**Supplement to the 6th Edition (2017) Florida Building Code, Energy Conservation**

**Note 1**: Throughout the document, change International Building Code to Florida Building Code, Building; change the International Energy Conservation Code tothe Florida Building Code, Energy Conservation; change the International Existing Building Code to Florida Building Code, Existing Building; change the International Fire code to Florida Fire Prevention Code; change International Fuel Gas Code to Florida Building Code, Fuel Gas; change the International Mechanical Code to Florida Building Code, Mechanical; change the International Plumbing Code to Florida Building Code, Plumbing; change the International Residential Code to Florida Building Code, Residential.

Commercial Provisions

**Chapter 2 [CE] DEFINITIONS**

**SECTION C202 GENERAL DEFINITIONS**

Revise as follows:

***Delete without substitution:***

**~~GENERAL PURPOSE ELECTRIC MOTOR (SUBTYPE II).~~** ~~A motor incorporating the design elements of~~ ~~a general purpose electric motor (Subtype I) that is configured as one of the following:~~

~~1. A U-frame motor.~~

~~2. A Design C motor.~~

~~3. A close-coupled pump motor.~~

~~4. A footless motor.~~

~~5. A vertical, solid-shaft, normal-thrust motor (as tested in a horizontal configuration).~~

~~6. An 8-pole motor (900 rpm).~~

~~7. A polyphase motor with voltage of not more than 600 volts (other than 230 or 460 volts).~~

**~~GENERAL PURPOSE ELECTRIC MOTOR (SUBTYPE I).~~** ~~A motor that is designed in standard ratings~~ ~~with either of the following:~~

~~1. Standard operating characteristics and standard mechanical construction for use under usual service conditions, such as those specified in NEMA MG1, paragraph 14.02, "Usual Service Conditions," and without restriction to a particular application or type of application.~~

~~2. Standard operating characteristics or standard mechanical construction for use under unusual service conditions, such as those specified in NEMA MG1, paragraph 14.03, "Unusual Service Conditions," or for a particular type of application, and that can be used in most general purpose applications.~~

~~General purpose electric motors (Subtype I) are constructed in NEMA T-frame sizes or IEC metric~~ ~~equivalent, starting at 143T.~~

**IEC DESIGN H MOTOR** An electric motor that meets all of the following:

1. It is an induction motor designed for use with three-phase power. 2.

3. It contains a cage rotor.

4. It is capable of direct-on-line starting.

5. It has 4, 6, or 8 poles.

6. It is rated from 0.4 kW to 1600 kW at a frequency of 60 Hz.

**IEC DESIGN N MOTOR** An electric motor that meets all of the following:

1. It is an induction motor designed for use with three-phase power.

2. It contains a cage rotor.

3. It is capable of direct-on-line starting.

4. It has 2, 4, 6, or 8 poles.

5. It is rated from 0.4 kW to 1600 kW at a frequency of 60 Hz.

**NEMA DESIGN A MOTOR** A squirrel-cage motor that meets all of the following:

2. It is designed to withstand full-voltage starting and developing locked-rotor torque as shown in paragraph 12.38.1 of NEMA MG 1.

3. It has pull-up torque not less than the values shown in paragraph 12.40.1 of NEMA MG 1.

4. It has breakdown torque not less than the values shown in paragraph 12.39.1 of NEMA MG 1.

5. It has a locked-rotor current higher than the values shown in paragraph 12.355.1 of NEMA MG 1 for 60 hertz and paragraph 12.35.2 of NEMA MG 1 for 50 hertz.

6. It has a slip at rated load of less than 5 percent for motors with fewer than 10 poles.

**NEMA DESIGN B MOTOR** A squirrel-cage motor that meets all of the following:

1. It is designed to withstand full-voltage starting.

2. It develops locked-rotor, breakdown, and pull-up torques adequate for general application as specified in Sections 12.38, 12.39 and 12.40 of NEMA MG1.

3. It draws locked-rotor current not to exceed the values shown in Section 12.35.1 for 60 hertz and Section 12.35.2 for 50 hertz of NEMA MG1.

4. It has a slip at rated load of less than 5 percent for motors with fewer than 10 poles.

**NEMA DESIGN C MOTOR** A squirrel-cage motor that meets all of the following:

2. It is Designed to withstand full-voltage starting and developing locked-rotor torque for high-torque applications up to the values shown in paragraph 12.38.2 of NEMA MG1 (incorporated by reference, see §431.15).

3. It has pull-up torque not less than the values shown in paragraph 12.40.2 of NEMA MG1.

4. It has breakdown torque not less than the values shown in paragraph 12.39.2 of NEMA MG1.

5. It has a locked-rotor current not to exceed the values shown in paragraph 12.35.1 of NEMA MG1 for 60 hertz and paragraph 12.35.2 for 50 hertz.

6. It has a slip at rated load of less than 5 percent.

(CE223-16)

**BUILDING THERMAL ENVELOPE.**The basement walls, exterior walls, ~~floor~~floors, ~~roof~~ceilings, roofs and any other building ~~elements~~element assemblies that enclose *~~conditioned space~~*conditioned space or provide a boundary between *~~conditioned space~~*conditioned space and exempt or unconditioned space.

**(EN7796)** /(I-Code)

**ROOF ASSEMBLY.** A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof covering, underlayment, and roof deck, and can also include a thermal barrier, insulation, or a vapor retarder ~~and interior finish~~, based on design

specifications.

Further Modified by Committee

***Modify as follows:***

**ROOF ASSEMBLY.** A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof covering, underlayment, and roof deck, and can also include a thermal barrier , ignition barrier, insulation or a vapor retarder~~, based~~ ~~on design specifications~~.

(G14-16 Part III AM)

(Final text included in the IEBC 2018)

**ROOF ASSEMBLY.** A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof covering, underlayment, roof deck, insulation,

vapor retarder and interior finish.

(G14-16 Part III AM)

NAMEPLATE HORSEPOWER. The nominal motor ~~horsepower~~ output power rating stamped on the motor nameplate

(EN7236) /(I-Code)

**~~SCREW LAMP HOLDERS.~~** ~~A lamp base that requires a screw-in-type lamp, such as a compact-~~ ~~fluorescent, incandescent or tungsten-halogen bulb.~~

(EN7237)

ACCESS (TO).  That which enables a device, appliance or equipment to be reached by ready access or by a means that first requires the removal or movement of a panel, or similar obstruction.

CAPTIVE KEY OVERRIDE.  A lighting control that will not release the key that activates the override when the lighting is on.

COMPUTER ROOM.  A room whose primary function is to house equipment for the processing and storage of electronic data and that has a design electronic data equipment power density ~~exceeding~~of less than 20 watts per square foot of conditioned floor area or a connected design electronic data equipment load of less than 10 kW.

~~LOW-VOLTAGE LIGHTING. Lighting equipment powered through a transformer such as a cable conductor, a rail conductor and track lighting.~~

LUMINAIRE-LEVEL LIGHTING CONTROLS. A lighting system consisting of one or more luminaires with embedded lighting control logic, occupancy and ambient light sensors, wireless networking capabilities and local override switching capability, where required.

NETWORKED GUESTROOM CONTROL SYSTEM.  A control system, accessible from the front desk or other central location associated with a Group R -1 building, that is capable of identifying the occupancy status of each guestroom according to a timed schedule, and is capable of controlling HVAC in each hotel and motel guestroom separately.

~~READILY ACCESSIBLE. Capable of being reached quickly for operation, renewal or inspection without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders or access equipment (see “Accessible”). In public facilities, accessibility may be limited to certified personnel through locking covers or by placing equipment in locked rooms.~~

READY ACCESS (TO).  That which enables a device, appliance or equipment to be directly reached, without requiring the removal or movement of any panel or similar obstruction.

(EN7240) /(I-Code)

~~FAN EFFICIENCY GRADE (FEG). A numerical rating identifying the fan's aerodynamic ability to convert shaft power, or impeller power in the case of a direct-driven fain, to air power.~~

(EN7884)

**Fan, Embedded.** A fan that is part of a manufactured assembly where the assembly includes functions other than air movement.

**Fan Array.** Multiple fans in parallel between two plenum sections in an air distribution system.

**Fan Energy Index (FEI).** The ratio of the electric input power of a reference fan to the electric input power of the actual fan as calculated in accordance with AMCA 208.

**Fan Nameplate Electrical Input Power.** The nominal electrical input power rating stamped on a fan assembly nameplate.

**Fan System Electrical Input Power.** The sum of the fan electrical power of all fans that are required to operate at fan system design conditions to supply air from the heating or cooling source to the conditioned spaces and/or return it to the source or exhaust it to the outdoors.

(EN7892-R1/EN8175)

CAVITY INSULATION. Insulating material located between framing members.

(EN8256) /(I-Code)

VISIBLE TRANSMITTANCE (ANNUAL) [VTannual] The ratio of visible light entering the space

through the fenestration product assembly to the incident visible light during the course of a

year, which includes the effects of glazing material, frame, and light well or tubular conduit, and

is expressed as a number between 0 and 1.

(EN7752-R1) /(I-Code)

**FAN SYSTEM DESIGN CONDITIONS.** Operating conditions that can be expected to occur during normal system operation that result in the highest supply fan airflow rate to conditioned spaces served by the system, other than during air economizer operation.

(EN8095) /(I-Code)

**ISOLATION DEVICES** Devices that isolate HVAC zones so that they can be operated independently of one another. *Isolation devices* include separate systems, isolation dampers, and controls providing shutoff at terminal boxes.

**NETWORKED GUEST ROOM CONTROL SYSTEM** A control system, accessible from the front desk or other central location associated with a *Group R*-1 building, that is capable of identifying the occupancy status of each guest room according to a timed schedule, and is capable of controlling HVAC in each hotel and motel guest room separately.

(EN8142) /(I-Code)

**ENTRANCE DOOR.** ~~Fenestration products~~A vertical fenestration product used for occupant ingress, egress and access in nonresidential buildings, including, but not limited to, exterior entrances ~~that utilize~~utilizing latching hardware and automatic closers and ~~contain~~containing over 50-percent ~~glass~~glazing specifically designed to withstand heavy ~~use and possibly abuse~~duty usage.

**FENESTRATION.** Products classified as either skylights or vertical fenestration ~~or skylights~~.

**Skylights.** Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees (1.05 rad) from horizontal. Glazing materials in skylights, including unit skylights, tubular daylighting devices, solariums, sunrooms, roofs and sloped walls are included in this definition.

**Vertical fenestration.** Windows ~~(~~that are fixed or ~~moveable~~operable~~)~~, opaque doors, glazed doors, glazed block and combination opaque~~/~~ and glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of ~~at least~~not less than 60 degrees (1.05 rad) from horizontal.

(EN7915 – G1)

**Chapter 3 [CE] GENERAL REQUIREMENTS**

Revise as follows:

**C303.1.3 Fenestration product rating.**

*U*-factors of fenestration products ~~(windows, doors and skylights)~~ shall be determined ~~in accordance with NFRC 100~~as follows.

1. For windows, doors and skylights, *U*-factor ratings shall be determined in accordance with NFRC 100.

~~Exception:~~ 2. Where required~~,~~ for garage door and rolling doors, *U*-factor~~s~~ ratings shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

*U*-factors shall be determined by an accredited, independent laboratory, and *labeled* and certified by the manufacturer.

Products lacking such a *labeled* *U*-factor shall be assigned a default *U*-factor from Table C303.1.3(1) or 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

(EN7924) /(I-Code)

**TABLE C303.1.3(2)**

**DEFAULT OPAQUE DOOR *U*-FACTORS**

|  |  |
| --- | --- |
| **DOOR TYPE** | ***U*-FACTOR** |
| Uninsulated Metal | 1.20 |
| Insulated Metal (Rolling) | 0.90 |
| Insulated Metal (Other) | 0.60 |
| Wood | 0.50 |

|  |  |
| --- | --- |
| Insulated, nonmetal edge, max 45% glazing,  any glazing double pane | 0.35 |

**TABLE C303.1.3(3)**

**DEFAULT ~~GLAZED FENESTRATION~~WINDOW, GLASS DOOR AND SKYLIGHT SHGC AND VT**

[Table values unchanged]

(EN7930) /(I-Code)

**Delete without substitution:**

**~~C303.3 Maintenance information.~~** ~~Maintenance instructions shall be furnished for equipment and~~ ~~systems that require preventive maintenance. Required regular maintenance actions shall be clearly~~ ~~stated and incorporated on a readily accessible label. The label shall include the title or publication~~ ~~number for the operation and maintenance manual for that particular model and type of product.~~

(EN8040/EN8093) /(I-Code)

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

Revise as follows:

**C401.2 Application.** Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1, excluding section 9.4.1.1(g) and section 8.4.2 of the standard.

2.       The requirements of Sections C402 through C405 and Section C408. In addition, commercial buildings shall comply with SectionC406and tenant spaces shall comply withSectionC406.1.1.

3. The requirements of Sections C402.5, C403.2, C404, C405.2, C405.3, C405.5, C405.6, C407, and ~~C407~~ Section C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

(EN8093/EN8045)

**Delete without substitution:**

**~~C403.2.11 Mechanical systems commissioning and completion requirements.~~** ~~Mechanical systems shall be commissioned and completed in accordance with Section C408.2.~~

**~~C404.11 Service water-heating system commissioning and completion requirements.~~** *~~Service water-heating systems~~*~~, swimming pool water-heating systems, spa water-heating systems and the controls for those systems shall be commissioned and completed in accordance with Section C408.2.~~

(EN8093)

Revise Table C402.1.4 as follows:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Opaque doors** | | | | | | | | | | | | | | | | |
| Swinging door | U-0.61 | U-0.61 | U-0.61 | U-0.61 | U-0.61 | U-0.61 | U-0.61 | U-0.61 | U-0.37 | U-0.37 | U-0.37 | U-0.37 | U-0.37 | U-0.37 | U-0.37 | U-0.37 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Garage door  <14% glazingg | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 | U-0.31 |

[Notes unchanged]

[Footnotes a-f unchanged]

g. Garage doors having a single row of *fenestration* shall have an assembly U-factor less than or equal to 0.44, provided that the *fenestration* area is not less than 14 percent and not more than 25 percent of the total door area.

(EN7904)

**C402.4.2.1 Lighting controls in toplit daylight zones ~~under skylights~~.**

Daylight responsive controls complying with Section C405.2.3.1 shall be provided to control all electric lights within ~~daylight~~ toplit zones ~~under skylights~~.

**C402.4.4 Daylight zones.**

Daylight zones referenced in Sections C402.4.1.1 through C402.4.3.2 shall comply with Sections C405.2.3.2 and C405.2.3.3, as applicable. Daylight zones shall include toplit zones and sidelit zones.

**~~C402.4.4 Doors.~~ C402.4.5 Doors**.

Opaque doors shall comply with the applicable requirements for doors as specified in Tables C402.1.3 and

C402.1.4 and be considered part of the gross area of above-grade walls that are part of the building thermal envelope. Other doors shall comply with the provisions of Section C402.4.3 for vertical fenestration.

(EN7244/EN7499) /(I-Code)

**C402.4.1 Maximum area.**

The vertical fenestration area (not including opaque doors and opaque spandrel panels) shall not be greater than 30 percent of the gross above-grade wall area. The skylight area shall not be greater than 3 percent of the gross roof area.

…

**C402.4.1.2 Increased skylight area with daylight responsive controls.**

Where daylight responsive controls  ~~The skylight area shall be permitted to be not more~~ ~~than 5 percent of the roof area provided daylight responsive controls~~ complying with Section C405.2.3.1 are ~~installed~~ provided in *daylight zones* under skylights, the allowed skylight area shall not be greater than 6 percent of the gross roof area. or that required for compliance with Section C402.4.2, item 1, whichever is greater.

**C402.4.2 Minimum skylight fenestration area.**

Skylights shall be provided in ~~In an~~ enclosed spaces greater than 2,500 square feet (232 m2) 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 ~~the~~ total toplit *daylight zone* ~~under skylights~~ shall be not less than half the floor area and shall ~~provide~~ comply with one of the following:

1. A minimum skylight area to toplit daylight zone ~~under skylights~~ of not less than 3 percent where all skylights have a VT of at least 0.40 , or VTannual of not less than 0.26 as determined in accordance with Section C303.1.3.
2. A minimum skylight effective aperture ~~of at least 1 percent,~~ determined in accordance with Equation 4-4.of:
   1. Not less than 1 percent, using a skylight’s VT rating; or
   2. Not less than 0.66 percent using a Tubular Daylighting Device’s VTannual rating.



where:

Skylight area = Total fenestration area of skylights.

Skylight VT = Area weighted average visible transmittance of skylights.

WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater, or 1.0 for Tubular Daylighting Devices with VTannual ratings.

Light well depth = Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

**Exception:** Skylights above *daylight zones* of enclosed spaces are not required in:

* + 1. Buildings in Climate Zones 6 through 8.
    2. Spaces where the designed general lighting power densities are less than 0.5 W/ft2 (5.4 W/m2).
    3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 a.m. and 4 p.m.
    4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.
    5. Spaces where the total area minus the area of sidelight daylight zones ~~adjacent to vertical fenestration~~ is less than 2,500 square feet (232 m2), and where the lighting is controlled according to Section C405.2.3.

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**C402.4.2.2 Haze factor.**

Skylights in office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store and distribution/sorting area spaces shall have a glazing material or diffuser with a haze factor greater than 90 percent when tested in accordance with ASTM D1003.

**Exception:** Skylights and/or tubular daylighting devices designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles ~~or,~~ the geometry of skylight and light well, or the use of optical diffuser components.

(EN7752-R1/EN7244) /(EN7499)

**TABLE C402.5.2**

**MAXIMUM AIR LEAKAGE RATE FOR FENESTRATION ASSEMBLIES**

|  |  |  |
| --- | --- | --- |
| **FENESTRATIONASSEMBLY** | **MAXIMUMRATE (CFM/FT2)** | **TESTPROCEDURE** |
| Windows | 0.20 a | AAMA/WDMA/CSA101/I.S.2/A440orNFRC 400 |
| Sliding doors | 0.20 a |
| Swinging doors | 0.20 a |
| Skylights – with condensation weepage openings | 0.30 |
| Skylights – all other | 0.20 a |
| Curtain walls | 0.06 | NFRC 400orASTM E283 at 1.57 psf(75 Pa) |
| Storefront glazing | 0.06 |
| Power-operated sliding doors and power-operated folding doors, Commercial glazed swinging entrance doors | 1.00 |
| Revolving doors | 1.00 |
| Garage doors | 0.40 | ANSI/DASMA 105,NFRC 400, or ASTM E283 at 1.57 psf (75 Pa) |
| Rolling doors | 1.00 |
| High-speed doors | 1.30 |

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

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

(EN7934) /(I-Code)

**C402.5.4 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 C402.5.2 shall be gasketed, weather stripped or sealed.

**Exceptions:**

1. Door openings required to comply with Section 716 ~~or 716.5~~ of the *Florida Building Code, Building.*

2. Doors and door openings required ~~by~~ to comply with UL 1784 by the *Florida Building Code Building*.

(EN8228) /(I-Code)

**C402.5.6 Loading dock weather seals.**

Cargo doors and loading dock ~~doors~~door openings shall be equipped with weather seals ~~to~~ that restrict infiltration ~~when~~ and provide direct contact along the top and sides of vehicles ~~are~~ parked in the doorway.

(EN7898) /(I-Code)

|  |
| --- |
|  |
|  |

**TABLE C403.2.3(1)**

**MINIMUM EFFICIENCY REQUIREMENTS:**

**ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **EQUIPMENT TYPE** | **SIZE CATEGORY** | **HEATING SECTION TYPE** | **SUBCATEGORY OR RATING CONDITION** | **MINIMUM EFFICIENCY** | | **TEST PROCEDUREa** |
| **~~Before 1/1/2016~~** | **~~As of 1/1/2016~~** |
| Air conditioners, air cooled | < 65,000 Btu/hb | All | Split System | ~~13.0 SEER~~ | ~~13.0 SEER~~  14.0 SEER | AHRI 210/240 |
| Single Package | ~~13.0 SEER~~ | 14.0 SEERc |
| Through-the-wall (air cooled) |  30,000 Btu/hb | All | Split system | ~~12.0 SEER~~ | 12.0 SEER |
| Single Package | ~~12.0 SEER~~ | 12.0 SEER |
| Small-duct high-velocity (air cooled) | < 65,000 Btu/hb | All | Split System | ~~11.0 SEER~~ | ~~11.0 SEER~~  12.0 SEER |
| Air conditioners, air cooled |  65,000 Btu/h and  < 135,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~11.2 EER~~  ~~11.4 IEER~~ | 11.2 EER  ~~12.8 IEER~~  12.9 IEER | AHRI 340/360 |
| All other | Split System and Single Package | ~~11.0 EER~~  ~~11.2 IEER~~ | 11.0 EER  ~~12.6 IEER~~  12.7 IEER |
|  135,000 Btu/h and  < 240,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~11.0 EER~~  ~~11.2 IEER~~ | 11.0 EER  12.4 IEER |
| All other | Split System and Single Package | ~~10.8 EER~~  ~~11.0 IEER~~ | 10.8 EER  12.2 IEER |
|  240,000 Btu/h and  < 760,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | * 1. ~~EER~~   2. ~~IEER~~ | 10.0 EER  11.6 IEER |
| All other | Split System and Single Package | * 1. ~~EER~~   2. ~~IEER~~ | 9.8 EER  11.4 IEER |
|  760,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | * 1. ~~EER~~   2. ~~IEER~~ | 9.7 EER  11.2 IEER |
| All other | Split System and Single Package | * 1. ~~EER~~   2. ~~IEER~~ | 9.5 EER  11.0 IEER |

**TABLE C403.2.3(1)—continued**

**MINIMUM EFFICIENCY REQUIREMENTS:**

**ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **EQUIPMENT TYPE** | **SIZE CATEGORY** | **HEATING SECTION TYPE** | **SUB-CATEGORY OR RATING CONDITION** | **MINIMUM EFFICIENCY** | | **TEST PROCEDUREa** |
| **~~Before 1/1/2016~~** | **~~As of 1/1/2016~~** |
| Air conditioners, water cooled | < 65,000 Btu/hb | All | Split System and Single Package | ~~12.1 EER~~  ~~12.3 IEER~~ | 12.1 EER  12.3 IEER | AHRI 210/240 |
|  65,000 Btu/h and  < 135,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~12.1 EER~~  ~~12.3 IEER~~ | 12.1 EER  13.9 IEER | AHRI 340/360 |
| All other | Split System and Single Package | ~~11.9 EER~~  ~~12.1 IEER~~ | 11.9 EER  13.7 IEER |
|  135,000 Btu/h and  < 240,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~12.5 EER~~  ~~12.5 IEER~~ | 12.5 EER  13.9 IEER |
| All other | Split System and Single Package | ~~12.3 EER~~  ~~12.5 IEER~~ | 12.3 EER  13.7 IEER |
|  240,000 Btu/h and  < 760,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~12.4 EER~~  ~~12.6 IEER~~ | 12.4 EER  13.6 IEER |
| All other | Split System and Single Package | ~~12.2 EER~~  ~~12.4 IEER~~ | 12.2 EER  13.4 IEER |
|  760,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~12.2 EER~~  ~~12.4 IEER~~ | 12.2 EER  13.5 IEER |
| All other | Split System and Single Package | ~~12.0 EER~~  ~~12.2 IEER~~ | 12.0 EER  13.3 IEER |
| Air conditioners, evaporatively cooled | < 65,000 Btu/hb | All | Split System and Single Package | ~~12.1 EER~~  ~~12.3 IEER~~ | 12.1 EER  12.3 IEER | AHRI 210/240 |
|  65,000 Btu/h and  < 135,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~12.1 EER~~  ~~12.3 IEER~~ | 12.1 EER  12.3 IEER | AHRI 340/360 |
| All other | Split System and Single Package | ~~11.9 EER~~  ~~12.1 IEER~~ | 11.9 EER  12.1 IEER |
|  135,000 Btu/h and  < 240,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~12.0 EER~~  ~~12.2 IEER~~ | 12.0 EER  12.2 IEER |
| All other | Split System and Single Package | ~~11.8 EER~~  ~~12.0 IEER~~ | 11.8 EER  12.0 IEER |
|  240,000 Btu/h and  < 760,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~11.9 EER~~  ~~12.1 IEER~~ | 11.9 EER  12.1 IEER |
| All other | Split System and Single Package | ~~11.7 EER~~  ~~11.9 IEER~~ | 11.7 EER  11.9 IEER |
|  760,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~11.7 EER~~  ~~11.9 IEER~~ | 11.7 EER  11.9 IEER |
| All other | Split System and Single Package | ~~11.5 EER~~  ~~11.7 IEER~~ | 11.5 EER  11.7 IEER |
| Condensing units, air cooled |  135,000 Btu/h |  |  | ~~10.5 EER~~  ~~11.8 IEER~~ | 10.5 EER  11.8 IEER | AHRI 365 |
| Condensing units, water cooled |  135,000 Btu/h |  |  | ~~13.5 EER~~  ~~14.0 IEER~~ | 13.5 EER  14.0 IEER |
| Condensing units, evaporatively cooled |  135,000 Btu/h |  |  | ~~13.5 EER~~  ~~14.0 IEER~~ | 13.5 EER  14.0 IEER |

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

1. Chapter 6 contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.
2. Single-phase, air-cooled air conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.
3. Minimum efficiency as of January 1, 2015.

