86**
		> 2,500,000 Btu/h[b] and ≤ 10,000,000 Btu/h[b]	84% E_c[c]	
		> 10,000,000 Btu/h[b]	84% E_c[c]	
	Gas fired	< 300,000 Btu/h[g] for applications outside US	82% AFUE	**DOE 10 CFR 430** Appendix N

Boilers, steam	Gas fired—all, except natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	79% E_t[d]	DOE 10 CFR 431.86
		> 2,500,000 Btu/h[b] and ≤ 10,000,000 Btu/h[b]	79% E_t[d]	
		> 10,000,000 Btu/h[b]	79% E_t[d]	
	Gas fired—natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	79% E_t[d]	
		> 2,500,000 Btu/h[b]	79% E_t[d]	
	Oil fired[f]	< 300,000 Btu/h[g] for applications outside US	82% AFUE	**DOE 10 CFR 430** Appendix N
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	84% E_t[d]	**DOE 10 CFR 431.86**
		> 2,500,000 Btu/h[b] and ≤ 10,000,000 Btu/h[b]	81% E_t[d]	
		> 10,000,000 Btu/h[b]	81% E_t[d]	

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

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

b. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.

c. E_c = Combustion efficiency (100 percent less flue losses).

d. E_t = Thermal efficiency.

e. Maximum capacity—minimum and maximum ratings as provided for and allowed by the unit's controls.

f. Includes oil-fired (residual).

g. Boilers shall not be equipped with a constant burning pilot light.

h. A boiler not equipped with a tankless domestic water-heating coil shall be equipped with an automatic means for adjusting the temperature of the water such that an incremental change in inferred heat load produces a corresponding incremental change in the temperature of the water supplied.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#163 Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mods:

~~TABLE C403.3.2(7)~~

~~**PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT—MINIMUM EFFICIENCY REQUIREMENTS**~~

~~EQUIPMENT TYPE~~	~~TOTAL SYSTEM HEAT-REJECTION CAPACITY AT RATED CONDITIONS~~	~~SUBCATEGORY OR RATING~~ CONDITION [h]	~~PERFORMANCE~~ REQUIRED [b, c, d, f, g]	~~TEST PROCEDURE~~ [a, e]
~~Propeller or axial fan open-circuit cooling towers~~	~~All~~	~~95°F entering water 85°F leaving water 75°F entering wb~~	~~≥ 40.2 gpm/hp~~	~~**CTI ATC-105** and CTI STD-201 RS~~
~~Centrifugal fan open-circuit cooling towers~~	~~All~~	~~95°F entering water 85°F leaving water 75°F entering wb~~	~~≥ 20.0 gpm/hp~~	~~**CTI ATC-105** and CTI STD-201 RS~~
~~Propeller or axial fan closed-circuit cooling towers~~	~~All~~	~~102°F entering water 90°F leaving water 75°F entering wb~~	~~≥ 16.1 gpm/hp~~	~~**CTI ATC-105S** and CTI STD-201 RS~~
~~Centrifugal fan closed-circuit cooling towers~~	~~All~~	~~102°F entering water 90°F leaving water 75°F entering wb~~	~~≥ 7.0 gpm/hp~~	~~**CTI ATC-105S** and CTI STD-201 RS~~
~~Propeller or axial fan dry coolers (air-cooled fluid coolers)~~	~~All~~	~~115°F entering water 105°F leaving water 95°F entering wb~~	~~≥ 4.5 gpm/hp~~	~~**CTI ATC-105DS**~~
~~Propeller or axial fan evaporative condensers~~	~~All~~	~~R-448A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb~~	~~≥ 160,000 Btu/h × hp~~	~~**CTI ATC-106**~~

		~~Propeller or axial fan evaporative condensers~~	~~All~~	~~Ammonia test fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb~~	~~≥ 134,000 Btu/h × hp~~	~~**CTI ATC-106**~~
		~~Centrifugal fan evaporative condensers~~	~~All~~	~~R-448A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb~~	~~≥ 137,000 Btu/h × hp~~	~~**CTI ATC-106**~~
		~~Centrifugal fan evaporative condensers~~	~~All~~	~~Ammonia test fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb~~	~~≥ 110,000 Btu/h × hp~~	~~**CTI ATC-106**~~
		~~Air-cooled condensers~~	~~All~~	~~125°F condensing temperature 190°F entering gas temperature 15°F subcooling 95°F entering db~~	~~≥ 176,000 Btu/h × hp~~	~~**AHRI 460**~~

~~For SI: °C = [(°F) – 32]/1.8, L/s × kW = (gpm/hp)/(11.83), COP = (Btu/h × hp)/(2550.7), db = dry bulb temperature, wb = wet bulb temperature.~~

a. ~~**Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

b. ~~For purposes of this table, open-circuit cooling tower performance is defined as the water- flow rating of the tower at the thermal rating condition listed in the table divided by the fan motor nameplate power.~~

c. ~~For purposes of this table, closed-circuit cooling tower performance is defined as the process water-flow rating of the tower at the thermal rating condition listed in the table divided by the sum of the fan motor nameplate power and the integral spray pump motor nameplate power.~~

d. ~~For purposes of this table, dry-cooler performance is defined as the process water-flow rating of the unit at the thermal rating condition listed in the table divided by the total fan motor nameplate power of the unit, and air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the total fan motor nameplate power of the unit.~~

e. ~~The efficiencies and test procedures for both open- and closed-circuit cooling towers are not applicable to hybrid cooling towers that contain a combination of separate wet and dry heat exchange sections. The certification requirements do not apply to field-erected cooling~~

~~towers.~~

f. ~~All cooling towers shall comply with the minimum efficiency listed in the table for that specific type of tower with the capacity effect of any project-specific accessories and/or options included in the capacity of the cooling tower.~~

g. ~~For purposes of this table, evaporative condenser performance is defined as the heat rejected at the specified rating condition in the table, divided by the sum of the fan motor nameplate power and the integral spray pump nameplate power.~~

h. ~~Requirements for evaporative condensers are listed with ammonia (R-717) and R-448A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-448A must meet the minimum efficiency requirements listed with R-448A as the test fluid. For ammonia, the condensing temperature is defined as the saturation temperature corresponding to the refrigerant pressure at the condenser entrance. For R-448A, which is a zeotropic refrigerant, the condensing temperature is defined as the arithmetic average of the dew point and the bubble point temperatures corresponding to the refrigerant pressure at the condenser entrance.~~

i. ~~This table is a replica of **ASHRAE 90.1** Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements.~~

TABLE C403.3.2(7)

PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	TOTAL SYSTEM HEAT-REJECTION CAPACITY AT RATED CONDITIONS	SUBCATEGORY OR RATING CONDITION[h]	PERFORMANCE REQUIRED[a, b, c, f, g]	TEST PROCEDURE[d, e]
Propeller or axial fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering wb	≥ 40.2 gpm/hp	**CTI ATC-105** and **CTI STD-201 RS**
Centrifugal fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering wb	≥ 20.0 gpm/hp	**CTI ATC-105** and **CTI STD-201 RS**

Propeller or axial fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering wb	≥ 16.1 gpm/hp	**CTI ATC-105S** and **CTI STD-201 RS**
Centrifugal fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering wb	≥ 7.0 gpm/hp	**CTI ATC-105S** and **CTI STD-201 RS**
Propeller or axial fan dry coolers (air-cooled fluid coolers)	All	115°F entering water 105°F leaving water 95°F entering wb	≥ 4.5 gpm/hp	**CTI ATC-105DS**
Propeller or axial fan evaporative condensers	All	R-448A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥ 160,000 Btu/h × hp	**CTI ATC-106**
Propeller or axial fan evaporative condensers	All	Ammonia test fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb	≥ 134,000 Btu/h × hp	**CTI ATC-106**
Centrifugal fan evaporative condensers	All	R-448A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥ 137,000 Btu/h × hp	**CTI ATC-106**

Centrifugal fan evaporative condensers	All	Ammonia test fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb	≥ 110,000 Btu/h × hp	**CTI ATC-106**
Air-cooled condensers	All	125°F condensing temperature 190°F entering gas temperature 15°F subcooling 95°F entering db	≥ 176,000 Btu/h × hp	**AHRI 460**

For SI: °C = (°F – 32)/1.8, L/s × kW = (gpm/hp)/(11.83), COP = (Btu/h × hp)/(2550.7), db = dry bulb temperature, wb = wet bulb temperature.

a. For purposes of this table, open-circuit cooling tower performance is defined as the water- flow rating of the tower at the thermal rating condition listed in the table divided by the fan motor nameplate power.
b. For purposes of this table, closed-circuit cooling tower performance is defined as the process water-flow rating of the tower at the thermal rating condition listed in the table divided by the sum of the fan motor nameplate power and the integral spray pump motor nameplate power.
c. For purposes of this table, dry-cooler performance is defined as the process water-flow rating of the unit at the thermal rating condition listed in the table divided by the total fan motor nameplate power of the unit, and air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the total fan motor nameplate power of the unit.
d. **ASHRAE 90.1** Section 13 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure. towers.
e. The efficiencies and test procedures for both open- and closed-circuit cooling towers are not applicable to hybrid cooling towers that contain a combination of separate wet and dry heat exchange sections. The certification requirements do not apply to field-erected cooling
f. All cooling towers shall comply with the minimum efficiency listed in the table for that specific type of tower with the capacity effect of any project-specific accessories and/or options included in the capacity of the cooling tower.
g. For purposes of this table, evaporative condenser performance is defined as the heat rejected at the specified rating condition in the table, divided by the sum of the fan motor nameplate power and the integral spray pump nameplate power.
h. Requirements for evaporative condensers are listed with ammonia R-717 and R-448A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-448A must meet the minimum efficiency requirements listed with R-448A as the test fluid. For ammonia, the condensing temperature is defined as the saturation temperature

corresponding to the refrigerant pressure at the condenser entrance. For R-448A, which is a zeotropic refrigerant, the condensing temperature is defined as the arithmetic average of the dew point and the bubble point temperatures corresponding to the refrigerant pressure at the condenser entrance.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#164

Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mod:

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22

~~TABLE C403.3.2(8)~~

~~**ELECTRICALLY OPERATED VARIABLE-REFRIGERANT-FLOW AIR CONDITIONERS—MINIMUM EFFICIENCY REQUIREMENTS**~~ ~~[b]~~

~~**EQUIPMENT TYPE**~~	~~**SIZE CATEGORY**~~	~~**HEATING SECTION TYPE**~~	~~**SUBCATEGORY OR RATING CONDITION**~~	~~**MINIMUM EFFICIENCY**~~	~~**TEST PROCEDURE**~~ [a]
~~VRF air conditioners, air cooled~~	~~< 65,000 Btu/h~~	~~All~~	~~VRFmultisplit system~~	~~13.0 SEER~~	~~**AHRI 1230**~~
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric resistance (or none)~~	~~VRFmultisplit system~~	~~11.2 EER~~ ~~13.1 IEER~~ ~~15.5 IEER~~	
	~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~Electric resistance (or none)~~	~~VRFmultisplit system~~	~~11.0 EER~~ ~~12.9 IEER~~ ~~14.9 IEER~~	
	~~≥ 240,000 Btu/h~~	~~Electric resistance (or none)~~	~~VRFmultisplit system~~	~~10.0 EER~~ ~~11.6 IEER~~ ~~13.9 IEER~~	

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

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. This table is a replica of **ASHRAE 90.1** Table 6.8.1-8 Electrically Operated Variable- Refrigerant-Flow Air Conditioners—Minimum Efficiency Requirements.~~

TABLE C403.3.2(8)

ELECTRICALLY OPERATED VARIABLE-REFRIGERANT-FLOW AIR CONDITIONERS—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
VRF air conditioners, air cooled	< 65,000 Btu/h three-phase for applications in the US and single- and three-phase for applications outside the US	All	VRF multisplit system	13.0 SEER	**AHRI 210/240**
	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	VRF multisplit system	10.5 EER 15.5 IEER	**AHRI 1230**
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)	VRF multisplit system	10.3 EER 14.9 IEER	
	≥ 240,000 Btu/h	Electric resistance (or none)	VRF multisplit system	9.5 EER 13.9 IEER	

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

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#165

Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mods:

CED1-156-22, CE2D-13-23, CE2D-16-23,

~~TABLE C403.3.2(9)~~

~~**ELECTRICALLY OPERATED VARIABLE-REFRIGERANT-FLOW AND APPLIED HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS**~~

~~**EQUIPMENT TYPE**~~	~~**SIZE CATEGORY**~~	~~**HEATING SECTION TYPE**~~	~~**SUBCATEGORY OR RATING CONDITION**~~	~~**MINIMUM EFFICIENCY**~~	~~**TEST PROCEDURE**~~ [a]
	~~< 65,000 Btu/h~~	~~All~~		~~13.0 SEER~~	

CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22		~~VRFair cooled (cooling mode)~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric resistance (or none)~~	~~VRFmultisplit system~~	~~11.0 EER~~ ~~12.9 IEER~~ ~~14.6 IEER~~	**~~AHRI 1230~~**
					~~VRFmultisplit system with heat recovery~~	~~10.8 EER~~ ~~12.7 IEER~~ ~~14.4 IEER~~	
			~~≥ 135,000 Btu/h and < 240,000 Btu/h~~		~~VRFmultisplit system~~	~~10.6 EER~~ ~~12.3 IEER~~ ~~13.9 IEER~~	
					~~VRFmultisplit system with heat recovery~~	~~10.4 EER~~ ~~12.1 IEER~~ ~~13.7 IEER~~	
			~~≥ 240,000 Btu/h~~		~~VRFmultisplit system~~	~~9.5 EER~~ ~~11.0 IEER~~ ~~12.7 IEER~~	
					~~VRFmultisplit system with heat recovery~~	~~9.3 EER~~ ~~10.8 IEER~~ ~~12.5 IEER~~	
		~~VRF water source (cooling mode)~~	~~< 65,000 Btu/h~~	~~All~~	~~VRFmultisplit systems 86°F entering water~~	~~12.0 EER~~ ~~16.0 IEER~~	**~~AHRI 1230~~**
					~~VRFmultisplit systems with heat recovery 86°F entering water~~	~~11.8 EER~~ ~~15.8 IEER~~	
			~~≥ 65,000 Btu/h and < 135,000 Btu/h~~		~~VRFmultisplit system 86°F entering water~~	~~12.0 EER~~ ~~16.0 IEER~~	
					~~VRFmultisplit system with heat recovery 86°F entering water~~	~~11.8 EER~~ ~~15.8 IEER~~	
			~~≥ 135,000 Btu/h and < 240,000 Btu/h~~		~~VRFmultisplit system 86°F entering water~~	~~10.0 EER~~ ~~14.0 IEER~~	

			~~VRFmultisplit system with heat recovery 86°F entering water~~	~~9.8 EER~~ ~~13.8 IEER~~	
	~~≥ 240,000 Btu/h~~		~~VRFmultisplit system 86°F entering water~~	~~10.0 EER~~ ~~12.0 IEER~~	
			~~VRFmultisplit system with heat recovery 86°F entering water~~	~~9.8 EER~~ ~~11.8 IEER~~	
~~VRF groundwater source (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~VRFmultisplit system 59°F entering water~~	~~16.2 EER~~	~~**AHRI 1230**~~
			~~VRFmultisplit system with heat recovery 59°F entering water~~	~~16.0 EER~~	
	~~≥ 135,000 Btu/h~~		~~VRFmultisplit system 59°F entering water~~	~~13.8 EER~~	
			~~VRFmultisplit system with heat recovery 59°F entering water~~	~~13.6 EER~~	
~~VRFground source (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~VRFmultisplit system 77°F entering water~~	~~13.4 EER~~	~~**AHRI 1230**~~
			~~VRFmultisplit system with heat recovery 77°F entering water~~	~~13.2 EER~~	
			~~VRFmultisplit system 77°F entering water~~	~~11.0 EER~~	

	~~≥ 135,000 Btu/h~~		~~VRFmultisplit system with heat recovery 77°F entering water~~	~~10.8 EER~~	
~~VRFair cooled (heating mode)~~	~~< 65,000 Btu/h (cooling capacity)~~		~~VRFmultisplit system~~	~~7.7 HSPF~~	**~~AHRI 1230~~**
	~~≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)~~		~~VRFmultisplit system~~ ~~47°F db/43°F wb outdoor air~~	~~3.3 COP~~ H	
	~~≥ 135,000 Btu/h (cooling capacity)~~		~~17°F db/15°F wb outdoor air~~	~~2.25 COP~~ H	
	~~< 65,000 Btu/h (cooling capacity)~~		~~VRF multisplit system~~ ~~47°F db/43°F wb outdoor air~~ ~~17°F db/15°F wb outdoor air~~ ~~VRFmultisplit system 68°F entering water~~	~~3.2 COP~~ H ~~2.05 COP~~ H ~~4.2 COP~~ H ~~4.3 COP~~ H	**~~AHRI 1230~~**

				~~VRFmultisplit system 68°F entering water~~	~~4.2 COP~~$_H$ ~~4.3 COP~~$_H$		
	~~VRFwater source (heating mode)~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)~~		~~VRFmultisplit system 68°F entering water~~ ~~VRFmultisplit system 68°F entering water~~ ~~VRFmultisplit system 50°F entering water~~ ~~VRFmultisplit system 50°F entering water~~ ~~VRFmultisplit system 32°F entering water~~	~~3.9 COP~~$_H$ ~~4.0 COP~~$_H$ ~~3.9 COP~~$_H$ ~~3.6 COP~~$_H$ ~~3.3 COP~~$_H$ ~~3.1 COP~~$_H$	~~**AHRI 1230**~~ ~~**AHRI 1230**~~	
		~~≥ 135,000 Btu/h and < 240,000 Btu/h (cooling capacity)~~					
		~~≥ 240,000 Btu/h (cooling capacity)~~					
		~~< 135,000 Btu/h~~					

~~VRFgroundwater source (heating mode)~~	~~(cooling capacity)~~				
	~~≥ 135,000 Btu/h (cooling capacity)~~				
~~VRF ground source (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~				
	~~≥ 135,000 Btu/h (cooling capacity)~~		~~VRFmultisplit system~~	~~2.8 COP_H~~	

~~For SI: °C = [(°F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 W, db = dry bulb temperature, wb = wet bulb temperature.~~

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. This table is a replica of **ASHRAE 90.1** Table 6.8.1-9 Electrically Operated Variable- Refrigerant-Flow and Applied Heat Pumps—Minimum Efficiency Requirements.~~

TABLE C403.3.2(9)

ELECTRICALLY OPERATED VARIABLE-REFRIGERANT-FLOW AND APPLIED HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
VRF air cooled	< 65,000 Btu/h three-phase for applications in the US and single- and three- phase for applications outside the US	All	VRF multisplit system	SEER2 = 13.4	**AHRI 210/240**
	≥ 65,000 Btu/h and < 135,000 Btu/h		VRF multisplit system	10.3 EER 14.6 IEER	
			VRF multisplit system with heat recovery	10.1 EER 14.4 IEER	

(cooling mode)	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)	VRF multisplit system	9.9 EER 14.4 IEER	**AHRI 1230**
			VRF multisplit system with heat recovery	9.7 EER 13.9 IEER	
	≥ 240,000 Btu/h		VRF multisplit system	9.1 EER 12.7 IEER	
			VRF multisplit system with heat recovery	8.9 EER 12.5 IEER	
VRF water source (cooling mode)	< 65,000 Btu/h	All	VRF multisplit systems 86°F entering water	12.0 EER 16.0 IEER	**AHRI 1230**
			VRF multisplit systems with heat recovery 86°F entering water	11.8 EER 15.8 IEER	
	≥ 65,000 Btu/h and < 135,000 Btu/h		VRF multisplit system 86°F entering water	12.0 EER 16.0 IEER	
			VRF multisplit system with heat recovery 86°F entering water	11.8 EER 15.8 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h		VRF multisplit system 86°F entering water	10.0 EER 14.0 IEER	
			VRF multisplit system with heat recovery 86°F entering water	9.8 EER 13.8 IEER	

	≥ 240,000 Btu/h		VRF multisplit system 86°F entering water	10.0 EER 12.0 IEER	
			VRF multisplit system with heat recovery 86°F entering water	9.8 EER 11.8 IEER	
VRF groundwater source (cooling mode)	< 135,000 Btu/h	All	VRF multisplit system 59°F entering water	16.2 EER	AHRI 1230
			VRF multisplit system with heat recovery 59°F entering water	16.0 EER	
	≥ 135,000 Btu/h		VRF multisplit system 59°F entering water	13.8 EER	
			VRF multisplit system with heat recovery 59°F entering water	13.6 EER	
VRF ground source (cooling mode)	< 135,000 Btu/h	All	VRF multisplit system 77°F entering water	13.4 EER	AHRI 1230
			VRF multisplit system with heat recovery 77°F entering water	13.2 EER	

		≥ 135,000 Btu/h		VRF multisplit system 77°F entering water	11.0 EER	
		< 65,000 Btu/h (cooling capacity) three-phase for applications in the US and single- and three- phase for applications outside the US		VRF multisplit system with heat recovery 77°F entering water	10.8 EER	
	VRF air cooled (heating mode)	≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)		VRF multisplit system	HSPF2 = 7.5	**AHRI 210/240**
		≥ 135,000 Btu/h (cooling capacity)		VRF multisplit system 47°F db/43°F wb outdoor air	3.3 COP_H	**AHRI 1230**
		< 65,000 Btu/h (cooling capacity)		17°F db/15°F wb outdoor air	2.25 COP_H	
				VRF multisplit system 47°F db/43°F wb outdoor air	3.2 COP_H	
		≥ 65,000 Btu/h and <		17°F db/15°F wb outdoor air	2.05 COP_H	

	VRF water source (heating mode)	135,000 Btu/h (cooling capacity)		VRF multisplit system 68°F entering water	4.3 COP_H	AHRI 1230
		≥ 135,000 Btu/h and < 240,000 Btu/h (cooling capacity)		VRF multisplit system 68°F entering water	4.3 COP_H	
				VRF multisplit system 68°F entering water	4.0 COP_H	
		≥ 240,000 Btu/h (cooling capacity)		VRF multisplit system 68°F entering water	3.9 COP_H	

	VRF groundwater source (heating mode)	< 135,000 Btu/h (cooling capacity)	VRF multisplit system 50°F entering water	3.6 COP_H	AHRI 1230
		≥ 135,000 Btu/h (cooling capacity)	VRF multisplit system 50°F entering	3.3 COP_H	

		water		
VRF ground source (heating mode)	< 135,000 Btu/h (cooling capacity)	VRF multisplit system 32°F entering water	3.1 COP_H	AHRI 1230
	≥ 135,000 Btu/h (cooling capacity)	VRF multisplit system 32°F entering water	2.8 COP_H	

For SI: °C = (°F – 32)/1.8, 1 British thermal unit per hour = 0.2931 W, db = dry bulb temperature, wb = wet bulb temperature.

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#166 Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mods:

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23,

~~TABLE C403.3.2(10)~~

~~FLOOR-MOUNTED AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS—MINIMUM EFFICIENCY REQUIREMENTS[b]~~

		~~≥ 65,000 Btu/h and < 240,000 Btu/h~~	~~2.10~~		
		~~≥ 240,000~~	~~2.10~~		

~~For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) – 32]/1.8, COP = (Btu/h × hp)/(2,550.7).~~

CE2D-19-23, CECD1-12-22

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. This table is a replica of **ASHRAE 90.1** Table 6.8.1-10 Floor-Mounted Air Conditioners and Condensing Units Serving Computer Rooms—Minimum Efficiency Requirements.~~

TABLE C403.3.2(10)

FLOOR-MOUNTED AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	STANDARD MODEL	NET SENSIBLE COOLING CAPACITY	MINIMUM NET SENSIBLE COP	RATING CONDITIONS RETURN AIR (dry bulb/dew point)	TEST PROCEDURE
Air cooled	Downflow	< 80,000 Btu/h	2.70	85°F/52°F (Class 2)	AHRI 1360
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.58		
		≥ 295,000 Btu/h	2.36		
	Upflow—ducted	< 80,000 Btu/h	2.67		
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.55		
		≥ 295,000 Btu/h	2.33		
	Upflow—nonducted	< 65,000 Btu/h	2.16	75°F/52°F (Class 1)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.04		
		≥ 240,000 Btu/h	1.89		
	Horizontal	< 65,000 Btu/h	2.65	95°F/52°F (Class 3)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.55		

				≥ 240,000 Btu/h	2.47		
		Air cooled with fluid economizer	Downflow	< 80,000 Btu/h	2.70	85°F/52°F (Class 1)	**AHRI 1360**
				≥ 80,000 Btu/h and < 295,000 Btu/h	2.58		
				≥ 295,000 Btu/h	2.36		
			Upflow—ducted	< 80,000 Btu/h	2.67		
				≥ 80,000 Btu/h and < 295,000 Btu/h	2.55		
				≥ 295,000 Btu/h	2.33		
			Upflow—nonducted	< 65,000 Btu/h	2.09	75°F/52°F (Class 1)	
				≥ 65,000 Btu/h and < 240,000 Btu/h	1.99		
				≥ 240,000 Btu/h	1.81		
			Horizontal	< 65,000 Btu/h	2.65	95°F/52°F (Class 3)	
				≥ 65,000 Btu/h and < 240,000 Btu/h	2.55		
				≥ 240,000 Btu/h	2.47		
			Downflow	< 80,000 Btu/h	2.82	85°F/52°F (Class 1)	
				≥ 80,000 Btu/h and < 295,000 Btu/h	2.73		
				≥ 295,000 Btu/h	2.67		
				< 80,000 Btu/h	2.79		

		Water cooled	Upflow—ducted	≥ 80,000 Btu/h and < 295,000 Btu/h	2.70		AHRI 1360	
				≥ 295,000 Btu/h	2.64			
			Upflow—nonducted	< 65,000 Btu/h	2.43	75°F/52°F (Class 1)		
				≥ 65,000 Btu/h and < 240,000 Btu/h	2.32			
				≥ 240,000 Btu/h	2.20			
			Horizontal	< 65,000 Btu/h	2.79	95°F/52°F (Class 3)		
				≥ 65,000 Btu/h and < 240,000 Btu/h	2.68			
				≥ 240,000 Btu/h	2.60			
		Water cooled with fluid economizer	Downflow	< 80,000 Btu/h	2.77	85°F/52°F (Class 1)	AHRI 1360	
				≥ 80,000 Btu/h and < 295,000 Btu/h	2.68			
				≥ 295,000 Btu/h	2.61			
			Upflow—ducted	< 80,000 Btu/h	2.74			
				≥ 80,000 Btu/h and < 295,000 Btu/h	2.65			
				≥ 295,000 Btu/h	2.58			
			Upflow—nonducted	< 65,000 Btu/h	2.35	75°F/52°F (Class 1)		
				≥ 65,000 Btu/h and < 240,000 Btu/h	2.24			

			≥ 240,000 Btu/h	2.12		
		Horizontal	< 65,000 Btu/h	2.71	95°F/52°F (Class 3)	
			≥ 65,000 Btu/h and < 240,000 Btu/h	2.60		
			≥ 240,000 Btu/h	2.54		
	Glycol cooled	Downflow	< 80,000 Btu/h	2.56	85°F/52°F (Class 1)	**AHRI 1360**
			≥ 80,000 Btu/h and < 295,000 Btu/h	2.24		
			≥ 295,000 Btu/h	2.21		
		Upflow—ducted	< 80,000 Btu/h	2.53		
			≥ 80,000 Btu/h and < 295,000 Btu/h	2.21		
			≥ 295,000 Btu/h	2.18		
		Upflow, nonducted	< 65,000 Btu/h	2.08	75°F/52°F (Class 1)	
			≥ 65,000 Btu/h and < 240,000 Btu/h	1.90		
			≥ 240,000 Btu/h	1.81		
		Horizontal	< 65,000 Btu/h	2.48	95°F/52°F (Class 3)	
			≥ 65,000 Btu/h and < 240,000 Btu/h	2.18		
			≥ 240,000 Btu/h	2.18		
			< 80,000 Btu/h	2.51		

Glycol cooled with fluid economizer	Downflow	≥ 80,000 Btu/h and < 295,000 Btu/h	2.19	85°F/52°F (Class 1)	AHRI 1360
		≥ 295,000 Btu/h	2.15		
	Upflow—ducted	< 80,000 Btu/h	2.48		
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.16		
		≥ 295,000 Btu/h	2.12		
	Upflow—nonducted	< 65,000 Btu/h	2.00	75°F/52°F (Class 1)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	1.82		
		≥ 240,000 Btu/h	1.73		
	Horizontal	< 65,000 Btu/h	2.44	95°F/52°F (Class 3)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.10		
		≥ 240,000 Btu/h	2.10		

For SI: 1 British thermal unit per hour = 0.2931 W, °C = (°F – 32)/1.8, COP = (Btu/h × hp)/(2,550.7).

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#167

Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mods:

CED1-156-22, CE2D-13-

~~TABLE C403.3.2(11)~~

~~VAPOR-COMPRESSION-BASED INDOOR POOL DEHUMIDIFIERS—MINIMUM EFFICIENCY REQUIREMENTS~~ [b]

~~EQUIPMENT TYPE~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~ [a]

23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22

~~Single package indoor (with or without economizer)~~	~~Rating Conditions: A or C~~	~~3.5 MRE~~	~~**AHRI 910**~~
~~Single package indoor water cooled (with or without economizer)~~	~~Rating Conditions: A, B or C~~	~~3.5 MRE~~	
~~Single package indoor air cooled (with or without economizer)~~	~~Rating Conditions: A, B or C~~	~~3.5 MRE~~	
~~Split systemindoor air cooled (with or without economizer)~~	~~Rating Conditions: A, B or C~~	~~3.5 MRE~~	

~~a.~~ ~~**Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. This table is a replica of **ASHRAE 90.1** Table 6.8.1-12 Vapor-Compression-Based Indoor Pool Dehumidifiers—Minimum Efficiency Requirements.~~

TABLE C403.3.2(11)

VAPOR-COMPRESSION-BASED INDOOR POOL DEHUMIDIFIERS—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	**SUBCATEGORY OR RATING CONDITION**	**MINIMUM EFFICIENCY**	**TEST PROCEDURE**
Single package indoor (with or without economizer)	Rating conditions: A or C	3.5 MRE	**AHRI 910**
Single package indoor water-cooled (with or without economizer)	Rating conditions: A, B or C	3.5 MRE	
Single package indoor air-cooled (with or without economizer)	Rating conditions: A, B or C	3.5 MRE	
Split system indoor air-cooled (with or without economizer)	Rating conditions: A, B or C	3.5 MRE	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#168

Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mods:

~~**TABLE C403.3.2(12)**~~

~~**ELECTRICALLY OPERATED DX-DOAS UNITS, SINGLE-PACKAGE AND REMOTE CONDENSER, WITHOUT ENERGY RECOVERY—MINIMUM EFFICIENCYREQUIREMENTS[b]**~~

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22	see below

EQUIPMENT TYPE	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~ [a]
~~Air cooled (dehumidification mode)~~	—	~~4.0 ISMRE~~	~~**AHRI 920**~~
~~Air-source heat pumps (dehumidification mode)~~	—	~~4.0 ISMRE~~	~~**AHRI 920**~~
~~Water cooled (dehumidification mode)~~	~~Cooling tower condenser water~~	~~4.9 ISMRE~~	~~**AHRI 920**~~
	~~Chilled water~~	~~6.0 ISMRE~~	
~~Air-source heat pump (heating mode)~~	—	~~2.7 ISCOP~~	~~**AHRI 920**~~
~~Water-source heat pump (dehumidification mode)~~	~~Ground source, closed loop~~	~~4.8 ISMRE~~	~~**AHRI 920**~~
	~~Ground-water source~~	~~5.0 ISMRE~~	
	~~Water source~~	~~4.0 ISMRE~~	
~~Water-source heat pump (heating mode)~~	~~Ground source, closed loop~~	~~2.0 ISCOP~~	~~**AHRI 920**~~
	~~Ground-water source~~	~~3.2 ISCOP~~	
	~~Water source~~	~~3.5 ISCOP~~	

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. This table is a replica of **ASHRAE 90.1** Table 6.8.1-13 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, without Energy Recovery—Minimum Efficiency Requirements.~~

TABLE C403.3.2(12)

ELECTRICALLY OPERATED DX-DOAS UNITS, SINGLE-PACKAGE AND REMOTE CONDENSER, WITHOUT ENERGY RECOVERY—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Air cooled (dehumidification mode)	—	3.8 ISMRE2	**AHRI 920**
Air-source heat pumps (dehumidification mode)	—	3.8 ISMRE2	**AHRI 920**
Water cooled (dehumidification mode)	Cooling tower condenser water	4.7 ISMRE2	**AHRI 920**

Air-source heat pump (heating mode)	—	2.05 ISCOP2	**AHRI 920**
Water-source heat pump (dehumidification mode)	Ground source, closed and open loop[b]	4.6 ISMRE2	**AHRI 920**
	Water source	3.8 ISMRE2	
Water-source heat pump (heating mode)	Ground source, closed and open loop[b]	2.13 ISCOP2	**AHRI 920**
	Water source	2.13 ISCOP2	

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.
b. Open-loop systems are rated using closed-loop test conditions.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#169

Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mods:

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22

~~TABLE C403.3.2(13)~~

~~**ELECTRICALLY OPERATED D X-DOAS UNITS, SINGLE-PACKAGE AND REMOTE CONDENSER, WITH ENERGYRECOVERY—MINIMUM EFFICIENCY REQUIREMENTS**[b]~~

EQUIPMENT TYPE	~~**SUBCATEGORY OR RATING CONDITION**~~	~~**MINIMUM EFFICIENCY**~~	~~**TEST PROCEDURE**~~ [a]
~~Air cooled (dehumidification mode)~~	—	~~5.2 ISMRE~~	~~**AHRI 920**~~
~~Air-source heat pumps (dehumidification mode)~~	—	~~5.2 ISMRE~~	~~**AHRI 920**~~
~~Water cooled (dehumidification mode)~~	~~Cooling tower condenser water~~	~~5.3 ISMRE~~	~~**AHRI 920**~~
	~~Chilled water~~	~~6.6 ISMRE~~	

~~Air-source heat pump (heating mode)~~	~~—~~	~~3.3 ISCOP~~	~~**AHRI 920**~~
~~Water-source heat pump (dehumidification mode)~~	~~Ground source, closed loop~~	~~5.2 ISMRE~~	~~**AHRI 920**~~
	~~Ground-water source~~	~~5.8 ISMRE~~	
	~~Water source~~	~~4.8 ISMRE~~	
~~Water-source heat pump (heating mode)~~	~~Ground source, closed loop~~	~~3.8 ISCOP~~	~~**AHRI 920**~~
	~~Ground-water source~~	~~4.0 ISCOP~~	
	~~Water source~~	~~4.8 ISCOP~~	

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. This table is a replica of **ASHRAE 90.1** Table 6.8.1-14 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, with Energy Recovery—Minimum Efficiency Requirements.~~

TABLE C403.3.2(13)

ELECTRICALLY OPERATED DX-DOAS UNITS, SINGLE-PACKAGE AND REMOTE CONDENSER, WITH ENERGY RECOVERY—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Air cooled (dehumidification mode)	—	5.0 ISMRE2	**AHRI 920**
Air-source heat pumps (dehumidification mode)	—	5.0 ISMRE2	**AHRI 920**
Water cooled (dehumidification mode)	Cooling tower condenser water	5.1 ISMRE2	**AHRI 920**
Air-source heat pump (heating mode)	—	3.2 ISCOP2	**AHRI 920**
Water-source heat pump (dehumidification mode)	Ground source, closed and open loop[b]	5.0 ISMRE2	**AHRI 920**
	Water source	4.6 ISMRE2	
Water-source heat pump (heating mode)	Ground source, closed and open loop[b]	3.5 ISCOP2	**AHRI 920**
	Water source	4.04 ISCOP2	

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

b. Open-loop systems are rated using closed-loop test conditions.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#170 Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mod:

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22

~~TABLE C403.3.2(14)~~

~~ELECTRICALLY OPERATED WATER-SOURCE HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS~~ [c]

EQUIPMENT TYPE	~~SIZE CATEGORY~~ b	~~HEATING SECTION~~ TYPE	~~SUBCATEGORY OR RATING~~ CONDITION	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~ a
~~Water-to-air, water loop (cooling mode)~~	~~< 17,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~12.2 EER~~	~~ISO 13256-1~~
	~~≥ 17,000 Btu/h and < 65,000 Btu/h~~			~~13.0 EER~~	
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~			~~13.0 EER~~	
~~Water-to-air, ground water (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~59°F entering water~~	~~18.0 EER~~	~~ISO 13256-1~~
~~Brine-to-air, ground loop (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~77°F entering water~~	~~14.1 EER~~	~~ISO 13256-1~~
~~Water-to-water, water loop (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~10.6 EER~~	~~ISO 13256-2~~
~~Water-to-water, ground water (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~59°F entering water~~	~~16.3 EER~~	~~ISO 13256-2~~
~~Brine-to-water, ground loop (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~77°F entering water~~	~~12.1 EER~~	~~ISO 13256-2~~

~~Water-to-water, water loop (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~68°F entering water~~	~~4.3 COP~~ H	**~~ISO 13256-1~~**
~~Water-to-air, ground water (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~50°F entering water~~	~~3.7 COP~~ H	**~~ISO 13256-1~~**
~~Brine-to-air, ground loop (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~32°F entering water~~	~~3.2 COP~~ H	**~~ISO 13256-1~~**
~~Water-to-water, water loop (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~68°F entering water~~	~~3.7 COP~~ H	**~~ISO 13256-1~~**
~~Water-to-water, ground water (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~50°F entering water~~	~~3.1 COP~~ H	**~~ISO 13256-2~~**
~~Brine-to-water, ground loop (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~32°F entering water~~	~~2.5 COP~~ H	**~~ISO 13256-2~~**

~~For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) – 32]/1.8.~~

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. Single-phase, US air-cooled heat pumps less than 19 kW are regulated as consumer products by **DOE 10 CFR 430**. SCOPC, SCOP2C, SCOPH and SCOP2H values for single- phase products are set by the USDOE.~~

~~c. This table is a replica of **ASHRAE 90.1** Table 6.8.1-15 Electrically Operated Water-Source Heat Pumps—Minimum Efficiency Requirements.~~

TABLE C403.3.2(14)

ELECTRICALLY OPERATED WATER-SOURCE HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS[b]

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Water-to-air, water loop (cooling mode)	< 17,000 Btu/h	All	86°F entering water	12.2 EER	**ISO 13256-1**
	≥ 17,000 Btu/h and < 65,000 Btu/h			13.0 EER	
	≥ 65,000 Btu/h and < 135,000 Btu/h			13.0 EER	
Water-to-air, ground water (cooling mode)	< 135,000 Btu/h	All	59°F entering water	18.0 EER	**ISO 13256-1**
Brine-to-air, ground loop (cooling mode)	< 135,000 Btu/h	All	77°F entering water	14.1 EER	**ISO 13256-1**
Water-to-water, water loop (cooling mode)	< 135,000 Btu/h	All	86°F entering water	10.6 EER	**ISO 13256-2**
Water-to-water, ground water (cooling mode)	< 135,000 Btu/h	All	59°F entering water	16.3 EER	**ISO 13256-2**
Brine-to-water, ground loop (cooling mode)	< 135,000 Btu/h	All	77°F entering water	12.1 EER	**ISO 13256-2**
Water-to-water, water loop (heating mode)	< 135,000 Btu/h (cooling capacity)	—	68°F entering water	4.3 COP_H	**ISO 13256-1**
Water-to-air, ground water (heating mode)	< 135,000 Btu/h (cooling capacity)	—	50°F entering water	3.7 COP_H	**ISO 13256-1**
Brine-to-air, ground loop (heating mode)	< 135,000 Btu/h (cooling capacity)	—	32°F entering water	3.2 COP_H	**ISO 13256-1**

Water-to-water, water loop (heating mode)	< 135,000 Btu/h (cooling capacity)	—	68°F entering water	3.7 COP_H	**ISO 13256-1**
Water-to-water, ground water (heating mode)	< 135,000 Btu/h (cooling capacity)	—	50°F entering water	3.1 COP_H	**ISO 13256-2**
Brine-to-water, ground loop (heating mode)	< 135,000 Btu/h (cooling capacity)	—	32°F entering water	2.5 COP_H	**ISO 13256-2**

For SI: 1 British thermal unit per hour = 0.2931 W, °C = (°F – 32)/1.8.

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

b. Single-phase, US air-cooled heat pumps < 65,000 Btu/h are regulated as consumer products by **10 CFR 430**. SEER, SEER2, HPSF and HPSF2 values for single-phase products are set by the US DOE. Informative Note: See **ASHRAE 90.1** Informative Appendix F for the US DOE minimum.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#171

Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mod:

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23,

Delete entire Table

~~TABLE C403.3.2(15)~~

~~**HEAT-PUMP AND HEAT RECOVERY CHILLER PACKAGES—MINIMUM EFFICIENCY REQUIREMENTS**[g]~~

~~or SI: °C = [(°F) – 32]/1.8.~~

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. Cooling-only rating conditions are standard rating conditions defined in **AHRI 550/590**, Table 1.~~

~~c. Heating full-load rating conditions are at rating conditions defined in **AHRI 550/590**, Table 1.~~

~~d. For water-cooled heat recovery chillers that have capabilities for heat rejection to a heat recovery condenser and a tower condenser, the COP_{HR} applies to operation at full load with 100 percent heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery shall meet the requirements of **Table C403.3.2(3)**.~~

~~e. Outdoor air entering dry-bulb (db) temperature and wet-bulb (wb) temperature.~~

~~f. Source-water entering and leaving water temperature.~~

~~g. This table is a replica of **ASHRAE 90.1** Table 6.8.1-16 Heat-Pump and Heat Recovery Chiller Packages—Minimum Efficiency Requirements.~~

CECD1-12-22	

TABLE C403.3.2(15)
HEAT-PUMP AND HEAT RECOVERY CHILLER PACKAGES—MINIMUM EFFICIENCY REQUIREMENTS[g]

ADD ENTIRE TABLE Table C403.3.2(15)

For SI: °C = (°F – 32)/1.8.

NA = Not Applicable.

a. Cooling rating conditions are standard rating conditions defined in **AHRI 550/590 (I-P)**, Table 4, except for liquid-cooled centrifugal chilling packages which can adjust cooling efficiency for nonstandard rating conditions using K_{adj} procedure in accordance with **ASHRAE 90.1** Section6.4.1.2.1.
b. Heating full-load rating conditions are at standard rating conditions defined in **AHRI 550/590 (I-P)**, Table 4; includes the impact of defrost for air source heating ratings.
c. For liquid-source heat recovery chilling packages that have capabilities for heat rejection to a heat recovery condenser and a tower condenser the COP_{HR} applies to operation at full load with 100 percent heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery shall meet the requirements of **ASHRAE 90.1** Table 6.8.1-3.
d. For cooling operation, compliance with both the FL and IPLV is required, but only compliance with Path A or Path B cooling efficiency isrequired.
e. For units that operate in both cooling and heating, compliance with both the cooling and heating efficiency is required.
f. For applications where the chilling package is installed to operate only in heating, compliance only with the heating performance COP_H is required at only one of theheating **AHRI 550/590 (I-P)** standard rating conditions of Low, Medium, High, or Boost. Compliance with cooling performance is not required.
g. For air source heat pumps, compliance with both the 47°F and 17°F heating source outdoor air temperature (OAT) rating efficiency is required for heating.
h. For heat-pump chilling package applications where the cooling capacity is not being used for conditioning, compliance with the heating performance COP_H is only required at one of the four heating AHRI 550/590 standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling performance is required as defined in notes a and d, except as noted in note f.
i. For simultaneous cooling and heating chillers applications where there is simultaneous cooling and heating, compliance with the simultaneous cooling performance heat recovery COP_{SHC} is only required at one of the four simultaneous cooling and heating **AHRI 550/590 (I-P)** standard ratings conditions of Low, Medium, High, or Boost. Compliance with the cooling only performance is required as defined in notes a and d.
j. For heat recovery heating chilling package applications where there is simultaneous cooling and heating, compliance with the heating performance heat recovery COP_{HR} is only required at one of the four heating **AHRI 550/590 (I-P)** standard ratings conditions of Low, Medium, Hot-Water 1, or Hot-Water 2. Compliance with the cooling only performance is required as defined in notes a and d.
k. Chilling packages employing a freeze-protection liquid in accordance with **ASHRAE 90.1** Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.
l. Outdoor air entering dry-bulb (db) temperature and wet-bulb (wb) temperature.
m. Source-leaving liquid temperature.

- The cooling evaporator liquid flow rate used for the heating rating for a reverse cycle air-to-water heat pump shall be the flow rate determined during the full-load cooling rating.
- The cooling evaporator liquid flow rate for the simultaneous cooling and heating and heat recovery liquid cooled chilling packages rating shall be the liquid flow rates from the cooling operation full load rating.
- For heating-only fluid-to-fluid chiller packages, the evaporator flow rate obtained with an entering liquid temperature of 54°F and a leaving liquid temperature of 44°F shall be used.

n. The size category is the full-load net refrigerating cooling mode capacity, which is the capacity of the evaporator available for cooling of the thermal load external to the chilling package.
o. A heat recovery condenser at its maximum load point must remove enough heat from the refrigerant to cool the refrigerant to remove all superheat energy and begin condensation of the refrigerant. A heat recovery system where only the superheat is reduced is not covered by **ASHRAE 90.1** Table 6.8.1-16 and is considered a desuperheater, and the chiller package must comply with **ASHRAE 90.1** Table 6.8.1-3.
p. Water-to-water heat pumps with a capacity less than 135,000 Btu/h are covered by **ASHRAE 90.1** Table6.8.1-15.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

Original text of mod is not consistent with that of the 2023 FBC -EC.

CE#172 Aligns the minimum efficiency requirements with the 2022 ASHRAE 90.1.

Related Mods:

CED1-156-22, CE2D-13-23, CE2D-16-23, CE2D-18-23, CED1-157-22, , CE2D-17-23, CE2D-19-23, CECD1-12-22

~~TABLE C403.3.2(16)~~

~~CEILING-MOUNTED COMPUTER-ROOM AIR CONDITIONERS—MINIMUM EFFICIENCY REQUIREMENTS~~ [b]

~~EQUIPMENT TYPE~~	~~STANDARD MODEL~~	~~NET SENSIBLE COOLING CAPACITY~~	~~MINIMUM NET SENSIBLE COP~~	~~RATING CONDITIONS RETURN AIR (dry bulb/ dew point)~~	~~TEST PROCEDURE~~ [a]
~~Air cooled with free air discharge condenser~~	~~Ducted~~	~~< 29,000 Btu/h~~	~~2.05~~	~~75°F/52°F (Class 1)~~	~~AHRI 1360~~
		~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~2.02~~		
		~~≥ 65,000 Btu/h~~	~~1.92~~		
	~~Nonducted~~	~~< 29,000 Btu/h~~	~~2.08~~		
		~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~2.05~~		
		~~≥ 65,000 Btu/h~~	~~1.94~~		
	~~Ducted~~	~~< 29,000 Btu/h~~	~~2.01~~		
		~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~1.97~~		

		~~Air cooled with free air discharge condenser with fluid economizer~~		~~≥ 65,000 Btu/h~~	~~1.87~~	~~75°F/52°F (Class 1)~~	**~~AHRI 1360~~**
			~~Nonducted~~	~~< 29,000 Btu/h~~	~~2.04~~		
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~2.00~~		
				~~≥ 65,000 Btu/h~~	~~1.89~~		
		~~Air cooled with ducted condenser~~	~~Ducted~~	~~< 29,000 Btu/h~~	~~1.86~~	~~75°F/52°F (Class 1)~~	**~~AHRI 1360~~**
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~1.83~~		
				~~≥ 65,000 Btu/h~~	~~1.73~~		
			~~Nonducted~~	~~< 29,000 Btu/h~~	~~1.89~~		
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~1.86~~		
				~~≥ 65,000 Btu/h~~	~~1.75~~		
		~~Air cooled with fluid~~	~~Ducted~~	~~< 29,000 Btu/h~~	~~1.82~~	~~75°F/52°F~~	
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~1.78~~		
				~~≥ 65,000 Btu/h~~	~~1.68~~		

		~~economizer and ducted condenser~~	~~Nonducted~~	~~< 29,000 Btu/h~~	~~1.85~~	~~(Class 1)~~	**~~AHRI 1360~~**
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~1.81~~		
				~~≥ 65,000 Btu/h~~	~~1.70~~		
		~~Water cooled~~	~~Ducted~~	~~< 29,000 Btu/h~~	~~2.38~~	~~75°F/52°F (Class 1)~~	**~~AHRI 1360~~**
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~2.28~~		
				~~≥ 65,000 Btu/h~~	~~2.18~~		
			~~Nonducted~~	~~< 29,000 Btu/h~~	~~2.41~~		
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~2.31~~		
				~~≥ 65,000 Btu/h~~	~~2.20~~		
		~~Water cooled with fluid economizer~~	~~Ducted~~	~~< 29,000 Btu/h~~	~~2.33~~	~~75°F/52°F (Class 1)~~	**~~AHRI 1360~~**
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~2.23~~		
				~~≥ 65,000 Btu/h~~	~~2.13~~		
				~~< 29,000 Btu/h~~	~~2.36~~		

			~~Nonducted~~	~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~2.26~~		
				~~≥ 65,000 Btu/h~~	~~2.16~~		
		~~Glycol cooled~~	~~Ducted~~	~~< 29,000 Btu/h~~	~~1.97~~	~~75°F/52°F (Class 1)~~	**~~AHRI 1360~~**
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~1.93~~		
				~~≥ 65,000 Btu/h~~	~~1.78~~		
			~~Nonducted~~	~~< 29,000 Btu/h~~	~~2.00~~		
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~1.98~~		
				~~≥ 65,000 Btu/h~~	~~1.81~~		
		~~Glycol cooled with fluid economizer~~	~~Ducted~~	~~< 29,000 Btu/h~~	~~1.92~~	~~75°F/52°F (Class 1)~~	**~~AHRI 1360~~**
				~~≥ 29,000 Btu/h and < 65,000 Btu/h~~	~~1.88~~		
				~~≥ 65,000 Btu/h~~	~~1.73~~		
			~~Nonducted~~	~~< 29,000 Btu/h~~	~~1.95~~		

		~~≥ 29,000 Btu/h and < 65,000~~	~~1.93~~		
		~~Btu/h~~	~~1.76~~		

~~For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) – 32]/1.8, COP = (Btu/h × hp)/(2,550.7).~~

~~a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.~~

~~b. This is a replica of **ASHRAE 90.1** Table 6.8.1-17 Ceiling-Mounted Computer-Room Air Conditioners—Minimum Efficiency Requirements.~~

TABLE C403.3.2(16)

CEILING-MOUNTED COMPUTER ROOM AIR CONDITIONERS—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	**STANDARD MODEL**	**NET SENSIBLE COOLING CAPACITY**	**MINIMUM NET SENSIBLE COP**	**RATING CONDITIONS RETURN AIR (dry bulb/dew point)**	**TEST PROCEDURE[a]**
Air cooled with free air discharge condenser	Ducted	< 29,000 Btu/h	2.05	75°F/52°F (Class 1)	**AHRI 1360**
		≥ 29,000 Btu/h and < 65,000 Btu/h	2.02		
		≥ 65,000 Btu/h	1.92		
	Nonducted	< 29,000 Btu/h	2.08		
		≥ 29,000 Btu/h and < 65,000 Btu/h	2.05		
		≥ 65,000 Btu/h	1.94		

		Air cooled with free air discharge condenser with fluid economizer	Ducted	< 29,000 Btu/h	2.01	75°F/52°F (Class 1)	**AHRI 1360**
				≥ 29,000 Btu/h and < 65,000 Btu/h	1.97		
				≥ 65,000 Btu/h	1.87		
			Nonducted	< 29,000 Btu/h	2.04		
				≥ 29,000 Btu/h and < 65,000 Btu/h	2.00		
				≥ 65,000 Btu/h	1.89		
		Air cooled with ducted condenser	Ducted	< 29,000 Btu/h	1.86	75°F/52°F (Class 1)	**AHRI 1360**
				≥ 29,000 Btu/h and < 65,000 Btu/h	1.83		
				≥ 65,000 Btu/h	1.73		
			Nonducted	< 29,000 Btu/h	1.89		
				≥ 29,000 Btu/h and < 65,000 Btu/h	1.86		
				≥ 65,000 Btu/h	1.75		
				< 29,000 Btu/h	1.82		

		Air cooled with fluid economizer and ducted condenser	Ducted	≥ 29,000 Btu/h and < 65,000 Btu/h	1.78	75°F/52°F (Class 1)	**AHRI 1360**
				≥ 65,000 Btu/h	1.68		
			Nonducted	< 29,000 Btu/h	1.85		
				≥ 29,000 Btu/h and < 65,000 Btu/h	1.81		
				≥ 65,000 Btu/h	1.70		
		Water cooled	Ducted	< 29,000 Btu/h	2.38	75°F/52°F (Class 1)	**AHRI 1360**
				≥ 29,000 Btu/h and < 65,000 Btu/h	2.28		
				≥ 65,000 Btu/h	2.18		
			Nonducted	< 29,000 Btu/h	2.41		
				≥ 29,000 Btu/h and < 65,000 Btu/h	2.31		
				≥ 65,000 Btu/h	2.20		
			Ducted	< 29,000 Btu/h	2.33		
				≥ 29,000 Btu/h and < 65,000 Btu/h	2.23		

		Water cooled with fluid economizer		≥ 65,000 Btu/h	2.13	75°F/52°F (Class 1)	**AHRI 1360**
			Nonducted	< 29,000 Btu/h	2.36		
				≥ 29,000 Btu/h and < 65,000 Btu/h	2.26		
				≥ 65,000 Btu/h	2.16		
		Glycol cooled	Ducted	< 29,000 Btu/h	1.97	75°F/52°F (Class 1)	**AHRI 1360**
				≥ 29,000 Btu/h and < 65,000 Btu/h	1.93		
				≥ 65,000 Btu/h	1.78		
			Nonducted	< 29,000 Btu/h	2.00		
				≥ 29,000 Btu/h and < 65,000 Btu/h	1.98		
				≥ 65,000 Btu/h	1.81		
		Glycol cooled with fluid economizer	Ducted	< 29,000 Btu/h	1.92	75°F/52°F (Class 1)	**AHRI 1360**
				≥ 29,000 Btu/h and < 65,000 Btu/h	1.88		
				≥ 65,000 Btu/h	1.73		

	Nonducted	< 29,000 Btu/h	1.95		
		≥ 29,000 Btu/h and < 65,000	1.93		
		Btu/h	1.76		

For SI: 1 British thermal unit per hour = 0.2931 W, °C = (°F – 32)/1.8, COP = (Btu/h × hp)/(2,550.7).

a. **Chapter 6** contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#173 Renumbers equation.

Related Mods:

C403.3.2.1 Water-cooled centrifugal chilling packages. Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44.00°F leaving and 54.00°F entering chilled-fluid temperatures, and with 85.00°F entering and 94.30°F leaving condenser-fluid temperatures, shall have maximum full-load kW/ton (FL) and part- load rating requirements adjusted using the following equations:

$$FL_{adj} = FL/K_{adj}$$ Equation 4-5~~6~~

$$PLV_{adj} = IPLV.IP/K_{adj}$$ **Equation 4-6~~7~~**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#174 Adds a new Section C403.3.4.
It requires combustion air positive shutoff control, and fan motors larger than 10 hp require a variable speed drive or control rather than a modulated fan air flow. This change increase the stringency of the code. Adds a new subsection C403.3.4.1. Renumbers Section C403.3.4.

Related Mods:

CEPI-97-21, CED1-158-22

C403.3.4 Boilers. Boiler systems shall comply with the following:

1. Combustion air positive shutoff shall be provided on all newly installed boiler systems that meet one or more of the following conditions:
   1.1. The total input capacity is not less than 2,500,000 Btu/h (733 kW) and one or more of the boilers are designed to operate with a nonpositive vent static pressure.
   1.2. Any stack serving the *boiler system* is connected to two or more boilers with a total combined input capacity of not less than 2,500,000 Btu/h (733 kW).
2. Newly installed boilers or boiler systems with a combustion air fan motor *nameplate horsepower* rating of 10 horsepower (7.46 kW) or more shall comply with one of the following:
   2.1. The fan motor shall be variable speed.
   2.2. The fan motor shall include controls that modulate fan airflow as a function of the load to a speed 50 percent or less of design air volume.

C403.3.4.1 Boiler oxygen concentration controls. Newly installed boilers with an input capacity of 5,000,000 Btu/h (1465 kW) and steady state full-load less than 90 percent shall maintain stack-gas oxygen concentrations not greater than the values specified in **Table C403.3.4.1**. Combustion air volume shall be controlled with respect to measured flue gas oxygen concentration. The use of a common gas and combustion air control linkage or jack shaft is not permitted.

Exception: These concentration limits do not apply where 50 percent or more of the *boiler system* capacity serves Group R-2 occupancies.

~~C403.3.4~~ C403.3.4.2 **Boiler turndown.** *Boiler systems* with design input of greater than 1,000,000 Btu/h (293 kW) shall comply with the turndown ratio specified in **Table C403.3.4.2**.

The system turndown requirement shall be met through the use of multiple single-input boilers, one or more *modulating boilers* or a combination of single-input and *modulating boilers* .

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#175

Adds a new table C403.3.4.1.

Related Mods:

CEPI-97-21,

TABLE C403.3.4.1
BOILER OXYGEN CONCENTRATIONS

CED1-158-22	(continued)

BOILER APPLICATION	MAXIMUM STACK-GAS OXYGEN CONCENTRATION[a]
Commercial boilers or where ≤ 10% of the boiler system capacity is used for process applications at design conditions	5%
Process boilers	3%

a. Concentration levels measured by volume on a dry basis over firing rates of 20 to 100 percent. These concentration limits do not apply where 50 percent or more of the boiler system capacity serves Group R-2 occupancies.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#176

Renumbers Table C403.3.4.

Related Mods:

CEPI-97-21, CED1-158-22

~~TABLE C403.3.4~~ TABLE C403.3.4.2

BOILER TURNDOWN

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#177

Replaces the text "Each heating" with "Heating" and updates referenced section. Replaces the text "building envelope" with "building thermal envelope" in the exception.

Related Mods:

CEPI-99-21, CED1-92-22

C403.4 Heating and cooling system controls. ~~Each heating~~ Heating and cooling system shall be provided with controls in accordance with **Sections C403.4.1** through **C403.4.8**.

C403.4.1 Thermostatic controls. The supply of heating and cooling energy to each *zone* shall be controlled by individual thermostatic controls capable of responding to temperature within the *zone*. Where humidification or dehumidification or both is provided, not fewer than one humidity control device shall be provided for each humidity control system.

Exception: Independent perimeter systems that are designed to offset only *building thermal envelope* heat losses, gains or both serving one or more perimeter *zones* also served by an interior system provided that both of the following conditions are met:

C403.4.1.1 Heat pump supplementary heat. Heat pumps having supplementary electric resistance heat shall have controls that limit supplemental heat operation to only those times when one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the *thermostat* setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions.

	4. The *thermostat* malfunctions.		

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#178	Revises thermostat deadband requirements for zones with heating and cooling controls. Requires: separately adjustable cooling and heating set-points, minimum dead band range of 1°F (0.56°C), and capable of supporting a dead band range of 5°F (3°C). Also revises the exceptions. This requirement already exists and it is current technology in most products. The change may increase the stringency in some circumstances but is cost-effective.
Related Mods: CEC2D-6-23	**C403.4.1.2 Deadband.** Where used to control both heating and cooling, *zone* thermostatic controls shall: ~~be configured to provide a temperature range or deadband of not less than 5°F (2.8°C) within which the supply of heating and cooling energy to the *zone* is shut off or reduced to a minimum.~~ 1. Have separate setpoints for heating and cooling, each individually adjustable. 2. Be capable of and initially configured to provide a temperature range or deadband between the two setpoints of not less than 5°F (3°C) within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum. 3. Have a minimum deadband of not less than 1°F (0.56°C) when setpoints are adjusted. Exceptions: 1. *Thermostats* requiring *manual* changeover between heating and cooling modes. 2. Occupancies or applications where applicable codes or accreditation standards requiring precision in indoor temperature control ~~as *approved* by the *code official* .~~ shall be permitted to be initially configured to not less than 1°F (0.56°C) deadband. FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#179	Adds new Section C403.4.1.3. This is mainly a clarification but may increase the stringency in some circumstances. Renumbers Section C403.4.1.3 and revises the requirement that mechanical or software means must be used to prevent heating set-point and cooling set-point overlap. In some situation the stringency may increase. Renumbers Section C403.4.1.4. Renumbers Section C403.4.1.5.

| Related Mods:

CEC2D-6-23 | **C403.4.1.3 Setpoint adjustment and display.** Where thermostatic control setpoints are capable of being adjusted by occupants or HVAC system operators, the adjustment shall be independent for the heating setpoint and the cooling setpoint; when one setpoint is changed, the other shall not change except as needed to maintain the minimum deadband required by **Section C403.4.1.2**. For thermostatic controls that display setpoints, both the heating and cooling setpoints shall be displayed simultaneously, or the setpoint of the currently active mode (heating or cooling) shall be displayed along with an indication of that mode.

~~C403.4.1.3~~ C403.4.1.4 **Setpoint overlap restriction.** Where heating and cooling to a *zone* are controlled by ~~has a~~ separate ~~heating and a separate cooling~~ *zone* thermostatic ~~control~~ controls located within the *zone* , mechanical or software means shall be provided ~~a limit switch, mechanical stop or direct digital control system with software programming shall be configured~~ to prevent the heating setpoint from exceeding the cooling setpoint, minus the deadband required by ~~and to maintain a deadband in accordance with~~ **Section C403.4.1.2**.

~~C403.4.1.4~~ C403.4.1.5 **Heated or cooled vestibules.** The heating system for heated vestibules and air curtains with integral heating shall be provided with controls configured to shut off the source of heating when the outdoor air temperature is greater than 45°F (7°C). Vestibule heating and cooling systems shall be controlled by a *thermostat* located in the vestibule configured to limit heating to a temperature not greater than 60°F (16°C) and cooling to a temperature not less than 85°F (29°C).

Exception: Control of heating or cooling provided by site-recovered energy or transfer air that would otherwise be exhausted.

~~C403.4.1.5~~ C403.4.1.6 **Hot water boiler outdoor temperature setback control.** Hot water boilers that supply heat to the *building* through one- or two-pipe heating systems shall have an outdoor setback control that lowers the boiler water temperature based on the outdoor temperature.

Original text is not consistent with that of the 2023 FBC – EC

FSEC – Anticipated energy impact on FBC-EC – Decrease |
| **CE#180** | Renames the section and makes editorial changes for clarification.
The change exempts Dwelling and Sleeping units from the optimum start and stop requirement. The exemption may decrease the stringency. |

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

Related Mods: CEPI-100-21, CED1-160-22	**C403.4.2.3 ~~Automatic~~ Optimum start and stop.** ~~Automatic~~ Optimum start and stop controls shall be provided for each heating and cooling system with direct control of individual *zones* . ~~HVAC system.~~ The ~~automatic~~ optimum start controls shall be configured to automatically adjust the daily start time of the heating and cooling system ~~HVAC system~~ in order to bring each space to the desired occupied temperature immediately prior to scheduled occupancy. ~~Automatic stop controls shall be provided for each HVAC system with direct digital control of individual *zones*.~~ The ~~automatic~~ optimum stop controls shall be configured to reduce the heating and cooling ~~HVAC~~ system's heating temperature setpoint and increase the cooling temperature setpoint by not less than 2°F (1.11°C) before scheduled unoccupied periods based on the thermal lag and acceptable drift in space temperature that is within comfort limits. **Exception:** *Dwelling units* and *sleeping units* are not required to have optimum start controls. Original text is not consistent with that of the 2023 FBC – EC Staff Classification: — ; Correlates Directly: — ; Energy Standard Needed: — ; Over lap: X Action: AS: — ; AS/IC: — ; D: x ; D/IC: —
CE#181	Reserved
Related Mods: CEPI-99-21, CEC2D-1-23, CED1-161-22, CED1-164-22	C403.4.6 Reserved. Original text is not consistent with that of the 2023 FBC – EC Staff Classification: — ; Correlates Directly: — ; Energy Standard Needed: — ; Over lap: X Action: AS: — ; AS/IC: — ; D: x ; D/IC: —
CE#182	Renumbers Section C402.5.11, renames the section titled "Operable openings interlocking" and revises the provision. Reduces HVAC system disabling cut-out time to 5 minutes from 10 minutes. Adds six new exemptions.
Related Mods: CEPI-65-21, CED1-160-22	**~~C402.5.11~~ C403.4.7 ~~Operable openings interlocking.~~ Heating and cooling system controls for operable openings to the outdoors.** ~~Where occupancies utilize operable openings to~~ All doors from a *conditioned space* to the outdoors and all other operable openings from a *conditioned space* to the outdoors that are larger than 40 square feet (3.7 m^2) when fully open shall have *automatic* controls interlocked with the heating and cooling system. The controls shall be configured to do the following within 5 minutes of opening: ~~in area, such openings shall be interlocked with the heating and cooling system so as to raise the cooling setpoint to 90°F (32°C) and lower the heating setpoint to 55°F (13°C) whenever the operable opening is open. The change in heating and cooling setpoints shall occur within 10 minutes of opening the operable opening.~~

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1. Disable mechanical heating to the *zone* or reset the space heating temperature setpoint to 55°F (12.5°C) or less.
2. Disable mechanical cooling to the *zone* or reset the space cooling temperature setpoint to 90°F (32°C) or more. Mechanical cooling can remain enabled if the outdoor air temperature is below the space temperature.

Exceptions:

1. ~~Separately zoned areas associated with the preparation of food that contain appliances that contribute to the HVAC loads of a restaurant or similar type of occupancy.~~ *Building entrances* with *automatic* closingdevices.
2. Emergency exits with an *automatic* alarm that sounds when open.
3. Operable openings and doors serving *enclosed spaces* without a *thermostat* or heating or cooling temperature sensor.
4. Separately zoned areas associated with the preparation of food that contain appliances that contribute to the heating or cooling loads of a restaurant or similar type of occupancy.

~~2.~~ 5. Warehouses that utilize ~~overhead doors~~operable openings for the function of the occupancy, where *approved* by the *code official*.

~~3.~~ 6. The first *entrance doors* where located in the *exterior wall* and are part of a vestibule system.

7. Operable openings into spaces served by radiant heating and cooling systems.
8. *Alterations* where walls would have to be opened solely for the purpose of meeting this requirement and where *approved* .
9. Doors served by air curtains meeting the requirements of **Section C402.6.6**.

Original text is not consistent with that of the 2023 FBC – EC

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

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<tr>
<td>**CE#183**</td>
<td>Adds new Section C403.4.8 and three subsections. This change adds clarifications to humidity control requirements and allows lower relative humidity where mechanical cooling is used for temperature control. No impact on construction costs but may avoid simultaneous dehumidification and humidification process that reduces energy use. May decrease the stringency in some circumstances. Adds new Section C403.4.8.1. Adds new Section C403.4.8.2. Adds new Section C403.4.8.3.</td>
</tr>
<tr>
<td>Related Mods:</td>
<td>

C403.4.8 Humidification and dehumidification controls. Humidification and dehumidification controls shall be in accordance with this section.

C403.4.8.1 Dehumidification. *Humidistatic controls* shall not use mechanical cooling to reduce the humidity below the lower of a dew point of 55°F (13°C) or relative humidity of

60 percent in the coldest *zone* served by the system. Lower humidity shall be permitted where mechanical cooling is being used for temperature control.

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</table>

Exceptions:

1. Where approved, systems serving zones where specific humidity levels are required, such as museums and hospitals, and where *humidistatic controls* are capable of and configured to maintain a dead band of at least 10 percent relative humidity where no active humidification or dehumidification takes place.
2. Systems serving *zones* where humidity levels are required to be maintained with precision of not more than ±5 percent relative humidity to comply with applicable codes or accreditation standards or as *approved* by the authority having jurisdiction.

C403.4.8.2 Humidification. *Humidistatic controls* shall not use fossil fuels or electricity to produce relative humidity above 30 percent in the warmest *zone* served by the system.

Exceptions:

1. Where *approved* , systems serving *zones* where specific humidity levels are required, such as museums and hospitals, and where *humidistatic controls* are capable of and configured to maintain a deadband of at least 10 percent relative humidity where no active humidification or dehumidification takes place.
2. Systems serving *zones* where humidity levels are required to be maintained with precision of not more than ±5 percent relative humidity to comply with applicable codes or accreditation standards or as *approved* by the authority having jurisdiction.

C403.4.8.3 Control interlock. Where a *zone* is served by a system or systems with both humidification and dehumidification capability, means such as limit switches, mechanical stops, or for DDC systems, software programming, shall be provided capable of and configured to prevent simultaneous operation of humidification and dehumidification equipment.

Exception: Systems serving *zones* where humidity levels are required to be maintained with precision of not more than ±5 percent relative humidity to comply with applicable codes or accreditation standards or as *approved* by the authority having jurisdiction.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#184

Removes air-economizer exception for VRF systems installed with a dedicated outdoor air system(DOAS) but adds an air-economizer exemption for DX systems with multi stage compressor capacity less than 54 kBtuh used with DOAS. Reduces the stringency by adding exception for the most common used DX system types.

Related Mods:

C403.5 Economizers. Economizers shall comply with **Sections C403.5.1** through **C403.5.5**.

An air or *water economizer* shall be provided for the following cooling systems:

CEPI-103-21	3. 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. Individual *fan systems* not served by chilled water for buildings located in Climate Zones 0A, 0B, 1A and 1B. 2. 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. 3. Systems expected to operate less than 20 hours per week. 4. Systems serving supermarket areas with open refrigerated casework. 5. Where the cooling efficiency is greater than or equal to the efficiency requirements in Table C403.5(2). 6. Systems that include a heat recovery system in accordance with **Section C403.11.5**. 7. ~~VRF systems installed with a *dedicated outdoor air system* .~~ Direct-expansion fan coils or unitary equipment with a capacity less than 54,000 Btu/h (15.8 kW) and multiple stages of compressor capacity installed with a dedicated outdoor air system. Original text is not consistent with that of the 2023 FBC – EC Staff Classification: Correlates Directly [ ], Energy Standard Needed [ ], Over lap [X] Action: AS [ ], AS/IC [ ], D [x], D/IC [ ]
CE#185	Revised the provision to clarify how to relieve excess outdoor air during economizer operation when the building is pressurized. Two options are provided that add to design flexibility.
Related Mods: CEPI-106-21	**C403.5.3.4 Relief of excess outdoor air.** ~~Systems shall be capable of relieving~~ Systems shall provide one of the following means to relieve excess outdoor air during *air economizer* operation to prevent overpressurizing the *building* . ~~The relief air outlet shall be located to avoid recirculation into the *building* .~~ 1. Return or relief fan(s) meeting the requirements of **Section C403.11.1**. 2. A barometric or motorized damper relief path with a total pressure drop at a design relief airflow rate less than 0.10 inches water column (25 Pa) from the occupied space to the outdoors. Design relief airflow rate shall be the design supply airflow rate minus any continuous exhaust flows, such as toilet exhaust fans, whose makeup is provided by the economizer system. The relief air outlet shall be located to avoid recirculation into the building. Staff Classification: Correlates Directly [X], Energy Standard Needed [ ], Over lap [ ] Action: AS [ ], AS/IC [ ], D [x], D/IC [ ]
CE#186	Revised the minimum airflow requirement for VAV systems.