(EN8000)

**TABLE C403.2.3(2) MINIMUM EFFICIENCY REQUIREMENTS:**

**ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **EQUIPMENT TYPE** | **SIZE CATEGORY** | **HEATING SECTION TYPE** | **SUBCATEGORY OR RATING CONDITION** | **MINIMUM EFFICIENCY** | | **TEST PROCEDUREa** |
| **Before 1/1/2016** | **As of 1/1/2016** |
| Air cooled (cooling mode) | < 65,000 Btu/hb | All | Split System | ~~13.0 SEER~~c | 14.0 SEERc | AHRI 210/240 |
| Single Package | 13.0 SEERc | 14.0 SEERc |
| Through-the-wall, air cooled |  30,000 Btu/hb | All | Split System | ~~12.0 SEER~~ | 12.0 SEER |
| Single Package | ~~12.0 SEER~~ | 12.0 SEER |
| Single-duct high- velocity air cooled | < 65,000 Btu/hb | All | Split System | ~~11.0 SEER~~ | ~~11.0 SEER~~  12.0 SEER |
| 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~~  ~~11.2 IEER~~ | 11.0 EER  12.0 IEER | AHRI 340/360 |
| All other | Split System and Single Package | ~~10.8 EER~~  ~~11.0 IEER~~ | 10.8 EER  11.8 IEER |
|  135,000 Btu/h and  < 240,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~10.6 EER~~  ~~10.7 IEER~~ | 10.6 EER  11.6 IEER |
| All other | Split System and Single Package | ~~10.4 EER~~  ~~10.5 IEER~~ | 10.4 EER  11.4 IEER |
|  240,000 Btu/h | Electric Resistance (or None) | Split System and Single Package | ~~9.5 EER~~  ~~9.6 IEER~~ | 9.5 EER  10.6 IEER |
| All other | Split System and Single Package | ~~9.3 EER~~  ~~9.4 IEER~~ | 9.3 EER  9.4 IEER |
| Water to Air: Water Loop (cooling mode) | < 17,000 Btu/h | All | 86oF entering water | ~~12.2 EER~~ | 12.2 EER | ISO 13256-1 |
|  17,000 Btu/h and  < 65,000 Btu/h | All | 86oF entering water | ~~13.0 EER~~ | 13.0 EER |
|  65,000 Btu/h and  < 135,000 Btu/h | All | 86oF entering water | ~~13.0 EER~~ | 13.0 EER |
| Water to Air: Ground Water (cooling mode) | < 135,000 Btu/h | All | 59oF entering water | ~~18.0 EER~~ | 18.0 EER | ISO 13256-1 |
| Brine to Air: Ground Loop (cooling mode) | < 135,000 Btu/h | All | 77oF entering water | ~~14.1 EER~~ | 14.1 EER | ISO 13256-1 |
| Water to Water: Water Loop (cooling mode) | < 135,000 Btu/h | All | 86oF entering water | ~~10.6 EER~~ | 10.6 EER | ISO 13256-2 |
| Water to Water: Ground Water  (cooling mode) | < 135,000 Btu/h | All | 59oF entering water | ~~16.3 EER~~ | 16.3 EER |
| Brine to Water: Ground Loop (cooling mode) | < 135,000 Btu/h | All | 77oF entering fluid | ~~12.1 EER~~ | 12.1 EER |

*(continued)*

**TABLE C403.2.3(2)—continued MINIMUM EFFICIENCY REQUIREMENTS:**

**ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **EQUIPMENT TYPE** | **SIZE CATEGORY** | **HEATING SECTION TYPE** | **SUBCATEGORY OR RATING CONDITION** | **MINIMUM EFFICIENCY** | | **TEST PROCEDUREa** |
| **Before 1/1/2016** | **As of 1/1/2016** |
| Air cooled (heating mode) | < 65,000 Btu/hb | — | Split System | ~~7.7 HSPF~~c | 8.2 HSPFc | AHRI 210/240 |
| — | Single Package | ~~7.7 HSPF~~c | 8.0 HSPFc |
| Through-the-wall, (air cooled, heating mode) |  30,000 Btu/hb (cooling capacity) | — | Split System | ~~7.4 HSPF~~ | 7.4 HSPF |
| — | Single Package | ~~7.4 HSPF~~ | 7.4 HSPF |
| Small-duct high velocity (air cooled, heating mode) | < 65,000 Btu/hb | — | Split System | ~~6.8 HSPF~~ | ~~6.8 HSPF~~  7.2 HSPF |
| Air cooled (heating mode) |  65,000 Btu/h and  < 135,000 Btu/h (cooling capacity) | — | 47ºF db/43ºF wb outdoor air | ~~3.3 COP~~ | 3.3 COP | AHRI 340/360 |
| 17ºF db/15ºF wb outdoor air | ~~2.25 COP~~ | 2.25 COP |
|  135,000 Btu/h (cooling capacity) | — | 47ºF db/43ºF wb outdoor air | ~~3.2 COP~~ | 3.2 COP |
| 17ºF db/15ºF wb outdoor air | ~~2.05 COP~~ | 2.05 COP |
| Water to Air: Water Loop (heating mode) | < 135,000 Btu/h (cooling capacity) | — | 68°F entering water | ~~4.3 COP~~ | 4.3 COP | ISO 13256-1 |
| Water to Air: Ground Water (heating mode) | < 135,000 Btu/h (cooling capacity) | — | 50°F entering water | ~~3.7 COP~~ | 3.7 COP |
| Brine to Air: Ground Loop (heating mode) | < 135,000 Btu/h (cooling capacity) | — | 32°F entering fluid | ~~3.2 COP~~ | 3.2 COP |
| Water to Water: Water Loop (heating mode) | < 135,000 Btu/h (cooling capacity) | — | 68°F entering water | ~~3.7 COP~~ | 3.7 COP | ISO 13256-2 |
| Water to Water: Ground Water (heating mode) | < 135,000 Btu/h (cooling capacity) | — | 50°F entering water | ~~3.1 COP~~ | 3.1 COP |
| Brine to Water: Ground Loop (heating mode) | < 135,000 Btu/h (cooling capacity) | — | 32°F entering fluid | ~~2.5 COP~~ | 2.5 COP |

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 test procedure, including the reference year version of the test procedure.

b. Single-phase, air-cooled air conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

c. Minimum efficiency as of January 1, 2015.

(EN8028)

**TABLE C403.2.3(5)**

**MINIMUM EFFICIENCY REQUIREMENTS: GAS- AND OIL-FIRED BOILERS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EQUIPMENT TYPEa** | **SUBCATEGORY OR RATING CONDITION** | **SIZE CATEGORY (INPUT)** | **MINIMUM EFFICIENCYd, e** | **TEST PROCEDURE** |
| Boilers, hot water | Gas-fired | < 300,000 Btu/hf,g | ~~80%~~ 84% AFUE | 10 CFR Part  430 |
| ≥ 300,000 Btu/h and ≤  2,500,000 Btu/hb | 80% *Et* | 10 CFR Part  431 |
| > 2,500,000 Btu/ha | 82% *Ec* |
| Oil-firedc | < 300,000 Btu/hg | ~~80%~~ 86% AFUE | 10 CFR Part  430 |
| ≥ 300,000 Btu/h and ≤  2,500,000 Btu/hb | 82% *Et* | 10 CFR Part  431 |
| > 2,500,000 Btu/ha | 84% *Ec* |
| Boilers, steam | Gas-fired | < 300,000 Btu/hf | ~~75%~~ 82% AFUE | 10 CFR Part  430 |
| Gas-fired- all, except natural  draft | ≥ 300,000 Btu/h and ≤  2,500,000 Btu/hb | 79% *Et* | 10 CFR Part  431 |
| > 2,500,000 Btu/ha | 79% *Et* |
| Gas-fired-natural draft | ≥ 300,000 Btu/h and ≤  2,500,000 Btu/hb | 77% *Et*  79% *Et* effective  March 2, 2022 |
| > 2,500,000 Btu/ha | 77% *Et*  79% *Et* effective  March 2, 2022 |
| Oil-firedc | < 300,000 Btu/h | ~~80%~~ 85% AFUE | 10 CFR Part  430 |
| ≥ 300,000 Btu/h and ≤  2,500,000 Btu/hb | 81% *Et* | 10 CFR Part  431 |
| > 2,500,000 Btu/ha | 81% *Et* |

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

a. 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.

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

c. Includes oil-fired (residual).

d. *Ec* = Combustion efficiency (100 percent less flue losses).

e. *Et* = Thermal efficiency. See referenced standard for detailed information. f. Boilers shall not be equipped with a constant burning ignition pilot.

g. 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.

(EN7995/CE154-16))

**TABLE C403.2.3(3)**

**MINIMUM EFFECIENCY REQUIREMENTS: ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS,**

**ACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, AND ROOM AIR-CONDITIONER HEAT SINGLE PUMPS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EQUIPMENT TYPE** | **SIZE CATEGORY (INPUT)** | **SUBCATEGORY OR RATING CONDITION** | **MINIMUM EFFICIENCY** | **TEST PROCEDUREa** |
| PTAC (cooling mode) new construction | All Capacities | 95°F db outdoor air | 14.0 – (0.300 ×  Cap/1000) EERc | AHRI 310/380 |
| PTAC (cooling mode) replacementsb | All Capacities | 95°F db outdoor air | 10.9 - (0.213 × Cap/1000) EER |
| PTHP (cooling mode) new construction | All Capacities | 95°F db outdoor air | 14.0 - (0.300 × Cap/1000) EER |
| PTHP (cooling mode) replacementsb | All Capacities | 95°F db outdoor air | 10.8 - (0.213 × Cap/1000) EER |
| PTHP (heating mode) new construction | All Capacities | — | ~~3.2 - (0.026 ×~~ ~~Cap/1000) COP~~ 3.7 - (0.052 ×  Cap/1000) COP |
| PTHP (heating mode) replacementsb | All Capacities | — | 2.9 - (0.026 × Cap/1000) COP |
| SPVAC (cooling mode) |  | 95°F db/ 75°F wb outdoor air | ~~9.0 EER~~  11.0 EER | AHRI 390 |
| ≥ 65,000 Btu/h and | 95°F db/ 75°F wb outdoor air | ~~8.9 EER~~  10.0 EER |
| ≥ 135,000 Btu/h  and | 95°F db/ 75°F wb outdoor air | ~~8.6 EER~~  10.0 EER |
| SPVHP (cooling mode) |  | 95°F db/ 75°F wb outdoor air | ~~9.0 EER~~  11.0 EER |
| ≥ 65,000 Btu/h and | 95°F db/ 75°F wb outdoor air | ~~8.9 EER~~  10.0 EER |
| ≥ 135,000 Btu/h  and | 95°F db/ 75°F wb outdoor air | ~~8.6 EER~~  10.0 EER |
| SPVHP (heating mode) |  | 47°F db/ 43°F wb outdoor air | ~~3.0 COP~~  3.3 COP | AHRI 390 |
| ≥ 65,000 Btu/h and | 47°F db/ 43°F wb outdoor air | 3.0 COP |
| ≥ 135,000 Btu/h  and | 47°F db/ 75°F wb outdoor air | ~~2.9 COP~~  3.0 COP |
| Room air conditioners, with  louvered sides | < 6,000 Btu/h | — | ~~9.7 SEER~~11.0 CEER | ANSI/ AHAM RAC-1 |
| ≥ 6,000 Btu/h and | — | ~~9.7 EER~~11.0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | CEER |  |
| ≥ 8,000 Btu/h and | — | ~~9.8 EER~~10.9 CEER |
| ≥ 14,000 Btu/h and | — | ~~9.7 EER~~10.7 CEER |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ≥ 20,000 Btu/h and  < 25,000 Btu/h  > 25,000 Btu/h | — | ~~8.5 EER~~9.4 CEER  9.0 CEER |  |
| Room air conditioners, without  louvered sides | < 6,000 Btu/h  > 6,000 Btu/h and <  8,000 Btu/h | — | 10.0 CEER  ~~9.0 EER~~10.0 CEER |
| ≥ 8,000 Btu/h and <  11,000 Btu/h  > 11,000 Btu/h and  < 14,000 Btu/h  > 14,000 Btu/h  and < 20,000 Btu/h | — | ~~8.5 EER~~9.6 CEER  9.5 CEER  9.3 CEER |
| ≥ 20,000 Btu/h | — | ~~8.5 EER~~9.4 CEER |
| Room air-conditioner heat pumps with louvered sides | < 20,000 Btu/h | — | ~~9.0 EER~~9.8 CEER |
| ≥ 20,000 Btu/h | — | ~~8.5 EER~~9.3 CEER |
| Room air-conditioner heat pumps without louvered sides | < 14,000 Btu/h | — | ~~8.5 EER~~9.3 CEER |
| ≥ 14,000 Btu/h | — | ~~8.0 EER~~8.7 CEER |
| Room air conditioner casement only | All capacities | — | ~~8.7 EER~~9.5 CEER | ANSI/ AHAM RAC-1 |
| Room air conditioner casement- slider | All capacities | — | ~~9.5 EER~~10.4 CEER |

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

"Cap" = The rated cooling capacity of the project in Btu/h. Where the unit's capacity is less than 7000 Btu/h, use 7000 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 test procedure, including the referenced year version of the test procedure.

b. Replacement unit shall be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY: NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406 mm) in height and less than 42 inches (1067 mm) in width.

c. ~~Before January 1, 2015 the minimum efficiency shall be 13.8 - (0.300 x Cap/1000) EER.~~

(EN7990/CE132-16))

**~~TABLE C403.2.3(9)~~**

**~~MINIMUM EFFICIENCY AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS~~**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **~~EQUIPMENT TYPE~~** | **~~NET SENSIBLE COOLING CAPACITY~~**~~a~~ |  | | **~~MINIMUM SCOP-127b~~** |  | | **~~TEST PROCEDURE~~** |
|  | **~~EFFICIENCYDOWNFLOW~~** | | |  |
|  | **~~UNITS/UPFLOWUNITS~~** | | |
| ~~Air conditioners, air cooled~~ | ~~< 65,000 Btu/h~~ | ~~2.20 / 2.09~~ | | | | | ~~ANSI/ASHRAE 127~~ |
| ~~65,000 Btu/h and < 240,000 Btu/h~~ | ~~2.10 / 1.99~~ | | | | |
| ~~240,000 Btu/h~~ | ~~1.90 / 1.79~~ | | | | |
| ~~Air conditioners, water cooled~~ | ~~< 65,000 Btu/h~~ | ~~2.60 / 2.49~~ | | | | |
| ~~65,000 Btu/h and < 240,000 Btu/h~~ | ~~2.50 / 2.39~~ | | | | |
| ~~240,000 Btu/h~~ | ~~2.40 /2.29~~ | | | | |
| ~~Air conditioners, water cooled with fluid economizer~~ | ~~< 65,000 Btu/h~~ | ~~2.55 /2.44~~ | | | | |
| ~~65,000 Btu/h and < 240,000 Btu/h~~ | ~~2.45 / 2.34~~ | | | | |
| ~~240,000 Btu/h~~ | ~~2.35 / 2.24~~ | | | | |
| ~~Air conditioners, glycol cooled (rated at 40% propylene glycol)~~ | ~~< 65,000 Btu/h~~ | ~~2.50 / 2.39~~ | | | | |
| ~~65,000 Btu/h and < 240,000 Btu/h~~ | ~~2.15 / 2.04~~ | | | | |
| ~~240,000 Btu/h~~ | ~~2.10 / 1.99~~ | | | | |
| ~~Air conditioners, glycol cooled (rated at 40% propylene glycol) with fluid economizer~~ | ~~< 65,000 Btu/h~~ | ~~2.45 / 2.34~~ | | | | |
| ~~65,000 Btu/h and < 240,000 Btu/h~~ | ~~2.10 / 1.99~~ | | | | |
| ~~240,000 Btu/h~~ | ~~2.05 / 1.94~~ | | | | |

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

~~a.   Net sensible cooling capacity: the total gross cooling capacity less the latent cooling less the energy to the air movement system. (Total Gross – latent – Fan Power).~~

~~Sensible coefficient of performance (SCOP-127): a ratio calculated by dividing the net sensible cooling capacity in watts by the total power input in watts (excluding reheaters and humidifiers) at conditions defined in ASHRAE Standard 127. The net sensible cooling capacity is the gross sensible capacity minus the energy dissipated into the cooled space by the fansystem.~~

**TABLE C403.2.3 (9)**

**MINIMUM EFFICIENCY AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Equipment**  **Type** | **Net Sensible Cooling Capacitya** | **Standard Model** | **Minimum Net Sensible COPb (NSCOP)** | | | **Test Procedure** |
| **Return Air Dry-Bulb Temperature /**  **Dew-Point Temperature** | | |
| **Class 1** | **Class 2** | **Class 3** |
| Air cooled | <65,000 Btu/h | Downflow unit |  | 2.30 |  | AHRI 1360 |
| Upflow unit—ducted |  | 2.10 |  |
| Upflow unit—nonducted | 2.09 |  |  |
| Horizontal-flow unit |  |  | 2.45 |
| =65,000 and <240,000 Btu/h | Downflow unit |  | 2.20 |  |
| Upflow unit—ducted |  | 2.05 |  |
| Uflow unit—nonducted | 1.99 |  |  |
| Horizontal-flow unit |  |  | 2.35 |
| =240,000 Btu/h | Downflow unit |  | 2.00 |  |
| Upflow unit—ducted |  | 1.85 |  |
| Upflow unit—nonducted | 1.79 |  |  |
| Horizontal-flow unit |  |  | 2.15 |
| Water cooled | <65,000 Btu/h | Downflow unit |  | 2.50 |  | AHRI 1360 |
| Upflow unit—ducted |  | 2.30 |  |
| Upflow unit—nonducted | 2.25 |  |  |
| Horizontal-flow unit |  |  | 2.70 |
| =65,000 and <240,000 Btu/h | Downflow unit |  | 2.40 |  |
| Upflow unit—ducted |  | 2.20 |  |
| Upflow unit—nonducted | 2.15 |  |  |
| Horizontal-flow unit |  |  | 2.60 |
| =240,000 Btu/h | Downflow unit |  | 2.25 |  |
| Upflow unit—ducted |  | 2.10 |  |
| Upflow unit—nonducted | 2.05 |  |  |
| Horizontal-flow unit |  |  | 2.45 |
| Water cooled with *fluid economizer* | <65,000 Btu/h | Downflow unit |  | 2.45 |  | AHRI 1360 |
| Upflow unit—ducted |  | 2.25 |  |
| Upflow unit—nonducted | 2.20 |  |  |
| Horizontal-flow unit |  |  | 2.60 |
| =65,000 and <240,000 Btu/h | Downflow unit |  | 2.35 |  |
| Upflow unit—ducted |  | 2.15 |  |
| Upflow unit—nonducted | 2.10 |  |  |
| Horizontal-flow unit |  |  | 2.55 |
| =240,000 Btu/h | Downflow unit |  | 2.20 |  |
| Upflow unit—ducted |  | 2.05 |  |
| Upflow unit—nonducted | 2.00 |  |  |
| Horizontal-flow unit |  |  | 2.40 |

**TABLE C403.2.3 (9) - Continued**

**MINIMUM EFFICIENCY AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Equipment**  **Type** | **Net Sensible Cooling Capacitya** | **Standard Model** | **Minimum Net Sensible COPb (NSCOP)** | | | **Test Procedure** |
| **Return Air Dry-Bulb Temperature /**  **Dew-Point Temperature** | | |
| **Class 1** | **Class 2** | **Class 3** |
| Glycol cooled | <65,000 Btu/h | Downflow unit |  | 2.30 |  | AHRI 1360 |
| Upflow unit—ducted |  | 2.10 |  |
| Upflow unit—nonducted | 2.00 |  |  |
| Horizontal-flow unit |  |  | 2.40 |
| =65,000 and <240,000 Btu/h | Downflow unit |  | 2.05 |  |
| Upflow unit—ducted |  | 1.85 |  |
| Upflow unit—nonducted | 1.85 |  |  |
| Horizontal-flow unit |  |  | 2.15 |
| =240,000 Btu/h | Downflow unit |  | 1.95 |  |
| Upflow unit—ducted |  | 1.80 |  |
| Upflow unit—nonducted | 1.75 |  |  |
| Horizontal-flow unit |  |  | 2.10 |
| Glycol cooled with *fluid economizer* | <65,000 Btu/h | Downflow unit |  | 2.25 |  | AHRI 1360 |
| Upflow unit—ducted |  | 2.10 |  |
| Upflow unit—nonducted | 2.00 |  |  |
| Horizontal-flow unit |  |  | 2.35 |
| =65,000 and <240,000 Btu/h | Downflow unit |  | 1.95 |  |
| Upflow unit—ducted |  | 1.80 |  |
| Upflow unit—nonducted | 1.75 |  |  |
| Horizontal-flow unit |  |  | 2.10 |
| =240,000 Btu/h | Downflow unit |  | 1.90 |  |
| Upflow unit—ducted |  | 1.80 |  |
| Upflow unit—nonducted | 1.70 |  |  |
| Horizontal-flow unit |  |  | 2.10 |

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

a.   Net Sensible Cooling Capacity. The rate, expressed in Btu/h and/or kW, at which the equipment removes sensible heat from the air passing through it under specified conditions of operation, including the fan energy dissipated into the conditioned space.

Net Sensible Coefficient of Performance (NSCOP). A ratio of the Net Sensible Cooling Capacity in kilowatts to the total power input in kilowatts (excluding reheaters and humidifiers) at any given set of Rating Conditions defined in AHRI Standard 1360.

(EN8025-R1)

TABLE C403.2.3(11)

**MINIMUM EFFICIENCY REQUIREMENTS**

**VARIABLE REFRIGERANT FLOW MULTI-SPLIT AIR CONDITIONERS AND HEAT PUMPS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EQUIPMENT TYPE** | **SIZE CATEGORY** | **HEATING TYPEa** | **MINIMUMEFFICIENCY** | **TEST PROCEDUREb** |
| VRF Multi-split Air Conditioners (Air-cooled) | < 65,000 Btu/h | All | 13.0 SEER | AHRI 1230  (omit Sections 5.1.2  and 6.6) |
|  65,000 Btu/h and  < 135,000 Btu/h | Electric resistance (or none) | 11.2 EER |
| All other | 11.0 EER |
|  135,000 Btu/h and  < 240,000 Btu/h | Electric resistance (or none) | 11.0 EER |
| All other | 10.8 EER |
|  240,000 Btu/h and  < 760,000 Btu/h | Electric resistance (or none) | 10.0 EER |
| All other | 9.8 EER |
| VRF Multi-split Heat Pumps (Air-cooled) | < 65,000 Btu/h | All | 13.0 SEER  7.7 HSPF |
|  65,000 Btu/h and  < 135,000 Btu/h | Electric resistance (or none) | 11.0 EER  3.3 COP |
| All other | 10.8 EER  3.3 COP |
|  135,000 Btu/h and  < 240,000 Btu/h | Electric resistance (or none) | 10.6 EER  3.2 COP |
| All other | 10.4 EER  3.2 COP |
|  240,000 Btu/h and  < 760,000 Btu/h | Electric resistance (or none) | 9.5 EER  3.2 COP |
| All other | ~~9.8 EER~~  9.3 EER  3.2 COP |
| VRF Multi-split Air Conditioners (Water-source) | < 17,000 Btu/h | Without heat recovery | 12.0 EER  ~~4.2 COP~~  ~~4.3~~ COP |
| With heat recovery | 11.8 EER  ~~4.2 COP~~  ~~4.3~~ COP |
|  17,000 Btu/h and  < 65,000 Btu/h | All | 12.0 EER  ~~4.2 COP~~  ~~4.3~~ COP |
|  65,000 Btu/h and  < 135,000 Btu/h | All | 12.0 EER  ~~4.2 COP~~  ~~4.3~~ COP |
|  135,000 Btu/h and  < 760,000 Btu/h | Without heat recovery | 10.0 EER  ~~3.9 COP~~  4.0 COP |
| With heat recovery | 9.8 EER ~~3.9 COP~~  4.0 COP |

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

a. VRAF Multi-split Heat Pumps (air-cooled) with heat recovery fall under the category of “All Other Types of Heating” unless they also have electric resistance heating, in which case it falls under the category for “No Heating or Electric Resistance Heating.”

b. Chapter 6, Referenced Standards, contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.

(EN8031)

**C403.2.12.2 Fan m~~M~~otor selection*~~nameplate horsepower~~***

For each fan, the *fan brake horsepower* shall be indicated on the construction documents and the selected motor shall be no larger than the first available motor size greater than the following:

1. For fans less than 6 bhp (~~4413~~ 4476 W), 1.5 times the *fan brake horsepower*.

2. For fans 6 bhp (~~4413~~ 4476 W) and larger, 1.3 times the *fan brake horsepower*.

**Exceptions:**

1. Fans equipped with electronic speed control devices to vary the fan airflow as a function of load.

2. Fans with *fan nameplate electrical input power* of less than 0.89 kW.

3. Systems complying with Section 403.8.1 *fan system motor nameplate hp*(Option 1).

4. Fans with motor *nameplate horsepower* less than 1 hp (746 W)~~are exempt from this section~~.

(EN8184)

**Revise as follows:**

**C403.2.14 Refrigeration equipment performance.**

Refrigeration equipment, as defined in 10  CFR part 431,have an energy use in kWh/day not greater than the values of Tables C403.2.14(1)and C403.2.14(2) when tested and rated in accordance with ~~AHRI Standard 1200~~10  CFR part 431.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.

TABLE C403.2.14(1)

MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL REFRIGERATION

|  |  |  |  |
| --- | --- | --- | --- |
| **EQUIPMENT TYPE** | **APPLICATION** | **ENERGY USE LIMITS**  **(kWh per day)a** | **TEST PROCEDURE** |
| Refrigerator with solid doors | Holding Temperature | 0.10 • V + 2.04 | ~~AHRI 1200~~  10 CFR Part 431 |
| Refrigerator with transparent doors | 0.12 • V + 3.34 |
| Freezers with solid doors | 0.40 • V + 1.38 |
| Freezers with transparent doors | 0.75 • V + 4.10 |
| Refrigerators/freezers with solid doors | the greater of ~~0.12 · V + 3.34~~  0.27AV-0.71 or 0.70 |
| Commercial refrigerators | Pulldown | 0.126 • V + 3.51 |

1. a.V = volume of the chiller or frozen compartment as defined in AHAM-HRF-1.

**TABLE C403.2.14(2) MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL REFRIGERATORS AND FREEZERS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EQUIPMENT TYPE** | | | | **ENERGY USE LIMITS**  **(kWh/day)a,b** | **TEST**  **PROCEDURE** |
| **Equipment Classc** | **Family Code** | **Operating Mode** | **Rating Temperature** |
| VOP.RC.M | Vertical open | Remote condensing | Medium | 0.82 • TDA + 4.07 | ~~AHRI 1200~~  10 CFR Part 431 |
| SVO.RC.M | Semivertical open | Remote condensing | Medium | 0.83 • TDA + 3.18 |
| HZO.RC.M | Horizontal open | Remote condensing | Medium | 0.35 • TDA + 2.88 |
| VOP.RC.L | Vertical open | Remote condensing | Low | 2.27 • TDA + 6.85 |
| HZO.RC.L | Horizontal open | Remote condensing | Low | 0.57 • TDA + 6.88 |
| VCT.RC.M | Vertical transparent door | Remote condensing | Medium | 0.22 TDA + 1.95 |
| VCT.RC.L | Vertical transparent door | Remote condensing | Low | 0.56 • TDA + 2.61 |
| SOC.RC.M | Service over counter | Remote condensing | Medium | 0.51 • TDA + 0.11 |
| VOP.SC.M | Vertical open | Self-contained | Medium | 1.74 • TDA + 4.71 |
| SVO.SC.M | Semivertical open | Self-contained | Medium | 1.73 • TDA + 4.59 |
| HZO.SC.M | Horizontal open | Self-contained | Medium | 0.77 • TDA + 5.55 |
| HZO.SC.L | Horizontal open | Self-contained | Low | 1.92 • TDA + 7.08 |
| VCT.SC.I | Vertical transparent door | Self-contained | Ice cream | 0.67 • TDA + 3.29 |
| VCS.SC.I | Vertical solid door | Self-contained | Ice cream | 0.38 • V + 0.88 |
| HCT.SC.I | Horizontal transparent door | Self-contained | Ice cream | 0.56 • TDA + 0.43 |
| SVO.RC.L | Semivertical open | Remote condensing | Low | 2.27 • TDA + 6.85 |
| VOP.RC.I | Vertical open | Remote condensing | Ice cream | 2.89 • TDA + 8.7 |
| SVO.RC.I | Semivertical open | Remote condensing | Ice cream | 2.89 • TDA + 8.7 |
| HZO.RC.I | Horizontal open | Remote condensing | Ice cream | 0.72 • TDA + 8.74 |
| VCT.RC.I | Vertical transparent door | Remote condensing | Ice cream | 0.66 • TDA + 3.05 |
| HCT.RC.M | Horizontal transparent door | Remote condensing | Medium | 0.16 • TDA + 0.13 |
| HCT.RC.L | Horizontal transparent door | Remote condensing | Low | 0.34 • TDA + 0.26 |
| HCT.RC.I | Horizontal transparent door | Remote condensing | Ice cream | 0.4 • TDA + 0.31 |
| VCS.RC.M | Vertical solid door | Remote condensing | Medium | 0.11 • V + 0.26 |
| VCS.RC.L | Vertical solid door | Remote condensing | Low | 0.23 • V + 0.54 |
| VCS.RC.I | Vertical solid door | Remote condensing | Ice cream | 0.27 • V + 0.63 |
| HCS.RC.M | Horizontal solid door | Remote condensing | Medium | 0.11 • V + 0.26 |
| HCS.RC.L | Horizontal solid door | Remote condensing | Low | 0.23 • V + 0.54 |
| HCS.RC.I | Horizontal solid door | Remote condensing | Ice cream | 0.27 • V + 0.63 |
| HCS.RC.I | Horizontal solid door | Remote condensing | Ice cream | 0.27 • V + 0.63 |
| SOC.RC.L | Service over counter | Remote condensing | Low | 1.08 • TDA + 0.22 |
| SOC.RC.I | Service over counter | Remote condensing | Ice cream | 1.26 • TDA + 0.26 |
| VOP.SC.L | Vertical open | Self-contained | Low | 4.37 • TDA + 11.82 |
| VOP.SC.I | Vertical open | Self-contained | Ice cream | 5.55 • TDA + 15.02 |
| SVO.SC.L | Semivertical open | Self-contained | Low | 4.34 • TDA + 11.51 |
| SVO.SC.I | Semivertical open | Self-contained | Ice cream | 5.52 • TDA + 14.63 |
| HZO.SC.I | Horizontal open | Self-contained | Ice cream | 2.44 • TDA + 9.0 |
| SOC.SC.I | Service over counter | Self-contained | Ice cream | 1.76 • TDA + 0.36 |
| HCS.SC.I | Horizontal solid door | Self-contained | Ice cream | 0.38 • V + 0.88 |

 a.V = Volume of the case, as measured in accordance with Appendix C of AHRI 1200.

b.TDA = Total display area of the case, as measured in accordance with Appendix D of AHRI 1200.

c.Equipment class designations consist of a combination [(in sequential order separated by periods (AAA).(BB).(C))] of:

(AAA)An equipment family code where:

VOP     =          vertical open

SVO     =          semivertical open

HZO     =          horizontal open

VCT     =          vertical transparent doors

VCS     =          vertical solid doors

HCT     =          horizontal transparent doors

HCS     =          horizontal solid doors

SOC     =          service over counter

(BB)    An operating mode code:

RC       =          remote condensing

SC        =          self-contained

(C)      A rating temperature code:

M         =          medium temperature (38°F)

L          =          low temperature (0°F)

I           =          ice-cream temperature (15°F)

For example, “VOP.RC.M” refers to the “vertical-open, remote-condensing, medium-temperature” equipment class.

**C403.2.15 Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers.**

*Refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with this section. *Walk-in coolers* and *walk-in freezers* that are not either site assembled or site constructed shall comply with the following:

Exception: Walk-in coolers and walk-in freezers regulated under federal law by the Department of Energy in 10 CFR 431, Subpart R - Walk-in Coolers and Walk-in Freezers.

1. Be equipped with automatic door-closers that firmly close walk-in doors

that have been closed to within 1 inch (25 mm) of full closure.

Exception: Automatic closers are not required for doors more than 45 inches (1143 mm) in width or more than 7 feet (2134 mm) in height.

2. Doorways shall have strip doors, curtains, spring hinged doors or other method of minimizing infiltration when doors are open.

3. Walk-in coolers and refrigerated warehouse coolers shall contain wall, ceiling, and door insulation of not less than R-25 and walk-in freezers and refrigerated warehouse freezers shall contain wall, ceiling and door insulation of not less than R-32.

Exception: Glazed portions of doors or structural members need not be insulated.

4. Walk-in freezers shall contain floor insulation of not less than R-28.

5. Transparent reach-in doors for walk-in freezers and windows in walk-in freezer doors shall be of triple-pane glass, either filled with inert gas or with heat-reflective treated glass.

6. Windows and transparent reach-in doors for walk-in coolers shall be of double-pane or triple pane, inert gas-filled, heat-reflective treated glass.

7. Evaporator fan motors that are less than 1 hp (0.746 kW) and less than 460 volts shall use electronically commutated motors, brushless direct current motors, or 3-phase motors.

8. Condenser fan motors that are less than 1 hp (0.746 kW) shall use electronically commutated motors, permanent split capacitor-type motors or 3-phase motors.

9. Where antisweat heaters without antisweat heater controls are provided, they shall have a total door rail, glass and frame heater power draw of not more than 7.1 W/ft2 (76 W/m2) of door opening for walk-in freezersand 3.0 W/ft2 (32 W/m2) of door opening for walk-in coolers.

10. Where antisweat heater controls are provided, they shall reduce the energy use of the antisweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

11. Lights in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall either use light sources with an efficacy of not less than 40 lumens per watt, including ballast losses, or shall use light sources with an efficacy of not less than 40 lumens per watt, including ballast losses, in conjunction with a device that turns off the lights within 15 minutes when the space is not occupied.

**C403.2.16 Walk-in coolers and walk-in freezers.**

Site-assembled or site-constructed *walk-in coolers* and *walk-in freezers* shall comply with the following:

Exception: Walk-in coolers and walk-in freezers regulated under federal law by the Department of Energy in 10 CFR 431, Subpart R - Walk-in Coolers and Walk-in Freezers.

1. Automatic door closers shall be provided that fully close walk-in doors that have been closed to within 1 inch (25 mm) of full closure.

**Exception:**Closers are not required for doors more than 45 inches (1143 mm) in width or more than 7 feet (2134 mm) in height.

2. Doorways shall be provided with strip doors, curtains, spring-hinged doors or other method of minimizing infiltration when the doors are open.

3. Walls shall be provided with insulation having a thermal resistance of not less than R-25, ceilings shall be provided with insulation having a thermal resistance of not less than R-25 and doors of *walk-in coolers* and *walk-in freezers* shall be provided with insulation having a thermal resistance of not less than R-32.

**Exception:**Insulation is not required for glazed portions of doors or at structural members associated with the walls, ceiling or door frame.

4. The floor of *walk-in freezers* shall be provided with insulation having a thermal resistance of not less than R-28.

5. Transparent reach-in doors for and windows in opaque *walk-in freezer* doors shall be provided with triple-pane glass having the interstitial spaces filled with inert gas or provided with heat-reflective treated glass.

6. Transparent reach-in doors for and windows in opaque *walk-in cooler* doors shall be double-pane heat-reflective treated glass having the interstitial space gas filled.

7. Evaporator fan motors that are less than 1 hp (0.746 kW) and less than 460 volts shall be electronically commutated motors or 3-phase motors.

8. Condenser fan motors that are less than 1 hp (0.746 kW) in capacity shall be of the electronically commutated or permanent split capacitor-type or shall be 3-phase motors.

**Exception:**Fan motors in *walk-in coolers* and *walk-in freezers* combined in a single enclosure greater than 3,000 square feet (279 m2) in floor area are exempt.

9. Antisweat heaters that are not provided with antisweat heater controls shall have a total door rail, glass and frame heater power draw not greater than 7.1 W/ft2 (76 W/m2) of door opening for *walk-in freezers*, and not greater than 3.0 W/ft2 (32 W/m2) of door opening for *walk-in coolers*.

10. Antisweat heater controls shall be capable of reducing the energy use of the antisweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

11. Light sources shall have an efficacy of not less than 40 lumens per Watt, including any ballast losses, or shall be provided with a device that automatically turns off the lights within 15 minutes of when the *walk-in cooler* or *walk-in freezer* was last occupied.

**C403.2.17 Refrigerated display cases.**

Site-assembled or site-constructed refrigerated display cases shall comply with the following:

Exception: Refrigerated display cases regulated under federal law by the Department of Energy in 10 CFR 431, Subpart C - Commercial Refrigerators, Freezers and Refrigerator-Freezers.

 1. Lighting and glass doors in refrigerated display cases shall be controlled by one of the following:

    1.1 Time switch controls to turn off lights during nonbusiness hours. Timed overrides for display cases shall turn the lights on for up to 1 hour and shall automatically time out to turn the lights off.

1.2 Motion sensor controls on each display case section that reduce lighting power by at least 50 percent within 3 minutes after the area within the sensor range is vacated.

2. Low-temperature display cases shall incorporate temperature-based defrost termination control with a time-limit default. The defrost cycle shall terminate first on an upper temperature limit breach and second upon a time limit breach.

3. Antisweat heater controls shall reduce the energy use of the antisweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

(EN8137)

**C403.2.16.1 Performance standards.** Effective January 1, 2020, walk-in coolers and walk-in freezers shall meet the requirements of Tables C403.2.16.1(1), C403.2.16.1(2) and C403.2.16.1(3)

**TABLE C403.2.16.1(1)**

**Walk-in Cooler and Freezer Display Doors Efficiency Requirements**

|  |  |  |
| --- | --- | --- |
| Class Descriptor | Class | Maximum Energy Consumption (kWh/day)a |
| Display Door, Medium Temperature | DD, M | 0.04 x Add + 0.41 |
| Display Door, Low Temperature | DD, L | 0.15 x Add + 0.29 |

a. Add is the surface area of the display door.

**TABLE C403.2.16.1(2)**

**Walk-in Cooler and Freezer Non-Display Doors Efficiency Requirements**

|  |  |  |
| --- | --- | --- |
| Class Descriptor | Class | Maximum Energy Consumption (kWh/day)a |
| Passage Door, Medium Temperature | PD, M | 0.05 x And + 1.7 |
| Passage Door, Low Temperature | PD, L | 0.14 x And + 4.8 |
| Freight Door, Medium Temperature | PD, M | 0.04 x And + 1.9 |
| Freight Door, Medium Temperature | PD, L | 0.12 x And + 5.6 |

**TABLE C403.2.16.1(3)**

**Walk-in Cooler and Freezer Refrigeration Systems Efficiency Requirements**

|  |  |  |
| --- | --- | --- |
| Class Descriptor | Class | Minimum Annual Walk-In Energy Factor AWEF (Btu/W-h) |
| Dedicated Condensing, Medium Temperature, Indoor System | DC.M.I | 5.61 |
| Dedicated Condensing, Medium Temperature, Indoor System, > 9,000 Btu/h Capacity | DC.M.I, > 9,000 | 5.61 |
| Dedicated Condensing, Medium Temperature, Outdoor System | DC.M.I | 7.60 |
| Dedicated Condensing, Medium Temperature, Outdoor System, > 9,000 Btu/h Capacity | DC.M.I, > 9,000 | 7.60 |

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(CE126-16 AM)

**TABLE C403.2.3 (8)**

**MINIMUM EFFICIENCY REQUIREMENTS: HEAT REJECTION EQUIPMENT**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **EQUIPMENT TYPE**a | **TOTAL SYSTEM HEAT REJECTION CAPACITY AT RATED CONDITIONS** | **SUBCATEGORY OR RATING CONDITION**i | **PERFORMANCE REQUIRED**b, c, d, g,  h | **TEST PROCEDURE**e,  f |  |
|  | 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 |  |
|  | 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 |  |
|  | Propeller or axial fan closed-circuit cooling towers | All | 102°F entering water 90°F leaving water 75°F entering wb | ≥ ~~14.0~~16.1 gpm/hp | CTI ATC-105S and CTI STD- 201 |  |
|  | 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 |  |
|  | 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 | 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 |  |
|  | Propeller or axial fan evaporative condensers | All | R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb | ≥ 157,000  Btu/h·hp | CTI ATC-106 |  |
|  | Centrifugal fan evaporative condensers | All | R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb | ≥ 135,000  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, °F, wb = wet bulb temperature, °F. | | | | | | |
| a. 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 wet and dry heat exchange sections. | | | | | | |

|  |
| --- |
| 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 Table 403.2.3(8) divided by the fan nameplate-rated motor power. |
| c. For purposes of this table, closed-circuit cooling tower performance is defined as the water flow rating of the tower at the thermal rating condition listed in Table 403.2.3(8) divided by the sum of the fan nameplate-rated motor power and the spray pump nameplate-rated motor power. |
| d. For purposes of this table, air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate-rated motor power. |
| e. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure. The certification requirements do not apply to field-erected cooling towers. |
| f. Where a certification program exists for a covered product and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program; or, where a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, but the product is not listed in the existing certification program, the ratings shall be verified by an independent laboratory test report. |
| g. 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 |
| h. 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 |
| i. Requirements for evaporative condensers are listed with ammonia (R-717) and R-507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-507A shall meet the minimum efficiency requirements listed in this table with R-507A as the test fluid. |

(CE152-16 AM)

(Final text included in the IECC 2018)



(CE152-16 AM)

**C403.2.12.3 Fan efficiency.**

~~Fans~~ Each fan and fan array shall have a fan ~~efficiency grade (FEG)~~ energy index (FEI) of not less than ~~67~~ 1.00 at the design point of operation when determined in accordance with AMCA ~~205~~ 208-18 by an *approved*, independent testing laboratory and labeled by the manufacturer. ~~The total efficiency of the fan at the design point of operation shall be within 15 percentage points of the maximum total efficiency of the fan.~~ Each fan and fan array used for a variable-air-volume system shall have an FEI of not less than 0.95 at the design point of operation as determined in accordance with AMCA 208 by an approved, independent testing laboratory and labeled by the manufacturer. The FEI for fan arrays shall be calculated in accordance with AMCA 208-18 Annex C.

**Exceptions:**The following fans are not required to have a fan ~~efficiency grade~~ energy index:

1.Fans that are not embedded fans with motor nameplate horsepower of less than 1.0 ~~of 5~~ hp (~~3.7~~ 0.75 kW) or l~~ess as follows:~~ with a fan nameplate electrical input power of less than 0.89 kW.

~~1.1.~~ 2.~~Single fan~~ Embedded fans ~~with~~ that have a motor nameplate horsepower of 5 hp (3.7 kW) or less, ~~unless Exception 1.2 applies.~~ or with a fan system electrical input power of 4.1 kW or less.

~~1.2.~~ 3.Multiple fans operated in series or parallel as the functional equivalent of a single fan that have a combined motor nameplate horsepower of 5 hp (3.7 kW) or less ~~and are operated as the functional equivalent of a single fan.~~ or with a fan system electrical input power of 4.1 kW or less.

2~~.~~ 4.Fans that are part of equipment covered under Section C403.2.3.

~~3.~~ 5Fans included in an equipment package certified by an *approved agency* for air or energy performance.

6. Ceiling fans, i.e., nonportable devices suspended from a ceiling or overhead structure for circulating air via the rotation of fan blades.

7. Fans used for moving gases at temperatures above 482°F (250°C).

8. Fans used for operation in explosive atmospheres.

9. Reversible fans used for tunnel ventilation.

~~4.Powered wall/roof ventilators.~~

~~5.~~ 11.Fans outside the scope of AMCA ~~205~~ 208-18.

~~6.~~ 10.Fans that are intended to operate only during emergency conditions.

(EN8122, EN7886)

**C403.2.12 Air system design and control.** Each HVAC system ~~having~~ with a ~~total~~ fan ~~system motor~~ ~~nameplate horsepower (hp) exceeding 5 hp (3.7 kW)~~ shall comply with the provisions of Sections C403.2.12.1 through ~~C403.2.12.3~~ C403.2.12.5.

**C403.2.12.1 Allowable fan ~~motor~~ horsepower.** Each HVAC system having a total fan system motor nameplate horsepower exceeding 5 hp (3.7 kW) at fan system design conditions shall not exceed the allowable *fan system motor nameplate hp* (Option 1) or *fan system bhp* (Option 2) as shown in Table C403.2.12.1(1). This includes supply fans, exhaust fans, return/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 returntomaintainspacepressurerelationshipsnecessaryforoccupanthealthandsafetyor 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 lessare exempt from the allowable fan horse power requirement.

**C403.2.12.2 Motor nameplate horsepower.** For each fan, the fan brake horsepower shall be indicated on the construction documents and the selected motor shall be not larger than the first available motor size greater than the following:

For fans less than 6 bhp (4413 W), 1.5 times the fan brake horsepower.

2.       For fans 6 bhp (4413 W) and larger, 1.3 times the fan brake horsepower.

3.       Systems complying with Section C403.2.12.1 *fan system motor nameplate hp* (Option1).

Exception: Fans with motor nameplate horsepower less than 1 hp are exempt from this section.

**~~C403.4.4.4~~ C403.2.12.4 Fractional hp fan motors.** Motors for fans that are not less than 1/ 12 hp (0.082 kW) and 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 also 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 motor speed shall be permitted.

**Exceptions:** The following motors are not required to comply with this section:

1.       Motors in the airstream within fan coils and terminal units that only provide heating to the space served.

2.       Motors in space-conditioning equipment that comply with Section 403.2.3 orC403.2.12.

3.       Motors that comply with SectionC405.8.

**~~C403.4.1~~ C403.2.12.5 Fan control.** *No change to text.*

TABLE ~~C403.4.1.1~~C403.2.12.5

**~~EFFECTIVE DATES~~ REQUIREMENTS FOR FAN CONTROL**

|  |  |  |
| --- | --- | --- |
| **COOLING SYSTEM TYPE** | **FAN MOTOR SIZE** | **MECHANICAL COOLING CAPACITY** |
| DX cooling | Any | ~~³ 75,000 Btu/h~~ ~~(before 1/1/2016)~~ |
| = 65,000 Btu/h ~~(after 1/1/2016~~ |
| Chilled water and evaporative cooling | ~~³ 5 hp~~ | ~~Any~~ |
| =1/4 / hp | Any |

For SI: 1 British thermal unit per hour = 0.2931 W; 1 hp = 0.746 kW.

**C403.2.12.5.1 Fan airflow control.** Each cooling system listed in Table C403.2.12.5 shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements:

1.       Direct expansion (DX) and chilled water cooling units that control the capacity of the mechanical cooling directly based on space temperature shall have not fewer than two stages of fan control. Low or minimum speed shall not be greater than 66 percent of full speed. At low or minimum speed, the fan system shall draw not more than 40 percent of the fan power at full fan speed. Low or minimum speed shall be used during period so flow cooling load and ventilation-only operation.

2.       Other units including DX cooling units and chilled water units that control the space temperature by modulating the airflow to the space shall have modulating fan control. Minimum speed shall be not greater than 50 percent of full speed. At minimum speed the fan system shall draw not more than 30 percent of the power at full fan speed. Low or minimum speed shall be used during periods of low cooling load and ventilation-only operation.

3.       Units that include an air- side economizer in accordance with Section C403.3 shall have not fewer than two speeds of fan control during economizer operation

**Exceptions:**

1.  Modulatingfancontrolisnotrequiredforchilledwaterandevaporativecoolingunitswith fan motors of less than 1 hp (0.746 kW) where the units are not used to

provide *ventilation* air and the indoor fan cycles with the load.

2.       Where the volume of outdoor air required to comply with the *ventilation* requirements of the *International Mechanical Code* at low speed exceeds the air that would be delivered at the speed defined in Section C403.4.1, the minimum speed shall be selected to provide the required *ventilation air*.

**C403.2.12.5.2 Static pressure sensor location.** Static pressure sensors used to control VAV fans shall be located such that the controller set point is not greater than 1.2 inches w.c. (299 Pa). Where this results in one or more sensors being located downstream of major duct splits, not less than one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.

**C403.2.12.5.3 Set points for direct digital control.** For systems with direct digital control of individual zones reporting to the central control panel, the static pressure set point shall be reset based on

the *zone* requiring the most pressure. In such case, the set point is reset lower until one zone damper is nearly wide open. The direct digital controls shall be capable of monitoring *zone* damper positions or shall have an alternative method of indicating the need for static pressure that is capable of all of the following:

Automatically detecting any *zone* that excessively drives the resetlogic.

Generating an alarm to the system operation allocation.

Allowing an operator to readily remove one or more zones from the resetalgorithm.

(EN8095)/(EN7886 and 8122) /(I-Code)

**C403.2.4.2.3 Automatic and Optimum start capabilities (Mandatory).** Automatic start controls shall be provided for each HVAC system. The controls shall be ~~capable of~~ configured to automatically adjusting the daily start time of the HVAC system in order to bring each space to the desired occupied temperature immediately prior to scheduled occupancy.

Individual heating and cooling *systems* with *setback controls* and direct digital control shall have *optimum start controls*. The *control* algorithm shall, as a minimum, be a function of the difference between *space* temperature and occupied *set point*, the outdoor temperature, and the amount of time prior to scheduled occupancy. Mass radiant *floor* slab *systems* shall incorporate *floor* temperature into the optimum start algorithm.

(EN7533)

**Add new text as follows:**

**C403.2.4.8 Automatic control of HVAC systems serving guest rooms.** In Group R-1 buildings containing over 50 guest rooms, each guest room shall be provided with controls complying with the provisions of Sections C403.2.4.3.1 and C403.2.4.3.2. Card key controls comply with these requirements.

**C403.2.4.8.1 Temperature setpoint controls.** Controls shall be provided on each HVAC system that are capable of and configured to automatically raise the cooling setpoint and lower the heating setpoint by not less than 4°F (2°C) from the occupant set-point within 30 minutes after the occupants have left the guest room. The controls shall also be capable of and configured to automatically raise the cooling setpoint to not lower than 80°F (27°C) and lower the heating set point to not higher than 60°F (16°C) when the guest room is unrented or has been continuously unoccupied for over 16 hours or a networked guest room control system indicates that the guest room is unrented and the guest room is unoccupied for more than 30 minutes. A networked guest room control system that is capable of returning the thermostat set-points to default occupied set-points 60 minutes prior to the time a guest room is scheduled to be occupied is not precluded by this section. Cooling that is capable of limiting relative humidity with a setpoint not lower than 65 percent Relative Humidity during unoccupied periods is not precluded by this section.

**C403.2.4.8.2 Ventilation controls.** Controls shall be provided on each HVAC system that are capable of and configured to automatically turn off the ventilation and exhaust fans within 30 minutes of the occupants leaving the guest room or isolation devices shall be provided to each guest room that are capable of automatically shutting off the supply of outdoor air to and exhaust air from the guest room.

**Exception**: Guest room ventilation systems are not precluded from having an automatic daily pre- occupancy purge cycle that provides daily outdoor air ventilation during unrented periods at the design ventilation rate for 60 minutes, or at a rate and duration equivalent to one air change.el and motel guest room separately

(EN8142)

**C403.2.8 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 that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.

Where total kitchen hood exhaust airflow rate is greater than 5,000 cfm (2360 L/s), each hood shall be a factory built commercial exhaust hood listed by a nationally recognized testing laboratory in compliance with UL 710. Each hood shall ~~have a maximum exhaust rate as specified in Table C403.2.8 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 capable of 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.

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

**~~TABLE C403.2.8~~**

**~~MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH~~**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **~~TYPE OF HOOD~~** | **~~LIGHT-DUTY EQUIPMENT~~** | **~~MEDIUM-DUTY EQUIPMENT~~** | **~~HEAVY-DUTY EQUIPMENT~~** | **~~EXTRA-HEAVY-DUTY EQUIPMENT~~** |
| ~~Wall-mounted canopy~~ | ~~140~~ | ~~210~~ | ~~280~~ | ~~385~~ |
| ~~Single island~~ | ~~280~~ | ~~350~~ | ~~420~~ | ~~490~~ |
| ~~Double island (per side)~~ | ~~175~~ | ~~210~~ | ~~280~~ | ~~385~~ |
| ~~Eyebrow~~ | ~~175~~ | ~~175~~ | ~~NA~~ | ~~NA~~ |
| ~~Backshelf/Pass-over~~ | ~~210~~ | ~~210~~ | ~~280~~ | ~~NA~~ |

~~For SI: 1 cfm = 0.4719 L/s; 1 foot = 305 mm.~~

~~NA = Not Allowed.~~

(EN8367)

**C403.4.3 Heat rejection equipment.** ~~Each fan powered by a motor of 7.5 hp (5.6 kW) or larger~~ Heat rejection equipment including air-cooled condensers, dry coolers, open-circuit cooling towers, closed-circuit cooling towers and evaporative condensers shall ~~have~~ comply with this section.

Exception: Heat rejection devices where energy usage is included in the ~~capability to operate that fan at~~ ~~two-thirds of full speed or less,~~ equipment efficiency ratings listed in Tables C403.2.3(6) and ~~shall have~~ ~~controls that automatically change the fan speed to control the leaving fluid temperature or condensing~~ ~~temperature/pressure of the heat rejection device~~C403.2.3(7).

**Exception~~:~~** ~~Factory-installed heat rejection devices within HVAC equipment tested and rated in~~ ~~accordance with Tables C403.2.3(6) and C403.2.3(7).~~

**C403.4.3.1 ~~General~~ Fan speed control.** ~~Heat~~ Each fan system powered by an individual motor or array of motors with a 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 heat rejection ~~equipment such as air-cooled~~ ~~condensers, dry coolers, open-circuit~~ device. Fan motor power input shall be not more than 30% of design wattage at 50% of the design airflow.

**Exceptions**:

1. Fans serving multiple refrigerant or fluid cooling ~~towers, closed-circuit cooling towers and evaporative~~ circuits.

2. Condenser fans serving flooded condensers ~~used for comfort cooling applications shall comply with this section~~.

**~~Exception:~~** ~~Heat rejection devices where energy usage is included in the equipment efficiency ratings~~ ~~listed in Tables C403.2.3(6) and C403.2.3(7).~~

**C403.4.3.2 ~~Fan speed control~~ 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 ~~controlled as provided~~ the minimum allowable speed of the fan drive system in ~~Sections C403.4.3.2.1 and C403.4.3.2.2~~ accordance with the manufacturer's recommendations.