For the DDC systems the minimum flow can be sized using the ASHRAE 62.1 minimum ventilation requirement per the Simplified Ventilation Procedure. The modification provides design flexibility and in some cases may reduce energy cost.

Related Mods:

CEPI-107-21

C403.6 Requirements for mechanical systems serving multiple zones. Sections C403.6.1 through **C403.6.9** shall apply to mechanical systems serving multiple *zones* .

C403.6.1 Variable air volume and multiple-zone systems. Supply air systems serving multiple *zones* shall be variable air volume (VAV) systems that have *zone* controls configured to reduce the volume of air that is reheated, recooled or mixed in each *zone* to one of the following:

1. ~~Twenty~~ Thirty percent of the *zone* design peak supply for systems with *direct digital control* (DDC)~~and 30 percent for other systems~~.
2. Systems with DDC where all of the following apply:
   2.1. The airflow rate in the deadband between heating and cooling does not exceed ~~20 percent of the *zone* design peak supply rate or higher~~ the highest of the allowed rates under Items 3, 4, ~~and~~ 5 or 6 of this section.
   2.2. The first stage of heating modulates the *zone* supply air temperature setpoint up to a maximum setpoint while the airflow is maintained at the deadband flow rate.
   2.3. The second stage of heating modulates the airflow rate from the deadband flow rate up to the heating maximum flow rate that is less than 50 percent of the *zone* design peak supply rate.
3. The outdoor airflow rate required to meet the minimum *ventilation* requirements of **Chapter 4** of the *International Mechanical Code*.
4. The minimum primary airflow rate required to meet the Simplified Procedure *ventilation* requirements of **ASHRAE 62.1** for the zone and is permitted to be the average airflow rate as allowed by **ASHRAE 62.1**.

~~4.~~ 5. Any higher rate that can be demonstrated to reduce overall system annual energy use by offsetting reheat/recool energy losses through a reduction in outdoor air intake for the system as *approved* by the *code official*.

5. 6. The airflow rate required to comply with applicable codes or accreditation standards such as pressure relationships or minimum air change rates.

Original text is not consistent with that of the 2023 FBC – EC

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#187

Replaces referenced code Sections "C403.7.1 through C403.7.7" with "C403.7.1 through C403.7.9." Revised demand control ventilation (DCV) requirements. Modified the minimum floor area threshold for the DCV requirement by climate zones.
Spaces served with heat recovery exemptions are now based on climate zone and floor area; the exception now applies to small floor areas only and is, hence, more restrictive. Increase the DCV stringency for climate zone 1A and 2A.

Also, adds one new exception: ventilation system design professional engineers prevent the maximum limit of contaminant concentration from being higher than that obtainable by the required outdoor ventilation rate and maintain a ventilation threshold of 15% or higher.

Related Mods:

C403.7.1 Demand control ventilation. Demand control ventilation (DCV) shall be provided for all single-zone systems required to comply with Sections C403.5 through C403.5.3 and spaces ~~larger than 500 square feet (46.5 m^2) and with an average occupant load of 15 people~~

~~or greater per 1,000 square feet (93 m^2) of floor area, as established in Table 403.3.1.1 of the~~ ~~*International Mechanical Code*, and served by systems with one or more of~~ the following:

1. ~~An air-side economizer.~~ Spaces with *ventilation* provided by single-zone systems where an air-side economizer is provided in accordance with **Section C403.5**.
2. Spaces larger than 250 square feet (23 m^2) in Climate Zones 5A, 6, 7, and 8 and spaces larger than 500 square feet (46.5 m^2) in other *climate zones* that have a design occupant load of 15 people or greater per 1,000 square feet (93 m^2) of floor area, as established in **Table 403.3.1.1** of the *International Mechanical Code*, and are served by systems with one or more of the following:
   - 2.1. An air-side economizer.
   - 2.2. *Automatic* modulating control of the outdoor air damper.
   - 2.3. A design outdoor airflow greater than 3,000 cfm (1416 L/s).

~~2. *Automatic* modulating control of the outdoor air damper.~~
~~3. A design outdoor airflow greater than 3,000 cfm (1416 L/s).~~

Exceptions:

1. ~~Systems~~ Spaces served by systems with energy recovery in accordance ~~complying~~ with **Section C403.7.4.2** and that have a floor area less than:.
   - 1.1. 6,000 square feet (557 m^2) in Climate Zone 3C.
   - 1.2. 2,000 square feet (186 m^2) in Climate Zones 1A, 3B and 4B.
   - 1.3. 1,000 square feet (93 m^2) in Climate Zones 2A, 2B, 3A, 4A, 4C, 5 and 6.
   - 1.4. 400 square feet (37 m^2) in Climate Zones 7 and 8.
2. Multiple-zone systems without *direct digital control* of individual zones communicating with a central control panel.
3. Spaces served by ~~Multiple~~ multiple-zone systems with a design outdoor airflow less than 750 cfm (354 L/s).
4. Spaces where more than 75 percent of the space design outdoor airflow is required for makeup air that is exhausted from the space or transfer air that is required for makeup air that is exhausted from other spaces.
5. Spaces with one of the following occupancy classifications as defined in **Table 403.3.1.1** of the *International Mechanical Code*: correctional cells, education laboratories, barber, beauty and nail salons, and bowling alley seating areas.
6. Spaces where the *registered design professional* demonstrates an engineered ventilation system design that:
   - 6.1. Prevents the maximum concentration of contaminants from being more than that obtainable by the required rate of outdoor air *ventilation* .
   - 6.2. Allows the required minimum design rate of outdoor air to be reduced by not less than 15 percent.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#188

Renamed the title of Section C403.7.2, and revised the provision to comply with Section C404.1 of IMC. Also modified the exception to be based on the fan motor power instead of the ventilation flow rate.

Related Mods:

CECPI-6-21, CED1-166-22

FBC C403.2.6.2

C403.7.2 ~~Enclosed parking~~ Parking garage ventilation controls. ~~Enclosed parking garages used for storing or handling automobiles operating under their own power shall employ carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors and automatic controls configured to stage fans or modulate fan average airflow rates to 50 percent or less of design capacity, or intermittently operate fans less than 20 percent of the occupied time or as required to maintain acceptable contaminant levels in accordance with International Mechanical Code provisions. Failure of contamination-sensing devices shall cause the exhaust fans to operate continuously at design airflow.~~ Ventilation systems employed in enclosed parking garages shall comply with **Section 404.1** of the *International Mechanical Code* and the following:

1. Separate ventilation systems and control systems shall be provided for each *parking garage section*.
2. Control systems for each *parking garage section* shall be capable of and configured to reduce fan airflow to not less than 0.05 cfm per square foot [0.00025 $m^3/(s \times m^2)$] of the floor area served and not more than 20 percent of the design capacity.
3. The ventilation system for each *parking garage section* shall have controls and devices that result in fan motor demand of not more than 30 percent of design wattage at 50 percent of the design airflow.

Exception~~s~~: Garage ventilation systems serving a single *parking garage section* having a total ventilation system motor *nameplate horsepower* (ventilation system motor nameplate kilowatt) not exceeding 5 hp (3.7 kW) at *fan system design conditions* and where the *parking garage section* has no mechanical cooling or mechanical heating.

~~1. Garages with a total exhaust capacity less than 8,000 cfm (3,755 L/s) with ventilation systems that do not utilize heating or mechanical cooling.~~

~~2. Garages that have a garage area to ventilation system motor nameplate power ratio that exceeds 1,125 cfm/hp (710 L/s/kW) and do not utilize heating or mechanical cooling.~~

Nothing in this section shall be construed to require more than one *parking garage section* in any parking structure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

<table>
<tr><td></td><td></td></tr>
<tr><td>CE#189</td><td>Adds new exception: "Units that heat the airstream using only series energy recovery when representative building loads or outdoor air temperature indicates that the majority of zones require cooling in Climate Zones 0A, 1A, 2A, 3A, and 4A.”</td></tr>
<tr><td>Related Mods:

CEPI-112-21</td><td>
C403.7.3 Ventilation air heating control. Units that provide ventilation air to multiple zones and operate in conjunction with zone heating and cooling systems shall not use heating or heat recovery to warm supply air to a temperature greater than 60°F (16°C) when representative building loads or outdoor air temperatures indicate that the majority of zones require cooling.
Exception: Units that heat the airstream using only series energy recovery when representative building loads or outdoor air temperature indicates that the majority of zones require cooling in Climate Zones 0A, 1A, 2A, 3A and 4A.
Original text is not consistent with that of the 2023 FBC – EC
<table>
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<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
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<tr><td>CE#190</td><td>Revised the subsection to include sensible recovery efficiency (SRE) and net moisture transfer (NMT) requirements as an alternative to enthalpy recovery ratio requirement. Revises two existing exceptions. Exception item #4 only applies to climate zones 5 through 8. Exception item #7 only applies to climate zones 0 through 4 and has a minimum SERR value of 0.4.</td></tr>
<tr><td>Related Mods:

CEPI-113-21, CECD1-25-22, CED1-167-22</td><td>
C403.7.4 Energy recovery systems. Energy recovery ventilation systems shall be provided as specified in either Section C403.7.4.1 or C403.7.4.2, as applicable.
C403.7.4.1 Nontransient dwelling units. Nontransient dwelling units shall be provided with outdoor air energy recovery ventilation systems complying with <s>an enthalpy recovery ratio of</s> not less than <s>50 percent at cooling design condition and not less than 60 percent at heating design condition.</s> one of the following:

The system shall have an enthalpy recovery ratio of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.
The system shall have a sensible recovery efficiency (SRE) that is not less than 65 percent at 32°F (0°C) and in Climate Zones 0A, 1A, 2A and 3A shall have a net moisture transfer (NMT) that is not less than 40 percent at 95°F (35°C). SRE and NMT shall be determined from a listed value or from interpolation of listed values at an airflow not less than the design airflow, based on testing in accordance with CAN/CSA C439.

Exceptions:

Nontransient dwelling units in Climate Zone 3C.
Nontransient dwelling units with not more than 500 square feet (46 m^2) of conditioned floor area in Climate Zones 0, 1, 2, 3, 4C and 5C.
Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1 and 2.
Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 4, 5, 6, 7 and 8.

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	Original text is not consistent with that of the 2023 FBC – EC	<table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td></td><td></td><td>X</td></tr></table><table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table>
CE#191	Revises two existing exceptions. Exception item #4 only applies to climate zones 5 through 8. Exception item #7 only applies to climate zones 0 through 4 and has a minimum SERR value of 0.4.	
Related Mods: CEPI-116-21	**C403.7.4.2 Spaces other than nontransient dwelling units.** Where the supply airflow rate of a *fan system* serving a space other than a nontransient dwelling unit exceeds the values specified in **Tables C403.7.4.2(1)** and **C403.7.4.2(2)**, the system shall include an energy recovery system. The energy recovery system shall provide an *enthalpy recovery ratio* of not less than 50 percent at design conditions. Where an *air economizer* is required, the energy recovery system shall include a bypass or controls that permit operation of the economizer as required by **Section C403.5**. **Exception:** An *energy recovery ventilation system* shall not be required in any of the following conditions: 1. Where energy recovery systems are prohibited by the ***International Mechanical Code*** . 2. Laboratory fume hood systems that include not fewer than one of the following features: 2.1. Variable-air-volume hood exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values. 2.2. Direct makeup (auxiliary) air supply equal to or greater than 75 percent of the exhaust rate, heated not warmer than 2°F (1.1°C) above room setpoint, cooled to not cooler than 3°F (1.7°C) below room setpoint, with no humidification added, and no simultaneous heating and cooling used for dehumidification control. 3. Systems serving spaces that are heated to less than 60°F (15.5°C) and that are not cooled. 4. Heating energy recovery where ~~Where~~ more than 60 percent of the outdoor heating energy is provided from site-recovered or site-solar energy in Climate Zones 5 through 8. 5. *Enthalpy recovery ratio* requirements at heating design condition in Climate Zones 0, 1 and 2. 6. *Enthalpy recovery ratio*requirements at cooling design condition in Climate Zones 3C, 4C, 5B, 5C, 6B, 7 and 8. 7. Systems in Climate Zones 0 through 4 requiring dehumidification that employ series energy recovery ~~in series with the cooling coil~~and have a minimum SERR of 0.40. 8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design *outdoor air*flow rate. 9. Systems expected to operate less than 20 hours per week at the *outdoor air*percentage covered by **Table C403.7.4.2(1)**. 10. Systems exhausting toxic, flammable, paint or corrosive fumes or dust. 11. Commercial kitchen hoods used for collecting and removing grease vapors and smoke Original text is not consistent with that of the 2023 FBC – EC	<table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td></td><td></td><td>X</td></tr></table><table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>X</td><td></td></tr></table>

CE#192	Clarifies the provision to require demand control ventilation (DCKV) for Kitchen exhaust hood systems serving Type I only. Revised an existing exception and added a new exception, “An energy recovery ventilation system installed on the kitchen exhaust with a sensible heat recovery effectiveness of ≥ 40 percent on not less than 50 percent of the total exhaust hood airflow.” No change in stringency.
Related Mods: CEPI-9-21 FBC – C403.2.8	**C403.7.5 Kitchen exhaust systems.** Replacement air introduced directly into the exhaust hood cavity shall not be greater than 10 percent 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. Kitchen exhaust hood systems serving Type I exhaust hoods shall be provided with *demand control kitchen ventilation* (DCKV) controls where a kitchen or kitchen/dining facility has a total Type I kitchen hood exhaust airflow rate greater than 5,000 cubic feet per minute (2360 L/s). DCKV systems shall be configured to provide a minimum of 50 percent reduction in exhaust and replacement air system airflow rates. Systems shall include controls necessary to modulate exhaust and replacement air system airflows in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle operation. Each hood shall be a factory-built commercial exhaust hood *listed* by a nationally recognized testing laboratory and shall have a maximum exhaust rate as specified in **Table C403.7.5**. ~~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 percent of all replacement air shall be transfer air that would otherwise be exhausted.~~ ~~2. Demand ventilation systems on not less than 75 percent of the exhaust air that are configured to provide not less than a 50-percent 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.~~ ~~3. *Listed* energy recovery devices with a sensible heat recovery effectiveness of not less than 40 percent on not less than 50 percent of the total exhaust airflow.~~ Where a single hood, or hood section, is installed over appliances with different duty ratings, the maximum allowable flow rate for the hood or hood section shall be based on the requirements for the highest appliance duty rating under the hood or hood section.

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Exceptions:

1. ~~Where not less than 75 percent of all the replacement air is transfer air that would otherwise be exhausted.~~ **UL 710** listed exhaust hoods that have a design maximum exhaust flow rate not greater than 250 cubic feet per minute (118 L/s) per linear foot (305 mm) of hood that serve kitchen or kitchen/dining facilities with a total kitchen hood exhaust airflow rate less than 5,000 cfm (2360 L/s).
2. Where allowed by the ***International Mechanical Code***, an *energy recovery ventilation system* is installed on the kitchen exhaust with a sensible heat recovery effectiveness of not less than 40 percent on not less than 50 percent of the total exhaust hood airflow.

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<tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr>
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<td>CE#193</td>
<td>Deletes the text “Card key controls comply with these requirements.”</td>
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<td>Related Mods:

CEPI-169-21</td>
<td>
C403.7.6 Automatic control of HVAC systems serving guestrooms. In Group R-1 buildings containing more than 50 guestrooms, each guestroom shall be provided with controls complying with the provisions of Sections C403.7.6.1 and C403.7.6.2. ~~Card key controls comply with these requirements.~~

Original text is not consistent with that of the 2023 FBC – EC

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<tr>
<td>CE#194</td>
<td>Made editorial changes by adding the texts “elevator”, “or by thermostatic control systems”, and deleting the text “or” for clarity.</td>
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<td>Related Mods:

CEPI-118-21

FBC C403.2.4.3</td>
<td>
C403.7.7 Shutoff dampers. Outdoor air intake and exhaust openings and stairway and shaft vents shall be provided with Class I motorized dampers. The dampers shall have an air leakage rate not greater than 4 cfm/ft ^{2}(20.3 L/s × m^2) of damper surface area at 1.0 inch water gauge (249 Pa) and shall be labeled by an approved agency when tested in accordance with AMCA 500D for such purpose.

Outdoor air intake and exhaust dampers shall be installed with automatic controls configured to close when the systems or spaces served are not in use or during unoccupied period warm-up and setback operation, unless the systems served require outdoor or exhaust air in accordance with the International Mechanical Code or the dampers are opened to provide intentional economizer cooling.

Stairway and elevator shaft vent dampers shall be installed with automatic controls configured to open upon the activation of any fire alarm initiating device of the building’s fire alarm system, ~~or~~ the interruption of power to the damper, or by thermostatic control systems.
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Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#195

Adds a new Section C403.7.8.

Occupied standby controls are required in the following space types: postsecondary classrooms, lecture rooms, and training rooms; Conference/meeting/multipurpose rooms; Lounges/breakrooms; Enclosed offices; Open-plan office areas; and Corridors.

The change incurs minimal or no construction cost increase while reduces lighting and fan power energy. This change is cost-effective and already included in the 2022 ASHRAE 90.1 code.
Adds new subsection C403.7.8.1. Adds new subsection C403.7.8.1.1.

Related Mods:

CEPI-108-21, CED1-168-22, CE2D-24-23

C403.7.8 Occupied standby controls. The following spaces shall be equipped with occupied standby controls in accordance with **Section C403.7.8.1** for each ventilation zone:

1. Postsecondary classrooms, lecture rooms and training rooms.
2. Conference/meeting/multipurpose rooms.
3. Lounges/breakrooms.
4. Enclosed offices.
5. Open-plan office areas.
6. Corridors.

Exception: *Zones* that are part of a multiple-zone system without *automatic* zone flow control dampers.

C403.7.8.1 Occupied-standby zone controls. Within 5 minutes of all spaces in that *zone* entering *occupied-standby mode* , the *zone* control shall operate as follows:

1. The active heating setpoint shall be set back by not less than 1°F (0.55°C).
2. The active cooling setpoint shall be set up by not less than 1°F (0.55°C).
3. All airflow supplied to the *zone* shall be shut off whenever the space temperature is between the active heating and cooling setpoints.
4. Multiple-zone systems shall comply with **Section C403.7.8.1.1**.

C403.7.8.1.1 Multiple-zone system controls. Multiple-zone systems required to automatically reset the effective minimum outdoor air setpoint, per **Section C403.6.6**, shall reset the effective minimum outdoor air setpoint based on a *zone* outdoor air requirement of zero for all *zones* in *occupied-standby mode* . Sequences of operation for system outside air reset shall comply with an *approved* method.

	FSEC – Anticipated energy impact on FBC-EC – Decrease | Staff Classification | Correlates Directly | Energy Standard Needed | Over lap | | | X | | | | Action | AS | AS/IC | D | D/IC | | | | | x | |
CE#196	Adds a new Section C403.7.9. This change prohibits integrated central fan system design for ventilation air delivery.
Related Mods: CEPI-120-21	**C403.7.9 Dwelling unit ventilation system.** A fan that is the air mover for a heating or cooling system that serves an individual *dwelling unit* shall not be used to provide outdoor air. **Exception:** Where the fan efficacy is not less than 1.2 cubic feet per minute (0.56 L/s) of outdoor airflow per watt when there is no demand for heating or cooling. FSEC – Anticipated energy impact on FBC-EC – Decrease | Staff Classification | Correlates Directly | Energy Standard Needed | Over lap | | | X | | | | Action | AS | AS/IC | D | D/IC | | | | | x | | x
CE#197	Editorial changes for clarification.
Related Mods: CEPI-119-21, CECD1-17-22	**C403.8 Fans and fan controls.** Fans in HVAC systems shall comply with **Sections C403.8.1** through **C403.8.6.1**. **C403.8.1 Allowable fan horsepower.** ~~Each HVAC system having a total~~ Where the summed fan system motor *nameplate horsepower* on an HVAC *fan system* is greater than ~~exceeding~~ 5 hp (3.7 kW) at *fan system design conditions* , it shall not ~~exceed~~ be greater than the allowable total *fan system motor nameplate hp* (Option 1) or *fan system bhp* (Option 2), ~~shown~~ as specified in **Table C403.8.1(1)**. Such summed HVAC fan system motor *nameplate horsepower* shall include ~~This includes~~ supply fans, exhaust fans, return ~~/~~ or relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single-zone variable air volume systems shall comply with the constant volume fan power limitation. Exceptions: 1. Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation. 2. Individual exhaust fans with motor *nameplate horsepower* of 1 hp (0.746 kW) or less are exempt from the allowable fan horsepower requirement.

	Original text is not consistent with that of the 2023 FBC – EC | Staff Classification | Correlates Directly | Energy Standard Needed | Over lap | | | | | X | | Action | AS | AS/IC | D | D/IC | | | | | x | |
CE#198	Editorial changes for clarification.
Related Mods: FBC C403.2.12.4	**C403.8.4 Fractional hp fan motors.** Motors for fans that are not less than $^{1}/_{12}$ hp (0.062 kW) and are less than 1 hp (0.746 kW) shall be electronically commutated motors or shall have a minimum motor efficiency of 70 percent, rated in accordance with **DOE 10 CFR 431**. These motors shall have the means to adjust motor speed for either balancing or remote control. The use of belt-driven fans to sheave adjustments for airflow balancing instead of a varying motorspeed shall be permitted. | Staff Classification | Correlates Directly | Energy Standard Needed | Over lap | | | X | | | | Action | AS | AS/IC | D | D/IC | | | x | | | |
CE#199	Revises Section C403.8.5 for clarity, adds three new exceptions that preempts the federal regulations and aligns the section with ASHRAE 90.1 and Energy Star requirements. No change in stringency.
Related Mods: CEPI-121-21 FBC C403..2.12.7	**C403.8.5 Low-capacity ventilation fans.** Mechanical ventilation system fans with motors less than $^{1}/_{12}$ hp (0.062 kW) in capacity shall meet the efficacy requirements of **Table C403.8.5** at one or more rating points. Airflow shall be tested in accordance with the test procedure referenced in **Table C403.8.5** and *listed* . The airflow shall be reported in the product listing or on the label. Fan efficacy shall be reported in the product listing or shall be derived from the input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV, ERV, balanced and in-line fans shall be determined at a static pressure not less than 0.2 inch w.c. (49.8 Pa). Fan efficacy for ducted range hoods, bathroom and utility room fans shall be determined at a static pressure not less than 0.1 inch w.c. (24.9 Pa). Exceptions: 1. Where ventilation fans are a component of a *listed* heating or cooling appliance. 2. Dryer exhaust *duct* power ventilators, domestic range hoods and domestic range booster fans that operate intermittently. 3. Fans in radon mitigation systems. 4. Fans not covered within the scope of the test methods referenced in **Table C403.8.5**. 5. Ceiling fans regulated under **10 CFR 430, Appendix U**. | Staff Classification | Correlates Directly | Energy Standard Needed | Over lap | | | X | | | | Action | AS | AS/IC | D | D/IC | | | | | x | |

CE#200	Updates Table C403.8.5 by adding test procedure by system type. Adds new system type category and edits the footnote.
Related Mods: CEPI-121-21	TABLE C403.8.5 **LOW-CAPACITY VENTILATION FAN**

SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/ WATT)	TEST PROCEDURE
Balanced ventilation system without heat or energy recovery	Any	1.2[a]	ASHRAE Standard 51 (ANSI/AMCA Standard 210)
HRV, ERV	Any	1.2	CAN/CSA 439
Range hood	Any	2.8	ASHRAE 51 (ANSI/AMCA Standard 210)
In-line supply or exhaust fan	Any	3.8	
Other exhaust fan	≤ 90	2.8	
	≥ 90 and < 200	3.5	
	≥ 200	4.0	

For SI: 1 cfm/ft = 0.47 L/s.

a. For balanced systems, HRVs and ERVs, determine the efficacy as the outdoor airflow divided by the total fan power.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#201	Adds new Section C403.8.6.2. This change make increase construction cost but reduce energy cost by reducing the fan runtime and avoid increasing the infiltration of outside air.
Related Mods: CEPI-123-21	**C403.8.6.2 Intermittent exhaust control for bathrooms and toilet rooms.** Where an exhaust system serving a bathroom or toilet room is designed for intermittent operation, the exhaust system shall be provided with *manual* on capability and one or more of the following controls: 1. A timer control that has a minimum setpoint not greater than 30 minutes.

	2. An *occupant sensor control* that automatically turns off exhaust fans within 30 minutes after all occupants have left the space. 3. A humidity control capable of *manual* or *automatic* adjustment from a minimum setpoint not greater than 50 percent to a maximum setpoint not greater than 80 percent relative humidity. 4. A contaminant control that responds to a particle or gaseous concentration. **Exception:** Bathroom and toilet room exhaust systems serving as an integral component of an outdoor air ventilation system in Group R-2, R-3 and R-4 occupancies shall not be required to provide controls other than *manual* on capability. An off setpoint shall not be used to comply with a minimum setpoint requirement. Staff Classification: Correlates Directly: X; Energy Standard Needed: ; Over lap: Action: AS: x; AS/IC: ; D: ; D/IC:
CE#202	Revised Section C403.9. Adds minimum efficiency requirement based on current technology in the market. The change has no impact on the construction cost. Adds new subsection C403.9.1.
Related Mods: CEPI-124-21	**C403.9 Large-diameter ceiling fans.** Where provided, *large-diameter ceiling fans* shall be tested and *labeled* in accordance with **AMCA 230** and shall meet the efficiency requirements of **Table C403.9** and **Section C403.9.1**. **C403.9.1 Ceiling Fan Energy Index (CFEI).** The Ceiling Fan Energy Index shall be calculated as the ratio of the electric input power of a reference *large-diameter ceiling fan* to the electric input power of the actual *large-diameter ceiling fan* as calculated in accordance with **AMCA 208** with the following modifications to the calculations for the reference fan: using an airflow constant (Q) of 26,500 cfm (12.5 m^3/s), a pressure constant (P) of 0.0027 inch of water (0.6719 Pa), and fan efficiency constant (η) of 42 percent. Staff Classification: Correlates Directly: X; Energy Standard Needed: ; Over lap: Action: AS: x; AS/IC: ; D: ; D/IC:
CE#203	Adds new Table C403.9.
Related Mods: CEPI-124-21	TABLE C403.9 **CEILING FAN EFFICIENCY REQUIREMENTS[a]**

TABLE C403.9 CEILING FAN EFFICIENCY REQUIREMENTS[a]

EQUIPMENT TYPE	MINIMUM EFFICIENCY[b, c]	TEST PROCEDURE
Large-diameter ceiling fan for applications outside the US[c]	CFEI ≥ 1.00 at high (maximum) speed CFEI ≥ 1.31 at 40% of high speed or the nearest speed that is not less than 40% of high speed	**10 CFR 430, Appendix U** or **AMCA 230** and **AMCA 208** (for FEI calculations)

Staff Classification

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Large-diameter ceiling fan	CFEI ≥ 1.00 at high (maximum) speed; and CFEI ≥ 1.31 at 40% of high speed or the nearest speed that is not less than 40% of high speed	**10 CFR 430, Appendix U**

a. The minimum efficiency requirements at both high speed and 40% of maximum speed shall be met or exceeded to comply with this code.
b. Ceiling fans are regulated as consumer products by **10 CFR 430**.
c. **Chapter 6** contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#204

Adds new Section C403.10. The changes require new construction condensing boiler to reach 90.0% efficiency levels. The changes increase the code stringency but is cost-effective. Adds new subsection C403.10.1. Adds new subsection C403.10.2.

Related Mods:

CEPI-77-21

C403.10 Buildings with high-capacity space-heating gas boiler systems. Gas hot water boiler systems for space heating with system input capacities of not less than 1,000,000 Btu/h (293 kW) and not greater than 10,000,000 Btu/h (2931 kW) in new buildings shall comply with **Sections C403.10.1** and **C403.10.2**.

Exceptions:

1. Where 25 percent of the annual space heating requirement is provided by *on-site renewable energy* , site-recovered energy or heat recovery chillers.
2. Space heating boilers installed in individual *dwelling units* .
3. Where 50 percent or more of the design heating load is served using perimeter convective heating, radiant ceiling panels or both.
4. Individual gas boilers with input capacity less than 300,000 Btu/h (88 kW) shall not be included in the calculations of the total system input or total system efficiency.

C403.10.1 Boiler efficiency. Gas hot water boilers shall have a thermal efficiency (E_t) of not less than 90 percent where rated in accordance with the test procedures in **Table C403.3.2(6)**. Systems with multiple boilers are allowed to meet this requirement where the space heating input provided by equipment with E_t above or below 90 percent provides an input capacity-weighted average E_t of not less than 90 percent. For boilers rated only for combustion efficiency, the calculation for the input capacity-weighted average E_t shall use the combustion efficiency value.

C403.10.2 Hot water distribution system design. The hot water distribution system shall be designed to meet the following:

1. Coils and other heat exchangers shall be selected so that at design conditions the hot water return temperature entering the boilers is 120°F (49°C) or less.

	2. Under all operating conditions, the water temperature entering the boiler is not greater than 120°F (49°C) or the flow rate of supply hot water that recirculates directly into the return system, such as by three-way valves or minimum flow bypass controls, shall be not greater than 20 percent of the design flow of the boilers. FSEC – Anticipated energy impact on FBC-EC – Decrease Staff Classification: Correlates Directly X; Energy Standard Needed; Over lap Action: AS x; AS/IC; D; D/IC
CE#205	Renumbers Section C403.10. Renumbers C403.10.1 through C403.10.5.
Related Mods: FBC C403.4>3	~~C403.10~~ C403.11 **Heat rejection equipment.** Heat rejection equipment, including air-cooled condensers, dry coolers, open-circuit cooling towers, closed-circuit cooling towers and evaporative condensers, shall comply with this section. **Exception:** Heat rejection devices where energy usage is included in the equipment efficiency ratings listed in **Tables C403.3.2(6)** and **C403.3.2(7)**. ~~C403.10.1~~ C403.11.1 **Fan speed control.** Each *fan system* powered by an individual motor or array of motors with connected power, including the motor service factor, totaling 5 hp (3.7 kW) or more shall have controls and devices configured to automatically modulate the fan speed to control the leaving fluid temperature or condensing temperature and pressure of the ~~C403.10.2~~ C403.11.2 **Multiple-cell heat rejection equipment.** Multiple-cell heat rejection equipment with variable speed fan drives shall be controlled to operate the maximum number of fans allowed that comply with the manufacturer's requirements for all system components and so that all fans operate at the same fan speed required for the instantaneous cooling duty, as opposed to staged on and off operation. The minimum fan speed shall be the minimum allowable speed of the fan drive system in accordance with the manufacturer's recommendations. ~~C403.10.3~~ C403.11.3 **Limitation on centrifugal fan open-circuit cooling towers.** Centrifugal fan open-circuit cooling towers with a combined rated capacity of 1,100 gpm (4164 L/m) or greater at 95°F (35°C) condenser water return, 85°F (29°C) condenser water supply, and 75°F (24°C) outdoor air wet-bulb temperature shall meet the energy efficiency requirement for axial fan open-circuit cooling towers listed in **Table C403.3.2(7)** . ~~C403.10.4~~ C403.11.4 **Tower flow turndown.** Open-circuit cooling towers used on water- cooled chiller systems that are configured with multiple- or variable-speed condenser water pumps shall be designed so that all open-circuit cooling tower cells can be run in parallel with the larger of the flow that is produced by the smallest pump at its minimum expected flow rate or at 50 percent of the design flow for the cell. ~~C403.10.5~~ C403.11.5 **Heat recovery for service water heating.** **Original text of mod is not consistent with that of the FBC-EC.** Staff Classification: Correlates Directly; Energy Standard Needed; Over lap X Action: AS; AS/IC; D x; D/IC

CE#206	Renumbers Section C403.10.6, revises the provision to clarify the heat recovery implementation, and updates exception item #1. This change neither impacts the stringency nor impacts the construction cost.
Related Mods: CECD1-13-22	~~**C403.10.6**~~ **C403.11.6 Heat recovery for space conditioning in health care facilities.** Where heated water is used for space heating, a heat pump chiller meeting the requirements of **Table C403.3.2(15)** for ~~condenser~~ heat recovery ~~system shall be installed provided that all of~~ and that uses the cooling system return water as the heat source shall be installed where the following are true: 1. The *building* is a Group I-2, Condition 2 occupancy. 2. The total design chilled water capacity for the Group I-2,Condition 2 occupancy, either air cooled or water cooled, required at cooling design conditions exceeds 3,600,000 Btu/h (1100 kw) of cooling. 3. Simultaneous heating, including reheat, and cooling occurs above 60°F (16°C) outdoor air temperature. The ~~required~~ heat recovery system shall have a cooling capacity ~~that is~~of not less than 7 percent of the total design chilled water capacity of the Group I-2, Condition 2 occupancy at peak design conditions. Exceptions: 1. Buildings that provide 60 percent or more of their reheat energy from *on-site renewable energy* or other site-recovered energy. *On-site renewable energy* used to meet **Section C405.15.1** or **C406.3.1** shall not be used to meet this exception. 2. Buildings in Climate Zones 5C, 6B, 7 and 8. **Original text of mod is not consistent with that of the FBC-EC.** Staff Classification | Correlates Directly | Energy Standard Needed | Over lap: X Action | AS | AS/IC | D | D/IC: D = x
CE#207	Renumbers Section C403.11. Renumbers Section C403.11.1. Renumbers Table C403.11.1. Renumbers Section C403.11.2. Renumbers Section C403.11.2.1.
Related Mods: CED1-156-22 FBC C403.2.4	~~**C403.11**~~ **C403.12 Refrigeration equipment performance.** Refrigeration equipment performance shall be determined in accordance with **Sections C403.12.1** and **C403.12.2** for commercial refrigerators, freezers, refrigerator-freezers, *walk-in coolers* , *walk-in freezers* and refrigeration equipment. The energy use shall be verified through certification under an *approved*certification program or, where a certification program does not exist, the energy use shall be supported by data furnished by the equipment manufacturer. **Exception:** *Walk-in coolers* and *walk-in freezers* regulated under federal law in accordance with Subpart R of **DOE 10 CFR 431**. ~~**C403.11.1**~~ **C403.12.1 Commercial refrigerators, refrigerator-freezers and refrigeration.** Refrigeration equipment, defined in **DOE 10 CFR Part 431.62**, shall have an energy use in kWh/day not greater than the values of **Table C403.12.1** when tested and rated in accordance with **AHRI Standard 1200**. ~~**TABLE C403.11.1**~~ **TABLE C403.12.1** **MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL REFRIGERATORS AND FREEZERS AND REFRIGERATION**

For SI: 1 square foot = 0.0929 m^2, 1 cubic foot = 0.02832 m^3, °C = (°F – 32)/1.8.

a. The meaning of the letters in this column is indicated in the columns to theleft.
b. Ice cream freezer is defined in **DOE 10 CFR 431.62** as a commercial freezer that is designed to operate at or below -5 °F and that the manufacturer designs, markets or intends for the storing, displaying or dispensing of ice cream.
c. Equipment class designations consist of a combination [in sequential order separated by periods (AAA).(BB).(C)] of the following:

- (AAA)—An equipment family code (VOP = vertical open, SVO = semivertical open, HZO = horizontal open, VCT = vertical closed transparent doors, VCS = vertical closed solid doors, HCT = horizontal closed transparent doors, HCS = horizontal closed solid doors, and SOC = service over counter);
- (BB)—An operating mode code (RC = remote condensing and SC = self-contained); and
- (C)—A rating temperature code [M = medium temperature (38°F), L = low temperature (0°F), or I = ice cream temperature (-15°F)].
- For example, "VOP.RC.M" refers to the "vertical open, remote condensing, medium temperature" equipment class.

d. V is the volume of the case (ft^3) as measured in **AHRI 1200**, AppendixC.
e. TDA is the total display area of the case (ft^2) as measured in **AHRI 1200**, Appendix D.

~~C403.11.2~~ C403.12.2 **Walk-in coolers and walk-in freezers.** *Walk-in cooler* and *walk-in freezer* refrigeration systems, except for walk-in process cooling refrigeration systems as defined in **DOE 10 CFR 431.302**, shall meet the requirements of **Tables C403.12.2.1(1)**, **C403.12.2.1(2)** and **C403.12.2.1(3)**.

~~C403.11.2.1~~ C403.12.2.1 **Performance standards.** *Walk-in coolers* and *walk-in freezers* shall meet the requirements of **Tables C403.12.2.1(1)**, **C403.12.2.1(2)** and **C403.12.2.1(3)**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#208 Renumbers Table C403.11.2.1(1). Renumbers Table C403.11.2.1(2).

Related Mods:

FBC - C403.2.14

~~TABLE C403.11.2.1(1)~~ TABLE C403.12.2.1(1)

WALK-IN COOLER AND FREEZER DISPLAY DOOR EFFICIENCY REQUIREMENTS[a]

CLASS DESCRIPTOR	CLASS	MAXIMUM ENERGY CONSUMPTION (kWh/day)[a]	TEST PROCEDURE
Display door, medium temperature	DD, M	$0.04 \times A_{dd} + 0.41$	**10 CFR 431**
Display door, low temperature	DD, L	$0.15 \times A_{dd} + 0.29$	**10 CFR 431**

a. A_{dd} is the surface area of the display door.

~~TABLE C403.11.2.1(2)~~ TABLE C403.12.2.1(2)

WALK-IN COOLER AND FREEZER NONDISPLAY DOOR EFFICIENCY REQUIREMENTS[a]

CLASS DESCRIPTOR	CLASS	MAXIMUM ENERGY CONSUMPTION (kWh/day)[a]	TEST PROCEDURE
Passage door, medium temperature	PD, M	$0.05 \times A_{nd} + 1.7$	10 CFR 431
Passage door, low temperature	PD, L	$0.14 \times A_{nd} + 4.8$	10 CFR 431
Freight door, medium temperature	FD, M	$0.04 \times A_{nd} + 1.9$	10 CFR 431
Freight door, low temperature	FD, L	$0.12 \times A_{nd} + 5.6$	10 CFR 431

a. A_{nd} is the surface area of the nondisplay door.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#209

Adds new Table C403.11.2.1(3).

Related Mods:

CED1-156-22

FBC

C403.2.14

TABLE C403.12.2.1(3)

WALK-IN COOLER AND FREEZER REFRIGERATION SYSTEM EFFICIENCY REQUIREMENTS

CLASS DESCRIPTOR	CLASS	MINIMUM ANNUAL WALK-IN ENERGY FACTOR (AWEF) (Btu/W-h)[a]	TEST PROCEDURE
Dedicated condensing, medium temperature, indoor system	DC.M.I	5.61	
Dedicated condensing, medium temperature, outdoor system	DC.M.O	7.60	
Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) < 6,500 Btu/h	DC.L.I < 6,500	$9.091 \times 10^{-5} \times q_{net} + 1.81$	
Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) ≥ 6,500 Btu/h	DC.L.I ≥ 6,500	2.40	

Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) < 6,500 Btu/h	DC.L.O < 6,500	$6.522 \times 10^{-5} \times q_{net} + 2.73$	**AHRI 1250**
Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) ≥ 6,500 Btu/h	DC.L.O ≥ 6,500	3.15	
Unit cooler, medium	UC.M	9.00	
Unit cooler, low temperature, net capacity (q_{net}) < 15,500 Btu/h	UC.L < 15,500	$1.575 \times 10^{-5} \times q_{net} + 3.91$	
Unit cooler, low temperature, net capacity (q_{net}) ≥ 15,500 Btu/h	UC.L ≥ 15,500	4.15	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#210

Renumbers Section C403.11.3. Renumbers subsection C403.11.3.1. Renumbers subsection C403.11.3.2 and replaces referenced “Table C403.12.3” with “Table C403.13.3(1) or C403.13.3(2).”

Related Mods:

CEPI-79-21

FBC –

C403.5

~~C403.11.3~~ C403.12.3 Refrigeration systems. Refrigerated display cases, *walk-in coolers* or *walk-in freezers* that are served by remote compressors and remote condensers not located in a condensing unit, shall comply with **Sections C403.12.3.1** and **C403.12.3.2**.

Exception: Systems where the working fluid in the refrigeration cycle goes through both subcritical and super-critical states (transcritical) or that use ammonia refrigerant are exempt.

~~C403.11.3.1~~ C403.12.3.1 Condensers serving refrigeration systems. Fan-powered condensers shall comply with the following:

~~C403.11.3.2~~ C403.12.3.2 Compressor systems. Refrigeration compressor systems shall comply with the following:

1. Compressors and multiple-compressor system suction groups shall include control systems that use floating suction pressure control logic to reset the target suction pressure temperature based on the temperature requirements of the attached refrigeration display cases or walk-ins.

    Exception: Controls are not required for the following:

    1. Single-compressor systems that do not have variable capacity capability.
    2. Suction groups that have a design saturated suction temperature of 30°F (-1.1°C) or higher, suction groups that comprise the high stage of a two-stage or cascade system, or suction groups that primarily serve chillers for secondary cooling fluids.

2. Liquid subcooling shall be provided for all low-temperature compressor systems with a design cooling capacity equal to or greater than 100,000 Btu (29.3 kW) with a design-saturated suction temperature of -10°F (-23°C) or lower. The sub-cooled

    liquid temperature shall be controlled at a maximum temperature setpoint of 50°F (10°C) at the exit of the subcooler using either compressor economizer (interstage) ports or a separate compressor suction group operating at a saturated suction temperature of 18°F (-7.8°C) or higher.

    2.1. Insulation for liquid lines with a fluid operating temperature less than 60°F (15.6°C) shall comply with ~~Table~~

	~~C403.12.3.~~ **Table C403.13.3(1)** or **C403.13.3(2).** 3. Compressors that incorporate internal or external crankcase heaters shall provide a means to cycle the heaters off during compressor operation. Staff Classification: Correlates Directly X; Energy Standard Needed; Over lap Action: AS x; AS/IC; D; D/IC
CE#211	Renumbers Section C403.12. Renumbers Section C403.12.1, C403.12.2. Renumbers Section C403.13.2.1 and C403.13.2.2. Renumbers Section C403.12.2.3. Renumbers Section C403.13.3.
Related Mods: CEPI-79-21	~~**C403.12**~~ C403.13 **Construction of HVAC system elements.** ~~**C403.12.1**~~ C403.13.1 **Duct and plenum insulation and sealing.** ~~**C403.12.2**~~ C403.13.2 **Duct construction.** ~~**C403.12.2.1**~~ C403.13.2.1 **Low-pressure duct systems.** ~~**C403.12.2.2**~~ C403.13.2.2 **Medium-pressure duct systems.** ~~**C403.12.2.3**~~ C403.13.2.3 **High-pressure duct systems.** *Ducts* and plenums designed to operate at static pressures equal to or greater than 3 inches water gauge (747 Pa) shall be insulated and sealed in accordance with **Section C403.13.1**. In addition, *ducts* and plenums shall be leak tested in accordance with the **SMACNA HVAC Air Duct Leakage Test Manual** and shown to have a rate of *air leakage* (CL) less than or equal to 4.0 as determined in accordance with **Equation 4-7**. $CL = F/P^{0.65}$ Equation 4-7~~8~~ where: ~~**C403.12.3**~~ C403.13.3 **Piping insulation.** Piping serving as part of a heating or cooling system shall be thermally insulated in accordance with **Table C403.13.3(1)** or **C403.13.3(2)**. Original text of mod is not consistent with that of the 2023 FBC – EC. Staff Classification: Correlates Directly; Energy Standard Needed; Over lap X Action: AS; AS/IC; D x; D/IC
CE#212	Updates Table C403.13.1(1). The table were revised to provide the minimum insulation thickness or the equivalent minimum insulation R-value. No stringency change.
Related Mods: CEPI-79-21	TABLE C403.13.3(1) **MINIMUM PIPE INSULATION THICKNESS (in inches or *R*-value)[a, c]** | | INSULATION CONDUCTIVITY | | NOMINAL PIPE OR TUBE SIZE (inches) |

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	Conductivity Btu × in/(h × ft^2 × °F)[b]	Mean Rating Temperature (°F)	INCHES OR *R*-VALUE	< 1	1 to < $1^1/_2$	$1^1/_2$ to < 4	4 to < 8	> 8
				Minimum insulation thickness (inches)				
> 350	0.32–0.34	250	Inches	4.5	5.0	5.0	5.0	5.0
			R-value	R-32	R-36	R-34	R-26	R-21
251–350	0.29–0.32	200	Inches	3.0	4.0	4.5	4.5	4.5
			R-value	R-20	R-29	R-32	R-24	R-20
201–250	0.27–0.30	150	Inches	2.5	2.5	2.5	3.0	3.0
			R-value	R-17	R-17	R-17	R-15	R-13
141–200	0.25–0.29	125	Inches	1.5	1.5	2.0	2.0	2.0
			R-value	R-9	R-9	R-11	R-10	R-9
105–140	0.21–0.28	100	Inches	1.0	1.0	1.5	1.5	1.5
			R-value	R-5	R-9	R-8	R-8	R-7
40–60	0.21–0.27	75	Inches	0.5	0.5	1.0	1.0	1.0
			R-value	R-2	R-2	R-5	R-5	R-4
< 40	0.20–0.26	50	Inches	0.5	1.0	1.0	1.0	1.5
			R-value	R-6	R-9	R-9	R-8	R-7

For SI: 1 inch = 25.4 mm, °C = (°F – 32)/1.8.

a. For piping smaller than $1^1/_2$ inches and located in partitions within conditioned spaces, reduction of these thicknesses by 1 inch shall be permitted (before thickness adjustment required in Note b but not to a thickness less than 1 inch).

b. For insulation outside the stated conductivity range, the minimum thickness (*T*) shall be determined as follows:

$$T = r[(1 + t/r)^{Kk} - 1]$$

where:

T = Minimum insulation thickness.

r = Actual outside radius of pipe.

t = Insulation thickness listed in the table for applicable fluid temperature and pipe size.

K = Conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu × in/h × ft^2 × °F).

	k = The upper value of the conductivity range listed in the table for the applicable fluid temperature. c. For direct-buried heating and hot water system piping, reduction of these thicknesses by $1^1/_2$ inches shall be permitted (before thickness adjustment required in Note b but not to thicknesses less than 1 inch).
CE#213	Adds new Table C403.13.3(2).
Related Mods: CEPI-79-21 FBC – C403.2.10	TABLE C403.13.3(2) MINIMUM PIPE INSULATION *R*-VALUE[a]

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	NOMINAL PIPE OR TUBE SIZE (inches)				
	< 1	1 to < $1^1/_2$	$1^1/_2$ to < 4	4 to < 8	≥ 8
	Minimum Insulation *R*-Value				
> 350	R-32	R-36	R-34	R-26	R-21
251–350	R-20	R-29	R-32	R-24	R-20
201–250	R-17	R-17	R-17	R-15	R-13
141–200	R-9	R-9	R-11	R-10	R-9
105–140	R-5	R-9	R-8	R-8	R-7
40–60	R-2	R-2	R-5	R-5	R-4
≤ 40	R-6	R-9	R-9	R-8	R-7

For SI: 1 inch = 25.4 mm, R-1 = RSI-0.176228, °C = (°F – 32)/1.8.

a. The *R*-value of cylindrical piping insulation shall be determined as follows:

$$R = \{ro[ln(ro/ri)]\}/k$$

where:

R = The interior *R*-value of the cylindrical piping insulation in Btu × ft^2 × °F/h.
ro = The outer radius of the piping insulation in inches.
ri = The inner radius of the piping insulation in inches.
k = the thermal conductivity of the insulation material in Btu × in/h × ft^2 × °F.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			X	

<table>
<tr><td>**CE#214**</td><td>Renumbers Section C403.12.3.1 and makes editorial changes to clarity the intent of the code.</td></tr>
<tr><td>Related Mods:

CEPI-80-21

FBC – C403.2.10</td><td>~~C403.12.3.1~~ C403.13.3.1 **Protection of piping insulation.** Piping insulation exposed to the weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance and wind ~~;~~ . ~~and~~ The protection shall provide shielding from solar radiation that can cause degradation of the material. The protection shall be removable and reuseable for not less than 6 inches (152 mm) from the connection to the equipment piping for maintenance. Adhesive tape shall not be permitted as a means of insulation protection.

<table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table>
<table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table></td></tr>
<tr><td>**CE#215**</td><td>Deletes with substitution.</td></tr>
<tr><td>Related Mods:

FBC – C403.6</td><td>~~**C403.14 Operable opening interlocking controls.** The heating and cooling systems shall have controls that will interlock these mechanical systems to the set temperatures of 90ºF (32ºC) for cooling and 55ºF (12.7ºC) for heating when the conditions of **Section C402.6.7** exist. The controls shall configure to shut off the systems entirely when the outdoor temperatures are below 90ºF (32ºC) or above 55ºF (12.7ºC).~~

<table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table>
<table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table></td></tr>
<tr><td>**CE#216**</td><td>Renumbers Section C403.13 and adds the text “building” for code clarity. Renumbers Section C403.13.1. Renumbers Section C403.13.2. Adds new Section C403.13.3. Renumbers Section C403.13.3.</td></tr>
<tr><td>Related Mods:

CEPI-82-21</td><td>~~C403.13~~ C403.14 **Mechanical systems located outside of the building thermal envelope.** Mechanical systems providing heat outside of the *building thermal envelope* of a *building* shall comply with **Sections C403.14.1** through **C403.14.4**.

~~C403.13.1~~ C403.14.1 **Heating outside a building.** Systems installed to provide heat outside a *building* shall be radiant systems. Such heating systems shall be controlled by an occupancy sensing device or a timer switch, so that the system is automatically de-energized when occupants are not present.

~~C403.13.2~~ C403.14.2 **Snow- and ice-melt system controls.** Snow- and ice-melting systems shall include *automatic* controls configured to shut off the system when the pavement temperature is above 50°F (10°C) and precipitation is not falling, and an *automatic* or *manual* control that is configured to shut off when the outdoor temperature is above 40°F (4°C).

C403.14.3 Roof and gutter deicing controls. Roof and gutter deicing systems, including but not limited to self-regulating cable, shall include *automatic* controls that are configured to shut off the system when the outdoor temperature is above 40°F (4°C) and that include one of the following:
1. A moisture sensor configured to shut off the system in the absence of moisture.
2. A daylight sensor or other means configured to shut off the system between sunset and sunrise.</td></tr>
</table>

~~C403.13.3~~ C403.14.4 **Freeze protection system controls.** Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, shall include *automatic* controls configured to shut off the systems when outdoor air temperatures are above 40°F (4°C) or when the conditions of the protected fluid will prevent freezing.

Original text of mod is not consistent with that of the 2023 FBC-EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			X	

CE#217

Adds new Section C403.15.
This measure requires installation of efficient dehumidification technology that may increase the initial equipment cost but saves operational energy and maintenance costs; it is a cost-effective code requirement.

Related Mods:

C403.15 Dehumidification in spaces for plant growth and maintenance. Equipment that dehumidifies *indoor grow* and *greenhouse* spaces shall be one or more of the following:

1. *Dehumidifiers* tested in accordance with the test procedure *listed* in **DOE 10 CFR 430** and **DOE 10 CFR 430**, Subpart B, Appendix X or X1.
2. An integrated HVAC system with on-site heat recovery designed to fulfill not less than 75 percent of the annual energy for dehumidification reheat.
3. A chilled water system with on-site heat recovery designed to fulfill not less than 75 percent of the annual energy for dehumidification reheat.
4. A solid or liquid desiccant dehumidification system for system designs that require a dewpoint of not more than 50°F (10°C).

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#218

Adds new Section C403.16.
A variable speed pressure booster systems can realize from 20%-50% energy savings using on-board pressure sensor and software for control logic, instead of a costly remote pressure sensors. This code change uses currently technology and has no impact on construction cost.

Related Mods:

CEPI-85-21

C403.16 Service water pressure-booster systems. Service water pressure-booster systems shall be designed such that the following apply:

1. One or more pressure sensors shall be used to vary pump speed and/or start and stop pumps. The sensors shall either be located near the critical fixtures that determine the pressure required or logic shall be employed that adjusts the setpoint to simulate the operation of remote sensors.

	2. No devices shall be installed for the purpose of reducing the pressure of all of the water supplied by any booster system pump or booster system, except for safety devices. 3. No booster system pumps shall operate when there is no service water flow. FSEC – Anticipated energy impact on FBC-EC – Decrease <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table>
CE#219	Adds new Section C403.17. This change specifies federal minimum efficiency requirements for clean water pumps and increases the stringency.
Related Mods: CEPI-83-21	**C403.17 Clean water pumps.** *Clean water pumps* meeting all the following criteria shall achieve a PEI rating not greater than 1.0: 1. Shaft input power is greater than or equal to 1.0 hp (0.75 kW) and less than or equal to 200 hp (149.1 kW) at its best efficiency point (BEP). 2. Designated as either an end-suction close-coupled, end-suction frame-mounted, in-line, radially split vertical or submersible turbine pump. 3. A flow rate of 25 gallons per minute (1.58 L/s) or greater at its BEP at full impeller diameter. 4. Maximum head of 459 feet (139.9 m) at its BEP at full impeller diameter and the number of stages required for testing. 5. Design temperature range from 14°F (-10°C) to 248°F (120°C). 6. Designed to operate with one of the following. Note that for either Item 6.1 or 6.2, the driver and impeller must rotate at the same speed. 6.1. A 2- or 4-pole induction motor. 6.2. A noninduction motor with a speed of rotation operating range that includes speeds of rotation between 2,880 and 4,320 rpm and/or 1,440 and 2,160 rpm. 7. For submersible turbine pumps, a 6-inch (152 mm) or smaller bowl diameter. 8. For end-suction close-coupled pumps and end-suction frame-mounted/own bearings pumps, specific speeds less than or equal to 5,000 rpm when calculated using US customary units. **Exceptions:** The following pumps are exempt from these requirements: 1. Fire pumps. 2. Self-priming pumps. 3. Prime-assisted pumps. 4. Magnet-driven pumps. 5. Pumps designed to be used in a nuclear facility subject to **10 CFR 50**. 6. Pumps meeting the design and construction requirements set forth in US Military Specification MIL-P-17639F (1996), “Pumps, Centrifugal, Miscellaneous Service Naval Shipboard Use” (as amended); MIL-P-17840C (1986), “Pump, Centrifugal, Close Coupled, Navy Standard for Use on Naval Ships” (as amended); MIL-P-17881D (1972), “Pump, Centrifugal, Boiler Feed, (Multi Stage)” (as amended); MIL-P-18472G (1989), “Pumps, Centrifugal, Condensate, Feed

Booster, Waste Heat Boiler, and Distilling Plant” (as amended); MIL-P-18682D (1984), “Pump, Centrifugal, Main Condenser Circulating, Naval Shipboard” (as amended).

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#220 Updated the minimum efficiency requirements. Now, the efficiency levels vary by water draw patterns. The update is based on the federal minimum requirements.

Related Mods:

CEPI-127-21, CECD1-19-22, CE2D-26-23

~~TABLE C404.2~~

~~**MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT**~~

~~**EQUIPMENT TYPE**~~	~~**SIZE CATEGORY (input)**~~	~~**SUBCATEGORY OR RATING CONDITION**~~	~~**PERFORMANCE**~~ **REQUIRED** [a, b]	~~**TEST PROCEDURE**~~
~~Water heaters, electric~~	≤ 12 kW [d]	Tabletop[e], ≥ 20 ~~gallons and ≤ 120 gallons~~	~~0.93 – 0.00132V, EF~~	~~**DOE 10 CFR Part 430**~~
		~~Resistance ≥ 20 gallons and ≤ 55 gallons~~	~~0.960 – 0.0003V, EF~~	
		Grid-enabled[f] > 75 ~~gallons and ≤ 120 gallons~~	~~1.061 – 0.00168V, EF~~	
	~~> 12 kW~~	~~Resistance~~	~~(0.3 + 27/V~~ $_m$ ~~), %/h~~	~~**ANSI Z21.10.3**~~
	~~≤ 24 amps and ≤ 250 volts~~	~~Heat pump > 55 gallons and ≤ 120 gallons~~	~~2.057 – 0.00113V, EF~~	~~**DOE 10 CFR Part 430**~~
	~~≤ 75,000 Btu/h~~	~~≥ 20 gallons and > 55 gallons~~	~~0.675 – 0.0015V, EF~~	~~**DOE 10 CFR Part 430**~~
		~~> 55 gallons and ≤ 100 gallons~~	~~0.8012 – 0.00078V, EF~~	

~~Storage water heaters, gas~~	~~> 75,000 Btu/h and ≤ 155,000 Btu/h~~	~~< 4,000 Btu/h/gal~~	~~80% E_t~~	~~**ANSI Z21.10.3**~~
	~~> 155,000 Btu/h~~	~~< 4,000 Btu/h/gal~~	~~80% E_t~~	
~~Instantaneous water heaters, gas~~	~~> 50,000 Btu/h and < 200,000~~ Btu/h [c]	~~≥ 4,000 Btu/h/gal and < 2 gal~~	~~0.82 – 0.00 19V, EF~~	~~**DOE 10 CFR Part 430**~~
	≥ 200,000 Btu/h	~~≥ 4,000 Btu/h/gal and < 10 gal~~	80% E_t	~~**ANSI Z21.10.3**~~
	~~≥ 200,000 Btu/h~~	~~≥ 4,000 Btu/h/gal and ≥ 10 gal~~	~~80% E_t~~	
~~Storage water heaters, oil~~	~~≤ 105,000 Btu/h~~	~~≥ 20 gal and ≤ 50 gallons~~	~~0.68 – 0.0019V, EF~~	~~**DOE 10 CFR Part 430**~~
	~~≥ 105,000 Btu/h~~	~~< 4,000 Btu/h/gal~~	~~80% E_t~~	~~**ANSI Z21.10.3**~~
~~Instantaneous water heaters, oil~~	~~≤ 210,000 Btu/h~~	~~≥ 4,000 Btu/h/gal and < 2 gal~~	~~0.59 – 0.0019V, EF~~	~~**DOE 10 CFR Part 430**~~
	~~> 210,000 Btu/h~~	~~≥ 4,000 Btu/h/gal and < 10 gal~~	~~80% E_t~~	~~**ANSI Z21.10.3**~~
	~~> 210,000 Btu/h~~	~~≥ 4,000 Btu/h/gal and ≥ 10 gal~~	~~78% E_t~~	
~~Hot water supply boilers, gas and oil~~	~~≥ 300,000 Btu/h and < 12,500,000 Btu/h~~	~~≥ 4,000 Btu/h/gal and < 10 gal~~	~~80% E_t~~	~~**ANSI Z21.10.3**~~
~~Hot water supply boilers, gas~~	~~≥ 300,000 Btu/h and < 12,500,000 Btu/h~~	~~≥ 4,000 Btu/h/gal and ≥ 10 gal~~	~~80% E_t~~	

~~Hot water supply boilers, oil~~	~~> 300,000 Btu/h and < 12,500,000 Btu/h~~	~~> 4,000 Btu/h/gal and > 10 gal~~	~~78% *E*~~ ~~$_t$~~	
~~Pool heaters, gas and oil~~	~~All~~	—	~~82% *E*~~ ~~$_t$~~	~~**ASHRAE 146**~~
~~Heat pump pool heaters~~	~~All~~	—	~~4.0 COP~~	~~**AHRI 1160**~~
~~Unfired storage tanks~~	All	—	~~Minimum insulation requirement R-12.5 (h ×~~ ft^2× °F)/Btu	~~(none)~~

~~For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m2, °C = [(°F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 W, 1 gallon = 3.785 L, 1 British thermal unit per hour per gallon = 0.078 W/L.~~

~~a. Energy factor (EF) and thermal efficiency (Et) are minimum requirements. In the EF equation, V is the rated volume in gallons.~~

~~b. Standby loss (SL) is the maximum Btu/h based on a nominal 70°F temperature difference between stored water and ambient requirements. In the SL equation, Q is the nameplate input rate in Btu/h. In the equations for electric water heaters, V is the rated volume in gallons and V m is the measured volume in gallons. In the SL equation for oil and gas water heaters and boilers, V is the rated volume in gallons.~~

~~c. Instantaneous water heaters with input rates below 200,000 Btu/h shall comply with these requirements where the water heater is designed to heat water to temperatures 180°F or higher.~~

~~d. Electric water heaters with an input rating of 12 kW (40,950 Btu/h) or less that are designed to heat water to temperatures of 180°F or greater shall comply with the requirements for electric water heaters that have an input rating greater than 12 kW (40,950 Btu/h).~~

~~e A tabletop water heater is a water heater that is enclosed in a rectangular cabinet with a flat top surface not more than 3 feet in height.~~

~~f. A grid-enabled water heater is an electric-resistance water heater that meets all of the follow-ing:~~

~~1.Has a rated storage tank volume of more than 75 gallons.~~

~~2.Was manufactured on or after April 16, 2015.~~

~~3.Is equipped at the point of manufacture with an activation lock.~~

~~4.Bears a permanent label applied by the manufacturer that complies with all of the following: following:~~

~~4.1. Is made of material not adversely affected by water.~~

~~4.2. Is attached by means of nonwater-soluble adhesive.~~

~~4.3. Advises purchasers and end users of the intended and appropriate use of the product with the following notice printed in 16.5 point Arial Narrow Bold font:~~

~~“IMPORTANT INFORMATION: This water heater is intended only for use as part of~~

TABLE C404.2

MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	DRAW PATTERN	PERFORMANCE REQUIRED[a]	TEST PROCEDURE[b]
Electric table-top water heaters[c]	≤ 12 kW	≥ 20 gal ≤ 120 gal[d]	Very small Low Medium High	UEF ≥ 0.6323 – (0.0058 × V_r) UEF ≥ 0.9188 – (0.0031 × V_r) UEF ≥ 0.9577 – (0.0023 × V_r) UEF ≥ 0.9884 – (0.0016 × V_r)	**DOE 10 CFR Part 430** App. E
Electric storage water heaters[e, f]: resistance and heat pump	≤ 12 kW	≥ 20 gal ≤ 55 gal[f]	Very small Low Medium High	UEF ≥ 0.8808 – (0.0008 × V_r) UEF ≥ 0.9254 – (0.0003 × V_r) UEF ≥ 0.9307 – (0.0002 × V_r) UEF ≥ 0.9349 – (0.0001 × V_r)	**DOE 10 CFR Part 430** App. E
	≤ 12 kW	> 55 gal ≤120 gal[f]	Very small Low Medium High	UEF ≥ 1.9236 – (0.0011 × V_r) UEF ≥ 2.0440 – (0.0011 × V_r) UEF ≥ 2.1171 – (0.0011 × V_r) UEF ≥ 2.2418 – (0.0011 × V_r)	**DOE 10 CFR Part 430** App. E
Electric storage water heaters[e, f, l]	> 12 kW	—	—	(0.3 + 27/V_m), %/h	**DOE 10 CFR 431.106** App. B
Grid-enabled water heaters[g]	—	> 75 gal[d]	Very small Low Medium High	UEF ≥ 1.0136 – (0.0028 × V_r) UEF ≥ 0.9984 – (0.0014 × V_r) UEF ≥ 0.9853 – (0.0010 × V_r) UEF ≥ 0.9720 – (0.0007 × V_r)	**DOE 10 CFR 430** App. E
Electric instantaneous water heaters[h]	≤ 12 kW	< 2 gal[d]	Very small Low Medium High	UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.92	**DOE 10 CFR Part 430**
	> 12 kW & ≤ 58.6 kW[i]	≤ 2 gal & ≤180°F	All	UEF ≥ 0.80	**DOE 10 CFR Part 430**
Gas storage water heaters[e, l]	≤ 75,000 Btu/h	≥20 gal & ≤ 55 gal[d]	Very small Low Medium High	UEF ≥ 0.3456 – (0.0020 × V_r) UEF ≥ 0.5982 – (0.0019 × V_r) UEF ≥ 0.6483 – (0.0017 × V_r) UEF ≥ 0.6920 – (0.0013 × V_r)	**DOE 10 CFR Part 430** App. E
	≤ 75,000 Btu/h	> 55 gal & ≤ 100 gal[d]	Very small Low Medium High	UEF ≥ 0.6470 – (0.0006 × V_r) UEF ≥ 0.7689 – (0.0005 × V_r) UEF ≥ 0.7897 – (0.0004 × V_r) UEF ≥ 0.8072 – (0.0003 × V_r)	**DOE 10 CFR Part 430** App. E
	> 75,000 Btu/h and ≤ 105,000 Btu/h[j, k]	≤ 120 gal & ≤180°F	Very small Low Medium High	UEF ≥ 0.2674 – (0.0009 × V_r) UEF ≥ 0.5362 – (0.0012 × V_r) UEF ≥ 0.6002 – (0.0011 × V_r) UEF ≥ 0.6597 – (0.0009 × V_r)	**DOE 10 CFR Part 430** App. E

	> 105,000 Btu/h[k]	—	—	80% E_t $SL \le (Q/800 + 110\sqrt{V})$, Btu/h	**DOE 10 CFR 431.106**
Gas instantaneous water heaters[i]	> 50,000 Btu/h and < 200,000 Btu/h[k]	< 2 gal[d]	Very small Low Medium High	UEF ≥ 0.80 UEF ≥ 0.81 UEF ≥ 0.81 UEF ≥ 0.81	**DOE 10 CFR Part 430** App. E
	≥ 200,000 Btu/h[k]	< 10 gal	—	80% E_t	**DOE 10 CFR 431.106**
	≥ 200,000 Btu/h[k]	≥10 gal	—	80% E_t $SL \le (Q/800 + 110\sqrt{V})$, Btu/h	
Oil storage water heaters[e, l]	≤ 105,000 Btu/h	≤ 50 gal[d]	Very small Low Medium High	UEF = 0.2509 – (0.0012 × V_r) UEF = 0.5330 – (0.0016 × V_r) UEF = 0.6078 – (0.0016 × V_r) UEF = 0.6815 – (0.0014 × V_r)	**DOE 10 CFR Part 430**
	> 105,000 Btu/h and ≤ 140,000 Btu/h[l]	≤ 120 gal & ≤180ºF	Very small Low Medium High	UEF ≥ 0.2932 – (0.0015 × V_r) UEF ≥ 0.5596 – (0.0018 × V_r) UEF ≥ 0.6194 – (0.0016 × V_r) UEF ≥ 0.6740 – (0.0013 × V_r)	**DOE 10 CFR Part 430** App. E
	> 140,000 Btu/h	All	—	80% E_t $SL \le (Q/800 + 110\sqrt{V})$, Btu/h	**DOE 10 CFR 431.106**
Oil instantaneous water heaters[h, l]	≤ 210,000 Btu/h	< 2 gal	—	80% E_t EF ≥ 0.59 – (0.0005 × V)	**DOE 10 CFR Part 430** App. E
	> 210,000 Btu/h	< 10 gal	—	80% E_t	**DOE 10 CFR 431.106**
	> 210,000 Btu/h	≥ 10 gal	—	78% E_t $SL \le (Q/800 + 110\sqrt{V})$, Btu/h	**DOE 10 CFR 431.106**
Hot water supply boilers, gas and oil[h]	≥ 300,000 Btu/h and < 12,500,000 Btu/h	< 10 gal	—	80% E_t	**DOE 10 CFR 431.106**

Hot water supply boilers, gas[i, l]	≥ 300,000 Btu/h and < 12,500,000 Btu/h	≥ 10 gal	—	80% E_t $SL \leq (Q/800 + 110\sqrt{V})$, Btu/h	**DOE 10 CFR 431.106**
Hot water supply boilers, oil[h, l]	≥ 300,000 Btu/h and < 12,500,000 Btu/h	≥ 10 gal	—	78% E_t $SL \leq (Q/800 + 110\sqrt{V})$, Btu/h	**DOE 10 CFR 431.106**
Pool heaters, gas[d]	All	—[f]	—	82% E_t	**DOE 10 CFR Part 430** App. P
Heat pump pool heaters	All	50°F db and 44.2°F wb outdoor air 80.0°F entering water	—	4.0 COP	**DOE 10 CFR Part 430** App. P
Unfired storage tanks	All	—	—	Minimum insulation requirement R-12.5 (h × ft^2 × °F)/Btu	(none)

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, °C = (°F – 32)/1.8, 1 British thermal unit per hour = 0.2931 W, 1 gallon = 3.785 L, 1 British thermal unit per hour per gallon = 0.078 W/L.

a. Thermal efficiency (E_t) is a minimum requirement, while standby loss is a maximum requirement. In the standby loss equation, V is the rated volume in gallons and Q is the nameplate input rate in Btu/h. V_m is the measured volume in the tank in gallons. Standby loss for electric water heaters is in terms of %/h and denoted by the term "S," and standby loss for gas and oil water heaters is in terms of Btu/h and denoted by the term "SL." Draw pattern (DP) refers to the water draw profile in the Uniform Energy Factor (UEF) test. UEF and Energy Factor (EF) are minimum requirements. In the UEF standard equations, V_r refers to the rated volume in gallons.

b. **Chapter 6** contains a complete specification, including the year version, of the referenced test procedure.

c. A tabletop water heater is a storage water heater that is enclosed in a rectangular cabinet with a flat top surface not more than 3 feet in height and has a ratio of input capacity (Btu/h) to tank volume (gal) < 4,000.

d. Water heaters or gas pool heaters in this category are regulated as consumer products by the US DOE, as defined in **10 CFR 430**.

e. Storage water heaters have a ratio of input capacity (Btu/h) to tank volume (gal) < 4,000.

f. Efficiency requirements for electric storage water heaters ≤ 12 kW apply to both electric-resistance and heat pump water heaters. There are no minimum efficiency requirements for electric heat pump water heaters greater than 12 kW or for gas heat pump water heaters.

g. A grid-enabled water heater is an electric-resistance water heater that meets all of the following:
   1. Has a rated storage tank volume of more than 75 gallons.
   2. Is manufactured on or after April 16, 2015.
   3. Is equipped at the point of manufacture with an activation lock.
   4. Bears a permanent label applied by the manufacturer that complies with all of the following:
      4.1. Is made of material not adversely affected by water.
      4.2. Is attached by means of nonwater soluble adhesive.

4.3. Advises purchasers and end users of the intended and appropriate use of the product with the following notice printed in 16.5 point Arial Narrow Bold font: “IMPORTANT INFORMATION: This water heater is intended only for use as a part of an electric thermal storage or demand response program. It will not provide adequate hot water unless enrolled in such a program and activated by your utility company or another program operator. Confirm the availability of a program in your local area before purchasing or installing this product.”

h. Instantaneous water heaters and hot water supply boilers have an input capacity (Btu/h) divided by storage volume (gal) ≥ 4,000 (Btu/h)/gal.

i. Electric instantaneous water heaters with input capacity >12 kW and ≤ 58.6 kW that (1) have a storage volume > 2 gallons, (2) are designed to provide outlet hot water at temperatures greater than 180°F, or (3) use three-phase power have no efficiency standard.

j. Gas storage water heaters with input capacity > 75,000 Btu/h and ≤ 105,000 Btu/h must comply with the requirements for the > 105,000 Btu/h if the water heater (1) has a storage volume > 120 gallons, (2) is designed to provide outlet hot water at temperatures greater than 180°F, or (3) uses three-phase power.

k. Refer to **Section C404.2.1** for additional requirements for gas storage and instantaneous water heaters and gas hot water supply boilers.l. Oil storage water heaters with input capacity > 105,000 Btu/h and ≤ 140,000 Btu/h must comply with the requirements for the > 140,000 Btu/h if the water heater either (1) has a storage volume > 120 gallons, (2) is designed to provide outlet hot water at temperatures greater than 180ºF, or (3) uses three-phase power.

l. Water heaters and hot water supply boilers with more than 140 gallons of storage capacity need not meet the standby loss requirement where: (1) the tank surface area is thermally insulated to R-12.5 or more, (2) there is no standing pilot light, and (3) for gas- or oil-fired storage water heaters, the heater is equipped with a fire damper or fan-assisted combustion.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#221

Revised the Section provision and the exceptions for clarity.

Related Mods:

CEPI-128-21, CECD1-14-22

C404.2.1 High-input service water-heating systems. Gas-fired ~~water-heating equipment~~ *water heaters* installed in new buildings ~~shall be in compliance with this section. Where a singular piece of water-heating equipment serves the entire *building* and the~~ where the total input capacity provided by high-capacity gas-fired *water heaters* ~~rating of the equipment~~ is 1,000,000 Btu/h (293 kW) or greater ~~, such equipment shall have a thermal efficiency, E_t, of not less than 92 percent. Where multiple pieces of water-heating equipment serve the *building* and the combined input rating of the water-heating equipment is 1,000,000 Btu/h (293 kW) or greater, the combined input-capacity-weighted-average thermal efficiency, E_t, shall be not less than 90 percent.~~ shall comply with either or both of the following requirements:

-

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1. Where a singular piece of a high-capacity gas-fired *water heater* is installed, the water heater shall have a thermal efficiency, E_t, of not less than 92 percent.
2. Where multiple pieces of high-capacity gas-fired *water heaters* are connected to the same service water-heating system, the combined input-capacity-weighted average thermal efficiency, E_t, shall be not less than 90 percent, and a minimum of 30 percent of the input to the high-capacity gas-fired *water heaters* in the service water-heating system shall have an E_t of not less than 92 percent.

Exceptions:

1. ~~Where not less than 25 percent of the annual service water-heating requirement is provided by *on-site renewable energy* or site-recovered energy, the minimum thermal efficiency requirements of this section shall not apply.~~ The input rating of *water heaters* installed in individual *dwelling units* shall not be required to be included in the total input rating of service water-heating equipment for a building.
2. ~~The input rating of *water heaters* installed in individual dwelling units shall not be required to be included in the total input rating of service water-heating equipment for a building.~~ ~~The input rating of water heaters~~ with an input rating of not greater than 105,000 Btu/h (30.8 kW) shall not be required to be included in the total input rating of service water-heating equipment for a building.
3. ~~The input rating of water heaters with an input rating of not greater than 100,000 Btu/h (29.3 kW) shall not be required to be included in the total input rating of service water-heating equipment for a building.~~ Where not less than 25 percent of the annual *service water-heating* requirement is provided by *on-site renewable energy* or site-recovered energy, the minimum E_t requirements of this section shall not apply. On-site renewable energy used to meet **Section C405.15.1** or **C406.3.1** shall not be used to meet this exception.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

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<tr>
<td>CE#222</td>
<td>This section renames the Section title, revises the code language for clarity, and adds an equation for insulation thickness update for alternate equivalent insulation material. It also revises the existing exceptions for tubular insulation and adds a new exception for piping not heated with fossil fuel or electricity.</td>
</tr>
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<td>Related Mods:

CEPI-130-21</td>
<td>

C404. ~~Insulation of piping.~~ Service water heating system piping insulation. ~~Piping from a water heater to the termination of the heated water fixture supply pipe shall be insulated in accordance with Table C403.13.3. On both the inlet and outlet piping of a storage water heater or heated water storage tank, the piping to a heat trap or the first 8 feet (2438 mm) of piping, whichever is less, shall be insulated. Piping that is heat traced shall be insulated in accordance with Table C403.13.3 or the heat trace manufacturer's instructions. Tubular pipe insulation shall be installed in accordance with the insulation manufacturer's instructions. Pipe insulation shall be continuous except where the piping passes through a framing member. The minimum insulation thickness requirements of this section shall not supersede any greater insulation thickness requirements necessary for the protection of piping from freezing temperatures or the protection of personnel against external surface temperatures on the insulation.~~ *Service water heating* system piping shall be surrounded by uncompressed insulation. The wall thickness of the insulation shall be not less than the thickness shown in **Table C404.4.1**. Where the insulation thermal conductivity is not within the range in the table, the following equation shall be used to calculate the minimum insulation thickness:

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</table>

$$t_{alt} = r \times [(1 + t_{table}/r)k_{alt}/k_{upper} - 1]$$ Equation 4-8

where:
t_{alt} = Minimum insulation thickness of the alternate material (in) (mm).
r = Actual outside radius of the pipe (in) (mm).
t_{table} = Insulation thickness listed in this table for applicable fluid temperature and pipe size.
k_{alt} = Thermal conductivity of the alternate material at mean rating temperature indicated for the applicable fluid temperature [Btu × in/h × ft^2 × °F] [W(m × °C)].
k_{upper} = The upper value of the thermal conductivity range listed in this table for the applicable fluid temperature [Btu × in/h × ft^2 × °F] [W(m × °C)].

For nonmetallic piping thicker than Schedule 80 and having thermal resistance greater than that of steel pipe, reduced insulation thicknesses are permitted if documentation is provided showing that the pipe with the proposed insulation has no more heat transfer per foot (meter) than a steel pipe of the same size with the insulation thickness shown in the table.

Exception: Tubular pipe insulation shall not be required on the following:

1. ~~The tubing from the connection at the termination of the fixture supply piping to a plumbing fixture or plumbing appliance.~~ Factory-installed piping within *water heaters* and hot water storage tanks.
2. Valves, pumps, strainers and threaded unions in piping that is 1 inch (25 mm) or less in nominal diameter.
3. Piping that conveys hot water that has not been heated through the use of fossil fuels or electricity.

~~3.~~4. Piping from user-controlled shower and bath mixing valves to the water outlets.
~~4.~~5. Cold-water piping of a *demand recirculation water system* .
~~5.~~6. ~~Tubing from a hot drinking-water heating unit to the water outlet.~~ Piping in existing buildings where *alterations* are made to existing *service water heating* systems where there is insufficient space or access to meet the requirements.
~~6.~~7. Piping at locations where a vertical support of the piping is installed.
~~7.~~8. ~~Piping surrounded by building insulation with a thermal resistance (*R*-value) of not less than R-3.~~ Where piping passes through a framing member if it requires increasing the size of the framing member.

Original text of mod is not consistent with that of the 2023 FBC-EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#223

Adds a new Section C404.4.1.

Related Mods:

CEPI-130-21

C404.4.1 Installation requirements. The following piping shall be insulated per the requirements of this section:

1. Recirculating system piping, including the supply and return piping.
2. The first 8 feet (2.4 m) of outlet piping from:
   2.1. Storage *water heaters*.
   2.2. Hot water storage tanks.

	2.3. Any *water heater* and hot water supply boiler containing not less than 10 gallons (37.9 L) of water heated by a direct heat source, an indirect heat source, or both a direct heat source and an indirect heat source. 3. The first 8 feet (2.4 m) of branch piping connecting to recirculated, heat traced or impedance-heated piping. 4. The makeup water inlet piping between *heat traps* and the storage *water heaters* and the storage tanks they are serving, in a nonrecirculating *service water heating* storage system. 5. Hot water piping between multiple *water heaters* , between multiple hot water storage tanks, and between *water heaters* and hot water storage tanks. 6. Piping that is externally heated (such as heat trace or impedance heating). 7. For direct-buried *service water heating* system piping, reduction of these thicknesses by $1^1/_2$ inches (38.1 mm) shall be permitted (before thickness adjustment required in **Section C404.4**) but not to thicknesses less than 1 inch (25.4 mm).
CE#224	Adds a new Table C404.4.1 instead of referencing from a different section. The insulation efficiency levels did not change.
Related Mods: CEPI-130-21	TABLE C404.4.1 **MINIMUM PIPING INSULATION THICKNESS FOR SERVICE WATER HEATING SYSTEMS[a]**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

TABLE C404.4.1

MINIMUM PIPING INSULATION THICKNESS FOR SERVICE WATER HEATING SYSTEMS[a]

SERVICE HOT-WATER TEMPERATURE RANGE	INSULATION THERMAL CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (inches)				
	Conductivity (Btu × in/h × ft^2 × °F)	Mean Rating Temperature (°F)	< 1	1 to < $1^1/_2$	$1^1/_2$ to < 4	4 to < 8	≥ 8
			Insulation Thickness (inches)				
105°F to 140°F	0.22 to 0.28	100	1.0	1.0	1.5	1.5	1.5
> 140°F to 200°F	0.25 to 0.29	125	1.0	1.0	2.0	2.0	2.0
> 200°F	0.27 to 0.30	150	1.5	1.5	2.5	3.0	3.0

For SI: 1 inch = 25.4 mm, 1 Btu/h × ft × °F = 1.73 W/mK, °C = [(°F) – 32]/1.8.

a. These thicknesses are based on energy efficiency considerations only. Additional insulation may be necessary for safety.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#225	The code is revised to require circulation pumps with thermostatic flow balancing valves and ECM motors. This increases construction costs but saves operating energy costs. The code change increases the stringency but is a cost-effective change.

Related Mods:

CEPI-131-21

C404.6.1 Circulation systems. Heated-water circulation systems shall be provided with a circulation pump. ~~The system return pipe shall be a dedicated return pipe or a cold water supply pipe.~~ Gravity and thermo-syphon circulation systems shall be prohibited. ~~Controls for circulating hot water system pumps shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water. The controls shall limit the temperature of the water entering the cold water piping to not greater than 104ºF (40°C).~~ The system return pipe shall be a dedicated return pipe. Controls shall be configured to automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water. Where a circulation pump serves multiple risers or piping zones, controls shall include self-actuating thermostatic balancing valves or another means of flow control to automatically balance the flow rate through each riser or piping zone.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Original text of mod is not consistent with that of the 2023 FBC-EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#226	Modifies the exception by adding the text, "On-site renewable energy used to meet Section C405.15.1 or C406.3.1 shall not be used to meet this exception." No change to the stringency.

Related Mods:

C404.8.3 Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than 75 percent of the energy for heating, computed over an operating season of not fewer than 3 calendar months, is from a heat pump or an on-site renewable energy system, covers or other vapor-retardant means shall not be required. *On-site renewable energy* used to meet **Section C405.15.1** or **C406.3.1** shall not be used to meet this exception.

Original text of mod is not consistent with that of the 2023 FBC-EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#227	Revises the code provision for clarity. Adds a new exception for dwelling and sleeping units lighting requirements. Deletes the Section and moves its provision to new Section C405.3.3.

Related Mods:	**C405.1 General.** ~~Lighting system controls, the maximum lighting power for interior and exterior applications, and electrical energy consumption shall comply with this section. *Sleeping units* shall comply with Section C405.2.5 and with either Section C405.1.1 or C405.3. *General lighting* shall consist of all lighting included when calculating the total connected interior lighting power in accordance with Section C405.3.1 and which does not require specific application controls in accordance with Section C405.2.5. Transformers, uninterruptable power supplies, motors and electrical power processing equipment in data center systems shall comply with Section 8 of ASHRAE 90.4 in addition to this code.~~ Electrical power and lighting systems and generation shall comply with this section. General lighting shall consist of all lighting included when calculating the total connected interior lighting power in accordance with **Section C405.3.1** and which does not require specific application controls in accordance with **Section C405.2.5**. **Exception:** *Dwelling units* and sleeping units that comply with **Sections C405.2.10**, **C405.3.3** and **C405.6**. ~~**C405.1.1 Lighting for dwelling units.** No less than 90 percent of the permanently installed lighting serving dwelling units, excluding kitchen appliance lighting, shall be provided by lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/ W, or shall comply with **Sections C405.2.4** and **C405.3**.~~ Original text of mod is not consistent with that of the 2023 FBC-EC.
CE#228	Revises the section such that interior parking area lighting requirement to comply with Section C405.2.9 and all other interior lighting system to comply with Sections C405.2.1 through C405.2.8. Revises the existing exceptions for security and emergency areas and adds two new ones related to emergency exit access and fire alarm lighting systems. No change to code stringency.
Related Mods: CEPI-150-21, CEPI-147-21, CEPI-148-21, CEPI-152-21, CEPI-187-21,	**C405.2 Lighting controls.** ~~Lighting systems shall be provided with controls that comply with one of the following.~~ Lighting systems in *interior parking areas* shall be provided with controls that comply with **Section C405.2.9**. All other lighting systems powered through the energy service for the *building* and building site lighting for which the building *owner* is responsible shall be provided with controls that comply with **Sections C405.2.1** through **C405.2.8**. ~~1. Lighting controls as specified in Sections C405.2.1 through C405.2.9.~~ ~~2. Luminaire level lighting controls (LLLC) and lighting controls as specified in Sections C405.2.1, C405.2.5 and C405.2.6. The LLLC luminaire shall be independently capable of:~~ ~~2.1. Monitoring occupant activity to brighten or dim lighting when occupied or unoccupied, respectively.~~ ~~2.2. Monitoring ambient light, both electric light and daylight, and brighten or dim artificial light to maintain desired light level.~~

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CECD1-21-22, CECD1-23-22, CED1-65-22	~~2.3. For each control strategy, configuration and reconfiguration of performance parameters including; bright and dim setpoints, timeouts, dimming fade rates, sensor sensitivity adjustments, and wireless zoning configurations.~~ **Exceptions:** Lighting controls are not required for the following: 1. ~~Areas designated as security or emergency areas that are required to be continuously lighted.~~ Spaces where an *automatic* shutoff could endanger occupant safety or security. 2. Interior exit stairways, interior exit ramps and exit passageways. 3. ~~Emergency egress lighting that is normally off.~~ Emergency lighting that is automatically off during normal operations. 4. Emergency lighting required by the ***International Building Code*** in exit access components that are not provided with fire alarm systems. 5. Up to 0.02 watts per square foot (0.22 W/m^2) of lighting in exit access components that are provided with fire alarm systems.
CE#229	This amendment adds four new space types to an existing space list requiring occupancy sensor lighting controls: a computer room, a data center, a medical supply room in a health care facility, a Laundry/washer area, and a telemedicine room in a health care facility. This change may increase the construction cost by expanding the occupancy sensor requirements to new space types but is a cost-effective measure. Replaces the text "warehouse" with "warehouse storage areas" for clarity.
Related Mods: CECD1-3-22, CE2D-39-23, CECD1-3-22	**C405.2.1 Occupant sensor controls.** Occupant *sensor controls* shall be installed to control lights in the following space types: 1. Classrooms/lecture/training rooms. *2. Computer room , data center.* ~~2.~~3. Conference/meeting/multipurpose rooms. ~~3.~~4. Copy/print rooms. ~~4.~~5. Lounges/breakrooms. 6. Medical supply room in a health care facility. ~~5.~~7. Enclosed offices. 8. Laundry/washing area. ~~6.~~9. Open plan office areas. ~~7.~~10. Restrooms. ~~8.~~11. Storage rooms. 12. Telemedicine room in a health care facility. ~~9.~~13. Locker rooms. ~~10.~~14. Corridors. ~~11.~~15. Warehouse storage areas. ~~12.~~16. Other spaces 300 square feet (28 m^2) or less that are enclosed by floor-to-ceiling height partitions.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Exception: Luminaires that are required to have specific application controls in accordance with **Section C405.2.5**.

C405.2.1.1 Occupant sensor control function. Occupant sensor controls in ~~warehouses~~ warehouse storage areas shall comply with **Section C405.2.1.2**. Occupant sensor controls in open plan office areas shall comply with **Section C405.2.1.3**. Occupant sensor controls in corridors shall comply with **Section C405.2.1.4**. Occupant sensor controls for all other spaces specified in **Section C405.2.1** shall comply with the following:

1. They shall automatically turn off lights within 20 minutes after all occupants have left the space.
2. They shall be manual on or controlled to automatically turn on the lighting to not more than 50 percent power.
3. They shall incorporate a manual control to allow occupants to turn off lights.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#230

Deletes three exceptions and modifies an existing exception in Section C405.2 as a substitute. No change in the code stringency.

Related Mods:

CEPI-152-21

C405.2.2 Time-switch controls. Each area of the *building* that is not provided with *occupant sensor controls* complying with **Section C405.2.1.1** shall be provided with *time-switch controls* complying with **Section C405.2.2.1**.

Exceptions:

1. Luminaires that are required to have specific application controls in accordance with Section C405.2.4.
2. Spaces where patient care is directly provided.
3. ~~Spaces where an *automatic* shutoff would endanger occupant safety or security.~~
4. ~~Lighting intended for continuous operation.~~
5. ~~Shop and laboratory classrooms.~~

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#231

Replaces the text "Automatically" with " Programmed to automatically" for clarity.
Adds a new requirement that says, "For spaces where schedules are not available, time switch controls are programmed to a schedule that turns off lights not less than 12 hours per day." Improves compliance enforcement when the schedule in not available but no impact on construction costs.

Related Mods:

C405.2.2.1 Time-switch control function. *Time-switch controls* shall comply with all of the following:

1. ~~Automatically~~ Programmed to automatically turn off lights when the space is scheduled to be unoccupied.
2. Have a minimum 7-day clock.
3. Be capable of being set for seven different day types per week.

	4. Incorporate an automatic holiday "shutoff" feature, which turns off all controlled lighting loads for not fewer than 24 hours and then resumes normally scheduled operations. 5. Have program backup capabilities, which prevent the loss of program and time settings for not fewer than 10 hours, if power is interrupted. 6. Include an override switch that complies with the following: 6.1. The override switch shall be a *manual* control. 6.2. The override switch, when initiated, shall permit the controlled lighting to remain on for not more than 2 hours. 6.3. Any individual override switch shall control the lighting for an area not larger than 5,000 square feet (465 m^2). 7. For spaces where schedules are not available, *time switch controls* are programmed to a schedule that turns off lights not less than 12 hours per day. FSEC – Anticipated energy impact on FBC-EC – Decrease
CE#232	Renames the Section title, revises the section code provision, lists space types where dimming controls are required for general lighting, and removes the existing exceptions but adds a new exception for special application lighting.
Related Mods:	**C405.2.3** ~~**Light-reduction controls.**~~ **Dimming controls.** ~~Where not provided with occupant sensor controls complying with Section C405.2.1.1, *general lighting* shall be provided with light-reduction controls complying with Section C405.2.3.1.~~ Dimming controls complying with **Section C405.2.3.1** are required for general lighting in the following space types: 1. Classroom/lecture hall/training room. 2. Conference/multipurpose/meeting room. 3. In a dining area for bar/lounge or leisure, family dining. 4. Laboratory. 5. Lobby. 6. Lounge/break room. 7. Offices. 8. Gymnasium/fitness center. 9. Library reading room. 10. In a health care facility for imaging rooms, exam rooms, nursery and nurses' station. 11. Spaces not provided with occupant sensor controls complying with **Section C405.2.1.1**. **Exception:** Luminaires controlled by special application controls complying with **Section C405.2.5**. ~~Exceptions:~~ ~~1. Luminaires controlled by daylight responsive controls complying with Section C405.2.4.~~ ~~2. Luminaires controlled by special application controls complying with Section C405.2.5.~~

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

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~~3. Where provided with *manual* control, the following areas are not required to have light-reduction control:~~
~~3.1. Spaces that have only one luminaire with a rated power of less than 60 watts.~~
~~3.2. Spaces that use less than 0.45 watts per square foot (4.9 W/m²).~~
~~3.3. Corridors, lobbies, electrical rooms and/or mechanical rooms.~~
<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
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<tr>
<td>**CE#233**</td>
<td>Renames the Section title, revises the section code provision, and reduces the dimming limit to 10% of full power output from 20% for dimming controls and from 30% for switchable controls. Adds two new exceptions from manual dimming control requirements for spaces with high-end trim lighting controls.</td>
</tr>
<tr>
<td>Related Mods:

CEPI-156-21, CECD1-4-22</td>
<td>
C405.2.3.1 ~~Light-reduction~~ Dimming control function. Spaces required to have ~~light- reduction controls~~ dimming control shall ~~have a~~ be provided with *manual* ~~*control* that allows the occupant to reduce the connected lighting load by not less than 50 percent in a reasonably uniform illumination pattern with an intermediate step in addition to full on or off, or with continuous dimming control, using one of the following or another *approved* method:~~ controls that allow lights to be dimmed from full output to 10 percent of full power or lower with continuous dimming, as well as turning off lights. *Manual* control shall be provided within each room to dim lights.
~~1. Continuous dimming of all luminaires from full output to less than 20 percent of full power.~~
~~2. Switching all luminaires to a reduced output of not less than 30 percent and not more than 70 percent of full power.~~
~~3. Switching alternate luminaires or alternate rows of luminaires to achieve a reduced output of not less than 30 percent and not more than 70 percent of full power.~~

Exceptions: *Manual* dimming control is not required in spaces where high-end trim lighting controls are provided that comply with the following:
1. The calibration adjustment equipment is located for ready *access* only by authorized personnel.
2. Lighting controls with ready *access* for users cannot increase the lighting power above the maximum level established by the high-end trim controls.

FSEC – Anticipated energy impact on FBC-EC – Decrease
<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
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<tr>
<td>**CE#234**</td>
<td>Reduces the interior lights connected to the load threshold for daylighting responsive controls. Primary sidelit area and toplit areas lighting connected load were reduced to 75W from 150W, and combined primary and secondary sidelit areas were reduced from 300 W to 150 W.

Also revises exception item #3 and deletes equation 4-9 to simplify the compliance process.</td>
</tr>
<tr>
<td>Related Mods:
CEPI-161-21,</td>
<td>**C405.2.4 Daylight-responsive controls.** *Daylight-responsive controls* complying with **Section C405.2.4.1** shall be provided to control the *general lighting* within *daylight zones* in the following spaces:</td>
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</table>

CEPI-164-21	1. Spaces with a total of more than ~~150~~ 75 watts of *gen eral lighting* within primary sidelit daylight zones complying with **Section C405.2.4.2**. 2. Spaces with a total of more than ~~300~~ 150 watts of *general lighting* within sidelit daylight zones complying with **Section C405.2.4.2**. 3. Spaces with a total of more than ~~150~~ 75 watts of *general lighting* within toplit daylight zones complying with **Section C405.2.4.3**. **Exceptions:** Daylight responsive controls are not required for the following: 1. Spaces in health care facilities where patient care is directly provided. 2. Sidelit daylight zones on the first floor above grade in Group A-2 and Group M occupancies. 3. ~~New buildings where the total connected lighting power calculated in accordance with Section C405.3.1 is not greater than the adjusted interior lighting power allowance (LPA_{adj}) calculated in accordance with Equation 4-9.~~ Enclosed office spaces less than 250 square feet (23.2 m^2). ~~where:~~ ~~LPA_{adj} = Adjusted building interior lighting power allowance in watts.~~ ~~(Equation 4-9)~~ ~~LPA_{norm} = Normal building lighting power allowance in watts calculated in accordance with **Section C405.3.2** and reduced in accordance with **Section C406.3** where Option 2 of **Section C406.1** is used to comply with the requirements of **Section C406**.~~ ~~*UDZFA* = Uncontrolled daylight zone floor area is the sum of all sidelit and toplit zones, calculated in accordance with **Sections C405.2.4.2** and **C405.2.4.3**, that do not have daylight responsive controls.~~ ~~*TBFA* = Total building floor area is the sum of all floor areas included in the lighting power allowance calculation in **Section C405.3.2**.~~ FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#235	Replaces the text "sidelit daylight zone" with "primary sidelit daylight zone" in requirement items #1 and #2 for code clarity. Adds a clarifying text "Where the fenestration is located in a wall" for item #3 and removes the secondary sidelit daylighting zone calculation requirement.
Related Mods: CEPI-167-21,	**C405.2.4.2 Sidelit daylight zone.** The sidelit daylight zone is the floor area adjacent to vertical *fenestration* that complies with all of the following: 1. Where the *fenestration* is located in a wall, the primary sidelit daylight zone shall extend laterally to the nearest full-height wall, or up to 1.0 times the height from the floor to the top of the *fenestration* , and longitudinally from the edge

CEPI-166-21	of the *fenestration* to the nearest full-height wall, or up to 0.5 times the height from the floor to the top of the *fenestration* , whichever is less, as indicated in **Figure C405.2.4.2(1)**. 2. Where the *fenestration* is located in a *rooftop monitor* , the primary sidelit daylight zone shall extend laterally to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 1.0 times the height from the floor to the bottom of the *fenestration* , whichever is less, and longitudinally from the edge of the *fenestration* to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 0.25 times the height from the floor to the bottom of the *fenestration* , whichever is less, as indicated in **Figures C405.2.4.2(2)** and **C405.2.4.2(3)**. 3. Where the *fenestration* is located in a wall, the~~The~~ secondary sidelit daylight zone is directly adjacent to the primary sidelit daylight zone and shall extend laterally to 2.0 times the height from the floor to the top of the *fenestration* or to the nearest full height wall, whichever is less, and longitudinally from the edge of the *fenestration* to the nearest full height wall, or up to 0.5 times the height from the floor to the top of the *fenestration* , whichever is less, as indicated in **Figure C405.2.4.2(1)**. ~~The area of secondary sidelit zones shall not be considered in the calculation of the daylight zones in Section C402.5.1.1.~~ 4. The area of the *fenestration* is not less than 24 square feet (2.23 m^2). 5. The distance from the *fenestration* to any *building* or geological formation that would block *access to* daylight is greater than one-half of the height from the bottom of the *fenestration* to the top of the *building* or geologic formation. 6. The *visible transmittance* of the *fenestration* is not less than 0.20. 7. The projection factor (determined in accordance with **Equation 4-4**) for any overhanging projection that is shading the *fenestration* is not greater than 1.0 for *fenestration* oriented 45 degrees or less from true north and not greater than 1.5 for all other orientations. Staff Classification: Correlates Directly: X; Energy Standard Needed: ; Over lap: Action: AS: x; AS/IC: ; D: ; D/IC:
CE#236	Revises the provision for clarity, removes sleeping and dwelling units lighting requirements from this section, and adds a new requirement, "lighting integrated into range hoods and exhaust fans must be controlled independently of fans."
Related Mods: CEPI-168-21, CEPI-169-21, CEPI-135-21, CECD1-1-22, CED1-27-22	**C405.2.5 Specific application controls.** Specific application controls shall be provided for the following: 1. The following lighting shall be controlled by an occupant sensor complying with **Section C405.2.1.1** or a *time-switch control* complying with **Section C405.2.2.1**. In addition, a *manual* control shall be provided to control such lighting separately from the *general lighting* in the space: 1.1. Luminaires for which additional lighting power is claimed in accordance with Section C405.3.2.2.1. 1.2. Display and accent, including lighting in display cases. 1.3. ~~Lighting in display cases.~~ 1.~~4~~3. Supplemental task lighting, including permanently installed under-shelf or under- cabinet lighting. 1.~~5~~4. Lighting equipment that is for sale or demonstration in lighting education. ~~1.6. Display lighting for exhibits in galleries, museums and monuments that is in addition to *general lighting* .~~

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

	2. ~~*Sleeping units* shall have control devices or systems that are configured to automatically switch off all permanently installed luminaires and switched receptacles within 20 minutes after all occupants have left the unit.~~ ~~Exceptions:~~ ~~1. Lighting and switched receptacles controlled by card key controls.~~ ~~2. Spaces where patient care is directly provided.~~ ~~3. Permanently installed luminaires within *dwelling units* shall be provided with controls complying with Section C405.2.1.1 or C405.2.3.1.~~ ~~4~~2. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a *time switch control* complying with **Section C405.2.2.1** that is independent of the controls for other lighting within the room or space. ~~5~~3. Task lighting for medical and dental purposes that is in addition to *general lighting* shall be provided with a *manual control*. 4. Lighting integrated into range hoods and exhaust fans shall be controlled independently of fans. FSEC – Anticipated energy impact on FBC-EC – Decrease Staff Classification | Correlates Directly: X | Energy Standard Needed: | Over lap: Action | AS: x | AS/IC: | D: | D/IC:
CE#237	Edits the language for clarity. Edits the code language for clarity. Edits the code language for clarity, and reduces parking lot luminaire's total wattage threshold to 40 W from 78 W. This change increases the stringency but is cost-effective.
Related Mods: CECD1-23-22, CEPI-172-21	**C405.2.7 Exterior lighting controls.** Exterior lighting systems shall be provided with controls that comply with **Sections C405.2.7.1** through **C405.2.7.4**. Exceptions: 1. Lighting for covered vehicle entrances ~~and exits from~~ to buildings ~~and parking structures~~ where required for eye adaptation. 2. Lighting controlled from within *dwelling units* . **C405.2.7.1 Daylight shutoff.** Lights shall be automatically turned off when daylight is present and satisfies the lighting needs. **C405.2.7.2 Building facade and landscape lighting.** Building facade and landscape lighting shall automatically shut off from not later than 1 hour after *building* or business closing to not earlier than 1 hour before *building* or business opening. **C405.2.7.3 Lighting setback.** Lighting that is not controlled in accordance with **Section C405.2.7.2** shall comply with the following: 1. Be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:

<table>
<tr>
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1.1. From not later than midnight to not earlier than 6 a.m.
1.2. From not later than 1 hour after *building* or business closing to not earlier than 1 hour before *building* or business opening.
1.3. During any time where activity has not been detected for 15 minutes or more.
2. Luminaires serving exterior ~~outdoor~~ parking areas and having a rated input wattage of greater than ~~78~~ 40 watts and a mounting height of 24 feet (7315 mm) or less above the ground shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent during any time where activity has not been detected for 15 minutes or more. Not more than 1,500 watts of lighting power shall be controlled together.

FSEC – Anticipated energy impact on FBC-EC – Decrease
<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
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<tr>
<td>**CE#238**</td>
<td>New reserved Section.
This reserved Section must have a title and requirement compatible with its sub-section. It looks like an incomplete code modification.</td>
</tr>
<tr>
<td>Related Mods:

CEPI-176-21, CECD1-5-22, CE2D-44-23, CE2D-45-23, CECD1-23-22</td>
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C405.2.8 Reserved.
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<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
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<tr>
<td>**CE#239**</td>
<td>It adds a new Section C405.2.8.1:

Simplifies the code by limiting the demand responsive lighting controls requirements to B, E, M, and S building occupancies group. Adds an exception for storage rooms and warehouse spaces from dimming control; instead, use 25% or more switch-off control for general lighting. Decreases the code stringency.</td>
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<tr>
<td>Related Mods:</td>
<td>**C405.2.8.1 Demand responsive lighting controls function.** Demand responsive controls for lighting shall be capable of the following:</td>
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CE2D-45-23, CECD1-5-22	1. Automatically reducing the output of controlled lighting to 80 percent or less of full power or light output upon receipt of a *demand response signal* . 2. Where high-end trim has been set, automatically reducing the output of controlled lighting to 80 percent or less of the high-end trim setpoint upon receipt of a *demand response signal*. 3. Dimming controlled lights gradually and continuously over a period of not longer than 15 minutes to achieve their demand response setpoint. 4. Returning controlled lighting to its normal operational settings at the end of the demand response period. **Exception:** Storage rooms and warehouse storage areas shall be permitted to switch off 25 percent or more of general lighting power rather than dimming.
CE#240	Renumbers Section C405.2.8 renames the title and edits the text for clarity.
Related Mods: CECD1-23-22	**~~C405.2.8~~ C405.2.9 ~~Parking garage~~ Interior parking area lighting control.** ~~Parking~~ Interior parking area ~~garage~~ lighting shall be controlled by an *occupant sensor* complying with **Section C405.2.1.1** or a *time-switch control* complying with **Section C405.2.2.1**. Additional lighting controls shall be provided as follows: 1. Lighting power of each luminaire shall be automatically reduced by not less than 30 percent when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be not larger than 3,600 square feet (334.5 m^2). **Exception:** Lighting zones provided with less than 1.5 footcandles of illumination on the floor at the darkest point with all lights on are not required to have *automatic* light-reduction controls. 2. Where lighting for eye adaptation is provided at ~~covered~~ vehicle entrances ~~and exits from~~ to buildings~~and parking structures~~, such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50 percent from sunset to sunrise. 3. The power to luminaires within 20 feet (6096 mm) of perimeter wall openings shall automatically reduce in response to daylight by at least 50 percent. Exceptions: 1. Where the opening-to-wall ratio is less than 40 percent as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element. 2. Where the distance from the opening to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or *fenestration* to the top of the obstruction. 3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

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CE#241	Adds new Section C405.2.10 requiring sleeping and dwelling units to be provided with lighting controls and switched receptacles, instead of occupancy sensor based lighting and receptacle controls. This change simplifies the requirements for dwelling and sleeping units. Thus decreases the stringency. Adds new subsection C405.2.10.1. Requires a switched receptacle and occupant sensor lighting controls. Automatic shutoff is not required where captive key override controls all lighting and switched receptacles in units with five or fewer permanently installed lights and switched receptacles. Adds new subsection C405.2.10.2. Requires bathroom lighting to be controlled by an occupant sensor control that can turn-off lighting automatically within 20 minutes not occupied and a manual lighting control at the entrance of each unit that can turn-off lighting and switched receptacle in the unit, except for lighting in bathrooms and kitchens.	
Related Mods: CE2D-40-23, CED1-27-22, CE2D-41-23	**C405.2.10** Sleeping unit and dwelling unit lighting and switched receptacle controls. *Sleeping units* and *dwelling units* shall be provided with lighting controls and switched receptacles as specified in **Sections C405.2.10.1** and **C405.2.10.2**. **C405.2.10.1 Sleeping units and dwelling units in hotels, motels and vacation timeshare properties.** *Sleeping units* and *dwelling units* in hotels, motels and vacation timeshare properties shall be provided with the following: 1. Not less than two 125V, 15- and 20- amp switched receptacles in each room, except for bathrooms, kitchens, foyers, hallways and closets. 2. Lighting controls that automatically turn off all lighting and switched receptacles within 20 minutes after all occupants have left the unit. **Exception:** *Automatic* shutoff is not required where *captive key override* controls all lighting and switched receptacles in units with five or fewer permanently installed lights and switched receptacles. **C405.2.10.2 Sleeping units in congregate living facilities.** *Sleeping units* in *congregate living facilities* shall be provided with the following controls: 1. Lighting in bathrooms shall be controlled by an *occupant sensor control* that automatically turns off lights within 20 minutes after all occupants have left the space. 2. Each unit shall have a *manual* control by the entrance that turns off all lighting and switched receptacles in the unit, except for lighting in bathrooms and kitchens. The *manual* control shall be marked to indicate its function. <table><tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table>	

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<tr><td>CE#242</td><td>Renumbers Equation 4-10 and revises the list of lighting equipment and applications not included in calculating total connected lighting power.</td></tr>
<tr><td>Related Mods:

CEPI-177-21, CEPI-135-21, CEPI-187-21, CE2D-47-23</td><td>

C405.3 Interior lighting power requirements. A *building* complies with this section where its total connected interior lighting power calculated under **Section C405.3.1** is not greater than the interior lighting power allowance calculated under **Section C405.3.2**. *Sleeping units* and *dwelling units* shall comply with **Section C405.3.3**.

C405.3.1 Total connected interior lighting power. The total connected interior lighting power shall be determined in accordance with **Equation 4-9**.

$$TCLP = [LVL + BLL + LED + TRK + Other]$$ Equation 4- 9~~10~~

where:

TCLP = Total connected lighting power (watts).
LVL = For luminaires with lamps connected directly to building power, such as line voltage lamps, the rated wattage of the lamp.
BLL = For luminaires incorporating a ballast or transformer, the rated input wattage of the ballast or transformer when operating that lamp.
LED = For light-emitting diode luminaires with either integral or remote drivers, the rated wattage of the luminaire.
TRK = For lighting track, cable conductor, rail conductor, and plug-in busway systems that allow the addition and relocation of luminaires without rewiring, the wattage shall be one of the following:

1. The specified wattage of the luminaires, but not less than 8 W per linear foot (25 W/lin m).
2. The wattage limit of the permanent current-limiting devices protecting the system.
3. The wattage limit of the transformer supplying the system.

Other = The wattage of all other luminaires and lighting sources not covered previously and associated with interior lighting verified by data supplied by the manufacturer or other approved sources.

The connected power associated with the following lighting equipment and applications is not included in calculating total connected lighting power.

~~1. Television broadcast lighting for playing areas in sports arenas.~~
~~2.~~1. Emergency lighting automatically off during normal building operation.
~~3.~~2. Lighting in spaces specifically designed for use by occupants with special lighting needs, including those with visual impairment and other medical and age-related issues.
~~4. Casino gaming areas.~~
~~5.~~3. Mirror lighting in makeup or dressing ~~rooms~~ areas used for video broadcasting, video or film recording, or live theatrical and music performance.
~~6.~~4. Task lighting for medical and dental purposes that is in addition to *general lighting* .
~~7.~~5. Display lighting for exhibits in galleries, museums and monuments that is in addition to *general lighting* .
~~8.~~6. Lighting ~~for theatrical purposes, including performance, stage, film production and video production.~~ in any location

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</table>

that is specifically used for video broadcasting, video or film recording, or live theatrical and music performance.

~~9.~~7. Lighting for photographic processes.

~~10.~~8. Lighting integral to equipment or instrumentation and installed by the manufacturer.

~~11.~~9. Task lighting for plant growth or maintenance.

~~12.~~10. Advertising signage or directional signage.

~~13.~~11. Lighting for food warming.

~~14.~~12. Lighting equipment that is for sale.

~~15.~~13. Lighting demonstration equipment in lighting education facilities.

~~16.~~14. Lighting approved because of safety considerations.

~~17.~~15. Lighting in retail display windows, provided that the display area is enclosed by ceiling- height partitions.

~~18.~~16. Furniture-mounted supplemental task lighting that is controlled by automatic shutoff.

~~19.~~17. Exit signs.

~~20.~~18. Antimicrobial lighting used for the sole purpose of disinfecting a space.

19. Lighting in *sleeping units* and *dwelling units*.

20. For exit access and exit stairways, including landings, where the applicable code requires an illuminance of 10 footcandles or more on the walking surface, the power in excess of the allowed power calculated according to **Section C405.3.2.2** is not included.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#243

Updates the LPD values in Table C405.3.2(1) based on improved lighting technologies and other requirements. The LPD values were mostly reduced. The measure is based on improved technology with little to no impact on the construction cost.

Related Mods:

~~TABLE C405.3.2(1)~~

~~**INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD**~~

~~**BUILDING AREA TYPE**~~	**LPD (w/ft^2)**
~~Automotive facility~~	~~0.75~~
~~Convention center~~	~~0.64~~
~~Courthouse~~	~~0.79~~
~~Dining: bar lounge/leisure~~	~~0.80~~
~~Dining: cafeteria/fast food~~	~~0.76~~
~~Dining: family~~	~~0.71~~
~~Dormitory [a, b]~~	~~0.53~~
~~Exercise center~~	~~0.72~~
~~Fire station [a]~~	~~0.56~~
~~Gymnasium~~	~~0.76~~

~~Health care clinic~~	~~0.81~~
~~Hospital~~ [a]	~~0.96~~
~~Hotel/Motel~~ [a, b]	~~0.56~~
~~Library~~	~~0.83~~
~~Manufacturing facility~~	~~0.82~~
~~Motion picture theater~~	~~0.44~~
~~Multiple-family~~ [c]	~~0.45~~
~~Museum~~	~~0.55~~
~~Office~~	~~0.64~~
~~Parking garage~~	~~0.18~~
~~Penitentiary~~	~~0.69~~
~~Performing arts theater~~	~~0.84~~
~~Police station~~	~~0.66~~
~~Post office~~	~~0.65~~
~~Religious building~~	~~0.67~~
~~Retail~~	~~0.84~~
~~School/university~~	~~0.72~~
~~Sports arena~~	~~0.76~~
~~Town hall~~	~~0.69~~
~~Transportation~~	~~0.50~~
~~Warehouse~~	~~0.45~~
~~Workshop~~	~~0.91~~

~~For SI: 1 watt per square foot = 10.76 w/m~~^{2}~~.~~

a. ~~Where sleeping units are excluded from lighting power calculations by application of **Section R404.1**, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.~~
b. ~~Where dwelling units are excluded from lighting power calculations by application of **Section R404.1**, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.~~
c. ~~Dwelling units are excluded. Neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.~~

TABLE C405.3.2(1)
INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD

BUILDING AREA TYPE	LPD (watts/ft^2)
Automotive facility	0.73
Convention center	0.64
Courthouse	0.75
Dining: bar lounge/leisure	0.74
Dining: cafeteria/fast food	0.70
Dining: family	0.65
Dormitory	0.52
Exercise center	0.72
Fire station	0.56
Gymnasium	0.75
Health care clinic	0.77
Hospital	0.92
Hotel/Motel	0.53
Library	0.83
Manufacturing facility	0.82
Motion picture theater	0.43
Multiple-family	0.46
Museum	0.56
Office	0.62
Parking garage	0.17
Penitentiary	0.65
Performing arts theater	0.82
Police station	0.62
Post office	0.64
Religious building	0.66

Retail	0.78
School/university	0.70
Sports arena	0.73
Town hall	0.67
Transportation	0.56
Warehouse	0.45
Workshop	0.86

For SI: 1 watt per square foot = 10.76 watts per square meter

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#244

Updates the LPD values in Table C405.3.2(2) based on improved lighting technologies and other requirements. The LPD values were mostly reduced. The measure is based on improved technology with little to no impact on the construction cost.

Related Mods:

CED1-9-22, CED1-75-22, CECPI-7-21, CEPI-135-21

Delete entire table

~~TABLE C405.3.2(2)~~

~~**INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD**~~

~~For SI: 1 foot = 304.8 mm, 1 watt per square foot = 10.76 w/m²~~.

a. ~~In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply.~~
b. ~~A 'Facility for the Visually Impaired' is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support or people with special visual needs.~~
c. ~~Where sleeping units are excluded from lighting power calculations by application of~~ **Section R404.1**, ~~neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.~~
d. ~~Where dwelling units are excluded from lighting power calculations by application of~~ **Section R404.1**, ~~neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.~~
e. ~~Class I facilities consist of professional facilities; and semiprofessional, collegiate, or club facilities with seating for 5,000 or more spectators.~~
f. ~~Class II facilities consist of collegiate and semiprofessional facilities with seating for fewer than 5,000 spectators; club facilities with seating for between 2,000 and 5,000 spectators; and amateur league and high school facilities with seating for more than 2,000 spectators.~~
g. ~~Class III facilities consist of club, amateur league and high school facilities with seating for 2,000 or fewer spectators.~~
h. ~~Class IV facilities consist of elementary school and recreational facilities; and amateur league and high school facilities without provision for sectators.~~

	TABLE C405.3.2(2) **INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD** **Please see attached** For SI: 1 foot = 304.8 mm, 1 watt per square foot = 10.76 w/m^2. a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply. b. A 'Facility for the Visually Impaired' is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult day care, senior support or people with special visual needs. c. Class I facilities consist of professional facilities; and semiprofessional, collegiate or club facilities with seating for 5,000 or more spectators. d. Class II facilities consist of collegiate and semiprofessional facilities with seating for fewer than 5,000 spectators, club facilities with seating for between 2,000 and 5,000 spectators, and amateur league and high school facilities with seating for more than 2,000 spectators. e. Class III facilities consist of club, amateur league and high school facilities with seating for 2,000 or fewer spectators. f. Class IV facilities consist of elementary school and recreational facilities; and amateur league and high school facilities without provision for spectators. FSEC – Anticipated energy impact on FBC-EC – Decrease
CE#245	Adds a clarifying statement that sleeping and dwelling units are excluded from lighting power allowance calculations by applying a new Section C405.3.3, and their floor area is not included in the calculation.
Related Mods: CEPI-135-21, CECD1-21-22	**C405.3.2.1 Building Area Method.** For the Building Area Method, the interior lighting power allowance is calculated as follows: 1. For each building area type inside the *building* , determine the applicable building area type and the allowed lighting power density for that type from **Table C405.3.2(1)**. For building area types not listed, select the building area type that most closely represents the use of that area. For the purposes of this method, an "area" shall be defined as all contiguous spaces that accommodate or are associated with a single building area type. 2. Determine the floor area for each building area type listed in **Table C405.3.2(1)** and multiply this area by the applicable value from **Table C405.3.2(1)** to determine the lighting power (watts) for each building area type. *Sleeping units* and *dwelling units* are excluded from lighting power allowance calculations by application of **Section C405.3.3**. The area of *sleeping units* and *dwelling units* is not included in the calculation. 3. The total interior lighting power allowance (watts) for the entire *building* is the sum of the lighting power from each building area type.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#246	A clarifying statement was added that sleeping and dwelling units are excluded from lighting power allowance calculations by applying a new Section C405.3.3, and their area is not included in the calculation. Also, the total connected lighting power maximum allowance for unfinished spaces reduced to 0.10 W/ft2 from 0.20 W/ft2.
Related Mods: CEPI-135-21, CEPI-181-21, CECD1-21-22,	**C405.3.2.2 Space-by-Space Method.** Where a *building* has unfinished spaces, the lighting power allowance for the unfinished spaces shall be the total connected lighting power for those spaces, or ~~0.~~ ~~2~~0.1 watts per square foot (~~10.76~~ 1.08 w/m^2), whichever is less. For the Space-by-Space Method, the interior lighting power allowance is calculated as follows: 1. For each space enclosed by partitions that are not less than 80 percent of the ceiling height, determine the applicable space type from **Table C405.3.2(2)**. For space types not listed, select the space type that most closely represents the proposed use of the space. Where a space has multiple functions, that space may be divided into separate spaces. 2. Determine the total floor area of all the spaces of each space type and multiply by the value for the space type in **Table C405.3.2(2)** to determine the allowed lighting power (watts) for each space type. *Sleeping units* and *dwelling units* are excluded from lighting power allowance calculations by application of **Section C405.3.3**. The area of *sleeping units* and *dwelling units* is not included in the calculation. 3. The total interior lighting power allowance (watts) shall be the sum of the lighting power allowances for all space types. FSEC – Anticipated energy impact on FBC-EC – Decrease Staff Classification | Correlates Directly: X | Energy Standard Needed: | Over lap: Action | AS: | AS/IC: | D: x | D/IC:
CE#247	Revises the code language for clarifications.
Related Mods: CECPI-7-21, CED1-76-22	**C405.3.2.2.1 Additional interior lighting power.** Where using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions. Additional power shall be permitted only where the specified lighting is installed and controlled in accordance with **Section C405.2.5**. ~~This~~ These additional power allowances shall be used only for the ~~specified~~ luminaires serving the specific lighting function and shall not be used for any other purpose. An increase in the interior lighting power allowance is permitted in the following cases: 1. For lighting equipment to be installed in sales areas specifically to highlight merchandise, the additional lighting power ~~shall be determined in accordance with Equation 4-11.~~ allowance shall be the connected lighting power of the luminaires specifically highlighting merchandise, calculated in accordance with **Equation 4-9**, or the additional power allowance calculated in accordance with **Equation 4-10**, whichever is less.

$$\text{Additional lighting power allowance} = 750\text{ W} + (\text{Retail Area }1 \times 0.40\text{ W/ft}^2) + (\text{Retail Area }2 \times 0.40\text{ W/ft}^2) + (\text{Retail Area }3 \times 0.70\text{ W/ft}^2) + (\text{Retail Area }4 \times 1.00\text{ W/ft}^2)$$

Equation 4-10

For SI: units:

$$\text{Additional lighting power allowance} = 750\text{ W} + (\text{Retail Area }1 \times 4.3\text{ W/m}^2) + (\text{Retail Area }2 \times 4.3\text{ W/m}^2) + (\text{Retail Area }3 \times 7.5\text{ W/m}^2) + (\text{Retail Area }4 \times 10.8\text{ W/m}^2)$$

2. For spaces in which lighting is specified to be installed in addition to the *general lighting* for the purpose of decorative appearance or for highlighting art or exhibits, ~~provided that the additional lighting power shall be not more than 0.9 W/ft² (9.7 W/m²) in lobbies and not more than 0.75 W/ft² (8.1 W/m²) in other spaces.~~

the additional lighting power allowance for that space shall be the smallest of the following:

2.1. 0.66 W/ft² (7.1W/m²) in lobbies,

2.2. 0.55 W/ft² (5.9 W/m ²) in other spaces, or

2.3. The connected lighting power of the luminaires specifically for decorative appearance or for highlighting art or exhibits, calculated according to **Equation 4-9**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#248 Adds a new Section C405.3.3 by moving from a deleted Section C405.1.1. No change in stringency.

Related Mods:

CE2D-48-23, CECD1-21-22, CECD1-1-22

C405.3.3 Lighting power for sleeping units and dwelling units. *Sleeping units* in Group I-2 occupancies that are patient rooms shall comply with **Sections C405.3.1** and **C405.3.2**. For all other *sleeping units* and *dwelling units* , permanently installed lighting, including lighting integrated into range hoods and exhaust fans, shall be provided by lamps capable of operating with an efficacy of not less than 65 lumens per watt or luminaires capable of operating with an efficacy of not less than 45 lumens per watt.

Exceptions:

1. Lighting integral to other appliances.
2. Antimicrobial lighting used for the sole purpose of disinfecting.
3. Luminaires with an input rating of less than 3 watts.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

<table>
<tr><td>CE#249</td><td>It renames the section title, edits the code language, and increases the photon efficiency. This change may slightly increase construction costs but saves more energy costs due to the improved efficiency requirement. It increases the stringency but is cost-effective.</td></tr>
<tr><td>Related Mods:

FBC –

C405.9</td><td>

C405.4 ~~Lighting for plant growth and maintenance.~~ Horticultural lighting. ~~Not less than 95 percent of the permanently installed luminaires used for plant growth and maintenance shall have a photon efficiency of not less than 1.6 μmol/J as defined in accordance with ANSI/ASABE S640.~~ Permanently installed luminaires shall have a *photosynthetic photon efficacy* of not less than 1.7 micromoles per joule (μmol/J) for *horticultural lighting* in greenhouses and not less than 1.9 μmol/J for all other *horticultural lighting* . Luminaires for *horticultural lighting* in greenhouses shall be controlled by a device that automatically turns off the luminaire when sufficient daylight is available. Luminaires for *horticultural lighting* shall be controlled by a device that automatically turns off the luminaire at specific programmed times.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

</td></tr>
<tr><td>CE#250</td><td>Renames the Section title, edits the code language and existing exception items #7 and #14 for clarity, and adds a new exception item #15. No change in code stringency. Revises the code language of exterior lighting power allowance to include “building site lighting for which the building owner is responsible.” This change improves the code clarity.</td></tr>
<tr><td>Related Mods:

FBC –
C405.4.1</td><td>

C405.5 Exterior lighting power requirements. The total connected exterior lighting power calculated in accordance with **Section C405.5.1** shall be not greater than the exterior lighting power allowance calculated in accordance with **Section C405.5.2**.

C405.5.1 Total connected exterior ~~*building* exterior~~ lighting power. The total exterior connected lighting power shall be the total maximum rated wattage of all exterior lighting that is powered through the energy service for the building and building site lighting for which the building *owner* is responsible.

Exception: Lighting used for the following applications shall not be included.

1. Lighting *approved* because of safety considerations.
2. Emergency lighting automatically off during normal business operation.
3. Exit signs.
4. Specialized signal, directional and marker lighting associated with transportation.
5. Advertising signage or directional signage.
6. Integral to equipment or instrumentation and installed by its manufacturer.
7. ~~Theatrical purposes, including performance, stage, film production and video production.~~ Lighting in any location that is specifically used for video broadcasting, video or film recording, or live theatrical and music performances.
8. Athletic playing areas.
9. Temporary lighting.
10. Industrial production, material handling, transportation sites and associated storage areas.
11. Theme elements in theme/amusement parks.
12. Used to highlight features of art, public monuments and the national flag.
13. Lighting for water features and swimming pools.

</td></tr>
</table>

14. Lighting controlled from within *sleeping units* and *dwelling units* ~~, where the lighting complies with Section R404.1~~.
15. Lighting of the exterior means of egress as required by the ***International Building Code***.

C405.5.2 Exterior lighting power allowance. The exterior lighting power allowance (watts) is calculated as follows:

1. Determine the Lighting Zone (LZ) for the *building* according to **Table C405.5.2(1)**, unless otherwise specified by the *code official*.
2. For each exterior area that is to be illuminated by lighting that is powered through the energy service for the *building* and building site lighting for which the building *owner* is responsible, determine the applicable area type from **Table C405.5.2(2)**. For area types not listed, select the area type that most closely represents the proposed use of the area.
3. Determine the total area or length of each area type and multiply by the value for the area type in **Table C405.5.2(2)** to determine the lighting power (watts) allowed for each area type.
4. The total exterior lighting power allowance (watts) is the sum of the base site allowance determined according to **Table C405.5.2(2)**, plus the watts from each area type.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#251

Updates the exterior lighting power allowance values in Table C405.5.2(2). Reduces the lighting power allowances based on advances in lighting technology and aligns with ASHRAE 90.1 requirements.

Related Mods:

CECD1-23-22, CEPI-189-21,CEPI-254-21

FBC – C405.4.2

Delete Table

~~**TABLE C405.5.2(2)**~~

~~**LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS**~~

~~For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m^2. W = watts~~

TABLE C405.5.2(2)

LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

	LIGHTING ZONES			
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
Base Site Allowance	160 W	280 W	400 W	560 W

Parking area, exterior	0.015 W/ft^2	0.026 W/ft^2	0.037 W/ft^2	0.052 W/ft^2
Walkways and ramps less	0.50 W/linear foot	0.50 W/linear foot	0.55 W/linear foot	0.60 W/linear foot
Plaza areas	0.028 W/ft^2	0.049 W/ft^2	0.070 W/ft^2	0.098 W/ft^2
Dining areas	0.156 W/ft^2	0.273 W/ft^2	0.390 W/ft^2	0.546 W/ft^2
Stairways	Exempt	Exempt	Exempt	Exempt
Pedestrian tunnels	0.063 W/ft^2	0.110 W/ft^2	0.157 W/ft^2	0.220 W/ft^2
Landscaping	0.014 W/ft^2	0.025 W/ft^2	0.036 W/ft^2	0.050 W/ft^2
Pedestrian and vehicular entrances and exits	5.6 W/linear foot of opening	9.8 W/linear foot of opening	14 W/linear foot of opening	19.6 W/linear foot of opening
Entry canopies	0.072 W/ft^2	0.126 W/ft^2	0.180 W/ft^2	0.252W/ft^2
Loading docks	0.104 W/ft^2	0.182 W/ft^2	0.260 W/ft^2	0.364 W/ft^2
Free-standing and attached	0.20 W/ft^2	0.35 W/ft^2	0.50 W/ft^2	0.70 W/ft^2
Open areas (including vehicle sales lots)	0.072 W/ft^2	0.126 W/ft^2	0.180 W/ft^2	0.252 W/ft^2
Street frontage for vehicle sales lots in addition to “open area” allowance	No allowance	7.2 W/linear foot	10.3 W/linear foot	14.4 W/linear foot

For SI: 1 foot = 304.8 mm, 1 watt per square foot = 10.76 W/m^2. W = Watt.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#252	Updates the individual exterior lighting power allowance values in Table C405.5.2(3). Reduces the individual lighting power allowances based on advances in lighting technology and aligns with ASHRAE 90.1 requirements. It increases the stringency but has no impact on the construction cost.

Related Mods: CEPI-189-21, CEPI-254-21, CECD1-23-22 FBC – C405.4.2	**Delete entire Table** ~~TABLE C405.5.2(3)~~ ~~**INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS**~~

TABLE C405.5.2(3)

INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

LIGHTNING ZONES				
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
Building facades	No allowance	0.075 W/ft^2 of gross above-grade wall area	0.113 W/ft^2 of gross above-grade wall area	0.15 W/ft^2 of gross above-grade wall area
Automated teller machines (ATM) and night depositories	90 W per location plus 35W per additional ATM per location			
Uncovered entrances and gatehouse inspection stations at guarded facilities	0.144 W/ft^2 of area	0.252 W/ft^2 of area	0.360 W/ft^2 of area	0.504 W/ft^2 of area
Uncovered loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.104 W/ft^2 of area	0.182 W/ft^2 of area	0.260 W/ft^2 of area	0.364 W/ft^2 of area
Drive-up windows and doors	53 W per drive-through	92 W per drive-through	132 W per drive-through	185 W per drive-through
Parking area near 24-hour retail entrances	80 W per main entry	140 W per main entry	200 W per main entry	280 W per main entry

For SI: 1 watt per square foot = 10.76 W/m^2. W = Watts.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#253	Revises the exception per the DOE definition of Distribution Transformers found in 10 CFR 431.192
Related Mods: FBC – C405.6	**C405.7 Electrical transformers.** Low-voltage dry-type distribution electric transformers shall meet the minimum efficiency requirements of **Table C405.7** as tested and rated in accordance with the test procedure *listed* in **DOE 10 CFR 431**. The efficiency shall be verified through certification under an *approved* certification program or, where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by the transformer manufacturer. **Exceptions:** The following transformers are exempt in accordance with the DOE definition of Distribution Transformers found in **10 CFR 431.192**: ~~1. Transformers that meet the *Energy Policy Act of 2005* exclusions based on the DOE 10 CFR 431 definition of special purpose applications.~~ ~~2. Transformers that meet the *Energy Policy Act of 2005* exclusions that are not to be used in general purpose applications based on information provided in DOE 10 CFR 431.~~ ~~3.~~ 1. Transformers ~~that meet the *Energy Policy Act of 2005* exclusions with multiple voltage taps where the highest tap is not less than 20 percent more than the lowest tap.~~ with a tap range of 20 percent or more. ~~4.~~ 2. Drive (isolation) transformers. ~~5.~~ 3. Rectifier transformers. ~~6.~~ 4. Auto-transformers. ~~7.~~ 5. Uninterruptible power system transformers. ~~8.~~ 6. ~~Impedance~~ Special impedance transformers. ~~9.~~ 7. Regulating transformers. ~~10.~~ 8. Sealed ~~and nonventilating~~ transformers. ~~11.~~ 9. Machine tool (control) transformers. ~~12.~~ 10. Welding transformers. ~~13.~~ 11. Grounding transformers. ~~14.~~ 12. Testing transformers. 13. Nonventilated transformers.
CE#254	Adds a new footnote and renumbers the existing ones for clarification. No impact on the stringency and construction cost.
Related Mods: CEPI-192-21 FBC –	TABLE C405.7 **MINIMUM NOMINAL EFFICIENCY LEVELS FOR DOE 10 CFR 431 LOW-VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	X			

SINGLE-PHASE TRANSFORMERS[a]		THREE-PHASE TRANSFORMERS[a]	
kVA[a] [b]	Efficiency (%)[b] [c]	kVA[a] [b]	Efficiency (%)[b] [c]

C405.6	

15	97.70	15	97.89
25	98.00	30	98.23
37.5	98.20	45	98.40
50	98.30	75	98.60
75	98.50	112.5	98.74
100	98.60	150	98.83
167	98.70	225	98.94
250	98.80	300	99.02
333	98.90	500	99.14
—	—	750	99.23
—	—	1000	99.28

a. ~~kiloVolt-Amp rating.~~ A low-voltage dry-type distribution transformer with a kVA rating not listed in the table shall have its minimum efficiency level determined by linear interpolation of the kVA and efficiency values listed in the table immediately above and below its kVA rating. Extrapolation shall not be used below the minimum values or above the maximum values shown for single-phase transformers and three-phase transformers.

b. kiloVolt-Amp rating.

~~b.~~ c. Nominal efficiencies shall be established in accordance with the **DOE 10 CFR 431** test procedure for low-voltage dry-type transformers.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#255 Adds a new exception, item #6, that says, "Definite-purpose machines within the scope of ANSI/NEMA MG 1, Part 18." This new exception prevents the construction increase.

Related Mods:

FBC – C405.7

C405.8 Electric motors. Electric motors shall meet the minimum efficiency requirements of **Tables C405.8(1)** through **C405.8(4)** when tested and rated in accordance with the **DOE 10 CFR 431**. The efficiency shall be verified through certification under an *approved* certification program or, where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by the motor manufacturer.

Exception: The standards in this section shall not apply to the following exempt electric motors:

1. Air-over electric motors.
2. Component sets of an electric motor.
3. Liquid-cooled electric motors.
4. Submersible electric motors.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

	5. Inverter-only electric motors. 6. Definite-purpose machines within the scope of **ANSI/NEMA MG 1**, Part 18.
CE#256	It adds a new Section C405.9 by moving the provision from Section C405.1 and aligns the requirement with the ASHRAE Standard 90.4 for computer rooms. This change may increase the stringency of computer room requirements and hence the construction cost. It adds a new subsection C405.9.1 for data centers by moving data center requirements from Section C405.1. No impact on the stringency. It adds a new Section C405.9.2 for computer rooms that aligns with ASHRAE Standard 90.4. This change increases the stringency of computer rooms code provision; hence, the construction cost of computer rooms.
Related Mods: CEPI-134-21, CED1-78-22	**C405.9 Data centers and computer rooms.** Electrical equipment in *data centers* and *computer rooms* shall comply with this section. **C405.9.1 Data centers.** Transformers, uninterruptable power supplies, motors and electrical power processing equipment in *data centers* shall comply with Section 8 of **ASHRAE 90.4** in addition to this code. **C405.9.2 Computer rooms.** Uninterruptable power supplies in *computer rooms* shall comply with the requirements in Tables 8.5 and 8.6 of **ASHRAE 90.4** in addition to this code. **Exception:** AC-output UPS that utilizes standardized NEMA 1-15P or NEMA 5-15P input plug, as specified in **ANSI/NEMA WD-6** FSEC – Anticipated energy impact on FBC-EC – Decrease
CE#257	Renumbers Section C405.9. C405.9.1, C405.9.2. Renumbers C405.11. C405.12. C405.12.1.
Related Mods:	~~C405.9~~ C405.10 **Vertical and horizontal transportation systems and equipment.** ~~C405.9.1~~ C405.10.1 **Elevator cabs.** ~~C405.9.2~~ C405.10.2 **Escalators and moving walks.** .~~C405.9.2.1~~ C405.10.2.1 **Energy recovery.** ~~C405.10~~ C405.11 **Voltage drop.** ~~C405.11~~ C405.12 **Automatic receptacle control.** ~~C405.11.1~~ C405.12.1 **Automatic receptacle control function**

CE#256:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#257:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#258	Renumbers Section C405.12. Reduces the building floor area threshold for energy monitoring from 25,000 ft2 to 10,000 ft2, makes editorial changes, updates referenced code section, and adds a new exceptions for dwelling units. Increases the stringency by reducing the floor area threshold but exempts all residential unit, which may reduce the stringency. Therefore, the stringency may increase depending on the building occupancy group but is a cost-effective change. Renumbers subsection C405.12.1. Renumbers subsection C405.12.2 and replaces the text "measured load" with "design load."
Related Mods: CEPI-138-21, CEPI-203-21, CED1-31-22, CED1-30-22, CE2D-29-23, CE2D-33-23	~~C405.12~~ C405.13 **Energy monitoring.** New buildings with a gross *conditioned floor area* of ~~25,000 square feet (2322 m²) or larger~~ not less than 10,000 square feet (929 m²) shall be equipped to measure, monitor, record and report energy consumption ~~data~~ in ~~compliance~~ accordance with **Sections C405.13.1** through ~~C405.13.5.~~ **Section C405.13.6** for load categories indicated in **Table C405.13.2** and **Sections C405.13.7** through **C405.13.11** for end-use categories indicated in **Table C405.13.8**. ~~Exception: R-2 occupancies and individual tenant spaces are not required to comply with this section provided that the space has its own utility services and meters and has less than 5,000 square feet (464.5 m2) of *conditioned floor area*.~~ Exceptions: 1. *Dwelling units* in R-2 occupancies. 2. Individual tenant spaces are not required to comply with this section provided that the space has its own utility services and meters and has less than 5,000 square feet (464.5 m²) of *conditioned floor area*. ~~C405.12.1~~ C405.13.1 **Electrical energy metering.** For ~~all~~ electrical energy supplied to the *building* and its associated site, including but not limited to site lighting, parking, recreational facilities and other areas that serve the *building* and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by **Section C405.13.2**. ~~C405.12.2~~ C405.13.2 **End-use electric metering categories.** Meters or other *approved* measurement devices shall be provided to collect energy use data for each end-use category indicated in **Table C405.13.2**. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the ~~measured~~ design load for each of the end-use categories indicated in **Table C405.13.2** shall be permitted to be from a load that is not within that category. Exceptions: **Original text of mod is not consistent with that of the 2023 FBC – EC.** FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#259

Renumbers Table C405.12.2, renames the title, edits texts for clarity, and adds “Electric hot water heating for uses other than space conditioning” as a new energy use category.

Related Mods:

CE2D-33-23, CED1-30-22, CED1-36-22, CEAPP-01-24

~~TABLE C405.12.2~~ TABLE C405.13.2 ELECTRICAL ENERGY USE CATEGORIES

LOAD CATEGORY	DESCRIPTION OF ENERGY USE
Total HVAC system	Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120-volt equipment, or by 208/ 120-volt equipment that is located in a building where the main service is 480/ 277-volt power, is permitted to be excluded from total HVAC system energy use.
Interior lighting	Lighting systems located within the building.
Exterior lighting	Lighting systems located on the building site but not within the building.
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process load	Any single load that is not included in an HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment and commercial kitchens.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table, including but not limited to vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ~~ornamental~~ fireplaces, swimming pools, ~~in- ground~~ spas and snow-melt systems.
Electric hot water heating for uses other than space conditioning	Electricity used to generate hot water. **Exception:** Electric water heating with design capacity that is less than 10 percent of the building service rating.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#260

Renumbers Section C405.12.3, renames the title and edits the code language for clarity. Renumbers Section C405.12.4, renames the title and edits the code language for clarity. Renumbers Section C405.12.5 and edits the code language for clarity.

Related Mods:

CEPI-203-21,

~~C405.12.3~~ C405.13.3 ~~Meters~~ Electrical meters. Meters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by **Section C405.13.4**. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC or other building systems that can

CE2D-33-23, CED1-30-22	self-monitor their energy consumption shall be permitted instead of meters. Current sensors shall be permitted, provided that they have a tested accuracy of ±2 percent. Required metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with **Sections C405.13.4** and **C405.13.5**. Nonintrusive load monitoring (NILM) packages that extract energy consumption data from detailed electric waveform analysis shall be permitted to substitute for individual meters if the equivalent data is available for collection in **Section C405.13.4** and reporting in **Section C405.13.5**. **~~C405.12.4~~ C405.13.4 ~~Data~~ Electrical energy data acquisition system.** A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for a minimum of 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly and yearly logged data for each end-use category required by Section **C405.13.2**. The data acquisition system shall have the capability of providing building total peak electric demand and the time(s) of day and time(s) per month at which the peak occurs. Peak demand shall be integrated over the same time period as the underlying whole-building meter reading rate. **~~C405.12.5~~ C405.13.5 Graphical energy report.** A permanent and readily ~~accessible~~ available reporting mechanism shall be provided in the *building* ~~that is accessible~~ for access by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by **Section C405.13.2** ~~at least~~ not less than every hour, day, month and year for the previous 36 months **Original text of mod is not consistent with that of the 2023 FBC – EC.** Staff Classification | Correlates Directly | Energy Standard Needed | Over lap: — | — | — | X Action | AS | AS/IC | D | D/IC: — | — | — | x | —
CE#261	Adds a new subsection C405.13.6. Adds a new subsection C405.13.7. Adds a new subsection C405.13.8. Adds a new Table C405.13.8. Adds a new subsection C405.13.9. Adds a new subsection C405.13.10. Adds a new subsection C405.13.11.
Related Mods: CE2D-33-23	**C405.13.6 Renewable energy.** On-site renewable energy sources shall be metered with no less frequency than nonrenewable energy systems in accordance with **Section C405.13.3**. **C405.13.7 Nonelectrical energy submetering.** For all nonelectrical energy supplied to the *building* and its associated site that serves the *building* and its occupants, submeters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by **Section C405.13.8**. Exceptions: 1. HVAC and water heating equipment serving only an individual *dwelling unit* shall not require end-use submetering. 2. End-use submetering shall not be required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency. 3. End-use submetering shall not be required for an individual tenant space having a floor area not greater than 2,500 square feet (232 m^2) where a dedicated source meter complying with **Section C405.13.9** is provided. 4. Equipment powered primarily by solid fuels serving loads other than building heating and service water heating loads.

C405.13.8 End-use nonelectrical submetering categories. Submeters or other *approved* measurement devices shall be provided to collect energy use data for each end-use category indicated in **Table C405.13.8**. Where multiple submeters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the design load for each of the end-use categories indicated in **Table C405.13.8** shall be permitted to be from a load that is not within that category.