***Delete without substitution:***

**~~C403.4.3.2.1 Fan motors not less than 7.5 hp.~~** ~~Each fan powered by a motor of 7.5 hp (5.6 kW) or~~ ~~larger shall have the capability to operate that fan at two-thirds of full speed or less, and shall have~~

~~controls that automatically change the fan speed to control the leaving fluid temperature or condensing~~

~~temperature/pressure of the heat rejection device.~~

**~~Exception:~~** ~~The following fan motors over 7.5 hp (5.6 kW) are exempt:~~

~~1. Condenser fans serving multiple refrigerant circuits.~~

~~2. Condenser fans serving flooded condensers.~~

~~3. Installations located in~~ *~~Climate Zones~~* ~~1 and 2.~~

**~~C403.4.3.2.2 Multiple-cell heat rejection equipment.~~** ~~Multiple-cell heat rejection equipment with variable~~ ~~speed fan drives shall be controlled in both of the following manners:~~

~~1. To operate the maximum number of fans allowed that comply with the manufacturer's requirements for all system components.~~

~~2. So all fans can operate at the same fan speed required for the instantaneous cooling duty, as opposed to staged (on/off) operation.~~

~~Minimum fan speed shall be the minimum allowable speed of the fan drive system in accordance with~~

~~the manufacturer's recommendations.~~

(CE165-16)

**C403.4.4.6 Multiple-zone VAV system ventilation optimization control.** Multiple-zone VAV systems with direct digital control of individual zone boxes reporting to a central control panel shall have automatic controls configured to reduce outdoor air intake flow below design rates in response to changes in system *ventilation* efficiency (*Ev*) as defined by the International Mechanical Code.

**Exceptions:**

1.VAV systems with zonal transfer fans that recirculate air from other zones without directly mixing it with outdoor air, dual-duct dual-fan VAV systems, and VAV systems with fan- powered terminal units.

~~2. Systems having exhaust air energy recovery complying with Section C403.2.7.~~

2. Systems where total design exhaust airflow is more than 70 percent of total design outdoor

air intake flow requirements.

(CE167-16)

**C403.4.4.7 Parallel-flow fan-powered VAV air terminal control.** Parallel-flow fan-powered VAV air

terminals shall have automatic controls configured to:

1. Turn off the terminal fan except when space heating is required or where required for ventilation.

2. Turn on the terminal fan as the first stage of heating before the heating coil is activated

3. During heating for warmup or setback temperature control, either: 3.1.

3.1 Operate the terminal fan and heating coil without primary air.

3.2. Reverse the terminal damper logic and provide heating from the central air handler

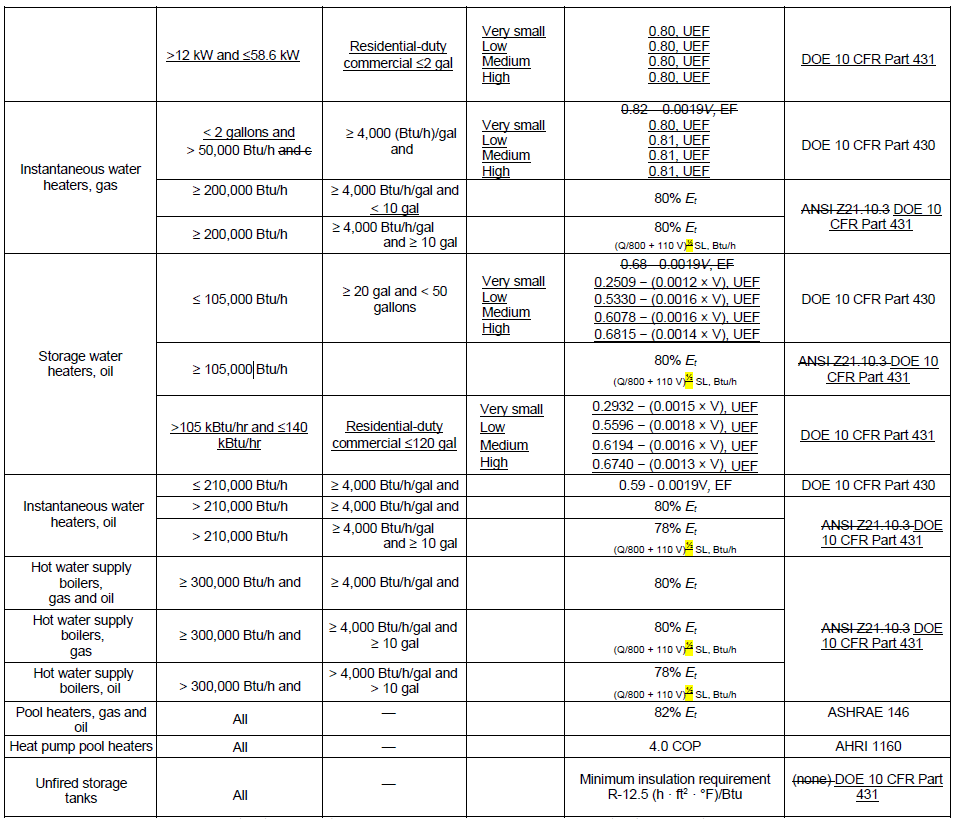
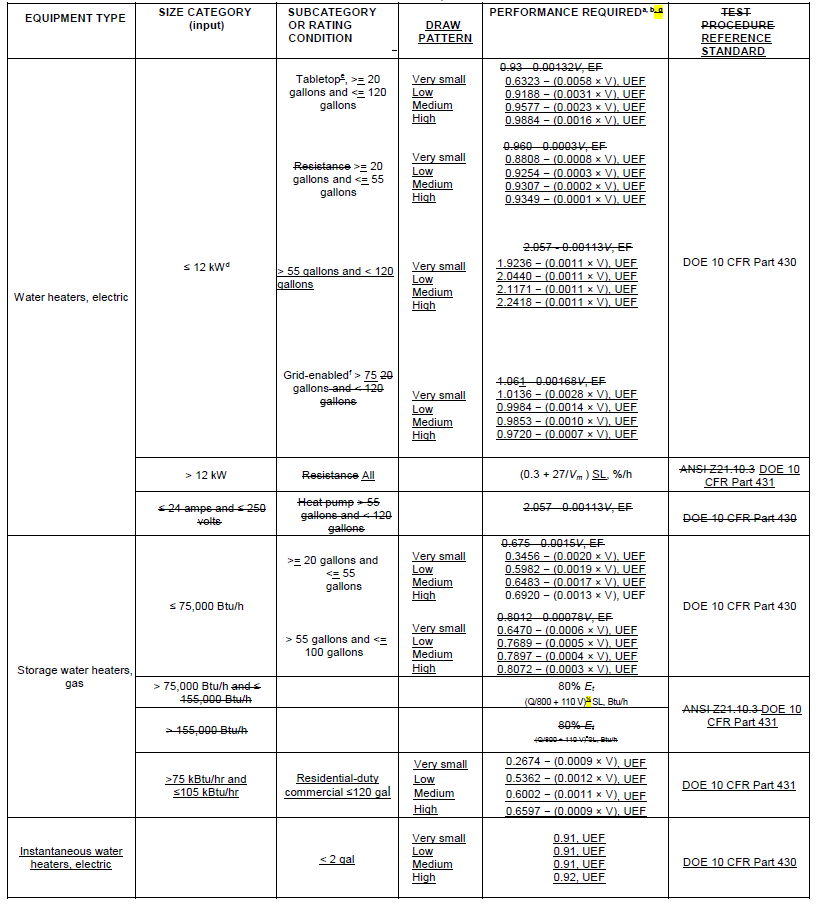
by primary air.

(CE168-16)

**[Modify Table C404.2 and associated notes as follows (starting from Supplement to the 6th Edition (2017) Florida Building Code, Energy Conservation Changes to the 2020 IECC, CE171-16 Modified by Public Comment 1):]**

**TABLE C404.2**

**MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT**



For SI: °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), uniform energy factor (UEF) and thermal efficiency (Et) are minimum requirements. In the EF and UEF equations, 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 Vm 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/hr) 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 (0.91 m) in height.

f. 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 non-water-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 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."

g. Water heaters and hot water supply boilers having more than 140 gallons of storage capacity need not meet the standby loss requirement if: (1) The tank surface area is thermally insulated to R-12.5 or more; (2) a standing pilot light is not used; and (3) for gas or oil-fired storage water heaters, they have a fire damper or fan-assisted combustion.

(EN7984-R1/CE171-16)

**C404.4 Insulation of piping.** ~~Piping from a water heater to the termination of the heated water fixture supply pipe shall be insulated in accordance with Table C403.2.10. 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 C403.2.10 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.~~

**~~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.~~

~~2.       Valves, pumps, strainers and threaded unions in piping that is 1 inch (25 mm) or less in nominal diameter.~~

~~3.       Piping from user-controlled shower and bath mixing valves to the cold water outlets.~~

~~4.       Cold-water piping of a demand recirculation water system~~

~~5.       Tubing from a hot drinking-water heating unit to the water outlet.~~

~~6.       Piping at locations where a vertical support of the piping is installed.~~

~~7.       Piping surrounded by building insulation with a thermal resistance (~~*~~R~~*~~-value) of not less than R-3.~~

The following piping shall be insulated to levels shown in Table C403.2.10:

a.       Recirculating system piping, including the supply and return piping of a circulating tank type water heater.

b.      The first 8 feet of outlet piping for a constant-temperature non-recirculating storage system.

c.       The first 8 feet of branch piping connecting to recirculated, heat-traced, or impedance heated piping.

d.      The inlet piping between the storage tank and a *heat trap* in a non-recirculating storage system.

e.      Piping that is externally heated (such as heat trace or impedance heating).

(EN7195)

C405.1 General (Mandatory).

This section covers lighting system controls, the maximum lighting power for interior and exterior applications and electrical energy consumption.

~~Exception: Dwelling units within commercial buildings shall not be required to comply with Sections C405.2 through C405.5, provided that they comply with Section R404.1.~~

~~Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.2.15 or C403.2.16.~~

Dwelling units within multifamily buildings shall comply with Section R404.1. All other dwelling units shall comply with Section R404.1, or with Sections C405.2.4 and C405.3. Sleeping units shall comply with Section C405.2.4, and with Section R404.1 or C405.3. Lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with the lighting requirements of Section C403.2.15 or C403.2.16.

(EN7239) /(I-Code)

C405.2 Lighting controls (Mandatory). Lighting systems shall be provided with controls that comply with one of the following. ~~as specified in Sections C405.2.1, C405.2.2, C405.2.3, C405.2.4 and C405.2.5.~~

1. Lighting controls as specified in Sections C405.2.1 through C405.2.6.

2. Luminaire level lighting controls (LLLC) and lighting controls as specified in Sections C405.2.1, C405.2.4 and C405.2.5. 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.

2.3. For each control strategy, configuration and reconfiguration of performance parameters including; bright and dim set points, timeouts, dimming fade rates, sensor sensitivity adjustments, and wireless zoning configurations.

(EN7245)

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. Conference/meeting/multipurpose rooms.

3. Copy/print rooms.

4. Lounges/breakrooms.

5. ~~Employee lunch and break rooms~~ Enclosed offices.

~~6. Private offices.~~

~~7~~ 6. Open plan office areas.

~~8~~ 7. Restrooms.

~~9~~ 8. Storage rooms.

~~10. Janitorial closets.~~

~~11~~ 9. Locker rooms.

~~12~~ 10. Other spaces 300 square feet (28 m2) or less that are enclosed by floor-to-ceiling height partitions.

~~13~~ 11. Warehouse~~s~~ storage areas.

C405.2.1.1 Occupant sensor control function. Occupant sensor controls in ~~spaces other than~~ warehouses shall comply with Section C405.2.1.2. Occupant sensor controls in ~~and~~ open plan office areas shall comply with Section C405.2.1.3. ~~,~~ Occupant sensor controls for all other space ~~as~~ specified in Section C405.2.1 shall comply with the following:

1. They shall ~~A~~automatically turn off lights within ~~30~~ 20 minutes of all occupants leaving the space.

2. They shall ~~B~~be manual on or controlled to automatically turn the lighting on to not more than 50 percent power.

Exception: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants.

3. They ~~S~~ shall incorporate a manual control to allow occupants to turn lights off.

C405.2.1.3 Occupant sensor control function in open plan office areas. Occupant sensor controls in open plan office spaces less than ~~250~~ 300 square feet (~~23~~ 28 m2) in area shall comply with Section C405.2.1.1. Occupant sensor controls in all other open plan office spaces shall comply with all of the following:

1. The controls shall be configured so that general lighting can be controlled separately in control zones with floor areas not greater than 600 square feet (55 m2) within the open plan office space.

2. The controls shall automatically turn off general lighting in all control zones within 20 minutes after all occupants have left the open plan office space.

3. The controls shall be configured so that general lighting power in each control zone is reduced by not less than 80 percent of the full zone general lighting power in a reasonably uniform illumination pattern within 20 minutes of all occupants leaving that control zone. Control functions that switch control zone lights completely off when the zone is vacant meet this requirement.

4. The controls shall be configured such that any daylight responsive control will activate open plan office space general lighting or control zone general lighting only when occupancy for the same area is detected.

(EN7246) /(I-Code)

**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. Conference/meeting/multipurpose rooms.

3. Copy/print rooms.

4. Lounges.

5. Employee lunch and break rooms.

6. Private offices.

7. Open plan office areas.

8. Restrooms.

9. Storage rooms.

10. Janitorial closets.

11. Locker rooms.

12. Other spaces 300 square feet (28 m2) or less that are enclosed by floor-to-ceiling height partitions.

13. Warehouses.

**C405.2.1.1 Occupant sensor control function.** Occupant sensor controls in spaces other than warehouses and open plan office areas, as specified in Section C405.2.1 shall comply with the following:

1. Automatically turn off lights within ~~30~~ 20 minutes of all occupants leaving the space.

2. Be manual on or controlled to automatically turn the lighting on to not more than 50 percent power.

**Exception:** Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants.

3. Shall incorporate a *manual control* to allow occupants to turn lights off.

***Add new text as follows:***

**C405.2.1.3 Occupant sensor control function in open plan office areas.** Occupant sensor controls in open

plan office spaces less than 300 square feet (28 m2) in area shall comply with Section C405.2.1.1. Occupant

sensor controls in all other open plan office spaces shall comply with all of the following:

1. The controls shall be configured so that general lighting can be controlled separately in control

zones with floor areas not greater than 600 square feet (55 m2) within the open plan office space.

2. The controls shall automatically turn off general lighting in all control zones within 20 minutes

after all occupants have left the open plan office space.

3. The controls shall be configured so that general lighting power in each control zone is reduced by

not less than 80 percent of the full zone general lighting power in a reasonably uniform illumination

pattern within 20 minutes of all occupants leaving that control zone. Control functions that

switch control zone lights completely off when the zone is vacant meet this requirement.

4. The controls shall be configured such that any daylight responsive control will activate open

plan office space general lighting or control zone general lighting only when occupancy for the

same area is detected.

(CE185-16 AM)/(CE187-16)

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.

Exception: Where a manual control provides light reduction in accordance with Section C405.2.2.2, ~~automatic~~ time-switch controls shall not be required for the following:

~~1. Sleeping units.~~

~~2.~~ 1. Spaces where patient care is directly provided.

~~3.~~ 2. Spaces where an automatic shutoff would endanger occupant safety or security.

~~4.~~ 3. Lighting intended for continuous operation.

~~5.~~ 4. Shop and laboratory classrooms.

C405.2.2.1 Time-switch control function. Each space provided with time-switch controls shall also be provided with a manual control for light reduction in accordance with Section C405.2.2.2. Time-switch controls shall include an override switching device that complies with the following:

1. Have a minimum 7-day clock.

2. Be capable of being set for seven different day types per week.

3. Incorporate an automatic holiday “shutoff” feature, which turns off all controlled lighting loads for at least 24 hours and then resumes normally scheduled operations.

4. Have program backup capabilities, which prevent the loss of program and time settings for at least 10 hours, if power is interrupted.

5. Include an override switch that complies with the following:

5.1. The override switch shall be a manual control.

5.2. The override switch, when initiated, shall permit the controlled lighting to remain on for not more than 2 hours.

5.3. Any individual override switch shall control the lighting for an area not larger than 5,000 square feet (465 m2).

Exceptions:

1. Within mall~~s~~ concourses, ~~arcades,~~ auditoriums, ~~single tenant retail spaces~~ sales areas, ~~industrial~~ manufacturing facilities and sport arenas:

1.1. The time limit shall be permitted to be greater than 2 hours, provided that the ~~override~~ switch is a captive key device.

1.2. The area controlled by the override switch ~~is permitted to be greater than~~ shall not be limited to 5,000 square feet (465 m2)~~, but shall not be greater~~  provided that such area is less than 20,000 square feet (1860 m2).

2. Where provided with manual control, the following areas are not required to have light reduction control:

2.1. Spaces that have only one luminaire with a rated power of less than 100 watts.

2.2. Spaces that use less than 0.6 watts per square foot (6.5 W/m2).

2.3. Corridors, ~~equipment rooms, public~~ lobbies, electrical rooms and or mechanical rooms.

(EN7313) /(I-Code)

**C405.2.3 Daylight-responsive controls**. Daylight-responsive controls complying with Section C405.2.3.1 shall be provided to control the electric lights within daylight zones in the following spaces:

1. Spaces with a total of more than 150 watts of general lighting within ~~sidelight daylight~~ sidelit zones complying with Section C405.2.3.2. General lighting does not include lighting that is required to have specific application control in accordance with Section C405.2.4.

2. Spaces with a total of more than 150 watts of general lighting within ~~toplight daylight~~ toplit zones complying with Section C405.2.3.3.

Exceptions: Daylight responsive controls are not required for the following:

1. Spaces in health care facilities where patient care is directly provided.

~~2. Dwelling units and sleeping units.~~

~~3.~~ 2. Lighting that is required to have specific application control in accordance with Section C405.2.4.

~~4. Sidelight daylight~~ 3. Sidleit zones on the first floor above grade in Group A-2 and Group M occupancies.

4. 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 (LPAadj) calculated in accordance with Equation 4-9:

LPAadj = [LPAnorm × (1.0 - 0.4 × UDZFA / TBFA)]

(Equation 4-9)

where:

LPAadj = Adjusted building interior lighting power allowance in watts.

LPAnorm = 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 C405.2.3.2 and C405.2.3.3, 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.

C405.2.3.1 Daylight-responsive control function. Where required, daylight-responsive controls shall be provided within each space for control of lights in that space and shall comply with all of the following:

1. Lights in ~~toplight daylight~~ toplit zones in accordance with Section C405.2.3.3 shall be controlled independently of lights in ~~sidelight daylight~~ sidelit zones in accordance with Section C405.2.3.2.

2. Daylight responsive controls within each space shall be configured so that they can be calibrated from within that space by authorized personnel.

3. Calibration mechanisms shall be ~~readily accessible~~ in a location with ready access.

4. Where located in offices, classrooms, laboratories and library reading rooms, daylight responsive controls shall dim lights continuously from full light output to 15 percent of full light output or lower.

5. Daylight responsive controls shall be capable of a complete shutoff of all controlled lights.

6. Lights in ~~sidelight daylight~~ sidelit zones in accordance with Section C405.2.3.2 facing different cardinal orientations [i.e., within 45 degrees (0.79 rad) of due north, east, south, west] shall be controlled independently of each other.

Exception: Up to 150 watts of lighting in each space is permitted to be controlled together with lighting in a daylight zone facing a different cardinal orientation.

C405.2.3.2 ~~Sidelight daylight~~ Sidelit zone. The ~~sidelight daylight~~ sidelit zone is the floor area adjacent to vertical fenestration which complies with all of the following:

1. Where the fenestration is located in a wall, the ~~daylight~~ sidelit 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 of the fenestration to the nearest full-height wall, or up to 2 feet (610 mm), whichever is less, as indicated in Figure C405.2.3.2~~(1)~~.

~~2. Where the fenestration is located in a rooftop monitor, the 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 C405.2.3.2(2) and C405.2.3.2(3).~~

~~3.~~ 2. The area of the fenestration is not less than 24 square feet (2.23 m2).

~~4.~~ 3. The distance from the fenestration to any building or geological formation which would block access to daylight is greater than the height from the bottom of the fenestration to the top of the building or geologic formation.

~~5. Where located in existing buildings, the~~ 4. The visible transmittance of the fenestration is not less than 0.20.

~~FIGURE C405.2.3.2(1)~~

~~DAYLIGHT ZONE ADJACENT TO FENESTRATION IN A WALL~~

~~FIGURE C405.2.3.2(2)~~

~~DAYLIGHT ZONE UNDER A ROOFTOP MONITOR~~

~~FIGURE C405.2.3.2(3)~~

~~DAYLIGHT ZONE UNDER A SLOPED ROOFTOP MONITOR~~

C405.2.3.3 ~~Toplight daylight~~ Toplit zone. The ~~toplight daylight~~ toplit zone is the floor area underneath a roof fenestration assembly which complies with all of the following:

1. The ~~daylight~~ toplit zone shall extend laterally and longitudinally beyond the edge of the roof fenestration assembly to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 0.7 times the ceiling height, whichever is less, as indicated in Figure C405.2.3.3(1).

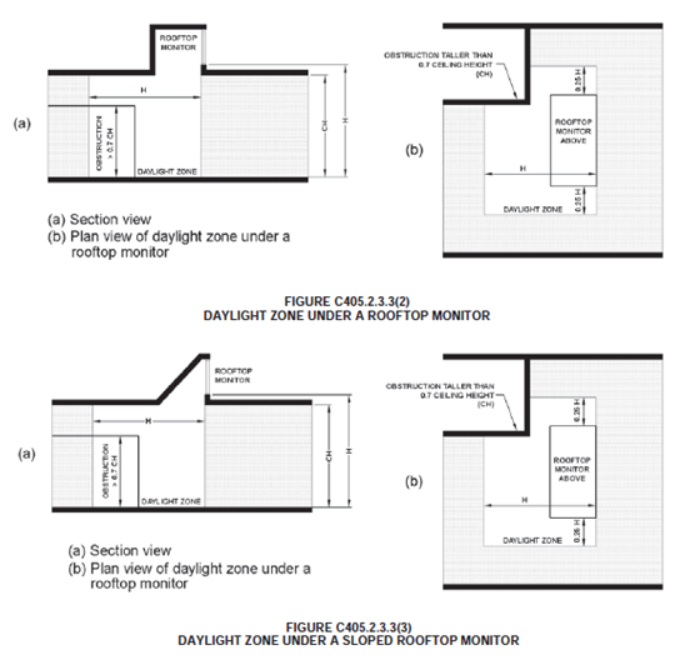
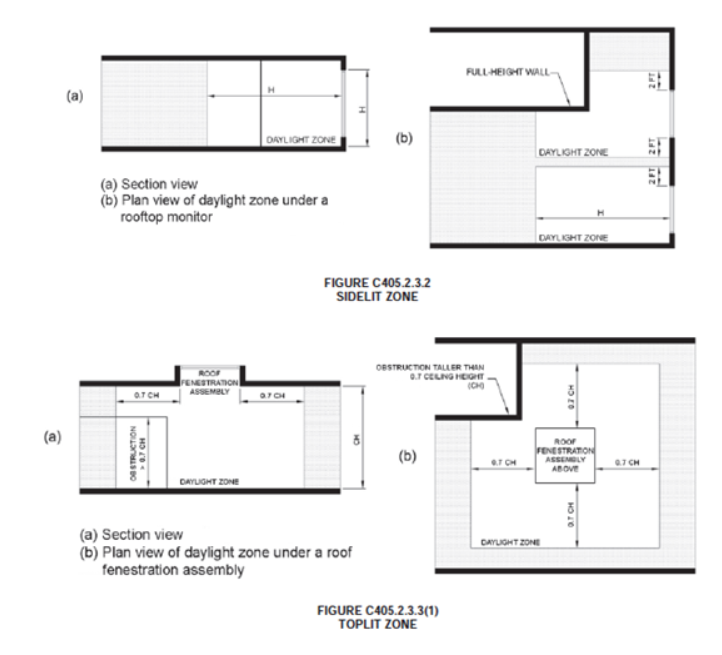
2. Where the fenestration is located in a rooftop monitor, the toplit zone shall extend laterally to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 1.0 times the height from the floor to the bottom of the fenestration, whichever is less, and longitudinally from the 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 C405.2.3.2(2) and C405.2.3.2(3).

~~2.~~ 3. ~~No building or geological formation blocks direct sunlight~~ Direct sunlight is not blocked from hitting the roof fenestration assembly at the peak solar angle on the summer solstice by buildings or geological formations.

~~3. Where located in existing buildings, the~~ 4. The product of the visible transmittance of the roof fenestration assembly and the area of the rough opening of the roof fenestration assembly divided by the area of the ~~daylight~~ toplit zone is not less than 0.008.

~~FIGURE C405.2.3.3~~

~~DAYLIGHT ZONE UNDER A ROOF FENESTRATION ASSEMBLY~~



(EN7317) /(I-Code)

C405.2.4 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. Display and accent ~~light shall be controlled by a dedicated control that is independent of the~~  ~~controls for other lighting within the room or space~~.

1.2. Lighting in display cases ~~used for display case purposes shall be controlled by a dedicated control~~  ~~that is independent of the controls for other lighting within the room or space~~.

1.3. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting.

1.4. Lighting equipment that is for sale or demonstration in lighting education.

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 C405.2.2.2.

4. 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.

~~3. Hotel and motel sleeping units and guest suites shall have a master control device that is capable of automatically switching off all installed luminaires and switched receptacles within 20 minutes after all occupants leave the room.~~

~~Exception: Lighting and switched receptacles controlled by captive key systems.~~

~~4. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided that the control device is readily accessible.~~

~~5. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a dedicated control that is independent of the controls for other lighting within the room or space.~~

~~6. Lighting equipment that is for sale or for demonstrations in lighting education shall be controlled by a dedicated control that is independent of the controls for other lighting within the room or space.~~

(EN7318) /(I-Code)

C405.2.5 ~~C405.2.2.3~~ Manual controls. ~~Manual~~ Where required by this code, manual controls for lights shall comply with the following:

1. ~~Shall be readily accessible~~ They shall be in a location with ready access to occupants.

2. ~~Shall~~ They shall be located where the controlled lights are visible, or shall identify the area served by the lights and indicate their status.

~~C405.2.5~~ C405.2.6 Exterior lighting controls. (Approved under CE196016)

(EN7315)

**C405.2.5 Exterior lighting controls.** Exterior lighting systems shall be provided with controls that comply with Sections C405.2.5.1 through C405.2.5.4. Decorative lighting systems shall comply with Sections C405.2.5.1, C405.2.5.2, and C405.2.5.4.

**Exceptions:**

1. Lighting for ~~exterior applications other than emergency lighting that is intended to be~~ automatically off during building operation, lighting specifically covered vehicle entrances and exits from buildings and parking structures where required ~~to meet health and life safety requirements or decorative~~ for eye adaptation.