TABLE C405.13.8 NONELECTRICAL ENERGY USE CATEGORIES

END USE CATEGORY	**DESCRIPTION OF END USE**
Total HVAC system	Heating and cooling systems, including but not limited to boilers, chillers and furnaces. District heating and cooling energy entering the building's distribution system shall be monitored at the point of entry to the building distribution system.
Process loads	Any single load that is not included in the HVAC or service water heating categories where the rated fuel gas or fuel oil input of the load and that is not less than 5 percent of the sum of the rated fuel gas or fuel oil input of all monitored equipment, including but not limited to manufacturing equipment, process equipment, commercial kitchens, and commercial laundry equipment.
Other miscellaneous loads	The remaining loads not included elsewhere in this table, including but not limited to fireplaces, swimming pools, spas, gas lighting, and snow-melt systems.
Service water heating	Fuel used to heat potable water. **Exception:** Water heating with design capacity that is less than 10 percent of the sum of the rated fuel gas or fuel oil input of all monitored equipment.

C405.13.9 Nonelectrical submeters. Submeters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by **Section C405.13.10**. Source submeters shall be allowed to be any digital-type meter that can provide a digital output to the data acquisition system. Required submetering systems and equipment shall be fully integrated into the data acquisition system and graphical energy report that updates at least hourly in accordance with **Sections C405.13.10** and **C405.13.11**.

C405.13.10 Nonelectrical energy data acquisition system. A data acquisition system shall have the capability to store the data from the required submeters and other sensing devices for not less than 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly and yearly logged data for each end-use category required by **Section C405.13.8**. The data acquisition system shall have the capability of providing building total nonelectrical peak demand and the time(s) of day and time(s) per month at which the peak occurs. Where

	applicable as determined by the authority having jurisdiction (AHJ), peak demand shall be integrated over the same time period as the underlying whole-building meter reading rate. **C405.13.11 Graphical energy report.** A permanent and readily accessible reporting mechanism shall be provided in the *building* that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the nonelectrical energy consumption for each end-use category required by **Section C405.13.8** not less than every hour, day, month and year for the previous 36 months. The graphical report shall incorporate natural gas interval data from the submeter or the ability to enter gas utility bills into the report. Staff Classification: Correlates Directly – X; Energy Standard Needed – ; Over lap – Action: AS – ; AS/IC – ; D – x; D/IC –
CE#262	Adds a reserved Section C405.14.
Related Mods: CECPI-1-21, CED1-39-22	C405.14 Reserved. Staff Classification: Correlates Directly – X; Energy Standard Needed – ; Over lap – Action: AS – x; AS/IC – ; D – ; D/IC –
CE#263	Adds a new Section C405.15. Adds on-site renewables energy requirement to reduce consumer energy cost and societal protection. Adds a new subsection C405.15.1. Requires that buildings must be provided with on-site renewable electricity generation systems with a direct current (DC) nameplate power rating of not less than 0.75 W/ft2 (8.1 W/m2) multiplied by the sum of the gross conditioned floor area of all floors, but not to exceed the combined gross conditioned floor area of the three largest floors. Has four exceptions. This change increases the code stringency but is cost-effective change. Adds a new subsection C405.15.2. Must procure off-site renewable electrical energy per Section C405.15.2.1 and C405.15.2.2 if it qualifies for one of the exceptions in Section C405.15.1
Related Mods: CECPI-2-21, CED1-50-22	**C405.15 Renewable energy systems.** Buildings in Climate Zones 0–7 shall comply with **Sections C405.15.1** through **C405.15.4**. **C405.15.1 On-site renewable energy systems.** Buildings shall be provided with on-site renewable electricity generation systems with a direct current (DC) nameplate power rating of not less than 0.75 watts per square foot (8.1 W/m^2) multiplied by the sum of the gross *conditioned floor area* of all floors, not to exceed the combined gross *conditioned floor area* of the three largest floors. **Exceptions:** The following buildings or building sites shall comply with **Section C405.15.2**: 1. A *building site* located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 1.1 kBtu/ft^2 per day (3.5 kWh/m^2/day).

	2. A *building* where more than 80 percent of the roof area is covered by any combination of permanent obstructions such as, but not limited to, mechanical equipment, vegetated space, access pathways or occupied roof terrace. 3. Any *building* where more than 50 percent of the roof area is shaded from direct- beam sunlight by natural objects or by structures that are not part of the building for more than 2,500 annual hours between 8:00 a.m. and 4:00 p.m. 4. A *building* with gross *conditioned floor area* less than 5,000 square feet (465 m^2). **C405.15.2 Off-site renewable energy.** Buildings that qualify for one or more of the exceptions to **Section C405.15.1** or do not meet the requirements of **Section C405.15.1** with an on-site renewable energy system shall procure off-site renewable electrical energy, in accordance with **Sections C405.15.2.1** and **C405.15.2.2**, that shall be not less than the total off-site renewable electrical energy determined in accordance with **Equation 4-11**. $$TRE_{off} = (REN_{off} \times 0.75\ \mathrm{W/ft^2} \times \mathrm{FLRA} - IRE_{on}) \times 15$$ **Equation 4-11** where: TRE_{off} = Total off-site renewable electrical energy in kilowatt-hours (kWh) to be procured in accordance with **Table C405.15.2**. REN_{off} = Annual off-site renewable electrical energy from **Table C405.15.2**, in units of kilowatt- hours per watt of array capacity. FLRA = The sum of the gross conditioned floor area of all floors not to exceed the combined floor area of the three largest floors. IRE_{on} = Annual on-site renewable electrical energy generation of a new on-site renewable energy system, to be installed as part of the building project, whose rated capacity is less than the rated capacity required in **Section C405.15.1** FSEC – Anticipated energy impact on FBC-EC – Decrease Staff Classification | Correlates Directly: X | Energy Standard Needed: | Over lap: Action | AS: | AS/IC: | D: x | D/IC:
CE#264	Adds a new subsection C405.15.2.1. Adds a new subsection C405.15.2.2
Related Mods: CECPI-2-21, CED1-50-22, CED1-55-22, CED1-56-22	**C405.15.2.1 Off-site procurement.** The building *owner,* as defined in the ***International Building Code***, shall procure and be credited for the total amount of off-site renewable electrical energy, not less than required in accordance with **Equation 4-11**, with one or more of the following: 1. *Physical renewable energy power purchase agreement*. 2. *Financial renewable energy power purchase agreement*. 3. *Community renewable energy facility*. 4. Off-site renewable energy system owned by the building property *owner.* 5. *Renewable energy investment fund.* 6. *Green retail tariff.* The generation source shall be located where the energy can be delivered to the

	building site by any of the following: 1. Direct connection to the off-site renewable energy facility. 2. The local utility or distribution entity. 3. An interconnected electrical network where energy delivery capacity between the generator and the *building site* is available. **C405.15.2.2 Off-site contract.** The renewable energy shall be delivered or credited to the *building site* under an energy contract with a duration of not less than 10 years. The contract shall be structured to survive a partial or full transfer of ownership of the building property. Staff Classification | Correlates Directly: X | Energy Standard Needed | Over lap Action | AS | AS/IC | D: x | D/IC
CE#265	Adds a new Table C405.15.2.
Related Mods:	TABLE C405.15.2 **ANNUAL OFF-SITE RENEWABLE ENERGY REQUIREMENTS** **CLIMATE ZONE** | **ANNUAL OFF-SITE RENEWABLE ELECTRICAL ENERGY (kWh/ W)** 1A, 2B, 3B, 3C, 4B and 5B | 1.75 0A, 0B, 1B, 2A, 3A and 6B | 1.55 4A, 4C, 5A, 5C, 6A and 7 | 1.35 Staff Classification | Correlates Directly: X | Energy Standard Needed | Over lap Action | AS | AS/IC | D: x | D/IC FSEC – Anticipated energy impact on FBC-EC – Decrease
CE#266	Adds a new subsection C405.15.3. Adds a new subsection C405.15.4.
Related Mods:	**C405.15.3 Renewable energy certificate (REC) documentation.** The property *owner* or owner's authorized agent shall demonstrate that where renewable energy certificates (RECs) or energy attribute certificates (EACs) are associated with on-site

CECPI-2-21, CED1-50-22

and off-site renewable energy production required by **Sections C405.15.1** and **C405.15.2**, all of the following criteria for RECs and EACs shall be met:

1. The RECs and EACs are retained and retired by or on behalf of the property owner or tenant for a period of not less than 15 years or the duration of the contract in **Section C405.15.2.2**, whichever is less.
2. The RECs and EACs are created within a 12-month period of the use of the REC.
3. The RECs and EACs are from a generating asset placed in service not more than 5 years before the issuance of the certificate of occupancy.

C405.15.4 Renewable energy certificate purchase. A *building* that qualifies for one or more of the exceptions to **Section C405.15.1**, and where it can be demonstrated to the *code official* that the requirements of **Section C405.15.2** cannot be met, the building owner shall contract the purchase of renewable electricity products before the certificate of occupancy is issued. The purchase of renewable electricty products shall comply with the **Green-e Energy National Standard** for renewable electricity products equivalent to five times the amount of total off-site renewable energy calculated in accordance with **Equation 4-11**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#267

Adds a new Section C405.16.
This change slightly increase stringency and hence the construction cost but is cost-effective.

Related Mods:

CEPI-142-21

C405.16 Inverters. Direct-current-to-alternating-current inverters serving on-site renewable energy systems or on-site electrical energy storage systems (ESS) shall be compliant with **IEEE 1547** and **UL 1741.**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#268

Deletes the existing Section C406 and replaces it with an expanded scope Section C406 measures to choose from and renames the title. Separate new measures for renewable energy and load management requirements. Increased the number of energy efficiency measures to 32 from 11 that provide design flexibility.

Related Mods:

CEPI-193-21

SECTION C406
ADDITIONAL EFFICIENCY, RENEWABLE AND LOAD MANAGEMENT REQUIREMENTS

~~**C406.1 Additional energy efficiency credit requirements.** New buildings shall achieve a total of 10 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~~

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~~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 C405.13**, 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**.~~

~~**C406.1.1 Tenant spaces.** Tenant spaces shall comply with sufficient options from **Tables C406.1(1)** through **C406.1(5)** to achieve a minimum number of 5 credits, where credits are selected from **Section C406.2**, **C406.3**, **C406.4**, **C406.6**, **C406.7** or **C406.10**. Where the entire building complies using credits from **Section C406.5**, **C406.8** or **C406.9**, tenant spaces shall be deemed to comply with this section.~~
~~**Exception:** Previously occupied tenant spaces that comply with this code in accordance with **Section C501**.~~

Original text of mod is not consistent with that of the 2023 FBC – EC.
<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
<tr><td></td><td></td><td></td><td>X</td></tr>
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<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
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<tr>
<td>**CE#269**</td>
<td>Deletes Tables C406.1(1) through C406.1(5)</td>
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<tr>
<td>Related Mods:

CEPI-193-21, CED1-190-22</td>
<td>
Delete entire tables:
~~TABLE C406.1(1) **ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP B OCCUPANCIES**~~

~~TABLE C406.1(2)~~
~~**ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP R AND I OCCUPANCIES**~~

~~TABLE C406.1(3)~~
~~**ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP E OCCUPANCIES**~~
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	~~TABLE C406.1(4)~~ ~~**ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP M OCCUPANCIES**~~ ~~TABLE C406.1(5)~~ ~~**ADDITIONAL ENERGY EFFICIENCY CREDITS FOR OTHER[a] OCCUPANCIES**~~ **Original text of mod is not consistent with that of the 2023 FBC – EC.**
CE#270	This amendment renames the title and rearranges the subsection for on-site renewable energy generation and load management requirements. It moves some of the section content to a new subsection, C406.1.1. It adds a new subsection, C406.1.1, that specifies the energy credit requirements by building occupancy group and climate zones. The building occupancy group has been increased, and efficiency measures have been expanded, which provides design flexibility by better matching the measures with building occupancy group. Most of the new measures may increase the stringency but are cost-effective.
Related Mods: CEPI-193-21, CED1-185-22, CED1-187-22, CED1-190-22, CE2D-51-23	**C406.1 Compliance.** Buildings shall comply as follows: 1. Buildings with greater than 2,000 square feet (186 m^2) of conditioned floor area shall comply with **Section C406.1.1**. 2. Buildings with greater than 5,000 square feet (465 m^2) of *conditioned floor area* shall comply with **Sections C406.1.1** and **C406.1.2**. 3. Build-out construction greater than 1,000 square feet (93 m^2) of *conditioned floor area* that does not have final lighting or final HVAC systems installed under a prior building permit shall comply with **Section C406.1.1.2**. **Exceptions:** Core and shell buildings where not less than 20 percent of the *net floor area* is without final lighting or final HVAC that comply with all of the following: 1. Buildings with greater than 5,000 square feet (465 m^2) of *conditioned floor area* shall comply with **Section C406.1.2**. 2. Portions of the *building* where the *net floor area* is without final lighting or final HVAC shall comply with **Section C406.1.1.2**. 3. Portions of the *building* where the *net floor area* has final lighting and final HVAC systems shall comply with **Section C406.1.1**. **C406.1.1 Additional energy efficiency credit requirements.** Buildings shall comply with measures from **Section C406.2** to achieve not less than the number of required efficiency credits from **Table C406.1.1(1)** based on building occupancy group and climate zone. Where a project contains multiple occupancies, the total required energy credits from each building occupancy shall be weighted by the gross conditioned floor area to determine the weighted- average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for the purposes of **Section C406**. Exceptions: 1. Portions of buildings devoted to manufacturing or industrial use. 2. Where a *building* achieves more renewable and load management credits in **Section C406.3** than are required in **Section C406.1.2**, surplus credits shall be permitted to reduce the required energy efficiency credits as follows:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

$$EEC_{red} = EEC_{tbl} - \{\text{the lesser of: } [SRLM_{lim}, SLRM_{adj} \times (RLM_{ach} - RLM_{req})]\}$$

(Equation 4-12)

where:

EEC_{red} = Reduced required energy efficiency credits.

EEC_{tbl} = Required energy efficiency credits from **Table C406.1.1(1)**.

$SRLM_{lim}$ = Surplus renewable and load management credit limit from Table C406.1.1(2).

$SRLM_{adj}$ = 1.0 for all-electric or all-renewable buildings (excluding emergency generation); 0.7 for buildings with fossil fuel equipment (excluding emergency generation).

RLM_{ach} = Achieved renewable and load management credits from **Section C406.3**. RLM_{req} = Required renewable and load management credits from **Section C406.1.2**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#271

It adds a new Table, C406.1.1(1), specifying the energy credit requirements by building occupancy group and climate zones. Increased the number of measures to 32 from 11 and expanded the building occupancy group that provides design flexibility.

Related Mods:

CEPI-193-21, CED1-190-22

TABLE C406.1.1(1)

ENERGY CREDIT REQUIREMENTS BY BUILDING OCCUPANCY GROUP

BUILDING OCCUPANCY GROUP	CLIMATE ZONE																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4 and I-1	65	66	67	77	80	86	80	81	90	86	90	90	86	90	90	70	89	80	78
I-2	43	42	38	37	36	38	32	32	30	36	36	35	43	43	44	46	47	50	53
R-1	63	62	66	65	70	71	77	80	84	81	83	88	85	86	90	83	87	87	85
B	62	62	64	66	66	65	64	64	68	70	72	74	71	73	77	71	74	74	71
A-2	70	70	72	72	75	75	70	73	82	69	74	78	67	72	78	60	67	57	51
M	80	79	83	79	81	84	67	74	87	80	66	65	79	62	50	75	67	75	58
E	56	57	55	58	58	57	59	62	59	61	66	62	64	67	67	65	67	63	58
S-1 and S-2	61	60	61	60	58	57	44	54	62	85	68	75	90	82	72	90	89	90	90
All other	31	31	31	32	32	33	30	32	36	35	35	35	37	36	36	36	37	36	34

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#272 It adds a new Table, C406.1.1(2), that specifies limits to energy efficiency credit carryover from renewable and load management by building occupancy group and climate zones.

Related Mods:

TABLE C406.1.1(2)
LIMIT TO ENERGY EFFICIENCY CREDIT CARRYOVER FROM RENEWABLE AND LOAD MANAGEMENT CREDITS

BUILDING OCCUPANCY GROUP	CLIMATE ZONE																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4 and I-1	5	5	5	5	5	5	5	24	19	5	22	18	5	5	19	5	5	5	5
I-2	16	14	11	8	6	5	5	10	6	8	14	10	17	26	29	21	21	22	39
R-1	7	5	8	5	19	5	32	40	41	24	41	42	17	37	41	5	24	15	22
B	7	5	5	8	6	6	14	26	31	23	39	34	19	35	45	5	19	17	27
A-2	18	16	14	15	13	9	11	23	32	5	23	23	5	5	26	5	5	5	5
M	5	5	5	5	5	5	5	5	20	5	5	5	5	5	5	5	5	5	5
E	13	13	18	16	17	14	21	35	40	25	43	29	23	32	27	11	17	25	5
S-1 and S-2	5	5	5	5	5	5	5	5	13	5	17	20	5	35	23	5	5	11	40
All other	5	5	5	5	5	5	5	7	17	5	10	7	5	6	11	5	5	5	5

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#273 **Reserves Section C406.1.1.1.**

Related Mods:

CEPI-193-21, CECD1-

C406.1.1.1 Reserved

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

<table>
<tr><td>18-22, CE2D-51-23, CE2D-57-23, As further modified by ICC Board Action</td><td></td></tr>
<tr><td>CE#274</td><td>Adds new Section C406.1.1.2. It increases the stringency for building types but is cost-effective measure.</td></tr>
<tr><td>Related Mods:

CEPI-193-21, CECD1-18-22</td><td>C406.1.1.2 Building core/shell and build-out construction. Where separate permits are issued for core and shell buildings and build-out construction, compliance shall be in accordance with the following requirements.
1. Core and shell buildings or portions of buildings shall comply with one of the following:
1.1. Where the permit includes a central HVAC system or service water heating system with chillers, heat pumps, boilers, service water heating equipment or loop pumping systems with heat rejection, the project shall achieve not less than 50 percent of the energy credits required by Section C406.1.1 in accordance with Section C406.2.
1.2. Alternatively, the project shall achieve not less than 33 percent of the energy credits required by Section C406.1.1.
2. For core and shell buildings or portions of buildings, the energy credits achieved shall be subject to the following adjustments:
2.1. Lighting measure credits shall be determined only for areas with final lighting installed.
2.2. Where HVAC or service water heating systems are designed to serve the entire building , full HVAC or service water heating measure credits shall be achieved.
2.3. Where HVAC or service water heating systems are designed to serve individual areas, HVAC or service water heating measure credits achieved shall be reduced in proportion to the floor area with final HVAC systems or final service water heating systems installed.
3. Build-out construction shall be deemed to comply with Section C406.1 where one of the following applies:
3.1. Where heating and cooling generation is provided by a previously installed central system, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 33 percent of the credits required by Section C406.1.1.
3.2. Where heating and cooling generation is provided by an HVAC system installed in the build-out, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 50 percent of the credits required by Section C406.1.1.
3.3. Where the core and shell building is approved in accordance with Section C407 under the 2021 IECC or later.</td></tr>
</table>

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#275 Adds new Section C406.1.2. It increases the stringency for some of the building types but is cost-effective measure.

Related Mods:

C406.1.2 Additional renewable and load management credit requirements. Buildings shall comply with measures from **Section C406.3** to achieve not less than the number of required renewable and load management credits from **Table C406.1.2** based on building occupancy group and *climate zone* . Where a project contains multiple occupancies, credits in **Table C406.1.2** from each building occupancy shall be weighted by the gross floor area to determine the weighted-average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for the purposes of **Section C406**.

Exception: Where a *building* achieves more energy efficiency credits in **Section C406.2** than are required in **Section C406.1.1**, the renewable and load management credits required in **Table C406.1.2** shall be permitted to be reduced by the amount of surplus energy efficiency credits.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#276 Adds new Table C406.1.2.

Related Mods:

CEPI-193-21, CED1-185-22, CED1-192-22

TABLE C406.1.2

RENEWABLE AND LOAD MANAGEMENT CREDIT REQUIREMENTS BY BUILDING OCCUPANCY GROUP

BUILDING OCCUPANCY GROUP	CLIMATE ZONE																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4 and I-1	34	37	31	46	48	56	49	56	38	31	42	32	26	33	34	23	27	25	25
I-2	23	24	25	25	25	28	26	30	22	25	32	24	25	28	29	26	28	22	20
R-1	30	28	35	30	34	36	34	37	41	32	37	27	28	33	32	25	29	22	18
B	38	39	45	42	45	49	47	56	57	44	55	42	38	47	46	38	45	38	31
A-2	8	8	9	9	8	9	9	11	13	8	11	9	8	10	9	8	9	8	3
M	32	32	42	37	39	47	44	58	57	42	54	46	38	48	5	42	45	38	34
E	27	34	38	37	39	47	44	58	57	42	54	46	38	48	50	42	45	38	34

S-1 and S-2	89	90	90	90	90	90	90	90	90	90	90	90	70	90	90	84	86	71	54
All other	35	39	46	42	46	52	49	56	56	40	52	42	37	44	44	36	39	32	28

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#277

Renames Section C406.2 title and describes achievable energy efficiency credits for each measure by building occupancy group and climate zones.

Related Mods:

CEPI-193-21, CED1-185-22, CED1-187-22, CE2D-61-23

~~**C406.2 More efficient HVAC equipment performance.** Equipment shall exceed the minimum efficiency requirements listed in the tables in **Section C403.3.2**. *Variable refrigerant flow systems* listed in the energy efficiency provisions of **ANSI/ASHRAE/IES 90.1** in accordance with **Section C406.2.1**, **C406.2.2**, **C406.2.3** or **C406.2.4** shall also meet applicable requirements of **Section C403**. Energy efficiency credits for heating shall be selected from **Section C406.2.1** or **C406.2.3** and energy efficiency credits for cooling shall be selected from **Section C406.2.2**, **C406.2.4** or **C406.2.5**. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in **Tables C403.3.2(1)** through **C403.3.2(9)** and *variable refrigerant flow systems* not listed in the energy efficiency provisions of **ANSI/ASHRAE/IES 90.1** shall be limited to 10 percent of the total building system capacity for heating equipment where selecting **Section C406.2.1** or **C406.2.3** and cooling equipment where selecting **Section C406.2.2**, **C406.2.4** or **C406.2.5**.~~

~~**C406.2.1 Five-percent heating efficiency improvement.** Equipment shall exceed the minimum heating efficiency requirements by 5 percent.~~

~~**C406.2.2 Five-percent cooling efficiency improvement.** Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER and IPLV.~~

~~**C406.2.3 Ten-percent heating efficiency improvement.** Equipment shall exceed the minimum heating efficiency requirements by 10 percent.~~

~~**C406.2.4 Ten-percent cooling efficiency improvement.** Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER and IPLV.~~

~~**C406.2.5 More than 10-percent cooling efficiency improvement.** Where equipment exceeds the minimum annual cooling and heat rejection efficiency requirements by more than 10 percent, energy efficiency credits for cooling may be determined using **Equation 4-12**, rounded to the nearest whole number. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER and IPLV~~

~~(Equation 4-12)~~

~~where:~~

~~*EEC HEC* = Energy efficiency credits for cooling efficiency improvement.~~

~~*EEC 10* = **Section C406.2.4** credits from **Tables C406.1(1)** through **C406.1(5)**.~~

~~*CEI* = The lesser of: the improvement above minimum cooling and heat rejection efficiency requirements~~

	C406.2 Additional energy efficiency credits achieved. Each energy efficiency credit measure used to meet credit requirements for the project shall have efficiency that is greater than the requirements in **Sections C402** through **C405**. Measures installed in the project that meet the requirements in **Sections C406.2.1** through **C406.2.6** shall achieve the base credits listed for the measure and occupancy type in **Tables C406.2(1)** through **C406.2(9)** or, where calculations required by **Sections C406.2.1** through **C406.2.6** create or modify the table credits, the credits achieved shall be based on the calculations. Energy credits achieved for measures shall be determined by one of the following, as applicable: 1. The measure's energy credit shall be the base energy credit from **Tables C406.2(1)** through **C406.2(9)** for the measure where no adjustment factor or calculation is included in the description of the measure in **Section C406.2**. 2. The measure's energy credit shall be the base energy credit for the measure adjusted by a factor or equation as stated in the description of the measure in **Section C406.2**. Where adjustments are applied, each measure's energy credit shall be rounded to the nearest whole number. 3. The measure's energy credit shall be calculated as stated in the measure's description in **Section C406.2**, where each individual measure credit shall be rounded to the nearest whole number. Energy credits achieved for the project shall be the sum of the individual measure's energy credits. Credits are available for the measures listed in this section. Where a project contains multiple building occupancy groups: 1. Credits achieved for each occupancy group shall be summed and then weighted by the conditioned floor area of each occupancy group to determine the weighted average project energy credits achieved. 2. Improved envelope efficiency (E01 through E06), HVAC performance (H01) and lighting reduction (L06) measure credits shall be determined for the building or permitted *conditioned floor area* as a whole. Credits for other measures shall be determined for each occupancy separately. Credits shall be taken from applicable tables or calculations for each occupancy and weighted by the building occupancy group floor area. **Original text of mod is not consistent with that of the 2023 FBC – EC.**
CE#278	Table C406.1(1) has been renamed, renumbered and rearranged. The measures have been expanded to 32 from 11, and the achievable energy credits have been updated.
Related Mods: CEPI-193-21, CECD1-6-22,	**TABLE C406.2(1)** **BASE ENERGY CREDITS FOR GROUP R-2, R-4 AND I-1 OCCUPANCIES[a]**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

ID	ENERGY CREDIT MEASURE	SECTION	CLIMATE ZONE																	
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8

CED1-185-22, CED1-194-22		E01	Envelope performance	**C406.2.1.1**	Determined in accordance with **Section C406.2.1.1**																		
		E02	UA reduction (15%)	**C406.2.1.2**	7	6	2	4	1	1	4	1	1	22	1	3	29	10	1	32	27	30	39
		E03	Reduced air leakage	**C406.2.1.3**	15	10	12	8	6	16	13	5	1	7	7	9	65	16	11	73	43	52	26
		E04	Add roof insulation	**C406.2.1.4**	1	1	1	1	1	1	4	3	1	5	3	4	6	5	4	7	7	6	8
		E05	Add wall insulation	**C406.2.1.5**	10	10	6	8	5	6	8	4	1	8	3	4	11	7	3	14	12	13	13
		E06	Improve fenestration	**C406.2.1.6**	7	7	4	6	9	11	13	3	1	22	5	10	27	18	7	41	33	22	21
		H01	HVAC performance	**C406.2.2.1**	20	19	16	17	14	13	11	11	5	13	10	8	15	12	7	18	14	17	19
		H02	Heating efficiency	**C406.2.2.2**	x	x	x	x	x	x	3	1	1	6	2	3	10	5	2	14	10	13	16
		H03	Cooling efficiency	**C406.2.2.3**	7	6	4	4	3	3	1	1	1	1	1	1	1	1	x	x	x	x	x
		H04	Residential HVAC control	**C406.2.2.4**	9	10	8	22	20	25	16	17	32	21	24	17	23	27	16	21	24	18	18
		H05	DOAS/fan control	**C406.2.2.5**	32	31	27	28	23	23	28	21	12	42	24	24	56	36	19	73	54	70	79
		W01	SHW preheat recovery	**C406.2.3.1 a**	61	63	74	74	85	88	101	100	121	103	109	122	102	111	130	93	106	99	96
		W02	Heat pump water heater	**C406.2.3.1 b**	50	52	62	61	72	74	86	85	104	88	94	106	88	96	112	81	92	87	84
		W03	Efficient gas water heater	**C406.2.3.1 c**	38	39	46	46	53	55	63	62	76	64	68	76	64	69	81	58	66	62	60
		W04	SHW pipe insulation	**C406.2.3.2**	7	7	8	7	8	8	8	9	10	8	9	9	7	8	9	6	7	6	6
		W05	Point of use water heaters	**C406.2.3.3 a**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		W06	Thermostatic bal. valves	**C406.2.3.3 b**	3	3	3	3	3	3	3	3	4	3	3	4	3	3	4	3	3	3	2
		W07	SHW heat trace system	**C406.2.3.3 c**	12	12	13	13	14	15	15	15	18	14	15	16	13	14	16	11	13	11	10

W08	SHW submeters	**C406.2.3.4**	11	11	13	13	15	16	18	18	22	19	20	22	19	20	24	17	20	18	18
W09	SHW flow reduction	**C406.2.3.5**	22	22	27	26	31	32	37	37	45	38	40	45	38	41	48	35	39	37	36
W10	Shower heat recovery	**C406.2.3.6**	15	16	19	19	22	23	26	26	32	27	29	32	27	29	34	25	28	27	26
P01	Energy monitoring	**C406.2.4**	3	3	2	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3
L01	Lighting performance	**C406.2.5.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	**C406.2.5.2**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
L03	Increase occp. sensor	**C406.2.5.3**	3	3	4	4	4	4	3	4	3	2	3	2	1	1	2	1	1	1	1
L04	Increase daylight area	**C406.2.5.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L05	Residential light control	**C406.2.5.5**	8	8	9	9	9	9	8	8	10	6	8	7	4	6	8	3	5	4	3
L06	Light power reduction	**C406.2.5.6**	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	1	1
Q01	Efficient elevator	**C406.2.6.1**	4	4	4	4	5	5	5	5	5	4	5	5	4	4	5	4	4	4	3
Q02	Commercial kitchen equip.	**C406.2.6.2**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	**C406.2.6.3**	15	15	17	16	17	18	17	18	20	16	17	18	15	16	18	13	15	13	12
Q04	Fault detection	**C406.2.6.4**	3	3	2	3	2	2	2	2	1	2	2	1	1	2	1	3	2	3	3

DOAS = Dedicated Outside Air System; HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water; UA = *U*-factor × Area.

a. “x” indicates credit is not available in that climate zone for that measure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#279	Table C406.1(2) has been renamed, renumbered and rearranged. The measures have been expanded to 32 from 11, and the achievable energy credits have been updated.
Related Mods: CEPI-193-21, CECD1-6-22, CED1-185-22, CED1-194-22	**TABLE C406.2(2)** **BASE ENERGY CREDITS FOR GROUP I-2 OCCUPANCIES[a]**

ID	ENERGY CREDIT MEASURE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope performance	**C406.2.1.1**	Determined in accordance with **Section C406.2.1.1**																		
E02	UA reduction (15%)	**C406.2.1.2**	1	1	1	1	2	1	1	1	3	1	3	11	27	7	10	3	3	2	10
E03	Reduced air leakage	**C406.2.1.3**	5	3	4	3	5	8	8	3	2	6	2	2	7	3	1	9	7	19	5
E04	Add roof insulation	**C406.2.1.4**	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	2	3
E05	Add wall insulation	**C406.2.1.5**	1	3	1	3	2	2	9	4	1	4	1	1	3	1	1	3	3	3	3
E06	Improve fenestration	**C406.2.1.6**	1	1	1	1	1	1	1	1	1	4	3	5	5	1	1	5	5	2	2
H01	HVAC performance	**C406.2.2.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	**C406.2.2.2**	x	x	x	x	2	3	4	3	7	6	4	6	8	6	10	11	12	15	19
H03	Cooling efficiency	**C406.2.2.3**	6	6	4	4	3	3	2	2	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	**C406.2.2.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	**C406.2.2.5**	41	41	40	40	42	36	42	37	39	49	40	46	56	46	61	65	68	82	93
W01	SHW preheat recovery	**C406.2.3.1a**	4	4	4	4	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5
W02	Heat pump water heater	**C406.2.3.1b**	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3

W03	Efficient gas water heater	**C406.2.3.1 c**	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
W04	SHW pipe insulation	**C406.2.3.2**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W05	Point of use water heaters	**C406.2.3.3 a**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	**C406.2.3.3 b**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	**C406.2.3.3 c**	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
W08	SHW submeters	**C406.2.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	**C406.2.3.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	**C406.2.3.6**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P01	Energy monitoring	**C406.2.4**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
L01	Lighting performance	**C406.2.5.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	**C406.2.5.2**	5	5	5	5	5	6	5	6	6	5	6	6	5	5	5	4	4	3	2
L03	Increase occp. sensor	**C406.2.5.3**	5	5	5	5	5	5	5	5	6	5	5	6	5	5	5	4	4	3	2
L04	Increase daylight area	**C406.2.5.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L05	Residential light control	**C406.2.5.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	**C406.2.5.6**	7	7	7	7	7	7	7	7	9	7	7	8	6	7	7	5	5	4	3
Q01	Efficient elevator	**C406.2.6.1**	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
Q02	Commercial kitchen equip.	**C406.2.6.2**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Q03	Residential kitchen equip.	**C406.2.6.3**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	**C406.2.6.4**	3	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3	3	4	4

DOAS = Dedicated Outside Air System; HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water; UA = *U*-Factor × Area.

a. "x" indicates credit is not available in that climate zone for that measure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#280

Table C406.1(3) has been renamed, renumbered and rearranged. The measures have been expanded to 32 from 11, and the achievable energy credits have been updated.

Related Mods:

CEPI-193-21, CECD1-6-22, CED1-185-22, CED1-194-22

TABLE C406.2(3)
BASE ENERGY CREDITS FOR GROUP R-1 OCCUPANCIES

ID	ENERGY CREDIT MEASURE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope performance	**C406.2.1.1**	Determined in accordance with **Section C406.2.1.1**																		
E02	UA reduction (15%)	**C406.2.1.2**	2	3	1	2	1	3	3	2	1	5	2	2	7	4	2	9	7	9	11
E03	Reduced air leakage	**C406.2.1.3**	15	9	12	8	6	16	7	5	10	14	3	1	19	5	1	28	16	28	18
E04	Add roof insulation	**C406.2.1.4**	1	1	1	2	2	1	2	1	1	2	1	2	2	1	2	3	2	2	3
E05	Add wall insulation	**C406.2.1.5**	18	26	11	25	3	4	5	3	1	6	2	4	7	4	4	8	6	8	5
E06	Improve fenestration	**C406.2.1.6**	2	2	1	2	2	3	5	3	1	6	3	4	9	7	6	13	8	6	6
H01	HVAC performance	**C406.2.2.1**	21	20	17	18	16	13	12	12	11	11	11	8	11	11	8	13	11	14	16
H02	Heating efficiency	**C406.2.2.2**	x	x	x	x	x	x	1	1	6	2	1	1	3	2	2	6	4	8	11

H03	Cooling efficiency	**C406.2.2.3**	7	6	4	4	3	2	1	2	1	1	2	1	1	1	1	x	x	x	x
H04	Residential HVAC control	**C406.2.2.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	**C406.2.2.5**	32	30	26	28	25	23	24	22	28	26	22	20	30	26	19	41	34	48	62
W01	SHW preheat recovery	**C406.2.3.1 a**	18	19	22	22	25	27	31	21	32	34	34	38	37	36	40	36	37	36	35
W02	Heat pump water heater	**C406.2.3.1 b**	14	15	18	17	20	22	25	25	27	29	29	32	31	31	34	30	32	31	30
W03	Efficient gas water heater	**C406.2.3.1 c**	11	12	14	14	16	17	19	19	20	21	21	24	23	23	25	22	23	23	22
W04	SHW pipe insulation	**C406.2.3.2**	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3
W05	Point of use water heaters	**C406.2.3.3 a**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	**C406.2.3.3 b**	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1
W07	SHW heat trace system	**C406.2.3.3 c**	5	6	6	6	6	7	7	7	7	7	7	8	7	7	8	7	7	6	6
W08	SHW submeters	**C406.2.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	**C406.2.3.5**	6	7	8	8	9	10	11	11	12	13	13	14	14	13	15	13	14	14	13
W10	Shower heat recovery	**C406.2.3.6**	4	5	5	5	6	7	8	8	8	9	9	10	10	9	10	9	10	10	9
P01	Energy monitoring	**C406.2.4**	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
L01	Lighting performance	**C406.2.5.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	**C406.2.5.2**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

L03	Increase occp. sensor	**C406.2.5.3**	3	3	3	3	3	3	3	3	3	4	2	3	2	2	3	2	2	1	1
L04	Increase daylight area	**C406.2.5.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L05	Residential light control	**C406.2.5.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	**C406.2.5.6**	1	1	2	2	2	2	2	2	2	2	1	2	1	1	2	1	1	1	1
Q01	Efficient elevator	**C406.2.6.1**	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	2	2	2	2
Q02	Commercial kitchen equip.	**C406.2.6.2**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	**C406.2.6.3**	9	9	10	10	10	11	11	11	11	11	11	12	11	11	12	10	11	10	9
Q04	Fault detection	**C406.2.6.4**	3	3	3	3	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2

DOAS = Dedicated Outside Air System; HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water; UA = *U*-Factor × Area.

a. "x" indicates credit is not available in that climate zone for that measure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#281

Table C406.1(4) has been renamed, renumbered and rearranged. The measures have been expanded to 32 from 11, and the achievable energy credits have been updated.

Related Mods:

CEPI-193-21, CED1-185-22, CED1-194-22

TABLE C406.2(4)

ID	**ENERGY CREDIT MEASURE**	**SECTION**	**CLIMATE ZONE**																		
			0A	**0B**	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6A**	**6B**	**7**	**8**
E01	Envelope performance	**C406.2.1.1**	Determined in accordance with **Section C406.2.1.1**																		
E02	UA reduction (15%)	**C406.2.1.2**	7	8	3	6	5	3	7	3	1	13	4	8	21	15	11	13	24	37	43

E03	Reduced air leakage	**C406.2.1.3**	5	3	4	2	2	2	5	1	x	8	x	2	13	4	x	18	9	18	7
E04	Add roof insulation	**C406.2.1.4**	2	2	2	2	2	2	3	2	1	3	1	2	3	2	2	3	3	2	3
E05	Add wall insulation	**C406.2.1.5**	13	14	8	11	4	4	7	4	1	5	2	4	6	4	3	9	7	10	8
E06	Improve fenestration	**C406.2.1.6**	5	5	4	5	7	7	8	2	1	8	2	4	10	5	1	21	17	10	9
H01	HVAC performance	**C406.2.2.1**	22	22	19	20	17	17	15	15	11	15	15	11	16	15	11	19	17	18	20
H02	Heating efficiency	**C406.2.2.2**	X	x	x	x	x	x	1	1	1	3	2	2	5	4	3	9	7	8	12
H03	Cooling efficiency	**C406.2.2.3**	7	6	4	5	3	3	1	2	1	1	2	1	1	1	1	x	x	x	x
H04	Residential HVAC control	**C406.2.2.4**	X	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	**C406.2.2.5**	31	31	27	29	25	25	28	26	18	35	28	28	47	38	29	64	53	58	74
W01	SHW preheat recovery	**C406.2.3.1 a**	8	9	10	9	11	11	12	12	14	13	13	14	13	13	15	12	13	14	14
W02	Heat pump water heater	**C406.2.3.1 b**	3	3	3	3	4	4	5	4	5	5	5	6	5	5	6	5	5	6	6
W03	Efficient gas water heater	**C406.2.3.1 c**	5	5	6	6	7	7	8	7	8	8	8	9	8	8	9	8	8	9	8
W04	SHW pipe insulation	**C406.2.3.2**	3	3	4	4	4	4	4	4	5	4	4	5	4	4	5	4	4	4	4
W05	Point of use water heaters	**C406.2.3.3 a**	12	15	17	16	18	18	19	19	22	20	20	22	20	20	22	18	19	20	19
W06	Thermostatic bal. valves	**C406.2.3.3 b**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	**C406.2.3.3 c**	4	4	4	4	5	5	5	5	6	5	5	6	5	5	6	5	5	5	5
W08	SHW submeters	**C406.2.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

W09	SHW flow reduction	**C406.2.3.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	**C406.2.3.6**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P01	Energy monitoring	**C406.2.4**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
L01	Lighting performance	**C406.2.5.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	**C406.2.5.2**	5	5	6	6	6	6	6	6	7	6	6	6	5	5	6	4	5	3	2
L03	Increase occp. sensor	**C406.2.5.3**	5	6	6	6	6	6	6	6	8	6	6	6	5	5	6	4	5	4	3
L04	Increase daylight area	**C406.2.5.4**	7	7	8	8	8	8	8	8	9	6	7	7	6	6	6	6	6	7	5
L05	Residential light control	**C406.2.5.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	**C406.2.5.6**	7	7	8	8	8	8	8	8	9	7	8	8	6	7	8	5	6	5	3
Q01	Efficient elevator	**C406.2.6.1**	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	4	5	4	4
Q02	Commercial kitchen equip.	**C406.2.6.2**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	**C406.2.6.3**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	**C406.2.6.4**	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	3	3	3	3

DOAS = Dedicated Outside Air System; HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water; UA = *U*-Factor × Area.

a. "x" indicates credit is not available in that climate zone for that measure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#282 Table C406.1(5) has been renamed, renumbered and rearranged. The measures have been expanded to 32 from 11, and the achievable energy credits have been updated.

Related Mods:

CEPI-193-21, CECD1-6-22, CED1-185-22, CED1-194-22

TABLE C406.2(5)
BASE ENERGY CREDITS FOR GROUP A-2 OCCUPANCIES[a]

ID	ENERGY CREDIT MEASURE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope performance	**C406.2.1.1**	Determined in accordance with **Section C406.2.1.1**																		
E02	UA reduction (15%)	**C406.2.1.2**	1	1	1	1	13	1	3	2	1	4	4	5	5	5	6	6	6	6	6
E03	Reduced air leakage	**C406.2.1.3**	2	1	1	1	2	3	11	2	1	24	4	6	33	9	3	42	29	36	16
E04	Add roof insulation	**C406.2.1.4**	1	1	x	1	1	1	2	1	1	1	1	1	2	2	1	2	2	1	2
E05	Add wall insulation	**C406.2.1.5**	1	1	x	1	1	2	3	3	1	2	1	1	2	2	2	2	2	2	2
E06	Improve fenestration	**C406.2.1.6**	1	1	1	1	1	1	2	2	1	1	2	2	3	2	1	4	4	1	1
H01	HVAC performance	**C406.2.2.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	**C406.2.2.2**	x	x	x	x	1	1	6	3	3	10	6	8	15	11	10	19	15	23	28
H03	Cooling efficiency	**C406.2.2.3**	6	5	3	4	3	2	1	1	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	**C406.2.2.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	**C406.2.2.5**	29	27	20	25	24	21	36	27	15	51	35	38	67	53	45	84	70	97	115
W01	SHW preheat recovery	**C406.2.3.1a**	24	26	31	29	33	35	37	38	45	38	41	44	37	40	44	34	38	33	30
W02	Heat pump water heater	**C406.2.3.1b**	15	16	19	18	21	23	25	25	29	26	28	30	26	28	31	25	27	24	22
W03	Efficient gas water heater	**C406.2.3.1c**	15	16	19	18	21	22	23	24	28	24	25	27	23	25	27	21	24	21	18

W04	SHW pipe insulation	**C406.2.3.2**	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3	2	2	2	2
W05	Point of use water heaters	**C406.2.3.3 a**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	**C406.2.3.3 b**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	**C406.2.3.3 c**	3	4	4	4	4	4	4	4	4	4	4	4	3	4	4	3	3	3	3
W08	SHW submeters	**C406.2.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	**C406.2.3.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	**C406.2.3.6**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P01	Energy monitoring	**C406.2.4**	2	2	2	2	2	1	2	1	1	2	1	1	2	2	1	2	2	2	3
L01	Lighting performance	**C406.2.5.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	**C406.2.5.2**	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	x
L03	Increase occp. sensor	**C406.2.5.3**	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	x
L04	Increase daylight area	**C406.2.5.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L05	Residential light control	**C406.2.5.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	**C406.2.5.6**	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	1	2	1	1
Q01	Efficient elevator	**C406.2.6.1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Q02	Commercial kitchen equip.	**C406.2.6.2**	24	26	28	27	28	29	27	29	32	26	28	29	24	26	28	21	23	19	17
Q03	Residential kitchen equip.	**C406.2.6.3**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Q04	Fault detection	**C406.2.6.4**	3	2	2	2	2	2	2	2	1	2	2	1	2	2	2	3	2	3	4

DOAS = Dedicated Outside Air System; HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water; UA = *U*-Factor × Area.

a. "x" indicates credit is not available in that climate zone for that measure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#283

Adds a new base energy credits Table C406.2(6) for group M occupancies with 32 measures.

Related Mods:

CEPI-193-21, CED1-185-22,

TABLE C406.2(6)
BASE ENERGY CREDITS FOR GROUP M OCCUPANCIES[a]

ID	ENERGY CREDIT MEASURE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope performance	**C406.2.1.1**	Determined in accordance with **Section C406.2.1.1**																		
E02	UA reduction (15%)	**C406.2.1.2**	14	14	8	13	7	9	20	15	1	35	18	28	41	37	40	43	44	46	31
E03	Reduced air leakage	**C406.2.1.3**	3	3	2	2	3	3	19	3	1	44	6	11	56	13	6	64	44	43	19
E04	Add roof insulation	**C406.2.1.4**	8	6	5	7	7	7	18	16	4	19	18	20	21	22	23	24	26	24	30
E05	Add wall insulation	**C406.2.1.5**	64	65	48	62	13	15	23	18	4	27	21	27	25	24	25	23	24	24	16
E06	Improve fenestration	**C406.2.1.6**	4	3	3	3	4	4	6	5	2	7	5	7	7	5	7	10	10	3	3
H01	HVAC performance	**C406.2.2.1**	31	30	26	28	23	21	23	20	14	27	21	22	29	25	23	32	28	30	33
H02	Heating efficiency	**C406.2.2.2**	x	x	x	x	x	x	10	3	1	19	8	15	26	17	18	29	24	27	31
H03	Cooling efficiency	**C406.2.2.3**	10	9	7	7	5	4	2	2	1	1	2	1	1	1	1	x	x	x	x
H04	Residential HVAC control	**C406.2.2.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

H05	DOAS/fan control	**C406.2.2.5**	48	48	42	47	40	38	66	46	31	98	61	82	120	91	90	134	115	125	141
W01	SHW preheat recovery	**C406.2.3.1 a**	12	13	16	15	18	20	19	21	26	17	21	21	16	19	21	13	16	15	13
W02	Heat pump water heater	**C406.2.3.1 b**	3	3	4	3	4	5	5	5	7	5	6	6	4	5	6	4	4	4	4
W03	Efficient gas water heater	**C406.2.3.1 c**	6	7	8	8	10	10	10	11	14	9	11	11	8	10	11	7	8	8	7
W04	SHW pipe insulation	**C406.2.3.2**	3	3	4	4	4	4	4	4	5	4	4	5	4	4	5	4	4	4	4
W05	Point of use water heaters	**C406.2.3.3 a**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	**C406.2.3.3 b**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	**C406.2.3.3 c**	4	4	4	4	5	5	5	5	6	5	5	6	5	5	6	5	5	5	5
W08	SHW submeters	**C406.2.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	**C406.2.3.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	**C406.2.3.6**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P01	Energy monitoring	**C406.2.4**	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
L01	Lighting performance	**C406.2.5.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	**C406.2.5.2**	9	9	11	10	12	13	11	13	15	9	12	11	7	9	10	5	7	5	3
L03	Increase occp. sensor	**C406.2.5.3**	9	9	11	10	12	13	12	13	15	10	12	11	7	10	11	6	8	5	4
L04	Increase daylight area	**C406.2.5.4**	12	13	15	14	16	17	15	16	20	11	14	13	9	12	11	8	10	10	8
L05	Residential light control	**C406.2.5.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	**C406.2.5.6**	12	12	14	14	15	16	12	15	19	8	12	9	6	10	7	6	7	6	5

Q01	Efficient elevator	**C406.2.6.1**	3	3	4	3	4	4	4	4	5	3	4	4	3	4	4	3	3	3	2
Q02	Commercial kitchen equip.	**C406.2.6.2**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	**C406.2.6.3**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	**C406.2.6.4**	3	2	2	2	2	2	2	2	1	2	2	1	2	2	2	3	2	3	4

DOAS = Dedicated Outside Air System; HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water; UA = *U*-Factor × Area

a. "x" indicates credit is not available in that climate zone for that measure

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#284 Adds new based energy credits Table C406.2(7) for group E occupancies with 32 measures.

Related Mods:

TABLE C406.2(7)
BASE ENERGY CREDITS FOR GROUP E OCCUPANCIES[a]

ID	ENERGY CREDIT MEASURE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope performance	**C406.2.1.1**	Determined in accordance with **Section C406.2.1.1**																		
E02	UA reduction (15%)	**C406.2.1.2**	8	18	7	19	12	13	20	17	11	24	20	17	33	32	29	40	38	46	44
E03	Reduced air leakage	**C406.2.1.3**	4	3	3	3	2	5	2	1	1	1	1	1	1	1	1	2	1	1	1
E04	Add roof insulation	**C406.2.1.4**	8	8	4	9	5	7	16	7	1	14	7	10	18	13	13	23	25	22	28
E05	Add wall insulation	**C406.2.1.5**	5	7	4	8	3	6	8	6	2	6	3	6	5	5	6	7	6	7	8
E06	Improve fenestration	**C406.2.1.6**	8	10	6	9	11	11	15	9	1	16	8	15	22	18	19	33	29	19	18

H01	HVAC performance	**C406.2.2.1**	30	28	25	26	23	21	20	18	15	19	18	17	19	20	15	23	20	25	29
H02	Heating efficiency	**C406.2.2.2**	x	x	x	x	x	x	4	3	3	5	5	10	9	11	6	15	11	18	26
H03	Cooling efficiency	**C406.2.2.3**	9	8	6	7	5	4	2	2	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	**C406.2.2.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	**C406.2.2.5**	45	42	37	41	36	34	41	39	30	43	46	58	57	65	40	79	63	88	117
W01	SHW preheat recovery	**C406.2.3.1 a**	7	7	9	8	10	11	13	13	15	14	15	15	15	14	17	13	15	14	12
W02	Heat pump water heater	**C406.2.3.1 b**	4	4	6	5	7	7	9	9	10	10	10	11	11	10	12	10	11	10	9
W03	Efficient gas water heater	**C406.2.3.1 c**	4	4	6	5	6	7	8	8	9	9	9	10	9	9	11	8	10	9	7
W04	SHW pipe insulation	**C406.2.3.2**	3	3	4	4	4	4	4	5	6	5	5	6	5	5	7	4	5	4	4
W05	Point of use water heaters	**C406.2.3.3 a**	3	4	4	4	4	5	5	5	6	5	5	5	5	5	6	4	5	4	3
W06	Thermostatic bal. valves	**C406.2.3.3 b**	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	1	2	1	1
W07	SHW heat trace system	**C406.2.3.3 c**	4	4	4	4	5	5	5	6	7	6	6	7	6	6	8	5	7	5	5
W08	SHW submeters	**C406.2.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	**C406.2.3.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	**C406.2.3.6**	2	2	2	2	3	3	3	3	4	3	3	4	3	3	4	3	3	3	3
P01	Energy monitoring	**C406.2.4**	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4
L01	Lighting performance	**C406.2.5.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

ID	ENERGY CREDIT MEASURE	SECTION	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
L02	Lighting dimming & tuning	**C406.2.5.2**	5	5	5	6	6	6	5	6	7	6	6	6	5	5	6	4	4	3	2
L03	Increase occp. sensor	**C406.2.5.3**	4	4	5	5	5	6	6	6	7	6	6	5	4	4	5	3	4	3	2
L04	Increase daylight area	**C406.2.5.4**	6	6	7	7	7	7	7	7	8	6	6	6	5	5	6	5	5	5	4
L05	Residential light control	**C406.2.5.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	**C406.2.5.6**	6	7	7	7	8	8	8	8	10	7	8	7	6	7	8	5	6	4	2
Q01	Efficient elevator	**C406.2.6.1**	3	4	4	4	4	5	5	5	5	5	5	5	5	5	5	4	5	4	3
Q02	Commercial kitchen equip.	**C406.2.6.2**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	**C406.2.6.3**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	**C406.2.6.4**	4	4	4	4	3	3	3	3	2	3	3	3	3	3	2	4	3	4	4

DOAS = Dedicated Outside Air System; HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water; UA = *U*-Factor × Area

a. "x" indicates measure is not available in that climate zone for that measure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#285 Adds a new base energy credits Table C406.2(8) for group S-1 and S-2 occupancies with 32 measures.

Related Mods:

CED1-194-22

TABLE C406.2(8)
BASE ENERGY CREDITS FOR GROUP S-1 AND S-2 OCCUPANCIES[a]

ID	ENERGY CREDIT MEASURE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope performance	C406.2.1.1	Determined in accordance with **Section C406.2.1.1**																		

E02	UA reduction (15%)	**C406.2.1.2**	14	14	1	12	1	9	27	16	2	37	29	39	44	47	50	43	52	55	74
E03	Reduced air leakage	**C406.2.1.3**	2	2	1	2	1	3	31	3	1	77	14	17	92	25	8	95	71	69	26
E04	Add roof insulation	**C406.2.1.4**	13	12	10	11	10	11	18	17	7	14	19	18	14	20	22	10	14	12	19
E05	Add wall insulation	**C406.2.1.5**	19	23	13	21	7	10	15	12	3	10	12	13	9	12	12	7	9	9	8
E06	Improve fenestration	**C406.2.1.6**	7	5	8	7	6	6	2	4	2	4	1	6	5	1	7	3	4	4	7
H01	HVAC performance	**C406.2.2.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	**C406.2.2.2**	x	x	x	x	x	x	16	3	1	33	17	22	41	31	21	44	38	43	43
H03	Cooling efficiency	**C406.2.2.3**	7	7	4	5	3	3	1	1	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	**C406.2.2.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	**C406.2.2.5**	35	37	26	33	24	27	77	35	14	141	83	96	168	132	90	180	157	177	178
W01	SHW preheat recovery	**C406.2.3.1 a**	8	7	9	8	10	10	8	10	12	5	8	8	4	6	9	3	4	3	3
W02	Heat pump water heater	**C406.2.3.1 b**	2	2	2	2	2	2	2	2	3	1	2	2	1	2	2	1	1	1	1
W03	Efficient gas water heater	**C406.2.3.1 c**	4	4	5	4	5	5	4	5	6	3	4	4	2	3	5	2	2	2	2
W04	SHW pipe insulation	**C406.2.3.2**	3	3	4	3	3	3	2	3	4	2	2	3	1	2	3	1	1	1	1
W05	Point of use water heaters	**C406.2.3.3 a**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	**C406.2.3.3 b**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	**C406.2.3.3 c**	4	4	4	3	4	4	3	4	5	2	3	3	2	2	4	2	2	2	2
W08	SHW submeters	**C406.2.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

W09	SHW flow reduction	**C406.2.3.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	**C406.2.3.6**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P01	Energy monitoring	**C406.2.4**	5	5	6	6	6	6	5	6	6	5	5	5	5	5	6	5	5	5	5
L01	Lighting performance	**C406.2.5.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	**C406.2.5.2**	10	10	12	11	12	14	9	12	14	6	9	9	3	6	9	3	5	3	2
L03	Increase occp. sensor	**C406.2.5.3**	12	12	14	13	15	14	12	14	17	7	11	11	5	7	11	4	6	3	3
L04	Increase daylight area	**C406.2.5.4**	15	14	18	16	18	17	13	16	21	7	12	11	5	8	10	4	6	6	5
L05	Residential light control	**C406.2.5.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	**C406.2.5.6**	14	14	17	16	17	17	13	17	19	8	13	12	5	8	12	4	6	4	2
Q01	Efficient elevator	**C406.2.6.1**	15	14	18	16	18	18	15	18	21	9	14	14	7	10	14	5	7	5	5
Q02	Commercial kitchen equip.	**C406.2.6.2**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	**C406.2.6.3**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	**C406.2.6.4**	3	3	2	3	2	2	3	2	1	5	3	3	5	4	3	6	5	6	6

DOAS= Dedicated Outside Air System; HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water; UA = *U*-Factor × Area.

a. “x” indicates credit is not available in that climate zone for that measure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#286 Adds a new base energy credits Table C406.2(9) for group S-1 and S-2 occupancies with 32 measures.

Related Mods:

CEPI-193-21, CECD1-6-22, CED1-185-22, CED1-194-22

TABLE C406.2(9)
BASE ENERGY CREDITS FOR OTHER OCCUPANCIES[a, b]

ID	ENERGY CREDIT MEASURE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope performance	**C406.2.1.1**	Determined in accordance with **Section C406.2.1.1**																		
E02	UA reduction (15%)	**C406.2.1.2**	7	8	3	7	5	5	11	7	2	18	10	14	26	20	19	24	25	29	32
E03	Reduced air leakage	**C406.2.1.3**	6	4	5	4	3	7	12	3	2	28	5	6	36	9	3	41	27	33	15
E04	Add roof insulation	**C406.2.1.4**	4	4	3	4	4	4	8	6	2	7	6	7	9	8	9	9	10	9	12
E05	Add wall insulation	**C406.2.1.5**	16	19	11	17	5	6	10	7	2	9	6	8	9	7	7	9	9	10	8
E06	Improve fenestration	**C406.2.1.6**	4	4	3	4	5	6	6	4	1	9	4	7	11	7	6	16	14	8	8
H01	HVAC performance	**C406.2.2.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	**C406.2.2.2**	x	x	x	x	x	x	6	2	3	11	6	8	15	11	9	18	15	19	23
H03	Cooling efficiency	**C406.2.2.3**	7	7	5	5	4	3	1	2	1	x	x	x	x	x	x	x	x	x	x
H04	Residential HVAC control	**C406.2.2.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	**C406.2.2.5**	37	36	31	34	30	28	43	32	23	61	42	49	75	61	49	90	77	93	90
W01	SHW preheat recovery	**C406.2.3.1 a**	18	19	22	21	25	26	28	29	34	29	31	34	29	31	35	26	29	27	26
W02	Heat pump water heater	**C406.2.3.1 b**	12	12	15	14	17	17	20	20	24	21	22	25	21	23	26	20	22	21	20
W03	Efficient gas water heater	**C406.2.3.1 c**	11	11	13	13	15	16	17	17	21	18	19	21	18	19	22	16	18	17	16
W04	SHW pipe insulation	**C406.2.3.2**	3	3	4	4	4	4	4	4	5	4	4	5	4	4	5	3	4	3	3

W05	Point of use water heaters	**C406.2.3.3 a**	8	10	11	10	11	12	12	12	14	13	13	14	13	13	14	11	12	12	11
W06	Thermostatic bal. valves	**C406.2.3.3 b**	1	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	1	1
W07	SHW heat trace system	**C406.2.3.3 c**	5	5	5	5	6	6	6	6	7	6	6	7	5	6	7	5	5	5	5
W08	SHW submeters	**C406.2.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	**C406.2.3.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	**C406.2.3.6**	6	6	7	7	8	9	10	10	11	10	11	12	10	11	12	10	11	10	10
P01	Energy monitoring	**C406.2.4**	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4
L01	Lighting performance	**C406.2.5.1**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	**C406.2.5.2**	5	5	5	5	6	6	5	6	7	5	5	5	4	4	5	3	4	3	2
L03	Increase occp. sensor	**C406.2.5.3**	5	6	6	6	7	7	6	7	8	5	6	6	4	5	6	3	4	3	2
L04	Increase daylight area	**C406.2.5.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L05	Residential light control	**C406.2.5.5**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	**C406.2.5.6**	7	7	8	7	8	8	7	8	9	5	7	6	4	5	6	4	4	3	2
Q01	Efficient elevator	**C406.2.6.1**	4	4	5	4	5	5	5	5	6	4	5	5	4	4	5	3	4	3	3
Q02	Commercial kitchen equip.	**C406.2.6.2**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	**C406.2.6.3**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Q04	Fault detection	**C406.2.6.4**	3	3	3	3	3	2	3	2	2	3	3	2	3	3	2	4	3	4	4

DOAS = Dedicated Outside Air System; HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water; UA = *U*-Factor × Area.

a. "x" indicates credit is not available in that climate zone for that measure.
b. Other occupancy groups include all groups except Groups A-2, B, E, I, M, S and R.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#287

Adds new Section C406.2.1 for achieving energy credits with the improved building envelope. It increases the stringency but is cost-effective measure.
Adds new Section C406.2.1 for achieving energy credits with the improved building envelope. It increases the stringency but is cost-effective measure.
Adds new subsection C406.2.1.2 based on the existing code C406.8. No change on stringency.
Adds new subsection C406.2.1.3 based on the existing code C406.9. No change on stringency.
Adds new subsection C406.2.1.4. It increases the stringency but is cost-effective.
Adds new subsection C406.2.1.5. It increases the stringency but is cost-effective.
Adds new subsection C406.2.1.6. It increases the stringency but is cost-effective.

Related Mods:

CEPI-193-21, CECD1-6-22, CED1-185-22, CED1-194-22, CED1-92-22, CE2D-9-23

C406.2.1 More efficient building thermal envelope. A project shall achieve credits for improved envelope performance by complying with one of the following measures:

1. **Section C406.2.1.1**: E01.
2. **Section C406.2.1.2**: E02.
3. **Section C406.2.1.3**: E03.
4. Both E02 and E03.
5. Any combination of:
   5.1. **Section C406.2.1.3**: E03.
   5.2. **Section C406.2.1.4**: E04.
   5.3. **Section C406.2.1.5**: E05.
   5.4. **Section C406.2.1.6**: E06.

C406.2.1.1 E01 Improved envelope performance ASHRAE 90.1 Appendix C. *Building thermal envelope* measures shall be installed to improve the energy performance of the project. The achieved energy credits shall be determined using **Equation 4-13**.

$$EC_{ENV} = 1{,}000 \times (EPF_B - EPF_P)/EPF_B \qquad \text{Equation 4-13}$$

where:
EC_{ENV} = E01 measure energy credits.
EPF_B = base envelope performance factor calculated in accordance with **ASHRAE 90.1** Appendix C.
EPF_P = proposed envelope performance factor calculated in accordance with **ASHRAE 90.1** Appendix C.

C406.2.1.2 E02 Component performance envelope reduction. Energy credits shall be achieved where the component performance of the *building thermal envelope* as designed is not less than 15 percent below the component performance of the *building thermal envelope* in accordance with **Section C402.1.4**.

C406.2.1.3 E03 Reduced air leakage. Energy credits shall be achieved where tested building *air leakage* is not less than 10 percent of the maximum leakage permitted by **Section C402.6.2**, provided that the *building* is tested in accordance with the applicable method in **Section C402.6.2**. Energy credits achieved for measure E03 shall be determined as follows:

$$EC_{E03} = EC_B \times EC_{adj}$$

Equation 4-14

where:

EC_{E03} = Energy efficiency credits achieved for envelope leakage reduction. EC_B = **Section C406.2.1.3** credits from **Tables C406.2(1)** through **C406.2(9)**. $EC_{adj} = L_s / EC_a$

L_s = Leakage savings fraction: the lesser of $[(L_r - L_m)/L_r]$ or 0.8.

L_r = Maximum leakage permitted for tested buildings, by occupancy group, in accordance with **Section C402.6.2**.

L_m = Measured leakage in accordance with Section **C402.6.2.1** or **C402.6.2.2**.

EC_a = Energy credit alignment factor: 0.37 for whole-building tests in accordance with **Section C402.6.2.1** or 0.25 for dwelling and sleeping unit enclosure tests in accordance with **Section C402.6.2.2**

C406.2.1.4 E04 Added roof insulation. Energy credits shall be achieved for insulation that is in addition to the required insulation in **Table C402.1.3**. All roof areas in the project shall have additional R-10 *continuous insulation* included in the *roof assembly*. For attics, this is permitted to be achieved with fill or batt insulation rated at R-10 that is continuous and not interrupted by ceiling or roof joists. Where interrupted by joists, the added insulation shall be not less than R-13. Alternatively, one-half of the base credits shall be achieved where the added *R-value* is one-half of the additional *R-value* required by this section.

C406.2.1.5 E05 Added wall insulation. Energy credits shall be achieved for insulation applied to not less than 90 percent of all opaque wall area in the project that is in addition to the required insulation in **Table C402.1.3**. Opaque walls shall have additional R-5 *continuous insulation* included in the wall assembly. Alternatively, one-half of the base credits shall be achieved where the added *R-value* is R-2.5.

C406.2.1.6 E06 Improve fenestration. Energy credits shall be achieved for improved energy characteristics of all vertical *fenestration* in the project meeting the requirements in **Table C406.2.1.6**. The area-weighted average *U-factor* and SHGC of all vertical *fenestration* shall be equal to or less than the value shown in the table. Where vertical *fenestration* is located under a permanently attached shading projection with a projection factor (PF) not less than 0.2 as determined in accordance with **Section C402.5.3**, the SHGC for that *fenestration* shall be permitted to be divided by 1.2. The area-weighted average *visible transmittance* (VT) of all vertical *fenestration* shall be equal to or greater than the value shown in the table.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#288

Adds new Table C406.2.1.6.
Decreases the U-Factor and the SHGC hence it increases the stringency.

Related Mods:

CEPI-193-21, CED1-194-22

TABLE C406.2.1.6
VERTICAL FENESTRATION REQUIREMENTS FOR ENERGY CREDIT E06

APPLICABLE CLIMATE ZONE	**MAXIMUM *U*-FACTOR**		**MAXIMUM SHGC**	**MINIMUM VT**
	Fixed	**Operable**		
0–2	0.45	0.52	0.21	0.28
3	0.33	0.44	0.23	0.30
4–5	0.31	0.38	0.34	0.41
6–7	0.26	0.32	0.38	0.44
8	0.24	0.28	0.38	0.44

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#289

Added new Section C406.2.2 for achieving credits with improved HVAC equipment. It increases the stringency but is cost-effective. Adds new subsection C406.2.2.1.
Adds new subsection C406.2.2.2 by expanding an existing measure. It increases the stringency but is cost-effective.
Adds new subsection C406.2.2.3 by expanding an existing measure. It increases the stringency but is cost-effective.
Adds new subsection C406.2.2.4. Requires centralized HVAC setback control in multi-family buildings. It increase the stringency but is cost effective.
Adds new subsection C406.2.2.5 by modifying an existing measure. It increases the stringency but is cost effective.

Related Mods:

CEPI-193-21, CED1-185-22, CED1-198-22, CE2D-61-23, CED1-173-22

C406.2.2 More efficient HVAC equipment performance. All heating and cooling systems shall meet the minimum requirements of **Section C403** and efficiency improvements shall be referenced to minimum efficiencies listed in tables referenced by **Section C403.3.2**. Where multiple efficiency requirements are listed, equipment shall meet the seasonal or part-load efficiencies including SEER, integrated energy efficiency ratio (IEER), *integrated part load value* (IPLV) or AFUE. Equipment that is larger than the maximum capacity range indicated in tables referenced by **Section C403.3.2** shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted-average improvement based on individual system capacity. Systems are permitted to achieve HVAC energy credits by meeting the requirements of one of the following:

1. **C406.2.2.1** H01.
2. **C406.2.2.2** H02.
3. **C406.2.2.3** H03.

4. **C406.2.2.4** H04.
5. **C406.2.2.5** H05.
6. Any combination of H02, H03, H04 and H05.
7. The combination of H01 and H04.

C406.2.2.1 H01 HVAC Total System Performance Ratio (TSPR). H01 energy credits shall be earned where systems are permitted to use **Section C409** and where the savings ($TSPR_s$) based on the proposed TSPR ($TSPR_p$) compared to the target TSPR is 5 percent or more. If savings are greater than 5 percent, determine H01 earned credits using **Equation 4-15**. Energy credits for H01 shall not be combined with energy credits from HVAC measures H02, H03 or H05.

$$EC_{TSPR} = EC_{BASE} \times AREA_{TSPR} \times TSPR_s / 0.05$$ Equation 4-15

EC_{TSPR} = Energy credits achieved for H01.
EC_{BASE} = H01 base energy credits from **Tables C406.2(1)** through **C406.2(9)**.
$TSPR_s$ = The lesser of 0.20 and [1 – ($TSPR_t$ / $TSPR_p$)]. where:
$AREA_{TSPR}$ = (floor area served by systems included in TSPR)/(total building conditioned floor area)
$TSPR_p$ = HVAC TSPR of the proposed design calculated in accordance with **Sections C409.4**, **C409.5** and **C409.6**.
$TSPR_t$ = $TSPR_r$ / *MPF*.
$TSPR_r$ = HVAC TSPR of the reference building design calculated in accordance with
Sections C409.4, C409.5 and C409.6.
MPF = Mechanical performance factor from **Table C409.4** based on climate zone and building use type. Where a building has multiple building use types, *MPF* shall be area weighted in accordance with **Section C409.4**.

C406.2.2.2 H02 More efficient HVAC equipment heating performance. In accordance with **Section C406.1.1**, not less than 90 percent of the total HVAC cooling capacity serving the total *conditioned floor area* of the entire *building* or tenant space shall comply with the requirements of this section.

1. Equipment installed shall be types that have their efficiency listed in tables referenced by **Section C403.3.2**. Electric resistance heating capacity shall be limited to 20 percent of system capacity, with the exception of heat pump supplemental heating.

2. Equipment shall exceed the minimum heating efficiency requirements listed in tables referenced by **Section C403.3.2** by not less than 5 percent. Where equipment exceeds the minimum annual heating efficiency requirements by more than 5 percent, energy efficiency credits for heating shall be determined using **Equation 4-16**, rounded to the nearest whole number.

$$EEC_{HEH} = EEC_{H5} \times (CEI/0.05)$$ Equation 4-16

where:
EEC_{HEH} = Energy efficiency credits for heating efficiency improvement.
EEC_{H5} = **Section C406.2.2.2** credits from **Tables C406.2(1)** through **C406.2(9)**.
HEI = The lesser of the improvement above minimum heating efficiency requirements, expressed as a fraction, or 20 percent (0.20). Where heating equipment with different minimum efficiencies are included in the building, a heating

capacity weighted-average improvement shall be used. Where electric resistance primary heating or reheat is included in the building, it shall be included in the weighted-average improvement with an HEI of 0. Supplemental gas and electric heat for heat pump systems shall be excluded from the weighted HEI. For heat pumps rated at multiple ambient temperatures, the efficiency at 47°F (8.3°C) shall be used. For metrics that increase as efficiency increases, HEI shall be calculated as follows:

$HEI = (HM_{DES} / HM_{MIN}) – 1$

where:

HM_{DES} = Design heating efficiency metric, part-load or annualized where available.

HM_{MIN} = Minimum required heating efficiency metric, part-load or annualized where available from **Section C403.3.2**.

Exception: In low-energy spaces complying with **Section C402.1.1**, not less than 90 percent of the installed heating capacity is provided by electric infrared or gas- fired radiant heating equipment for localized heating applications. Such spaces shall achieve base energy credits only for EEC_{H5}.

C406.2.2.3 H03 More efficient HVAC cooling equipment and fan performance. In accordance with **Section C406.1.1**, not less than 90 percent of the total HVAC cooling capacity serving the total *conditioned floor area* of the entire *building* or tenant space shall comply with all of the requirements of this section.

1. Equipment installed shall be types that are listed in tables referenced by **Section C403.3.2**.
2. Equipment shall exceed the minimum cooling efficiency requirements listed in tables referenced by **Section C403.3.2** by not less than 5 percent. For water- cooled chiller plants, heat-rejection equipment performance in **Table C403.3.2(7)** shall also be increased by at least the chiller efficiency improvement. Where equipment exceeds both the minimum annual cooling efficiency and heat- rejection efficiency requirements by more than 5 percent, energy efficiency credits for cooling shall be determined using **Equation 4-17**, rounded to the nearest whole number.

Where fan energy is not included in the packaged equipment rating or it is and the fan size has been increased from the as-rated equipment condition, fan power or horsepower shall be less than 95 percent of the allowed fan power in **Section C403.8.1**.

$$EEC_{HEC} = EEC_5 \times (CEI/0.05) \qquad \text{Equation 4-17}$$

EEC_{HEC} = Energy efficiency credits for cooling efficiency improvement.

EEC_5 = **Section C406.2.2.3** base energy credits from **Tables C406.2(1)** through C406.2(9).

CEI = The lesser of the improvement above minimum cooling efficiency and heat- rejection performance requirements, expressed as a fraction, or 20 percent (0.20). Where cooling equipment with different minimum efficiencies is included in the building, a cooling capacity weighted-average improvement shall be used. Where multiple cooling efficiency or performance requirements are provided, the equipment shall exceed the annualized energy or part-load requirement. Meeting both part-load and full-load efficiencies is not required. For metrics that increase as efficiency increases, *CEI* shall be calculated as follows:

$CEI = (CM_{DES} / CM_{MIN}) – 1$. For metrics that decrease as efficiency increases, *CEI* shall be calculated as follows:

$CEI = (CM_{MIN} / CM_{DES}) – 1$.

where:

CM_{DES} = Design cooling efficiency metric, part-load or annualized where available.

CM_{MIN} = Minimum required cooling efficiency metric, part-load or annualized where available from **Section C403.3.2**. For data centers using **ASHRAE Standard 90.4**, *CEI* shall be calculated as follows:

$CEI = (AMLC_{MAX} / AMLC_{DES}) – 1$

where:

$AMLC_{DES}$ = As-designed annualized mechanical load component calculated in accordance with **ASHRAE Standard 90.4**, Section 6.5.

$AMLC_{MAX}$ = Maximum annualized mechanical load component from **ASHRAE Standard 90.4**, Table 6.5.

C406.2.2.4 H04 Residential HVAC control. HVAC systems serving *dwelling units* or *sleeping units* shall be controlled to automatically activate a setback at least 5°F (3°C) for both heating and cooling. The temperature controller shall be configured to provide setback during occupied sleep periods. The unoccupied setback mode shall be configured to operate in conjunction with one of the following:

1. A *manual* main control device by each *dwelling unit* main entrance that initiates setback and nonventilation mode for all HVAC units in the *dwelling unit* and is clearly identified as "Heating/Cooling Master Setback."
2. Occupancy sensors in each room of the *dwelling unit* combined with a door switch to initiate setback and nonventilation mode for all HVAC units in the dwelling within 20 minutes of all spaces being vacant immediately after a door switch operation. Where separate room HVAC units are used, an individual occupancy sensor on each unit that is configured to provide setback shall meet this requirement.
3. An advanced learning *thermostat* or controller that recognizes occupant presence and automatically creates a schedule for occupancy and provides a dynamic setback schedule based on when the spaces are generally unoccupied.
4. An automated control and sensing system that uses geographic fencing connected to the *dwelling unit* occupants' cell phones and initiates the setback condition when all occupants are away from the *building* .

C406.2.2.5 H05 Dedicated outdoor air system. Credits for this measure are allowed

only where single- *zone* HVAC units are not required to have multi-speed or variable- speed fan control in accordance with **Section C403.8.6.1**. HVAC controls and ventilation systems shall include all of the following:

1. *Zone* controls shall cycle the heating/cooling unit fans off when not providing required heating and cooling or shall limit fan power to 0.12 watts/cfm (0.056 w/l/s) of *zone* supply air.
2. Outdoor air shall be supplied by an independent ventilation system designed to provide not more than 130 percent of the minimum outdoor air to each individual occupied *zone* , as specified by the ***International Mechanical Code***.

   Exception: Outdoor airflow is permitted to increase during emergency or economizer operation, implemented as described in Item 4.

3. The ventilation system shall have energy recovery with an *enthalpy recovery ratio* of 65 percent or more at heating design conditions in Climate Zones 3 through 8 and an *enthalpy recovery ratio* of 65 percent or more at cooling design conditions in Climate Zones 0, 1, 2, 3A, 3B, 4A, 4B, 5A and 6A. In "A" climate zones, energy recovery shall include latent recovery. Where no humidification is provided, heating energy recovery effectiveness is permitted to be based on *sensible energy recovery ratio* . Where energy recovery effectiveness is less than the 65 percent required for full credit, adjust the credits from **Section C406.2** by the factors in **Table C406.2.2.5**.
4. Where the ventilation system serves multiple *zones* and the system is not in a latent recovery outside air dehumidification mode, partial economizer cooling through an outdoor air bypass or wheel speed control shall automatically do one of the following:
   4.1. Set the energy recovery leaving-air temperature 55°F (13°C) or 100 percent outdoor air bypass when a majority of *zones* require cooling and outdoor air temperature is below 70°F (21°C).
   4.2. The HVAC ventilation system shall include supply-air temperature controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperatures. The controls shall

	reset the supply-air temperature not less than 25 percent of the difference between the design supply-air temperature and the design room-air temperature. 5. Ventilation systems providing mechanical dehumidification shall use recovered energy for reheat within the limits of Item 4. This shall not limit the use of latent energy recovery for dehumidification. Where only a portion of the *building* is permitted to be served by constant air volume units or the *enthalpy recovery ratio* or *sensible energy recovery ratio* is less than 65 percent, the base energy credits shown in **Section C406.2** shall be prorated as follows: $EC_{DOAS} = EC_{BASE} \times FLOOR_{CAV} \times ERE_{ADJ}$ Equation 4-18 where: EC_{DOAS} = Energy credits achieved for H05. EC_{BASE} = H05 base energy credits in **Section C406.2**. $FLOOR_{CAV}$ = Fraction of whole-project gross conditioned floor area not required to have variable-speed or multi-speed fan airflow control in accordance with **Section C403.8.6**. ERE_{adj} = The energy recovery adjustment from **Table C406.2.2.5** based on the lower of actual cooling or heating enthalpy recovery ratio or sensible energy recovery ratio where required for the climate zone. Where recovery ratios vary, use a weighted average by supply airflow. FSEC – Anticipated energy impact on FBC-EC – Decrease Staff Classification: Correlates Directly: X; Energy Standard Needed: ; Over lap: Action: AS: ; AS/IC: ; D: x; D/IC:
CE#290	Adds new Table C406.2.2.5.
Related Mods: CEPI-193-21, CED1-185-22	TABLE C406.2.2.5 **DOAS ENERGY RECOVERY ADJUSTMENTS**

***ERE_{adj}* BASED ON LOWER OF ACTUAL HEATING OR COOLING ENERGY RECOVERY EFFECTIVENESS WHERE REQUIRED**		
Cooling *ERR* is at least	**Heating enthalpy recovery ratio or sensible energy recovery ratio is at least**	**Energy recovery effectiveness adjustment (*ERE_{adj}*)**

65%	65%	1.00
60%	60%	0.67
55%	55%[a]	0.33
50%	50%[a]	0.25

a. In climate zones where heating recovery is required in **Section C403**, a heating recovery effectiveness below 60 percent is not allowed for dwelling units.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#291

Adds new Section C406.2.3. Achieving energy credits by reducing water heating energy for SWH.
Adds new subsection C406.2.3.1 based on existing requirements.
Adds new subsection C406.2.3.1.1 based on the existing code C406.7.2. No change on stringency.
Adds new subsection C406.2.3.1.2 by modifying an existing measure.
Adds new subsection C406.2.3.1.3 based on the existing code C406.7.3. No change on stringency.
Adds new subsection C406.2.3.1.4. It increases the stringency but is a cost-effective measure.

Related Mods:

CEPI-193-21, CED1-185-22

C406.2.3 Reduced energy use in service water heating. For projects with service water heating equipment that serves the whole building, a building *addition* or a tenant space shall achieve credits through compliance with the requirements of this section. Systems are permitted to achieve energy credits by meeting the requirements of one of the following:

1. **Section C406.2.3.1** by selecting one allowed measure W01, W02, W03 or a combination in accordance with **Section C406.2.3.1.4**.
2. **Section C406.2.3.2** W04.
3. **Section C406.2.3.3** by selecting one allowed measure: W05, W06 or W07. 4. **Section C406.2.3.4** W08.
5. **Section C406.2.3.5** W09.
6. **Section C406.2.3.6** W10.
7. Any combination of measures in **Sections C406.2.3.1** through **C406.2.3.6** as long as not more than one allowed measure from **Sections C406.2.3.1** and **C406.2.3.3** are selected.

C406.2.3.1 Service water heating system efficiency. A project is allowed to achieve energy credits from only one of **Sections C406.2.3.1.1** through **C406.2.3.1.4**.

C406.2.3.1.1 W01 Recovered or renewable water heating. The building service water-heating system shall have one or more of the following that are sized to provide not less than 30 percent of the building's annual hot water requirements, or sized to provide not less than 70 percent of the building's annual hot water requirements if the *building* is required to comply with **Section C403.11.5**:

1. Waste heat recovery from service hot water, heat recovery chillers, building equipment or process equipment

2.A water-to-water heat pump that precools chilled water return for building cooling while heating SHW
3.On-site renewable energy water heating systems

C406.2.3.1.2 W02 Heat pump water heater. Air-source heat pump *water heaters* shall be installed according to the manufacturer's instructions and at least 30 percent of design end-use *service water heating* requirements shall be met using only heat pump heating at an ambient condition of 67.5°F (19.7°C), db without supplemental electric resistance or fossil fuel heating. For a heat pump *water heater* with supplemental electric resistance heating, the heat pump-only capacity shall be deemed at 40 percent of first-hour draw. Where the heat pump-only capacity exceeds 50 percent of the design end-use load, excluding recirculating system losses, the credits from the **Section C406.2** tables shall be prorated as follows:

$$EC_{HPWH} = (EC_{BASE}/0.5) \times \{(CAP_{HPWH})/(\text{Endload})[\text{not greater than } 2]\}$$

Equation 4-19

where:

EC_{HPWH} = Energy credits achieved for W02.

EC_{BASE} = W02 base energy credits from **Tables C406.2(1)** through **C406.2(9)**. Endload = End-use peak hot water load, excluding load for heat trace or recirculation, Btu/h or kW.

CAP_{HPWH} = The heat pump-only capacity at 50°F (10°C) entering air and 70°F (21°C) entering potable water without supplemental electric resistance or fossil fuel heat, Btu/h or kW.

The heat pump service water heating system shall comply with the following requirements:

1. For systems with an installed total output capacity of more than 100,000 Btu/h (29 kW) at an ambient condition of 67.5°F (19.7°C) db, a preheat storage tank with greater than or equal to 0.75 gallons per 1,000 Btu/h (≥ 9.7 L/kW) of design end-use service water-heating requirements shall be heated only with a heat pump heating when the ambient temperature is greater than 45°F (7.2°C).
2. For systems with piping temperature maintenance, either a heat trace system or a separate *water heater* in series for recirculating system and final heating shall be installed.
3. Heat pump *water heater* efficiency shall meet or exceed one of the following:
   3.1. Output-capacity-weighted-average UEF of 3.0 in accordance with **10 CFR 430** Appendix E.
   3.2. Output-capacity-weighted-average COP of not less than 4.0 tested at 50°F (10°C) entering air and 70°F (21°C) entering potable water in accordance with **ANSI/AHRI 1300**.

C406.2.3.1.3 W03 Efficient fossil fuel water heater. The combined input-capacity- weighted-average equipment rating of all gas water heating equipment in the *building* shall be not less than 95 percent E_t or 0.93 UEF. Adjustments shall apply as follows:

1. Where the *service water heating* system is required to comply with **Section C404.2.1**, this measure shall achieve 30 percent of the listed base W03 energy credits in **Tables C406.2(1)** through **C406.2(9)**.
2. Where the installed building *service water heating* capacity is less than 200,000 Btu/h (59 kW) and weighted UEF is less than 0.93 UEF and not less than 0.82, this measure shall achieve 25 percent of the base W03 credit in **Tables C406.2(1)** through **C406.2(9)**.

C406.2.3.1.4 Combination service water heating systems. Combination *service water heating* systems shall achieve credits using one of the measure combinations as follows:

1. (W01 + W02) Where *service water heating* employs both energy recovery and heat pump water heating, W01 may be combined with W02 and receive the sum of both credits.
2. (W01 + W03) Where *service water heating* employs both energy recovery and efficient gas water heating, W01 may be combined with W03 and receive the sum of the W01 credit and the portion of the W03 credit based on Item 4.
3. (W02 + W03) Where *service water heating* employs both heat pump water heating and efficient gas water heating, W02 may be combined with W03 and receive the sum of the W02 credit and the portion of the W03 credit based on Item 4.
4. For Items 2 and 3, the achieved W03 credit shall be the **Section C406.2.3.1.3** W03 credit multiplied by the fractional share of total water-heating installed capacity served by gas water heating that is not less than 95 percent E_t or

   0.93 UEF. In no case shall the achieved W03 credit exceed 60 percent of the W03 credit in the Section C406.2 tables. In buildings that have a service water heating design generating capacity greater than 900,000 Btu/h (264 kW), that proportioned W03 credit shall be further multiplied by 30 percent.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			X	

CE#292

Adds new subsection C406.2.3.2. It increases the stringency but is a cost-effective measure.
Adds new subsection C406.2.3.3. It increases the stringency but is a cost-effective measure.
1. W05 Point of use water heaters. It increases the stringency but is a cost-effective measure.
2. W06 Thermostatic balancing valves. It increases the stringency but is a cost-effective measure.
3. W07 Heat trace system. It increases the stringency but is a cost-effective measure.
Adds new subsection C406.2.3.4. It increases the stringency but is a cost-effective measure.
Adds new subsection C406.2.3.5. It increases the stringency but is a cost-effective measure.
Adds new subsection C406.2.3.6. It increases the stringency but is a cost-effective measure.

Related Mods:

CEPI-193-21, CED1-185-22, CED1-174-22

C406.2.3.2 W04 Service hot water piping insulation increase. Where service hot water is provided by a central water-heating system, the hot water pipe insulation thickness shall be at least 1.5 times the thickness required in **Section C404.4**. All service hot water piping shall be insulated from the hot water source to the fixture shutoff. Where 50 percent or more of hot water piping does not have increased insulation due to installation in partitions, the credit shall be prorated as a percentage of lineal feet of piping with increased insulation.

C406.2.3.3 Service water-heating distribution temperature maintenance. A project is allowed to claim energy credits from only one of the following SHW distribution temperature maintenance measures.

1. **W05 Point of use *water heaters* .** Credits are available for Group B or E buildings larger than 5,000 square feet (465 m^2) where *service water heating* systems meet the following requirements:

1.1. Fixtures requiring hot water shall be supplied from a local *water heater* with no recirculating system or heat trace piping.

Exception: Commercial kitchens or showers in locker rooms shall be permitted to have a local recirculating system or heat trace piping where *water heaters* are located not more than 50 lineal feet (15 m) from the farthest fixture served.

1.2. Supply piping from the *water heater* to the termination of the fixture supply pipe shall be insulated to the levels shown in **Table C404.4.1**.

Exceptions:

1. Piping at locations where a vertical support of the piping is installed.
2. Where piping passes through a framing member and insulation requires increasing the size of the framing member.

1.3. The water volume in the piping from the *water heater* to the termination of any individual fixture shall be limited as follows:

1.3.1. Nonresidential public lavatory faucets that are available for use by members of the general public: not more than 2 ounces (59 mL).

1.3.2. Commercial kitchens or showers in locker rooms with recirculating systems or heat trace piping: not more than 24 ounces (710 mL) from the recirculating system or heat trace piping.

1.3.3. All other plumbing fixtures or appliances: not more than 16 ounces (473 mL).

2. **W06 Thermostatic balancing valves.** Credits are available where *service water heating* is provided centrally and distributed throughout the *building* with a recirculating system. Each recirculating system branch return connection to the main SHW supply piping shall have an *automatic* thermostatic balancing valve set to a minimal return water flow when the branch return temperature is greater than 120°F (49°C).

3. **W07 Heat trace system.** Credits are available for projects with gross floor area greater than 10,000 square feet (929m^2) and a central water-heating system. The energy credits achieved shall be from **Tables C406.2(1)** through **C406.2(9)**. This system shall include self-regulating electric heat cables, connection kits and electronic controls. The cable shall be installed directly on the hot water supply pipes underneath the insulation to replace standby losses.

C406.2.3.4 W08 Water-heating system submeters. Each individual *dwelling unit* in a Group R-2 occupancy served by a central service water-heating system shall be provided with a service hot water meter connected to a reporting system that provides individual *dwelling unit* reporting of actual domestic hot water use. Preheated water serving the cold water inlet to showers need not be metered.

C406.2.3.5 W09 Service hot water flow reduction. *Dwelling unit* , *sleeping unit* and guestroom plumbing fixtures that are connected to the service water-heating system shall have a flow or consumption rating less than or equal to the values shown in **Table C406.2.3.5**.

C406.2.3.6 W10 Shower drain heat recovery. Cold water serving building showers shall be preheated by shower drain heat recovery units that comply with **Section C404.7**. The efficiency of drain heat recovery units shall be 54 percent or greater measured in accordance with **CSA B55.1**. Full credits are applicable to the following building uses: I-2, I-4, R-1, R-2 and also Group E where there are more than eight showers. Partial credits are applicable to buildings where all but ground floor showers are served where the base energy credit from **Section C406.2** is adjusted by **Equation 4-20**.

Equation 4-20

$$\text{W10 credit} = \text{W10 base energy credit} \times (\text{showers with drain heat recovery/total showers in building})$$

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#293 Adds new Table C406.2.3.5.

Related Mods:

CEPI-193-21

TABLE C406.2.3.5

MAXIMUM FLOW RATING FOR RESIDENTIAL PLUMBING FIXTURES WITH HEATED WATER

PLUMBING FIXTURE	MAXIMUM FLOW RATE
Faucet for private lavatory,[a] hand sinks, or bar sinks	1.2 gpm at 60 psi
Faucet for residential kitchen sink[a, b, c]	1.8 gpm at 60 psi
Shower head (including hand-held shower spray)[a, b, d]	1.8 gpm at 80 psi

For SI: 1 gallon per minute = 3.785 L/min, 1 pound per square inch = 6.89 kPa.

a. Showerheads, lavatory faucets and kitchen faucets are subject to US federal requirements listed in **10 CFR 430.32**(o)–(p).
b. Maximum flow allowed is less than required by flow rates listed in **10 CFR 430.32**(o)–(p) for showerheads and kitchen faucets.
c. Residential kitchen faucets may temporarily increase the flow above the maximum rate, but not above 2.2 gallons per minute at 60 psi (8.3 L/min at 414 kPa), and must default to the maximum flow rate listed.
d. Where a shower is served by multiple shower heads, the combined flow rate of all shower heads controlled by a single valve shall not exceed the maximum flow rate listed or the shower shall be designed to allow only one shower head to operate at a time.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#294 Adds new Section C406.2.4 based on an existing measure. Achieving energy credits using an energy monitoring system.

<table>
<tr>
<td>Related Mods:

CEPI-193-21</td>
<td>

C406.2.4 P01 Energy monitoring. A project not required to comply with **Section C405.13** can achieve energy credits for installing an energy monitoring system that complies with all the requirements of **Sections C405.13.1** through **C405.13.5**.

FSEC – Anticipated energy impact on FBC-EC – Decrease

<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
<tr><td></td><td>X</td><td></td><td></td></tr>
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<tr>
<td>**CE#295**</td>
<td>Adds new Section C406.2.5. Achieving energy credits by enhancing lighting performance.
C406.2.5.1 Reserves for future use.
Adds new Section C406.2.5.2 by modifying an existing lighting control measure.
Adds new Section C406.2.5.3. It increases the stringency but is a cost-effective measure.
Adds new subsection C406.2.5.3.1.
Adds new subsection C406.2.5.3.2.
Adds new subsection C406.2.5.3.3.</td>
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<tr>
<td>Related Mods:

CEPI-193-21, CED1-81-22, CECD1-3-22, CECD1-4-22,</td>
<td>

C406.2.5 Energy savings in lighting systems. Projects are permitted to achieve energy credits for increased lighting system performance by meeting the requirements of one of the following:

1. **Section C406.2.5.2** L02.
2. **Section C406.2.5.3** L03.
3. **Section C406.2.5.4** L04.
4. **Section C406.2.5.5** L05.
5. **Section C406.2.5.6** L06.
6. Any combination of L03, L04, L05 and L06.
7. Any combination of L02, L03 and L04.

C406.2.5.1 L01 Lighting system performance (reserved). Reserved for future use.

C406.2.5.2 L02 High-end trim lighting controls. Measure credits shall be achieved where qualifying spaces are not less than 50 percent of the project interior floor area exclusive of *dwelling* and *sleeping units* . Qualifying spaces are those where *general lighting* is controlled by high-end trim lighting controls complying with the following:

1. The calibration adjustment equipment is located for ready *access* only by authorized personnel.
2. Lighting controls with ready *access* for users cannot increase the lighting power above the maximum level established by the high-end trim controls.
3. *Construction documents* shall state that maximum light output or power of *general lighting* in spaces contributing to the qualifying floor area shall be not greater than 85 percent of full power or light output.
4. High-end trim lighting controls shall be tested in accordance with **Section C408.3.1.5**.

The base credits from **Tables C406.2(1)** through **C406.2(9)** shall be prorated as follows:

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</table>

HET × [Base energy credits for **C406.2.5.2**]/50% where:

HET = Floor area of qualifying spaces where *general lighting* is provided with high-end trim lighting controls complying with this section, expressed as a percentage of total interior floor area, excluding *dwelling* and *sleeping units* .

C406.2.5.3 L03 Increase occupancy sensor. Lighting controls shall comply with Sections C406.2.5.3.1, C406.2.5.3.2 and C406.2.5.3.3.

C406.2.5.3.1 Occupant sensor controls. Occupant sensor controls shall be installed to control lights in the following space types:

1. Food preparation area.
2. Laboratory.
3. Elevator lobby.
4. Pharmacy area.
5. Vehicular maintenance area.
6. Workshop.
7. Recreation room in a facility for the visually impaired.
8. Exercise area in a fitness center.
9. Playing area in a fitness center.
10. Exam/treatment room in a health care facility.
11. Imaging room in a health care facility.
12. Physical therapy room in a health care facility.
13. Library reading area.
14. Library stacks.
15. Detailed manufacturing area.
16. *Equipment room* in a manufacturing facility.
17. Low-bay area in a manufacturing facility.
18. Post office sorting area.
19. Religious fellowship hall.
20. Hair salon.
21. Nail salon.
22. Banking activity area.
23. Museum restoration room.

C406.2.5.3.2 Occupant sensor control function. Occupant sensors in library stacks and laboratories shall comply with **Section C405.2.1.2**. Occupant sensors in elevator lobbies shall comply with **Section C405.2.1.4**. All other occupant sensors required by **Section C406.2.5.3.1** shall comply with **Section C405.2.1.1**.

Exception: In spaces where an *automatic* shutoff could endanger occupant safety or security, occupant sensor controls shall uniformly reduce lighting power to not more than 20 percent of full power within 10 minutes after all occupants have left the space.Time-switch controls complying with **Section C405.2.2.1** shall automatically

	turn off lights. **C406.2.5.3.3 Occupant sensor time delay and setpoint.** Occupant sensor controls installed in accordance with **Sections C405.2.1.1**, **C405.2.1.2**, **C405.2.1.3** and **C405.2.1.4** shall automatically turn off lights or reduce lighting power within 10 minutes after all occupants have left the space. Occupant sensor controls installed in accordance with **Section C405.2.1.2** shall have an unoccupied setpoint of not greater than 20 percent of full power. FSEC – Anticipated energy impact on FBC-EC – Decrease
CE#296	Adds new subsection C406.2.5.4. It may lightly increases the stringency but is a cost-effective measure.
Related Mods: CEPI-193-21, CED1-185-22, CECD1-6-22	**C406.2.5.4 L04 Increased daylight area.** The total daylight area of the *building* (DLA_{BLDG}) determined by **Equation 4-21** shall be at least 5 percent greater than the typical daylight area (DLA_{TYP}) from **Table C406.2.5.4**. Credits for measure L04 shall be determined by **Equation 4-22** or **Equation 4-23**, whichever is less: $DLA_{BLDG} = DLZ/LFA$ Equation 4-21 where: *DLZ* = The total building floor area located within sidelit and toplit daylight zones complying with **Section C405.2.4.2** or **C405.2.4.3** and provided with daylight-responsive controls complying with **Section C405.2.4.1**, ft^2 or m^2. *LFA* = The total building floor area used to determine the lighting power allowance in **Section C405.3.2**, ft^2 or m^2. $EC_{DL} = EC_{DL5} \times 20 \times (DLA_{BLDG} - DLA_{TYP})$ Equation 4-22 where: EC_{DL} = The lesser of actual area of daylight zones in the *building* with continuous daylight dimming, ft^2 or m^2 and ($GLFA \times DLA$); see **Table C406.2.5.4**. Daylight zones shall meet the criteria in **Sections C405.2.4.2** and **C405.2.4.3** for primary sidelit daylight zones, secondary sidelit daylight zones and toplit daylight zones. DLA_{TYP} = Typical percent of building area with daylight control (as a fraction) from **Table C406.2.5.4**. EC_{DL5} = **Section C406.2.5.4** L04 base energy credits from **Section C406.2**. $EC_{DL} = EC_{DL5} \times 20 \times (DLA_{MAX} - DLA_{TYP})$ Equation 4-23 where: EC_{DL} = The number of credits achieved by this measure.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

	EC_{DL5} = **Section C406.2.5.4** L04 base energy credits from **Section C406.2** and **Tables C406.2(4)**, **C406.2(6)**, **C406.2(7)** and **C406.2(8)**. *DLA_{TYP}* = Typical percent of building floor area with daylight control (as a fraction) from Table C406.2.5.4. *DLA_{MAX}* = Maximum percent of building floor area with daylight control that can be counted for compliance with this measure, from **Table C406.2.5.4**. FSEC – Anticipated energy impact on FBC-EC – Decrease
CE#297	Adds new Table C406.2.5.4.
Related Mods: CEPI-193-21, CECD1-6-22	TABLE C406.2.5.4 **ADDED DAYLIGHTING PARAMETERS**
CE#298	Adds new subsection C406.2.5.5. This is simpler lighting control strategy. It does impact the stringency since lighting control is required elsewhere in the code. Adds new subsection C406.2.5.6 by expanding an existing measure.
Related Mods:	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

TABLE C406.2.5.4
ADDED DAYLIGHTING PARAMETERS

BUILDING-USE TYPE	**DLA_{TYP}**	**DLA_{MAX}**
Group B; ≤ 5,000 ft^2 (460 m^2)	10%	20%
Group B; > 5,000 ft^2 (460 m^2)	21%	31%
Group M; with ≤ 1,000 ft^2 (900 m^2) roof area	0%	20%
Group M; with > 1,000 ft^2 (900 m^2) roof area	60%	80%
Group E; education	42%	52%
Groups S-1 and S-2; warehouse	50%	70%
Groups S-1 and S-2; other than warehouse	NA	NA

NA = Not available.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CEPI-193-21, CE2D-64-23, CECD1-16-22, CE2D-64-23, CECD1-7-22	**C406.2.5.5 L05 Residential light control.** In buildings with Group R-2 occupancy spaces, interior lighting systems shall comply with the following: 1. In *common areas* , the following space types shall have occupant sensor controls that comply with the requirements of **Section C405.2.1.1**: 1.1. Laundry/washing areas. 1.2. Dining areas. 1.3. Food preparation areas. 1.4. Seating areas. 1.5. Exercise areas. 1.6. Massage spaces. 2. In *dwelling units* , not less than one receptacle in each living room and each sleeping room shall be controlled by a switch in that room. 3. Lights and switched receptacles in bathrooms and kitchens shall be controlled by an occupant sensor complying with **Section C405.2.1.1**. All other lights and switched receptacles in each *dwelling unit* shall be controlled by a switch at the main entrance. The switch shall be marked to indicate its function. **Exception:** Lighting and switched receptacles controlled by an occupant sensor complying with **Section C405.2.1.1** are not required to be controlled by the switch at the main entrance. **C406.2.5.6 L06 Reduced lighting power.** Interior lighting within all building areas shall comply with this section. 1. The connected interior lighting power (LP) determined in accordance with **Section C405.3.1** shall be 95 percent or less than the interior lighting power allowance (LPA) determined in accordance with **Section C405.3.2** using the same method used to comply with **Section C405.3**. Energy credits shall not be greater than four times the L06 base credit from **Section C406.2** and shall be determined using **Equation 4-24**. 2. All permanently installed lighting serving *dwelling units* and *sleeping units* , including ceiling fan light kits and lighting integrated into range hoods and exhaust fans shall be provided by lamps with an efficacy of not less than 90 lumens per watt or by luminaires that have an efficacy of not less than 65 lumens per watt. Exceptions: 1. Lighting integral to other appliances. 2. Antimicrobial lighting used for the sole purpose of disinfecting. $EC_{LPA} = EC_5 \times 20 \times (LPA - LP)/LPA$ Equation 4-24 where: *EC_{LPA}* = Additional energy credit for lighting power reduction. *LP* = Connected interior lighting power calculated in accordance with **Section C405.3.1**, watts. *LPA* = Interior lighting power allowance calculated in accordance with the requirements of **Section C405.3.2**, watts. *EC_5* = L06 base credit from **Section C406.2**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

	FSEC – Anticipated energy impact on FBC-EC – Decrease
CE#299	Adds new Section C406.2.6. Adds new subsection C406.2.6.1. The measure requires the installation of higher-efficiency elevator equipment. Thus, it increases the stringency but is cost-effective measure. Adds new subsection C406.2.6.2 based on an existing measure. No change in stringency. Adds new subsection C406.2.6.3. Requires the installation of higher efficiency or the highest Energy Star refrigerators in apartment and hotel guestrooms. It slightly increases the stringency but is a cost-effective measure. Adds new subsection C406.2.6.4 based on an existing measure. No change in stringency.
Related Mods: CEPI-193-21, CED1-185-22, CED1-175-22	**C406.2.6 Efficient equipment credits.** Projects are permitted to achieve energy credits using any combination of Efficient Equipment Credits Q01 through Q04. **C406.2.6.1 Q01 Efficient elevator equipment.** Qualifying elevators in the *building* shall be energy efficiency class A per **ISO 25745-2**, Table 7. Only buildings three or more floors above grade may use this credit. Credits shall be prorated based on **Equation 4-25**, rounded to the nearest whole credit. Projects with a compliance ratio below 0.5 do not qualify for this credit. $EC_e = EC_t \times CR_e$ Equation 4-25 where: EC_e = Elevator energy credit achieved for the building. EC_t = Q01 base energy credit from applicable **Table C406.2(1)** through **Table C406.2(9)**. CR_e = Compliance ratio = *FA*/*FB*. *FA* = Sum of floors served by class A elevators. *FB* = Sum of floors served by all building elevators and escalators. **C406.2.6.2 Q02 Efficient commercial kitchen equipment.** For buildings and spaces designated as Group A-2, or facilities whose primary business type involves the use of a commercial kitchen where at least one gas or electric fryer is installed before the issuance of the certificate of occupancy, all fryers, dishwashers, steam cookers and ovens installed before the issuance of the certificate of occupancy shall comply with all of the following: 1. Achieve performance levels in accordance with the equipment specifications listed in **Tables C406.2.6.2(1)** through **C406.2.6.2(4)** where rated in accordance with the applicable test procedure. 2. Have associated performance levels listed on the *construction documents* submitted for permitting. **C406.2.6.3 Q03 Efficient residential kitchen equipment.** For projects with Group R-1 and R-2 occupancies, energy credits shall be achieved where all dishwashers, refrigerators and freezers comply with all of the following: 1. Achieve the Energy Star Most Efficient 2021 label in accordance with the specifications current as of: 1.1. Refrigerators and freezers 5.0, 9/15/2014. 1.2. Dishwashers 6.0, 1/29/2016. 2. Be installed before the issuance of the certificate of occupancy.

For Group R-1 where only some guestrooms are equipped with both refrigerators and dishwashers, the table credits shall be prorated as follows:

[Section C406.2 base credits] × [floor area of guestrooms with kitchens] / [total guestroom floor area] **Equation 4-26**

C406.2.6.4 Q04 Fault detection and diagnostics system. A project not required to comply with **Section C403.2.3** can achieve energy credits for installing a fault detection and diagnostics system to monitor the HVAC system's performance and automatically identify faults. The installed system shall comply with Items 1 through 6 in **Section C403.2.3**.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#300 Adds new Table C406.2.6.2(1) based on an existing Table C406.12(1). No change in stringency.

Related Mods:

CEPI-193-21

TABLE C406.2.6.2(1)

MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL FRYERS

	HEAVY-LOAD COOKING ENERGY EFFICIENCY	IDLE ENERGY RATE	TEST PROCEDURE
Standard open deep-fat gas fryers	≥ 50%	≤ 9,000 Btu/h	ASTM F1361
Standard open deep-fat electric fryers	≥ 83%	≤ 800 watts	
Large vat open deep-fat gas fryers	≥ 50%	≤ 12,000 Btu/h	ASTM F2144
Large vat open deep-fat electric fryers	≥ 80%	≤ 1,100 watts	

For SI: 1 British thermal unit per hour = 0.293 watts.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#301 Adds new Table C406.2.6.2(2) based on an existing Table C406.12(2). No change in stringency.

Related Mods:

CEPI-193-21

TABLE C406.2.6.2(2)

MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL STEAM COOKERS

FUEL TYPE	PAN CAPACITY	COOKING ENERGY EFFICIENCY[a]	IDLE ENERGY RATE	TEST PROCEDURE
Electric steam	3-pan	50%	400 watts	ASTM F1484
	4-pan	50%	530 watts	
	5-pan	50%	670 watts	
	6-pan and larger	50%	800 watts	
Gas steam	3-pan	38%	6,250 Btu/h	
	4-pan	38%	8,350 Btu/h	
	5-pan	38%	10,400 Btu/h	
	6-pan and larger	38%	12,500 Btu/h	

For SI: 1 British thermal unit per hour = 0.293 watts.

a.. Cooking energy efficiency is based on heavy-load (potato) cooking capacity.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#302

Adds new Table C406.2.6.2(3) based on an existing Table C406.12(3). No change in stringency.

Related Mods:

CEPI-193-21

TABLE C406.2.6.2(3)

MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL DISHWASHERS

MACHINE TYPE	HIGH-TEMPERATURE EFFICIENCY REQUIREMENTS			LOW-TEMPERATURE EFFICIENCY REQUIREMENTS			TEST PROCEDURE
	Idle Energy Rate[a]	Washing Energy	Water Consumption[b]	Idle Energy Rate[a]	Washing Energy	Water Consumption[b]	
Under counter	≤ 0.30 kW	≤ 0.35 kWh/ rack	≤ 0.86 GPR (≤ 3.3 LPR)	≤ 0.25 kW	≤ 0.15 kWh/ rack	≤ 1.19 GPR ≤ 4.5 LPR	

Stationary single-tank door	≤ 0.55 kW	≤ 0.35 kWh/ rack	≤ 0.89 GPR (≤ 3.4 LPR)	≤ 0.30 kW	≤ 0.15 kWh/ rack	≤ 1.18 GPR ≤ 4.47 LPR	ASTM F1696 ASTM F1920
Pot, pan and utensil	≤ 0.90 kW	kWh/ rack ≤ 0.55 + 0.05 × SF_{rack}^{c} (≤ 0.55 + 0.0046 × SM_{rack}^{c})	≤ 0.58 GPSF (≤ 2.2 LPSM)	NA	NA	NA	
Single-tank conveyor	≤ 1.20 kW	≤ 0.36 kWh/ rack	≤ 0.70 GPR (≤ 2.6 LPR)	≤ 0.85 kW	≤ 0.16 kWh/ rack	≤ 0.79 GPR ≤ 3.0 LPR	
Multiple-tank conveyor	≤ 1.85 kW	≤ 0.36 kWh/ rack	≤ 0.54 GPR (≤ 2.0 LPR)	≤ 1.00 kW	≤ 0.22 kWh/ rack	≤ 0.54 GPR ≤ 2.0 LPR	
Single-tank flight type	Reported	Reported	GPH ≤ 2.975c + 55.0 (LPH ≤ 0.276d + 208)	NA	NA	NA	
Multiple-tank flight type	Reported	Reported	GPH ≤ 4.96c+ 17.00 (LPH ≤ 0.461d + 787)	NA	NA	NA	

a. Idle results should be measured with the door closed and represent the total idle energy consumed by the machine, including all tank heaters and controls. The most energy- consumptive configuration in the product family shall be selected to test the idle energy rate. Booster heater (internal or external) energy consumption shall be measured and reported separately, if possible, per **ASTM F1696** and **ASTM F1920**, Sections 10.8 and 10.9, respectively. However, if booster energy cannot be measured separately, it will be included in the idle energy rate measurements.

b. GPR = gallons per rack, LPR = liters per rack, GPSF = gallons per square foot of rack, LPSM = liters per square meter of rack, GPH = gallons per hour, c = [maximum conveyor belt speed (feet/minute)] × [conveyor belt width (feet)], LPH = liters per hour, d = [maximum conveyor belt speed (m/minute)] × [conveyor belt width (m)].

c. Pot, pan and utensil (PPU) washing energy is still in the format kWh/rack when evaluated; SF_{rack} (SM_{rack}) is square feet of rack area (square meters of rack area), the same as in the PPU water consumption metric.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#303	Adds new Table C406.2.6.2(4) based on an existing Table C406.12(4). No change in stringency.
Related Mods: CEPI-193-21	

TABLE C406.2.6.2(4)
MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL OVENS

FUEL TYPE	**CLASSIFICATION**	**IDLE RATE**	**COOKING ENERGY EFFICIENCY, %**	**TEST PROCEDURE**
Gas	Full-size	≤ 12,000 Btu/h	≥ 46	**ASTM F1496**
Electric	Half-size	≤ 1.0 kW	≥ 71	
Electric	Full-size	≤ 1.60 kW		
Gas	Steam mode	≤ 200 P[a] + 6,511 Btu/h	≥ 41	**ASTM F2861**
	Convection mode	≤ 150 P[a] + 5,425 Btu/h	≥ 56	
Electric	Steam mode	≤ 0.133 P[a] + 0.6400 kW	≥ 55	
	Convection mode	≤ 0.080 P[a] + 0.4989 kW	≥ 76	
Gas	Single	≤ 25,000 Btu/h	≥ 48	**ASTM F2093**
	Double	≤ 30,000 Btu/h	≥ 52	

For SI: 1 British thermal unit per hour = 0.293 watts.

a. P = Pan capacity: the number of steam table pans the combination oven is able to accommodate in accordance with **ASTM F1495**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#304	Adds new Section C406.3. Achieving energy credits for renewable and load management measures. It increase the stringency but is cost-effective measure.
Related Mods: CEPI-193-21, CED1-175-22	~~**C406.3 Reduced lighting power.** Buildings shall comply with **Section C406.3.1** or **C406.3.2**, and dwelling units and sleeping units within the building shall comply with **Section C406.3.3**.~~ ~~**C406.3.1 Reduced lighting power by more than 10 percent.** The total connected interior lighting power calculated in accordance with **Section C405.3.1** shall be less than 90 percent of the total lighting power allowance calculated in accordance with **Section C405.3.2**.~~ ~~**406.3.2 Reduced lighting power by more than 15 percent.** Where the total connected interior lighting power calculated in accordance with **Section C405.3.1** is less than 85 percent of the total lighting power allowance calculated in accordance with **Section C405.3.2**, additional energy efficiency credits shall be determined based on **Equation 4-13**, rounded to the nearest whole number.~~ ~~(Equation 4-13)~~ ~~where:~~ ~~*AEEC $_{LPA}$* = **Section C406.3.2** additional energy efficiency credits.~~ ~~*AEEC $_{10}$* = **Section C406.3.1** credits from **Tables C406.1(1)** through **C406.1(5)**.~~ ~~*LPA*= Total lighting power allowance calculated in accordance with **Section C405.3.2**.~~ ~~*LPD*= Total connected interior lighting power calculated in accordance with **Section C405.3.1**~~ ~~**C406.3.3 Lamp efficacy.** Not less than 95 percent of the permanently installed lighting, excluding kitchen appliance light fixtures, serving dwelling units and sleeping units shall be provided by lamps with an~~ ~~efficacy of not less than 65 lumens per watt or luminaires with an efficacy of not less than 45 lumens per watt.~~ **C406.3 Renewable and load management credits achieved.** Renewable energy and load management measures shall achieve credits as follows: *1.* General measure requirements. Credits are achieved for measures installed in the *building* that comply with **Sections C406.3.1** through **C406.3.8**. 2. Achieved credits are determined as follows: 2.1. Measure credits achieved shall be determined in one of two ways, depending on the measure: 2.1.1. The measure credit shall be the base credit listed by occupancy group and *climate zone* for the measure in **Tables C406.3(1)** through **C406.3(9)** where no adjustment factor or formula is shown in the description of the measure in **Section C406.3**. 2.1.2. The measure credit shall be the base energy credit for the measure adjusted by a factor or formula as stated in the description of the measure in **Section C406.3**. Where adjustments are applied, each energy credit shall be rounded to the nearest whole number.

2.2. Load management and renewable credits achieved for the project shall be the sum of credits for individual measures included in the project. Credits are available for the measures listed in this section.

2.3. Where a project contains multiple building use groups, credits achieved for each building use group shall be summed and then weighted by the gross floor area of each building use group to determine the weighted-average project energy credits achieved.

3. Load management control requirements. The load management measures in **Sections C406.3.2** (G01) through **C406.3.7** (G06) require load management control sequences that are capable of and configured to automatically provide the load management operation specified based on indication of a peak period related to high short-term electric prices, grid condition or peak building load. Such a peak period shall, where possible, be initiated by a *demand response signal* from the controlling entity, such as a utility or service operator. Where communications are disabled or unavailable, all demand-responsive controls shall continue backup demand response based on a local schedule or building-demand monitoring. The local building schedule shall be adjustable without programming and reflect the electric rate peak period dates and times. The load management control sequences shall be activated for peak period control by one of the following:

3.1. A certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN), as specified under Clause 11, Conformance, in the applicable OpenADR 2.0 Specification.

3.2. A device certified by the manufacturer as being capable of responding to a *demand response signal* from a certified OpenADR 2.0b VEN by automatically implementing the control functions requested by the VEN for the equipment it controls.

3.3. The physical configuration and communication protocol of **CTA-2045-A** or CTA-2045-B.

3.4. For air conditioners and heat pumps with two or more stages of control and cooling capacity of less than 65,000 Btu/h (19 kW), *thermostats* with a *demand responsive control* that complies with the communication and performance requirements of **AHRI 1380**.

3.5. A device that complies with **IEC 62746-10-1**, an international standard for the open automated demand response system interface between the appliance, system, or energy management system and the controlling entity.

3.6. An interface that complies with the communication protocol required by a controlling entity to participate in an automated demand response program.

3.7. Where the controlling entity does not have a *demand response signal* available for the building type and size, local load management control shall be provided based on either:

3.7.1. Building demand management controls that monitor building electrical demand and initiate controls to minimize monthly or peak time period demand charges.

3.7.2. A local building schedule that reflects the electric rate peak period dates and times where buildings are less than 25,000 gross square feet (2322 m^2).

Original text of mod is not consistent with that of the 2023 FBC – EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#305	Adds new Tables C406.3(1) through Table C406.3(9). Adds new Table C406.3(6). It slightly increase the stringency.
Related Mods: CEPI-193-21	

TABLE C406.3(1)
RENEWABLE AND LOAD MANAGEMENT CREDITS FOR GROUP R-2, R-4 AND I-1 OCCUPANCIES

ID	ENERGY CREDIT ABBREVIATED TITLE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	Renewable energy	C406.3.1	9	15	11	17	18	20	19	21	13	10	13	9	9	11	10	9	10	9	7
G01	Lighting load management	C406.3.2	16	7	9	12	12	16	11	14	12	11	16	14	8	11	14	5	7	7	11
G02	HVAC load management	C406.3.3	42	41	21	35	23	37	30	28	28	17	33	24	20	22	23	10	13	15	17
G03	Automated shading	C406.3.4	11	x	7	18	10	13	5	13	12	2	14	7	10	13	11	1	8	8	16
G04	Electric energy storage	C406.3.5	10	10	10	11	10	13	13	14	17	16	13	17	14	13	17	14	14	14	15
G05	Cooling energy storage	C406.3.6	28	6	31	13	22	21	21	37	11	12	22	11	9	17	9	7	17	2	3
G06	SHW energy storage	C406.3.7	17	17	19	18	19	19	20	20	22	19	19	21	19	19	20	18	19	18	17
G07	Building thermal mass	C406.3.8	7	2	11	5	16	28	22	27	60	19	43	46	32	58	37	27	45	40	19

HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water. x = Credits excluded from this building use type and climate zone.

TABLE C406.3(2)
RENEWABLE AND LOAD MANAGEMENT CREDITS FOR GROUP I-2 OCCUPANCIES

	ENERGY		CLIMATE ZONE

ID	CREDIT ABBREVIATED TITLE	SECTION	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	Renewable energy	**C406.3.1**	6	6	6	6	6	8	7	9	8	6	8	6	6	7	7	6	7	5	4
G01	Lighting load management	**C406.3.2**	11	12	13	13	13	12	12	12	6	13	16	12	13	14	15	14	14	12	12
G02	HVAC load management	**C406.3.3**	10	11	10	10	8	21	10	10	13	11	18	11	12	14	13	12	11	9	7
G03	Automated shading	**C406.3.4**	1	1	1	1	x	x	x	1	x	x	2	x	x	2	x	x	1	1	x
G04	Electric energy storage	**C406.3.5**	13	13	13	13	14	15	14	15	15	14	15	15	14	15	15	13	14	13	12
G05	Cooling energy storage	**C406.3.6**	25	6	33	14	25	19	27	37	27	16	22	19	14	18	11	11	20	2	3
G06	SHW energy storage	**C406.3.7**	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	4
G07	Building thermal mass	**C406.3.8**	6	2	10	4	15	25	20	24	57	18	39	44	31	53	33	25	40	34	14

HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water. x = Credits excluded from this building use type and climate zone.

TABLE C406.3(3)
RENEWABLE AND LOAD MANAGEMENT CREDITS FOR GROUP R-1 OCCUPANCIES

ID	ENERGY CREDIT ABBREVIATED TITLE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	Renewable energy	**C406.3.1**	9	8	12	9	11	11	10	12	13	9	12	8	9	11	9	8	9	7	5
G01	Lighting load management	**C406.3.2**	12	12	11	12	12	14	14	13	15	14	13	11	10	11	14	9	11	8	8
G02	HVAC load management	**C406.3.3**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

G03	Automated shading	**C406.3.4**	2	2	2	3	1	2	3	2	4	3	2	1	1	1	3	1	2	1	1
G04	Electric energy storage	**C406.3.5**	9	9	10	10	9	13	13	15	13	14	13	14	14	12	16	13	12	12	13
G05	Cooling energy storage	**C406.3.6**	31	7	38	17	29	24	31	44	26	18	26	16	15	21	11	12	24	2	4
G06	SHW energy storage	**C406.3.7**	25	25	28	26	28	29	29	30	31	29	30	31	28	29	31	26	28	25	24
G07	Building thermal mass	**C406.3.8**	6	1	10	4	14	24	19	23	53	17	38	41	30	52	33	26	42	37	17

HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water. x = Credits excluded from this building use type and climate zone

TABLE C406.3(4)
RENEWABLE AND LOAD MANAGEMENT CREDITS FOR GROUP B OCCUPANCIES

ID	**ENERGY CREDIT ABBREVIATED TITLE**	**SECTION**	**CLIMATE ZONE**																		
			0A	**0B**	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6A**	**6B**	**7**	8
R01	Renewable energy	**C406.3.1**	14	14	17	15	17	19	18	22	24	17	22	16	14	18	18	14	17	14	11
G01	Lighting load management	**C406.3.2**	10	11	11	12	11	11	11	12	9	10	11	10	10	11	10	10	11	10	9
G02	HVAC load management	**C406.3.3**	x	10	10	9	9	3	8	12	7	12	8	11	9	10	12	8	9	10	2
G03	Automated shading	**C406.3.4**	4	7	7	8	7	8	5	6	6	4	6	5	4	5	5	5	5	4	7
G04	Electric energy storage	**C406.3.5**	14	15	14	14	16	16	17	16	18	17	16	18	17	17	18	16	15	17	18
G05	Cooling energy storage	**C406.3.6**	28	7	36	16	27	24	28	45	27	17	27	15	15	20	9	12	25	2	4
G06	SHW energy storage	**C406.3.7**	5	5	6	6	6	6	7	7	8	7	7	7	7	7	8	6	7	6	6

G07	Building thermal mass	**C406.3.8**	3	1	5	2	6	9	6	7	14	4	11	8	9	15	5	8	12	15	7

HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water. x = Credits excluded from this building use type and climate zone.

TABLE C406.3(5)
RENEWABLE AND LOAD MANAGEMENT CREDITS FOR A-2 OCCUPANCIES

ID	ENERGY CREDIT ABBREVIATED TITLE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	Renewable energy	**C406.3.1**	2	2	2	2	2	2	2	3	4	2	3	2	2	3	2	2	2	2	1
G01	Lighting load management	**C406.3.2**	4	4	5	5	4	5	5	5	5	4	5	5	4	4	5	4	5	4	1
G02	HVAC load management	**C406.3.3**	32	26	37	28	31	26	27	22	23	20	17	14	19	14	10	16	14	14	1
G03	Automated shading	**C406.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
G04	Electric energy storage	**C406.3.5**	4	4	4	4	5	5	5	5	4	4	4	4	3	4	4	4	3	3	2
G05	Cooling energy storage	**C406.3.6**	15	4	17	8	12	10	10	16	6	5	7	3	3	4	1	2	4	x	x
G06	SHW energy storage	**C406.3.7**	13	13	15	14	15	16	16	17	19	16	17	19	16	17	18	15	16	14	13
G07	Building thermal mass	**C406.3.8**	3	1	5	2	7	12	8	10	21	6	15	14	8	18	10	6	12	8	3

HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water. x = Credits excluded from this building use type and climate zone

TABLE C406.3(6)
RENEWABLE AND LOAD MANAGEMENT CREDITS FOR GROUP M OCCUPANCIES

ID	ENERGY CREDIT ABBREVIATED TITLE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	Renewable energy	**C406.3.1**	8	8	12	9	11	12	12	17	17	11	13	9	10	11	10	9	10	9	6
G01	Lighting load management	**C406.3.2**	16	16	18	19	17	19	19	21	17	18	21	21	18	21	22	18	22	18	16
G02	HVAC load management	**C406.3.3**	x	15	16	15	15	6	15	21	13	23	15	23	17	19	26	14	17	18	3
G03	Automated shading	**C406.3.4**	7	11	11	12	11	13	10	11	11	7	11	11	8	10	11	8	9	8	12
G04	Electric energy storage	**C406.3.5**	6	10	8	10	11	12	11	10	14	11	10	12	10	11	12	11	9	10	8
G05	Cooling energy storage	**C406.3.6**	40	9	51	22	35	31	34	53	21	17	28	10	11	19	4	9	18	2	2
G06	SHW energy storage	**C406.3.7**	3	3	4	3	4	4	4	4	5	4	4	5	4	4	5	4	4	4	3
G07	Building thermal mass	**C406.3.8**	5	1	6	3	8	12	10	10	20	7	17	15	14	24	10	13	20	24	12

HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water. x = Credits excluded from this building use type and climate zone.

TABLE C406.3(7)
RENEWABLE AND LOAD MANAGEMENT CREDITS FOR GROUP E OCCUPANCIES

ID	ENERGY CREDIT ABBREVIATED TITLE	SECTION	CLIMATE ZONE																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R01	Renewable energy	**C406.3.1**	10	11	13	12	13	16	15	21	22	15	19	15	14	17	16	13	16	12	10
G01	Lighting load management	**C406.3.2**	7	12	12	13	13	15	14	16	13	12	16	16	10	14	18	16	13	14	14

G02	HVAC load management	**C406.3.3**	18	22	32	23	25	31	26	26	20	23	31	24	20	31	12	18	27	16	9
G03	Automated shading	**C406.3.4**	7	13	16	12	18	17	17	18	13	12	17	17	10	15	13	14	10	16	17
G04	Electric energy storage	**C406.3.5**	16	16	18	17	19	21	21	23	26	22	24	24	23	24	24	20	22	19	19
G05	Cooling energy storage	**C406.3.6**	36	9	46	21	36	32	39	62	39	24	37	22	20	28	13	16	31	3	4
G06	SHW energy storage	**C406.3.7**	5	5	6	5	6	6	7	7	8	7	7	8	7	7	8	7	7	7	6
G07	Building thermal mass	**C406.3.8**	7	2	11	5	17	28	23	27	63	21	44	48	37	60	38	31	50	47	21

HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water. x = Credits excluded from this building use type and climate zone.

TABLE C406.3(8)
RENEWABLE AND LOAD MANAGMENT CREDITS FOR GROUP S-1 AND S-2 OCCUPANCIES

ID	**ENERGY CREDIT ABBREVIATED TITLE**	**SECTION**	**CLIMATE ZONE**																		
			0A	**0B**	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6A**	**6B**	**7**	**8**
R01	Renewable energy	**C406.3.1**	38	37	55	45	53	53	49	58	66	36	56	38	29	41	36	24	32	23	16
G01	Lighting load management	**C406.3.2**	13	26	32	28	32	35	36	33	36	31	27	37	32	23	28	36	22	25	22
G02	HVAC load management	**C406.3.3**	18	46	37	37	28	36	29	26	22	23	17	12	16	13	5	14	8	10	3
G03	Automated shading	**C406.3.4**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
G04	Electric energy storage	**C406.3.5**	40	40	47	41	47	44	40	44	42	30	38	31	21	31	26	24	29	23	21
G05	Cooling energy storage	**C406.3.6**	20	5	21	11	14	14	11	21	5	5	9	2	2	5	1	1	3	x	x

G06	SHW energy storage	**C406.3.7**	3	3	3	3	4	3	4	4	4	3	4	4	3	3	4	2	2	2	2
G07	Building thermal mass	**C406.3.8**	7	2	12	5	17	29	23	28	66	18	44	47	28	56	37	20	39	29	13

HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water.

x indicates measure is not available for building occupancy in that climate zone.

TABLE C406.3(9)
RENEWABLE AND LOAD MANAGEMENT CREDITS FOR OTHER[a] OCCUPANCIES

ID	**ENERGY CREDIT ABBREVIATED TITLE**	**SECTION**	**CLIMATE ZONE**																		
			0A	**0B**	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6A**	**6B**	**7**	**8**
R01	Renewable energy	**C406.3.1**	12	13	16	14	16	18	17	20	21	13	18	13	12	15	14	11	13	10	8
G01	Lighting load management	**C406.3.2**	11	13	14	14	14	16	15	16	14	14	16	16	13	14	16	14	13	12	12
G02	HVAC load management	**C406.3.3**	24	24	23	22	20	23	21	21	18	18	20	17	16	18	14	13	14	13	6
G03	Automated shading	**C406.3.4**	5	6	7	9	8	9	7	9	8	5	9	7	5	8	7	5	6	6	9
G04	Electric energy storage	**C406.3.5**	14	15	16	15	16	17	17	18	19	16	17	17	15	16	17	14	15	14	14
G05	Cooling energy storage	**C406.3.6**	28	7	34	15	25	22	25	39	20	14	22	12	11	17	7	9	18	2	3
G06	SHW energy storage	**C406.3.7**	9	9	11	10	11	11	11	12	13	11	12	13	11	11	12	10	11	10	9
G07	Building thermal mass	**C406.3.8**	6	2	9	4	13	21	16	20	44	14	31	33	24	42	25	20	33	29	13

HVAC = Heating, Ventilation and Air Conditioning; SHW = Service Hot Water.

a. Other occupancy groups include all Groups except for Groups A-2, B, E, I, M and R.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#306	Adds new Section C406.3.1 by expanding an existing additional energy efficiency measure. Increases the renewable energy generation capacity by at least 0.1 watts per gross square foot (1.08 W/m2) of building area or securing off-site renewable energy. This change may increases the code stringency but provides simpler compliance verification alternative. Adds new Section C406.3.2. Lighting dimming reduces lighting levels and power. The lighting dimming control requires integration with automated controls that interface with utility signals or local building demand monitoring software. Thus, it increases the stringency but is a cost-effective measure. Adds new Section C406.3.3. Requires thermostats to be reset during peak price periods or a gradual pre-cooling set-point adjustment control sequence, as well as integration with automated controls that interface with utility signals or local building demand monitoring software. Thus, it increases the stringency but is cost-effective measure. Adds new Section C406.3.4. The measure requires an automated external exterior roller, movable blind, or movable shutter shading devices to reduce solar gain through fenestration during peak price hours. Thus, it increases the stringency but is cost-effective measure. Adds new Section C406.3.5. Batteries or other electric energy storage devices are required, as is integration with automated controls that interface with utility signals or local building demand monitoring software. Thus, it increases the stringency but is cost-effective measure. Adds new Section C406.3.6. Ice or chilled water cooling energy storage is required, as is integration with automated controls that interface with utility signals or local building demand monitoring software. Thus, it increases the stringency but is cost-effective measure. Adds new Section C406.3.7. Requires integration with automated controls that interface with utility signals or local building demand monitoring software. Thus, it increases the stringency but is cost-effective measure.
Related Mods: CEPI-193-21, CECD1-5-22, CED1-161-22, CED1-141-22, CED1-185-22, CED1-176-22, CED1-92-22	**C406.3.1 R01 Renewable energy.** Projects installing on-site renewable energy systems with a capacity of at least 0.1 watts per gross square foot (1.08 W/m ^{2}) of building area or securing off-site renewable energy shall achieve energy credits for this measure calculated as follows: $$EC_R = EC_{0.1} \times (R_t + R_{off} - R_{ex})/(0.1 \times \mathrm{PGFA})$$ Equation 4-27 where: EC_R = **Section C406.3.1** R01 energy credits achieved for this project. $EC_{0.1}$ = **Section C406.3.1** R01 base credits from **Tables C406.3(1)** through **C406.3(9)**. R_t = Actual total rating of on-site renewable energy systems (W). R_{off} = Actual total equivalent rating of off-site renewable energy contracts (W), calculated as follows: $R_{off} = TRE/(REN \times 20)$ *where:* *TRE* = Total off-site renewable electrical energy in kilowatt-hours (kWh) that is procured in accordance with **Sections C405.15.2.1** through **C405.15.4**. *REN* = Annual off-site renewable electrical energy from **Table C405.15.2**, in units of kilowatt-hours per watt of array capacity. R_{ex} = Rating (W) of renewable energy resources capacity excluded from credit calculated as follows: $R_{ex} = RR_r + RR_x + RR_c$ where: RR_r = Rating of on-site renewable energy systems required by **Section C405.15.1**, without exception (W). RR_x = Rating of renewable energy resources used to meet any exceptions of this code (W). RR_c = Rating of renewable energy resources used to achieve other energy credits in **Section C406** (W). *PGFA* = Project gross floor area, ft ^{2}. Where renewable requirements, exceptions or credits are expressed in annual kWh or Btu rather than watts of output capacity, they shall be converted as 3413 Btu = 1 kWh and converted to W equivalent capacity as follows: RR_w = Actual total equivalent rating of renewable energy capacity (W), calculated as follows: $RR_w = TRE_x/(REN \times PGFA)$

where:
TRE_x = Total renewable energy in kilowatt-hours (kWh) that is excluded from R01 energy credits.

C406.3.2 G01 Lighting load management. A project not required to comply with **Section C405.2.8** can achieve energy credits for installing demand-responsive lighting controls for interior *general lighting* that comply with **Section C405.2.8.1**. The demand-responsive lighting controls shall automatically reduce the light output or power of controlled lighting to not more than 80 percent of full output, or 80 percent of the high-end trim setpoint, whichever is less. Energy credits can be earned where demand-responsive lighting controls are installed for the following:

1. Not less than 10 percent of the interior floor area in *Group R* or I occupancies.
2. Not less than 50 percent of the interior floor area in all other occupancies.

G01 credits shall be prorated using **Equation 4-28** with not more than 75 percent of the interior floor area being counted.

[interior floor area with lighting load management, %] x [table credits for C406.3.2]/75%

Equation 4-28

C406.3.3 G02 HVAC load management. *Automatic* load management controls shall be configured as follows:

1. Cooling temperature shift: Where electric cooling is in use, controls shall gradually increase the cooling setpoint by at least 3°F (1.7°C) over a minimum of 3 hours or reduce effective cooling capacity to 60 percent of installed capacity during the peak period or adjust the cooling temperature setpoint as described in **Section C403.6.1**.
2. Heating temperature shift: Where electric heating is in use, controls shall gradually decrease the heating setpoint by at least 3°F (1.7°C) over a minimum of 3 hours or reduce effective heating capacity to 60 percent of installed capacity during the peak period or adjust the heating temperature setpoint as described in **Section C403.6.1**.
3. Ventilation shift: Where HVAC systems serve multiple *zones* and have less than 70 percent outdoor air required, include controls that provide excess outdoor air preceding the peak period and reduce outdoor air by at least 30 percent during the peak period, in accordance with **ASHRAE Standard 62.1** Section 6.2.5.2 or provisions for *approved* engineering analysis in **Section 403.3.1.1** of the *International Mechanical Code*.

Credits achieved for measure G02 shall be calculated as follows:

$$EC_{\mathrm{G02}\_ach} = EC_{\mathrm{G02}\_base} \times EC_{\mathrm{G02}\_adj} \qquad \text{Equation 4-29}$$

where:
EC_{G02_ach} = Demand responsive control credit achieved for project.
EC_{G02_base} = G02 Base energy credit from **Section C406.3**.
EC_{G02_adj} = Energy credit adjustment factor from **Table C406.3.3**.

C406.3.4 G03 Automated shading load management. Where *fenestration* on east, south and west exposures is greater than 20 percent of the wall area, load management credits shall be achieved as follows:

1. *Automatic* exterior shading devices or *dynamic glazing* that is capable of reducing solar gain through sunlit *fenestration* by not less than 50 percent when fully closed shall receive the full credits in **Tables C406.3(1)** through **C406.3(9)**. The

exterior shades shall have fully open and fully closed solar heat gain coefficient (SHGC) determined in accordance with **AERC 1**.

2. *Automatic* interior shading devices with a solar reflectance of not less than 0.50 for the surface facing the *fenestration* shall receive 40 percent of the credits in **Tables C406.3(1)** through **C406.3(9)**.
3. All shading devices, *dynamic glazing* or shading attachments shall:
   - 3.1. Provide not less than 90 percent coverage of the total *fenestration* on east, south and west exposures in the *building* to achieve the credits determined in Item 1 or 2. Alternatively, provide not less than 70 percent coverage of the total *fenestration* on the south and west exposures in the *building* to achieve 50 percent of the credits determined in Item 1 or 2.
   - 3.2. Be automatically controlled and shall modulate in multiple steps or continuously the amount of solar gain and light transmitted into the space in response to peak periods and either daylight levels or solar intensity.
   - 3.3. Include a *manual* override located in the same *enclosed space* as the shaded vertical *fenestration* that shall override operation of *automatic* controls for not longer than 4 hours. Such override shall be locked out during peak periods.

For this section, directional exposures shall exclude *fenestration* that has an orientation deviating by more than 45 degrees of facing the cardinal direction. In the southern hemisphere, where the south exposure is referred to, it shall be replaced by the north exposure.

C406.3.5 G04 Electric energy storage. Electric storage devices shall be charged and discharged by *automatic* load management controls to store energy during nonpeak periods and use stored energy during peak periods to reduce building demand. Electric storage devices shall have a minimum capacity of 1.5 watt-hours per square foot (Wh/ft^2) (16 Wh/m^2) of gross building area. Base credits in **Tables C406.3(1)** through **C406.3(9)** are based on installed electric storage of 5 Wh/ft^2 (54 Wh/m^2) and shall be prorated for actual installed storage capacity between 1.5 and 15 Wh/ft^2 (16 to 161 Wh/m^2), as follows:

$$[\text{installed electric storage capacity, Wh/ft}^2\ (\text{Wh/m}^2)]/5\ (54) \times [\text{C406.3.5 credits from tables}]$$

Equation 4-30

Larger energy storage shall be permitted; however, credits are limited to the range of 1.5 to 15 Wh/ft^2 (16 to 161 Wh/m^2).

C406.3.6 G05 Cooling energy storage. *Automatic* load management controls shall be capable of activating ice or chilled water storage equipment to reduce demand during summer peak periods. Storage tank standby loss shall be demonstrated through analysis to be not more than 2 percent of storage capacity over a 24-hour period for the cooling design day. Base credits in **Section C406.3** are based on storage capacity of the design peak hour cooling load with a 1.15 sizing factor. Credits shall be prorated for installed storage systems sized between 0.5 and 4.0 times the design day peak hour cooling load, rounded to the nearest whole credit. Larger storage shall be permitted but the associated credits are limited to the

range provided in this section. Energy credits shall be determined as follows:

$$EC_s = EC_{1.0} \times (1.44 \times SR + 0.71)/2.15$$

Equation 4-31

where:

EC_s = Cooling storage credit achieved for project.

$EC_{1.0}$ = G05 base energy credit for building use type and climate zone based on 1.0 ton-hours storage per design day ton (kWh/kW) of cooling load.
SR = Storage ratio in ton-hours storage per design day ton (kWh/kW) of cooling load where $0.5 \le SR \le 4.0$.

C406.3.7 G06 Service hot water energy storage. Where service hot water (SHW) is heated by electricity, *automatic* load management controls complying with **ANSI/CTA-2045-B** shall preheat stored SHW before the peak period and suspend electric water heating during the peak period. Storage capacity shall be provided by either:

1. Preheating water above 140°F (60°C) delivery temperature with at least 1.34 kWh of energy storage per kW of water-heating capacity. Tempering valves shall be provided at the *water heater* delivery location.
2. Providing additional heated water tank storage capacity above peak SHW demand with equivalent peak storage capacity to Item 1.

Credits earned for measure G06 shall be calculated using **Equation 4-32**:

$$EC_{G06\_ach} = EC_{G06\_base} \times EC_{G06\_adj} \qquad \text{Equation 4-32}$$

where:
EC_{G06_ach} = SWH energy storage credit achieved for project. EC_{G06_base} = G06 Base energy credit from **Section C406.3**. EC_{G06_adj} = Energy credit adjustment factor from **Table C406.3.7**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#307 Adds new Table C406.3.3

Related Mods:

CEPI-193-21, CED1-161-22

TABLE C406.3.3
ENERGY CREDIT ADJUSTMENT BASED ON USE OF VENTILATION SHIFT OR DEMAND RESPONSE

DEMAND RESPONSE SIGNAL AVAILABLE[a]	DEMAND RESPONSE REQUIRED BY SECTION C403.4.6.1[b]	INCLUDES VENTILATION SHIFT[c]	EC_{G02_adj}
No	No	Yes	100%
No	Yes	Yes	80%
Yes	No	Yes	80%
Yes	Yes	Yes	40%
No	No	No	70%

No	Yes	No	50%
Yes	No	No	50%
Yes	Yes	No	0%

a. "Demand Response Signal Available" is "Yes" where a controlling entity other than the owner makes a demand response signal available to the building.
b. Where the exception is invoked in **Section C403.4.6.1** for buildings that comply with Load Management measure G02, then "Demand Response Required" is "Yes."
c. Ventilation shift controls in accordance with **Section C406.3.3**, item 3.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#308 Adds new Table C406.3.7.

Related Mods:

CEPI-193-21, CED1-176-22

TABLE C406.3.7

ENERGY CREDIT ADJUSTMENT BASED ON USE OF HEAT PUMP WATER HEATER OR DEMAND RESPONSE

DEMAND RESPONSE READY PER SECTION C404.10	DEMAND RESPONSE SIGNAL AVAILABLE[a]	HAS HPWH	EC_{G06_adj}[b]
No	NA	No	100%
No	NA	Yes	33%
Yes	No	No	50%
Yes	No	Yes	17%
Yes	Yes	NA	0%

HPWH = Heat Pump Water Heater, NA = Not available.

a. "Demand Response Signal Available" is "Yes" where a controlling entity currently makes a demand response signal available to the building.
b. The lower values of EC_{G06_adj} in this column apply where not less than 67 percent of the whole-building design end use service water heating requirements are met using only heat pump heating at the conditions described in **Section C406.2.3.1.2**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#309	Adds new Section C406.3.8. This measure is primarily an operational strategies change and the use of interior thermal mass. Has no impact on the stringency.
Related Mods: CEPI-193-21, CED1-92-22, CED1-185-22	**C406.3.8 G07 Building thermal mass.** The project shall have additional passive interior mass and a night flush control of the HVAC system. The credit is available to projects that have at least 80 percent of gross floor area unoccupied between midnight and 6:00 a.m. The project shall meet the following requirements: 1. Interior to the building thermal envelope insulation, provide 10 pounds per foot (15 kg/m) of project *conditioned floor area* of passive thermal mass in the building interior wall, the inside of the *exterior wall* or the interior floor construction. Mass construction shall have mass surfaces directly contacting the air in *conditioned spaces* with directly attached gypsum panels allowed. Mass with carpet or furred gypsum panels or exterior wall mass that is on the exterior of the insulation layer [e.g., the portion of concrete masonry unit (CMU) block on the exterior of insulation-filled cell cavities] shall not be included toward the building mass required. 2. HVAC units for 80 percent or more of the supply airflow in the project shall be equipped with outdoor air economizers and fans that have variable or low speed capable of operating at 66 percent or lower airflow and be included in the night flush control sequence. 3. Night flush controls shall be configured with the following sequence or another night flush strategy shall be permitted where demonstrated to be effective, avoids added morning heating and is *approved* by the authority having jurisdiction. 3.1. Summer mode shall be activated when outdoor air temperature exceeds 70°F (21°C) and shall continue uninterrupted until deactivated when outdoor air temperature falls below 45°F (7°C). During summer mode, the occupied cooling setpoint shall be set 1°F (0.6°C) higher than normal and the occupied heating setpoint shall be reset 2°F (1.1°C) lower than normal. 3.2. Where all the following conditions exist, night flush shall be activated: 3.2.1. Summer mode is active in accordance with Item 3.1. *3.2.2.* Outdoor air temperature is 5°F (2.8°C) or more below indoor average *zone* temperature. 3.2.3. Indoor average *zone* temperature is greater than morning occupied heating setpoint. 3.2.4. In Climate Zones 0A, 1A, 2A and 3A, outdoor dewpoint is below 50°F (10°C) or outdoor air enthalpy is less than indoor air enthalpy. 3.2.5. Local time is between 10:00 p.m. and 6:00 a.m. 3.3. When night flush is active, *automatic* night flush controls shall operate outdoor air economizers at low fan speed not exceeding 66 percent during the unoccupied period with mechanical cooling and heating locked out. FSEC – Anticipated energy impact on FBC-EC – Decrease Staff Classification: Correlates Directly: X; Energy Standard Needed: — Action: AS: —; AS/IC: —; D: x; D/IC: —
CE#310	Deletes Sections C406.4, C406.5, C406.6, C406.7, C406.8, C406.9, C406.10, Table C406.10.2, C406.11, C406.12, C406.12(1), C406.12(2), C406.12(3), C406.12(4).