2. Lighting controlled from within dwelling units.

~~3. Be provided with a control that automatically turns off the lighting as a function of available daylight.~~

~~4. Where lighting the building façade or landscape, the lighting shall have controls that automatically shut off the lighting as a function of dawn/dusk and a set opening and closing time.~~

~~5. Where not covered in Item 2, the lighting shall have controls configured to automatically reduce the connected lighting power by not less than 30 percent from not later than midnight to 6 a.m., from one hour after business closing to one hour before business opening or during any period when activity has not been detected for a time of longer than 15 minutes.~~

~~All time switches shall be able to retain programming and the time setting during loss of power for a~~ ~~period of at least 10 hours.~~

**Exception~~:~~** ~~Lighting for covered vehicle entrances or exits from buildings or parking structures where~~ ~~required for safety, security or eye adaptation.~~

***Add new text as follows:***

**C405.2.5.1 Daylight shutoff.** Lights shall be automatically turned off when daylight is present and satifies the lighting needs.

**C405.2.5.2 Decorative lighting shutoff.** Building facade and landscape lighting shall automatically shut off from not later than one hour after business closing to not earlier than one hour before business opening..

**C405.2.5.3 Lighting setback.** Lighting that is not controlled in accordance with Section C405.2.5.2 shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 30 percent by selectively switching off or dimming luminaires at one of the following times:

1. From not later than midnight to not earlier than 6 a.m.

2. From not later than one hour after business closing to not earlier than one hour before business opening.

3. During any time where activity has not been detected for 15 minutes or more.

**C405.2.5.4 Exterior time-switch control function.** Time-switch controls for exterior lighting shall comply with the following:

1. They shall have a clock that is not less than 7 day.

2. They shall be capable of being set for seven different day types per week.

3. They shall incorporate an automatic holiday setback feature.

4. They shall have program backup capabilities that prevent the loss of program and time settings for not less than 10 hours, if power is interrupted.

(CE196-16 AMPC2)

**C405.2.5.3 Lighting setback.** Lighting that is not controlled in accordance with Section C405.2.5.2 shall be controlled so that the total wattage of such lighting is automatically reduced by not less than ~~30~~50 percent by selectively switching off or dimming luminaires at one of the following times:

1.    From not later than midnight to not earlier than 6a.m.

2.    From not later than one hour after business closing to not earlier than one hour before business opening.

3.    During any time where activity has not been detected for 15 minutes or more

(EN7503)

***Delete without substitution:***

**~~C405.3 Exit signs (Mandatory).~~** ~~Internally illuminated exit signs shall not be more than 5 watts per side~~

(CE198-16)

**C405.4 Interior lighting power requirements (Prescriptive).** A building complies with this section where its total connected interior lighting power calculated under Section C405.4.1 is not greater than the interior lighting power calculated under Section C405.4.2.

C405.4.1 Total connected interior lighting power. The total connected interior lighting power shall be determined in accordance with Equation 4-9.

~~TCLP = [SL + LV + LTPB + Other]~~ TCLP = [LVL + BLL + LED + TRK + Other] (Equation 4-9)

where:

TCLP = Total connected lighting power (watts).

~~SL = Labeled wattage of luminaires for screw-in lamps.~~

~~LV = Wattage of the transformer supplying low-voltage lighting.~~

~~LTPB = Wattage of line-voltage lighting tracks and plugin busways as the specified wattage of the luminaires, but at least 30 W/lin. ft. (100 W/lin m), or the wattage limit of the system’s circuit breaker, or the wattage limit of other permanent current-limiting devices on the system.~~

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.

~~Exceptions: 1.~~ The connected power associated with the following lighting equipment and applications is not included in calculating total connected lighting power.

~~1.~~1. ~~Professional sports arena playing field lighting~~ Television broadcast lighting for playing areas in sport arenas.

~~1.2. Lighting in sleeping units, provided that the lighting complies with Section R404.1.~~

~~1.3.~~ 2. Emergency lighting automatically off during normal building operation.

~~1.4.~~ 3. 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.

~~1.5. Lighting in interior spaces that have been specifically designated as a registered interior historic~~  ~~landmark~~.

~~1.6.~~ 4. Casino gaming areas.

~~1.7.~~ 5. Mirror lighting in dressing rooms.

~~2. Lighting equipment used for the following shall be exempt provided that it is in addition to general lighting and is controlled by an independent control device:~~

~~2.1.~~ 6. Task lighting for medical and dental purposes that is in addition to general lighting and controlled by an independent control device.

~~2.2.~~ 7. Display lighting for exhibits in galleries, museums and monuments that is is addition to general lighting and controlled by an independent control device.

~~3.~~ 8. Lighting for theatrical purposes, including performance, stage, film production and video production.

~~4.~~ 9. Lighting for photographic processes.

~~5.~~ 10. Lighting integral to equipment or instrumentation and installed by the manufacturer.

~~6.~~ 11. Task lighting for plant growth or maintenance.

~~7.~~ 12. Advertising signage or directional signage.

~~8. In restaurant buildings and areas,~~ l 13. Lighting for food warming ~~or integral to food preparation equipment~~.

~~9.~~ 14. Lighting equipment that is for sale.

~~10.~~ 15. Lighting demonstration equipment in lighting education facilities.

~~11.~~ 16. Lighting approved because of safety or emergency considerations~~, inclusive of exit lights~~.

~~12. Lighting integral to both open and glass enclosed refrigerator and freezer cases.~~

~~13.~~ 17. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.

~~14.~~ 18. Furniture-mounted supplemental task lighting that is controlled by automatic shutoff.

~~15.~~ 19. Exit signs.

**C405.4.2 Interior lighting power allowance.** The total interior lighting power allowance (watts) is determined according to Table C405.4.2(1) using the Building Area Method, or Table C405.4.2(2) using the Space-by-Space Method, for all areas of the building covered in this permit.

TABLE C405.4.2(1) INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD

a. Where sleeping units are excluded from lighting power calculations by application of Section R405.1, 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 R405.1, 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 C405.4.2(2) INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

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 R405.1, 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 R405.1, 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 spectators.

(EN7325) /(I-Code)

**TABLE C405.4.2 (1)**

**INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD**

|  |  |
| --- | --- |
| **BUILDING AREA TYPE** | **LPD (w/ft2)** |
| Automotive facility | ~~0.80~~ 0.71 |
| Convention center | ~~1.01~~ 0.76 |
| Courthouse | ~~1.01~~ 0.90 |
| Dining: bar lounge/leisure | ~~1.01~~ 0.90 |
| Dining: cafeteria/fast food | ~~0.9~~ 0.79 |
| Dining: family | ~~0.95~~ 0.78 |
| Dormitory | ~~0.57~~ 0.61 |
| Exercise center | ~~0.84~~ 0.65 |
| Fire station | ~~0.67~~ 0.53 |
| Gymnasium | ~~0.94~~ 0.68 |
| Health care clinic | ~~0.90~~ 0.82 |
| Hospital | 1.05 |
| Hotel/Motel | ~~0.87~~ 0.75 |
| Library | ~~1.19~~ 0.78 |
| Manufacturing facility | ~~1.17~~ 0.90 |
| Motion picture theater | ~~0.76~~ 0.83 |
| Multifamily | ~~0.51~~ 0.68 |
| Museum | ~~1.02~~ 1.06 |
| Office | ~~0.82~~ 0.79 |
| Parking garage | ~~0.21~~ 0.15 |
| Penitentiary | ~~0.81~~ 0.75 |
| Performing arts theater | ~~1.39~~ 1.18 |
| Police station | ~~0.87~~ 0.80 |
| Post office | ~~0.87~~ 0.67 |
| Religious building | ~~1.0~~ 0.94 |
| Retail | ~~1.26~~ 1.06 |
| School/university | ~~0.87~~ 0.81 |
| Sports arena | ~~0.91~~ 0.87 |
| Town hall | ~~0.89~~ 0.80 |
| Transportation | ~~0.70~~ 0.61 |
| Warehouse | ~~0.66~~ 0.48 |
| Workshop | ~~1.19~~ 0.90 |

**TABLE C405.4.2 (2)**

**INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD**

|  |  |
| --- | --- |
| **COMMON SPACE TYPESa** | **LPD (watts/sq.ft)** |
| Atrium | |
| Less than 40 feet in height | 0.03 per foot in total height |
| Greater than 40 feet in height | 0.40 + 0.02 per foot in total height |
| Audience seating area | |
| In an auditorium | 0.63 |
| In a convention center | 0.82 |
| In a gymnasium | 0.65 |
| In a motion picture theater | 1.14 |
| In a penitentiary | 0.28 |
| In a performing arts theater | ~~2.43~~ 2.03 |
| In a religious building | 1.53 |
| In a sports arena | 0.43 |
| Otherwise | 0.43 |
| Banking activity area | ~~1.01~~ 0.86 |
| Breakroom (See Lounge/Breakroom) | |
| Classroom/lecture hall/training room | |
| In a penitentiary | 1.34 |
| Otherwise | ~~1.24~~ 0.96 |
| Conference/meeting/multipurpose room | ~~1.23~~ 1.07 |
| Copy/print room | ~~0.72~~ 0.56 |
| Corridor | |
| In a facility for the visually impaired (and not used primarily by the staff)b | 0.92 |
| In a hospital | ~~0.79~~ 0.92 |
| In a manufacturing facility | ~~0.41~~ 0.29 |
| Otherwise | 0.66 |
| Courtroom | ~~1.72~~ 1.39 |
| Computer room | ~~1.71~~ 1.33 |
| Dining area | |
| In a penitentiary | 0.96 |
| In a facility for the visually impaired (and not used primarily by the staff)b | ~~1.9~~ 2.00 |
| In bar/lounge or leisure dining | ~~1.07~~ 0.93 |
| In cafeteria or fast food dining | ~~0.65~~ 0.63 |
| In family dining | ~~0.89~~ 0.71 |
| Otherwise | ~~0.65~~ 0.63 |
| Electrical/mechanical room | ~~0.95~~ 0.43 |

|  |  |
| --- | --- |
| Emergency vehicle garage | ~~0.56~~ 0.41 |
| Food preparation area | ~~1.21~~ 1.06 |
| Guest room | ~~0.47~~0.77 |
| Laboratory |
| In or as a classroom | ~~1.43~~1.20 |
| Otherwise | ~~1.81~~1.45 |
| Laundry/washing area | ~~0.6~~0.43 |
| Loading dock, interior | ~~0.47~~0.58 |
| Lobby |
| In a facility for the visually impaired (and not used primarily by the staff)b | ~~1.8~~2.03 |
| For an elevator | ~~0.64~~0.68 |
| In a hotel | 1.06 |
| In a motion picture theater | ~~0.59~~0.45 |
| In a performing arts theater | ~~2.0~~1.70 |
| Otherwise | ~~0.9~~1.0 |
| Locker room | ~~0.75~~0.48 |
| Lounge/breakroom |
| In a healthcare facility | ~~0.92~~0.78 |
| Otherwise | ~~0.73~~0.62 |
| Office |
| Enclosed | ~~1.11~~0.93 |
| Open plan | ~~0.98~~0.81 |
| Parking area, interior | ~~0.19~~0.14 |
| Pharmacy area | ~~1.68~~1.34 |
| Restroom |
| In a facility for the visually impaired (and not used primarily by the staffb | ~~1.21~~0.96 |
| Otherwise | ~~0.98~~0.85 |
| Sales area | ~~1.59~~1.22 |
| Seating area, general | ~~0.54~~0.42 |
| Stairway (See space containing stairway) |
| Stairwell | ~~0.69~~0.58 |
| Storage room | ~~0.63~~0.46 |
| Vehicular maintenance area | ~~0.67~~0.56 |
| Workshop | ~~1.59~~1.14 |
| **BUILDING TYPE SPECIFIC SPACE TYPESa** | **LPD (watts/sq.ft)** |
| Facility for the visually impairedb |
| In a chapel (and not used primarily by the staff) | ~~2.21~~1.06 |
| In a recreation room (and not used primarily by the staff) | ~~2.41~~1.80 |
| Automotive (See Vehicular Maintenance Area above) |
| Convention Center—exhibit space | ~~1.45~~0.88 |
| Dormitory—living quarters | ~~0.38~~0.54 |
| Fire Station—sleeping quarters | ~~0.22~~0.20 |
| Gymnasium/fitness center |
| In an exercise area | ~~0.72~~0.50 |
| In a playing area | ~~1.2~~0.82 |

|  |  |
| --- | --- |
| **BUILDING TYPE SPECIFIC SPACE TYPESa** | **LPD (watts/sq.ft)** |
| **healthcare facility** | |
| In an exam/treatment room | ~~1.66~~ 1.68 |
| In an imaging room | ~~1.51~~1.06 |
| In a medical supply room | ~~0.74~~ 0.54 |
| In a nursery | ~~0.88~~ 1.00 |
| In a nurse's station | ~~0.71~~ 0.81 |
| In an operating room | ~~2.48~~ 2.17 |
| In a patient room | 0.62 |
| In a physical therapy room | ~~0.91~~ 0.84 |
| In a recovery room | ~~1.15~~ 1.03 |
| Library | |
| In a reading area | ~~1.06~~ 0.82 |
| In the stacks | ~~1.71~~ 1.20 |
| Manufacturing facility | |
| In a detailed manufacturing area | ~~1.29~~ 0.93 |
| In an equipment room | ~~0.74~~ 0.65 |
| In an extra high bay area (greater than 50′ floor-to-ceiling height) | 1.05 |
| In a high bay area (25-50′ floor-to-ceiling height) | ~~1.23~~ 0.75 |
| In a low bay area (less than 25'' floor-to- ceiling height) | ~~1.19~~ 0.96 |
| Museum | |
| In a general exhibition area | 1.05 |
| In a restoration room | ~~1.02~~ 0.85 |
| Performing arts theater—dressing room | ~~0.61~~ 0.36 |
| Post Office—Sorting Area | ~~0.94~~ 0.68 |
| Religious buildings | |
| In a fellowship hall | ~~0.64~~ 0.55 |
| In a worship/pulpit/choir area | 1.53 |
| Retail facilities | |
| In a dressing/fitting room | ~~0.71~~ 0.50 |
| In a mall concourse | ~~1.1~~ 0.90 |
| Sports arena—playing area | |
| For a Class I facility | ~~3.68~~ 2.47 |
| For a Class II facility | ~~2.4~~ 1.96 |
| For a Class III facility | ~~1.8~~ 1.70 |
| For a Class IV facility | ~~1.2~~ 1.13 |
| Transportation facility | |

|  |  |
| --- | --- |
| In a baggage/carousel area | ~~0.53~~ 0.45 |
| In an airport concourse | ~~0.36~~ 0.31 |
| At a terminal ticket counter | ~~0.8~~ 0.62 |
| Warehouse—storage area | |
| For medium to bulky, palletized items | ~~0.58~~ 0.35 |
| For smaller, hand-carried items | ~~0.95~~ 0.69 |

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.

(CE206-16)

**C405.4.2.2.1 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 automatically controlled separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires 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 4-10.

~~Additional interior lighting power allowance = 500 watts + (Retail Area 1~~ **~~•~~** ~~0.6 W/ft 2 )~~

~~+ (Retail Area 2~~ **~~•~~** ~~0.6 W/ft 2 ) +~~

~~(Retail Area 3~~ **~~•~~** ~~1.4 W/ft 2 ) + (Retail Area 4~~**~~•~~** ~~2.5 W/ft 2 )~~

**~~(Equation 4-10)~~**

**C405.4.2.2.1 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 automatically controlled separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires 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 4-10.

|  |  |
| --- | --- |
| Additional interior lighting power allowance = 500 watts + (Retail Area 1 **~~•~~** ~~0.6~~ ~~W/ft 2 ) + (Retail Area 2~~ **~~•~~** ~~0.6 W/ft 2 ) + (Retail Area 3~~ **~~•~~** ~~1.4 W/ft 2 ) + (Retail~~ ~~Area 4~~**~~•~~** ~~2.5 W/ft 2 )~~ | **(Equation 4-10~~)~~** |
| Additional interior lighting power allowance = 500 watts + (Retail Area 1 **•** 0.6 W/ft 2 ) + (Retail Area 2 **•** 0.6 W/ft 2 ) + (Retail Area 3 **•** 1.4 W/ft 2 ) + (Retail Area 4 **•** 2.5 W/ft 2 ) | |
| **(Equation 4-10)** |  |

where:

|  |  |  |
| --- | --- | --- |
| Retail Area 1 | = | The floor area for all products not listed in Retail Area 2, 3 or 4. |
| Retail Area 2 | = | The floor area used for the sale of vehicles, sporting goods and small electronics. |
| Retail Area 3 | = | The floor area used for the sale of furniture, clothing, cosmetics and artwork. |
| Retail Area 4 | = | The floor area used for the sale of jewelry, crystal and china. |

**Exception:** Other merchandise categories are permitted to be included in Retail Areas 2 through 4, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the code official.

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 ~~1.0 w~~0.9 W/ft2 ~~(10.7 w~~ (9.7 W/m2) in lobbies or museum

exhibition areas and not more than 0.75 W/ft2 (8.1 W/m2) ~~of such~~ in other spaces.

**C405.4.2.2.1 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 automatically controlled separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires 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 4-10.

|  |
| --- |
| Additional interior lighting power allowance = 500 watts + (Retail Area 1 **•** 0.6 W/ft 2 ) + (Retail Area 2 **•** 0.6 W/ft 2 ) + (Retail Area 3 **•** 1.4 W/ft 2 ) + (Retail Area 4 **•** 2.5 W/ft 2 ) |
| **(Equation 4-10)** |

where:

|  |  |  |
| --- | --- | --- |
| Retail Area 1 | = | The floor area for all products not listed in Retail Area 2, 3 or 4. |
| Retail Area 2 | = | The floor area used for the sale of vehicles, sporting goods and small electronics. |
| Retail Area 3 | = | The floor area used for the sale of furniture, clothing, cosmetics and artwork. |
| Retail Area 4 | = | The floor area used for the sale of jewelry, crystal and china. |

**Exception:** Other merchandise categories are permitted to be included in Retail Areas 2 through 4, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the code official.

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 ~~or museum exhibition areas~~ and not more than 0.75 W/ft2 (8.1 W/m2) in other spaces.

(CE210-16 AM)

C405.5 Exterior lighting power requirements (Mandatory). ~~Where the power for exterior lighting is supplied through the energy service to the building, all exterior lighting shall comply with Section C405.5.1.~~ 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.

~~Exception: Where approved because of historical, safety, signage or emergency considerations.~~

~~C405.5.1 Exterior building lighting power. The total exterior lighting power allowance for all exterior building applications is the sum of the base site allowance plus the individual allowances for areas that are to be illuminated and are permitted in Table C405.5.1(2) for the applicable lighting zone. Trade-offs are allowed only among exterior lighting applications listed in Table C405.5.1(2), in the Tradable Surfaces section. The lighting zone for the building exterior is determined from Table C405.5.1(1) unless otherwise specified by the local jurisdiction.~~

C405.4.1 Total connected exterior building exterior lighting power. The total exterior connected lighting power shall be the total maximum rated wattage of all lighting that is powered through the energy service for the building.

Exception: Lighting used for the following ~~exterior~~ applications ~~is exempt where equipped with a control device independent of the control of the nonexempt lighting:~~ shall not be included.

1. Lighting approved because of safety considerations.

2. Emergency lighting automatically off during normal business operation.

3. Exit signs.

~~1.~~ 4. Specialized signal, directional and marker lighting associated with transportation.

~~2.~~ 5. Advertising signage or directional signage.

~~3.~~ 6. Integral to equipment or instrumentation and is installed by its manufacturer.

~~4.~~ 7. Theatrical purposes, including performance, stage, film production and video production.

~~5.~~ 8. Athletic playing areas.

~~6.~~ 9. Temporary lighting.

~~7.~~ 10. Industrial production, material handling, transportation sites and associated storage areas.

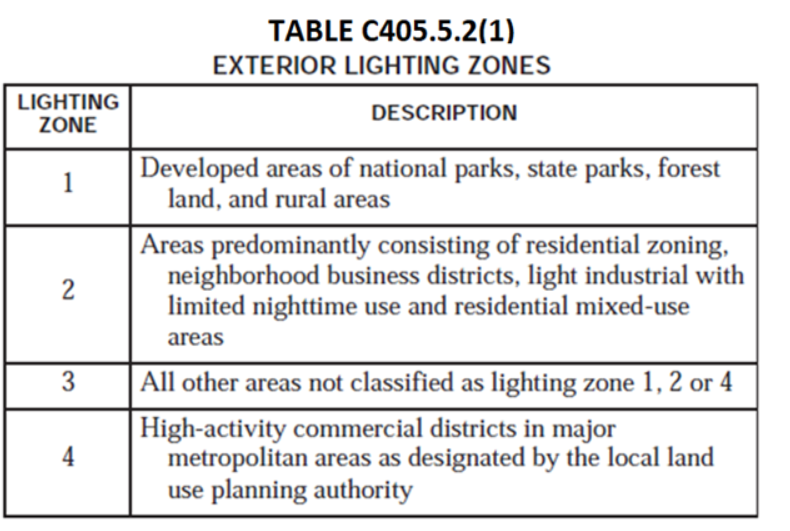
~~8.~~ 11. Theme elements in theme/amusement parks.

~~9.~~  12. Used to highlight features of art, public monuments and ~~registered historic landmark structures or buildings~~ and the national flag.

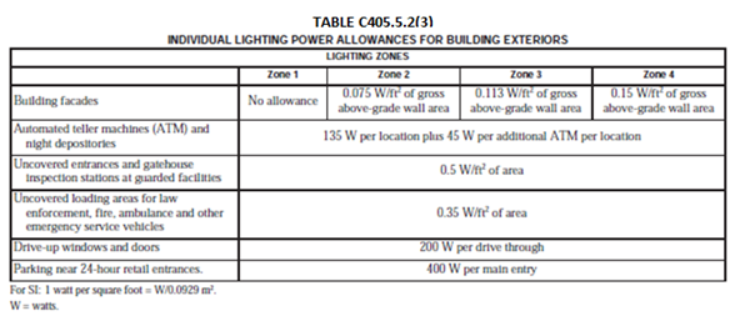
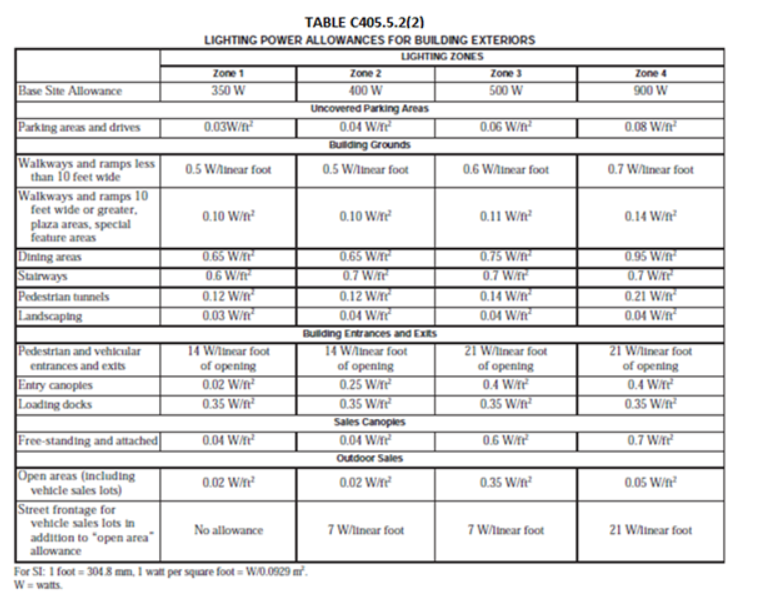
13. Lighting for water features and swimming pools.

14. Lighting controlled from within dwelling units, where the lighting complies with Section R404.1.

C405.5.2 Exterior lighting power allowance. The total exterior lighting power allowance is the sum of the base site allowance plus the individual allowances for areas that are to be illuminated by lighting that is powered through the energy service for the building. Lighting power allowances are as specified in Table C405.5.2(2). The lighting zone for the building exterior is determined in accordance with Table C405.5.2(1) unless otherwise specified by the code official.



C405.5.2.1 Additional exterior lighting power. Any increase in the exterior lighting power allowance is limited to the specific lighting applications indicated in Table C405.5.2(3). The additional power shall be used only for the luminaires that are serving these applications and shall not be used for any other purpose.



(EN7326) /(I-Code)

**TABLE C405.7**

**MINIMUM NOMINAL EFFICIENCY LEVELS FOR 10 CFR 431 LOW-VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS**

|  |  |  |  |
| --- | --- | --- | --- |
| **SINGLE-PHASE TRANSFORMERS** | | **THREE-PHASE TRANSFORMERS** | |
| **kVAa** | **Efficiency (%)b** | **kVAa** | **Efficiency (%)**b |
| 15 | 97.70 | 15 | ~~97.0~~ 97.89 |
| 25 | 98.00 | 30 | ~~97.5~~ 98.23 |
| 37.5 | 98.20 | 45 | ~~97.7~~ 98.40 |
| 50 | 98.30 | 75 | ~~98.0~~ 98.60 |
| 75 | 98.50 | 112.5 | ~~98.2~~ 98.74 |
| 100 | 98.60 | 150 | ~~98.3~~ 98.83 |
| 167 | 98.70 | 225 | ~~98.5~~ 98.94 |
| 250 | 98.80 | 300 | ~~98.6~~ 99.02 |
| 333 | 98.90 | 500 | ~~98.7~~ 99.14 |
|  |  | 750 | ~~98.8~~ 99.23 |
|  |  | 1000 | ~~98.9~~ 99.28 |

a. kiloVolt-Amp rating.

b. Nominal efficiencies shall be established in accordance with the DOE 10 CFR 431 test procedure for low-voltage dry-type transformers.