Staff Classification	Correlates Directly	Energy Standard Needed
	X	

Action	AS	AS/IC	D	D/IC
			x	

Related Mods:

~~**C406.4 Enhanced digital lighting controls.** Interior general lighting in the building shall have the following enhanced lighting controls that shall be located, scheduled and operated in accordance with **Sections C405.2.1** through **C405.2.3**.~~

1. ~~Luminaires shall be configured for continuous dimming.~~
2. ~~Luminaires shall be addressed individually. Where individual addressability is not available for the luminaire class type, a controlled group of not more than four luminaries shall be allowed.~~
3. ~~Not more than eight luminaires shall be controlled together in a *daylight zone* .~~
4. ~~Fixtures shall be controlled through a digital control system that includes the following function:~~
   - ~~4.1. Control reconfiguration based on digital addressability.~~
   - ~~4.2. Load shedding.~~
   - ~~4.3. Occupancy sensors shall be capable of being reconfigured through the digital control system.~~
5. ~~Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions in Item 4.~~
6. ~~Functional testing of lighting controls shall comply with **Section C408**.~~

~~**C406.5 On-site renewable energy.** Buildings shall comply with **Section C406.5.1** or **C406.5.2**.~~

~~**C406.5.1 Basic renewable credit.** The total minimum ratings of on-site renewable energy systems, not including systems used for credits under **Sections C406.7.2**, shall be one of the following:~~

~~1.~~ Not less than 0.86 Btu/h per square foot (2.7 W/m ^{2}) or 0.25 watts per square foot (2.7 W/m^2) of *conditioned floor area* .

~~2. Not less than 2 percent of the annual energy used within the building for building mechanical and service water-heating equipment and lighting regulated in **Section C405**.~~

~~**C406.5.2 Enhanced renewable credit.** Where the total minimum ratings of on-site renewable energy systems exceeds the rating in **Section C406.5.1**, additional energy efficiency credits shall be determined based on **Equation 4-14**, rounded to the nearest whole number.~~

~~(Equation 4-14)~~

~~where:~~

~~*AEEC* $_{RRa}$ = **Section C406.5.2** additional energy efficiency credits.~~

~~*AEEC* $_{2.5}$ = **Section C406.5** credits from **Tables C406.1(1)** through **C406.1(5)**.~~

~~*RRa* = Actual total minimum ratings of *on-site renewable energy* systems (in Btu/h, watts per~~ square foot or W/m^2).

~~*RR* $_1$ = Minimum ratings of *on-site renewable energy* systems required by **Section C406.5.1** (in~~ Btu/h, watts per square foot or W/m^2).

~~**C406.6 Dedicated outdoor air system.** Buildings containing equipment or systems regulated by **Section C403.3.4.2**, **C403.4.3**, **C403.4.4**, **C403.4.5**, **C403.6**, **C403.8.4**, **C403.8.6**, **C403.8.6.1**, C403.11.1, C403.11.2, **C403.11.3** or **C403.11.4** shall be equipped with an independent ventilation system designed to provide not less than the minimum 100-percent outdoor air to each individual occupied space, as specified by the ***International Mechanical Code***. The ventilation system shall be capable of total energy recovery. The HVAC system shall include supply-air temperature controls that automatically reset the supply-air temperature in~~

~~response to representative building loads or to outdoor air temperatures. The controls shall reset the supply-air temperature not less than 25 percent of the difference between the design supply-air temperature and the design room- air temperature.~~

~~**C406.7 Reduced energy use in service water heating.** Buildings shall comply with **Section C406.7.1** and **Section C406.7.2**, **C406.7.3** or **C406.7.4**.~~

~~**C406.7.1 Building type.** To qualify for this credit, the building shall contain one of the following use groups, and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following use groups:~~

1. ~~Group R-1: Boarding houses, hotels or motels.~~
2. ~~Group I-2: Hospitals, psychiatric hospitals and nursing homes.~~
3. ~~Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.~~
4. ~~Group F: Laundries.~~
5. ~~Group R-2.~~
6. ~~Group A-3: Health clubs and spas.~~
7. ~~Group E: Schools with full-service kitchens or locker rooms with showers.~~
8. ~~Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in **Section C407**.~~

~~**C406.7.2 Recovered or renewable water heating.** The building service water-heating~~ system shall have one or more of the following that are sized to provide not less than 30 percent of the building's annual hot water requirements, or sized to provide 70 percent of the building's annual hot water requirements if the building is required to comply with **Section ~~C403.11.5~~**~~:~~

1. ~~Waste heat recovery from service hot water, heat-recovery chillers, building equipment or process equipment.~~
2. ~~*On-site renewable energy* water-heating systems.~~

~~**C406.7.3 Efficient fossil fuel water heater.** The combined input-capacity weighted-average equipment rating of all fossil fuel water-heating equipment in the building shall be not less than 95 percent Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with **Section C404.2.1**.~~

~~**C406.7.4 Heat pump water heater.** Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity weighted-average EF of 3.0. Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.~~

~~**C406.8 Enhanced envelope performance.** The total UA of the *building thermal envelope* as designed shall be not less than 15 percent below the total UA of the *building thermal envelope* in accordance with **Section C402.1.4**.~~

~~**C406.9 Reduced air infiltration.** Air infiltration shall be verified by whole-building pressurization testing conducted in accordance with **ASTM E779** or **ASTM E1827** by an independent third party. The measured air-leakage rate of the building envelope shall not~~

~~exceed 0.25 cfm/ft^2(2.0 L/s × m^2) under a pressure differential of 0.3 inches water column (75 Pa), with the calculated surface area being the sum of the above- and below-grade building envelope. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.~~

> ~~**Exception:** For buildings having over 250,000 square feet (25 000 m^2) of *conditioned floor area* , air leakage testing need not be conducted on the whole building where testing is conducted on representative above-grade sections of the building. Tested areas shall total not less than 25 percent of the conditioned floor area and shall be tested in accordance with this section.~~

~~**C406.10 Energy monitoring.** Buildings shall be equipped to measure, monitor, record and report energy consumption data in compliance with **Sections C406.10.1** through **C406.10.5**.~~

~~**C406.10.1 Electrical energy metering.** For all electrical energy supplied to the building and its associated site, including but not limited to site lighting, parking, recreational facilities, and~~

~~other areas that serve the building and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by **Section C406.10.2**.~~

~~**C406.10.2 End-use metering categories.** Meters or other *approved* measurement devices shall be provided to collect energy use data for each end-use category listed in **Table 406.10.2**. These meters shall have the capability to collect energy consumption data for the whole building or for each separately metered portion of the building. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories listed in **Table 406.10.2** is permitted to be from a load not within the category.~~

~~Exceptions:~~

1. ~~HVAC and water-heating equipment serving only an individual dwelling unit does not require end-use metering.~~
2. ~~End-use metering is not required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.~~

~~**C406.10.3 Meters.** Meters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by **Section C406.10.4**. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC or other building systems that can monitor their energy consumption shall be permitted instead of meters. Current sensors shall be permitted, provided that they have a tested accuracy of ±2 percent. Required metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with **Sections C406.10.4** and **C406.10.5**.~~

~~**C406.10.4 Data acquisition system.** A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for a minimum of 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly and yearly logged data for each end-use category required by **Section C406.10.2**.~~

~~**C406.10.5 Graphical energy report.** A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by **Section C406.10.2** at least every hour, day, month and year for the previous 36 months.~~

~~**C406.11 Fault detection and diagnostics system.** A fault detection and diagnostics system shall be installed to monitor the HVAC system's performance and automatically identify faults. The system shall do all of the following:~~

1. ~~Include permanently installed sensors and devices to monitor the HVAC system's performance.~~
2. ~~Sample the HVAC system's performance at least once every 15 minutes.~~
3. ~~Automatically identify and report HVAC system faults.~~
4. ~~Automatically notify authorized personnel of identified HVAC system faults.~~
5. ~~Automatically provide prioritized recommendations for repair of identified faults based on analysis of data collected from the sampling of the HVAC system performance.~~
6. ~~Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.~~

~~**C406.12 Efficient kitchen equipment.** For buildings and spaces designated as Group A-2 or facilities that include a commercial kitchen with at least one gas or electric fryer, all fryers, dishwashers, steam cookers and ovens shall comply with all of the following:~~

1. ~~Achieve performance levels in accordance with the equipment specifications listed in **Tables C406.12(1)** through **C406.12(4)** when rated in accordance with the applicable test procedure.~~
2. ~~Be installed prior to the issuance of the Certificate of Occupancy.~~
3. ~~Have associated performance levels listed on the construction documents submitted for permitting.~~

~~Energy efficiency credits for efficient kitchen equipment shall be independent of climate zone and determined based on Equation 4-15, rounded to the nearest whole number.~~

~~(Equation 4-15)~~

~~where:~~

~~$AEEC_K$ = Section C406.12 additional energy efficiency credits.~~

~~$Area_K$ = Floor area of full-service kitchen (ft² or m²).~~

~~$Area_B$ = Gross floor area of building (ft² or m²).~~

~~TABLE C406.10.2~~

~~ENERGY USE CATEGORIES~~

~~**LOAD CATEGORY**~~	~~**DESCRIPTION OF ENERGY USE**~~
~~Total HVAC system~~	~~Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120-volt equipment, or by 208/120-volt equipment that is located in a building where the main service is 480/277-volt power, is permitted to be excluded from total HVAC system energy use.~~
~~Interior lighting~~	~~Lighting systems located within the building.~~
~~Exterior lighting~~	~~Lighting systems located on the building site but not within the building.~~
~~Plug loads~~	~~Devices, appliances and equipment connected to convenience receptacle outlets.~~

~~Process loads~~	~~Any single load that is not included in an HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment and commercial kitchens.~~
~~Building operations and other miscellaneous loads~~	~~The remaining loads not included elsewhere in this table, including but not limited to vertical transportation systems and automatic doors.~~

~~TABLE C406.12(1)~~

~~MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL FRYERS~~

~~FRYER TYPE~~	~~HEAVY-LOAD COOKING ENERGY EFFICIENCY~~	~~IDLE ENERGY RATE~~	~~TEST PROCEDURE~~
~~Standard open deep-fat gas fryers~~	~~≥ 50%~~	~~≤ 9,000 Btu/h~~	**~~ASTM F1361~~**
~~Standard open deep-fat electric fryers~~	~~≥ 83%~~	~~≤ 800 watts~~	
~~Large-vat open deep-fat gas fryers~~	~~≥ 50%~~	~~≤ 12,000 Btu/h~~	**~~ASTM F2144~~**
~~Large-vat open deep-fat electric fryers~~	~~≥ 80%~~	~~≤ 1,100 watts~~	

~~For SI: 1 Btu/h = 0.293/W.~~

Delete entire ~~TABLE C406.12(2)~~

~~MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL STEAM COOKERS~~

Delete entire Table

~~TABLE C406.12(3)~~

~~MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL DISHWASHERS~~

Delete entire Table

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

	~~TABLE C406.12(4)~~ **~~MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL OVENS~~** **Original text of mod is not consistent with that of the 2023 FBC – EC.**
CE#311	Renames the Section title by replacing the text "Total" with "Simulated."
Related Mods: CEPI-24-21 Part I	SECTION C407 **~~TOTAL~~ SIMULATED BUILDING PERFORMANCE** **C407.1 Scope.** This section establishes criteria for compliance using ~~total~~ simulated building performance. The following systems and loads shall be included in determining the ~~total~~ simulated building performance: heating systems, cooling systems, *service water heating* , *fan systems* , lighting power, receptacle loads and process loads. **Exception:** Energy used to recharge or refuel vehicles that are used for on-road and off-site transportation purposes.
CE#312	Replaces text "total" with "simulated." Revises the provision that the proposed building design's annual energy cost is compared to a percentage calculated based on a new equation 4-33 that accounts for energy credits instead of a fixed percentage of 80.0%. Also Adds a new exception, which allows to use source energy as a substitute for energy cost.
Related Mods: CEPI-193-21, CEPI-207-21, CEPI-24-21 Part I, CED1-185-22	**C407.2 Mandatory requirements.** Compliance based on ~~total~~ simulated building performance requires that a *proposed design* meet all of the following: **1.** The requirements of the sections indicated within **Table C407.2(1).** 2. An annual *energy cost* that is less than or equal to ~~80 percent~~ the percentage of the annual *energy cost* (PAEC) of the *standard reference design* calculated in Equation 4-33. Energy prices shall be taken from a source *approved* by the *code official* , such as the Department of Energy, Energy Information Administration's *State Energy Data System Prices and Expenditures* reports. *Code officials* shall be permitted to require time-of-use pricing in *energy cost* calculations. The reduction in *energy cost* of the *proposed design* associated with *on-site renewable energy* shall be not more than 5 percent of the total *energy cost* . The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design* .

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Exceptions:

1. Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than *energy cost* as the metric of comparison.
2. Where energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* is substituted for the *energy cost*, the energy use shall be calculated using source energy factors from **Table C407.2(2)**. For electricity, US locations shall use values from eGRID subregions. Locations outside the United States shall use the value for "All other electricity" or locally derived values.

$$PAEC = 100 \times (0.80 + 0.025 - EC_r/1{,}000)$$

Equation 4-33

where:

PAEC = The percentage of the annual energy cost of the standard reference design.

EC_r = Energy efficiency credits required for the building in accordance with **Section C406.1** (do not include load management and renewable credits).

Original text of mod is not consistent with that of the 2023 FBC – EC.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#313 Updated Table C407.2(1).

Related Mods:

CEPI-193-21, CEPI-24-21 Part I, CED1-92-22

CEPI-207-21

Delete entire table

~~TABLE C407.2~~

~~REQUIREMENTS FOR TOTAL BUILDING Performance~~

TABLE C407.2(1)

REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Please see attached PDF

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

Original text of mod is not consistent with that of the 2023 FBC – EC.

CE#314 Adds new Table C407.2(2) for source energy conversion factors by fuel types.

Related Mods:	TABLE C407.2(2) **SOURCE ENERGY CONVERSION FACTORS FOR ELECTRICITY** **Please see attached PDF**
CE#315	Updates Table C407.4(1). Replaces the solar absorptance requirement with solar reflectance for roofs and above-grade walls. Updates the roof's emittance requirement. Adds thermal bridge requirement but climate zones 0 through 3 are exempted. Replaces "Mechanical ventilation" with "Outdoor airflow" and revises the standard reference design mechanical ventilation air requirements based on the system type. If the proposed building has natural ventilation, then use the same for the standard reference design. Adds "Energy recovery" as a new building component characteristic. If the proposed design specifies ventilation airflow, then use the same as the proposed; otherwise, if the proposed design has mechanical ventilation, use the same but with the standard reference design airflow. Adds "Fan power" as a new building component characteristic and requires modeling per Section C403.8. Adds "On-site renewable energy" as a new building component characteristic and has requirements.
Related Mods: CECPI-2-21, CECPI-4-21, CEPI-211-21, CEPI-212, 21, CED1-197-22	See table below

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

TABLE C407.4.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	**STANDARD REFERENCE DESIGN**	**PROPOSED DESIGN**
Space use classification	Same as proposed	The space use classification shall be chosen in accordance with **Table C405.3.2(1)** or **C405.3.2(2)** for all areas of the building covered by this permit. Where the space use classification for a building is not known, the building shall be categorized as an office building.
	Type: insulation entirely above deck	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in **Table C402.1.2**	As proposed

		Roofs	~~Solar absorptance: 0.75~~ Solar reflectance: 0.25, except as specified in **Section C402.4** and **Table C402.4** for Climate Zones 0, 1, 2 and 3	As proposed
			Emittance: 0.90, except as specified in **Section C402.4** and **Table C402.4** for Climate Zones 0, 1, 2 and 3	As proposed
		Walls, above-grade	Type: same as proposed	As proposed
			Gross area: same as proposed	As proposed
			U-factor: as specified in **Table C402.1.2**	As proposed
			Thermal bridges: account for heat transfer consistent with compliant psi- and chi-factors from **Table C402.1.4** for thermal bridges as identified in **Section C402.7** that are present in the proposed design	As proposed; psi- and chi-factors for proposed thermal bridges shall be determined in accordance with requirements in **Section C402.1.4**.
			Solar ~~absorptance: 0.75~~ reflectance: 0.25	As proposed
			Emittance: 0.90	As proposed
		Walls, below-grade	Type: mass wall	As proposed
			Gross area: same as proposed	As proposed

	Schedules	Same as proposed **Exception:** Thermostat settings and schedules for HVAC systems that utilize radiant heating, radiant cooling and elevated air speed, provided that equivalent levels of occupant thermal comfort are demonstrated by means of equal Standard Effective Temperature as calculated in Normative Appendix B of **ASHRAE Standard 55**.	Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays and any seasonal operation. Schedules shall model the time-dependent variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads. The schedules shall be typical of the proposed building type as determined by the designer and approved by the jurisdiction.
	~~Mechanical ventilation~~ Outdoor airflow	~~Same as proposed~~ Where the proposed design specifies mechanical ventilation: 1. For systems 1–4 as specified in **Tables C407.4.1(2)** and **C407.4.1(3)**, the outdoor airflow rate shall be determined in accordance with **Section C403.7** and *International Mechanical Code* Section 403.3.1.1.2.3.4, **Equation 4-8**, using a system ventilation efficiency (E_v) of 0.75. 2. For systems 5–11 as specified in **Tables C407.4.1(2)** and **C407.4.1(3)**, the outdoor airflow rate shall be determined in accordance with **Section C403.7** and *International Mechanical Code* **Section 403.3**.	As proposed, in accordance with **Section C403.2.2**.

	Where the proposed design specifies natural ventilation, as proposed.	
Heating systems	Fuel type: same as proposed design	As proposed
	Equipment type[a]: as specified in **Tables C407.4.1(2)** and **C407.4.1(3)**	As proposed

Energy recovery	Where the proposed design specifies mechanical ventilation, as specified in **Section C403.7.4** based on the standard reference design airflows.	**As proposed**
	Where the proposed de-sign specifies natural ven-tilation, as proposed	

Fan power	As specified in Section C403.8 for the proposed design 1. Where the fan power of the proposed design is exempted from the requirements of **Section C403.8**, as proposed. 2. Fan systems addressed by **Section C403.8.1**: fan system BHP shall be as proposed or to the limits specified in **Section C403.8.1**, whichever is smaller. If the limit is reached, the power of each fan shall be reduced proportionally until the limit is met. 3. Fan systemsserving areas where the mechanical ventilation is provided in accordance with an engineered ventilation	**As proposed**

		system design of **Section 403.2** of the *International Mechanical Code* shall not use the particulate filtration or air cleaner pressure drop adjustment available in **Table C403.8.1(1)** when calculating the fan system BHP limit for the portion of the airflow being treated to comply with the engineered ventilation system design.	
	On-site renewable energy	Where a system providing on-site renewable energy has been mod-eled in the proposed design, the same system shall be modeled identically in the standard refer-ence design except the rated ca-pacity shall meet the requirements of Section C405.15.1 Where no system is designed or included in the proposed design, model an unshaded photovoltaic system with the following characteristics: Size: rated capacity per **Section C405.15.1**. Module type: crystalline silicone panel with glass cover, 19.1% nominal efficiency and temperature coefficient of -0.35%/°C. Performance shall be based on a reference temperature of 77°F (25°C), air mass of 1.5 atmosphere and irradiance of 317 Btu/h × ft^2 (1000 W/m^2). Array type: rack-mounted array with installed nominal operating cell temperature (INOCT) of 103°F (45°C).	**As proposed**

	Total system losses (DC output to AC output): 11.3%. Tilt: 0 degrees (mounted horizontally). Azimuth: 180 degrees.	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
			X

Action	AS	AS/IC	D	D/IC
			x	

CE#316

Revises and reorganizes Section C407.5. Moves the software capability requirement under new subsection C407.5.1.1.
Renames the "Specific approval" section and edits the code language for clarity.
Created a new subsection by moving the software capability requirements from Section C407.5.
Created new subsection C407.5.1.2.

Requires compliance software vendors to test their software per ASHRAE Standard 140 and publish the results in publicly accessibly web-site. No impact on construction cost.

Related Mods:

CECD1-8-22, CE2D-10-23 CEPI-24-21 Part I

C407.5 Calculation software tools. Calculation procedures used to comply with **Section C407** shall apply an *approved* version of a performance analysis software tool capable of calculating the annual energy consumption of all building elements that differ between the *standard reference design* and the *proposed design* . The same *approved* version of the performance analysis tool shall be used to calculate the *proposed design* and *standard reference design* .

C407.5.1 ~~Specific~~ Software tool approval. ~~Performance analysis tools complying with the applicable subsections of Section C407 and tested according to ASHRAE Standard 140~~ Any version of a performance analysis tool meeting the requirements of **Sections C407.5.1.1** and **C407.5.1.2** shall be permitted to be *approved.* Tools are permitted to be *approved* based on meeting a specified threshold for a jurisdiction. The *code official* shall be permitted to approve tools for a specified application or limited scope.

~~**C407.5**~~ **C407.5.1.1** ~~**Calculation software tools.**~~ **Software tool capabilities.** ~~Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the *standard reference design* and the *proposed design* and shall include the following capabilities.~~ *Approved* software tools shall include the following capabilities:

1. Building operation for a full calendar year (8,760 hours).
2. Climate data for a full calendar year (8,760 hours) and shall reflect *approved* coincident hourly data for temperature, solar radiation, humidity and wind speed for the building location.
3. Ten or more thermal zones.
4. Thermal mass effects.
5. Hourly variations in occupancy, illumination, receptacle loads, *thermostat* settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads.
6. Part-load performance curves for mechanical equipment.
7. Capacity and efficiency correction curves for mechanical heating and cooling equipment.

	8. Printed *code official* inspection checklist listing each of the *proposed design* component characteristics from **Table C407.4.1(1)** determined by the analysis to provide compliance, along with their respective performance ratings, including but not limited to *R*-value, *U-factor* , SHGC, HSPF, AFUE, SEER and EF. **C407.5.1.2 Testing required by software vendors.** Prior to approval, software tools shall be tested by the software vendor in accordance with **ASHRAE Standard 140**, except Sections 7 and 8. During testing, hidden inputs that are not normally available to the user shall be permitted to avoid introducing source code changes strictly used for testing. Software vendors shall publish, on a publicly available website, the following **ASHRAE Standard 140** test results, input files and modeler reports for each tested version of a software tool: 1. Test results that demonstrate the software tool was tested in accordance with **ASHRAE Standard 140** and that meet or exceed the values for "The Minimum Number of Range Cases within the Test Group to Pass" for all test groups in **ASHRAE Standard 140**, Table A3-14. 2. Test results of the performance analysis tool and input files used for generating the **ASHRAE Standard 140** test cases along with the results of the other performance analysis tools included in **ASHRAE Standard 140**, Annexes B8 and B16. 3. The modeler report in **ASHRAE Standard 140**, Annex A2, Attachment A2.7, Report Blocks A and G shall be completed for results exceeding the maximum or falling below the minimum of the reference values shown in **ASHRAE Standard 140**, Tables A3-1 through A3-13, and Report Blocks A and E shall be completed for any omitted results. **Original text of mod is not consistent with that of the 2023 FBC – EC.** Staff Classification: Correlates Directly: — ; Energy Standard Needed: — ; Over lap: X Action: AS: — ; AS/IC: — ; D: x ; D/IC: — FSEC – Anticipated energy impact on FBC-EC – Decrease
CE#317	Creates new subsection C407.5.2.
Related Mods: CECD1-8-22, CE2D-10-23 CEPI-24-21 Part I	**C407.5.2 Algorithms not tested.** Algorithms not tested in accordance with **Section C407.5.1.2**, including algorithms that are alternatives to those that were tested, and numerical settings not tested, such as time steps and tolerances, shall be permitted to be used where modeling the *proposed design* and *standard reference design*. Staff Classification: Correlates Directly: X ; Energy Standard Needed: — ; Over lap: — Action: AS: x ; AS/IC: — ; D: — ; D/IC: —

CE#318

Renumbers Section C407.5.2.
Renumbers Section C407.5.3. Replaces the text “building performance” with “simulated building performance” in two places.

Related Mods:

CECD1-8-22,
CE2D-10-23
CEPI-24-21 Part I

FBC – C407.6

~~C407.5.2~~ C407.5.3 Input values.

~~C407.5.3~~ C407.5.4 Exceptional calculation methods. Where the simulation program does not model a design, material or device of the *proposed design* , an exceptional calculation method shall be used where *approved* by the *code official* . Where there are multiple designs, materials or devices that the simulation program does not model, each shall be calculated separately and exceptional savings determined for each. The total exceptional savings shall not constitute more than half of the difference between the baseline simulated building performance and the proposed simulated building performance. Applications for approval of an exceptional method shall include all of the following:

1. Step-by-step documentation of the exceptional calculation method performed, detailed enough to reproduce the results.
2. Copies of all spreadsheets used to perform the calculations.
3. A sensitivity analysis of energy consumption where each of the input parameters is varied from half to double the value assumed.
4. The calculations shall be performed on a time step basis consistent with the simulation program used.
5. The performance rating calculated with and without the exceptional calculation method.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#319

Revises exceptions items #1 and #2.

Exception #1 is now based upon a gross conditioned floor area of less than 10,000 ft2 and a combined cooling, heating, and service water heating capacity of less than 960 kBtu/h, instead of a capacity limit only.

Exception item #2 is now based on the HVAC system type and single-zone thermostat serving sleeping and dwelling units.

We believe the code changes are mostly less stringent.

Related Mods:

CEPI-215-21,
CED1-177-22

C408.2 Mechanical systems and service water-heating systems commissioning and completion requirements. Prior to the final mechanical and plumbing inspections, the *registered design professional or approved agency* shall provide evidence of mechanical systems *commissioning* and completion in accordance with the provisions of this section.

*Construction document*notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the *owner* or owner’s authorized agent and made available to the*code official* upon request in accordance with **Sections C408.2.4** and **C408.2.5**.

Exceptions: The following systems are exempt:

1. ~~Mechanical systems and service water-heating systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h (140.7 kW) cooling capacity and 600,000 Btu/h (175.8 kW) combined service water-heating and~~

~~space-heating capacity.~~ Buildings with less than 10,000 square feet (929 m^2) gross *conditioned floor area* and combined heating, cooling and service water heating capacity of less than 960,000 Btu/h (281 kW).

2. ~~Systems included in Section C403.5 that serve individual *dwelling units* and *sleeping units* .~~ ~~Components within~~ dwelling units and sleeping units served by one of the following systems:
   - 2.1. Simple unitary or packaged HVAC equipment listed in **Table C403.3.2(1)**, **C403.3.2(2)**, **C403.3.2(4)** or **C403.3.2(5)**, each serving one *zone* and controlled by a single *thermostat* in the *zone* served.
   - 2.2. Two-pipe heating systems installed in the dwelling, serving one or more *zones* .

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#320

Renames the section title by adding the text "and receptacle." Now, this section includes a functional testing requirement for receptacle controls. It slightly increases construction costs due to additional code verification efforts.
Revised Section C408.3.1.2 time-switch control requirements to include receptacle controls. It slightly increases construction costs due to additional code verification efforts.

Related Mods:

C408.3 Functional testing of lighting and receptacle controls. *Automatic* lighting and receptacle controls required by this code shall comply with this section.

C408.3.1 Functional testing. Prior to passing final inspection, the *registered design professional* or *approved agency* shall provide evidence that the lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the *construction documents* and manufacturer's instructions. Functional testing shall be in accordance with **Sections C408.3.1.1** through **C408.3.1.3** for the applicable control type.

C408.3.1.2 Time-switch controls. Where *time-switch controls* are provided, ~~the following procedures shall be performed:~~ Items 1 through 5 shall be performed for all *time- switch controls*. For projects with more than seven spaces where lighting or receptacles are controlled by *time-switch controls*, not less than 10 percent of spaces and in no case fewer than one space shall be tested according to Items 6 and 7 unless the *code official* or *registered design professional* requires a higher percentage to be tested. Where 30 percent or more of the tested spaces fail any of the requirements in Items 6 and 7, all remaining spaces shall be tested.

1. Confirm that the *time-switch control* is programmed with accurate weekday, weekend and holiday schedules.
2. Provide documentation to the *owner* of *time-switch controls* programming including weekday, weekend, holiday schedules, and set-up and preference program settings.
3. Verify the correct time and date in the time switch.
4. Verify that any battery back-up is installed and energized.
5. Verify that the override time limit is set to not more than 2 hours.
6. Simulate occupied condition. Verify and document the following:
   - 6.1. All lights can be turned on and off by their respective area control switch.
   - 6.2. The switch only operates lighting in the *enclosed space* in which the switch is located.
   - 6.3. Receptacles in the space controlled by the *time-switch controls* turn on.
7. Simulate unoccupied condition. Verify and document the following:
   - 7.1. Nonexempt lighting turns off.

	7.2. *Manual* override switch allows only the lights and receptacles controlled by the time-switch controls in the *enclosed space* where the override switch is located to turn on controlled lighting and receptacles for more than 2 hours ~~or remain on until the next scheduled shutoff occurs~~. 7.3. Receptacles controlled by the *time-switch controls* turn off. 8. Additional testing as specified by the *registered design professional*.
CE#321	Adds new Section C408.3.1.4. Lighting control verification requirement for High-end trim. Adds new Section C408.3.1.5. This section is used with additional efficiency credits. It may slightly increase construction cost due to the additional verification and testing requirement. Adds new Section C408.3.1.6. This section is used with additional efficiency credits. It may slightly increase construction cost due to the additional verification and testing requirement.
Related Mods: CEPI-156-21, CECD1-4-22, CE2D-66-23, CECD1-5-22, CE2D-67-23	**C408.3.1.4 High-end trim controls.** Where lighting controls are configured for high-end trim, verify the following: 1. High-end trim maximum level has been set. 2. The calibration adjustment equipment is located for ready *access* only by authorized personnel. 3. Lighting controls with ready *access* for users cannot increase the lighting power above the maximum level established by the high-end trim controls. **C408.3.1.5 High-end trim lighting control verification for L02 Additional Efficiency Credit.** For the qualifying spaces associated with the project receiving the additional efficiency credits in **Section C406.2.5.2**, the following shall be documented while daylight responsive controls are not reducing lighting power: 1. The maximum setting for power or light output for each control group of general lighting luminaires. 2. The high-end trim setting for power or light output for each control group of general lighting luminaires. 3. For projects with seven or fewer claimed qualifying spaces, the reduction in light output or reduction in power due to high-end trim shall be tested in all spaces and shown to reduce the general lighting power or light output to not greater than 85 percent of full power or light output. For projects with more than seven claimed qualifying spaces, the reduction in light output or reduction in power due to high- end trim shall be tested in not less than 10 percent of spaces, and not less than seven spaces, and be shown to reduce general lighting power or light output to not greater than 85 percent of full power or light output. Where more than 30 percent of the tested spaces fail, the remaining qualifying spaces shall be tested. 4. Summarize the reduction in general lighting power or light output resulting from the high-end trim setting for each qualifying space and the floor area of each qualifying space. 5. Summarize the fraction of total floor area for spaces where high-end trim reduces general lighting power or light output to not greater than 85 percent of full power or light output. **C408.3.1.6 Demand responsive lighting controls G01.** For spaces associated with the project receiving renewable and load management credits in **Section C406.3.2**, the following procedures shall be performed: 1. Confirm the maximum setpoint upon receipt of the *demand response signal* has been established for each space. 2. For projects with seven or fewer spaces with controls, each space shall be tested.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

	3. For projects with more than seven spaces with controls, testing shall be done for each unique space type. Where multiple spaces of each space type exist, not less than 10 percent of each space type, and in no case fewer than one space, shall be tested unless the *code official* requires a higher percentage to be tested. Where 30 percent or more of the tested controls fail in a space type, all remaining identical space types shall be tested. 4. For demand responsive controls to be tested, verify the following: 4.1. Where high-end trim controls are used, the high-end trim shall be set before testing. 4.2. Turn off all nongeneral lighting in the space. 4.3. Set *general lighting* to its maximum illumination level. Where high-end trim is set, this will be the maximum illumination level at the high-end trim setpoint. 4.4. An illumination measurement shall be taken in an area of the space not controlled by daylight responsive controlled lighting. If there is not an area without daylight responsive controls, the daylight responsive controls shall be overridden from reducing the lighting level during the test. 4.5. Measure and document the maximum illumination level of the space. 5. Simulate a *demand response signal* and measure the illumination level at the same location as for the measurement in **Section C408.3.1.6**, Item 4.5. Verify the illumination level has been reduced to not greater than 80 percent of the maximum illumination level documented in **Section C408.3.1.6**, Item 4.5. 6. Simulate the end of a demand event by turning off the *demand response signal*; confirm controls automatically return to their normal operational settings at the end of the demand response event. Staff Classification: Correlates Directly: X; Energy Standard Needed: ; Over lap: Action: AS: ; AS/IC: ; D: x; D/IC:
CE#322	Adds new Section C409. The TRSP method is an alternative to the prescriptive or performance compliance method and allowed in office, retail, hotel, motel, multifamily, dormitory, school, and library building use types only. The compliance method excludes system types listed in the new subsection C409.2.1. TRSP is an optional compliance path; hence has no construction cost impact but provides compliance method flexibility. Adds new Section C409.1 that defines when the TRSP method is used. Adds new Section C409.2 that defines the HVAC system type, building occupancy group and other limits of the method. Adds new Section C409.2.1 that specifies the HVAC system types not permitted to use the TRSP method. Check the reference to Section C403.1. Is it Section C409.3? It adds a new Section C409.3 that lists HVAC systems types required to comply with the TSPR method in addition to the requirements of Section C409.4. It adds a new Section C409.4 that introduces a procedure for calculating the target HVAC total system performance ratio (TSPR) based on the standard reference building design TSPR and Mechanical Performance Factor (MPF) from a new Table C409.4. Adds new Table C409.4.
Related Mods: CEPI-76-21, CED1-	SECTION C409 **CALCULATION OF THE HVAC TOTAL SYSTEM PERFORMANCE RATIO** **C409.1 Applicability.** Use of the *HVAC total system performance ratio* (TSPR) method shall comply with this section. **C409.2 Permitted uses.** Only HVAC systems that serve building occupancies and uses in **Table C409.4** and are not excluded by **Section C409.2.1** shall be permitted to use the TSPR method.

198-22, CED1-182-22	**C409.2.1 Systems not permitted.** The following HVAC systems are not permitted to use **Section C403.1**, Item 3: 1. HVAC systems using: 1.1. District heating water, chilled water or steam. 1.2. Small-duct high-velocity air-cooled, space-constrained air-cooled, or single- package vertical air conditioner; single-package vertical heat pump; or double-duct air conditioner or double-duct heat pump, as defined in subpart F to **10 CFR Part 431**. 1.3. Packaged terminal air conditioners and packaged terminal heat pumps that have a cooling capacity greater than 12,000 Btu/h (3.5 kW). *1.4.* A common heating source serving both HVAC and *service water heating* equipment. *2.* HVAC systems that provide recovered heat for *service water heating*. 3. HVAC systems not specified in **Table C409.6.1.10.1**. 4. HVAC systems specified in **Table C409.6.1.10.1** with characteristics or parameters in **Table C409.6.1.10.2(1)**, not identified as applicable to that HVAC system type. 5. HVAC systems with chilled water supplied by absorption chillers, heat recovery chillers, water-to-water heat pumps, air-to-water heat pumps, or a combination of air- and water- cooled chillers on the same chilled water loop. 6. HVAC systems served by heating water systems that include air-to-water or water-to- water heat pumps. 7. Underfloor air distribution and displacement ventilation HVAC systems. 8. Space-conditioning systems that do not include mechanical cooling. 9. HVAC systems serving laundry rooms, elevator rooms, mechanical rooms, electrical rooms, *data centers* and *computer rooms*. 10. Buildings or areas of medical office buildings required to use **ASHRAE Standard 170**. 11. Buildings or areas that are required by regulation to have continuous air-handling unit operation. 12. HVAC systems serving laboratories with fume hoods. 13. Locker rooms with more than two showers. 14. Natatoriums and rooms with saunas. 15. Restaurants and commercial kitchens with a total cooking capacity greater than 100,000 Btu/h (29 kW). 16. Areas of buildings with commercial refrigeration equipment exceeding 100 kW of power input. 17. Cafeterias and dining rooms **C409.3 HVAC TSPR compliance.** HVAC systems permitted to use TSPR shall comply with **Section C409.4** and the following: 1. HVAC systems shall comply with applicable requirements of **Section C403** as follows: 1.1. Air economizers shall meet the requirements of **Sections C403.5.3.4** and **C403.5.5**. 1.2. Variable-air-volume systems shall meet the requirements of **Sections C403.6.5**, **C403.6.6** and **C403.6.9**. 1.3. Hydronic systems shall meet the requirements of **Section C403.4.4**. 1.4. Plants with multiple chillers or boilers shall meet the requirements of **Section C403.4.5**. 1.5. Hydronic (water loop) heat pumps and water-cooled unitary air conditioners shall meet the requirements of **Section C403.4.3.3**.

1.6. Cooling tower turndown shall meet the requirements of **Section C403.11.4**.

1.7. Heating of unenclosed spaces shall meet the requirements of **Section C403.14.1**.

1.8. Hot-gas bypass shall meet the requirements of **Section C403.3.3**.

1.9. Systems shall meet the operable openings interlock requirements of **Section C403.4.7**. Refrigeration systems shall meet the requirements of **Section C403.12**

2. Systems shall comply with the applicable provisions of **Section C403** required by **Table C407.2**.

C409.4 Performance target. For HVAC systems serving uses or portions of uses listed in **Section C409.2** that are not served by systems listed in **Section C409.2.1**, the *HVAC TSPR* of the *proposed design* shall be greater than or equal to the *HVAC TSPR* of the *standard reference design* divided by the mechanical performance factor (MPF) using **Equation 4-34**.

$$TSPR_p > TSPR_r/MPF$$ Equation 4-34

where:

$TSPR_p$ = HVAC TSPR of the proposed design calculated in accordance with **Sections C409.4**, **C409.5** and **C409.6**.

$TSPR_r$ = HVAC TSPR of the reference building design calculated in accordance with **Sections C409.4**, **C409.5** and **C409.6**.

MPF = Mechanical performance factor from **Table C409.4** based on climate zone and building use type.

$$MPF = (A_1 \times MPF_1 + A_2 \times MPF_2 + \ldots + A_n \times MPF_n)/(A_1 + A_2 + \ldots + A_n)$$ **Equation 4-35**

where:

MPF_1, MPF_2 through MPF_n= Mechanical performance factors from **Table C409.4** based on climate zone and building use types 1, 2 through *n*.

A_1, A_2 through A_n = Conditioned floor areas for building use types 1, 2 through *n*.

C409.4.1 HVAC TSPR. *HVAC TSPR* is calculated according to **Equation 4-36**.

$$\text{HVAC TSPR} = \text{heating and cooling load/building HVAC system energy}$$ Equation 4-36

where:

Building HVAC system energy = Sum of the annual site energy consumption for heating, cooling, fans, energy recovery, pumps and heat rejection in thousands of Btu (kWh).

Heating and cooling load = Sum of the annual heating and cooling loads met by the building HVAC system in thousands of Btu (kWh).

TABLE C409.4 MECHANICAL PERFORMANCE FACTORS

		CLIMATE ZONE

BUILDING USE	OCCUPANCY GROUP	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Office (all others)[a]	B	0.72	0.715	0.70	0.705	0.685	0.65	0.71	0.68	0.645	0.805	0.70	0.78	0.845	0.765	0.805	0.865	0.835	0.875	0.895
Office (large)[a]	B	0.83	0.83	0.84	0.84	0.79	0.82	0.72	0.81	0.77	0.67	0.76	0.63	0.71	0.72	0.63	0.73	0.71	0.71	0.71
Retail	M	0.60	0.57	0.50	0.55	0.46	0.46	0.43	0.51	0.40	0.45	0.57	0.68	0.46	0.68	0.67	0.50	0.45	0.44	0.38
Hotel/ motel	R-1	0.62	0.62	0.63	0.63	0.62	0.68	0.61	0.71	0.73	0.45	0.59	0.52	0.38	0.47	0.51	0.35	0.38	0.31	0.26
Multi-family/ dormitory	R-2	0.64	0.63	0.67	0.63	0.65	0.64	0.59	0.72	0.55	0.53	0.50	0.44	0.54	0.47	0.38	0.55	0.50	0.51	0.47
School/ education and libraries	E (A-3)	0.82	0.81	0.80	0.79	0.75	0.72	0.71	0.72	0.67	0.73	0.72	0.68	0.82	0.73	0.61	0.89	0.80	0.83	0.77

a. Large-office conditioned floor area greater than 150,000 square feet or more than five stories.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#323

Adds new Section C409.5 that defines the calculation procedure for the TSPR method.
Adds new subsection C409.5.1 that specifies the simulation program capability requirements for TSPR method.
Adds a new Section C409.5.2 that specifies the hourly 8760 climatic data requirements for the simulation.
Adds a new Section C409.5.3 that specifies the submittal documentation requirements.
Adds a new subsection, C409.5.3.1, that specifies the building permit compliance report submittal requirements.

Related Mods:

CEPI-76-21, CED1-198-22, CED1-182-22,

C409.5 General. Projects shall use the procedures of this section when calculating compliance using HVAC total system performance ratio.

C409.5.1 Simulation program. Simulation tools used to calculate the *HVAC TSPR* of the *standard reference design* shall comply with the following:

1. The simulation program shall calculate the *HVAC TSPR* based only on the input for the *proposed design* and the requirements of **Section C409**. The calculation procedure shall not allow the user to directly modify the building component characteristics of the *standard reference design*.
2. Performance analysis tools shall meet the applicable subsections of **Section C409** and be tested in accordance with **ASHRAE Standard 140**, except for Sections 7 and 8. The required tests shall include the *building thermal envelope* and fabric load test (Sections 5.2.1, 5.2.2 and 5.2.3), ground-coupled slab-on-grade analytical verification tests (Section 5.2.4), space-cooling equipment performance tests (Section 5.3), space- heating equipment performance tests (Section 5.4), and air-side HVAC equipment analytical verification test (Section 5.5), along with the associated reporting (Section 6).
3. The test results and modeler reports shall be publicly available and shall include the test results of the simulation programs and input files used for generating the results along with the results of the other simulation programs included in **ASHRAE Standard 140**, Annexes B8 and B16. The modeler report in **ASHRAE Standard 140** Annex A2 Attachment A2.7

shall be completed for results exceeding the maximum or falling below the minimum of the reference values and for omitted results.

4. The simulation program shall have the ability to model part-load performance curves or other part-load adjustment methods based on manufacturer's part-load performance data for mechanical equipment.
5. The *code official* shall be permitted to approve specific software deemed to meet these requirements in accordance with **Section C101.4.1**.

C409.5.2 Climatic data. The simulation program shall perform the simulation using hourly values of climatic data for a full calendar year (8,760 hours) and shall reflect *approved* coincident hourly data for temperature, solar radiation, humidity and wind speed for the building location.

C409.5.3 Documentation. Documentation or web links to documentation conforming to the provisions of this section shall be provided to the *code official* .

C409.5.3.1 Compliance report. Building permit submittals shall include:

1. A report produced by the simulation software that includes the following:
   1.1. Address of the *building*.
   1.2. Name of the individual completing the compliance report.
   1.3. Name and version of the compliance software tool.
   1.4. The dimensions, floor heights and number of floors for each thermal block.
   1.5. By thermal block, the *U-factor* , *C-factor* or *F-factor* for each simulated opaque envelope component and the *U-factor* and SHGC for each fenestration component.
   1.6. By *thermal block* or by surface for each thermal block, the fenestration area.
   1.7. By *thermal block* , a list of the HVAC equipment simulated in the *proposed design,* including the equipment type, fuel type, equipment efficiencies and system controls.
   1.8. Annual site HVAC energy use by end use for the proposed and baseline building.
   1.9. Annual sum of heating and cooling loads for the baseline building.
   1.10. The *HVAC TSPR* for both the *standard reference design* and the *proposed design*.
2. A mapping of the actual building HVAC component characteristics and those simulated in the *proposed design* showing how individual pieces of HVAC equipment identified in Item 1 have been combined into average inputs as required by **Section C409.6.1.10**, including:
   2.1. Fans.
   2.2. Hydronic pumps.
   2.3. Air handlers.
   2.4. Packaged cooling equipment.
   2.5. Furnaces.
   2.6. Heat pumps.
   2.7. Boilers.
   2.8. Chillers.
   2.9. Heat rejection equipment (open- and closed-circuit cooling towers, dry coolers).

	2.10. Electric resistance coils. 2.11. Condensing units. 2.12. Motors for fans and pumps. 2.13. Energy recovery devices. 3. For each piece of equipment identified in Item 2, include the following, as applicable: 3.1. Equipment name or tag consistent with that found on the design documents. 3.2. Rated efficiency level. 3.3. Rated capacity. 3.4. Where not provided by the simulation program report in Item 1, documentation of the calculation of any weighted equipment efficiencies input into the program. 3.5. Electrical input power for fans and pumps (before any speed or frequency control device) at design condition and calculation of input value (W/cfm or W/gpm) or W/gpm (W/Lps). 4. Floor plan of the *building,* identifying: 4.1. How portions of the buildings are assigned to the simulated thermal blocks. 4.2. Areas of the *building* that are not covered under the requirements of **Section C403.1.1**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#324	Adds a new Section C409.6. Prescribes how the standard reference design and proposed design building models must be configured and analyzed. Adds a new subsection C409.6.1. Defines how the proposed design must be configured and analyzed. Adds a new subsection C409.6.1.1 that prescribes how the geometry of buildings must be configured using one or more thermal blocks. Adds a new subsection C409.6.1.1.1. Adds a new subsection C409.6.1.2. Adds a new subsection C409.6.1.2.1. Adds a new subsection C409.6.1.3. Adds a new subsection C409.6.1.3.1. Adds a new subsection C409.6.1.3.2. Adds a new subsection C409.6.1.4. Adds a new subsection C409.6.1.4.1. Adds a new subsection C409.6.1.4.2. Adds a new subsection C409.6.1.4.3. Adds a new subsection C409.6.1.4.4. Adds a new subsection C409.6.1.4.5. Adds a new subsection C409.6.1.4.6. Adds a new subsection C409.6.1.4.7. Adds a new subsection C409.6.1.4.8. Adds a new subsection C409.6.1.5. Adds a new subsection C409.6.1.6. Adds a new subsection C409.6.1.7.

	Adds a new subsection C409.6.1.8. Adds a new subsection C409.6.1.9. Adds a new subsection C409.6.1.10. Adds a new subsection C409.6.1.10.1. Adds a new Table C409.6.1.10.1. Adds a new subsection C409.6.1.10.2. Adds a new subsection C409.6.1.10.3. Adds a new subsection C409.6.1.10.3.
Related Mods: CEPI-76-21, CED1-182-22, CED1-198-22,	**C409.6 Calculation procedures.** Except as specified by this section, the *standard reference design* and *proposed design* shall be configured and analyzed using identical methods and techniques. **C409.6.1 Simulation of the proposed building design.** The *proposed design* shall be configured and analyzed as specified in this section. **C409.6.1.1 Thermal block geometry.** The geometry of buildings shall be configured using one or more thermal blocks. Each *thermal block* shall define attributes, including *thermal block* dimensions, number of floors, floor-to-floor height and floor-to-ceiling height. Simulation software may allow the use of simplified shapes (such as rectangle, L-shaped, H-shaped, U-shaped or T-shaped) to represent thermal blocks. Where actual building shape does not match these predefined shapes, simplifications are permitted, provided that the following requirements are met: 1. The *conditioned floor area* and volume of each thermal block shall match the *proposed design* within 10 percent. 2. The area of each exterior envelope component from **Table C402.1.4** is accounted for within 10 percent of the actual design. 3. The area of vertical *fenestration* and skylights is accounted for within 10 percent of the actual design. 4. The orientation of each component in Items 2 and 3 is accounted for within 45 degrees of the actual design. The creation of additional thermal blocks may be necessary to meet these requirements. A more complex zoning of the *building* shall be allowed where all thermal zones in the reference and proposed models are the same, and rules related to thermal block geometry and HVAC system assignment to *thermal blocks* are met with appropriate assignment to thermal zones. **Exception:** Portions of the *building* that are unconditioned or served by systems not covered by the requirements of **Section C403.1.1** shall be omitted. **C409.6.1.1.1 Number of thermal blocks.** One or more thermal blocks may be required per *building* based on the following restrictions: 1. Each thermal block shall have not more than one building use. 2. Each thermal block shall be served by not more than one type of HVAC system. A single block shall be created for each unique HVAC system and building use combination, and multiple HVAC units or components of the same type shall be combined in accordance with **Section C409.6.1.10.2**. 3. Each thermal block shall have not more than a single defined floor-to-floor or floor-to-ceiling height. Where floor heights differ by more than 2 feet, separate thermal blocks shall be created. 4. Each block shall include either above-grade or below-grade stories. For buildings with both above-grade and below-grade stories, separate blocks shall be created for each. Where blocks have *exterior walls* partially below

grade, if greater than 50 percent of the exterior wall surface is below grade, then simulate the block as below grade; otherwise, simulate as above grade.

5. Where a block includes multiple stories, separate blocks shall be created, if needed, to comply with both the following fenestration modeling requirements:

   5.1. The product of the *proposed design U-factor* times the area of windows ($U \times A$) on a given story of each facade shall not differ by more than 15 percent of the average $U \times A$ for that modeled facade in each block.

   5.2. The product of the *proposed design* SHGC times the area of windows (SHGC × A) on a given story of each facade shall not differ by more than 15 percent of the average SHGC × A for that modeled facade in each block.

6. For a building model with multiple blocks, the blocks shall be configured together to have the same adjacencies as the actual building design.

C409.6.1.2 Thermal zoning. Each story in a thermal block shall be modeled as follows:

1. Below-grade stories shall be modeled as a single thermal zone.
2. Where any facade in the block is less than 45 feet (13.7 m) in length, it shall be modeled as a single thermal zone per story.
3. For stories not covered by Item 1 or Item 2, each story shall be modeled with five thermal zones. A perimeter zone shall be created, extending from each facade to a depth of 15 feet (4572 mm). Where facades intersect, the zone boundary shall be formed by a 45-degree angle with the two facades. The remaining area of each story shall be modeled as a core zone with no *exterior walls* .

C409.6.1.2.1 Core and shell, build-out and future system construction analysis. Where the building permit applies to only a portion of the HVAC system in a *building* and the remaining components will be designed under a future building permit or were previously installed, such components shall be modeled as follows:

1. Blocks including existing or future HVAC *zone* served by independent systems and not part of the construction project shall not be modeled.
2. Where the HVAC *zones* that do not include complete HVAC systems in the permit are intended to receive HVAC services from systems that are part of the construction project, their proposed zonal systems shall be modeled with equipment that meets, but does not exceed, the requirements of **Section C403**.
3. Where existing HVAC systems serve permitted *zone* equipment, the existing systems shall be modeled with equipment matching the manufacturer's stated efficiency for the installed equipment or equipment that meets, but does not exceed, the requirements of **Section C403**.
4. Where the central plant heating and cooling equipment is completely replaced and HVAC *zones* with existing systems receive HVAC services from systems in the permit, their proposed zonal systems shall be modeled with equipment that meets, but does not exceed, the requirements of **Section C403**.

C409.6.1.3 Occupancy. Building occupancies modeled in the *standard reference design* and the *proposed design* shall comply with the following requirements.

C409.6.1.3.1 Occupancy type. The occupancy type for each thermal block shall be consistent with the building occupancy and uses specified in **Table C409.4**. Portions of the building occupancy and uses other than those specified in **Table C409.4** shall not be included in the simulation. Surfaces adjacent to such excluded *building* portions shall be modeled as adiabatic in the simulation program.

C409.6.1.3.2 Occupancy schedule, density and heat gain. The occupant density, heat gain and schedule shall be for multifamily, offices, retail spaces, libraries, hotels/ motels or schools as specified by **ANSI/ASHRAE/IES 90.1**, Normative Appendix C.

C409.6.1.4 Building thermal envelope components. *Building thermal envelope* components modeled in the *standard reference design* and the *proposed design* shall comply with the requirements of this section.

C409.6.1.4.1 Roofs. The roof *U-factor* and area shall be modeled as in the *proposed design* . If different roof thermal properties are present in a single thermal block, an area-weighted *U-factor* shall be used. Roofs shall be modeled with insulation above a steel roof deck, with a solar reflectance of 0.25 and an *emittance* of 0.90.

Exception: For Climate Zones 0, 1, 2 and 3, solar reflectance and *emittance* shall be as specified in **Section C402.4** and **Table C402.4**.

C409.6.1.4.2 Above-grade walls. The *U-factor* and area of *above-grade walls* shall be modeled as in the *proposed design* . If different wall constructions exist on the facade of a thermal block, an area-weighted *U-factor* shall be used. Walls will be modeled as steel-frame construction.

C409.6.1.4.3 Below-grade walls. The *C-factor* and area of below-grade walls shall be modeled as in the *proposed design* . If different below-grade wall constructions exist in a thermal block, an area-weighted *C-factor* shall be used.

C409.6.1.4.4 Above-grade exterior floors. The *U-factor* and area of floors shall be modeled as in the *proposed design* . If different floor constructions exist in the thermal block, an area-weighted *U-factor* shall be used. Exterior floors shall be modeled as steel frame.

C409.6.1.4.5 Slab-on-grade floors. The *F-factor* and perimeter of slab-on-grade floors shall be modeled as in the *proposed design* . If different slab-on-grade floor constructions exist in a thermal block, a perimeter-weighted *F-factor* shall be used.

C409.6.1.4.6 Vertical fenestration. The window area and area-weighted *U-factor* and SHGC shall be modeled for each facade based on the *proposed design* . Each exterior surface in a thermal block must comply with **Section C409.6.1.1.1**, Item 5. Windows shall be combined into a single window centered on each facade based on the area and sill height input by the user. Where different *U*-values, SHGC or sill heights exist on a single facade in a block, the area-weighted average for each shall be input by the user.

C409.6.1.4.7 Skylights. The skylight area and area-weighted *U-factor* and SHGC shall be modeled for each roof based on the *proposed design* . Skylights shall be combined into a single skylight centered on the roof of each zone based on the area input by the user.

C409.6.1.4.8 Exterior shading. Permanent window overhangs shall be modeled. Where windows with and without overhangs or windows with different overhang projection factors exist on a facade, window width-weighted projection factors shall be

input by the user as follows:

$$P_{avg} = (A_1 \times L_{o1} + A_2 \times L_{o2} ... + A_n \times L_{on})/(L_{w1} + L_{w2} ... + L_{wn})$$

Equation 4-37

where:

P_{avg} = Average overhang projection modeled in the simulation tool

A = Distance measured horizontally from the farthest continuous extremity of any overhang, eave or permanently attached shading device to the vertical surface of the glazing.

L_o = Length off the overhang.

L_w = Length of the window.

C409.6.1.5 Lighting. Interior lighting power density shall be equal to the allowance in **Table C405.3.2(1)** for multifamily buildings, offices, retail spaces, libraries or schools. The lighting schedule shall be for multifamily buildings, offices, retail spaces, libraries or schools as specified by **ANSI/ASHRAE/IES 90.1**, Normative Appendix C. The impact of lighting controls is assumed to be captured by the lighting schedule and no explicit controls shall be modeled. Exterior lighting shall not be modeled.

C409.6.1.6 Miscellaneous equipment. The miscellaneous equipment schedule and power shall be for multifamily buildings, offices, retail spaces, libraries or schools as specified by **ANSI/ASHRAE/IES 90.1**, Normative Appendix C. The impact of miscellaneous equipment controls is assumed to be captured by the equipment schedule and no explicit controls shall be modeled.

Exceptions:

1. Multiple-family dwelling units shall have a miscellaneous load density of 0.42 watts per square foot.
2. Multiple-family *common areas* shall have a miscellaneous load density of 0 watts per square foot.

C409.6.1.7 Elevators. Elevators shall not be modeled.

C409.6.1.8 Service water heating equipment. *Service water heating* shall not be modeled.

C409.6.1.9 On-site renewable energy systems. On-site renewable energy systems shall not be modeled.

C409.6.1.10 HVAC equipment. Where proposed or where reference system parameters are not specified in **Section C409**, HVAC systems shall be modeled to meet the minimum requirements of **Section C403**.

C409.6.1.10.1 Supported HVAC systems. At a minimum, the HVAC systems shown in **Table C409.6.1.10.1** shall be supported by the simulation program.

C409.6.1.10.2 Proposed building HVAC system simulation. The HVAC systems shall be modeled as in the *proposed design* at design conditions unless otherwise stated, with clarifications and simplifications as described in **Tables C409.6.1.10.2(1)** and **C409.6.1.10.2(2)**. System parameters not described in the following sections shall be simulated to meet the minimum requirements of **Section C403**. All *zones* within a thermal block shall be served by the same HVAC system type as described in **Section C409.6.1.1.1**, Item 2. Heat loss from *ducts* and pipes shall not be modeled. The proposed building system parameters in **Table C409.6.1.10.2(1)** are based on input of full-load equipment efficiencies with adjustments using part-load curves integrated into the simulation program. Where other approaches to part-load adjustments are used, it is permitted for specific input parameters to vary. The simulation program shall model part-load HVAC equipment performance using one of the following:

1. Full-load efficiency adjusted for fan power input that is modeled separately and typical part-load performance adjustments for the proposed equipment.
2. Part-load adjustments based on input of both full-load and part-load metrics.
3. Equipment-specific adjustments based on performance data provided by the equipment manufacturer for the proposed equipment.

Where multiple system components serve a thermal block, average values weighted by the appropriate metric as described in this section shall be used.

1. Where multiple *fan systems* serve a single thermal block, fan power shall be based on a weighted average using the design supply air (cfm).
2. Where multiple cooling systems serve a single thermal block, the coefficient of performance (COP) shall be based on a weighted average using cooling capacity. Direct expansion (DX) coils shall be entered as multistage if more than 50 percent of coil capacity serving the thermal block is multistage with staged controls.
3. Where multiple heating systems serve a single thermal block, thermal efficiency or heating COP shall be based on a weighted average using heating capacity.
4. Where multiple boilers or chillers serve a heating water or chilled water loop, efficiency shall be based on a weighted average for using heating or cooling capacity.
5. Where multiple cooling towers serving a condenser water loop are combined, the cooling tower efficiency, cooling tower design approach and design range are based on a weighted average of the design water flow rate through each cooling tower.
6. Where multiple pumps serve a heating water, chilled water or condenser water loop, pump power shall be based on a weighted average for using design water flow rate.
7. Where multiple system types with and without economizers are combined, the economizer maximum outside air fraction of the combined system shall be based on the weighted average of 100 percent supply air for systems with economizers and design outdoor air for systems without economizers.
8. Multiple systems with and without ERVs cannot be combined.
9. Systems with and without supply-air temperature reset controls cannot be combined.
10. Systems with different fan controls (constant volume, multispeed or VAV) for supply fans cannot be combined.

C409.6.1.10.3 Demand control ventilation. Demand control ventilation (DCV) shall be modeled using a simplified approach that adjusts the design outdoor supply airflow rate based on the floor area of the *building* that is covered by DCV. The simplified method shall accommodate both variable DCV and on/off DCV, giving on/off DCV one third of

	the effective floor control area of the variable DCV. Outdoor air reduction coefficients shall be as stated in **Table C409.6.1.10.3**. **Exception:** On/off DCV shall receive full effective area adjustment for R-1 and R-2 occupancies.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#325	Adds a new Table C409.6.1.10.1 Adds a new Table C409.6.1.10.2(1). Adds a new Table C409.6.1.10.2(2). Adds a new Table C409.6.1.10.3.
Related Mods: CEPI-76-21, CED1-198-22	TABLE C409.6.1.10.1

PROPOSED BUILDING HVAC SYSTEMS SUPPORTED BY HVAC TSPR SIMULATION SOFTWARE

SYSTEM NO.	SYSTEM NAME
1	Packaged terminal air conditioner (with electric or hydronic heat)
2	Packaged terminal air heat pump
3	Packaged single-zone gas furnace[a] and/or air-cooled air conditioner (includes split systems)[b]
4	Packaged single-zone heat pump (air to air only)(includes split systems[b] and electric or gas supplemental heat)
5	Variable refrigerant flow (air cooled only)
6	Four pipe fan coil
7	Water-source heat pump (water loop), water-source v*ariable refrigerant flow system* or water-source air conditioner
8	Ground source heat pump
9	Packaged variable air volume (DX cooling)[a]
10	Variable air volume (hydronic cooling)[a]
11	Variable air volume with fan-powered terminal units
12	Dedicated outdoor air system (in conjunction with systems 1–8)

a. Reheat or primary heat may be electric, hydronic or gas furnace.
b. Condensing units with DX air handlers are modeled as package furnaces with air conditioners or heat pumps.

TABLE C409.6.1.10.2(1) PROPOSED BUILDING SYSTEM PARAMETERS

CATEGORY	PARAMETER	FIXED OR USER DEFINED	REQUIRED	APPLICABLE SYSTEMS
HVAC system type	System type	User defined	Selected from **Table C409.6.1.10.1**	All
System sizing	Design day information	Fixed	99.6% heating design and 1% dry-bulb and 1% wet-bulb cooling design	All
	Zone coil capacity	Fixed	Sizing factors used are 1.25 for heating equipment and 1.15 for cooling equipment	All
	Supply airflow	Fixed	Based on a supply-air-to-room-air temperature setpoint difference of 20°F (11.2°C)	1–11
		Fixed	Equal to required outdoor air ventilation	12
Outdoor ventilation air	Portion of supply air with proposed filter ≥ MERV 13	User defined	Percentage of supply airflow subject to higher filtration (adjusts baseline fan power higher; prorated)	All
	Outdoor ventilation airflow rate	Fixed	As specified in **ANSI/ASHRAE/ IES 90.1**, Normative Appendix C; adjusted for proposed DCV control	All
	Outdoor ventilation supply airflow rate adjustments	Fixed	Based on **ASHRAE 62.1** Section 6.2.4.3, system ventilation efficiency (E_v) is 0.75	9–11
		Fixed	System ventilation efficiency (E_v) is 1.0	1–8, 12
		Fixed	Basis is 1.0 zone air distribution effectiveness	All

System operation	Space temperature setpoints	Fixed	As specified in **ANSI/ASHRAE/ IES 90.1**, Normative Appendix C, except: • Multiple-family, which shall use 68°F heating and 76°F cooling setpoints. • Hotel/motel setpoints, which shall be 70°F heating and 72°F cooling.	1–11
	Fan operation—occupied	User defined	Runs continuously during occupied hours or cycles to meet load. Multispeed fans reduce airflow related to thermal loads.	1–11
	Fan operation—occupied	Fixed	Fan runs continuously during occupied hours	12
	Fan operation—night cycle	Fixed	Fan cycles on to meet setback temperatures	1–11
Packaged equipment efficiency	DX cooling efficiency	User defined	Cooling COP without fan energy calculated in accordance with **Section C409.6.1.10.2**	1, 2, 3, 4, 5,7, 8, 9, 11,12
	DX coil number of stages	User defined	Single stage or multistage	3, 4, 9, 10, 11, 12
	Heat pump efficiency	User defined	Heating COP without fan energy calculated in accordance with **Section C409.6.1.10.2**	2, 4, 5, 7, 8, 12
	Furnace efficiency	User defined	Furnace thermal efficiency	3, 9, 11, 12
	Heat source	User defined	Electric resistance or gas furnace	2, 4, 7, 8, 12

Heat pump supplemental heat	Control	Fixed	Supplemental electric heat locked out above 40°F OAT. Runs as needed in conjunction with compressor between 40°F and 0°F. Gas heat operates in place of the heat pump when the heat pump cannot meet load.	2, 4, 7, 8, 12
System fan power and controls	Part-load fan controls[a]: • Constant volume. • Two speed or three speed. • VAV.	User defined	Static pressure reset included for VAV	1–8 (CAV, two or three speed), 9, 10, 11 (VAV), 12 (CAV and VAV)
	Design fan power (W/cfm)	User defined	Input electric power for all fans required to operate at fan system design conditions divided by the supply airflow rate. This is a wire- to-air value, including all drive, motor efficiency and other losses.	All
	Low-speed and medium-speed fan power	User defined	Low-speed input electric power for all fans required to operate at low- speed conditions divided by the low-speed supply airflow rate. This is a wire-to-air value, including all drive, motor efficiency and other losses. Also provide medium-speed values for three- speed fans.	1-8
	Supply air temperature (SAT) controls	User defined	If not SAT reset, then constant at 55°F. Options for reset based on OAT or warmest zone. If warmest zone, then the user can specify the minimum and maximum temperatures. If OAT reset, SAT is reset higher to 60°F at an outdoor low of 50°F. SAT is 55°F at an outdoor high of 70°F.	9, 10, 11

Variable air volume systems	Minimum terminal unit airflow percentage	User defined	Average minimum terminal unit airflow percentage for thermal block weighted by cfm or minimum required for outdoor air ventilation, whichever is higher.	9, 10, 11
	Terminal unit heating source	User defined	Electric or hydronic	9, 10, 11
	Dual setpoint minimum VAV damper position	User defined	Heating maximum airflow fraction	9, 10
	Fan-powered terminal unit (FPTU) type	User defined	Series or parallel FPTU	11
	Parallel FPTU fan	Fixed	Sized for 50% peak primary air at 0.35 W/cfm	11
	Series FPTU fan	Fixed	Sized for 50% peak primary air at 0.35 W/cfm	11
Economizer	Economizer presence	User defined	Yes or no	3, 4, 5, 6, 9, 10, 11
	Economizer control type	Fixed	Lockout on differential db temperature (OAT > RAT) in Climate Zones 5A, 6A, all B & C; fixed enthalpy > 28 Btu/lb (47kJ/ kg) or fixed db OAT > 75°F (24°C) in Climate Zones 0A through 4A	3, 4, 5, 6, 9, 10, 11
Energy recovery	Sensible effectiveness	User defined	Heat exchanger sensible effectiveness at design heating and cooling conditions	3, 4, 9, 10, 11, 12
	Latent effectiveness	User defined	Heat exchanger latent effectiveness at design heating and cooling conditions	3, 4, 9, 10, 11, 12
	Economizer bypass	User defined	If ERV is bypassed or wheel rotation is slowed during economizer conditions (yes/no)	3, 4, 9, 10, 11, 12

	Economizer bypass active	Fixed	If there is a bypass, it will be active between 45°F and 75°F outside air temperature	3, 4, 9, 10, 11, 12
	Bypass SAT setpoint	User defined	If bypass, target SAT	3, 4, 9, 10, 11, 12
	Fan power reduction during bypass (W/ cfm)	User defined	If ERV system includes bypass, static pressure setpoint and variable speed fan, fan power can be reduced during economizer conditions	3, 4, 9, 10, 11, 12
Demand control ventilation (DCV)	DCV application on/ off	User defined	Percent of thermal block floor area under occupied standby controls, on/off only with occupancy sensor and no variable control	3, 4, 9, 10, 11, 12
	DCV application CO_2	User defined	Percentage of thermal block floor area under variable DCV control (CO_2); may include both variable and on/off controls	3, 4, 9, 10, 11, 12
DOAS	DOAS fan power W/ cfm	User defined	Fan electrical input power in W/ cfm of supply airflow	12
	DOAS supplemental heating and cooling	User defined	Heating source, cooling source, energy recovery and respective efficiencies	12
	Maximum SAT setpoint (cooling)	User defined	SAT setpoint if DOAS includes supplemental cooling	12
	Minimum SAT setpoint (heating)	User defined	SAT setpoint if DOAS includes supplemental heating	12
Heating plant	Boiler efficiency	User defined	Boiler thermal efficiency	1, 6, 7, 9, 10, 11, 12
	Heating water loop configuration	User defined	Constant flow primary only; variable flow primary only; constant flow primary/variable flow secondary; variable flow primary and secondary	1, 6, 7, 9, 10, 11, 12

			Heating water primary pump power (W/gpm)	User defined	Heating water primary pump input W/gpm heating water flow	1, 6, 7, 9, 10, 11, 12
			Heating water secondary pump power (W/gpm)	User defined	Heating water secondary pump input W/gpm heating water flow (if primary/secondary)	1, 6, 7, 9, 10, 11, 12
			Heating water loop temperature	User defined	Heating water supply and return temperatures, °F	1, 6, 9, 10,11
			Heating water loop supply temperature reset	Fixed	Reset HWS by 27.3% of design delta-T (HWS-70°F space heating temperature setpoint) between 20°F and 50°F OAT	1, 6, 7, 9, 10, 11, 12
			Boiler type	Fixed	Noncondensing boiler where input thermal efficiency is less than 86%; condensing boiler otherwise	1, 6, 7, 9, 10, 11, 12
		Chilled water plant	Chiller compressor type	User defined	Screw/scroll, centrifugal or reciprocating	6, 10, 11, 12
			Chiller condenser type	User defined	Air cooled or water cooled	6, 10, 11, 12
			Chiller full-load efficiency	User defined	Chiller COP	6, 10, 11, 12
			Chilled water loop configuration	User defined	Variable flow primary only, constant flow primary/variable flow secondary, variable flow primary and secondary	6, 10, 11,12
			Chilled water primary pump power (W/gpm)	User defined	Primary pump input W/gpm chilled water flow	6, 10, 11,12
			Chilled water secondary pump power (W/gpm)	User defined	Secondary pump input W/gpm chilled water flow (if primary/ secondary)	6, 10, 11,12
			Chilled water temperature reset included	User defined	Yes/no	6, 10, 11,12

	Chilled water temperature reset schedule (if included)	Fixed	Outdoor air reset: CHW supply temperature of 44°F at 80°F (26.7°C) outdoor air db temperature and above, CHW supply temperature of 54°F at 60°F outdoor air db temperature and below, ramped linearly between	6, 10, 11,12
	Condenser water pump power (W/ gpm)	User defined	Pump input W/gpm condenser water flow	6, 7, 8, ,10, 11, 12
	Condenser water pump control	User defined	Constant speed or variable speed	6, 7, 8, 10, 11,12
	Heat rejection equipment efficiency	User defined	Gpm/hp tower fan	6, 7, 10, 11, 12
	Heat rejection fan control	User defined	Constant or variable speed	6, 7, 10, 11, 12
	Heat rejection approach and range	User defined	Design cooling tower approach and range temperature	6, 7, 10, 11, 12
Heat pump loop	Loop flow and heat pump control valve	Fixed	Two-position valve with VFD on pump; loop flow at 3 gpm/ton	7, 8
	Heat pump loop minimum and maximum temperature control	User defined	User input: restrict to minimum 20°F and maximum 40°F temperature difference	7
GLHP well field	—	Fixed	Bore depth = 250 ft Bore length 200 ft/ton for the greater of cooling or heating load Bore spacing = 15 ft Bore diameter = 5 in ¾″ (19 mm) polyethylene pipe Ground and grout conductivity = 4.8 Btu × in/h × ft^2 × °F	8

or SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, °C = (°F – 32)/1.8, 1 British thermal unit per hour = 0.2931 W, 1 British thermal unit per pound = 2.33 kJ/kg, 1 cubic foot per minute = 0.4719 L/s, 1 cubic foot per minute/foot = 47.82 W, COP = (Btu/h × hp)/(2,550.7), 1 gallon per minute = 3.79 L/ m.