(CE221-16)

**C405.7 Electrical transformers (Mandatory).** ~~Electric~~ 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.

(EN7328) /(I-Code)

**C405.8 Electrical motors (Mandatory).** 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.

**Exceptions:** 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

5. Inverter-only electric motors

**TABLE C405.8 (1)**

**MINIMUM NOMINAL FULL-LOAD EFFICIENCY FOR ~~60 HZ~~ NEMA DESIGN A, NEMA ~~GENERAL PURPOSE~~ DESIGN B, AND IEC DESIGN N MOTORS (EXCLUDING FIRE PUMP ELECTRIC MOTORS ~~(SUBTYPE~~ ~~I~~) ~~RATED~~**

**~~600 VOLTS OR LESS (Random Wound)~~ AT 60 HZ~~a~~a,b**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **~~MOTOR~~ ~~HORSEPOWER~~** | **~~NUMBER OF POLES~~** | **~~OPEN DRIP-PROOF~~ ~~MOTORS~~** | | | **~~TOTALLY ENCLOSED FAN-COOLED~~ ~~MOTORS~~** | | |
| **~~2~~** | **~~4~~** | **~~6~~** | **~~2~~** | **~~4~~** | **~~6~~** |
| **~~Synchronous Speed~~ ~~(RPM)~~** | **~~3600~~** | **~~1800~~** | **~~1200~~** | **~~3600~~** | **~~1800~~** | **~~1200~~** |
| ~~1~~ |  | ~~77.0~~ | ~~85.5~~ | ~~82.5~~ | ~~77.0~~ | ~~85.5~~ | ~~82.5~~ |
| ~~1.5~~ |  | ~~84.0~~ | ~~86.5~~ | ~~86.5~~ | ~~84.0~~ | ~~86.5~~ | ~~87.5~~ |
| ~~2~~ |  | ~~85.5~~ | ~~86.5~~ | ~~87.5~~ | ~~85.5~~ | ~~86.5~~ | ~~88.5~~ |
| ~~3~~ |  | ~~85.5~~ | ~~89.5~~ | ~~88.5~~ | ~~86.5~~ | ~~89.5~~ | ~~89.5~~ |
| ~~5~~ |  | ~~86.5~~ | ~~89.5~~ | ~~89.5~~ | ~~88.5~~ | ~~89.5~~ | ~~89.5~~ |
| ~~7.5~~ |  | ~~88.5~~ | ~~91.0~~ | ~~90.2~~ | ~~89.5~~ | ~~91.7~~ | ~~91.0~~ |
| ~~10~~ |  | ~~89.5~~ | ~~91.7~~ | ~~91.7~~ | ~~90.2~~ | ~~91.7~~ | ~~91.0~~ |
| ~~15~~ |  | ~~90.2~~ | ~~93.0~~ | ~~91.7~~ | ~~91.0~~ | ~~92.4~~ | ~~91.7~~ |
| ~~20~~ |  | ~~91.0~~ | ~~93.0~~ | ~~92.4~~ | ~~91.0~~ | ~~93.0~~ | ~~91.7~~ |
| ~~25~~ |  | ~~91.7~~ | ~~93.6~~ | ~~93.0~~ | ~~91.7~~ | ~~93.6~~ | ~~93.0~~ |
| ~~30~~ |  | ~~91.7~~ | ~~94.1~~ | ~~93.6~~ | ~~91.7~~ | ~~93.6~~ | ~~93.0~~ |
| ~~40~~ |  | ~~92.4~~ | ~~94.1~~ | ~~94.1~~ | ~~92.4~~ | ~~94.1~~ | ~~94.1~~ |
| ~~50~~ |  | ~~93.0~~ | ~~94.5~~ | ~~94.1~~ | ~~93.0~~ | ~~94.5~~ | ~~94.1~~ |
| ~~60~~ |  | ~~93.6~~ | ~~95.0~~ | ~~94.5~~ | ~~93.6~~ | ~~95.0~~ | ~~94.5~~ |
| ~~75~~ |  | ~~93.6~~ | ~~95.0~~ | ~~94.5~~ | ~~93.6~~ | ~~95.4~~ | ~~94.5~~ |
| ~~100~~ |  | ~~93.6~~ | ~~95.4~~ | ~~95.0~~ | ~~94.1~~ | ~~95.4~~ | ~~95.0~~ |
| ~~125~~ |  | ~~94.1~~ | ~~95.4~~ | ~~95.0~~ | ~~95.0~~ | ~~95.4~~ | ~~95.0~~ |
| ~~150~~ |  | ~~94.1~~ | ~~95.8~~ | ~~95.4~~ | ~~95.0~~ | ~~95.8~~ | ~~95.8~~ |
| ~~200~~ |  | ~~95.0~~ | ~~95.8~~ | ~~95.4~~ | ~~95.4~~ | ~~96.2~~ | ~~95.8~~ |
| ~~250~~ |  | ~~95.0~~ | ~~95.8~~ | ~~95.4~~ | ~~95.8~~ | ~~96.2~~ | ~~95.8~~ |
| ~~300~~ |  | ~~95.4~~ | ~~95.8~~ | ~~95.4~~ | ~~95.8~~ | ~~96.2~~ | ~~95.8~~ |
| ~~350~~ |  | ~~95.4~~ | ~~95.8~~ | ~~95.4~~ | ~~95.8~~ | ~~96.2~~ | ~~95.8~~ |
| ~~400~~ |  | ~~95.8~~ | ~~95.8~~ | ~~95.8~~ | ~~95.8~~ | ~~96.2~~ | ~~95.8~~ |
| ~~450~~ |  | ~~95.8~~ | ~~96.2~~ | ~~96.2~~ | ~~95.8~~ | ~~96.2~~ | ~~95.8~~ |
| ~~500~~ |  | ~~95.8~~ | ~~96.2~~ | ~~96.2~~ | ~~95.8~~ | ~~96.2~~ | ~~95.8~~ |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Motor horsepower (standard kilowatt equivalent)** | **Nominal full-load efficiency (%) as of June 1, 2016** | | | | | | | |
| **2 Pole** | | **4 Pole** | | **6 Pole** | | **8 Pole** | |
| **Enclosed** | **Open** | **Enclosed** | **Open** | **Enclosed** | **Open** | **Enclosed** | **Open** |
| 1 (0.75) | 77.0 | 77.0 | 85.5 | 85.5 | 82.5 | 82.5 | 75.5 | 75.5 |
| 1.5 (1.1) | 84.0 | 84.0 | 86.5 | 86.5 | 87.5 | 86.5 | 78.5 | 77.0 |
| 2 (1.5) | 85.5 | 85.5 | 86.5 | 86.5 | 88.5 | 87.5 | 84.0 | 86.5 |
| 3 (2.2) | 86.5 | 85.5 | 89.5 | 89.5 | 89.5 | 88.5 | 85.5 | 87.5 |
| 5 (3.7) | 88.5 | 86.5 | 89.5 | 89.5 | 89.5 | 89.5 | 86.5 | 88.5 |
| 7.5 (5.5) | 89.5 | 88.5 | 91.7 | 91.0 | 91.0 | 90.2 | 86.5 | 89.5 |
| 10 (7.5) | 90.2 | 89.5 | 91.7 | 91.7 | 91.0 | 91.7 | 89.5 | 90.2 |
| 15 (11) | 91.0 | 90.2 | 92.4 | 93.0 | 91.7 | 91.7 | 89.5 | 90.2 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Motor horsepower (standard kilowatt equivalent)** | **Nominal full-load efficiency (%) as of June 1, 2016** | | | | | | | |
| **2 Pole** | | **4 Pole** | | **6 Pole** | | **8 Pole** | |
| **Enclosed** | **Open** | **Enclosed** | **Open** | **Enclosed** | **Open** | **Enclosed** | **Open** |
| 20 (15) | 91.0 | 91.0 | 93.0 | 93.0 | 91.7 | 92.4 | 90.2 | 91.0 |
| 25 (18.5) | 91.7 | 91.7 | 93.6 | 93.6 | 93.0 | 93.0 | 90.2 | 91.0 |
| 30 (22) | 91.7 | 91.7 | 93.6 | 94.1 | 93.0 | 93.6 | 91.7 | 91.7 |
| 40 (30) | 92.4 | 92.4 | 94.1 | 94.1 | 94.1 | 94.1 | 91.7 | 91.7 |
| 50 (37) | 93.0 | 93.0 | 94.5 | 94.5 | 94.1 | 94.1 | 92.4 | 92.4 |
| 60 (45) | 93.6 | 93.6 | 95.0 | 95.0 | 94.5 | 94.5 | 92.4 | 93.0 |
| 75 (55) | 93.6 | 93.6 | 95.4 | 95.0 | 94.5 | 94.5 | 93.6 | 94.1 |
| 100 (75) | 94.1 | 93.6 | 95.4 | 95.4 | 95.0 | 95.0 | 93.6 | 94.1 |
| 125 (90) | 95.0 | 94.1 | 95.4 | 95.4 | 95.0 | 95.0 | 94.1 | 94.1 |
| 150 (110) | 95.0 | 94.1 | 95.8 | 95.8 | 95.8 | 95.4 | 94.1 | 94.1 |
| 200 (150) | 95.4 | 95.0 | 96.2 | 95.8 | 95.8 | 95.4 | 94.5 | 94.1 |
| 250 (186) | 95.8 | 95.0 | 96.2 | 95.8 | 95.8 | 95.8 | 95.0 | 95.0 |
| 300 (224) | 95.8 | 95.4 | 96.2 | 95.8 | 95.8 | 95.8 |  | |
| 350 (261) | 95.8 | 95.4 | 96.2 | 95.8 | 95.8 | 95.8 |
| 400 (298) | 95.8 | 95.8 | 96.2 | 95.8 |  | | | |
| 450 (336) | 95.8 | 96.2 | 96.2 | 96.2 |
| 500 (373) | 95.8 | 96.2 | 96.2 | 96.2 |

a. Nominal efficiencies shall be established in accordance with DOE 10 CFR 431.

b. For purposes of determining the required minimum nominal full-load efficiency of an electric motor that has a horsepower or kilowatt rating between two horsepower or two kilowatt ratings listed in this table, each such motor shall be deemed to have a listed horsepower or kilowatt rating, determined as follows:

(1) A horsepower at or above the midpoint between the two consecutive horse powers shall be rounded up to the higher of the two horse powers.

(2) A horsepower below the midpoint between the two consecutive horse powers shall be rounded down to the lower of the two horse powers.

(3) A kilowatt rating shall be directly converted from kilowatts to horsepower using the formula 1 kilowatt = (1/0.746) horsepower. The conversion should be calculated to three significant decimal places, and the resulting horsepower shall be rounded in accordance with paragraph (1) or (2), whichever applies.

**TABLE C405.8 (2)**

**MINIMUM NOMINAL FULL-LOAD EFFICIENCY ~~OF GENERAL PURPOSE ELECTRIC~~ FOR NEMA DESIGN C AND IEC DESIGN H MOTORS ~~(SUBTYPE II) AND ALL DESIGN B MOTORS GREATER THAN 200~~ ~~HORSEPOWER~~ AT 60 HZ~~a~~a,b**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **~~MOTOR~~ ~~HORSEPOWER~~** | **~~NUMBER OF POLES~~** | **~~OPEN DRIP-PROOF~~ ~~MOTORS~~** | | | | **~~TOTALLY ENCLOSED FAN-COOLED~~ ~~MOTORS~~** | | | |
| **~~2~~** | **~~4~~** | **~~6~~** | **~~8~~** | **~~2~~** | **~~4~~** | **~~6~~** | **~~8~~** |
| **~~Synchronous Speed~~ ~~(RPM)~~** | **~~3600~~** | **~~1800~~** | **~~1200~~** | **~~900~~** | **~~3600~~** | **~~1800~~** | **~~1200~~** | **~~900~~** |
| ~~1~~ |  | ~~NR~~ | ~~82.5~~ | ~~80.0~~ | ~~74.0~~ | ~~75.5~~ | ~~82.5~~ | ~~80.0~~ | ~~74.0~~ |
| ~~1.5~~ |  | ~~82.5~~ | ~~84.0~~ | ~~84.0~~ | ~~75.5~~ | ~~82.5~~ | ~~84.0~~ | ~~85.5~~ | ~~77.0~~ |
| ~~2~~ |  | ~~84.0~~ | ~~84.0~~ | ~~85.5~~ | ~~85.5~~ | ~~84.0~~ | ~~84.0~~ | ~~86.5~~ | ~~82.5~~ |
| ~~3~~ |  | ~~84.0~~ | ~~86.5~~ | ~~86.5~~ | ~~86.5~~ | ~~85.5~~ | ~~87.5~~ | ~~87.5~~ | ~~84.0~~ |
| ~~5~~ |  | ~~85.5~~ | ~~87.5~~ | ~~87.5~~ | ~~87.5~~ | ~~87.5~~ | ~~87.5~~ | ~~87.5~~ | ~~84.0~~ |
| ~~7.5~~ |  | ~~87.5~~ | ~~88.5~~ | ~~88.5~~ | ~~88.5~~ | ~~88.5~~ | ~~89.5~~ | ~~89.5~~ | ~~85.5~~ |
| ~~10~~ |  | ~~88.5~~ | ~~89.5~~ | ~~90.2~~ | ~~89.5~~ | ~~89.5~~ | ~~89.5~~ | ~~89.5~~ | ~~88.5~~ |
| ~~15~~ |  | ~~89.5~~ | ~~91.0~~ | ~~90.2~~ | ~~89.5~~ | ~~90.2~~ | ~~91.0~~ | ~~90.2~~ | ~~88.5~~ |
| ~~20~~ |  | ~~90.2~~ | ~~91.0~~ | ~~91.0~~ | ~~90.2~~ | ~~90.2~~ | ~~91.0~~ | ~~90.2~~ | ~~89.5~~ |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **~~MOTOR~~ ~~HORSEPOWER~~** | **~~NUMBER OF POLES~~** | **~~OPEN DRIP-PROOF~~ ~~MOTORS~~** | | | | **~~TOTALLY ENCLOSED FAN-COOLED~~ ~~MOTORS~~** | | | |
| **~~2~~** | **~~4~~** | **~~6~~** | **~~8~~** | **~~2~~** | **~~4~~** | **~~6~~** | **~~8~~** |
| **~~Synchronous Speed~~ ~~(RPM)~~** | **~~3600~~** | **~~1800~~** | **~~1200~~** | **~~900~~** | **~~3600~~** | **~~1800~~** | **~~1200~~** | **~~900~~** |
| ~~25~~ |  | ~~91.0~~ | ~~91.7~~ | ~~91.7~~ | ~~90.2~~ | ~~91.0~~ | ~~92.4~~ | ~~91.7~~ | ~~89.5~~ |
| ~~30~~ |  | ~~91.0~~ | ~~92.4~~ | ~~92.4~~ | ~~91.0~~ | ~~91.0~~ | ~~92.4~~ | ~~91.7~~ | ~~91.0~~ |
| ~~40~~ |  | ~~91.7~~ | ~~93.0~~ | ~~93.0~~ | ~~91.0~~ | ~~91.7~~ | ~~93.0~~ | ~~93.0~~ | ~~91.0~~ |
| ~~50~~ |  | ~~92.4~~ | ~~93.0~~ | ~~93.0~~ | ~~91.7~~ | ~~92.4~~ | ~~93.0~~ | ~~93.0~~ | ~~91.7~~ |
| ~~60~~ |  | ~~93.0~~ | ~~93.6~~ | ~~93.6~~ | ~~92.4~~ | ~~93.0~~ | ~~93.6~~ | ~~93.6~~ | ~~91.7~~ |
| ~~75~~ |  | ~~93.0~~ | ~~94.1~~ | ~~93.6~~ | ~~93.6~~ | ~~93.0~~ | ~~94.1~~ | ~~93.6~~ | ~~93.0~~ |
| ~~100~~ |  | ~~93.0~~ | ~~94.1~~ | ~~94.1~~ | ~~93.6~~ | ~~93.6~~ | ~~94.5~~ | ~~94.1~~ | ~~93.0~~ |
| ~~125~~ |  | ~~93.6~~ | ~~94.5~~ | ~~94.1~~ | ~~93.6~~ | ~~94.5~~ | ~~94.5~~ | ~~94.1~~ | ~~93.6~~ |
| ~~150~~ |  | ~~93.6~~ | ~~95.0~~ | ~~94.5~~ | ~~93.6~~ | ~~94.5~~ | ~~95.0~~ | ~~95.0~~ | ~~93.6~~ |
| ~~200~~ |  | ~~94.5~~ | ~~95.0~~ | ~~94.5~~ | ~~93.6~~ | ~~95.0~~ | ~~95.0~~ | ~~95.0~~ | ~~94.1~~ |
| ~~250~~ |  | ~~94.5~~ | ~~95.4~~ | ~~95.4~~ | ~~94.5~~ | ~~95.4~~ | ~~95.0~~ | ~~95.0~~ | ~~94.5~~ |
| ~~300~~ |  | ~~95.0~~ | ~~95.4~~ | ~~95.4~~ | ~~NR~~ | ~~95.4~~ | ~~95.4~~ | ~~95.0~~ | ~~NR~~ |
| ~~350~~ |  | ~~95.0~~ | ~~95.4~~ | ~~95.4~~ | ~~NR~~ | ~~95.4~~ | ~~95.4~~ | ~~95.0~~ | ~~NR~~ |
| ~~400~~ |  | ~~95.4~~ | ~~95.4~~ | ~~NR~~ | ~~NR~~ | ~~95.4~~ | ~~95.4~~ | ~~NR~~ | ~~NR~~ |
| ~~450~~ |  | ~~95.8~~ | ~~95.8~~ | ~~NR~~ | ~~NR~~ | ~~95.4~~ | ~~95.4~~ | ~~NR~~ | ~~NR~~ |
| ~~500~~ |  | ~~95.8~~ | ~~95.8~~ | ~~NR~~ | ~~NR~~ | ~~95.4~~ | ~~95.8~~ | ~~NR~~ | ~~NR~~ |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Motor horsepower (standard kilowatt equivalent)** | **Nominal full-load efficiency (%) as of June 1, 2016** | | | | | |
| **4 Pole** | | **6 Pole** | | **8 Pole** | |
| **Enclosed** | **Open** | **Enclosed** | **Open** | **Enclosed** | **Open** |
| 1 (0.75) | 85.5 | 85.5 | 82.5 | 82.5 | 75.5 | 75.5 |
| 1.5 (1.1) | 86.5 | 86.5 | 87.5 | 86.5 | 78.5 | 77.0 |
| 2 (1.5) | 86.5 | 86.5 | 88.5 | 87.5 | 84.0 | 86.5 |
| 3 (2.2) | 89.5 | 89.5 | 89.5 | 88.5 | 85.5 | 87.5 |
| 5 (3.7) | 89.5 | 89.5 | 89.5 | 89.5 | 86.5 | 88.5 |
| 7.5 (5.5) | 91.7 | 91.0 | 91.0 | 90.2 | 86.5 | 89.5 |
| 10 (7.5) | 91.7 | 91.7 | 91.0 | 91.7 | 89.5 | 90.2 |
| 15 (11) | 92.4 | 93.0 | 91.7 | 91.7 | 89.5 | 90.2 |
| 20 (15) | 93.0 | 93.0 | 91.7 | 92.4 | 90.2 | 91.0 |
| 25 (18.5) | 93.6 | 93.6 | 93.0 | 93.0 | 90.2 | 91.0 |
| 30 (22) | 93.6 | 94.1 | 93.0 | 93.6 | 91.7 | 91.7 |
| 40 (30) | 94.1 | 94.1 | 94.1 | 94.1 | 91.7 | 91.7 |
| 50 (37) | 94.5 | 94.5 | 94.1 | 94.1 | 92.4 | 92.4 |
| 60 (45) | 95.0 | 95.0 | 94.5 | 94.5 | 92.4 | 93.0 |
| 75 (55) | 95.4 | 95.0 | 94.5 | 94.5 | 93.6 | 94.1 |
| 100 (75) | 95.4 | 95.4 | 95.0 | 95.0 | 93.6 | 94.1 |
| 125 (90) | 95.4 | 95.4 | 95.0 | 95.0 | 94.1 | 94.1 |
| 150 (110) | 95.8 | 95.8 | 95.8 | 95.4 | 94.1 | 94.1 |
| 200 (150) | 96.2 | 95.8 | 95.8 | 95.4 | 94.5 | 94.1 |

NR = No requirement.

a. Nominal efficiencies shall be established in accordance with DOE 10 CFR 431.

b. For purposes of determining the required minimum nominal full-load efficiency of an electric motor that has a horsepower or kilowatt rating between two horsepower or two kilowatt ratings listed in this table, each such motor shall be deemed to have a listed horsepower or kilowatt rating, determined as follows:

(1) A horsepower at or above the midpoint between the two consecutive horse powers shall be rounded up to the higher of the two horse powers.

(2) A horsepower below the midpoint between the two consecutive horse powers shall be rounded down to the lower of the two horse powers.

(3) A kilowatt rating shall be directly converted from kilowatts to horsepower using the formula 1 kilowatt = (1/0.746) horsepower. The conversion should be calculated to three significant decimal places, and the resulting horsepower shall be rounded in accordance with paragraph (1) or (2), whichever applies

(CE223-16)

C405.9.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44 and shall have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.

Exception: A variable voltage drive system that reduces operating voltage in response to light loading conditions is an alternative to the reduced speed function.

(EN7329) /(I-Code)

**C406.1.1 Tenant spaces.** Tenant spaces shall comply with Section C406.2, C406.3, C406.4, C406.6 or C406.7. Alternatively, tenant spaces shall comply with Section C406.5 where the entire building is in compliance.

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

(EN8148) /(I-Code)

**C406.5 On-site renewable energy.** ~~Total~~ The total minimum ratings of on-site renewable energy systems shall ~~comply with~~ be one of the following:

1. ~~Provide not~~ Not less than 1.71 Btu/h per square foot (5.4 W/m2) or 0.50 watts per square foot

(5.4 W/m2) of conditioned floor area.

2. ~~Provide not~~ Not less than 3 percent of the energy used within the building for building mechanical

nd service water heating equipment and lighting regulated in Chapter 4.

(CE242-16)

**C406.7.1 Load fraction.** The building service water-heating system shall have one or more of the following that are sized to provide not less than 60 percent of the building's annual hot water requirements, or sized to provide 100 percent of the building's annual hot water requirements if the building shall otherwise comply with Section C403.4.5.

1. Waste heat recovery from service hot water, heat- recovery chillers, building equipment, or process equipment~~, or a combined heat and power system~~.

2. ~~Solar~~ *On site renewable energy* water-heating systems

(CE246-16)

**C407.1 Scope.** This section establishes criteria for compliance using total building performance. The following systems and loads shall be included in determining the total 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.

(CE248-16 Part I)

**TABLE C407.5.1(1)**

**SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

**All other cells of the table remain the same**

|  |  |  |
| --- | --- | --- |
| Building Component Characteristics | Standard Reference Design | Proposed Design |
| 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 55-2013. | Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays and any season 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. |

(EN7882) /(I-Code)

**Revise as follows:**

**SECTION C408**

**MAINTENANCE INFORMATION AND SYSTEM COMMISSIONING**

**C408.1 General.** This section covers the provison of maintenance information and the commissioning of the building mechanical systems in Section C403 and electrical power and lighting systems in Section C405**.**

**Add new text as follows:**

**C408.1.1 Building operations and maintenance information.** The buildings operations and maintenance documents shall be provided to the owner and shall consist of manufacturer's information, specifications, and recommendations, programming procedures and data points, narratives, and other means of illustrating to the owner how the building equipment and systems are intended to be installed, maintained and operated. Required regular maintenance actions for equipment and systems shall be clearly stated on a readily accessible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.

(EN8040) /(I-Code)

**SECTION C408**

**MAINTENANCE INFORMATION AND SYSTEM COMMISSIONING**

**C408.1 General.** This section covers the provision of maintenance information, functional testing requirements and the commissioning of ~~the~~ building ~~mechanical~~ systems ~~in Section C403 and electrical power and lighting systems in Section~~ ~~C405~~.

**Add new text as follows:**

**C408.1.1 Building operations and maintenance information.** The buildings operations and maintenance documents shall be provided to the owner and shall consist of manufacturer's information, specifications, and recommendations, programming procedures and data points, narratives, and other mean of illustrating to the owner how the building, site, equipment and systems are intended to be installed, maintained and operated. Required regular maintenance actions for equipment and systems shall be clearly stated on a readily accessible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.

(EN8040/EN8093)

**C408.2 Mechanical systems and service water-heating systems commissioning and completion requirements.**

Prior to the final mechanical and plumbing inspections, the licensed design professional, electrical engineer, mechanical engineer 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 heater 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.

Capacities of individual systems serving dwelling or sleeping units shall not be counted in determining the total mechanical and/or water heating systems’ capacity for the whole building.

2. Systems included in Section C403.3 that serve individual dwelling units and sleeping units.

(EN8377)

**.**

**C408.2.5.2 Manuals.** An operating and maintenance manual shall be provided and include all of the following:

1.   Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.

2.       Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.

3.       Name and address of at least one service agency.

4.       HVAC and service hot water controls system maintenance and calibration information, including wiring diagrams, schematics and control sequence descriptions. Desired or field-determined set points shall be permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.

5.       ~~Submittal data indicating all selected options for~~a Anarrative of how each ~~piece of lighting equipment and lighting controls~~ system is intended to operate, including recommended setpoints.

6.       ~~Operation and maintenance manuals for each piece of lighting equipment. Required routine maintenance actions, cleaning and recommended relamping shall be clearly identified.~~

7.       ~~A schedule for inspecting and recalibrating all lighting controls.~~

~~8. A narrative of how each system is intended to operate, including recommended setpoints.~~

**C408.3 Lighting ~~system~~ controls functional testing.** ~~Controls for automatic~~ Automatic lighting ~~systems~~ controls required by this code shall comply with this section.

**C408.3.1 Functional testing. Prior to passing final inspection, the *registered design professional* 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 ~~and C408.3.1.2~~ through C408.3.1.3 for the applicable control type.

No change to the remaining text

**C408.3.2 Documentation requirements.** The *construction documents* shall specify

**that the documents ~~certifying that the installed lighting controls meet documented performance criteria of Section C405 are to~~ described in this section be provided to the building owner or owner's authorized agent within 90 days ~~from~~ of the date of receipt of the *certificate of occupancy*.**

**Add new text as follows:**

**C408.3.2.1 Drawings.** *Construction documents* shall include the location and catalogue number of eachpiece of equipment.

**C408.3.2.2 Manuals. An operating and maintenance manual shall be provided and include the following:**

1.       Name and address of not less than one service agency for installed equipment.

2.       A narrative of how each system is intended to operate, including recommended setpoints.

3.       Submittal data indicating all selected options for each piece of lighting equipment and lighting controls.

4.       Operation and maintenance manuals for each piece of lighting equipment. Required routine maintenance actions, cleaning and recommended relamping shall be clearly identified.

5. A schedule for inspecting and recalibrating all lighting controls.

**C408.3.2.3 Report.** A report of test results shall be provided and include the following:

**1.       Results of functional performance tests.**

2.       Disposition of deficiencies found during testing, including details of corrective measures used or proposed.

(EN8093) /(I-Code)

**CHAPTER 5 [CE] EXISTING BUILDINGS**

Revise as follows:

**C503.2 Change in space conditioning.** Any nonconditioned or low-energy space that is altered to become conditioned space shall be required to be brought into full compliance with this code.

**Exceptions:**

1. Where the component performance alternative in Section C402.1.5 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 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 General.** Spaces undergoing a change in occupancy 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 C405.4.2(1) or C405.4.2(2) to another use in Table C405.4.2(1) or C405.4.2(2), the installed lighting wattage shall comply with Section C405.4.

**Exceptions:**

1. Where the component performance alternative in Section C402.1.5 is used to comply with this section, the proposed UA shall be not greater than 110 percent of the target UA.

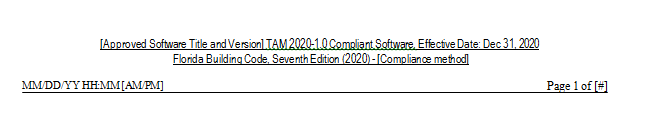
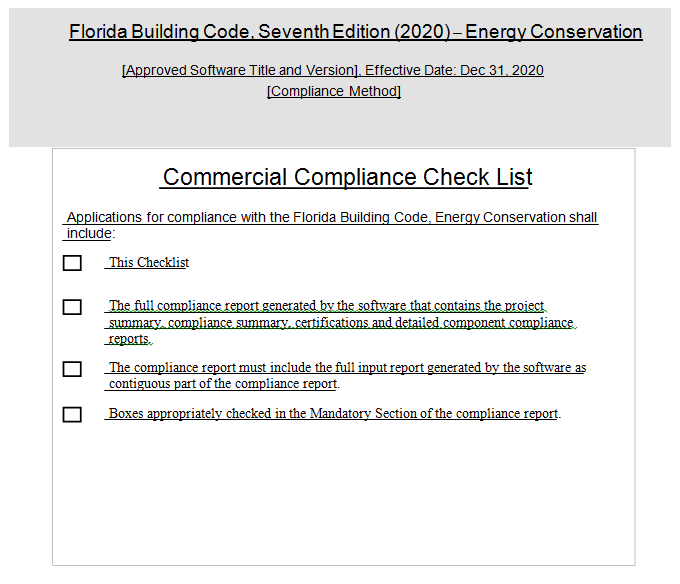
2. Where the total building performance option in Section C407 is used to comply with this section, the annual energy cost of the proposed design shall be not greater than 110 percent of the annual energy cost otherwise permitted by Section C407.3.

(EN8190) /(I-Code)

**CHAPTER 6 [CE] REFERENCED STANDARDS**

**See attached**

**Add to Appendix CA – Forms**



(EN8366)

**Add Appendix CB as a new appendix:**

APPENDIX CB

SOLAR-READY ZONE—COMMERCIAL

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User note:

About this appendix: Appendix CB is intended to encourage the installation of renewable energy systems by preparing buildings for the future installation of solar energy equipment, piping and wiring.

SECTION CB101

SCOPE

CB101.1 General. These provisions shall be applicable for new construction where solar-ready provisions are required.

SECTION CB102

GENERAL DEFINITION

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

SECTION CB103

SOLAR-READY ZONE

CB103.1 General. A solar-ready zone shall be located on the roof of buildings that are five stories or less in height above grade plane, and are oriented between 110 degrees and 270 degrees of true north or have low-slope roofs. Solar-ready zones shall comply with Sections CB103.2 through CB103.8.

Exceptions:

1. A building with a permanently installed, on-site renewable energy system.

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

3. A building where the licensed design professional certifies that the incident solar radiation available to the building is not suitable for a solar-ready zone.

4. A building where the licensed design professional certifies that the solar zone area required by Section CB103.3 cannot be met because of extensive rooftop equipment, skylights, vegetative roof areas or other obstructions.

CB103.2 Construction document requirements for a solar-ready zone. Construction documents shall indicate the solar-ready zone.

CB103.3 Solar-ready zone area. The total solar-ready zone area shall be not less than 40 percent of the roof area calculated as the horizontally projected gross roof area less the area covered by skylights, occupied roof decks, vegetative roof areas and mandatory access or set back areas as required by the Florida Fire Prevention Code. The solar-ready zone shall be a single area or smaller, separated sub-zone areas. Each subzone shall be not less than 5 feet (1524 mm) in width in the narrowest dimension.

CB103.4 Obstructions. Solar ready zones shall be free from obstructions, including pipes, vents, ducts, HVAC equipment, skylights and roof-mounted equipment.

CB103.5 Roof loads and documentation. A collateral dead load of not less than 5 pounds per square foot (5 psf) (24.41 kg/m2) shall be included in the gravity and lateral design calculations for the solar-ready zone. The structural design loads for roof dead load and roof live load shall be indicated on the construction documents.

CB103.6 Interconnection pathway. Construction documents shall indicate pathways for routing of conduit or piping from the solar-ready zone to the electrical service panel or service hot water system.

CB103.7 Electrical service reserved space. The main electrical service panel shall have a reserved space to allow installation of a dual-pole circuit breaker for future solar electric installation and shall be labeled “For Future Solar Electric.” The reserved space shall be positioned at the end of the panel that is opposite from the panel supply conductor connection.

CB103.8 Construction documentation certificate. A permanent certificate, indicating the solar-ready zone and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.

(EN7332)

Residential Provisions

**CHAPTER 1 [RE] SCOPE AND ADMINISTRATION**

No change

**Chapter 2 [RE] DEFINITIONS**

~~HIGH-EFFICACY LAMPS. Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, or lamps with a minimum efficacy of:~~

~~1.60 lumens per watt for lamps over 40 watts;~~

~~2.50 lumens per watt for lamps over 15 watts to 40 watts; and~~

~~3.40 lumens per watt for lamps 15 watts or less.~~

(EN7203/RE5-16)

APPROVED AGENCY.  An established and recognized agency that is regularly engaged in conducting tests, ~~or~~ furnishing inspection services, or finishing product certification, when such agency has been approved by the code official.

LABELED. Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, ~~inspection~~ approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and where labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

(EN7241) /(I-Code)

CAVITY INSULATION. Insulating material located between framing members.

(EN8257)

**SKYLIGHT.** Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees (1.05 rad) from horizontal~~. Glazing materials in skylights~~, including unit skylights, tubular daylighting devices, solariums, sunrooms, roofs and sloped walls~~, are included in this definition~~.

(EN7823)

**R202 (N1101.6) BUILDING THERMAL ENVELOPE.** The basement walls, exterior walls, ~~floor~~ floors, ~~roof~~ ceilings, roofs and any other building ~~elements~~ element assemblies that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.

(EN7796) /(I-Code)

**Chapter 3 [RE] GENERAL REQUIREMENTS**

Revise as follows:

**R303.1.3 Fenestration product rating.**

*U*-factors of fenestration products ~~(windows, doors and skylights)~~ shall be determined ~~in accordance with NFRC 100~~as follows.

                            1. For windows, doors and skylights, *U*-factor ratings shall be determined in accordance with NFRC 100.

**~~Exception:~~**2. Where required, garage door *U*-factors shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

[remainder unchanged]

(EN7939) /(I-Code)

**TABLE R303.1.3(2)**

**DEFAULT OPAQUE DOOR *U*-FACTORS**

|  |  |
| --- | --- |
| **DOOR TYPE** | ***U*-FACTOR** |
| Uninsulated Metal | 1.20 |
| Insulated Metal | 0.60 |
| Wood | 0.50 |
| Insulated, nonmetal edge, max 45% glazing,any glazing double pane | 0.35 |

**TABLE R303.1.3(3)**

**DEFAULT ~~GLAZED FENESTRATION~~WINDOW, GLASS DOOR AND SKYLIGHT SHGC AND VT**

[table unchanged]

(EN7940 A2+Original) /(I-Code)

**Chapter 4 [RE] RESIDENTIAL ENERGY EFFICIENCY**

Revise as follows:

**R402.1 General (Prescriptive).** The *building thermal envelope* shall meet the requirements of Sections R402.1.1 through R402.1.5.

~~Exception~~ Exceptions:

1.      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 R402.

1.1 Those with a peak design rate of energy usage less than 3.4 Btu/h • ft2 (10.7 W/m2) or 1.0 watt/ft2 of floor area for space-conditioning purposes.

1.2. Those that do not contain *conditioned space*.

 2. Log homes designed in accordance with ICC-400.

(EN7958) /(I-Code)

**Table R402.4.11 (N1102.4.1.1)**

**AIR BARRIER AND INSULATION INSTALLATION**

|  |  |  |
| --- | --- | --- |
| **COMPONENT** | **AIR BARRIER CRITERIA** | **INSULATION INSTALLATION CRITERIA** |
| General requirements | A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed. | Air-permeable insulation shall not be used as a sealing material. |
| Ceiling/attic | The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed.  Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed. | The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. |
| Walls | The junction of the foundation and sill plate shall be sealed.  The junction of the top plate and the top of exterior walls shall be sealed.  Knee walls shall be sealed. | Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum.  Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. |
| Windows, skylights and doors | The space between window/door jambs and framing, and skylights and framing shall be sealed. |  |
| Rim joists | Rim joists shall include the air barrier. | Rim joists shall be insulated. |
| Floors (including above garage and cantilevered floors) | The air barrier shall be installed at any exposed edge of insulation. | Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members. |
| Crawl space walls | Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped. | Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls. |
| Shafts, penetrations | Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed. |  |
| Narrow cavities |  | Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space. |
| Garage separation | Air sealing shall be provided between the garage and conditioned spaces. |  |
| Recessed lighting | Recessed light fixtures installed in the building thermal envelope shall be sealed to the drywall. | Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated. |
| Plumbing and wiring |  | Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring. |
| Shower/tub on exterior wall | The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs. | Exterior walls adjacent to showers and tubs shall be insulated. |
| Electrical/phone box on exterior walls | The air barrier shall be installed behind electrical or communication boxes or air- sealed boxes shall be installed. |  |
| HVAC register boots | HVAC register boots that penetrate the building thermal envelope shall be sealed to the subfloor, wall covering or ~~drywall~~ ceiling. |  |
| Concealed sprinklers | When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings. |  |

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

(RE64-16)

**TABLE R402.4.1.1 (N1102.4.1.1)**

**AIR BARRIER AND INSULATION INSTALLATION**

|  |  |  |
| --- | --- | --- |
| **COMPONENT** | **AIR BARRIER CRITERIA** | **INSULATION INSTALLATION CRITERIA** |
| General requirements | A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed. | Air-permeable insulation shall not be used as a sealing material. |
| Ceiling/attic | The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed.  Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed. | The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. |
| Walls | The junction of the foundation and sill plate shall be sealed.  The junction of the top plate and the top of exterior walls shall be sealed.  Knee walls shall be sealed. | Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum.  Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. |
| Windows, skylights and doors | The space between window/door jambs and framing, and skylights and framing shall be sealed. |  |
| Rim joists | Rim joists shall include the air barrier. | Rim joists shall be insulated. |
| Floors (including above garage and cantilevered floors) | The air barrier shall be installed at any exposed edge of insulation. | Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members. |
| Crawl space walls | Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped. | Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls. |
| Shafts, penetrations | Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed. |  |
| Narrow cavities |  | Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space. |
| Garage | Air sealing shall be provided between the |  |

|  |  |  |
| --- | --- | --- |
| separation | garage and conditioned spaces. |  |
| Recessed lighting | Recessed light fixtures installed in the building thermal envelope shall be sealed to the ~~drywall~~ finished surface. | Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated. |
| Plumbing and wiring |  | Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring. |
| Shower/tub on exterior wall | The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs. | Exterior walls adjacent to showers and tubs shall be insulated. |
| Electrical/phone box on exterior walls | The air barrier shall be installed behind electrical or communication boxes or air- sealed boxes shall be installed. |  |
| HVAC register boots | HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall. |  |
| Concealed sprinklers | When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings. |  |

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400

(RE65-16)

**TABLE R402.4.1.1 (N1102.4.1.1)**

**AIR BARRIER AND INSULATION INSTALLATION**

|  |  |  |
| --- | --- | --- |
| **COMPONENT** | **AIR BARRIER CRITERIA** | **INSULATION INSTALLATION CRITERIA** |
| General requirements | A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed. | Air-permeable insulation shall not be used as a sealing material. |
| Ceiling/attic | The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed.  Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed. | The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. |
| Walls | The junction of the foundation and sill plate shall be sealed.  The junction of the top plate and the top of exterior walls shall be sealed.  Knee walls shall be sealed. | Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum.  Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. |
| Windows, skylights and doors | The space between window/door jambs and framing, and skylights and framing shall be sealed. |  |
| Rim joists | Rim joists shall include the air barrier. | Rim joists shall be insulated. |
| Floors (including above garage and cantilevered floors) | The air barrier shall be installed at any exposed edge of insulation. | Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members. |
| Crawl space walls | Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped. | Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls. |
| Shafts, penetrations | Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed. |  |
| Narrow cavities |  | Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space. |
| Garage separation | Air sealing shall be provided between the garage and conditioned spaces. |  |

|  |  |  |
| --- | --- | --- |
| Recessed lighting | Recessed light fixtures installed in the building thermal envelope shall be sealed to the drywall. | Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated. |
| Plumbing and wiring |  | Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring. |
| Shower/tub on exterior wall | The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs. | Exterior walls adjacent to showers and tubs shall be insulated. |
| Electrical/phone box on exterior walls | The air barrier shall be installed behind electrical or communication boxes or air- sealed boxes shall be installed. |  |
| HVAC register boots | HVAC supply and return register boots ~~that~~ ~~penetrate building thermal envelope~~ shall be sealed to the subfloor or  drywall penetrated by the boot. |  |
| Concealed sprinklers | When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings. |  |

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

(RE71-16)

**R403.3.3 Duct testing (Mandatory).**

Ducts shall be pressure tested to determine air leakage by one of the following methods:

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

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

**Exceptions:**

1. A duct air leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope.

2. Duct testing is not mandatory for buildings complying by Section R405 of this code. Duct leakage testing is required for Section R405 compliance where credit is taken for leakage, and a duct air leakage Qn to the outside of less than 0.080 (where Qn = duct leakage to the outside in cfm per 100 square feet of conditioned floor area tested at 25 Pascals) is indicated in the compliance report for the *proposed design*.

[No other changes to the remaining text.]

(EN7570 A1 only)

**R403.5.1 Heated water circulation and temperature maintenance systems (Mandatory).** IF Heated water circulation systems ARE INSTALLED, THEY shall be in accordance with Section R403.5.1.1. No change to the remaining text.

(EN7783)

**R403.6.1. Whole-house mechanical ventilation system fan efficacy.** When installed to function as a whole house mechanical ventilation system fans shall meet the efficacy requirements of TableR403.6.1.

**Exception:** ~~Where whole-house mechanical ventilation fans are integral to tested and listed HVAC~~ ~~equipment, they shall be powered by an electronically commutated motor.~~ Where an air handler that is integral to tested and listed HVAC equipment is used to provide whole-house mechanical ventilation, the air handler shall be powered by an electronically commutated motor.

**TABLE R403.6.1 (N1103.6.1)**

**WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY**

|  |  |  |  |
| --- | --- | --- | --- |
| **FAN LOCATION** | **RATE MINIMUM (CFM)** | **MINIMUM EFFICACYa (CFM/WATT)** | **RATE MAXIMUM (CFM)** |
| HRV or ERV | Any | 1.2 cfm/watt | Any |
| Range hoods | Any | 2.8 cfm/watt | Any |
| In-line fan | Any | 2.8 cfm/watt | Any |
| Bathroom, utility room | 10 | 1.4 cfm/watt | < 90 |
| Bathroom, utility room | 90 | 2.8 cfm/watt | Any |

For SI 1 cfm = 28.3 L/min.

a. When tested in accordance with HVI Standard 916

(EN8014) /(I-Code)

**R403.7 Heating and cooling equipment ~~(Mandatory)~~.**

**R403.7.1 Equipment sizing (Mandatory).**

[ Remaining text unchanged.]

**R403.7.2. Electric space heating (Prescriptive).** Electric resistance space heating shall not be the primary heating system used in Climate Zone 2.

(EN7154)

**R403.13 Dehumidifiers (Mandatory).**

If installed, a dehumidifier shall conform to the following requirements:

1. The minimum rated efficiency of the dehumidifier shall be greater than 1.7 Liters/ kWh if the total dehumidifier capacity for the house is less than 75 pints/day and greater than 2.38 Liters/kWh if the total dehumidifier capacity for the house is greater than or equal to 75 pints/day.

2. The dehumidifier shall be controlled by a sensor that is installed in a location where it is exposed to mixed house air.

3.  Any dehumidifier unit located in unconditioned space that treats air from conditioned space shall be insulated to a minimum of R-2.

4.  Condensate disposal shall be in accordance with Section M1411.3.1 of the *Florida Building Code, Residential*.

**R403.13.1 Ducted Dehumidifiers.**

Ducted dehumidifiers shall, in addition to conforming to the requirements of Section R403.13, conform to the following requirements:

1.   If a ducted dehumidifier is configured with return and supply ducts both connected into the supply side of the cooling system, a backdraft damper shall be installed in the supply air duct between the dehumidifier inlet and outlet duct.

2.   If a ducted dehumidifier is configured with only its supply duct connected into the supply side of the central heating and cooling system, a backdraft damper shall be installed in the dehumidifier supply duct between the dehumidifier and central supply duct.

3.   A ducted dehumidifier shall not be ducted to or from a central ducted cooling system on the return duct side upstream from the central cooling evaporator coil.

4.  Ductwork associated with a dehumidifier located in unconditioned space shall be insulated to a minimum of R-6.

(EN7649 A3 only)

R404.1 Lighting equipment (Mandatory).

Not less than ~~75~~ 90 percent of the lamps in permanently installed ~~lighting fixtures~~ luminaires shall have an efficacy of at least 45 lumens-per-watt or shall ~~be high-efficacy~~ utilize lamps with an efficacy of not less than 65 lumens-per-watt. ~~or not less than 75 percent of the permanently installed lighting fixtures shall contain only high-efficacy lamps.~~

~~Exception: Low-voltage lighting.~~

(EN7204) /(I-Code)

**R405.2.2 Building Air leakage testing.**

Building or dwelling air leakage testing shall be in accordance with Sections R402.4 through R402.4.1.2. If an air leakage rate below seven air changes per hour at a pressure of 0.2 inch w.g. (50 pascals) is specified for the *proposed design*, testing shall verify the air leakage rate does not exceed the air leakage rate of the *proposed design* instead of seven air changes per hour.

(EN7566)

**R405.2.3. Duct air leakage testing.**

In cases where duct air leakage lower than the default Qn to outside of 0.080 **(where Qn = duct leakage to the outside in cfm per 100 square feet of conditioned floor area tested at 25 Pascals)** is specified for the *proposed design*, testing in accordance with Section R403.3.2 shall verify a duct air leakage rate not exceeding the leakage rate of the *proposed design*. Otherwise, in accordance with Section R403.3.3, duct testing is not mandatory for buildings complying by Section R405.

(EN7575 A1 only)

**R405.4.2.2** **Compliance report for certificate of occupancy.**

A compliance report submitted for obtaining the certificate of occupancy shall include the following:

            1. Building street address, or other building site identification.

            2. A statement indicating that the as-built building complies with Section R405.3.

3. A certificate indicating that the building passes the performance matrix for code compliance and listing the energy saving features of the buildings.

            4. A site-specific energy analysis report that is in compliance with Section R405.3.

            5. The name of the individual performing the analysis and generating the report.

            6. The name and version of the compliance software tool.

**Exception:** If there is no change to the proposed design during the course of construction and all required inspections to verify compliance has been performed a compliance report for certificate of occupancy is not required.

(EN7802)

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**Section 405.5.2(1)**

**Text of Modification**

|  |  |  |
| --- | --- | --- |
| Building Component | Standard Reference Design | Proposed Design |
| Vertical Fenestration other than opaque doors | Vertical Fenestration area h =  (a) The proposed vertical fenestration area (AVF), where the  proposed total fenestration area (AF)is less than 15 percent of the conditioned floor area(CFA)  (b) The adjusted vertical fenestration area (AVFadj), where ~~the proposed fenestration~~  ~~area~~ AF is 15 percent or more of ~~the conditioned floor area~~ CFA. ~~The adjusted~~ ~~vertical fenestration area~~ AVFadj shall be calculated as follows:  AVFadj = AVF • 0.15° • CFA/AF  ~~where:~~  ~~AVF~~adj ~~= adjusted vertical fenestration~~ ~~AVF = proposed vertical fenestration area~~ ~~CFA = conditioned floor area AF = proposed total fenestration area~~ | As proposed |
| Orientation: equally distributed to four cardinal compass orientations (N, E, S & W) | As proposed |
| U-factor: as specified for Fenestration in Table R402.1.4 | As proposed |
| SHGC: as specified for Glazed Fenestration in Table R402.1.2 except that for climate~~s~~ zones with no requirement (NR) SHGC=0.40 shall be used. | As proposed |
| Interior shade fraction: 0.92 - (0.21 x SHGC for the standard reference design) | Interior shade fraction:  0.92 - (0.21 x SHGC as proposed) |
| External shading: none | As proposed |
| Skylights | Skylight area h =  (a) The proposed skylight area (ASKY), where the proposed total  fenestration area(AF) is less than 15 percent of the conditioned floor area (CFA), or  (b) The adjusted skylight area (ASKYadj), where ~~the~~  ~~proposed fenestration area~~ AF is 15 percent or ~~greater~~ more of ~~the conditioned~~ ~~floor area~~ CFA. ~~The adjusted skylight area~~ASKYadj shall be calculated as follows:  ASKYadj = ASKY • 0.15° • CFA/AF  ~~where:~~  ~~ASKY~~~~adj~~ ~~= adjusted vertical fenestration~~ ~~AVF = proposed vertical fenestration area~~ ~~CFA = conditioned floor area~~  ~~AF = proposed total fenestration area~~ | As proposed |
| Orientation: as proposed | As proposed |
| U-factor: as specified for Skylights in Table R402.1.4 | As proposed |
| SHGC: as specified by the exception in footnote (b) of Table R402.1.2 ~~including~~  ~~footnote (b) of that table~~, except that for climate~~s~~ zones with no requirement (NR), SHGC = 0.40 shall be used | As proposed |
| Interior shade fraction: for the area of proposed skylights equipped and rated with ~~SHGC ratings that include pre-~~ factory-installed interior shades, the interior shade fraction is:  0.92 - (0.21 · SHGC)  [SHGC as above for the standard reference design]) | As proposed, with shades assumed closed 50% of the ~~time~~ daylight hours |
| External shading: none | As proposed |

h. Light-transmitting fenestration area includes the area of sash, curbing or other framing elements that are part of the conditioned space enclosure, including light-transmitting assemblies in walls bounding conditioned basements. For doors where the light-transmitting opening is less than 50 percent of the door area, only the light-transmitting area is included.

Unadjusted AF= AVF+ASKY

For residences with conditioned basements, R-2 and R-4 residences and townhouses, the following formula shall be used to determine fenestration area:

*AF = As· FA · F*

where:

AF = Proposed Ttotal fenestration area.

As = Standard reference design total fenestration area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

*F* = (Above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.80, whichever is greater, and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions. Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact. Common wall area is the area of walls shared with an adjoining dwelling unit. ~~L~~AF, As and *CFA* are in the same units.

(other table entries and footnotes are unchanged)

(EN7231 A4 only)

[Add following two sections to Table R405.5.2(1)]

|  |  |  |
| --- | --- | --- |
| **Building Component** | **Standard Reference Design** | **Proposed Design** |
| Dehumidification Systems | None, except where dehumidification equipment is specified by the proposed design, in which case:  Fuel Type: electric  Capacity: sufficient to maintain humidity at setpoint all hours  Efficiency: 1.7 Liters/kWh if proposed house total capacity is less than 75 pints/day; 2.38 Liters/kWh if proposed house total capacity is greater than or equal to 75 pints per day  Location: in conditioned space  Dehumidifier Ducts: None  Dehumidifier Duct Location: N/A  Dehumidifier Duct R Value: N/A  Dehumidifier Duct Surface Area: N/A | As proposed  As proposed  Sufficient to maintain humidity at setpoint all hours  As proposed  As proposed  As proposed  As proposed  As proposed  As proposed |
| Dehumidistat | None, except where dehumidification equipment is specified by the proposed design, in which case:     Setpoint turn on = 60% relative humidity     Setpoint turn off = 55% relative humidity | Same as standard reference design |

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|  |

(EN7651)

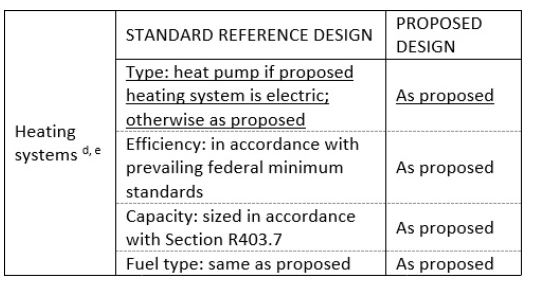
[Table R405.5.2(1) footnote "a".]

a. ~~Where required by the code official, t~~Testing shall be conducted ~~by an approved party~~ in accordance with Section R402.4.1.2. Hourly calculations as specified in the ASHRAE Handbook of Fundamentals, or the equivalent shall be used to determine the energy loads resulting from infiltration.

[No other changes to table.]

(EN7574)

[Heating systems section of Table R405.5.2(1)]



[No other changes to table.]

(EN7577)

[Table R405.5.2(1) footnote "e".]

e. For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design, and this heating system shall be an electric heat pump if the proposed design has an electric water heater.

[No other changes to table.]

(EN7578)

**Section 405.5.2**

[Starting from 2017 Florida Energy Code Table R405.5.2(1) Service water heating section, make the following changes to stipulate ANSI/RESNET/ICC Standard 301 Addendum A-2015 for the reference and proposed designs’ hot water use and energy consumption specifications:]

|  |  |  |
| --- | --- | --- |
| Service water heating d, e, f, g | **STANDARD**  **REFERENCE DESIGN** | **PROPOSED DESIGN** |
| Fuel type: as proposed | Fuel type: As proposed |
| Use (gal/day): ~~same as~~ ~~proposed design~~ determined in accordance with ANSI/RESNET/ICC 301  Addendum A-2015 | Use (gal/day): ~~= 30 + (10~~  ~~×~~ *~~Nbr~~*~~)~~ determined in accordance with ANSI/RESNET/ICC 301  Addendum A-2015 |
| Efficiency: in accordance with prevailing federal minimum standards | Efficiency: As proposed |
| Energy consumption: determined in accordance with ANSI/RESNET/ICC 301 Addendum A-2015 | Energy consumption: determined in accordance with ANSI/RESNET/ICC 301  Addendum A-2015 |

[No other changes to Table R405.5.2(1).]

(EN7597 A3 only)

**Revise as follows:**

**TABLE R405.5.2(1)**

**SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

|  |  |  |
| --- | --- | --- |
| BUILDING  COMPONENT | STANDARD REFERENCE DESIGN | PROPOSED DESIGN |
| Mechanical ventilation | None, except where mechanical ventilation is specified by the proposed design, in which case: Annual vent fan energy use:   kWh/yr  = (1/ef) × (0.0876 × CFA + 65.7 × (Nbr+1))  ~~0.03942 ×~~ *~~CFA~~* ~~+ 29.565 × (~~*~~N~~~~br~~*~~+1)~~  where: *CFA* = conditioned floor area, *Nbr* = number of bedrooms, and ef = the minimum exhaust fan efficacy from Table R403.6.1 corresponding to a flow rate of 0.01 × CFA + 7.5 × (Nbr+1)) | As proposed |
| **No change to the remainder of table or notes.** | | |

(EN8036/RE149-16))

**R406.3 (N1106.3) Energy Rating Index.** The Energy Rating Index (ERI) shall be a numerical integer value that is based on a linear scale constructed such that the *ERI reference design* has an Index value of 100 and a *residential building* that uses no net purchased energy has an Index value of 0. Each integer value on the scale shall represent a 1-percent change in the total energy use of the rated design relative to the total energy use of the *ERI reference design*. The ERI shall consider all energy used in the *residential building*. Energy used to recharge or refuel a vehicle for on-road (and off-site) transportation purposes shall not be included in the *ERI reference design* or the *rated design*.