CHW = Chilled Water, db = dry bulb, DOAS = Dedicated Outdoor Air System, GLHP = Ground Loop Heat Pump, HWS = Hot Water Supply, OAT = Outdoor Air Temperature, SAT = Supply Air Temperature, VFD = Variable Frequency Drive, wb = wet bulb.

a. Part-load fan power and pump power modified in accordance with **Table C409.6.1.10.2(2).**

TABLE C409.6.1.10.2(2)

FAN AND PUMP POWER CURVE COEFFICIENTS

EQUATION TERM	FAN POWER COEFFICIENTS	PUMP POWER COEFFICIENTS	
	VSD + SP Reset	Ride Pump Curve	VSD + DP/Valve Reset
b	0.0408	0	0
x	0.088	3.2485	0.0205
x^2	-0.0729	-4.7443	0.4101
x^3	0.9437	2.5295	0.5753

TABLE C409.6.1.10.3

DCV OUTDOOR AIR REDUCTION CURVE COEFFICIENTS

EQUATION TERM	DCV OSA REDUCTION (*y*) AS A FUNCTION OF EFFECTIVE DCV CONTROL FLOOR AREA (*x*)			
	Office	School	Hotel, Motel, Multiple-Family, Dormitory	Retail
b	0	0	0	0
x	0.4053	0.2676	0.5882	0.4623
x^2	-0.8489	0.7753	-1.0712	-0.848
x^3	1.0092	-1.5165	1.3565	1.1925
x^4	-0.4168	0.7136	-0.6379	-0.5895

	OSA = Outside Air.	

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#326	Adds a new subsection C409.6.2. Adds a new subsection C409.6.2.1. Adds a new subsection C409.6.2.2. Adds a new subsection C409.6.2.3. Adds a new subsection C409.6.2.4. Adds a new subsection C409.6.2.5. Adds a new subsection C409.6.2.6. Adds a new subsection C409.6.2.7. Adds a new subsection C409.6.2.8. Adds a new subsection C409.6.2.9. Adds a new subsection C409.6.2.10. Adds a new subsection C409.6.2.11. Adds a new Table C409.6.2.11(1). Adds a new Table C409.6.2.11(2). Systems types for office and retail building occupancy groups. Adds a new Table C409.6.2.11(3). System types for hotel and multifamily building occupancy groups.
Related Mods: CEPI-76-21	**C409.6.2 Simulation of the standard reference design.** The *standard reference design* shall be configured and analyzed as specified in this section. **C409.6.2.1 Utility rates.** Same as the *proposed design* . **C409.6.2.2 Thermal blocks.** Same as the *proposed design* . **C409.6.2.3 Thermal zoning.** Same as the *proposed design* . **C409.6.2.4 Occupancy type, schedule, density and heat gain.** Same as the *proposed design* . **C409.6.2.5 Envelope components.** Same as the *proposed design* **C409.6.2.6 Lighting.** Same as the *proposed design* . **C409.6.2.7 Miscellaneous equipment.** Same as the *proposed design* . **C409.6.2.8 Elevators.** Not modeled. Same as the *proposed design* . **C409.6.2.9 Service water heating equipment.** Not modeled. Same as the *proposed design*. **C409.6.2.10 On-site renewable energy systems.** Not modeled. Same as the *proposed design*. **C409.6.2.11 HVAC equipment.** The reference building design HVAC equipment consists of separate space conditioning systems as described in **Tables C409.6.2.11(1)** through **C409.6.2.11(3)** for the appropriate building use types. In these tables, "warm" refers to Climate Zones 0 through 2 and 3A, and "cold" refers to Climate Zones 3B, 3C and 4 through 8.

TABLE C409.6.2.11(1)

REFERENCE BUILDING DESIGN HVAC COMPLEX SYSTEMS

BUILDING TYPE PARAMETER	BUILDING TYPE			
	Large Office (warm)	**Large Office (cold)**	**School (warm)**	**School (cold)**
System type	VAV/RH	VAV/RH	VAV/RH	VAV/RH
	Water-cooled chiller	Water-cooled chiller	Water-cooled chiller	Water-cooled chiller
	Electric reheat (PIU)	Gas boiler	Electric reheat (PIU)	Gas boiler
Fan control	VSD (no SP reset)	VSD (no SP reset)	VSD (no SP reset)	VSD (no SP reset)
Main fan power [W/cfm (W × s/L)] proposed ≥ MERV 13	1.165 (2.468)	1.165 (2.468)	1.165 (2.468)	1.165 (2.468)
Main fan power [W/cfm (W × s/L)] proposed < MERV 13	1.066 (2.259)	1.066 (2.259)	1.066 (2.259)	1.066 (2.259)
Zonal fan power [W/cfm (W × s/L)]	0.35 (0.75)	NA	0.35 (0.75)	NA
Minimum zone airflow fraction	1.5 × Voz	1.5 × Voz	1.2 × Voz	1.2 × Voz
Heat/cool sizing factor	1.25/1.15	1.25/1.15	1.25/1.15	1.25/1.15
Outdoor air economizer	No	Yes except 4A	No	Yes except 4A
Occupied OSA (= proposed)	Sum(Voz)/0.75	Sum(Voz)/0.75	Sum(Voz)/0.65	Sum(Voz)/0.65

Energy recovery ventilator efficiency ERR; ERV bypass SAT setpoint	NA	NA	50% No bypass	50% 60°F except 4A
DCV	No	No	No	No
Cooling source	(2) Water-cooled centrifugal chillers	(2) Water-cooled centrifugal chillers	(2) Water-cooled screw chillers	(2) Water-cooled screw chillers
Cooling COP (net of fan)	Path B for profile	Path B for profile	Path B for profile	Path B for profile
Heating source (reheat)	Electric resistance	Gas boiler	Electric resistance	Gas boiler
Furnace or boiler efficiency	1.0	75% E_t	1.0	80% E_t
Condenser heat rejection	Axial fan open circuit cooling tower			
Cooling tower efficiency [gpm/fan hp (L/s × fan kW)]	38.2	38.2	38.2	38.2
Tower turndown [> 300 ton (1060 kW)]	50%	50%	50%	50%
Pump (constant flow/ variable flow)	Constant flow; 10°F (5.6°C) range	Constant flow; 10°F (5.6°C) range	Constant flow; 10°F (5.6°C) range	Constant flow; 10°F (5.6°C) range
Tower approach	25.72 – (0.24 × wb), where wb is the 0.4% evaporation design wet- bulb temperature (°F)			
Cooling condenser pump power [W/gpm (W × s/L)]	19 (300)	19 (300)	19 (300)	19 (300)
Cooling primary pump power [W/gpm (W × s/L)]	9 (142)	9 (142)	9 (142)	9 (142)
Cooling secondary pump power [W/gpm (W × s/L)]	13 (205)	13 (205)	13 (205)	13 (205)
Cooling coil chilled water delta-T, °F (°C)	12 (6.7)	12 (6.7)	12 (6.7)	12 (6.7)

Design chilled water supply temperature, °F (°C)	44 (6.7)	44 (6.7)	44 (6.7)	44 (6.7)
Chilled water supply temperature (CHWST) reset setpoint vs. outside air temperature (OAT), °F (°C)	CHWST: 44-54/ OAT 80-60 (6.7-12.2/ 26.7-15.6)	CHWST: 44-54/ OAT 80-60 (6.7-12.2/ 26.7-15.6)	CHWST: 44-54/ OAT 80-60 (6.7-12.2/ 26.7-15.6)	CHWST: 44-54/ OAT 80-60 (6.7-12.2/ 26.7-15.6)
CHW cooling loop pumping control	2-way valves & pump VSD	2-way valves & pump VSD	2-way valves & pump VSD	2-way valves & pump VSD
Heating pump power [W/ gpm (W × s/L)]	16.1 (254)	16.1 (254)	19 (300)	19 (300)
Heating oil HW dT, °F (°C)	50 (10)	50 (10)	50 (10)	50 (10)
Design hot water supply temperature (HWST), °F (°C)	180 (82.2)	180 (82.2)	180 (82.2)	180 (82.2)
HWST reset setpoint vs. OAT, °F (°C)	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)
Heat loop pumping control	2-way valves & pump VSD	2-way valves & pump VSD	2-way valves & pump VSD	2-way valves & pump VSD

For SI: °C = (°F – 32)/1.8, 1 hp = 0.746 kW, 1 ton = 3.517 kW.

CHW = Chilled Water, ERR = Enthalpy Recovery Ratio, NA = Not Applicable, OSA = Outside Air, PIU = Parallel Powered Induction Unit, RH = Relative Humidity, SP = Static Pressure, Voz = Outdoor airflow to the zone, VSD = Variable Speed Drive.

TABLE C409.6.2.11(2)

TSPR REFERENCE BUILDING DESIGN HVAC SIMPLE SYSTEMS

	BUILDING TYPE

BUILDING TYPE PARAMETER	Medium Office (warm)	Medium Office (cold)	Small Office (warm)	Small Office (cold)	Retail (warm)	Retail (cold)
System type	Package VAV—electric reheat	Package VAV—hydronic reheat	PSZ-HP	PSZ-AC	PSZ-HP	PSZ-AC
Fan control	VSD (no SP reset)	VSD (no SP reset)	Constant volume	Constant volume	Constant volume	Constant volume
Main fan power [W/cfm (W × s/L)] proposed ≥ MERV 13	1.285 (2.723)	1.285 (2.723)	0.916 (1.941)	0.916 (1.941)	0.899 (1.905)	0.899 (1.905)
Main fan power [W/cfm (W × s/L)] proposed < MERV 13	1.176 (2.492)	1.176 (2.492)	0.850 (1.808)	0.850 (1.808)	0.835 (1.801)	0.835 (1.801)
Zonal fan power [W/ cfm (W × s/L)]	0.35 (0.75)	NA	NA	NA	NA	NA
Minimum zone airflow fraction	30%	30%	NA	NA	NA	NA
Heat/cool sizing factor	1.25/1.15	1.25/1.15	1.25/1.15	1.25/ 1.15	1.25/1.15	1.25/ 1.15
Supplemental heating availability	NA	NA	< 40°F OAT	NA	< 40°F OAT	NA
Outdoor air economizer	No	Yes except 4A	No	Yes except 4A	No	Yes except 4A
Occupied OSA source	Packaged unit, occupied damper, all building use types					
Energy recovery ventilator	No	No	No	No	No	No
DCV	No	No	No	No	No	No
Cooling source	DX, multistage	DX, multistage	DX, 1 stage (heat pump)	DX, single stage	DX, 1 stage (heat pump)	DX, single stage
Cooling COP (net of fan)	3.40	3.40	3.00	3.00	3.40	3.50

Heating source	Electric resistance	Gas boiler	Heat pump	Furnace	Heat pump	Furnace
Heating COP (net of fan)/furnace or boiler efficiency	1.0	75% E_t	3.40	80% E_t	3.40	80% E_t

For SI: °C = (°F – 32)/1.8.

NA = Not Applicable, OSA = Outside Air, RH = Relative Humidity, SP = Static Pressure, VSD = Variable Speed Drive.

TABLE C409.6.2.11(3)

TSPR REFERENCE BUILDING DESIGN HVAC SIMPLE SYSTEMS

BUILDING TYPE PARAMETER	**BUILDING TYPE**			
	Hotel (warm)	**Hotel (cold)**	**Multifamily (warm)**	**Multifamily (cold)**
System type	PTHP	PTAC	PTHP	PTAC
Fan control	Constant volume	Constant volume	Constant volume	Constant volume
Main fan power [W/cfm (W × s/L)]	0.300 (0.636)	0.300 (0.636)	0.300 (0.636)	0.300 (0.636)
Heat/cool sizing factor	1.25/1.15	1.25/1.15	1.25/1.15	1.25/1.15
Supplemental heating availability	< 40°F	NA	< 40°F	NA
Outdoor air economizer	No	No	No	No
Occupied OSA source	Packaged unit, occupied damper	Packaged unit, occupied damper	Packaged unit, occupied damper	Packaged unit, occupied damper
Energy recovery ventilator	No	No	No	No
DCV	No	No	No	No

Cooling source	DX, 1 stage (heat pump)	DX, 1 stage	DX, 1 stage (heat pump)	DX, 1 stage
Cooling COP (net of fan)	3.10	3.20	3.10	3.20
Heating source	PTHP	(2) Hydronic boiler	PTHP	(2) Hydronic boiler
Heating COP (net of fan)/furnace or boiler efficiency	3.10	75% E_t	3.10	75% E_t
Heating pump power [W/gpm (W × s/L)]	NA	19 (300)	NA	19 (300)
Heating coil heating water delta-T, °F (°C)	NA	50 (27.8)	NA	50 (27.8)
Design HWST, °F (°C)	NA	180 (82.2)	NA	180 (82.2)
HWST reset setpoint vs. OAT, °F (°C)	NA	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)	NA	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)
Heat loop pumping control	NA	2-way valves & ride pump curve	NA	2-way valves & ride pump curve

For SI: °C = (°F – 32)/1.8.
HWST = Hot Water Supply Temperature, NA = Not Applicable, OAT = Outdoor Air Temperature, OSA = Outside Air

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#327

Adds new Section C409.7. Defines the target systems are used for developing MPF values
Adds a new Table C409.7(1).

Target system types for large office and school building occupancy groups. These system types are used to develop mechanical performance factors (MPF) but not directly used with TSPR compliance procedure.
Adds a new Table C409.7(2).

Target system types for medium and small office and retail building occupancy groups. These system types are used to develop mechanical performance factors (MPF) but not directly used with TSPR compliance procedure.
Adds a new Table C409.7(3).

	Target system types for hotel and multifamily building occupancy groups. These system types are used to develop mechanical performance factors (MPF) but not directly used with TSPR compliance procedure.
Related Mods: CEPI-76-21	**C409.7 Target design HVAC systems.** Target system descriptions in **Tables C409.7(1)** through **C409.7(3)** are provided as reference for **Section C403.1.1**, Exception 10. The target systems are used for developing mechanical performance factors and do not need to be programmed into TSPR software

TABLE C409.7(1)
TARGET BUILDING DESIGN CRITERIA HVAC COMPLEX SYSTEMS

BUILDING TYPE PARAMETER	BUILDING TYPE			
	Large Office (warm)	**Large Office (cold)**	**School (warm)**	**School (cold)**
System type	VAV/RH	VAV/RH	VAV/RH	VAV/RH
	Water-cooled chiller	Water-cooled chiller	Water-cooled chiller	Water-cooled chiller
	Electric reheat (PIU)	Gas boiler	Electric reheat (PIU)	Gas boiler
Fan control	VSD (no SP reset)	VSD (no SP reset)	VSD (no SP reset)	VSD (no SP reset)
Main fan power [W/cfm (W × s/L] Proposed ≥ MERV 13	1.127 (2.388)	1.127 (2.388)	1.127 (2.388)	1.127 (2.388)
Zonal fan power [W/CFM (W × s/L)]	0.35 (0.75)	NA	0.35 (0.75)	NA
Minimum zone airflow fraction	1.5 × Voz	1.5 × Voz	1.2 × Voz	1.2 × Voz
Heat/cool sizing factor	1.25/1.15	1.25/1.15	1.25/1.15	1.25/1.15
Outdoor air economizer	Yes except 0–1	Yes	Yes except 0–1	Yes
Occupied OSA (= proposed)	Sum(Voz)/0.75	Sum(Voz)/0.75	Sum(Voz)/0.65	Sum(Voz)/0.65

Energy recovery ventilator efficiency ERR	NA	NA	50%	50%
ERV bypass SAT setpoint	NA	NA	No bypass	60°F (15.6°C) except 4A
DCV	Yes	Yes	Yes	Yes
% Area variable control	15%	15%	70%	70%
% Area on/off control	65%	65%	20%	20%
Cooling source	(2) Water-cooled centrif chillers	(2) Water-cooled centrif chillers	(2) Water-cooled screw chillers	(2) Water-cooled screw chillers
Cooling COP (net of fan)	**ASHRAE 90.1** Appendix G, Table G3.5.3	**ASHRAE 90.1** Appendix G, Table G3.5.3	**ASHRAE 90.1** Appendix G, Table G3.5.3	**ASHRAE 90.1** Appendix G, Table G3.5.3
Heating source (reheat)	Electric resistance	Gas boiler	Electric resistance	Gas boiler
Furnace or boiler efficiency	1.0	90% E_t	1.0	90% E_t
Condenser heat rejection	Cooling tower	Cooling tower	Cooling tower	Cooling tower
Cooling tower efficiency [gpm/hp (L/s × kW)]—See **ASHRAE 90.1** Appendix G, Section G3.1.3.11	40.2 (3.40)	40.2 (3.40)	40.2 (3.40)	40.2 (3.40)

Tower turndown (> 300 ton (1060 kW))	50%	50%	50%	50%
Pump (constant flow/variable flow)	Constant flow; 10°F (5.6°C) range	Constant flow; 10°F (5.6°C) range	Constant flow; 10°F (5.6°C) range	Constant flow; 10°F (5.6°C) range
Tower approach	**ASHRAE 90.1** Appendix G, Table G3.1.3.11	**ASHRAE 90.1** Appendix G, Table G3.1.3.11	**ASHRAE 90.1** Appendix G, Table G3.1.3.11	**ASHRAE 90.1** Appendix G, Table G3.1.3.11
Cooling condenser pump power [W/gpm (W·s/L)]	19 (300)	19 (300)	19 (300)	19 (300)
Cooling primary pump power [W/gpm (W·s/L)]	9 (142)	9 (142)	9 (142)	9 (142)
Cooling secondary pump power [W/gpm (W·s/L)]	13 (205)	13 (205)	13 (205)	13 (205)
Cooling coil chilled water delta-T, °F (°C)	18 (10)	18 (10)	18 (10)	18 (10)
Design chilled water supply temperature, °F (°C)	42 (5.56)	42 (5.56)	42 (5.56)	42 (5.56)

Chilled water supply temperature (CHWST) reset setpoint vs. OAT, °F (°C)	CHWS 44-54/OAT 80-60 (6.7-12.2)/26.7-15.6)	CHWS 44-54/OAT 80-60 (6.7-12.2)/26.7-15.6)	CHWS 44-54/OAT 80-60 (6.7-12.2)/26.7-15.6)	CHWS 44-54/OAT 80-60 (6.7-12.2)/26.7-15.6)
CHW cooling loop pumping control	2-way valves & pump VSD	2-way valves & pump VSD	2-way valves & pump VSD	2-way valves & pump VSD
Heating pump power [W/gpm (W·s/L)]	16.1 (254)	16.1 (254)	19 (254)	19 (254)
Heating HW delta-T, °F (°C)	50 (27.78)	20 (11.11)	50 (27.78)	20 (11.11)
Design hot water supply temperature (HWST), °F (°C)	180 (82)	140 (60)	180 (82)	140 (60)
Hot water supply temperature (HWST) range vs. outside air temperature (OAT) range	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)
Heat loop pumping control	2-way valves & pump VSD	2-way valves & pump VSD	2-way valves & pump VSD	2-way valves & pump VSD

For SI: °C = (°F – 32)/1.8.

CHW = Chilled Water, ERR = Enthalpy Recovery Ratio, NA = Not Applicable, OSA = Outside Air, PIU = Parallel Powered Induction Unit, RH = Relative Humidity, SP = Static Pressure, Voz = Outdoor airflow to the zone, VSD = Variable Speed Drive.

TABLE C409.7(2)

TARGET BUILDING DESIGN CRITERIA HVAC SIMPLE SYSTEMS

BUILDING TYPE PARAMETER	BUILDING TYPE					
	Medium Office (warm)	**Medium Office (cold)**	**Small Office (warm)**	**Small Office (cold)**	**Retail (warm)**	**Retail (cold)**
System type	Package VAV—electric reheat	Package VAV—hydronic reheat	PSZ-HP	PSZ-AC	PSZ-HP	PSZ-AC
Fan control	VSD (with SP reset)	VSD (with SP reset)	Constant volume	Constant volume	2-speed	2-speed
Main fan power [W/cfm(W × s/L)] proposed ≥ MERV 13	0.634 (1.343)	0.634 (1.343)	0.486 (1.03)	0.486 (1.03)	0.585 (1.245)	0.585 (1.245)
Zonal fan power [W/CFM (W × s/L)]	0.35 (5.53)	NA	NA	NA	NA	NA
Minimum zone airflow fraction	1.5 × Voz	1.5 × Voz	NA	NA	NA	NA
Heat/cool sizing factor	1.25/1.15	1.25/1.15	1.25/1.15	1.25/1.15	1.25/1.15	1.25/1.15
Supplemental heating availability	NA	NA	< 40°F (< 4.4°C) OAT	NA	< 40°F (< 4.4°C) OAT	NA
Outdoor air economizer	Yes except 0–1	Yes	Yes except 0–1	Yes	Yes except 0–1	Yes
Occupied OSA source	Packaged unit, occupied damper, all building use types					
Energy recovery ventilator	No	No	No	No	Yes in 0A, 1A, 2A, 3A	Yes all A, 6,7,8 CZ

ERR					50%	50%
DCV	Yes	Yes	No	No	Yes	Yes
% Area variable control	15%	15%			80%	80%
% Area on/off control	65%	65%			0%	0%
Cooling source	DX, multistage	DX, multistage	DX, 1 stage (heat pump)	DX, single stage	DX, 2 stage (heat pump)	DX, 2 stage
Cooling COP (net of fan)	3.83	3.83	3.82	3.8248	3.765	3.765
Heating source	Electric resistance	Gas boiler	Heat pump	Furnace	Heat pump	Furnace
Heating COP (net of fan)/furnace or boiler efficiency	100%	81% E_t	3.81	81% E_t	3.536	81% E_t
Heating coil HW delta-T, °F (°C)	NA	20 (11.11)	NA	NA	NA	NA
Design HWST, °F (°C)	NA	140 (60)	NA	NA	NA	NA
HWST reset setpoint vs OAT, °F (°C)	NA	HWST: 180-150/ OAT 20-50 (82-65.6/-6.7-10)	NA	NA	NA	NA
Heat loop pumping control	NA	2-way valves & ride pump curve	NA	NA	NA	NA
Heating pump power [W/gpm (W·s/L)]	NA	16.1	NA	NA	NA	NA

For SI: °C = (°F – 32)/1.8.

CHW = Chilled Water, ERR = Enthalpy Recovery Ratio, HWST = Hot Water Supply Temperature, NA = Not Applicable, OAT = Outside Air Temperature, OSA = Outside Air, SP = Static Pressure, Voz = Outdoor airflow to the zone, VSD = Variable Speed Drive.

TABLE C409.7(3)

TARGET BUILDING DESIGN CRITERIA HVAC SIMPLE SYSTEMS

BUILDING TYPE PARAMETER	BUILDING TYPE			
	Hotel (warm)	**Hotel (cold)**	**Multifamily (warm)**	**Multifamily (cold)**
System type	PTHP	PTAC with hydronic boiler	Split HP	Split AC
Fan control	Cycling	Cycling	Cycling	Cycling
Main fan power [W/cfm (W × s/L)]	0.300 (0.638)	0.300 (0.638)	0.246 (0.523)	0.271 (0.576)
Heat/cool sizing factor	1.25/1.15	1.25/1.15	1.25/1.15	1.25/1.15
Supplemental heating availability	< 40°F (< 4.4°C)	NA	< 40°F (< 4.4°C)	NA
Outdoor air economizer	Only CZ 2, 3	No	No	No
Occupied OSA source	DOAS	DOAS	DOAS	DOAS except 3C
Energy recovery ventilator	NA	NA	Yes	Yes except 3C
ERR	NA	NA	60%	60%
DCV	Yes	Yes	No	No
% Area variable control	70%	70%		
% Area variable control	0%	0%		
Cooling source	DX, 1 stage (heat pump)	DX, 1 stage	DX, 1 stage (heat pump)	DX, 1 stage
Cooling COP (net of fan)	3.83	3.83	3.823	3.6504
Heating source	Heat pump	(2) Hydronic boiler	Heat pump	Furnace
Heating COP (net of fan)/furnace or boiler efficiency	3.44	81% E_t	3.86	80% AFUE
Heating pump power (W/ gpm (W·s/L))	NA	16.1	NA	NA

Heating coil heating water delta-T, °F (°C)	NA	20 (11.11)	NA	NA
Design HWST, °F (°C)	NA	140 (60)	NA	NA
HWST reset setpoint vs. OAT, °F (°C)	NA	HWST: 180-150/OAT 20-50 (82-65.6/ -6.7-10)	NA	NA
Heat loop pumping control	NA	2-way valves & ride pump curve	NA	NA

For SI: °C = (°F – 32)/1.8.

DOAS = Dedicated Outdoor Air System, ERR = Enthalpy Recovery Ratio, HWST = Hot Water Supply Temperature, NA = Not Applicable, OAT = Outdoor Air Temperature, OSA = Outside Air

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#328 Replaced the text "total building performance" with "simulated building performance."

Related Mods:

CEPI-24-21 Part I

C502.1 General. *Additions* to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. *Additions* shall not create an unsafe or hazardous condition or overload existing building systems. An *addition* shall be deemed to comply with this code if the *addition* alone complies or if the existing building and *addition* comply with this code as a single *building*.

C502.2 Change in space conditioning. Any nonconditioned or low-energy space that is altered to become *conditioned space* shall be required to comply with **Section C502**.

Exceptions:

1. Where the component performance alternative in **Section C402.1.4** is used to comply with this section, the proposed UA shall be not greater than 110 percent of the target UA.
2. Where the ~~total~~ simulated building performance option in **Section C407** is used to comply with this section, the annual *energy cost* of the *proposed design* shall be not greater than 110 percent of the annual *energy cost* otherwise permitted by **Section C407.2**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#329

Adds new Section C502.3.7.
Additional energy efficiency credit requirement for building additions.
There are five exceptions to this requirement based on building occupancy group, additions gross floor size less than 1000 ft2 and less than 50% of existing conditioned floor size, HVAC equipment type, additions that don't increase the conditioned floor area, and compliance with Section C407.
Adds new Section C502.3.8.
Additions must comply with renewable energy system requirements of new Section C405.15.

Related Mods:

CEPI-217-21, CE2D-51-23

C502.3.7 Additional energy efficiency credit requirements. *Additions* shall comply with sufficient measures from **Sections C406.2** and **C406.3** to achieve not less than 50 percent of the number of required efficiency credits from **Table C406.1.1(1)** based on building occupancy group and *climate zone* . Where a project contains multiple occupancies, credits from **Table C406.1.1** for each building occupancy shall be weighted by the gross floor area to determine the project weighted average energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of this section. *Alterations* to the existing building that are not part of the *addition* , but are permitted with an *addition* , shall be permitted to be used to achieve the required credits.

Exceptions:

1. Buildings in Group U (Utility and Miscellaneous), Group S (Storage), Group F (Factory), Group H (High-Hazard).
2. *Additions* less than 1,000 square feet (93 m^2) and less than 50 percent of existing floor area.
3. *Additions* that do not include the *addition* or replacement of equipment covered by **Tables C403.3.2(1)** through **C403.3.2(16)** or **Section C404.2**.
4. *Additions* that do not increase *conditioned space*.
5. Where the *addition* alone or the existing building and *addition* together comply with Section C407.

C502.3.8 Renewable energy systems. *Additions* shall comply with **Section C405.15** for the *addition* alone.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#330

Revised of Section C503.1. Removes exception items #3 and #4 and adds two new exceptions.

Related Mods:

CED1-92-22, CEPI-221-21

SECTION C503 ALTERATIONS

C503.1 General. *Alterations* to any *building* or structure shall comply with the requirements of **Section C503**. *Alterations* shall be such that the existing building or structure is not less conforming to the provisions of this code than the existing *building* or structure was prior to the *alteration* . *Alterations* to an existing *building*, *building* system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing *building* or *building* system to comply with this code. *Alterations* shall not create an unsafe or hazardous condition or overload existing building systems.

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

<table>
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1. Storm windows installed over existing *fenestration* .
2. Surface-applied window film installed on existing single-pane fenestration assemblies reducing solar heat gain, provided that the code does not require the glazing or *fenestration* to be replaced.

3. ~~Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.~~
4. ~~Construction where the existing roof, wall or floor cavity is not exposed.~~

~~5.~~3. *Roof recover* .

4. *Roof replacement* where roof assembly insulation is integral to or located below the structural roof deck.

~~6.~~5. *Air barriers* shall not be required for *roof recover* and *roof replacement* where the *alterations* or renovations to the *building* do not include *alterations* , renovations or *repairs* to the remainder of the *building thermal envelope*.

6. An existing building undergoing *alterations* that complies with **Section C407**.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

</td>
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<tr>
<td>CE#331</td>
<td>C503.2. Renames the section title by adding the text “thermal.” Revises and clarifies the building thermal envelope U-value requirement for alterations and edits the exceptions. This change requires walls and floors alteration to meet the requirements of Section C402.1 and air barriers to meet the requirements of Section C402.6.1. It may slightly increase the stringency for walls, floors and air barrier alterations.
C503.2.1. Renames the Section title and revises the code provisions for clarity of applicability.</td>
</tr>
<tr>
<td>Related Mods:

CEPI-221, CED1-92-22, CED1-144-22, CED1-147-22, CED1-145-22, CED1-146-22, CEPI-225-21, CEPI-221-21, CEPI-226-21,</td>
<td>

C503.2 Building thermal envelope. ~~New building envelope assemblies that are part of the *alteration* shall comply with Sections C402.1 through C402.6.~~*Alterations* of existing *building thermal envelope* assemblies shall comply with this section. New *building thermal envelope* assemblies that are part of the *alteration* shall comply with **Section C402**. An area-weighted average *U-factor* for new and altered portions of the *building thermal envelope* shall be permitted to satisfy the *U-factor* requirements in **Table C402.1.4**. The existing *R-value* of insulation shall not be reduced or the *U-factor* of a *building thermal envelope* assembly be increased as part of a *building thermal envelope alteration* except where complying with **Section C407**.

Exception: Where the existing *building* exceeds the fenestration area limitations of **Section C402.5.1** prior to alteration, the building is exempt from **Section C402.5.1** provided that there is ~~not an~~no increase in fenestration area.

C503.2.1 Roof ~~replacement.~~, ceiling and attic alterations. ~~*Roof replacements* shall comply with Section C402.1.3, C402.1.2, C402.1.4 or C407 where the existing *roof assembly* is part of the *building thermal envelope* and contains insulation entirely above the roof deck. In no case shall the *R*-value of the roof insulation be reduced or the *U*-factor of the roof assembly be increased as part of the *roof replacement*.~~Insulation complying with **Sections C402.1** and **C402.2.1**, or an *approved* design that minimizes deviation from the insulation requirements, shall be provided for the following *alterations*:

1. An *alteration* of roof/ceiling construction other than *reroofing* where existing insulation located below the roof deck or on an attic floor above *conditioned space* does not comply with **Table C402.1.2**.
2. Roof replacement or a roof *alteration* that includes removing and replacing the roof covering, where the roof assembly includes insulation entirely above the roof deck.

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<tr>
<td>CE2D-69-23</td>
<td>
Exceptions: Where compliance with Section C402.1 cannot be met due to limiting conditions on an existing roof, an approved design shall be submitted with the following:
1. Construction documents that include a report by a registered design professional or an approved source documenting details of the limiting conditions affecting compliance with the insulation requirements.
2. Construction documents that include a roof design by a registered design professional or an approved source that minimizes deviation from the insulation requirements.
3. Conversion of unconditioned attic space into conditioned space .
4. Replacement of ceiling finishes exposing cavities or surfaces of the roof/ceiling construction.
<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
<tr><td></td><td></td><td></td><td>X</td></tr>
</table>
<table>
<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
<tr><td></td><td></td><td></td><td>x</td><td></td></tr>
</table>
Original text of mod is not consistent with that of the 2023 FBC – EC.
FSEC – Anticipated energy impact on FBC-EC – Decrease
</td>
</tr>
<tr>
<td>CE#332</td>
<td>Adds new Section C503.2.4.
Adds new Section C503.2.5.
Adds new Section C503.2.6.
Adds new Section C503.2.7.</td>
</tr>
<tr>
<td>Related Mods:

CEPI-221-21</td>
<td>
C503.2.4 Above-grade wall alterations. Above-grade wall alterations shall comply with the following:
1. Where wall cavities are exposed, the cavity shall be filled with cavity insulation complying with Section C303.1.4. New cavities created shall be insulated in accordance with Section C402.1 or an approved design that minimizes deviation from the insulation requirements.
2. Where exterior wall coverings and fenestration are added or replaced for the full extent of any exterior wall assembly on one or more elevations of the building , insulation shall be provided where required in accordance with one of the following:
2.1. An R-value of continuous insulation not less than that designated in Table C402.1.3 for the applicable above-grade wall type and existing cavity insulation R-value , if any;
2.2. An R-value of not less than that required to bring the above-grade wall into compliance with Table C402.1.2; or,
2.3. An approved design that minimizes deviation from the insulation requirements of Section C402.1.
3. Where Items 1 and 2 apply, the insulation shall be provided in accordance with Section C402.1.
Where any of the above requirements are applicable, the above-grade wall alteration shall comply with Sections 1402.2 and 1404.3 of the International Building Code.
</td>
</tr>
</table>

	C503.2.5 Floor alterations. Where an *alteration* to a floor or floor overhang exposes cavities or surfaces to which insulation can be applied, and the floor or floor overhang is part of the *building thermal envelope*, the floor or floor overhang shall be brought into compliance with **Section C402.1** or an *approved* design that minimizes deviation from the insulation requirements. This requirement applies to floor *alterations* where the floor cavities or surfaces are exposed and unobstructed prior to construction. **C503.2.6 Below-grade wall alterations.** Where unconditioned below-grade space is changed to *conditioned space*, walls enclosing such *conditioned space* shall be insulated where required in accordance with **Section C402.1**. Where the below-grade space is *conditioned space* and where walls enclosing such space are altered, they shall be insulated where required in accordance with **Section C402.1**. **C503.2.7 Air barrier.** Altered *building thermal envelope* assemblies shall be provided with an *air barrier* in accordance with **Section C402.6.1**. Such *air barrier* need not be continuous with unaltered portions of the *building thermal envelope*. Testing requirements of **Section C402.6.1.2** shall not be required. FSEC – Anticipated energy impact on FBC-EC – Decrease Staff Classification | Correlates Directly: X | Energy Standard Needed: | Over lap: Action | AS: | AS/IC: | D: x | D/IC:
CE#333	Removes reference to Section C408 and moves it to the new subsection C503.3.2 for clarity. Adds new Section C503.3.2. Adds compliance requirement with relevant specific subsections C408.2.2, C408.2.3, and C408.2.5. This section has exceptions based on building size and type. The testing requirement may increase the stringency since it requires testing the unaltered portions of mechanical systems in existing buildings. Adds new Section C503.3.3. It requires existing ductwork serving new equipment, and additions and alterations must be tested. Adds new Section C503.3.4. Requires that thermostatic controls comply with current control requirements when equipment is replaced. This change is cost-effective. Adds new Section C503.3.5. Right-sized equipment, often smaller, generally has lower construction costs and saves operating energy costs.
Related Mods: CEPI-229-21	**C503.3 Heating and cooling systems.** New heating, cooling and *duct systems* that are part of the *alteration* shall comply with **Section C403**. ~~and C408.~~ **C503.3.1 Economizers.** New cooling systems that are part of *alteration* shall comply with Section C403.5. **C503.3.2 Mechanical system acceptance testing.** Where an *alteration* requires compliance with **Section C403** or any of its subsections, mechanical systems that serve the *alteration* shall comply with **Sections C408.2.2**, **C408.2.3** and **C408.2.5**. Exceptions: 1. *Buildings* with less than 10,000 square feet (929 m^2) and a combined heating, cooling and service water-heating capacity of less than 960,000 Btu/h (281 kW). 2. Systems included in **Section C403.5** that serve individual *dwelling units* and

sleeping units .

C503.3.3 Duct testing. *Ducts* and plenums designed to operate at static pressures not less than 3 inches water gauge (747 Pa) that serve an *alteration* shall be tested in accordance with this section where the *alteration* includes any of the following:

1. Twenty-five percent or more of the total length of the *ducts* in the system arerelocated.
2. The total length of all *ducts* in the system is increased by 25 percent or more.

Ducts and plenums shall be leak tested in accordance with the SMACNA ***HVAC Air Duct Leakage Test Manual*** and shown to have a rate of *air leakage* (CL) less than or equal to 12.0 as determined in accordance with **Equation 4-7** of Section C403.13.2.3. Documentation shall be available demonstrating that representative sections totaling not less than 25 percent of the

duct area have been tested and that all tested sections comply with the requirements of this section.

C503.3.4 Controls. New heating and cooling equipment that is part of the *alteration* shall be provided with controls that comply with the control requirements in **Sections C403.4** and **C403.5** other than the requirements of **Sections C403.4.3.3** and **C403.4.4**.

Exceptions:

1. Systems with *direct digital control* of individual *zones* reporting to a central control panel.
2. The replacement of individual components of multiple-zone VAV systems.

C503.3.5 System sizing. New heating and cooling equipment that is part of an *alteration* shall be sized in accordance with **Section C403.3.1** based on the existing building features as modified by the *alteration*.

Exceptions:

1. Where it has been demonstrated to the *code official* that compliance with this section would result in heating or cooling equipment that is incompatible with the rest of the heating or cooling system.
2. Where it has been demonstrated to the *code official* that the additional capacity will be needed in the future.

FSEC – Anticipated energy impact on FBC-EC – Decrease

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#334

Adds new Section C503.3.6.
Adds new Table C503.3.6.

Related Mods:

C503.3.6 Replacement or added roof-mounted mechanical equipment. For roofs with insulation entirely above the roof deck and where existing roof-mounted mechanical equipment is replaced or new equipment is added, and the existing roof does not comply with the insulation requirements for new construction in accordance with **Sections C402.1** and **C402.2.1**, curbs for

CED1-148-22	added or replaced equipment shall be of a height necessary to accommodate the future addition of above-deck roof insulation to be installed in accordance with **Section C503.2.1**, Item 2. Alternatively, the curb height shall comply with **Table C503.3.6**. Curb height shall be the distance measured from the top of the curb to the top of the roof deck.

TABLE C503.3.6

ROOF-MOUNTED MECHANICAL EQUIPMENT CURB HEIGHTS

CLIMATE ZONE	CURB HEIGHT, MINIMUM
0, 1, 2 and 3	16 inches
4, 5 and 6	17 inches
7 and 8	18 inches

For SI: 1 inch = 25.4 mm.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	x		

Action	AS	AS/IC	D	D/IC
			x	

CE#335

Removes reference to Section C408 and moves the requirement to the new subsection C503.4.1.
Adds new subsection C503.4.1. Adds compliance requirement with specific subsections C408.2.3 and C408.2.5. This change my increase the stringency of the SHW testing requirements since it requires testing the unaltered portions of hot water systems in existing buildings.

Related Mods:

CEPI-229-21

C503.4 Service hot water systems. New service hot water systems that are part of the *alteration* shall comply with **Section C404** ~~and C408~~.

C503.4.1 Service hot water system acceptance testing. Where an *alteration* requires compliance with **Section C404** or any of its subsections, service hot water systems that serve the *alteration* shall comply with **Sections C408.2.3** and **C408.2.5**.

Exceptions:

1. *Buildings* with less than 10,000 square feet (929 m^2) and a combined heating, cooling and service water-heating capacity of less than 960,000 Btu/h (281 kW).
2. Systems included in **Section C403.5** that serve individual *dwelling units* and *sleeping units* .

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

FSEC – Anticipated energy impact on FBC-EC – Decrease

CE#336

Removes the exception. Improves lighting alteration code clarity and enforceability. No change in stringency.
Adds new subsection C503.5.1.

<table>
<tr><td></td><td>Adds new subsection C503.5.2.</td></tr>
<tr><td>Related Mods:

CECD1-2-22, CE2D-70-23
CECD1-2-22, CE2D-71-23, CE2D-71-23</td><td>
C503.5 Lighting systems. New lighting systems that are part of the alteration shall comply with Sections C503.5.1 and C503.5.2.

~~**Exception:** *Alterations* that replace less than 10 percent of the luminaires in a space, provided that such *alterations* do not increase the installed interior lighting power.~~

C503.5.1 Interior lighting and controls. Alterations to interior spaces, lighting or controls shall comply with the following:
1. Where an alteration of an interior space includes the addition or relocation of full height partitions, the space shall comply with Sections C405.2, C405.3 and C408.3.
2. Where the lighting within interior spaces is altered, those spaces shall comply with Sections C405.2, C405.3 and C408.3.
3. Where the lighting controls within interior spaces are altered, those spaces shall comply with Sections C405.2 and C408.3.

Exception: Compliance with Section C405.2.8 is not required for alterations .

C503.5.2 Exterior lighting and controls. Alterations to exterior lighting and controls shall comply with the following:
1. Where the connected exterior lighting power is increased by more than 400 watts, all exterior lighting, including lighting that is not proposed to be altered, shall comply with Section C405.5.
2. Where the combined power of added and replacement luminaires is more than 400 watts, all lighting that is added or altered shall be controlled in accordance with Sections C405.2 and C408.3.

Exception: Individual luminaires less than 50 watts provided they pass functional tests verifying automatic shut off where daylight is present.

3. Where portions of exterior lighting controls are added or altered, those portions shall comply with Sections C405.2 and C408.3.

<table>
<tr><td>Staff Classification</td><td>Correlates Directly</td><td>Energy Standard Needed</td><td>Over lap</td></tr>
<tr><td></td><td>X</td><td></td><td></td></tr>
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<tr><td>Action</td><td>AS</td><td>AS/IC</td><td>D</td><td>D/IC</td></tr>
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</td></tr>
<tr><td>CE#337</td><td>Adds new Section C503.6. Alterations that are substantial improvements must comply with efficiency measures from Sections C406.2, C406.3, or both to achieve the required energy credits specified in Table C406.1.1(1). There are four exceptions to the requirements of this section. This change increases the stringency but is cost-effective.</td></tr>
<tr><td>Related Mods:

CED1-92-22,</td><td>C503.6 Additional energy efficiency credit requirements for alterations. Alterations that are substantial improvements shall comply with measures from Sections C406.2, C406.3 or both to earn the number of required credits specified in Table C406.1.1(1) based on building occupancy group and climate zone . Where a project contains multiple occupancies, credits specified in Table C406.1.1(1) for each building occupancy shall be weighted by the gross conditioned floor area to determine the weighted average credits required. Accessory occupancies, other than Group F or H, shall be included with the primary occupancy group for the</td></tr>
</table>

CED1-149-22, CED1-203-22, CEPI-217-21	purposes of this section. Exceptions: 1. *Alterations* that do not contain *conditioned space*. 2. Portions of *buildings* devoted to manufacturing or industrial use. 3. *Alterations* to *buildings* where the *building* after the *alteration* complies with **Section C407**. 4. *Alterations* that are permitted with an *addition* complying with **Section C502.3.7**. FSEC – Anticipated energy impact on FBC-EC – Decrease Staff Classification / Correlates Directly: X / Energy Standard Needed: / Over lap: Action / AS: / AS/IC: / D: x / D/IC:
CE#338	Replaced the text "building envelope" with "building thermal envelope."
Related Mods: CED1-92-22	**C504.2 Application.** For the purposes of this code, the following shall be considered to be *repairs* : 1. Glass-only replacements in an existing sash and frame. 2. *Roof repairs*. 3. *Air barriers* shall not be required for *roof repair* where the *repairs* to the *building* do not include *alterations* , renovations or *repairs* to the remainder of the *building* *thermal* envelope. 4. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed. 5. *Repairs* where only the bulb, the ballast or both within the existing luminaires in a space are replaced, provided that the replacement does not increase the installed interior lighting power. Staff Classification / Correlates Directly: X / Energy Standard Needed: / Over lap: Action / AS: / AS/IC: / D: x / D/IC:
CE#339	Revises the code language that spaces undergoing a change in occupancy from Group F, H, S, or U occupancy classification group must comply with Section C503 Alterations. Also removes exception item #1, which provides exemptions based on the component performance alternative method, and edits exception item #2 by replacing the text "total" with "simulated." Adds new subsection C505.1.1. Created by moving existing provisions from Section C505.1 for alterations and occupancy changes. No change in stringency. Adds new subsection C505.1.2. Created by moving existing provisions from Section C505.1 for buildings going alterations and occupancy changes for a portions of an existing buildings. No change in stringency.
Related Mods:	**C505.1 General.** Spaces undergoing a change in occupancy from Group F, H, S or U occupancy classification shall comply with **Section C503**. *Buildings* or portions of *buildings* undergoing a *change of occupancy* without *alterations* s hall comply with **Section C505.2**. ~~that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.3.2(1) or C405.3.2(2) to another use in Table~~

CED1-12-22, CEPI-232-21, CEPI-24-21 Part I	~~C405.3.2(1) or C405.3.2(2), the installed lighting wattage shall comply with Section C405.3. Where the space undergoing a change in occupancy or use is in a building with a fenestration area that exceeds the limitations of Section C402.5.1, the space is exempt from Section C402.5.1 provided that there is not an increase in fenestration area.~~ Exception~~s~~: ~~1. Where the component performance alternative in Section C402.1.4 is used to comply with this section, the proposed UA shall not be greater than 110 percent of the target UA.~~ ~~2.~~ Where the ~~total~~simulated building performance option in **Section C407** is used to comply with this section, the annual *energy cost* of the *proposed design* shall be not greater than 110 percent of the annual *energy cost* otherwise permitted by **Section C407.3**. **C505.1.1 Alterations and change of occupancy.** *Alterations* made concurrently with any *change of occupancy* shall be in accordance with **Section C503**. **C505.1.2 Portions of buildings.** Where changes in occupancy and use are made to portions of an existing building, only those portions of the *building* shall be required to comply with **Section C505.2**. <table><tr><th>Staff Classification</th><th>Correlates Directly</th><th>Energy Standard Needed</th><th>Over lap</th></tr><tr><td></td><td>X</td><td></td><td></td></tr></table> <table><tr><th>Action</th><th>AS</th><th>AS/IC</th><th>D</th><th>D/IC</th></tr><tr><td></td><td></td><td></td><td>x</td><td></td></tr></table>
CE#340	Adds new Section C505.2. Created compliance requirement for thermal envelope, mechanical systems, service water heating system, and lighting under separate new subsections for an existing buildings without alterations. Adds new subsection C505.2.1. Created by moving from Section C505.1. No change in stringency. Adds new subsection C505.2.2. Where a change of occupancy results in the same or increased energy use intensity, the systems serving the building or space undergoing the change must comply with Section C403. No change in stringency. It is not clear what the reference EUI is prior to the change. Adds new Table C505.2.2.
Related Mods: CEPI-232-21, CED1-92-22, CED1-110-22	**C505.2 Energy use intensities.** *Building thermal envelope*, space heating, cooling, *ventilation* , lighting and *service water heating* shall comply with **Sections C505.2.1** through **C505.2.4**. Exceptions: 1. Where it is demonstrated by analysis *approved* by the *code official* that the change will not increase *energy use intensity*. 2. Where the occupancy or use change is less than 5,000 square feet (465 m^2) in area.

C505.2.1 Building thermal envelope. Where a *change of occupancy* or use is made to a whole *building* that results in a fenestration area greater than the maximum fenestration area allowed by **Section C402.5.1**, the *building* shall comply with **Section C402.1.4**, with a proposed UA that shall be not greater than 110 percent of the target UA.

Exception: Where the *change of occupancy* or use is made to a portion of the *building* , the new occupancy is exempt from **Section C402.5.1**, provided that there is not an increase in fenestration area.

C505.2.2 Building mechanical systems. Where a *change of occupancy* or use results in the same or increased *energy use intensity* rank as specified in **Table C505.2.2**, the systems serving the *building* or space undergoing the change shall comply with **Section C403**.

TABLE C505.2.2 BUILDING MECHANICAL SYSTEMS

ENERGY USE INTENSITY RANK	*INTERNATIONAL BUILDING CODE* OCCUPANCY CLASSIFICATION AND USE
High	A-2, B (laboratories), I-2
Medium	A-1, A-3,[a] A-4, A-5, B,[b] E, I-1, I-3, I-4, M, R-4
Low	A-3 (places of religious worship), R-1, R-2, R-3,[c] S-1, S-2

a. Excluding places of religious worship.
b. Excluding laboratories.
c. Buildings three stories or less in height above grade plane shall comply with **Section R505**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#341

Adds new subsection C505.2.3.
Where a change of occupancy results in the same or increased energy use intensity, the SWH systems serving the building or space undergoing the change must comply with Section C404. No change in stringency.
Adds new Table C505.2.3.
Adds new subsection C505.2.4. Where a change of occupancy results in the same or increased energy use intensity, the lighting systems serving the building or space undergoing the change must comply with Section C405 with the exception of Sections C405.2.6 and C405.4. No change in stringency.
Adds new Table C505.2.4.

Related Mods:

CEPI-232-21

C505.2.3 Service water heating. Where a *change of occupancy* or use results in the same or increased *energy use intensity* rank as specified in **Table C505.2.3**, the *service water heating* systems serving the *building* or space undergoing the change shall comply with **Section C404**

TABLE C505.2.3 SERVICE WATER HEATING

ENERGY USE INTENSITY RANK	*INTERNATIONAL BUILDING CODE* OCCUPANCY CLASSIFICATION AND USE
High	A-2, I-1, I-2, R-1
Low	All other occupancies and uses

C505.2.4 Lighting. Where a *change of occupancy* or use results in the same or increased *energy use intensity* rank as specified in **Table C505.2.4**, the lighting systems serving the *building* or space undergoing the change shall comply with **Section C405** except for **Sections C405.2.6** and **C405.4**

TABLE C505.2.4 LIGHTING

ENERGY USE INTENSITY RANK	*INTERNATIONAL BUILDING CODE* OCCUPANCY CLASSIFICATION AND USE
High	B (laboratories), B (outpatient healthcare), I-2, M
Medium	A-2, A-3 (courtrooms), B,[a] I-1, I-3, I-4, R-1, R-2, R-3,[b] R-4, S-1, S-2
Low	A-1, A-3,[c] A-4, E

a. Excluding laboratories and outpatient healthcare.
b. Buildings three stories or less in height above grade plane shall comply with **Section R505**.
c. Excluding courtrooms.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#342	
Related Mods:	**AERC** **Attachments Energy Rating Council** **355 Lexington Ave 15th Floor** **New York, NY 10017** **AERC 1—2017: Procedures for Determining Energy Performance Properties of Fenestration Attachments**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#343	
Related Mods:	**AHAM** **ANSI/AHAM RAC-1—~~2015~~2020: Room Air Conditioners ...Table C403.3.2(4)**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#344	
Related Mods:	**AHRI** **210/240—~~2017 and~~ 2023 (2020):** **Performance Rating of Unitary Air-conditioning and Air-source Heat Pump Equipment Table C403.3.2(1)Table C403.3.2(2)Table C403.3.2(8)Table C403.3.2(9)** **310/380—2017 (CSA-C744-17):** **Packaged Terminal Air Conditioners and Heat Pumps** **Table C403.3.2(4)** **340/360—~~2019~~2022:** **Performance Rating of Commercial and Industrial Unitary Air-conditioning and Heat Pump Equipment Table C403.3.2(1)Table C403.3.2(2)** **365 (I-P)—2009:** **Commercial and Industrial Unitary Air-conditioning Condensing Units** **Table C403.3.2(1)** **390 (I-P)—2003:** **Performance Rating of Single Package Vertical Air-conditioners and Heat Pumps C403.3.2(4)** **400 (I-P)—2015:** **Performance Rating of Liquid to Liquid Heat Exchangers** **C403.3.2** **440 (I-P)~~—2008~~2019:** **Performance Rating of ~~Room~~ Fan Coils~~—with Addendum 1~~** **C403.13.3** **460—2005:** **Performance Rating of Remote Mechanical-draft Air-cooled Refrigerant Condensers Table C403.3.2(7)** **550/590 (I-P)—~~2018~~2022:** **Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle** **Table C403.3.2(3)Table C403.3.2(15)** **560—~~2018~~2000:** **Absorption Water Chilling and Water Heating Packages** **Table C403.3.2(3)Table C403.3.2(15)** **840 (I-P)—1998:** **Performance Rating of Unit Ventilators** **C403.13.3** **910 (I-P)—2014:** **Performance Rating of Indoor Pool Dehumidifiers** **Table C403.3.2(11)** **920 (I-P)—2020:** **Performance Rating of Direct Expansion-Dedicated Outdoor Air System Units (with Addendum 1) Table C403.3.2(12)Table C403.3.2(13)** ~~**920—2015::** **Performance Rating of DX-Dedicated Outdoor Air System Units**~~ ~~**TT**~~ ~~**920—2015::** **Performance Rating of DX-Dedicated Outdoor Air System Units**~~ ~~**TT**~~ **1200 (I-P)—~~2013~~2022:** **Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets Table C403.12.1** **1230—~~2014~~2021:** **Performance Rating of Variable Refrigerant Flow (VRF) Multi-split Air-Conditioning and Heat Pump Equipment ~~(with Addendum 1)~~** **1250 (I-P)—~~2014~~2020:** **Standard for Performance Rating in Walk-in Coolers and Freezers** **Table C403.12.2.1(3)** **1360 (I-P)—2017:** **Performance Rating of Computer and Data Processing Room Air Conditioners Table C403.3.2(10)Table C403.3.2(16)** **1380 (I-P)—2019: Demand Response through Variable Capacity HVAC Systems in Residential and Small Commercial Applications C403.4.6.1** **ANSI/AHRI 1300-2013(R2023)(I-P):** **Performance Rating of Commercial Heat Pump Water Heaters C406.2.3.1.2** **ASHRAE/ANSI/AHRI/ISO 13256-1 (2012):** **Water-to-Air and Brine-to-Air Heat Pumps—Testing and Rating for Performance Table C403.3.2(14)** **ASHRAE/ANSI/AHRI/ISO 13256-2 (2012):** **Water-to-Water and Brine-to-Water Heat Pumps—Testing and Rating for Performance ....Table**

C403.3.2(14)

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#345

Related Mods:

AISI

American Iron and Steel Institute
25 Massachusetts Avenue, NW, Suite 800
Washington, DC 20001

AISI S250—22: North American Standard for Thermal Transmittance of Building Envelopes with Cold-Formed Steel Framing, with Supplement 1, dated 2022

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#346

Related Mods:

AMCA

208—18: Calculation of the Fan Energy Index
C403.8.3C403.9.1

500D—18: Laboratory Methods for Testing Dampers for Rating C403.7.7

ANSI/AMCA 220—~~19~~21: Laboratory Methods of Testing Air Curtain Units for Aerodynamic Performance Rating C402.6.6

ANSI/AMCA 230—~~15~~22: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification C403.9

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#347

Related Mods:

ANSI

American National Standards Institute 25 West 43rd Street, 4th Floor New York, NY 10036

ANSI Z21.47—2016/CSA 2.3—~~2016~~21: Gas-Fired Central Furnaces ....Table C403.3.2(5)

ANSI Z83.8—2016/CSA 2.6—2016: Gas Unit Heater, Gas Packaged Heaters, Gas Utility Heaters And Gas-Fired Duct Furnaces Table C403.3.2(5)

ANSI/CTA-2045-A—2018: Modular Communications Interface for Energy Management
C403.4.6.2C406.3

ANSI/CTA-2045-B—2018: Modular Communications Interface for Energy Management
C406.3.7

ANSI/CTA-2045-B—2019: Modular Communications Interface for Energy Management
C403.4.6.2

ANSI/CTA-2045-B—2021: Modular Communications Interface for Energy Management
Table C404.10

ANSI/NEMA WD 6—2016: Wiring Devices—Dimensional Specifications
C405.9.2

~~Z21.10.3/CSA 4.3—17:: Gas Water Heaters, Volume III—Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating Tank and Instantaneous~~

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#348	
Related Mods:	ASABE S640—~~2017~~July 2017(R2022): Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms) C202
CE#349	
Related Mods:	ASHRAE 55—~~2017~~2020: Thermal Environmental Conditions for Human Occupancy Table C407.4.1(1) 62.1—2019: Ventilation for Acceptable Indoor Air Quality C403.6.1C406.3.3Table C409.6.1.10.2(1) 90.1—~~2019~~2022: Energy Standard for Buildings Except Low-rise Residential Buildings C101.3C401.2.2 C402.1.2Table C402.1.2C402.1.2.1C402.1.3Table C403.3.2(5)Table C403.3.2(15)C406.2C406.2C406.2.1.1C409.6.1.3.2C409.6.1.5C409.6.1.6Table C409.6.1.10.2(1)Table C409.7(1)C501.2C501.3 90.4—~~2016~~2022: Energy Standard for Data Centers C403.1.2C405.9.1C405.9.2C406.2.2.3 140—~~2014~~2020: ~~Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs~~Method of Test for Evaluating Building Performance Simulation Software (with Addenda A and B) C407.5.1.2C409.5.1 ~~146—2011::~~ ~~Testing for Rating PoolHeaters~~ ~~T~~ ANSI/ASHRAE/ACCA Standard 183—~~(RA2017)~~2007 (RA2020): Peak Cooling and Heating Load Calculations in Buildings, Except Low-rise Residential Buildings C403.1.1 ANSI/ASHRAE/ASHE Standard 170—2021: Ventilation of Health Care Facilities C409.2.1 ASHRAE Standard 51—16/ANSI/AMCA Standard 210—16: Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating Table C403.8.5 ASHRAE—2020: 2020 ASHRAE Handbook—HVAC Systems and Equipment C403.1.1 ISO/AHRI/ASHRAE 13256-1 (2012): Water-to-Air and Brine-to-Air Heat Pumps—Testing and Rating for Performance Table C403.3.2(14) ISO/AHRI/ASHRAE 13256-2 (2012): Water-to-Water and Brine-to-Water Heat Pumps—Testing and Rating for Performance…..Table C403.3.2(14)

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#350

Related Mods:

ASME

ASME A17.1—~~2019~~2022/CSA B44—~~1922~~: **Safety Code for Elevators and Escalators**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#351

Related Mods:

ASTM

C90—~~2016A~~21: **Specification for Load-bearing Concrete Masonry Units Table C402.1.3**

C835—06(2020): **Standard Test Method for Total Hemispherical Emittance of Surfaces up to 1400°C C402.3**

C1363—~~11~~19: **Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus**
C303.1.4.1Table C402.1.2C402.1.2.1C402.1.2.1.7Table C402.1.2.1.7C402.2.7

C1371—15: **Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers**
C402.3Table C402.4

C1549—16: **Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer**
C402.3Table C402.4

D1003—~~13~~21: **Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics C402.6.2.3.2**

D8052/D8052M—~~2017~~22: **Standard Test Method for Quantification of Air Leakage in Low-Sloped Membrane Roof Assemblies C402.6.2.3.2**

E283/E283M—~~2004(2012)~~19: **Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen**
C402.6.1.2.1 C402.6.2.3.2Table C402.6.3

E408—13(2019): **Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-meter Techniques C402.3Table C402.4**

E779—~~10(2018)~~19: **Standard Test Method for Determining Air Leakage Rate by Fan Pressurization C402.6.2.1C402.6.2.2**

E903—20~~12~~: **Standard Test Method Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres ~~(Withdrawn 2005)~~**
C402.3Table C402.4

E1186—22: **Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems C402.6.2**

E1677—~~11~~19: **Standard Specification for Air Barrier (AB) Material or ~~Systems~~Assemblies for Low-Rise Framed Building Walls C402.6.2.3.2**

E1827—~~2011(2017)~~22: **Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door C402.6.2.1C402.6.2.2**

E1918—~~06(2016)~~21: **Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field Table C402.4**

E1980—11(2019): **Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-sloped Opaque Surfaces Table C402.4**

E2178—~~13~~21a: **Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials C402.6.2.3.1**

E2357—~~2018~~23: **Standard Test Method for Determining Air Leakage of Air Barriers Assemblies C402.6.2.3.2**

E3158— 18: Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building C402.6.2.1

F1281—17(2021): Standard Specification for Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL_PEX) Pressure Pipe
Table C404.5.2.1

F1361—~~2017~~21: Standard Test Method for Performance of Open ~~Deep Fat~~Vat Fryers
Table C406.2.6.2(1)

F1484—18: Standard Test Method for Performance of Steam Cookers
Table C406.2.6.2(2)

F1495—~~2014a~~20: Standard Specification for Combination Oven Electric or Gas Fired
Table C406.2.6.2(4)

F1496—~~2013~~13(2019): Standard Test Method for Performance of Convection Ovens
Table C406.2.6.2(4)

F1696—~~2018~~20: Standard Test Method for Energy Performance of Stationary-Rack, Door-Type Commercial Dishwashing Machines
Table C406.2.6.2(3)

F1920—~~2015~~20: Standard Test Method for Performance of Rack Conveyor Commercial Dishwashing Machines Table C406.2.6.2(3)

F2093—18: Standard Test Method for Performance of Rack Ovens
Table C406.2.6.2(4)

F2144—~~2017~~21: Standard Test Method for Performance of Large Open Vat Fryers
Table C406.2.6.2(1)

F2861—~~2017~~20: Standard Test Method for Enhanced Performance of Combination Oven in Various Modes Table C406.2.6.2(4)

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#352

Related Mods:

CRRC

ANSI/CRRC S100—~~2020~~2021: Standard Test Methods for Determining Radiative Properties of Materials

Table C402.4 C402.4.1

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#353

Related Mods:

CSA

AAMA/WDMA/CSA 101/I.S.2/A440—~~17~~22: North American Fenestration Standard/Specification for Windows, Doors and Skylights Table C402.6.3

CAN/CSA C439—18: Laboratory Methods of Test for Rating the Performance of Heat/Energy-Recovery Ventilators C403.7.4.1

CSA B55.1—20~~15~~: Test Method for Measuring Efficiency and Pressure Loss of Drain Water Heat Recovery Units C404.7C406.2.3.6

CSA B55.2—20~~15~~: Drain Water Heat Recovery Units
C404.7

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#354

Related Mods:	**CTI** **ATC-105—2019: Acceptance Test Code for Water Cooling Towers** **Table C403.3.2(7)** **ATC-105DS—~~2018~~2019: Acceptance Test Code for Dry Fluid Coolers** **Table C403.3.2(7)** **ATC-105S—~~11~~2021: Acceptance Test Code for Closed Circuit Cooling Towers** **Table C403.3.2(7)** **ATC-106—2011: Acceptance Test for Mechanical Draft Evaporative Vapor Condensers** **Table C403.3.2(7)** **CTI STD-201 RS~~(17)~~2021: Performance Rating of Evaporative Heat Rejection Equipment**
CE#355	
Related Mods:	**DASMA** **ANSI/DASMA 105—~~2017~~2020: Test Method for Thermal Transmittance and Air Infiltration of Garage Doors and Rolling Doors C303.1.3Table C402.6.3**
CE#356	
Related Mods:	**DOE** **10 CFR 50: Domestic Licensing of Production and Utilization Facilities** **C403.17** **10 CFR, Part 430—2015: Energy Conservation Program for Consumer Products: Test Procedures and Certification and Enforcement Requirement for Plumbing Products; and Certification and Enforcement Requirements for Residential Appliances; Final Rule** **Table C403.3.2(1)Table C403.3.2(2)Table C403.3.2(4)Table C403.3.2(5)Table C403.3.2(6)Table C403.3.2(14)C403.15Table C404.2C406.2.3.1.2Table C406.2.3.5** **10 CFR, Part 430, Appendix U: Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans C403.8.5Table C403.9** **10 CFR, Part 431—2015: Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures and Efficiency Standards; Final Rules** **Table C403.3.2(6)C403.8.4 C403.12 C403.12.1Table C403.12.1 C403.12.2Table C403.12.2.1(2)C404.2Table C404.2C405.7Table C405.7C405.8Table C405.8(1)Table C405.8(2)Table C405.8(3)Table C405.8(4)**

CE#354 (CTI):

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#355 (DASMA):

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#356 (DOE):

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#357	
Related Mods:	~~AAMA~~FGIA Fenestration & Glazing Industry Alliance (formerly American Architectural Manufacturers Association) 1900 E. Golf Road, Suite 1250 **AAMA/WDMA/CSA 101/I.S.2/A440—~~17~~22: North American Fenestration Standard/Specification for Windows, Doors, and Skylights** Table C402.6.3

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#358	
Related Mods:	Green-e Green-e c/o Center for Resource Solutions 1012 Torney Ave., 2nd Floor San Francisco, CA 94129 **Green-e, Version 1.0, July 7, 2017: Green-e Framework for Renewable Energy Certification**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			X	

CE#359	
Related Mods:	ICC **IBC—~~21~~24: International Building Code®** **C201.3C202C303.1.1C303.1.2C303.2C402.1.5C402.2.7 C402.6.4C405.2C405.5.1 CG101.2.6C405.15.2.1C501.2C501.2C503.2.4** **ICC 500—20: Standard for the Design and Construction of Storm Shelters** **C402.5.2** **IFC—~~21~~24: International Fire Code®** **C201.3C405.16.2.1C405.16.2.2C501.2** **IFGC—~~21~~24: International Fuel Gas Code®** **C201.3C501.2** **IMC—~~21~~24: International Mechanical Code®** **C201.3C402.1.5C403.2.2C403.6C403.6.1C403.6.6C403.7.1C403.7.2C403.7.4.2C403.7.5C403.7.7C403.8.6.1 C403.13.1C403.13.2 C403.13.2.1 C403.13.2.2C406.2.2.5C406.3.3Table C407.4.1(1)C408.2.2.1C501.2** **IPC—~~21~~24: International Plumbing Code®** **C201.3C501.2** **IPMC—~~21~~24: International Property Maintenance Code®** **C501.2** IPSDC—~~21~~24: International Private Sewage Disposal Code® C501.2

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#360	

Related Mods:	# IEC IEC Regional Centre for North America IEC International Electrotechnical Commission 446 Main Street, 16th Floor Worcester, MA 01608 **IEC 62746-10-1—2018: Systems interface between customer energy management system and the power management system – Part 10-1: Open automated demand response** C403.4.6.2
CE#361	
Related Mods:	**IEEE** **515.1—2012: IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications** **C404.6.2** **1547—2018a: IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces** C405.16
CE#362	
Related Mods:	# IES **ANSI/ASHRAE/IES 90.1—~~2019~~2022: Energy Standard for Buildings, Except Low-Rise Residential Buildings C101.3C401.2C401.2.2Table C402.1.2C402.1.2.1C402.1.3Table C402.1.3Table C403.3.2(5)Table C403.3.2(15)C406.2C406.2.1.1C409.6.1.3.2C409.6.1.3.2C409.6.1.5C409.6.1.6Table C409.6.1.10.2(1)Table C409.7(1)C501.2C501.3** **ANSI/IES RP-2—2020: Recommended Practice: Lighting Retail Spaces** **C406.2.5** **ANSI/IES RP-3—2020: Recommended Practice: Lighting Educational Facilities** C406.2.5
CE#363	

CE#361:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#362:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#363:

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Related Mods:	ANSI/IES RP-4—2020: Recommended Practice: Lighting Library Spaces C406.2.5 ANSI/IES RP-6—2020: Recommended Practice: Lighting Sports and Recreational Areas C406.2.5 ANSI/IES RP-7—2020: Recommended Practice: Lighting Industrial Facilities C406.2.5 ANSI/IES RP-8—2021: Recommended Practice: Lighting Roadway and Parking Facilities C406.2.5 ANSI/IES RP-9—2020: Recommended Practice: Lighting Hospitality Spaces C406.2.5 ANSI/IES RP-10—2020: Recommended Practice: Lighting Common Applications C406.2.5 ANSI/IES RP-27—2020: Recommended Practice: Photobiological Safety for Lighting Systems C406.2.5 ANSI/IES RP-29—2020: Recommended Practice: Lighting Hospital and Healthcare Facilities C406.2.5 ANSI/IES RP-30—2020: Recommended Practice: Lighting Museums C406.2.5 ANSI/IES RP-41—2020: Recommended Practice: Lighting Theaters and Worship Spaces C406.2.5 ANSI/IES/ALA RP-11—2020: Recommended Practice: Lighting for Interior and Exterior Residential Environments C406.2.5
CE#364	
Related Mods:	ISO ISO 9050—2003: Glass in Building: Determination of Light Transmittance, Solar Direct Transmittance, Total Solar Energy Transmittance, Ultraviolet Transmittance and Related Glazing Factors C402.3 ISO 25745-2—2015: Energy Performance of Lifts, Escalators and Moving Walks—Part 2: Energy calculation and classification for lifts (elevators) C406.2.6.1 ISO 27327-1—2009: Fans—Air Curtain Units—Laboratory Methods of Testing for Aerodynamic Performance Rating C402.6.6 ISO/AHRI/ASHRAE 13256-1—2017: Water-to-Air and Brine-to-Air Heat Pumps—Testing and Rating for Performance Table C403.3.2(14) ISO/AHRI/ASHRAE 13256-2—2017: Water-to-Water and Brine-to-Water Heat Pumps—Testing and Rating for Performance Table C403.3.2(14)

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#365

Related Mods:

NEMA

ANSI/NEMA MG1—~~2016~~2021: Motors and Generators
C202

OS 4—2016: Requirements for Air-Sealed Boxes for Electrical and Communication Applications C402.6.1.2.2.1

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#366

Related Mods:

NFPA

70—~~20~~23: National Electrical Code
C405.12.1 CG101.2.6C405.16.2.3C501.2

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#367

Related Mods:

NFRC

100—~~2020~~2023: Procedure for Determining Fenestration Products *U*-factors
C303.1.3Table C402.1.2C402.1.2.1.7Table C402.1.4 C402.2.1.2 C402.5.1.1

200—~~2020~~2023: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
C303.1.3 C402.5.1.1

203—~~2017~~2023: Procedure for Determining Visible Transmittance of Tubular Daylighting Devices C303.1.3

300—2023: Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems C402.3

400—~~2020~~2023: Procedure for Determining Fenestration Product Air Leakage

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#368

Related Mods:

OpenADR

OpenADR Alliance
111 Deerwood Road, Suite 200 San Roman, CA 94583

OpenADR 2.0a and 2.0b—2019: Profile Specification Distributed Energy Resources

C403.4.6.2, C406.3

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#369	
Related Mods:	RESNET Residential Energy Services Network, Inc. P.O. Box 4561 Oceanside, CA 92052-4561 **ANSI/RESNET/ICC 380-2022: Standard for Testing Airtightness of Building, Dwelling Unit and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#370	
Related Mods:	SMACNA **ANSI/SMACNA 016, 2nd edition—2012: HVAC Air Duct Leakage Test Manual Second Edition (ANSI/SMACNA 016—2012) C403.13.2.3 C503.3.3**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#371	
Related Mods:	**UL** **710—2012: Exhaust Hoods for Commercial Cooking Equipment—with Revisions through ~~November 2013~~February 2021 C403.7.5** **727—2018: Oil-fired Central Furnaces** **Table C403.3.2(5)** **731—2018: Oil-fired Unit Heaters** **Table C403.3.2(5)** **1741—2021: Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources** **C405.16** **1784—2015: Air Leakage Tests of Door Assemblies—with Revisions through February 2015**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

CE#372	
Related Mods:	**WDMA** **AAMA/WDMA/CSA 101/I.S.2/A440—~~17~~22: North American Fenestration Standard/Specification for windows, doors and skylights Table C402.6.3**
CE#373	Replaces the “net zero carbon” text with “net zero operational energy.” New Definition. Adds new Definition. Deleted existing definition. Adds new Definition. Adds new Definition. Modifies an existing definition. Modifies an existing definition. Adds new Definition. Modifies an existing definition. Deletes an existing definition. Renames the table title and updates the values.
Related Mods: CECPI-5-21, CED1-204-22	APPENDIX CC ZERO ENERGY COMMERCIAL BUILDING PROVISIONS (continued below)

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
	x			

APPENDIX CC ZERO ENERGY COMMERCIAL BUILDING PROVISIONS

CC101.1 Purpose. The purpose of this appendix is to supplement the *International Energy Conservation Code* and require renewable energy systems of adequate capacity to achieve net zero ~~carbon~~operational energy.

CC101.2 Scope. This appendix applies to new buildings that are addressed by the *International Energy Conservation Code*.

Exceptions:

1. Detached one- and two-family dwellings and townhouses as well as Group R-2 buildings three stories or less in height above grade plane, manufactured homes (mobile dwellings), and manufactured houses (modular dwellings).
2. Buildings that use neither electricity nor fossil fuel.

SECTION CC102 DEFINITIONS

CC102.1 Definitions. The definitions contained in this section supplement or modify the definitions in the *International Energy Conservation Code*.

ADJUSTED OFF-SITE RENEWABLE ENERGY. The amount of energy production from off-site renewable energy systems that may be used to offset building energy.

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

DIRECT ACCESS TO WHOLESALE MARKET. An agreement by the *owner* and a renewable energy developer to purchase renewable energy from the wholesale market.

DIRECT OWNERSHIP. An off-site renewable energy system under the ownership or control of the building project *owner*.

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

GREEN RETAIL PRICING. A program by the retail electricity provider to provide 100 percent renewable energy to the building project *owner* .

MINIMUM RENEWABLE ENERGY REQUIREMENT. The minimum amount of on-site or adjusted off-site renewable energy needed to comply with this appendix.

OFF-SITE RENEWABLE ENERGY SYSTEM. A ~~R~~renewable energy system that serves the building project and is not an on-site renewable energy system, including contracted purchases of renewable energy and renewable energy certificates (RECs)~~located on the building project~~.

ON-SITE RENEWABLE ENERGY SYSTEM. Renewable energy systems ~~on the *building* project.~~located on any of the following:

1. The building.
2. The property on which the building is located.
3. A property that shares a boundary with and is under the same ownership or control as the property on which the building is located.
4. A property that is under the same ownership or control as the property on which the building is located and is separated only by a public right-of-way from the building served by the renewable energy system.

RENEWABLE ENERGY INVESTMENT FUND (REIF). A fund established by a jurisdiction to accept payment from building project owners to construct or acquire interests in qualifying renewable energy systems, together with their associated RECS, on the building project owner's behalf.

RENEWABLE ENERGY SYSTEM. Photovoltaic, solar thermal, geothermal energy extracted from hot fluid or steam, wind, or other *approved* ~~and wind~~ systems used to generate renewable energy.

SEMIHEATED SPACE. An *enclosed space* within a *building* that is heated by a heating system whose output capacity is greater than or equal to 3.4 Btu/h × ft^2 of floor area but is not a *conditioned space*.

~~**ZERO ENERGY PERFORMANCE INDEX (ZEPI PB/EE).** The ratio of the proposed building EUI without renewables to the baseline building EUI, expressed as a percentage.~~

SECTION CC103 MINIMUM RENEWABLE ENERGY

CC103.1 Renewable energy. On-site renewable energy systems shall be installed ~~, or off-site renewable energy shall be procured to offset the building energy as calculated in Equation CC-1.~~, or adjusted off-site renewable energy shall be procured to meet the minimum renewable energy requirement in accordance with **Equation CC-1**.

$$RE_{on\text{-}site} + RE_{off\text{-}site} \geq RE_{min}$$ Equation CC-1

where:

$RE_{on\text{-}site}$ = Annual site energy production from on-site renewable energy systems ~~(see Section CC103.2).~~, including installed on-site renewable energy systems used for compliance with **Sections C405.13.1** and **C406**.

$RE_{off\text{-}site}$ = Adjusted annual site energy production from off-site renewable energy systems that ~~may be credited against building energy use (see Section CC103.3).~~is permitted to be credited against the minimum renewable energy requirement. This includes off-site renewable energy purchased for compliance with **Section C405.13.2**.

~~$E_{building}$ = Building energy use without consideration of renewable energy systems.~~ RE_{min} = Minimum renewable energy requirement.

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

~~When Section C401.2.1, Item 2 or Section C401.2.2 is used for compliance with the *International Energy Conservation Code*, building energy shall be determined from energy simulations.~~ the minimum renewable energy requirement shall be determined by multiplying the gross conditioned floor area plus the gross semiheated floor area of the proposed building by the prescriptive renewable energy requirement from **Table CC103.1**. An area-weighted average shall be used for mixed-use buildings.

When **Section C401.2.1**, Item 2 or **Section C401.2.2** is used for compliance with the *International Energy Conservation Code*, the minimum renewable energy requirement shall be equal to the building energy as determined from energy simulations.

Delete entire Table CC103.1

TABLE CC103.1
PRESCRIPTIVE RENEWABLE ENERGY REQUIREMENT FOR BUILDING TYPES AND CLIMATES (kWh/ft^2-yr)

CLIMATE ZONE	BUILDING AREA TYPE											
	Multifamily (R-2)	Healthcare/ Hospital (I-2)	Hotel/ Motel (R-2)	Office (B)	Restaurant (A-2)	Retail (M)	School (E)	Warehouse (S)	Grocery Store (M)	Laboratory (B)	Assembly (A)	All Others
0A	13	35	23	10	129	17	16	3	27	41	5	17
0B	12	34	22	10	123	17	15	3	26	40	5	16
1A	11	32	20	9	113	14	13	3	24	36	4	15
1B	11	32	20	9	118	15	14	3	24	37	5	15
2A	11	32	20	8	114	13	12	3	22	34	4	14
2B	11	30	18	8	108	12	11	3	22	33	4	13
3A	11	30	18	8	117	13	11	3	21	31	4	13
3B	10	29	18	8	110	12	10	3	20	31	4	13
3C	9	28	18	7	100	10	9	2	18	27	3	12
4A	12	31	18	8	123	15	11	6	21	32	4	14
4B	11	29	18	7	113	12	10	4	20	30	4	13
4C	10	28	17	7	111	13	10	4	18	28	3	13
5A	12	31	19	8	133	17	11	8	22	34	4	15

5B	11	29	18	8	125	14	11	5	21	31	4	14
5C	10	29	17	7	116	13	10	4	18	27	3	13
6A	14	33	20	10	151	20	13	11	26	39	5	17
6B	13	33	19	8	137	17	11	7	22	34	4	16
7	14	37	21	9	164	20	13	10	25	37	5	18
8	15	40	22	11	190	23	16	10	28	43	5	20

For SI: 1 kilowatt hour per square foot = 10.76 kWh/m^2

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#374

Modifies the on-site renewable energy calculation software requirement.
Adds new Table CC103.2.
Adds new subsection CC103.2.1.
Revises the code provision for clarity.

Related Mods:

CECPI-5-21, CED1-204-22

CC103.2 Calculation of on-site renewable energy. The annual energy production from on-site renewable energy systems shall be determined using ~~the PVWatts software or other~~ *approved* software ~~*approved* by the code official~~

TABLE CC103.2
PROCUREMENT FACTORS FOR RENEWABLE ENERGY SYSTEM COMPLIANCE ALTERNATIVES

ON-SITE RENEWABLE ENERGY	**PROCUREMENT FACTOR**	
	Unbundled RECs	**Other Procurement Methods**
7.5 W/ft^2 of roof area or more or where one or more of Exceptions 1, 2 and 3 to **Section C405.15.1** are satisfied.	0.20	1.0
Less than 7.5 W/ft^2 of roof area and none among Exceptions 1, 2 and 3 to Section C405.15.1 is satisfied.	0.20	0.75

For SI: 1 watt per square foot = W/0.0929 m^2.

W = Watts.

CC103.2.1 Renewable energy certificates. Renewable energy certificates (RECs) associated with the on-site renewable energy system shall be assigned to the initial and subsequent building owner(s) for a cumulative period of not less than 15 years. The building owner(s) are permitted to transfer RECs to building tenants occupying the *building* .

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#375

Renames the section title and revises the provision for clarity.
Revises the code provision for clarity.
Edits the off-site renewable calculation equation and updates definition of the variables.
Adds new Section CC103.3.3.1.
Deletes Table CC103.3.3.

Related Mods:

CECPI-5-21, CED1-204-22

CC103.3 Off-site renewable energy. Off-site energy shall comply with **Sections CC103.3.1** and CC103.3.2.

CC103.3.1 ~~Qualifying off-site~~Off-site procurement methods. ~~The following are considered qualifying off-site renewable energy procurement methods:~~One or more of the following off- site renewable energy procurement methods shall be used to comply with **Section CC103.1**:

~~1.~~ Community renewables energy facility ~~: an off-site renewable energy system for which the owner has purchased or leased renewable energy capacity along with other subscribers.~~

2. *Renewable energy investment fund* ~~: an entity that installs renewable energy capacity on behalf of the owner~~.

~~3. Virtual power purchase agreement: a power purchase agreement for off-site renewable energy where the owner agrees to purchase renewable energy output at a fixed price schedule.~~*Financial renewable energy power purchase agreement* .

4. Direct ownership~~: an off-site renewable energy system owned by the building project owner~~.

5. Direct access to wholesale market~~: an agreement between the owner and a renewable energy developer to purchase renewable energy~~.

6. Green retail pricing~~tariffs: a program by the retail electricity provider to provide 100-percent renewable energy to the owner~~.

7. Unbundled Renewable Energy Certificates (RECs)~~: certificates purchased by the owner representing the environmental benefits of renewable energy generation that are sold separately from the electric power~~.

8. *Physical renewable energy power purchase agreement* .

CC103.3.2 Requirements for all procurement methods. ~~The following requirements shall apply to all *off-site renewable energy* procurement methods:~~Off-site renewable energy systems and procurement methods used to comply with **Section CC103.1** shall comply with all of the following:

1. The building *owner* shall sign a legally binding contract or other *approved* agreement to procure qualifying off-site renewable energy.
2. The procurement contract shall have duration of not less than 15 years and shall be structured to survive a partial or full transfer of ownership of the property.
3. RECs ~~and other environmental attributes~~ associated with the procured *off-site renewable energy* shall comply with the following requirements:~~be assigned to the building project for the duration of the contract.~~
   3.1. The RECs shall be retained or retired by or on behalf of the property *owner* or tenant for a period of not less than 15 years.
   3.2. The RECs shall be created within a 12-month period of use of the REC.
   3.3. The RECs shall be from a generating asset constructed not more than 5 years before the issuance of the certificate of occupancy.
4. ~~The renewable energy generating source shall include one or more of the following: photovoltaic systems, solar thermal power plants, geothermal power plants and wind turbines.~~The generating source shall be a renewable energy system.
5. The generation source shall be located where the energy can be delivered to the *building site* by any of the following:

   ~~the same utility or distribution entity, the same~~ independent system operator (ISO) or regional transmission organization (RTO), or ~~within integrated ISOs (electric coordination council).~~
   5.1. Direct connection to the off-site renewable energy facility.
   5.2. The local utility or distribution entity.
   5.3. An interconnected electrical network where energy delivery capacity between the generator and the *building* site is available.

6. ~~The *off-site renewable energy* producer shall maintain transparent accounting that clearly assigns production to the building. Records on power sent to or purchased by the building shall be retained by the building *owner* and made available for inspection by the *code official* upon request.~~Records on power sent to or purchased by the building shall be retained by the building owner and made available for inspection by the code official upon request.

CC103.3.3 Adjusted off-site renewable energy. The process for calculating the adjusted *off-site renewable energy* is shown in **Equation CC-2**.

$$RE_{off\text{-}site} = PF_{NonRecs} \times RE_{NonRecs} + 0.20 \times RE_{Recs}$$

~~$RE_{off\text{-}site} = PF_{NonRecs} \times RE_{NonRecs} + 0.20 \times RE_{Recs}$~~ **Equation CC-2**

where:

$RE_{off\text{-}site}$ = Adjusted off-site renewable energy.

PF_i = ~~Procurement factor for the i^{th} renewable energy procurement method or class taken from Table CC103.3.3.~~ $PF_{NonRecs}$ = The renewable energy procurement factor for off-site renewable energy other than RECs, in accordance with **Section CC103.3.1**.

~~RE_i = Annual energy production for the i^{th} renewable energy procurement method or class.~~ $RE_{NonRecs}$ = Annual energy production for renewable energy procurement methods other than RECs.

~~n = The number of renewable energy procurement options or classes considered.~~ RE_{Recs} = Annual energy production associated with unbundled RECs.

CC103.3.3.1 Procurement factors. The procurement factors for renewable energy system compliance alternatives shall be as specified in **Table CC103.2**.

Delete entire Table CC103.3.3 ~~DEFAULT OFF-SITE RENEWABLE ENERGY PROCUREMENT METHODS, CLASSES AND COEFFICIENTS~~

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#376

Adds new Appendix CD.

Related Mods:

CEPI-257-21

APPENDIX CD THE 2030 GLIDE PATH

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User notes:

About this appendix: *This voluntary appendix is suited for adopting authorities that wish to extend beyond the mandatory provisions of this code toward zero net energy goals.* Appendix CD is intended to be adopted by jurisdictions that will require new construction to operate at zero net energy by the year 2030. It reduces the net annual energy use of buildings by approximately one- third in comparison with buildings constructed in compliance with the 2021 IECC. It is assumed that the 2027 and 2030 editions will also reduce energy use by one-third each.

SECTION CD101 COMPLIANCE

CD101.1 Reserved.

CD101.2 Simulated Building Performance compliance. Where compliance is demonstrated using the Simulated Building Performance option of **Section C401.2.1**, the percentage of annual *energy cost* (PAEC), applied to the *standard reference design* referenced in **Equation 4-32**, shall be multiplied by 0.97.

CD101.3 On-site renewable electricity systems. In addition to any renewable energy generation equipment provided to comply with **Section C406.3**, buildings shall install equipment for *on-site renewable energy* generation with a direct current (DC) nameplate capacity rating of not less than that computed using **Equation CD-2**.

$$AA = CA + SNA/3 \qquad \text{Equation CD-1}$$

where:

AA = Adjusted area, in ft^2 (m^2).

CA = Conditioned area, in ft^2 (m^2).

SNA = Semi-heated and nonconditioned area, in ft^2 (m^2).

$$REQ = AA \times CF \qquad \text{Equation CD-2}$$

where:

REQ = Required on-site capacity, in DC watts.

AA = Adjusted area from **Equation CD-1**, in ft^2 (m^2).

CF = Capacity factor from **Table CD101.3**, in watts/ft^2 (m^2).

Exceptions:

1. Any required renewable energy generation capacity in excess of 10 watts per square foot (108 W/m^2) of net available roof area is permitted to be provided using an off-site renewable energy system in accordance with **Section CD101.4**. For the purposes of this section, net available roof area is the gross roof area minus the roof area occupied by any combination of skylights, mechanical equipment, vegetated areas, required access pathways, vehicle parking and occupied roof terrace area.
2. The following buildings are permitted to provide off-site renewable energy generation in accordance with **Section CD101.4** in lieu of all or part of the *on-site renewable energy* generation capacity required by **Section CD101.3**:

   2.1. Any *building* where more than 50 percent of roof area would be shaded from direct- beam sunlight by existing natural objects or by structures that are not part of the *building* for more than 2,500 annual hours between 8:00 a.m. and 4:00 p.m.

   2.2. Any *building* with gross *conditioned floor area* less than 1,000 square feet (93 m^2).

   2.3. Any *building* whose primary roof slope is 2 units vertical in 12 units horizontal (17 percent slope) or greater.
3. Alternate forms of renewable energy generation capacity are permitted where the annual energy generation is not less than that produced by the required solar capacity, and where annual energy generation is calculated using an *approved* methodology.
4. All or part of the required renewable energy generation capacity is permitted to be replaced by other efficiency measures provided that such measures will reduce the annual energy consumption of the *building* by an amount no less than that which would otherwise be produced annually by the required renewable energy capacity, as calculated using the Simulated Building Performance compliance path in **Section C407** and an *approved* calculation methodology for solar production.

TABLE CD101.3
ON-SITE RENEWABLE ELECTRICITY

CLIMATE ZONE	CAPACITY FACTOR
1A, 2B, 3B, 3C, 4B and 5B	2.0 W/ft^2
0A, 0B, 1B, 2A, 3A and 6B	2.3 W/ft^2
4A, 4C, 5A, 5C, 6A, 7 and 8	2.6 W/ft^2

For SI: 1 watt per square foot = 10.76 W/m^2

CD101.4 Off-site renewable energy. *Buildings* that qualify for one or more of the exceptions to **Section CD101.3** and that do not have on-site renewable energy systems sufficiently sized to fully comply with **Section CD101.3** shall procure off-site renewable energy in accordance with **Sections CD101.4.1** through **CD101.4.3**. Such procured energy shall provide not less than the total annual required off-site renewable energy determined in accordance with **Equation CD-4** and shall be provided in addition to any renewable energy provided to comply with **Section C406.3**.

$$DEF = REQ - INSTL$$ Equation CD-3

where:
DEF = Renewable capacity deficit, in DC watts.
REQ = Required on-site capacity in DC watts, from **Equation CD-2**.
INSTL = Installed on-site capacity, in DC watts

$$OFF = 4.4 \times DEF$$

Equation CD-4

where:
OFF = Off-site renewable energy to be procured, in kWh/year.

CD101.4.1 Off-site procurement. The *building owner* shall procure and be credited for the total amount of off-site renewable energy required by **Equation CD-4**. Procured off-site renewable energy shall comply with the requirements applicable to not less than one of the following:

1. Community renewables energy facility.
2. Financial renewable energy power purchase agreement.
3. Physical renewable energy power purchase agreement.
4. Direct ownership.

5. Renewable Energy Investment Fund.
6. Green retail tariff.

CD101.4.2 Off-site contract. The renewable energy shall be delivered or credited to the *building site* under an energy contract with a duration of not less than 10 years. The contract shall be structured to survive a partial or full transfer of ownership of the building property. The total required off-site renewable energy shall be procured in equal installments over the duration of the off-site contract.

CD101.4.3 Renewable energy certificate (REC) documentation. The property *owner* or *owner's* authorized agent shall demonstrate that where RECs are associated with on-site and off-site renewable energy production required by **Sections CD101.3** and **CD101.4**, the following criteria shall be met:

1. The RECs shall be retained and retired by or on behalf of the property *owner* or tenant for a period of not less than 10 years or the duration of the contract in **Section CD101.4.2**, whichever is less.
2. The RECs shall be created within a 12-month period of the use of the REC.
3. The RECs represent a generating asset constructed not more than 5 years before the issuance of the certificate of occupancy.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#377 New Appendix CE. It is not mandatory unless specifically referenced in the adopting ordinance.

Related Mods:

CEPI76-21

APPENDIX CE REQUIRED HVAC TOTAL SYSTEM PERFORMANCE RATIO (TSPR)

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User notes:

About this appendix: *Appendix CE can be adopted for stretch codes and utility incentive certification that requires Total System Performance Ratio (TSPR) analysis where it is applicable and requires a higher level of performance, saving 5 percent versus minimum efficiency systems.*

SECTION CE101 GENERAL

CE101.1 Required HVAC total system performance ratio (TSPR). For jurisdictions that wish to adopt a stretch code or HVAC incentive system, make the following changes to **Section C403**.

CE101.2 (Replace Section C403.1 with the following) General. Mechanical systems and equipment serving the building heating, cooling, ventilating or refrigerating needs shall comply with one of the following:

1. **Sections C403.1.1** and **C403.2** through **C403.17** and where applicable, **Section C409**.
2. *Data centers* shall comply with **Sections C403.1.1**, **C403.1.2** and **C403.6** through**C403.17**.

CE101.3 HVAC total system performance ratio (TSPR). (Add the following three exceptions to Section C409.2)

Exceptions:

1. Buildings with *conditioned floor area* less than 5,000 square feet (465 m^2).
2. *Alterations* to existing buildings that do not substantially replace the entire HVAC system and are not serving initial build-out construction.
3. HVAC systems meeting or exceeding all the requirements of the applicable target design HVAC system described in **Tables C409.7(1)** through **C409.7(3)**.

TABLE CE101.3 MECHANICAL PERFORMANCE FACTORS

BUILDING TYPE	OCCUPANCY GROUP	CLIMATE ZONE																		
		0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Office (small and medium)[a]	B	0.68	0.68	0.67	0.67	0.65	0.62	0.67	0.65	0.61	0.76	0.67	0.74	0.80	0.73	0.76	0.82	0.79	0.83	0.85
Office (large)[a]	B	0.79	0.79	0.80	0.80	0.75	0.78	0.68	0.77	0.73	0.64	0.72	0.60	0.67	0.68	0.60	0.69	0.67	0.67	0.67
Retail	M	0.57	0.54	0.48	0.52	0.44	0.44	0.41	0.48	0.38	0.43	0.54	0.65	0.44	0.65	0.64	0.48	0.43	0.42	0.36
Hotel/ motel	R-1	0.59	0.59	0.60	0.60	0.59	0.65	0.58	0.67	0.69	0.43	0.56	0.49	0.36	0.45	0.48	0.33	0.36	0.29	0.25
Multifamily/ dormitory	R-2	0.61	0.60	0.64	0.60	0.62	0.61	0.56	0.68	0.52	0.50	0.48	0.42	0.51	0.45	0.36	0.52	0.48	0.48	0.45
School/ education and libraries	E (A-3)	0.78	0.77	0.76	0.75	0.71	0.68	0.67	0.68	0.64	0.69	0.68	0.65	0.78	0.69	0.58	0.85	0.76	0.79	0.73

For SI: 1 square foot = = 0.0929 m^2.

a. Large office = gross conditioned floor area greater than 150,000 square feet or greater than 5 floors; all other offices are small or medium.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#378 Ads new Appendix CF. It is not mandatory unless specifically referenced in the adopting ordinance.

Related Mods:

APPENDIX CF ENERGY CREDITS

CEPI-193-21

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User notes:

***About this appendix:** Appendix CF can be adopted by authorities having jurisdiction seeking stretch codes building on the methodology of **Section C406**.*

SECTION CF101 GENERAL

CF101.1 Purpose. The purpose of this appendix is to supplement the *International Energy Conservation Code* and requires projects to comply with Advanced Energy Credit Package requirements.

CF101.2 Scope. This appendix applies to all buildings that, in accordance with **Section C406.1**, are required to comply with **Section C406.1.1** or **C406.1.2**.

SECTION CF102

ADVANCED ENERGY CREDIT PACKAGE

CF102.1 Advanced Energy Credit Package requirements. The requirements of this section supersede the requirements of **Section C406.1.1**. Projects shall comply with measures from **Section C406.2** to achieve the minimum number of required efficiency credits from **Table CF102.1(1)** based on building occupancy group and *climate zone* . Projects with multiple occupancies, unconditioned parking garages and *buildings* with separate shell-and-core and build- out construction permits shall comply as follows:

Where a project contains multiple occupancies, credits in **Table CF102.1(1)** from each building occupancy shall be weighted by the gross floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of **Section C406** and this appendix.

Exceptions:

1. Unconditioned parking garages that achieve 50 percent of the credits required for use groups S-1 and S-2 in **Table CF102.1(1)**.
2. Portions of buildings devoted to manufacturing or industrial use.
3. Where a *building* achieves more renewable and load management credits in **Section C406.3** than are required in **Section C406.1.2**, surplus credits shall be permitted to reduce required energy efficiency credits as follows:

$$EEC_{red} = EEC_{tbl} - \{\text{the lesser of: } [SRLM_{lim}, SLRM_{adj} \times (RLM_{ach} - RLM_{req})]\}$$

where:

EEC_{red} = Reduced required energy efficiency credits.

EEC_{tbl} = Required energy efficiency credits from **Table C406.1.1(1)**.

$SRLM_{lim}$ = Surplus renewable and load management credit limit from **Table C406.1.1(2)**. $SRLM_{adj}$ = 1.0 for all-electric or all-renewable buildings (excluding emergency generation); 0.7 for buildings with fossil fuel equipment (excluding emergency generation).

RLM_{ach} = Achieved renewable and load management credits from **Section C406.3**.

RLM_{req} = Required renewable and load management credits from **Section C406.1.2**

TABLE CF102.1(1)

ENERGY CREDIT REQUIREMENTS BY BUILDING OCCUPANCY GROUP

BUILDING OCCUPANCY GROUPS	CLIMATE ZONE																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4, and I-1	179	174	188	197	200	200	200	200	200	200	200	200	193	200	200	200	200	200	200
I-2	78	75	73	71	80	90	100	85	90	97	83	90	99	90	96	107	106	130	117
R-1	106	100	110	105	109	122	123	125	131	137	129	136	157	139	147	171	158	180	176
B	114	110	112	115	108	107	116	111	114	126	118	123	135	125	125	152	142	153	141
A-2	83	81	82	82	86	86	108	91	97	126	99	111	147	117	113	160	143	163	151
M	113	113	121	118	123	127	116	116	133	109	100	92	99	134	125	171	146	150	137
E	91	95	91	100	96	100	105	104	101	113	110	110	120	117	122	131	132	126	131
S-1 and S-2	108	106	111	109	109	108	89	106	108	134	100	130	200	143	123	200	190	189	148
All Other	54	53	55	56	57	60	61	60	63	68	60	65	73	68	69	84	79	84	78

TABLE CF102.1(2)

LIMIT TO ENERGY EFFICIENCY CREDIT CARRYOVER FROM RENEWABLE AND LOAD MANAGEMENT CREDITS

BUILDING OCCUPANCY GROUPS	CLIMATE ZONE																		
	OA	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4, AND I-1	100	100	114	110	113	91	95	115	101	73	102	99	54	73	101	45	50	66	62
I-2	30	25	26	20	28	33	38	31	33	37	30	32	41	41	50	53	56	75	80
R-1	20	8	20	5	26	22	20	28	30	19	26	23	24	28	28	27	30	43	54
B	25	19	18	20	15	15	15	24	25	31	36	32	37	40	43	42	40	51	66
A-2	9	5	5	5	5	5	5	5	5	9	5	5	21	9	5	32	19	49	61
M	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10
E	24	24	31	29	29	28	19	33	39	31	43	33	34	37	33	31	33	46	54
S-1 and S-2	5	5	5	5	5	5	5	5	5	5	5	5	37	19	5	49	41	51	56
All other	5	5	5	5	5	5	5	5	15	5	6	8	5	11	15	5	5	9	20

SECTION CF103 BUILDINGS WITHOUT HEAT PUMPS

CF103.1 Buildings without heat pumps. The number of efficiency credits required by **Section C406.1.1** shall be multiplied by 1.25 for the following:

1. Buildings using *purchased energy* that is not electricity for space heating or *service water heating*.
2. Buildings with electric storage water heaters that are not heat pumps.
3. Buildings with total heat pump space heating capacity less than the space heating load at heating design conditions calculated in accordance with **Section C403.1.1**.

Exceptions:

1. Portions of buildings devoted to manufacturing or industrial use.
2. Buildings complying with all of the following:
   - 2.1. The building's peak heating load calculated in accordance with **Section C403.1.1** is greater than the building's peak cooling load calculated in accordance with **Section C403.1.1**.
   - 2.2. The building's total heat pump space heating capacity is not less than 50 percent of the building's space heating load at heating design conditions calculated in accordance with **Section C403.1.1**.
   - 2.3. Any energy source other than electricity or *on-site renewable energy* is used for space heating only where a heat pump cannot provide the necessary heating energy to satisfy the *thermostat* setting.
   - 2.4. Electric resistance heat is used only in accordance with **Section C403.4.1.1**.
3. Low-energy buildings complying with **Section C402.1.1.1**.
4. Portions of buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F or High-Hazard Group H.
5. Buildings located in Climate Zones 0A, 0B, 1A, 1B, 2A and 2B.

SECTION CF104 EXISTING BUILDINGS

CF104.1 Additions not served by heat pumps. The number of efficiency credits required by **Section C502.3.7** shall by multiplied by 1.25 for the following:

1. Additions using *purchased energy* that is not electricity for space heating or *service water heating*.
2. Additions served by electric storage water heaters that are not heat pumps.
3. Additions served by total heat pump space heating capacity less than the peak space heating load at heating design conditions calculated in accordance with **Section C403.1.1**.

Exceptions: Additions complying with all of the following:

1. The *addition* 's peak heating load calculated in accordance with **Section C403.1.1** is greater than the *addition* 's peak cooling load calculated in accordance with **Section C403.1.1**.
2. The *addition* 's total heat pump space heating capacity serving the *addition* is not less than 50 percent of the *addition* 's space heating load at heating design conditions calculated in accordance with **Section C403.1.1**.

3. Any energy source other than electricity or *on-site renewable energy* is used for space heating serving the *addition* only where a heat pump cannot provide the necessary

eating energy to satisfy the *thermostat* setting.

4. Electric resistance heat serving the *addition* is used only in accordance with **Section C403.4.1.1**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#379	Adds new Appendix CG. It is not mandatory unless specifically referenced in the adopting ordinance.

Related Mods:

CED1-15-22

APPENDIX CG ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User notes:

About this appendix: *Appendix CG can be adopted by authorities having jurisdiction seeking electric vehicle charging infrastructure requirements.*

SECTION CG101

ELECTRIC VEHICLE POWER TRANSFER

CG101.1 Definitions.

AUTOMOBILE PARKING SPACE. A space within a building or private or public parking lot, exclusive of driveways, ramps, columns, office and work areas, for the parking of an automobile.

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, electric vehicle supply equipment (EVSE), a rechargeable storage battery, a fuel cell, a photovoltaic array or another source of electic current.

ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE). A designated automobile parking space that is provided with electrical infrastructure such as, but not limited to, raceways, cables, electrical capacity, a panelboard or other electrical distribution equipment space necessary for the future installation of an EVSE

ELECTRIC VEHICLE READY SPACE (EV READY SPACE). An automobile parking space that is provided with a branch circuit and an outlet, junction box or receptacle that will support an installed EVSE

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer, including: ungrounded, grounded and equipment grounding conductors; electric vehicle connectors; attached plugs; any personal protection system; and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

ELECTRIC VEHICLE SUPPLY EQUIPMENT INSTALLED SPACE (EVSE SPACE). An automobile parking space that is provided with a dedicated EVSE connection.

CG101.2 Electric vehicle power transfer infrastructure. Parking facilities shall be provided with electric vehicle power transfer infrastructure in accordance with **Sections CG101.2.1** through **CG101.2.6**.

CG101.2.1 Quantity. The number of required electric vehicle (EV) spaces, *EV capable spaces* and *EV ready spaces* shall be determined in accordance with this section and **Table CG101.2.1** based on the total number of *automobile parking spaces* and shall be rounded up to the nearest whole number. For R-2 buildings, the **Table CG101.2.1** requirements shall be based on the total number of *dwelling units* or the total number of *automobile parking spaces*, whichever is less

1. Where more than one parking facility is provided on a *building site*, the number of required *automobile parking spaces* required to have EV power transfer infrastructure shall be calculated separately for each parking facility.
2. Where one shared parking facility serves multiple building occupancies, the required number of spaces shall be determined proportionally based on the floor area of each building occupancy.
3. Installed electric vehicle supply equipment installed spaces (*EVSE spaces*) that exceed the minimum requirements of this section may be used to meet the minimum requirements for *EV ready spaces* and *EV capable spaces*.
4. Installed *EV ready spaces* that exceed the minimum requirements of this section may be used to meet the minimum requirements for *EV capable spaces*.
5. Where the number of *EV ready spaces* allocated for R-2 occupancies is equal to the number of *dwelling units* or to the number of *automobile parking spaces* allocated to R-2 occupancies, whichever is less, requirements for *EVSE spaces* for R-2 occupancies shall not apply.
6. Requirements for a Group S-2 parking garage shall be determined by the occupancies served by that parking garage. Where new automobile spaces do not serve specific occupancies, the values for Group S-2 parking garage in Table CG101.2.1 shall be used.

Exception: Parking facilities serving occupancies other than R2 with fewer than 10 *automobile parking spaces*.

TABLE CG101.2.1
REQUIRED EV POWER TRANSFER INFRASTRUCTURE

OCCUPANCY	EVSE SPACES	EV READY SPACES	EV CAPABLE SPACES
Group A	10%	0%	10%
Group B	15%	0%	30%
Group E	15%	0%	30%

Group F	2%	0%	5%
Group H	1%	0%	0%
Group I	15%	0%	30%
Group M	15%	0%	30%
Group R-1	20%	5%	75%
Group R-2	20%	5%	75%
Groups R-3 and R-4	2%	0%	5%
Group S exclusive of parking garages	1%	0%	0%
Group S-2 parking garages	15%	0%	30%

CG101.2.2 EV capable spaces. Each *EV capable space* used to meet the requirements of **Section CG101.2.1** shall comply with the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the *EV capable space* and electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with **Section CG101.2.5**.
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have dedicated overcurrent protection device space and electrical capacity to supply a calculated load in accordance with **Section CG101.2.5**.
4. The enclosure or outlet and the electrical distribution equipment directory shall be marked: "For electric vehicle supply equipment (EVSE)."

CG101.2.3 EV ready spaces. Each branch circuit serving *EV ready spaces* used to meet the requirements of **Section CG101.2.1** shall comply with the following:

1. Terminate at an outlet or enclosure located within 3 feet (914 mm) of each *EV ready space* it serves.
2. Have a minimum system and circuit capacity in accordance with **Section CG101.2.5**.
3. The electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

CG101.2.4 EVSE spaces. An installed EVSE with multiple output connections shall be permitted to serve multiple *EVSE spaces*. Each EVSE installed to meet the requirements of **Section CG101.2.1**, serving either a single *EVSE space* or multiple *EVSE spaces*, shall comply with the following:

1. Have a minimum system and circuit capacity in accordance with **Section CG101.2.5**.
2. Have a nameplate rating not less than 6.2 kW.
3. Be located within 3 feet (914 mm) of each *EVSE space* it serves.

4. Be installed in accordance with **Section CG101.2.6**.

CG101.2.5 System and circuit capacity. The system and circuit capacity shall comply with Sections CG101.2.5.1 and CG101.2.5.2.

CG101.2.5.1 System capacity. The electrical distribution equipment supplying the branch circuit(s) serving each *EV capable space*, *EV ready space* and *EVSE space* shall comply with one of the following:

1. Have a calculated load of 7.2 kVA or the nameplate rating of the equipment, whichever is larger, for each *EV capable space*, *EV ready space* and *EVSE space*.
2. Meets the requirements of **Section CG101.2.5.3.1**.

CG101.2.5.2 Circuit capacity. The branch circuit serving each *EV capable space*, *EV ready space* and *EVSE space* shall comply with one of the following:

1. Have a rated capacity not less than 50 amperes or the nameplate rating of the equipment, whichever is larger.
2. Meets the requirements of **Section CG101.2.5.3.2**.

CG101.2.5.3 System and circuit capacity management. Where system and circuit capacity management is selected in **Section CG101.2.5.1** or **CG101.2.5.2**, the installation shall comply with **Sections CG101.2.5.3.1** and **CG101.2.5.3.2**.

CG101.2.5.3.1 System capacity management. The maximum equipment load on the electrical distribution equipment supplying the branch circuits(s) serving *EV capable spaces*, *EV ready spaces* and *EVSE spaces* controlled by an energy management system shall be the maximum load permitted by the energy management system, but not less than 3.3 kVA per space.

CG101.2.5.3.2 Circuit capacity management. Each branch circuit serving multiple *EVSE spaces*, *EV ready spaces* or *EV capable spaces* controlled by an energy management system shall comply with one of the following:

1. Have a minimum capacity of 25 amperes per space.
2. Have a minimum capacity of 20 amperes per space for R-2 occupancies where all *automobile parking spaces* are *EV ready spaces* or *EVSE spaces*.

CG101.2.6 EVSE installation. *EVSE*shall be installed in accordance with **NFPA 70** and shall be *listed*and *labeled*in accordance with UL 2202 or UL 2594. *EVSE*shall be accessible in accordance with **Section 1107** of the *International Building Code*.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#380	Adds new Appendix CH. It is not mandatory unless specifically referenced in the adopting ordinance.

Related Mods:	APPENDIX CH ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS
CECD1-28-22	

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User notes:

About this appendix: *Appendix CH can be adopted where authorities having jurisdiction seek new building to be electric-ready.*

SECTION CH101 GENERAL

CH101.1 Intent. The intent of this appendix is to amend the *International Energy Conservation Code* to reduce future retrofit costs by requiring *commercial buildings* with combustion equipment to install the electrical infrastructure for electric equipment.

CH101.2 Scope. The provisions in this appendix are applicable to *commercial buildings* . New construction shall comply with **Section CH103**.

SECTION CH102 DEFINITIONS

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, service water heating, cooking, clothes drying or lighting that uses a fossil fuel.

COMMERCIAL COOKING APPLIANCES. Commercial cooking appliances used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such appliances include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries and similar appliances.

SECTION CH103

NEW COMMERCIAL BUILDING

CH103.1 Additional electric infrastructure. Electric infrastructure in *buildings* that contain combustion equipment shall be installed in accordance with this section.

CH103.1.1 Combustion space heating. Spaces containing combustion equipment for space heating shall comply with **Sections CH103.1.1.1**, **CH103.1.1.2** and **CH103.1.1.3**

TABLE CH103.1.1

99.6% HEATING DESIGN TEMPERATURE		P_s
Greater than (°F)	**Not greater than**	**VA/kBtu/h**
50	N/A	N/A
45	50	94
40	45	100
35	40	107
30	35	115

25	30	124
20	25	135
15	20	149
10	15	164
5	10	184
0	5	210
-5	0	243
-10	-5	289
-15	-10	293

For SI: °C = [(° F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 kW

CH103.1.1.1 Designated exterior locations for future electric space-heating equipment. Spaces containing combustion equipment for space heating shall be provided with designated exterior location(s) shown on the plans and of sufficient size for outdoor space-heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the space- heating equipment, and with natural drainage for condensate from heating operation or a condensate drain located within 3 feet (914 mm) of the location of the future exterior space-heating heat pump equipment.

CH103.1.1.2 Dedicated branch circuits for future electric space-heating equipment. Spaces containing combustion space-heating equipment with a capacity not more than 65,000 Btu/h (19 kW) shall be provided with a dedicated 240-volt branch circuit with ampacity of not less than 50. The branch circuit shall terminate within 6 feet (1829 mm) of the space heating equipment and be in a location with ready *access* . Both ends of the branch circuit shall be labeled with the words "For Future Electric Space Heating Equipment" and be electrically isolated. Spaces containing combustion equipment for space heating with a capacity of not less than 65,000 Btu/h (19 kW) shall be provided with a dedicated branch circuit rated and sized in accordance with **Section CH103.1.1.3**, and terminating in a junction box within 3 feet (914 mm) of the location the space heating equipment in a location with ready *access* . Both ends of the branch circuit shall be labeled "For Future Electric Space Heating Equipment."

Exceptions:

1. Where a branch circuit provides electricity to the space heating combustion equipment and is rated and sized in accordance with **Section CH103.1.1.3**.
2. Where a branch circuit provides electricity to space cooling equipment and is rated and sized in accordance with **Section CH103.1.1.3**.
3. Where future electric space heating equipment would require three-phase power and the space containing combustion equipment for space heating is provided with an electrical panel with a label stating "For Future Electric Space Heating Equipment" and a bus bar rated and sized in accordance with **Section CH103.1.1.3**.
4. Buildings where the 99.6 percent design heating temperature is not less than 50^{0}F (10°C).

CH103.1.1.3 Additional space heating electric infrastructure sizing. Electric infrastructure for future electric space heating equipment shall be sized to accommodate not less than one of the following:

1. An electrical capacity not less than the nameplate space heating combustion equipment heating capacity multiplied by the value in **Table CH103.1.1**, in accordance with **Equation CH-1**.

$$VA_s = Q_{com} \times P_s$$

Equation CH-1

VA s = The required electrical capacity of the electrical infrastructure in volt-amps. *Q* com = The nameplate heating capacity of the combustion equipment in kBtu/h. *P* s = The VA per kBtu/h from **Table CH103.1.1** in VA/kBtu/h.

2. An electrical capacity not less than the peak space heating load of the building areas served by the space heating combustion equipment, calculated in accordance with **Section C403.1.1**, multiplied by the value for the 99.6 percent design heating temperature in **Table CH103.1.1**, in accordance with **Equation**

CH-2.

$$VA_s = Q_{design} \times P_s$$

Equation CH-2

VA s = The required electrical capacity of the electrical infrastructure in volt-amps. *Q* design = The 99.6 percent design heating load of the spaces served by the combustion equipment in kBtu/h.
P s = The VA per kBtu/h from **Table CH103.1.1** in VA/kBtu/h.

3. An *approved* alternate design that uses no energy source other than electricity or *on-site renewable energy* .

CH103.1.2 Combustion service water heating Spaces containing combustion equipment for *service water heating* shall comply with **Sections CH103.1.2.1**, **CH103.1.2.2** and **CH103.1.2.3**.

TABLE CH103.1.2

ALTERNATE ELECTRIC WATER HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

99.6% HEATING DESIGN TEMPERATURE		**P w**
Greater than (°F)	**NOT MORE THAN**	**VA/kBtu/h**
55	60	118
50	55	123
45	50	129
40	45	136
35	40	144
30	35	152

25	30	162
20	25	173
15	20	185
10	15	293
5	10	293
0	5	293
Less than 0 °F		293

For SI: °C = [(°F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 kW

CH103.1.2.1 Combustion service water heating electrical infrastructure. For each piece of combustion equipment for water heating with an input capacity of not more than 75,000 Btu/h (22 kW), the following electrical infrastructure is required:

1. An individual 240-volt branch circuit with an ampacity of not less than 30 shall be provided and terminate within 6 feet (1829 mm) of the *water heater* and shall be in a location with ready *access*.
2. The branch circuit overcurrent protection device and the termination of the branch circuit shall be labeled "For future electric water heater."
3. The space for containing the future *water heater* shall include the space occupied by the combustion equipment and shall have a height of not less than 7 feet (2134 mm), a width of not less than 3 feet (914 mm), a depth of not less than 3 feet (914 mm) and with a volume of not less than 700 cubic feet (20 m^3).

Exception: Where the space containing the *water heater* provides for air circulation sufficient for the operation of a heat pump *water heater* , the minimum room volume shall not be required.

CH103.1.2.2 Designated locations for future electric heat pump water heating equipment. Designated locations for future electric heat pump water heating equipment shall be in accordance with one of the following:

1. Designated exterior location(s) shown on the plans, of sufficient size for outdoor water heating heat pump equipment , and with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the water heating equipment.
2. An interior location with a minimum volume the greater of 700 cubic feet (19 822 L) or 7 cubic feet (198 L) per 1,000 Btu/h (293 W) combustion equipment water heating capacity. The interior location shall include the space occupied by the combustion equipment.
3. An interior location with sufficient airflow to exhaust cool air from future water heating heat pump equipment provided by not fewer than one 16-inch (406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203 mm) *duct* of not more than 10 feet (3048 mm) in length for cool exhaust air.

CH103.1.2.3 Dedicated branch circuits for future electric heat pump water heating equipment. Spaces containing combustion equipment for water heating with a capacity of greater than 75,000 Btu/h (21 980 W) shall be provided with a dedicated branch circuit rated and sized in accordance with **Section CH103.1.2.4** and terminating in a junction box within 3 feet (914 mm) of the location the water heating equipment in a location with ready *access* . Both ends of the branch circuit shall be labeled "For Future Electric Water Heating Equipment."

Exception: Where future electric water heating equipment would require three-phase power and the main electrical service panel has a reserved space for a bus bar rated and sized in accordance with **Section CH103.1.2.4** and labeled "For Future Electric Water Heating Equipment."

CH103.1.2.4 Additional water heating electric infrastructure sizing. Electric infrastructure water heating equipment with a capacity of greater than 75,000 Btu/h (21 980 W) shall be sized to accommodate one of the following:

1. An electrical capacity not less than the combustion equipment water heating capacity multiplied by the value in **Table CH103.1.2** plus electrical capacity to serve recirculating loads as shown in **Equation CH-3**.

$$VA_w = (Q_{capacity} \times P_w) + [Q_{recirc} \times 293(VA/(\mathrm{Btu/h}))]$$

2. An alternate design that complies with this code, is *approved* by the authority having jurisdiction and uses no energy source other than electricity or *on-site renewable energy*.

CH103.1.3 Combustion cooking. Spaces containing combustion equipment for cooking shall comply with **Section CH103.1.3.1** or **CH103.1.3.2**.

CH103.1.3.1 Commercial cooking. Spaces containing commercial cooking appliances shall be provided with a dedicated branch circuit with a minimum electrical capacity in accordance with **Table CH103.1.3.1** based on the appliance in the space. The branch circuit shall terminate within 3 feet (914 mm) of the appliance in a location with ready *access* . Both ends of the branch circuit shall be labeled with the words "For Future Electric Cooking Equipment" and be electrically isolated.

TABLE CH103.1.3.1

COMMERCIAL COOKING MINIMUM BRANCH CIRCUIT CAPACITY

COMMERCIAL COOKING APPLIANCE	MINIMUM BRANCH CIRCUIT CAPACITY
Range	469 VA/kBtu/h
Steamer	114 VA/kBtu/h
Fryer	200 VA/kBtu/h
Oven	266 VA/kBtu/h
Griddle	195 VA/kBtu/h
All other commercial cooking appliances	114 VA/kBtu/h

For SI: 1 British thermal unit per hour = 0.2931 kW

CH103.1.3.2 All other cooking. Spaces containing all other cooking equipment not designated as commercial cooking appliances shall be provided with a dedicated branch circuit in compliance with **NFPA 70** Section 422.10. The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be in a location with ready *access* . Both ends of the branch circuit shall be labeled with the words “For Future Electric Cooking Equipment” and be electrically isolated.

CH103.1.4 Combustion clothes drying. Spaces containing combustion equipment for clothes drying shall comply with **Section CH103.1.4.1** or **CH103.1.4.2**.

CH103.1.4.1 Commercial drying. Spaces containing clothes drying equipment and end uses for commercial laundry applications shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for equivalent electric equipment with equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, “For Future Electric Clothes Drying Equipment.”

CH103.1.4.2 Residential drying. Spaces containing clothes drying equipment, appliances and end uses serving multiple *dwelling units* or sleeping areas with a capacity less than or equal to 9.2 cubic feet (0.26 m^3) shall be provided with a dedicated 240-volt branch circuit with a minimum capacity of 30 amperes, shall terminate within 6 feet (1829 mm) of fossil fuel clothes dryers and shall be in a location with ready *access* . Both ends of the branch circuit shall be labeled with the words “For Future Electric Clothes Drying Equipment” and be electrically isolated.

CH103.1.5 On-site transformers. *Enclosed spaces* and underground vaults containing on- site electric transformers on the *building* side of the electric utility meter shall have sufficient space to accommodate transformers sized to serve the additional electric loads identified in **Sections CH103.1.1**, **CH103.1.2**, **CH103.1.3** and **CH103.1.4**.

CH103.2 Hydronic heating design requirements. For all hydronic space heating systems, the design entering water temperature for coils, radiant panels, radiant floor systems, radiators, baseboard heaters and any other device that uses hot water to provide heat to a space shall be not more than 130°F (54°C).

CH103.3 Construction documentation. The *construction documents* shall provide details for additional electric infrastructure including branch circuits, conduit, prewiring, panel capacity and electrical service capacity, as well as designated for future electric equipment.

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#381 Adds new Appendix CI. It is not mandatory unless specifically referenced in the adopting ordinance.

Related Mods: APPENDIX CI DEMAND RESPONSIVE CONTROLS

CEAPP-01-24	*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

User notes:

About this appendix: *Appendix CI can by adopted by authorities having jurisdiction seeking demand responsive controls to be integrated into heating and cooling systems, water heating systems and lighting systems.*

SECTION CI101

DEMAND RESPONSIVE HEATING AND COOLING SYSTEMS

CI101.1 Demand responsive controls. Electric heating and cooling systems shall be provided with demand responsive controls capable of executing the following actions in response to a *demand response signal*:

1. Automatically increasing the zone operating cooling setpoint by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C).
2. Automatically decreasing the zone operating heating setpoint by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C).

Where a *demand response signal* is not available, the heating and cooling system controls shall be capable of performing all other functions. Where *thermostats* are controlled by direct digital control including, but not limited to, an energy management system, the system shall be capable of *demand responsive control* and capable of adjusting all thermal setpoints to comply. The demand responsive controls shall comply with either **Section CI101.1.1** or **CI101.1.2**.

Exceptions:

1. Group I occupancies.
2. Group H occupancies.
3. Controls serving *data center systems*.
4. Occupancies or applications requiring precision in indoor temperature control as approved by the *code official*.
5. Buildings that comply with Load Management measure G02 in **Section C406.3.3**.
6. Buildings with energy storage capacity for not less than a 25 percent load reduction at peak load for a period of not less than 3 hours.

CI101.1.1 Air conditioners and heat pumps with two or more stages of control and cooling capacity of less than 65,000 Btu/h. *Thermostats* for air conditioners and heat pumps with two or more stages of control and a cooling capacity less than 65,000 Btu/h (19 kW) shall be provided with a *demand responsive control* that complies with the communication and performance requirements of **AHRI 1380**.

CI101.1.2 All other heating and cooling systems. *Thermostats* for heating and cooling systems shall be provided with a *demand responsive control* that complies with one of the following:

1. Certified **OpenADR 2.0a** VEN, as specified under Clause 11, Conformance.
2. Certified **OpenADR 2.0b** VEN, as specified under Clause 11, Conformance.
3. Certified by the manufacturer as being capable of responding to a *demand response signal* from a certified **OpenADR 2.0b** VEN by automatically implementing the control functions requested by the VEN for the equipment it controls.
4. **IEC 62746-10-1**.
5. The communication protocol required by a controlling entity, such as a utility or service provider, to participate in an automated demand response program.

6. The physical configuration and communication protocol of **ANSI/CTA 2045-A** or **ANSI/ CTA 2045-B**.

SECTION CI102

DEMAND RESPONSIVE WATER HEATING

CI102.1 Demand responsive water heating. Electric storage water heaters with a rated water storage volume of 40 gallons (151 L) to 120 gallons (454 L) and a nameplate input rating equal to or less than 12 kW shall be provided with demand responsive controls in accordance with **Table CI102.1**.

Exceptions:

1. Water heaters that provide a hot water delivery temperature of 180°F (82°C) or greater.
2. Water heaters that comply with Section IV, Part HLW or Section X of the **ASME Boiler and Pressure Vessel Code**.
3. Water heaters that use three-phase electric power.

TABLE CI102.1
DEMAND RESPONSIVE CONTROLS FOR WATER HEATING

EQUIPMENT TYPE	CONTROLS	
	Manufactured before 7/1/2025	**Manufactured on or after 7/ 1/2025**
Electric storage water heaters	**AHRI Standard 1430** or **ANSI/CTA-2045-B** Level 1 and also capable of initiating water heating to meet the temperature setpoint in response to a demand response signal	**AHRI Standard 1430**

SECTION CI103
DEMAND RESPONSIVE LIGHTING CONTROLS

CI103.1 Demand responsive lighting controls. Interior general lighting in Group B, E, M and S occupancies shall have demand responsive controls complying with **Section C405.2.8.1** in not less than 75 percent of the interior floor area.

Exceptions:

1. Where the combined interior floor area of Group B, E, M and S occupancies is less than 10,000 square feet (929 m^2).
2. Buildings where a *demand response signal* is not available from a controlling entity other than the *owner*.
3. Parking garages.
4. Ambulatory care facilities.
5. Outpatient clinics.
6. Physician or dental offices.

SECTION CI104 REFERENCED STANDARDS

CI104.1 General. See **Table CI104.1** for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE CI104.1 REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
AHRI 1430 (I-P)—2022	*Demand Flexible Electric Storage Water Heaters (with Addendum 1)*	**Table CI102.1**
ASME BPVC	*Boiler and Pressure Vessel Code*	**CI102.1**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#382	Adds new Appendix CJ. It is not mandatory unless specifically referenced in the adopting ordinance.

Related Mods:

CEPI-7-21

APPENDIX CJ ELECTRICAL ENERGY STORAGE SYSTEM

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User notes:

About this appendix: *This voluntary appendix provides requirements for electric energy storage readiness provisions.*

SECTION CJ101 ELECTRICAL ENERGY STORAGE SYSTEM

CJ101.1 Electrical energy storage system. Buildings shall comply with **Section CJ101.1.1** or CJ101.1.2.

CJ101.1.1 Electrical energy storage system (ESS) capacity. Each building shall have one or more ESS with a total rated energy capacity and rated power capacity as follows:

1. ESS-rated energy capacity (kWh) ≥ 1.0 × installed on-site renewable electric energy system rated power (kWDC).
2. ESS-rated power capacity (kW) ≥ 0.25 × installed on-site renewable electric energy system rated power (kWDC).

Where installed, DC-coupled battery systems shall meet the requirements for rated energy capacity alone.

CJ101.1.2 Electrical energy storage system (ESS) ready. Each building shall have one or more reserved ESS-ready areas to accommodate future electrical storage in accordance with **Sections CJ101.1.2.1** through **CJ101.1.2.4**.

Related Mods:	**CJ101.1.2.1 ESS-ready location.** Each ESS-ready area shall be located in accordance with **Section 1207** of the *International Fire Code*. **CJ101.1.2.2 ESS-ready minimum area requirements.** Each ESS-ready area shall be sized in accordance with the spacing requirements of **Section 1207** of the *International Fire Code* and the **UL 9540** or **UL 9540A** designated rating of the planned system. Where rated to **UL 9540A**, the area shall be sized in accordance with the manufacturer's instructions. **CJ101.1.2.3 Electrical distribution equipment.** The on-site electrical distribution equipment shall have sufficient capacity, rating and space to allow the installation of overcurrent devices and circuit wiring in accordance with **NFPA 70** for future electrical ESS complying with the capacity criteria of **Section CJ101.1.2.4**. **CJ101.1.2.4 ESS-ready minimum system capacity.** Compliance with ESS-ready requirements in **Sections CJ101.1.2.1** through **CJ101.1.2.3** shall be based on a minimum total energy capacity and minimum rated power capacity as follows: 1. ESS-rated energy capacity (kWh) ≥ gross conditioned floor area of the three largest floors (ft^2) × 0.0008 kWh/ft^2. 2. ESS-rated power capacity (kW) ≥ gross conditioned floor area of the three largest floors (ft^2) × 0.0002 kW/ft^2. SECTION CJ102 REFERENCED STANDARDS **CJ102.1 General.** See **Table CJ102.1** for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard. TABLE CJ102.1 REFERENCED STANDARDS **STANDARD ACRONYM** | **STANDARD NAME** | **SECTIONS HEREIN REFERENCED** ANSI/CAN/UL 9540—2020 | *Energy Storage Systems and Equipment* | **CJ101.1.2.2** ANSI/CAN/UL 9540A—2019 | *Test Method for Evaluating Runaway Fire Propagation Energy Storage Systems* | **CJ101.1.2.2** Staff Classification | Correlates Directly: X | Energy Standard Needed | Over lap Action | AS | AS/IC | D: x | D/IC
CE#383	Adds new Resource CRB.
Related Mods:	**RESOURCE CRB THE 2030 GLIDE PATH (PRESCRIPTIVE)** *Resources are related information that is not part of the code.*

User notes:

About this resource: *This resource is intended to be adopted by jurisdictions that will require new construction to operate at net zero energy by the year 2030. It reduces the net annual energy use of buildings by approximately one-third in comparison with buildings constructed in compliance with the 2021 IECC. It is assumed that the 2027 and 2030 editions will also reduce energy use by one- third each.*

ICC Council Policy-49 Note: *This resource is an accompaniment to the performance pathway included within Appendix CD and is intended for adopting authorities that wish to extend beyond the mandatory provisions of this code toward Zero Net Energy goals. For jurisdictions in the United States, compliance options for this prescriptive path may be limited if using only minimum efficiency mechanical and service water heating equipment. Adopting authorities may need to consider alternative means to expand methods for compliance under these conditions (see Section C104.1). Adopting authorities should be aware of potential preemption issues based on the Energy Policy and Conservation Act when evaluating whether to adopt the content in this resource. See the Public Health and Welfare Act, 42 U.S.C. § 6297: Effect on other law. Whether the content in this resource or a modification thereof is subject to preemption may depend on court decisions or whether a waiver has been issued by the US Department of Energy pursuant to 42 U.S.C. § 6297(d).*

SECTION CRB101 COMPLIANCE

CRB101.1 Prescriptive compliance. Where compliance is demonstrated using the Prescriptive Compliance option in **Section C401.2.1**, the number of additional efficiency credits required by **Section C406.1** shall be 1.4 times the number that is required by **Section C406.1.1**.

Exception: Where a building achieves more renewable and load management credits in **Section C406.3** than are required in **Section C406.1.2**, surplus credits shall be permitted to reduce required energy efficiency credits as follows:

$$EEC_{red} = EEC_{tbl} - \{\text{the lesser of: } [SRLM_{lim}, SLRM_{adj} \times (RLM_{ach} - RLM_{req})]\}$$

where:

EEC_{red} = Reduced required energy efficiency credits.

EEC_{tbl} = Required energy efficiency credits from **Table C406.1.1(1)**.

$SRLM_{lim}$ = Surplus renewable and load management credit limit from **Table CRB101.1**.

$SRLM_{adj}$ = 1.0 for all-electric or all-renewable buildings (excluding emergency generation); 0.7 for buildings with fossil fuel equipment (excluding emergency generation).

RLM_{ach} = Achieved renewable and load management credits from **Section C406.3**.

RLM_{req} = Required renewable and load management credits from **Section C406.1.2**.

TABLE CRB101.1
LIMIT TO ENERGY EFFICIENCY CREDIT CARRYOVER FROM RENEWABLE AND LOAD MANAGEMENT CREDITS

BUILDING OCCUPANCY GROUP	CLIMATE ZONE																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4, AND I-1	19	25	27	29	33	20	15	37	36	5	37	34	5	8	36	5	5	5	5

I-2	17	13	10	5	5	5	5	5	5	5	5	5	7	16	20	15	21	20	43
R-1	9	5	9	5	22	7	13	23	25	5	22	19	5	18	16	5	5	5	6
B	5	5	5	5	6	6	5	9	13	10	26	20	9	25	34	5	9	9	32
A-2	31	28	25	26	23	16	5	8	16	5	8	7	5	5	9	5	5	5	5
M	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E	17	15	23	16	20	14	5	22	27	10	32	16	10	21	12	5	5	15	10
S-1 and S-2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
All other	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	

CE#384 Adds new Resource CRA.

Related Mods:

RESOURCE CRA ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS

Resources are related information that is not part of the code.

User notes:

About this resource: *This resource provides code compliance pathways for commercial buildings intended to result in all-electric buildings for adopting jurisdictions or individual projects.*

ICC Council Policy-49 Note: In considering whether to adopt the content in this resource, jurisdictions in the United States should note that federal law might be found to preempt the provisions it prescribes. See the Public Health and Welfare Act, 42 U.S.C. § 6297: Effect on other law. Whether the content of this resource or a modification thereof is subject to preemption may depend on court decisions or whether a waiver has been issued by the US Department of Energy pursuant to 42 U.S.C. § 6297(d).

SECTION CRA101 GENERAL

CRA101.1 Intent. The intent of this resource is to amend the *International Energy Conservation Code* to reduce greenhouse gas emissions from *buildings* and improve the safety and health for *commercial building* occupants by requiring new *all-electric buildings* and efficient electrification of *existing buildings*.

CRA101.2 Scope. The provisions in this resource are applicable to *commercial buildings* . New construction shall comply with **Section CRA103**. *Additions* , *alterations* , *repairs* and *changes of occupancy* to *existing buildings* shall comply with **Chapter 5** and **Section CRA104**.

SECTION CRA102 DEFINITIONS

ALL-ELECTRIC BUILDING. A *building* using no *purchased energy* other than electricity when utility power is available.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, *service water heating* , cooking, clothes drying, humidification or lighting that uses fuel gas or fuel oil.

PURCHASED ENERGY. Energy or power purchased for consumption and delivered to the building site.

SUBSTANTIAL IMPROVEMENT. Any repair, reconstruction, rehabilitation, alteration, *addition* or other improvement of a building or structure, the cost of which is equal to or greater than 50 percent of the market value of the structure before the improvement. Where the structure has sustained substantial damage as defined in the ***International Building Code*** , any repairs are considered substantial improvement regardless of the actual repair work performed. Substantial improvement does not include the following:

1. Improvement of a building required to correct health, sanitary or safety code violations ordered by the code official.
2. Alteration of a historic building where the alteration will not affect the building's designation as a historic building.

SECTION CRA103

NEW COMMERCIAL BUILDINGS

CRA103.1 Application. New *commercial buildings* shall be all-electric buildings and comply with Section C401.2.1 or C401.2.2.

1. *Purchased energy* other than electricity shall be permitted where it has been demonstrated to the *code official* that the building is required by an applicable law or regulation to provide space heating with an emergency power system or a standby power system.
2. *Purchased energy* shall be permitted for an emergency power system or a standby power system.

CRA103.2 Electric resistance heating equipment. The sole use of electric resistance equipment and *appliances* for space and water heating shall be prohibited other than for *buildings* or portions of *buildings* that comply with not less than one of **Sections CRA103.2.1** through **CRA103.2.8**.

CRA103.2.1 Low space heating capacity. Electric resistance *appliances* or equipment shall be permitted in *buildings* or areas of *buildings* not served by a mechanical cooling system and with a total space heating capacity not greater than 4.0 Btu/h (1.2 watts) per square foot of *conditioned space*.

CRA103.2.2 Small systems. *Buildings* in which electric resistance *appliances* or equipment comprise less than 5 percent of the total system heating capacity or serve less than 5 percent of the *conditioned floor area* .

CRA103.2.3 Specific conditions. Portions of *buildings* or specific equipment and *appliances,* subject to approval, that require electric resistance heating and cannot practicably be served by electric heat pumps.

CRA103.2.4 Kitchen makeup air. Makeup air for commercial kitchen exhaust systems required to be tempered by **Section 508.1.1** of the *International Mechanical Code* is permitted to be heated by electric resistance.

CRA103.2.5 Freeze protection. The use of electric resistance heat for freeze protection shall comply with **Sections CRA103.2.5.1** and **CRA103.2.5.2**.

CRA103.2.5.1 Low indoor design conditions. Space heating systems sized for spaces with indoor design conditions of not greater than 40°F (4.5°C) and intended for freeze protection, including temporary systems in unfinished spaces, shall be permitted to use electric resistance. The *building thermal envelope* of any such space shall be insulated in accordance with **Section C402.1**.

CRA103.2.5.2 Freeze protection system. Freeze protection systems shall comply with Section C403.13.3.

CRA103.2.6 Preheating of outdoor air. Hydronic systems without energy recovery ventilation and that do not use freeze protection fluids shall be permitted to utilize electric resistance to temper air to not more than 40°F (4.5°C). All systems with energy recovery ventilation shall be permitted to utilize electric resistance to preheat outdoor air to defrost or temper air entering the energy recovery device and shall comply with one of the following:

1. Where the space is mechanically humidified or has a *process application* that will maintain the space above 30 percent relative humidity when the outdoor temperature is not greater than 25°F (-4°C) and the system recovers latent energy, the outdoor air shall not be preheated to greater than 25°F (-4°C).
2. For sensible-only heat recovery exchangers, outdoor air shall not be preheated to greater than 25°F (-4°C).
3. For all other systems, outdoor air shall not be preheated to greater than 5°F (-15°C).

CRA103.2.7 Small buildings. *Buildings* with a *conditioned floor area* of not more than 250 square feet (23.2 m^2) and not served by a mechanical space cooling system shall be permitted to use electric resistance *appliances* or equipment for space heating.

CRA103.2.8 Supplemental heat. Electric resistance heat shall be permitted as supplemental heat where installed with heat pumps sized in accordance with **Section CRA103.3** and where operated only when a heat pump cannot provide the necessary heating energy to satisfy the *thermostat* setting.

CRA103.3 Heat pump sizing for space heating. Heat pump space heating systems shall be sized to meet the building heating load at the greater of 0°F (-18°C) or the 99 percent annual heating dry-bulb for the nearest weather station provided in the ASHRAE ***Handbook of Fundamentals*** . The heat pump space heating system shall not require the use of supplemental electric heat at or above this temperature other than for defrosting. Lower capacity heat pumps that operate in conjunction with thermal storage shall be permitted if the system meets the requirements of this section.

CRA103.4 Heat pump sizing for water heating. Heat pump *service heating systems* shall be sized to meet not less than the *building service water heating* load at the greater of 15°F (-9.5°C) or the 99 percent annual heating dry-bulb for the nearest weather station provided in the latest edition of the ASHRAE ***Handbook of Fundamentals*** . Supplemental electric heat shall not be required at or above this temperature other than for temperature maintenance in recirculating systems and defrosting.

CRA103.5 Heating outside a building. Systems for heating outside a *building* shall comply with Section C403.13.1.

CRA103.6 Low capacity cooling equipment. Air conditioners with capacities less than 240,000 Btu/h (70 kW) shall be electric heat pump equipment sized and configured to provide both space cooling and space heating.

SECTION CRA104 EXISTING COMMERCIAL BUILDINGS

CRA104.1 Combustion equipment in additions. *Additions* shall use no *purchased energy* other than electricity and new equipment installed to serve additions shall not use *purchased energy* other than electricity. Where existing systems using *purchased energy* other than electricity serve an *addition,* the *existing building* and *addition* together shall not use more *purchased energy* other than electricity than the *existing building* alone.

CRA104.2 Substantial improvement. Buildings undergoing *substantial improvements* shall be all-electric buildings, comply with **Section C402.5** and meet a site EUI by building type in accordance with **ASHRAE Standard 100** Table 7-2a.

> **Exception:** Compliance with **ASHRAE Standard 100** shall not be required where *Group R* occupancies achieve an ERI score of 80 or below without *on-site renewable energy* included, in accordance with **ANSI/RESNET/ICC 301**, for each *dwelling unit* .

CRA104.3 Cooling equipment. New and replacement air conditioners shall be electric heat pump equipment sized and configured to provide both space cooling and space heating. Any existing

space heating systems, other than existing heat pump equipment, that serve the same *zone* as the new equipment shall be configured as supplementary heat in accordance with **Section CRA104.6**.

CRA104.4 Service water heating equipment. Where *water heaters* are added or replaced, they shall not use *purchased energy* other than electricity.

CRA104.5 Furnace replacement. Newly installed warm air furnaces provided for space heating shall be permitted only as supplementary heat controlled in accordance with **Section CRA104.6**.

CRA104.6 Heat pump supplementary heat. Heat pumps having combustion equipment or electric resistance equipment for supplementary space or *service water heating* shall have controls that limit supplemental heat operation to only those times when one of the following applies:

1. The heat pump is operating in defrost mode.
2. The vapor compression cycle malfunctions.
3. For space heating systems, the *thermostat* malfunctions.
4. For space heating systems, the vapor compression cycle cannot provide the necessary heating energy to satisfy the *thermostat* setting.
5. The outdoor air temperature is less than the design temperature determined in accordance with **Section CRA103.3**.
6. For *service water heating* , the heat pump *water heater* cannot maintain an output water temperature of 120°F (49°C) .
7. For temperature maintenance in *service water heating* systems.

New supplementary space and *service water heating* systems for heat pump equipment shall not be permitted to have a heating output capacity greater than the heating output capacity of the heat pump equipment.

SECTION CRA105 REFERENCED STANDARDS

CRA105.1 General. See **Table CRA105.1** for standards that are referenced in various sections of this resource. Standards are listed by the standard indentification with the effective date, the standard title, and the section or sections of this resource that reference this standard.

TABLE CRA105.1 REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTION HEREIN REFERENCED
ASHRAE 100—2018	*Energy Efficiency in Existing Buildings*	**CRA104.2**
ASHRAE—2017	*2017 ASHRAE Handbook of Fundamentals*	**CRA103.3**
ANSI/RESNET/ ICC 301—2022	*Standard for the Calculation and Labeling of Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index —* includes Addendum A, Approved July 28, 2022, and Addendum B, Approved October 12, 2022	**CRA104.2**

Staff Classification	Correlates Directly	Energy Standard Needed	Over lap
	X		

Action	AS	AS/IC	D	D/IC
			x	