(CE248-16 Part II)

**Chapter 5 [RE] EXISTING BUILDINGS**

Revise as follows:

**R501.7 Building systems and components.**

Thermal efficiency standards are set for the following building systems and components where new products are installed or replaced in existing buildings, and for which a permit must be obtained. New products shall meet the minimum efficiencies allowed by this code for the following systems and components:

Heating, ventilating or air-conditioning systems;

Service water or pool heating systems;

Lighting systems; and

Replacement fenestration.

**Exceptions:**

1. Where part of a functional unit is repaired or replaced. For example, replacement of an entire HVAC system is not required because a new compressor or other part does not meet code when installed with an older system.

2. If the unit being replaced is itself a functional unit, such as a condenser, it does not constitute a repair. Outdoor and indoor units that are not designed to be operated together must meet the U.S. Department of Energy certification requirements contained in Section R303.1.2. Matched systems are required; this match may be verified by any one of the following means:

a.      AHRI data

b.      Accredited laboratory

c.      Manufacturer’s letter

d.      Letter from registered P.E. State of Florida

3. Where existing components are utilized with a replacement system, such as air distribution system ducts or electrical wiring for lights, such components or controls need not meet code if meeting code would require that component’s replacement.

4. Replacement equipment that would require extensive revisions to other systems, equipment or elements of a building where such replacement is a like-for-like replacement, such as through-the-wall condensing units and PTACs, chillers and cooling towers in confined spaces.

5. If space does not permit replacement air distribution systems to meet the prescriptive R-value requirement of this code, replacement ducts shall have either the same R-value as the ducts being replaced or a higher R-value. Ducts with R-6 insulation value shall be considered sufficient to satisfy the requirements of R501.7.

(EN8371 A3 only)

**R503.1.1.1 Replacement fenestration.**  Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and SHGC as provided in Table R402.1.2. Where more than one replacement *fenestration* unit is being installed, an area-weighted average of the U-factor and/or SHGC of all replacement *fenestration* units shall be permitted to be used to demonstrate compliance.

(EN7254) /(I-Code)

**R503.2 Change in space conditioning.**

Any nonconditioned or low-energy space that is altered to become conditioned space shall be required to be brought into full compliance with this code.

**Exception:** Where the simulated performance option in Section R405 is used to comply with this section, the annual ~~energy cost~~ total normalized Modified Loads of the proposed design ~~is~~ are permitted to be 110 percent of the annual ~~energy cost otherwise allowed by Section R405.3~~total loads of the standard reference design as calculated in accordance with Appendix RC of this standard.

(EN7598)

**R505.2 General.**

Any space that is converted to a dwelling unit or portion thereof from another use or occupancy shall comply with this code.

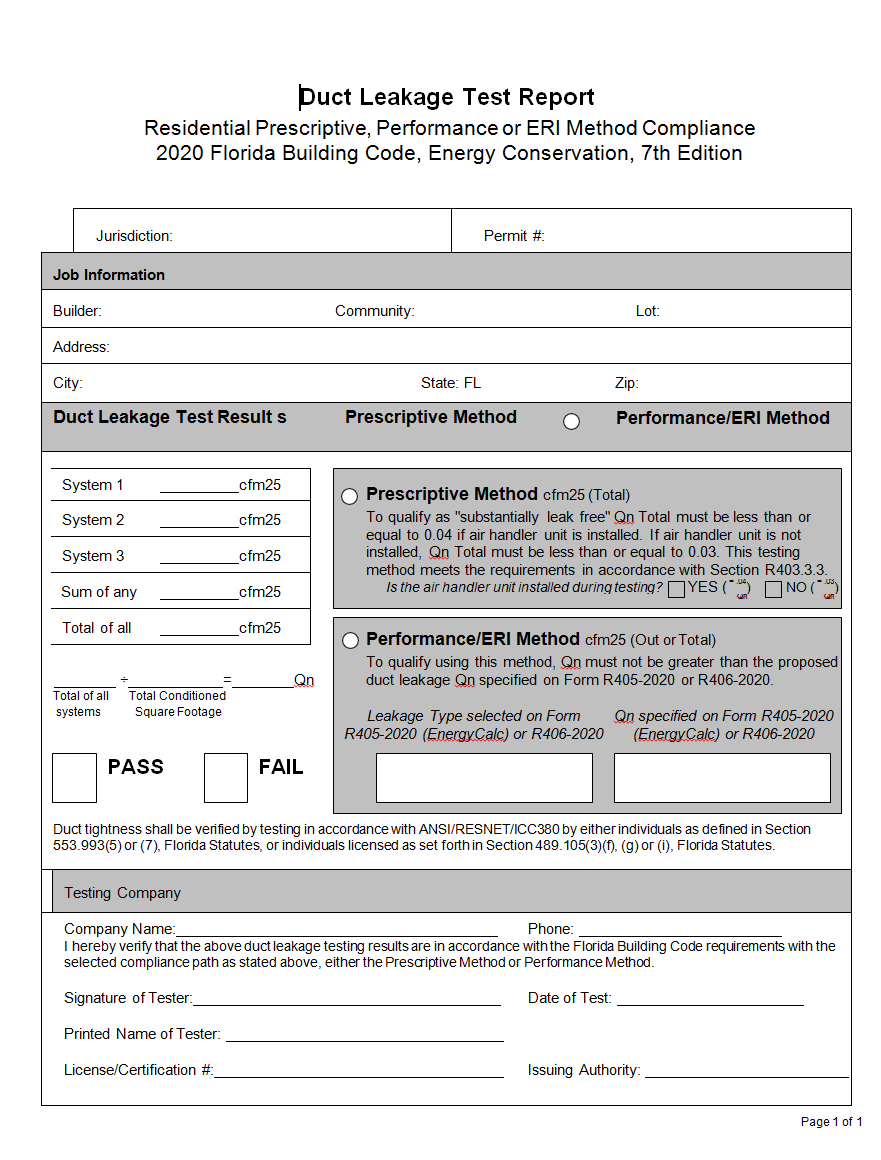
**Exception:** Where the simulated performance option in Section R405 is used to comply with this section, the annual ~~energy cost~~ total normalized Modified Loads of the proposed design ~~is~~ are permitted to be 110 percent of the annual ~~energy cost otherwise allowed by Section R405.3~~total loads of the standard reference design as calculated in accordance with Appendix RC of this standard.

(EN7599)

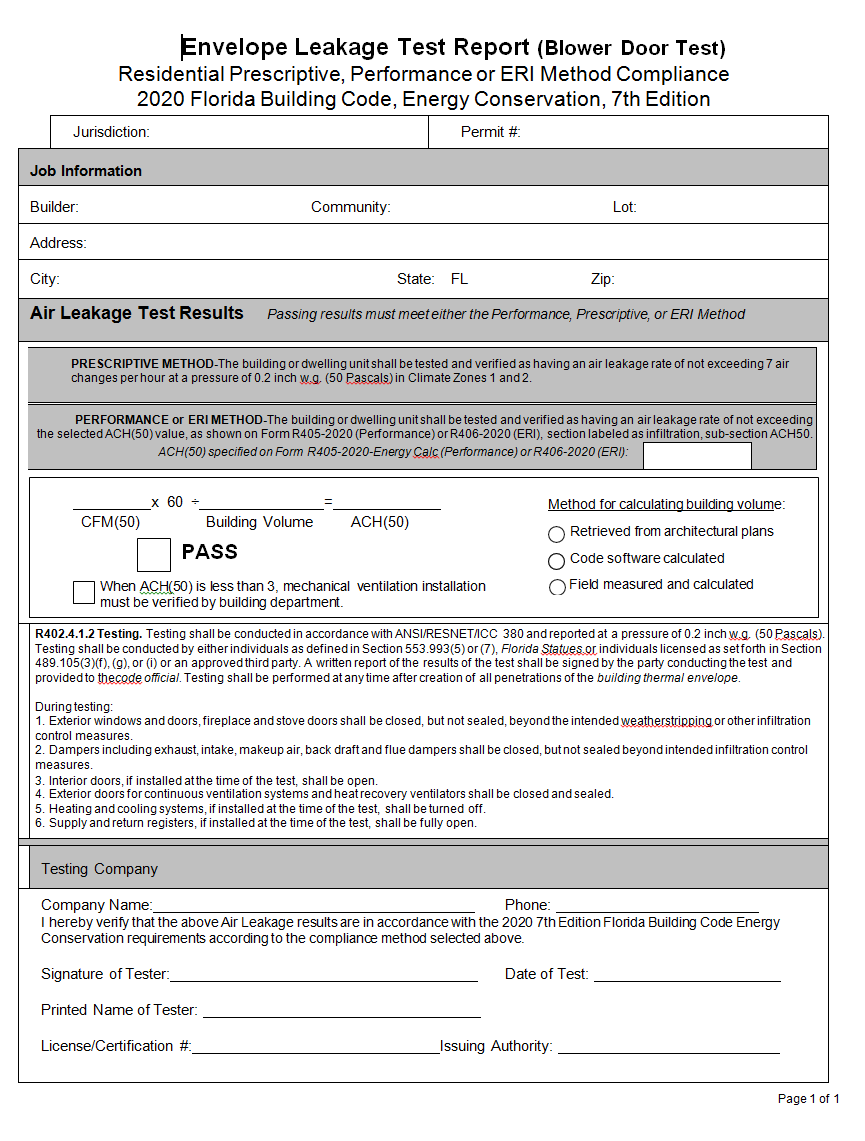
**CHAPTER 6 [RE] REFERENCED STANDARDS**

**See attached**

Appendix RD - **FORMS** – Add the following forms



N7677)



(EN7675)

[Replace existing Appendix RD Form R402 with new version of Form R402 below (and also [provided as attached PDF.]

***Florida Building Code, Energy Conservation***

**Residential Building Thermal Envelope Approach**

**FORM R402-2020 R-Value Computation Method Florida Climate Zone**

|  |  |  |
| --- | --- | --- |
| **PROJECT NAME AND ADDRESS:** |  | **BUILDER:** |
|  | **PERMITTING OFFICE:** |
|  | **JURISDICTION NUMBER:** |
| **OWNER:** |  | **PERMIT NUMBER:** |
| **PERMIT TYPE:** |  | **NUMBER OF UNITS:** |
| **WORST CASE?** |  | **CONDITIONED FLOOR AREA:** |

**Scope:** Compliance with Section R402.1.2 of the *Florida Building Code, Energy Conservation*, shall be demonstrated by the use of Form R402 for single- and multiple-family residences of three stories or less in height, additions to existing residential buildings, alterations, renovations, and building systems in existing buildings, as applicable. To comply, a building must meet or exceed all of the energy efficiency requirements and applicable mandatory requirements summarized on this form. If a building does not comply with this method, or by the UA Alternative method, it may still comply under Section R405 or R406 of the *Florida Building Code, Energy Conservation*.

**General Instructions:**

1. Fill in all the applicable spaces of the “INSTALLED" row in the INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT table with the information requested. All "INSTALLED" values must be equal to or more efficient than the required levels. “AVG” indicates an area weighted average is allowed; “LOWEST” indicates the lowest R-value to be installed must be entered.
2. Complete the tables for air infiltration and installed equipment.
3. Read the MANDATORY REQUIREMENTS table and check each box to indicate your intent to comply with all applicable items.
4. Read, sign and date the "Prepared By" certification statement at the bottom of this form. The owner or owner's agent must also sign and date the form.

**INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **REQUIRE- MENT** | **FENESTRATION U-FACTOR2, 3, 4** | **SKYLIGHT2 U-FACTOR** | **GLAZED FENESTRATION** | **CEILING R-VALUE** | **WOOD FRAME**  **WALL R-** |  | **MASS WALL R-** | **FLOOR R-VALUE** | **BASEMENT WALL R-** | **SLAB7 R- VALUE &** | **CRAWL SPACE**  **WALL R-** |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| CLIMATE ZONE 1 | NR | 0.75 | 0.25 | 30 | 13 |  | 3/4 | 13 | 0 | 0 | 0 |
| CLIMATE ZONE 2 | 0.40 | 0.65 | 0.25 | 38 | 13 |  | 4/6 | 13 | 0 | 0 | 0 |
| VALUE | AVG | AVG | AVG | LOWEST | LOWEST |  | LOWEST | LOWEST | LOWEST | LOWEST | LOWEST |
| **INSTALLED:** |  |  |  |  |  |  |  |  |  |  |  |

R-Value Calculation Method - [PASS / FAIL]

For SI: 1 foot = 304.8 mm; NR = No requirement.

(1) R-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table.

(2) The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

(3) For impact rated fenestration complying with Section R301.2.1.2 of the *Florida Building Code, Residential* or Section 1609.1.2 of the *Florida Building Code, Building*, the maximum *U*-factor shall be 0.65 in Climate Zone 2. An area-weighted average of *U*-factor and SHGC shall be accepted to meet the requirements, and up to 15 square feet of glazed fenestration area are exempted from the *U*-factor and SHGC requirement based on Section R402.3.1, R402.3.2 and R402.3.3.

(4) One side-hinged opaque door assembly up to 24 square feet is exempted from this *U*-factor requirement based on Section R402.3.4.

(5) R-values are for insulation material only as applied in accordance with manufacturer’s installation instructions.

(6) The second R-value applies when more than half the insulation is on the interior of the mass wall.

(7) R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

|  |  |
| --- | --- |
| **Air infiltration**: | Blower door test is required on the building envelope to verify leakage <= 7 ACH50; test report must be provided to code official before CO is issued. *Florida Building Code, Energy Conservation* Section R402.4.1.2 testing exception may apply for additions, alterations, or renovations. |

**EQUIPMENT REQUIREMENTS AND INSTALLED VALUES**

Fill in the “INSTALLED EFFICIENCY LEVEL" column with the information requested. For multiple systems of the same type, indicate the minimum efficient system. All "INSTALLED" values must be equal to or more efficient than the required level. If a listed “SYSTEM TYPE” is not to be installed, write in “N/A” for not applicable.

|  |  |  |
| --- | --- | --- |
| **SYSTEM TYPE** | **MINIMUM EFFICIENCY LEVEL REQUIRED** | **INSTALLED EFFICIENCY LEVEL** |
| Air distribution system1 | Not allowed in attic | Location: |
| Air handling unit | Factory Sealed | Factory Sealed? Y/N |
| Duct R-Value | = R-8 (Ducts in unconditioned attics, Diameter => 3 in.)  = R-6 (Ducts in unconditioned non attics, Diam. => 3 in.)  = R-6 (Ducts in unconditioned attics, Diameter < 3 in.)  = R-4.2 (Ducts in uncond not attics, Diam. < 3 in.) All ducts are in conditioned space (No minimum) | R-Value (In unc. attic) =  R-Value (In unc. non attics) = R-value (Small ducts in attic) = R-Value (Small ducts in unc) = All in conditioned space? Y/N |
| Air Leakage/Duct test | Air handler installed: Total leakage = 4 cfm/100 s.f.  Air handler not installed: Total leakage = 3 cfm/100 s.f. | Total leakage (cfm/100 s.f.) = Air handler installed? Y/N |
| Duct testing | Test not required if all ducts and AHU are within the building thermal envelope and for additions or alterations where ducts extended from existing heating and cooling system through unconditioned space are < 40 linear ft. | Test report required? Y/N |
| Air conditioning systems:  Central system <= 65,000 Btu/h PTAC  Other: | Minimum federal standard required by NAECA2 SEER=14.0  EER [from Table C403.2.3(3)]  See Tables C403.2.3(1)-(11) | SEER (Min)= EER (Min) =  Type = Effic.(Min) = |
| Heating systems:  Heat Pump <= 65,000 Btu/h  Gas Furnace, non-weatherized  Oil Furnace, non-weatherized  Other: | Minimum federal standard required by NAECA2  HSPF >= 8.2  AFUE >= 80%  AFUE >= 83% | HSPF (Min) = AFUE (Min) = AFUE (Min) =  Type = Effic.(Min)= |
| Water heating system (storage type):  Electric3, 6  Gas fired4, 6  Other (describe)5, 6: | Minimum federal standard required by NAECA2  UEF: 40 gal.: ~~0.931~~ 0.923, 50 gal.: ~~0.930~~ 0.921, 60 gal.: ~~2.176~~\_2.051  UEF: 40 gal.: ~~0.64~~ 0.580, 50 gal.: ~~0.627~~ 0.563, 60 gal.: ~~0.789~~ 0.766 | Capacity =  UEF (Min) = UEF (Min) =  Type= Effic.(Min)= |

Equipment Efficiency - [PASS / FAIL]

(1) Ducts & AHU installed “substantially leak free” per Section R403.3.2. Test required by either individuals as defined in Section 553.993(5) or (7),*Florida Statutes*, or individuals licensed as set forth in Section 489.105(3)(f), (g), or (i), *Florida Statutes*. The total leakage test is not required for ducts and air handlers located entirely within the building thermal envelope, and for additions where ducts from an existing heating and cooling system extended to the addition through unconditioned space are less than 40 linear ft.

*(2)* Minimum efficiencies are those set by the *National Appliance Energy Conservation Act* of 1987 for typical residential equipment and are subject to NAECA rules and regulations. For other types of equipment, see Tables C403.2.3 (1-11) of the Commercial Provisions of the *Florida Building Code, Energy Conservation.*

(3) For electric storage volumes <= 55 gallons, minimum UEF = 0.9349 – (0.0001 \* volume). For electric storage volumes > 55 gallons, minimum UEF = 2.2418

– (0.0011 \* volume).

(4) For natural gas storage volumes <= 55 gallons, minimum UEF = 0.692 – (0.0013 \* volume). For natural gas storage volumes > 55 gallons, minimum UEF = 0.8072 – (0.0003 \* volume).

(5) For electric tankless, min. UEF = 0.92. For natural gas tankless, min. UEF = 0.81.

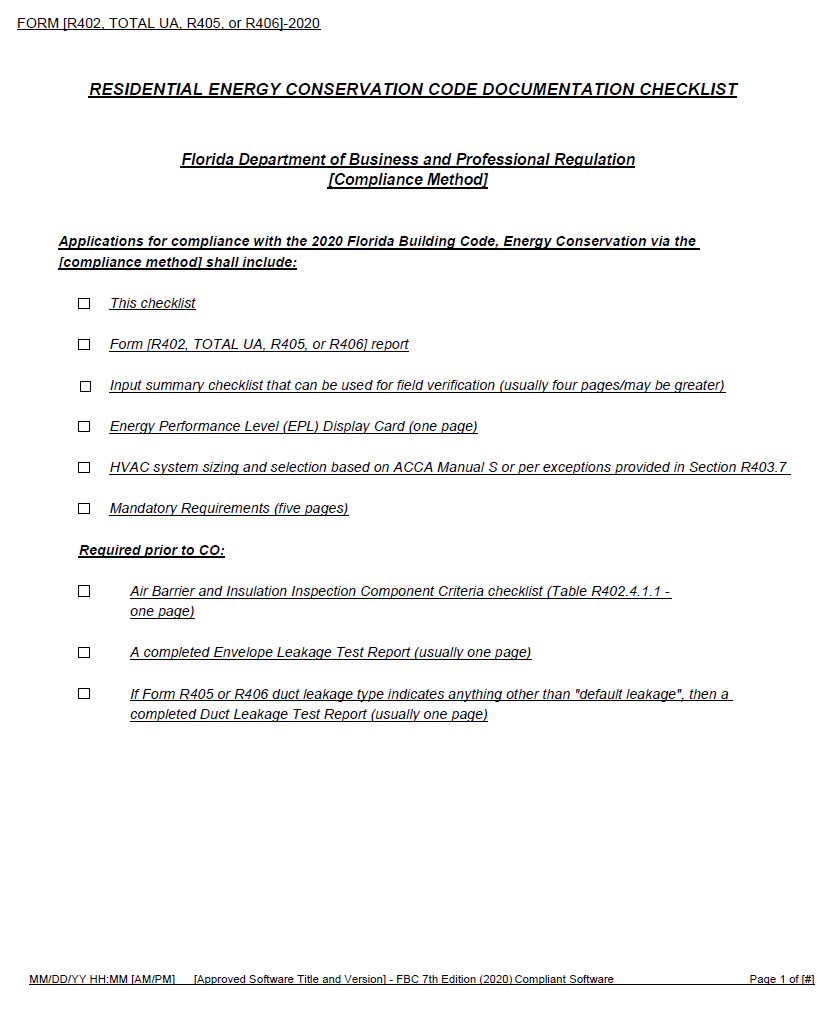
(6) Referenced UEFs shown are for ~~high~~ medium draw pattern value provided by manufacturer.

FORM R402-2020

|  |  |  |  |
| --- | --- | --- | --- |
| **MANDATORY REQUIREMENTS** | | | |
| **Component** | **Section** | **Summary of Requirement(s)** | **Check** |
| Air leakage | R402.4 | To be caulked, gasketed, weatherstripped or otherwise sealed per Table R402.4.1.1. Recessed lighting IC-rated as having <= 2.0 cfm tested to ASTM E 283.Windows and doors: 0.3 cfm/sq.ft. (swinging doors: 0.5 cfm/sf) when tested to NFRC 400 or AAMA/WDMA/CSA 101/I.S. 2/A440. Fireplaces: Tight-fitting flue dampers & outdoor combustion air. |  |
| Programmable thermostat | R403.1.2 | A programmable thermostat is required for the primary heating or cooling system. |  |
| Air distribution system | R403.3.2 R403.3.4 | Ducts shall be tested as per Section R403.3.2 by either individuals as defined in  Section553.993(5) or (7), *Florida Statutes*, or individuals licensed as set forth in Section 489.105(3) (f), (g) or (i), *Florida Statutes*. Air handling units are not allowed in attics. |  |
| Water heaters | R403.5 | Comply with efficiencies in Table C404.2. Hot water pipes insulated to >= R-3 to kitchen outlets, other cases. Circulating systems to have an automatic or accessible manual OFF switch. Heat trap required for vertical pipe risers. |  |
| Cooling/heating equipment | R403.7 | Sizing calculation performed & attached. Special occasion cooling or heating capacity requires separate system or variable capacity system. |  |
| Swimming pools & spas | R403.10 | Spas and heated pools must have vapor-retardant covers or a liquid cover or other means proven to reduce heat loss except if 70% of heat from site-recovered energy. Off/timer switch required. Gas heaters minimum thermal efficiency is 82%. Heat pump pool heaters minimum COP is 4.0. |  |
| Lighting equipment | R404.1 | At least 75% of permanently installed lighting fixtures shall be high-efficacy lamps. |  |

|  |  |
| --- | --- |
| I hereby certify that the plans and specifications covered by this form are in compliance with the *Florida Building Code, Energy Conservation.*  PREPARED BY: Date | Review of plans and specifications covered by this form indicate compliance with the *Florida Building Code, Energy Conservation* Before construction is complete, this building will be inspected for compliance in accordance with Section 553.908, F.S.  CODE OFFICIAL: \_ Date: \_ |
| I hereby certify that this building is in compliance with the *Florida Building Code, Energy Conservation.*  OWNER/AGENT: Date |

(EN7652-R2)



(EN8074)

[Starting from the original mod, make the following changes as indicated below: 1) change the Energy Rating language in the first footnote, 2) fix Windows section Area Weighted Average Overhang Depth and SHGC units errors, 3) remove typo asterisk from Heating system section, 4) add date and time, software version and compliance statement, and page numbering at bottom of card:]

**ENERGY PERFORMANCE LEVEL (EPL) DISPLAY CARD**

ESTIMATED ENERGY PERFORMANCE INDEX\* = [value]

The lower the Energy Performance Index, the more efficient the home.

[Address]

1. New home or, addition
2. Single family or multiple family
3. Number of units (if multiple family)
4. Number of Bedrooms
5. Is this a worst case? (yes/no)
6. Conditioned floor area (sq. ft.)

-family [#]

[#]

1. Wall type and insulation
   1. [Type]
   2. [Type or N/A]
   3. [Type or N/A]
   4. [Type or N/A]

Insulation R =

R = R = R =

Area

ft2 ft2

ft2 ft2

1. Windows\*\*
   1. U-Factor: SHGC:
   2. U-Factor: SHGC:
   3. U-Factor:

Description

U-Factor: SHGC:

[Type or N/A], U =

[Type or N/A], U =

Area

ft2 ft2

ft2

1. Ceiling type and insulation level
   1. [Type]
   2. [Type or N/A]
   3. [Type or N/A]
2. Ducts, location and insulation level

Insulation R =

R = R =

Area

ft2 ft2 ft2

SHCG:

* 1. U-Factor: SHGC:

[Type or N/A], U =

ft2

* + 1. Sup: [loc.], Ret: [loc], AH: [loc]
    2. Sup: , Ret: , AH: [or N/A]

1. Cooling systems

R ft2

kBtu/hr Efficiency

Area Weighted Average Overhang Depth: Area Weighted Average SHGC:

ft.2 ~~ft.~~

* 1. [Type]
  2. [Type or N/A]
  3. [Type or N/A]

1. Skylights
   1. U-Factor: SHGC:
2. Floor type, insulation level
   1. [Type]
   2. [Type or N/A]
   3. [Type or N/A]

Description

U-Factor: SHGC:

Insulation R =

R =

R =

Area

ft2

Area

ft2 ft2 ft2

1. Heating systems
   1. [Type]
   2. [Type or N/A]
   3. [Type or N/A]\*
2. Water heating system
   1. [Type]
   2. Conservation features

kBtu/hr Efficiency

Cap: [#] gallons UEF:

Use medium draw pattern UEF provided by manufacturer.

Credits (Performance method)

I certify that this home has complied with the *Florida Building Code, Energy Conservation,* through the above energy saving features which will be installed (or exceeded) in this home before final inspection. Otherwise, a new EPL Display Card will be completed based on installed Code compliant features.

Builder Signature:

Date:

Address of Home: \_ \_ City/FL Zip: \_ \_

\*Note: This is not a Building Energy Rating. If your Index is below 70, your home may qualify for energy efficient mortgage (EEM) incentives if you obtain an ~~Florida~~ Energy~~Gauge~~ Rating. For information about the *Florida Building Code, Energy Conservation*, contact the Florida Building Commission's support staff.

\*\*Label required by Section R303.1.3 of the *Florida Building Code, Energy Conservation*, if not DEFAULT.

[Date and time] [Software version and code compliance statement] [Page # of #]

(EN7678 A1 Only)